TENDER NO: H19/029 AI

CLOSING DATE: 4 May 2020 @ 11:00

PROCUREMENT DOCUMENTS

MASERU BRIDGE: PORT OF ENTRY: APPOINTMENT OF A SERVICE PROVIDER FOR THE MAINTENANCE AND REPAIRS OF BUILDING, CIVIL, MECHANICAL, ELECTRICAL INFRASTRUCTURE AND INSTALLATIONS FOR A PERIOD OF 36 MONTH (APPOINTMENT OF CONTRACTOR)

Technical & Particular specifications

MARCH 2020

ISSUED BY: NATIONAL DEPARTMENT OF PUBLIC WORKS, PRETORIA HEAD OFFICE CGO BUILDING CNR BOSMAN AND MADIBA STREET, PRETORIA

PROJECT MANAGER: K Seemane

NAME OF TENDERER: ________________________________
2.3.3 TECHNICAL & PARTICULAR SPECIFICATIONS
TECHNICAL SPECIFICATION

AA PLUMBING AND DRAINAGE INSTALLATIONS

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AA 01 SCOPE

This Specification covers the general maintenance and servicing of plumbing and drainage installations, which include the following:

(a) Rainwater disposal systems
(b) Soil and wastewater drainage systems
(c) Domestic water distribution and reticulation systems
(d) Sanitary and brassware equipment
(e) Fire water piped reticulation networks.

This Specification shall form an integral part of the maintenance and servicing contract document, and shall be read in conjunction with the additional and particular Specifications compiled as part of this document.

This Specification shall act as a guideline to the Particular Specification and, in the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.

AA02 STANDARD SPECIFICATIONS

AA 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

The latest edition, including all amendments up to date of tender, of the following Specifications, publications and codes of practice shall be read in conjunction with this Specification and shall be deemed to form part thereof:

AA 02.01.01 SANS Specifications and codes

SANS 10400  The application of the National Building Regulations
SANS 1200 DB  Earthworks (pipe trenches)
SANS 1200 LB  Bedding (pipes)
SANS 1200  Medium-pressure pipelines
SANS 1200 LD  Sewers
SANS 10252: Part 1 -  Water supply installations for buildings
SANS 10252: Part 2 -  Drainage installations for buildings
SANS Specifications listed on page 3 of the DPW Specification OW 371

Maselru Bridge  Port of Entry: Technical and Particular Specification
AA 02.01.02 Department of Public Works Specifications
OW 371 - Specification of materials and methods to be used (Fourth revision, October 1993)
Guide for architects concerning drainage, water supply and stormwater drainage
PW 343 - Building Specifications for regional offices
FPO/G61/3E - Guide to architects
Drainage details.

AA 02.01.03 Occupational Health and Safety Act of 1993
All regulations and statutory REQUIREMENTS as laid down in the latest edition of the Occupational Health and Safety Act of 1993. Construction Regulations, 2014 as promulgated in Gazette No 37305 of 7 February 2014 shall be adhered to

AA 02.01.04 Manufacturers’ Specifications, codes of practice and installation instructions
All equipment and materials shall be installed, serviced and maintained strictly in accordance with the manufacturers’ Specifications, instructions and codes of practice.

AA 02.01.05 Municipal regulations, laws and by-laws
All municipal regulations, laws, by-laws and special REQUIREMENTS of the Local Authority shall be adhered to unless otherwise specified.

AA 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS
The following additional general Specifications and REQUIREMENTS shall be read in conjunction with this Specification and shall be adhered to unless otherwise specified in the Particular Specification.

AA 03.01 GENERAL INSTALLATION REQUIREMENTS
(a) All materials and equipment supplied and installed shall be new, high quality and designed and manufactured to the relevant Specifications and suitable for providing efficient, reliable and trouble-free service.

(b) All work shall be executed in a first-class workman-like manner by qualified registered plumbers.

(c) All equipment, component parts, fittings and materials supplied and/or installed, shall conform in respect of Quality, manufacture, test and performance to the REQUIREMENTS of the applicable current SANS Specifications and codes, except where otherwise specified or approved by the Engineer in writing.

(d) All materials and workmanship which, in the opinion of the Engineer, are inferior to that specified for the work will be condemned. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer.

(e) The Contractor shall submit a detailed list of the equipment and material to be used to the Engineer for approval before placing orders or commencing installation.
(f) All new piping shall be installed and positioned such as to not impede on access routes, entrances and other services. The Contractor shall coordinate these new pipe routes taking other services and equipment into account.

(g) All control equipment and serviceable items shall be installed and positioned such that they will be easily accessible and maintainable.

(h) The Contractor shall make sure that all safety regulations and measures are applied and enforced during the maintenance work to ensure the safety of the public and the User Client.

(i) Service and maintenance work shall be programmed in such a manner as to ensure the shortest possible downtime of any service and the least inconvenience to the User Client and the public. The Contractor shall make sure that the necessary notifications and notices are timely put into place for these activities.

AA 03.02 GENERAL REQUIREMENTS AND INSTALLATION OF DOMESTIC WATER INSTALLATIONS

(a) All pipes are to be carefully examined for defects and flaws before installation and shall be neatly fitted. They shall be installed in such manner as to prevent the formation of air locks. Automatic air vents shall be installed on all high points of the installation.

(b) The ends of all the pipes are to be cleaned, free from burrs, and rough edges and joined together tightly. Where applicable, an approved pipe joint compound may be sparingly used with best quality hemp. All surplus or exposed hemp is to be thoroughly cleaned off joints before the painting of pipes.

(c) All vertical pipes must be securely fixed with brackets and supports of approved type, fixed securely into the wall and not more than 40 mm from the wall. These fixings must be strictly adhered to.

(d) Pipes installed in service ducts and ceiling voids are to be perfectly plumbed and secured with approved brackets, fixed securely at distances not exceeding the specified distances and not more than 40 mm away from the face of the walls or soffits. Pipes inside buildings and where specified shall be chased into walls, wrapped with building paper and properly secured and covered. Pipes must be free to move in the brackets.

(e) Pipes passing through the walls and concrete floors are to be provided with suitable pipe sleeves extending 10 mm beyond finished floor or wall surfaces. All pipe fixings and throughways shall be free to allow movement for expansion and contraction. Any pipe fitting feeding a pipe which is rigidly secured by a structural element shall be securely anchored to prevent any stress developing between the fitting and the structural element.

(f) Chromium or nickel-plated metal covering plates are to be provided and fixed securely to pipes passing through the ceilings and walls. This requirement is not applicable to concrete floors and ceilings.

(g) Pipes passing through the ceilings or floors shall be offset from the wall to the front of the cornice with sufficient clearance to allow for the clear fixing of a ceiling plate. Pipes installed directly through the cornice will not be allowed. In multi-storey buildings where wall thickness varies, the same shall apply.
(h) All offsets are to be evenly and symmetrically set the offsets being as high and as near the ceiling as possible.

(i) Pipes shall be installed in such a manner to allow for contraction and expansion.

(u) During construction all pipe ends shall be kept plugged to prevent any ingress of dirt, rubble, etc.

(k) Damages, chases, holes, etc. in brickwork, concrete and other finishes resulting from repair, replacement and service work shall be made good to match the existing and shall include plaster, concrete work, brickwork, paint, tiling, ceilings and all required materials for the remedial action.

(l) The work shall be of a high quality and executed by qualified tradesmen in accordance with the relevant Specifications.

AA 03.03 GENERAL REQUIREMENTS AND INSTALLATION OF SOIL AND WASTEWATER INSTALLATIONS

The following REQUIREMENTS shall apply to this installation unless otherwise specified.

AA 03.03.01 Underground sanitary drainage installations

(a) All manhole covers and frames shall be cast into the concrete cover slabs.

(b) Manholes in trafficable areas shall be provided with type 1A heavy-duty cover and frame and surrounded by concrete slabs.

(c) Fittings in the ground and below floor slabs shall be without access eyes.

(d) Sewer pipes in the ground with a slope steeper than 1.5 and under surface beds shall be encased in concrete as detailed.

(e) The sewer outside the boundary of the building complex shall be constructed strictly in accordance with the details and Specifications of the local authorities.

(f) Existing drainage invert levels and positions are to be checked against invert levels given on the drawings before commencing the work. The Contractor shall inform the Engineer immediately of any discrepancy.

(g) All existing services are to be located and opened before commencing the proposed drainage work.

(h) The drainage system shall be tested according to the Specifications laid down by the NBRI. This shall be carried out in the presence and to the satisfaction and approval of the Engineer.

(i) During construction all pipe ends are to be suitably plugged to prevent any ingress of dirt, rubble, etc.

(j) Modern technology video surveying equipment and detection equipment shall be utilised to establish blockage problems and indicate the positions of such problems.

(k) Any drainage pipe within the 45° range below building foundations shall be encased in concrete or soilcrete as specified.
AA 03.03.02 Above ground sanitary drainage installations

(a) All accessible waste and soil fittings above ground level shall have inspection eyes. Inspection eyes shall not be underneath any fittings.

(b) All single wash hand basins shall be connected to a 40 mm internal diameter waste pipe.

(c) All groups of wash hand basins and sinks shall be connected to a 50 mm internal diameter waste pipe, unless otherwise indicated.

(d) All traps up to and including 50 mm diameter shall be of the "deep reseal" (75 mm) type.

(e) The maximum bend on any single fitting shall be 45°, with the exception of ventilation pipes where bends of up to 90° may be used.

(f) Drainage pipes and fittings running below concrete slabs and along walls and columns shall be suspended by means of approved type hangers, holdertats, etc. and at appropriate intervals, to provide a rigid, proper suspended system and as required by the manufacturer.

(g) All ventilation pipes shall be finished off with a suitable, durable grating.

(h) All S-trap WC pans shall have plugged anti-siphon horns fitted to provide for cleaning access.

AA 03.04 PRESSURE TESTING OF PIPES

(a) All new pipe installations under the maintenance Contract shall be pressure tested before being taken into use. The Engineer shall witness this pressure test.

(b) Completed sections of the pipe installation shall be filled with water after all branches have been plugged, sealed or closed.

(c) The section of pipe shall be hydraulically pressure tested by means of a suitable manually operated or mechanically driven pressure pump.

(d) A pressure of at least 1.5 times the working pressure of the class rating of pipes or fittings shall be applied for a period of time specified in the Specifications or as recommended by the manufacturers. (Refer to SANS 1200 L for minimum and maximum test pressures)

(e) Tests shall not be performed against closed valves.

(f) Leakage which occurs shall be measured and calculated and checked against the allowable losses, as specified in SANS 1200 L.

(g) If the completed section of pipe complies with all Specifications and passes the tests and inspection, it can be approved by the Engineer and the Contractor instructed to backfill the open sections of trench at the joints and connections, where applicable.

(h) The Contractor shall then proceed to build all the valve chambers, inspection chambers, etc. for underground installations and close off pipes in walls, voids and ducts for above ground installations.
AA 03.05 STERILISING OF WATER PIPES

(a) Before any repaired and new pipeline is taken into use, the pipeline shall be sterilised over its complete length, including the fittings. The pipe shall be filled with potable water chlorinated to a concentration of 15 mg of chlorine per litre of water, which shall remain in contact with the inner surface of the pipeline for a period of not less than 24 hours. The pipeline shall be filled for sterilising in such a manner that no chlorine shock is created or air is trapped in the pipeline.

(b) The Contractor shall submit full details of the proposed method of sterilising the pipeline to the Engineer for approval at least fourteen days prior to the commencement of sterilising.

(c) The cost of water for filling the pipeline for sterilising shall be borne by the Contractor.

(d) The Contractor shall provide all necessary materials, tools, equipment and labour required for sterilising the pipeline. After sterilising the pipeline the Contractor shall, at no extra cost, empty the pipeline and dispose of the water in a manner approved by the Engineer.

The Contractor may use the following products as a source of chlorine:

- chloride of lime to SANS 295 yielding 33% free chlorine by mass.
- calcium hypochlorite to SANS 295 yielding 70% free chlorine by mass.
- chlorine gas applied by chlorinator.

After sterilisation, an approved water quality test shall be carried out to a minimum number of 10% of the total water points, randomly selected, evenly spread and marked on drawings. These tests shall include a full bacteriological test as per SANS 241 and the results shall be submitted to the Engineer for approval. Each abortive test shall be for the Contractor’s account.

AA 03.05.01 Bacteriological requirements

When tested the water shall comply with the limits given in table AA 03.05.01/1.

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>RECOMMENDED MAXIMUM LIMIT</th>
<th>MAXIMUM ALLOWABLE LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total coliform bacteria count per 100 millilitre</td>
<td>NII*</td>
<td>5</td>
</tr>
<tr>
<td>Faecal coliform bacteria count per 100 millilitre</td>
<td>NII</td>
<td>NII</td>
</tr>
<tr>
<td>Standard plate count per millilitre</td>
<td>100</td>
<td>Not specified</td>
</tr>
</tbody>
</table>

*(a) If any coliform bacteria are found in a sample, a second sample must be taken immediately after the tests on the first sample have been completed. This sample shall be free from coliform bacteria.

(b) Not more than 5% of the total number of water samples (from anyone reticulation system) tested per year may contain coliform bacteria.

The Engineer shall witness the sterilisation of the pipes.
The Contractor shall ensure that during the sterilising procedure the necessary safety precautions are instituted to prevent the intake of water by the user and/or public from the system. On completion the system shall be properly flushed out.

**AA 03.06**  
**AIR TEST FOR SEWER AND DRAINS**

The following air test REQUIREMENTS as specified in the NBRI information sheet XIBOU 2-34 shall be applicable to all air tests on new sewers and drains installed under the servicing phase, and shall be executed by the Contractor and witnessed by the Engineer.

**AA 03.06.01**  
**Method of air testing**

All openings in the pipeline are plugged by means of sewer testing plugs. The sewer plug at the lowest end of the pipeline is connected to an air supply hose, which is attached to a mechanically driven air blower, compressor or hand pump. Air is pumped into the pipeline at a pressure of approximately 375 mm water gauge. The pressure is held at this level for a period of two minutes to allow the air temperature to become constant. Subsequently the air supply is closed off and the time recorded for the air pressure to drop from 250 to 125 mm water gauge. If the recorded time is less than the value given in table AA 03.06.01/1 below, it means that the pipeline leaks and does not comply with the required standards of tightness. The apparatus required for the air test is commercially available.

The following REQUIREMENTS have to be taken into account when performing the air test:

(a) Air-permeable pipelines such as vitrified clay or asbestos cement should preferably be tested when moist or wet.

(b) The trench should be partially backfilled before the test is carried out. This is to stop possible temperature variations and to prevent damage to the pipeline during subsequent backfilling operations.

(c) The testing equipment should be shielded from the direct rays of the sun.

(d) Flexible joints are recommended for sewer and drain pipelines. Good quality flexible joints are superior to cement caulked joints and they also provide the pipeline with flexibility to prevent cracking due to subsequent soil movement.

(e) The test method is very sensitive to flaws in the pipeline, such as cracks or leaking joints. The actual positions of flaws along the pipeline can be determined by using the special equipment.

(f) If the pipeline is below the water table and subjected to external water pressure, the test method should be modified so that the final pressure value is higher than that of the external water pressure acting on the lowest part of the installation.
### TABLE AA 03.06 01/1. MINIMUM TIMES FOR PRESSURE DROP OF 250 mm TO 125 mm WATER GAUGE

<table>
<thead>
<tr>
<th>PIPE (DIAMETER) (mm)</th>
<th>MINIMUM TIME (min - $)$</th>
<th>CRITICAL LENGTH OF PIPELINE (m) (58 m² INTERNAL SURFACE AREA)</th>
<th>MINIMUM TIME (S) FOR LONGER LENGTH (L) OF PIPELINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>1 - 58</td>
<td>184.6</td>
<td>0.640 L</td>
</tr>
<tr>
<td>150</td>
<td>2 - 57</td>
<td>123.1</td>
<td>1.439 L</td>
</tr>
<tr>
<td>200</td>
<td>3 - 56</td>
<td>92.3</td>
<td>2.559 L</td>
</tr>
<tr>
<td>225</td>
<td>4 - 26</td>
<td>82.1</td>
<td>3.239 L</td>
</tr>
<tr>
<td>250</td>
<td>4 - 55</td>
<td>73.8</td>
<td>3.998 L</td>
</tr>
<tr>
<td>300</td>
<td>5 - 54</td>
<td>61.5</td>
<td>5.757 L</td>
</tr>
<tr>
<td>375</td>
<td>7 - 23</td>
<td>49.2</td>
<td>8.996 L</td>
</tr>
<tr>
<td>450</td>
<td>8 - 51</td>
<td>41.0</td>
<td>12.954 L</td>
</tr>
<tr>
<td>525</td>
<td>10 - 20</td>
<td>35.2</td>
<td>17.632 L</td>
</tr>
<tr>
<td>600</td>
<td>11 - 49</td>
<td>30.8</td>
<td>23.030 L</td>
</tr>
</tbody>
</table>

#### AA04 OPERATING AND MAINTENANCE MANUALS

The Contractor shall be responsible for the compilation of an inventory list and operating and maintenance manuals.

This shall be done in accordance with Additional Specification S8 Operating and Maintenance manuals.

All information shall be recorded and captured in electronic format as well as supplying the Department with three sets of hard copies.

#### AA05 TESTS AND INSPECTIONS ON COMPLETION OF WORK

Except where otherwise provided in the Contract, the Contractor shall provide all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out such tests. The Contractor shall make arrangements for such tests and he shall give at least 72 hours notice to the Engineer, in writing, prior to commencing test.

In the event of the plant or installation not passing the test, the Employer shall be at liberty to deduct from the Contract price all reasonable expenses incurred by the Employer or the Engineer attending the repeated test.

Whenever any installation or equipment is to be operated for testing or adjusting as provided for above, the Contractor shall operate the entire system for as long a period as may be required to prove satisfactory performance at all times in the occupied space served by that system for up to twenty-four hours a day continuously until the system is handed over.

The Contractor shall provide all labour and supervision required for such operation and the Department may assign operating personnel as observers, but such observation time shall not be counted as instruction time.

After completing the installation or system, all equipment shall be tested, adjusted and readjusted until it operates to the satisfaction and approval of the Engineer.
The Contractor shall submit certificates of tests carried out to prove the performance of all equipment and also certificates to be obtained from all relevant authorities and statutory bodies, etc.

AA 06
QUALITY ASSURANCE SYSTEM

The Contractor shall institute an approved quality assurance (QA) system which shall be submitted to the Engineer for approval. The records of this QA system shall be kept throughout the duration of the Contract and be submitted to the Engineer at regular intervals as required.

AA 07
OPERATING AND COMMISSIONING OF PLANT AND INSTALLATION

On completion of the work and/or the installation of new systems the plant and equipment shall be put into operation after all tests and adjustments have been carried out to the satisfaction of the Engineer. The Contractor shall run and operate the system for a period of time as specified by the Engineer and train the staff of the User Client to operate and maintain the system. This period of time shall not exceed one month.

Logging of the operation of the installations shall commence immediately upon start-up.

The Contractor shall submit a full commissioning report.

AA 08
GUARANTEE OF INSTALLATION AND EQUIPMENT

The Contractor shall provide and obtain guarantees from the manufacturer(s) and/or supplier(s) to the effect that each piece of new equipment, supplied and installed under the maintenance and servicing contract, shall comply with the required performance and will function as part of the complete system.

All new equipment, including the complete new installations and the systems as a whole shall be guaranteed for a period of 12 (twelve) months commencing on the day of issue of a certificate of completion of the installation.

AA 09
INSTALLATIONS, SYSTEMS AND EQUIPMENT

AA 09.01 GENERAL

During the maintenance and servicing Contract all the systems, installations and equipment shall be serviced and maintained as specified in the Particular Specification. The work shall include but not be limited to the specified Particular Specification details.

All work shall be executed using approved materials and equipment suitable to the systems and/or Installations they serve.

All materials and equipment shall comply fully with the REQUIREMENTS as specified for each installation.

The said work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturers specifications and codes of practice and all additional and particular specifications included in this document.
The work items shall be listed in tabular form in the Particular Specification with all relevant details, such as capacity, size, manufacturer, model number, etc. All work shall be executed within the specified durations listed in the Appendix to Tender. All new equipment, materials and systems shall be furnished with a written guarantee with a defects liability period of 12 months from date of issue of a certificate of completion for the work. These guarantees shall be furnished in favour of the Department of Public Works. On completion of the required and specified repair work, the systems, installations and equipment shall be commissioned and handed over to the satisfaction of the Engineer.

Repair work items for the plumbing and drainage installations shall be categorised under the following headings:

(a) Rainwater disposal systems
(b) Soil and wastewater drainage systems
(c) Domestic water distribution and reticulation networks
(d) Sanitary and brassware equipment
(e) Fire water piped reticulation networks.

AA 09.02  RAINWATER DISPOSAL SYSTEMS

AA 09.02.01 General

Repair work to the rainwater disposal system shall be detailed in the Particular Specification and shall include but not be limited to the following:

(a) Replacement of damaged, broken, leaking, corroded pipework and fittings;
(b) Replacement of damaged, broken and missing rainwater outlets, stormwater catch pit gratings, manhole covers and frames and floor drains;
(c) Repair work to damaged manholes, catch pits, kerb inlets, channel drains and drain points including builder's work and benching;
(d) Initial unblocking and clearing of all rainwater drainage pipes, manholes, catch pits, drain points, channel drains and gutters;
(e) Repair and upgrading of drainage system where necessary;
(f) Provision of additional rainwater drainage points where outlets are insufficient and ponding occurs;
(g) Prevention of any unauthorised effluent into this drainage system;
(h) Reinstatement and making good of walls, tiling, floors, concrete, road surfaces, etc. to approved acceptable levels where any repair, upgrade and/or service work have been executed;
(i) Realign and fix gutters to correct falls where necessary, including additional brackets where required.
Material and equipment specification for rainwater disposal systems

Materials and equipment to be used for repair items shall be suitable and/or adaptable to the existing installation and shall comply with the following:

(a) Vitrified clay pipe and fittings

Vitrified clay pipes shall only be used for underground installations. The pipes and fittings shall strictly conform to SANS 559. The pipes and fittings shall have a minimum crushing strength of 45 kN/m.

The joining method to be used shall be polypropylene couplings with integral rubber seal similar or equal to Vitrosleeve in accordance with SANS 974 allowing up to 25 angular movement per joint and 5 mm line displacement per joint. The joint shall retain an effective water seal with regard to above conditions with a 6 m water head.

Pipes shall be cut using an approved pipe cutter and the ends shall then be trimmed by means of a pipe trimmer to remove any sharp edges.

The piping system shall be tested as indicated in this specification.

(b) Supercast cast-iron pipe and fittings

Supercast cast-iron pipes can be used for underground and above ground installations. Plain-ended cast-iron pipes and fittings, manufactured from 150 grade A grey iron in accordance with SANS 1034 shall be used. Fittings and pipes shall be free of pinholes, blowholes, blemishes, flash and foundry sand and have a smooth bore. All pipes and fittings shall be sand-blasted and coated on the inside and outside by submersion in a corrosion inhibiting oxide primer or bitumen paint.

The pipes and fittings shall be joined by means of stainless steel neoprene couplings as supplied by the manufacturer of the pipe system. The coupling shall be installed according to the manufacturer's specification and tightened with a torque wrench to a torque of 8.8 Nm.

(c) uPVC pipe and fittings above ground

uPVC pipes and fittings can be used for above ground installations.

For pipe sizes larger than 160 mm diameter uPVC class 6 pressure pipe to SANS 966 shall be used with prefabricated uPVC bends and junctions. Prefabrications shall be done by means of hot-air welding of fittings to be covered with three layers of fibreglass reinforced lining over welded sections. The resin to be used shall be as specified by the manufacturer for usage with PVC. Bends shall be manufactured out of 3 to 4 sections per bend. Pipe joints shall be done by means of couplings fixed with solvent cement for PVC piping. This joint shall be reinforced with a fibreglass lining of three layers.

Piping has to be supported and bracketed with properly sized and designed brackets consisting of two half sections clamped over the pipe and hanged with two hanger rods.

Pipes to be pressure tested in sections as specified in this specification.
(d) Prefabricated galvanized steel piping and fittings above ground

Prefabricated galvanized steel piping can be used for above ground rainwater drainage systems. The pipe to be used shall be plain ended medium gauge uncoated pipe to SANS 62 galvanized to SANS 703. All fittings are to be manufactured from the same material welded with flanged ends or rolled ends to fit clam bon fittings. All joints to be either flanged or equipped with clam bon couplings. All fittings and junction to be 45° sections.

The pipe system shall be properly secured and bracketed at regular intervals with correctly sized and designed galvanized brackets.

Pipes are to be pressure tested in sections as specified in this Specification.

(e) Geberit HOPe pipe and fittings

Geberit HOPe pipes and fittings can be used for underground and above ground installations where specified. Pipes shall be plain ended and only Geberit HOPe bends and fittings shall be used. Joining of pipes and fittings shall be done by butt welding, electro-sleeve couplings and/or flanged joints. Pipes and fittings shall only be installed by Geberit approved installers and the Contractor shall furnish a certificate to this effect. Pipes and fittings shall be installed strictly according to the Geberit application technique.

Pipes to be pressure tested in sections as specified in this specification.

(f) Roof outlets

Where waterproofing is installed, as for roof slabs, an adjustable roof outlet drainage point to be used consisting of a cast-iron unit with cast-iron ring clamp to fit over waterproofing edge and an adjustable height outlet to fit in with the screed level. For surfaces such as paving and walkways a flat grating of brass or cast iron shall be used with a catch basket. Within paving blocks a square top frame shall be used. For roof outlets a domed grating is to be used. Where roofs are to be covered with stones, a mesh shall be installed to prevent any stones from entering the rainwater system.

Two-way side outlets shall be used in cases where required.

Floor and roof outlets to be fitted to cast-iron pipe by means of SSN couplings.

AA 09.03 SOIL AND WASTEWATER DRAINAGE SYSTEM AA

09.03.01 General

Repair work to the soil and wastewater drainage system shall be detailed in the Particular Specification and shall include but not be limited to the following:

(a) Replacement of damaged, broken, leaking, corroded above and underground pipework and fittings;
(b) Replacement of damaged, broken and missing gully gratings, manhole covers and frames, cleaning eye covers, screws and bolts, inspection eye covers, end caps and vent cowls;
(c) Repair work to damaged manholes, gullies, cleaning eyes, floor drains, etc., including builder's work and benching;
(d) Initial unblocking and cleaning of all drainage pipework, traps, floor drains, gullies and sanitary ware equipment.
(e) Video surveying of all underground drainage pipework to establish root ingress, damaged pipework, fat build-up, blockages, incorrect falls, sagging and as-built information. This survey shall be utilised to establish the extent of repair and upgrade work to be executed.

(f) Repair and upgrading of soil and wastewater drainage systems where necessary;

(g) Repair work to bracketing systems including fixing and repair of existing brackets and the introduction of additional brackets where required;

(h) Repair, re-fix and bracket sanitary ware equipment to walls, floors, etc., where required;

(i) Repair, replace and clean out sanitary ware and equipment traps;

(j) Test pipe system, traps and equipment for leakage;

(k) Empty, clean out separators, clean out strainers, and test for leak tightness, repair and recommission, oil and grease separators. Check the conformance of the capacities of the oil and grease separators in relation to the facilities they serve, where necessary, these shall be upgraded and where no separators have been provided, new separators shall be provided;

(l) Reinstatement of walls, tiling, floors, concrete finishes, holes, chases, surfaces, etc., to an approved acceptable level; where any repair, upgrade and/or service work have been executed;

(m) Prepare, paint and repaint pipework and equipment where necessary in accordance with Technical Specification BH Fittings.

AA 09.03.02 Material and equipment Specification for soil and wastewater drainage systems

Material and equipment to be used for repair items shall be suitable and/or adaptable to the existing installation and shall comply with the following:

(a) Vitrified clay pipe and fittings

Vitrified clay pipes shall only be used for underground installations. The pipes and fittings shall strictly conform to SANS 559. The pipes and fittings shall have a minimum crushing strength of 45 kN/m.

The jointing method to be used shall be polypropylene couplings with integral rubber seal similar or equal to Vitroseal according to SANS 974 allowing up to 2.5° angular movement per joint and 5 mm line displacement per joint. The joint shall retain an effective water seal with regard to the above conditions with a 6 meter water head.

Pipes shall be cut using an approved pipe cutter and the ends shall then be trimmed by means of a pipe trimmer to remove any sharp edges.

The installation shall be tested according to the NBRI information sheet XIBOU 2-34

(b) Supercast cast-iron pipe and fittings

Supercast cast-iron pipes can be used for underground and above ground installations. Plain-ended spun cast-iron pipes and fittings manufactured from 150 grade A grey iron in accordance with SANS 1034 shall be used. Fittings and pipes shall be free of pinholes, blowholes, blemishes, flash and foundry sand and to have a smooth bore. All pipes and fittings are to be sand-blasted.
and coated on the inside and outside by submersion in corrosion inhibited oxide primer or bitumen paint.

The pipes and fittings shall be joined by means of stainless steel neoprene couplings as supplied by the manufacturer of the pipe system. The coupling shall be installed according to the manufacturer’s Specification and be tightened with a torque wrench to a torque of 6.8 Nm.

Where cast-iron stub stack overflow gullies are used with pipe materials such as PVC, a rubber O-ring shall be used to fit over the PVC pipe into the cast-iron fitting. The joint shall be grouted up afterwards.

Above ground piping shall be bracketed with properly sized and designed brackets according to the manufacturer’s Specification at correct intervals.

The piping system shall be tested in accordance with the NBRI information sheet XIBOU 2-34.

(c) uPVC soil and waste pipe and fittings

UPVC soil, vent and waste pipe systems can be used for underground and above ground drainage installations. This piping shall conform in all respects to SANS 971 for underground systems and to SANS 987 for above ground systems.

All underground pipes, as well as soil pipes above ground, shall be joined by means of rubber ring seal couplings and fittings in accordance with the manufacturer’s specification. All waste and vent pipes shall be joined by means of solvent weld fittings and couplings. The solvent weld glue to be used shall be as specified by the pipe manufacturer, allowing for thermal contraction and expansion.

The piping system shall be pressure tested in accordance with the NBRI information sheet XIBOU 2-34.

(d) Structural wall uPVC pipes and fittings

Structural wall uPVC drainage pipe can be used for underground drainage systems. This piping system shall be used with standard underground uPVC pipe fittings, equipped with rubber ring joints. The pipe shall be equipped with Z-lock type rubber ring joints.

The piping system shall be pressure tested in accordance with the NBRI information sheet XIBOU 2-34.

(e) Geberit HDPe pipes and fittings

Geberit HDPe pipes and fittings can be used for underground and above ground installations. Pipes shall be plain ended and only Geberit HDPe bends and fittings shall be used. Jointing of pipes and fittings shall be done by but welding, electro-sleeve couplings and/or flanged joints. Pipes and fittings may only be installed by Geberit approved installers and the Contractor shall furnish a certificate to this effect. Pipes and fittings shall be installed strictly according to the Geberit application technique.

The complete system shall be pressure tested in accordance with the NBRI information sheet XIBOU 2-34.
(f) Stainless steel floor traps and floor channels

Stainless steel floor traps and channels shall be manufactured from 304 stainless steel with a load capacity of 1500 kg. The floor traps shall have a flow capacity of 3 litre/second.

The units shall be fitted with a double water seal, large sludge box and shall be easily dismantlable for cleaning purposes. Tiling keys and waterproofing flanges shall be provided where required. Side inlets with diameter of 50 mm shall be provided for waste connections to other equipment where required.

(g) Cast-iron floor traps

Cast-iron floor traps shall be manufactured from cast iron and shall be fitted with a water seal and a large sludge box and lid to be easy removable for maintenance purposes. The unit shall be designed such as to provide access to the drainage system and to be used as a cleaning point.

AA 09.04 DOMESTIC WATER DISTRIBUTION AND RETICULATION NETWORKS

AA 09.04.01 General

Repair work to the domestic water distribution and reticulation networks shall be detailed in the Particular Specification and shall include, but not be limited to the following:

(a) Replacement of damaged, broken, leaking, corroded above and underground pipe work, fittings and equipment;

(b) Repair, replace and service valves, which shall include new gaskets, gland packings, seals, bolts and nuts, etc;

(c) Where valves do not close properly, all these valves shall be refurbished, descaled and replaced where necessary;

(d) Repair, clean and service all strainers, including the replacement of strainer elements where corroded and installation of new gaskets;

(e) Repair, service, test and readjust pressure-reducing valves. Pressure gauges are to be recalibrated and checked. Up and downstream pressures are to be logged. Downstream pressure has to be adjusted to an acceptable level, taking into account the allowable working pressure of the system and its components;

(f) Repair, service and check the proper functioning of all non-return valves;

(g) Repair, service, readjust and calibrate all safety and expansion relief valves;

(h) Repair, service and clean out all air release valves and vacuum breakers;

(i) Repair work to bracketing systems including fixing and repair of existing brackets and provision of additional brackets where required;

(k) Hot-water pipe lagging and cladding shall be inspected, repaired, sealed and replaced where required;

(k) Repair, service and log readings of water meters including cleaning of integral strainers;
(i) Water storage tanks are to be emptied, cleaned out, repaired, sealed and put back into operation. Ball float and/or filling valves to these tanks are to be serviced and repaired where required.

(m) Water pipes are to be sampled for corrosion and scaling. The Engineer will evaluate the actions to be taken if the results of this sampling indicate that attention is required.

(n) Water supply has to be sampled and chemically analysed for the suitability to the systems and materials it serves.

(o) Domestic geysers are to be repaired and serviced in accordance with the manufacturer’s Specification and shall include descaling, replacement of elements, testing for any leaks, checking of safety valve operation (replace if required), testing of the thermostat operation and set point (replace if necessary).

(p) Pressure test and sterilise repaired new installation and equipment;

(q) Reinstatement and making good of walls, tiling, floors, concrete, finishes, holes, chases, surfaces, etc, to an acceptable level where repair, upgrade and/or service work have been executed.

AA 09.04.02 Material and equipment Specification for domestic water distribution and reticulation networks

Materials and equipment to be used for repair items shall be suitable and/or adaptable to the existing installation and shall comply with the following requirements:

(a) Copper pipe installation

   (i) The installation of copper piping systems shall be done in accordance with the manufacturer’s code of practice and all relevant codes, standards and regulations.

   (ii) Copper pipes shall only be installed downstream of galvanized mild steel pipes when applicable.

   (iii) Where dissimilar metals are joined, dielectric or isolating couplings shall be used. This is not required where copper and brass dezincified alloys join.

   (iv) Copper pipes shall be of the hard drawn type Class 0 in accordance with SANS 460 and shall be joined by means of capillary soldered type fittings. No compression type fittings shall be allowed unless otherwise specified.

   (v) Copper capillary soldered type fittings shall be used in accordance with ISO 2016, SANS 1067, DIN 2856 or BSS 864.

   (vi) The soldering flux to be used shall be water based and easily flushed out, withstand temperatures above 240°C and shall contain no ammonia. The flux shall be non-toxic when dissolved in water.

   (vii) The solder to be used shall be in accordance with SANS 24 and shall consist of a material containing 97% tin and 3% copper. Solders containing lead, resin core and acid core shall not be used.

   (viii) The heat source to be used shall be propane gas with induction air, at a temperature not higher than 240 °C. The pipe ends and fittings shall be cleaned and waxed with an approved solder flux, before soldering.
The pipe and fittings shall then be fitted together and heated to the correct temperature before the solder is applied. Care must be taken not to add too much or too little solder to the joint. Immediately after setting of the solder the joint shall be wiped clean with a wet cloth. Pipes shall be washed out as soon as possible after jointing and all traces of flux shall be removed.

(ix) All bronze or brass equipment and fittings shall be of the dezincified type.

(x) Copper pipes and fitting shall be installed strictly to the manufacturers Specification and include the following:

1. No labour bends.

2. Provision for thermal contraction and expansion of pipes.

3. Pipe brackets shall be installed at appropriate positions where pipes are installed on surface level.

4. Pipes chased or built into walls or floors shall be wrapped with two layers of building paper or similar approved material. Hot and cold water pipes running next to each other shall be at least 50 mm apart.

5. Equipment fixed to copper pipe outlets, where the pipes are surface mounted or built into walls, shall be done by means of copper wall plate fittings on the copper pipes, properly secured to the structure to prevent structural damage to soldered joints.

(xi) Pipe hangers and brackets shall be of copper, copper alloy or non-conductive materials. No piece of copper pipe shall touch any other conductive surface. Brackets shall be designed to structurally support and fix the pipe system, and shall allow enough clearance from walls, soffits, etc., to insulate hot-water pipes and maintain equipment.

(xii) Pipe hangers and brackets shall be installed according to the manufacturers Specification on the following maximum spacings.

<table>
<thead>
<tr>
<th>PIPE DIAMETER (mm)</th>
<th>HORIZONTAL (metre)</th>
<th>VERTICAL (metre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>1.3</td>
<td>1.9</td>
</tr>
<tr>
<td>22 and 28</td>
<td>1.9</td>
<td>2.5</td>
</tr>
<tr>
<td>35 and 42</td>
<td>2.5</td>
<td>2.8</td>
</tr>
<tr>
<td>54</td>
<td>2.5</td>
<td>3.9</td>
</tr>
<tr>
<td>67 -105</td>
<td>2.8</td>
<td>3.9</td>
</tr>
</tbody>
</table>

(xiii) All copper pipes open to structural damage shall be protected by steel sleeves or structurally designed cover.

(xiv) All pipework shall be pressure tested and sterilised as specified.

(xv) Where flanged fittings are used, cadmium-plated bolts, nuts and spring washer shall be used to joint these flanges.

(xvi) All hot-water pipes shall be lagged as specified.
(xvii) Shut-off valves shall be installed on all branch pipes and ball-o-stop valves shall be installed on all connectors to basin pillar cocks, sink mixers, cistern type WCs and other fittings.

(xviii) All types shall be marked in accordance with SANS 10140 or as specified by the Engineer.

(xix) Approved type expansion bellows shall be installed where required for expansion and contraction to prevent excessive strain on fittings and soldered joints.

(b) Galvanized steel pipe installations

(i) All galvanized steel pipes shall be medium gauge mild steel screwed and socketed pipes to SANS 62 and shall be normalised and marked as such by the manufacturer. Pipes shall be hot-dip galvanized to SANS 763.

(ii) All fittings shall be malleable cast-iron fittings to SANS 509 and galvanized to SANS 763.

(iii) All 50 mm diameter and larger pipes shall be joined with Class 16 flanged couplings to SANS 1123/1800. The bolts, nuts and spring washers to be used on these joints shall be cadmium-plated.

(iv) In pipe ducts and elsewhere pipes shall be fixed onto walls, soffits, etc., with approved type of supports, holdenbadls, clamps, etc. Brackets shall be designed to structurally support and fix the pipe system and shall have enough clearance from walls, soffits, etc., to insulate hot-water pipes and maintain equipment.

(v) Pipes shall be supported according to the manufacturer’s Specifications with approved brackets at the following maximum intervals:

<table>
<thead>
<tr>
<th>PIPE DIAMETER (mm)</th>
<th>HORIZONTAL (metre)</th>
<th>VERTICAL (metre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 dia to 20 eta</td>
<td>1.200</td>
<td>1.630</td>
</tr>
<tr>
<td>32 dia to 40 dia</td>
<td>1.830</td>
<td>2.450</td>
</tr>
<tr>
<td>50 dia to 150 dia</td>
<td>2.450</td>
<td>3.050</td>
</tr>
</tbody>
</table>

(vi) Pipes shall be installed in such a manner as to prevent air locks. A minimum rise of 1:250 shall be maintained to high points, which shall be fitted with suitable air release valves.

(vii) All pipes shall be marked according to SANS 10140 or as specified by the Engineer. All surface pipes shall be painted.

(viii) Pipes shall be installed flush unless otherwise instructed by the Engineer.

(ix) Provision shall be made for thermal contraction and expansion.

(x) The type of pipe joint compound shall be approved by the Engineer and used sparingly with good quality hemp. For pipes larger than 50 mm diameter a jointing compound such as Epidermix 32 shall be used.
(xi) Any pipe buried shall have at least 900 mm cover and be coated and wrapped to SANS 1117 and tested in the presence of the Engineer.

(xii) All exposed hot-water pipes shall be lagged as specified.

(xiii) All pipework and fittings shall be pressure tested and sterilised as specified.

(xiv) Valves shall be installed on all branch pipes and ball-o-stop valves on all connectors to basin, pillar, sinks, mixers, cistern type WC's and other fittings.

(xv) Approved type expansion bellows shall be installed where required for expansion and contraction to prevent excessive strain on fittings and pipe joints.

(c) uPVC underground pipe installations

(i) uPVC piping shall conform to SANS 966 with rubber ring type joints.

(ii) All bends shall be uPVC type fittings with rubber ring joints.

(iii) All other fittings such as T-pieces, reducers, flanges, etc. shall be bitumen-dipped cast-iron rubber ring jointed fittings to SANS 546.

(iv) No solvent weld type fittings will be allowed.

(v) All cast-iron fittings shall be coated and wrapped to SANS 1117.

(vi) All pipes shall be laid on a 100 mm sand-bedding cradle and covered with 300 mm sand before backfilling.

(vii) All backfilling shall be in accordance with SANS 1200 DB and to the Engineer's and approval.

(viii) Pipe trenching and bedding:

<table>
<thead>
<tr>
<th>AREA</th>
<th>MINIMUM COVER</th>
<th>BEDDING TYPE</th>
<th>MAIN FILL</th>
</tr>
</thead>
</table>
| Vehicle traffic   | 1 100         | Flexible pipe bedding as per SANS 1200 LB | Soilcrete
| Under surface bed | 600           | Soilcrete    | 90% of modified AASHTO density |
| Other areas       | 900           |              |                    |

(ix) All thrust blocks shall be cast between the pipe and the undisturbed trench material.

(x) No concrete shall come into direct contact with the UPVC pipe. At the thrust blocks the bend shall be wrapped with a Densopol 80 HT Tape or similar approved.

(xi) HOPE pipe connections to uPVC pipes up to 50 mm can be done by means of SG Iron manufactured saddles with the appropriate gaskets and cadmium-plated bolts and nuts.

(xii) All pipe crossings under traffic areas shall be backfilled with soilcrete and compacted as specified.
(xiii) All pipework shall be pressure tested with all joints uncovered, to the satisfaction of the Engineer.

(xiv) Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipeline.

(d) HOPe underground pipe installations

(i) HOPE piping shall be Type 4 HOPe pipe to SANS 533

(ii) All fittings shall be of Plasoon compression type and shall conform to ISO/IDIS 3458.

(iii) All pipes shall be laid on a 100 mm sand bedding cradle and covered with 300 mm of sand of selected material.

(iv) All backfilling shall be in accordance with SANS 1200 DB and to the Engineer’s and approval.

(v) Pipe trenching and bedding:

<table>
<thead>
<tr>
<th>AREA</th>
<th>MINIMUM COVER</th>
<th>BEDDING TYPE</th>
<th>MAIN FILL</th>
</tr>
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<tbody>
<tr>
<td>Vehicle traffic</td>
<td>1 100</td>
<td>Flexible pipe bedding per SANS 1200 LB</td>
<td>Soilcrete</td>
</tr>
<tr>
<td>Undersurface bed</td>
<td>600</td>
<td></td>
<td>Soilcrete</td>
</tr>
<tr>
<td>Other areas</td>
<td>900</td>
<td>SANS 1200 LB</td>
<td>90 % of modified AASHTO density</td>
</tr>
</tbody>
</table>

(vi) No concrete shall come into direct contact with the HOPe pipe. At these points the fittings shall be wrapped with Densopol 80 HT tape or similar approved.

(vii) All pipe crossings under traffic areas shall be backfilled with soilcrete and compacted as specified.

(viii) All pipework shall be pressure tested with all joints uncovered to the satisfaction of the Engineer.

(ix) Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipeline.

(e) Valves

(i) Gate valves underground in valve chambers to connect to uPVC piping (65 mm NB and larger)

Gate valves are to be equipped with non-rising spindle, spherical graphite iron body to SANS 936 Grade 42, cast-iron nitrile butadiene rubber covered gate, stainless steel spindle, nitrile butadiene rubber O-rings and seals, cast-iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valves shall conform to SANS 664 and/or 665 and shall be capable of withstanding a working pressure of 1 600 kPa.

The valves shall be fitted with a square key spindle top to close the valves in clockwise direction and socket ends to SANS 665 to fit into uPVC Class 12 pipe and installed to detail.
(ii) Gate valves underground in valve chamber to connect to HOPe's piping

The gate valves shall be of the dezincified brass type with brass gate, brass body, non-rising spindle and BSP threaded socket ends. The valves shall conform to SANS 776 Class 125. The valves shall be able to withstand a working pressure of 1600 kPa. The valve shall be fitted with a hand wheel on an extended spindle shaft of 700 mm to close in a clockwise direction and installed to detail.

(iii) Gate valves above ground for temperatures up to 40 °C to connect to steel piping (85 mm NB and larger)

Gate valves are to be equipped with non-rising spindle, spherical graphite iron body to SANS 935 Grade 42, cast-iron nitrile butadiene rubber covered gate, stainless steel spindle, nitrile butadiene rubber O-rings and seals, cast-iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valves shall conform to SANS 664 and/or 665 and shall be capable of withstanding a working pressure of 1600 kPa.

The valves shall be fitted with flanged ends to SANS 1123, Table 16, hand wheel to close the valve in a clockwise direction and installed in an upright position or sideways to a maximum 90° from upright.

(iv) Gate valves above ground for temperatures above 40 °C to connect to steel piping (65 NB mm and larger)

Gate valves shall be equipped with non-rising spindle, spherical graphite iron body to SANS 933 Grade 42, cast-iron gate, gunmetal seat and gate rings, high-tensile bronze spindle, cast-iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valves shall conform to SANS 665 and shall be capable of withstanding a working pressure of 1600 kPa and a temperature of 90°C.

The valve shall be fitted with flanged ends to SANS 1123, Table 16, hand wheel to close the valve in a clockwise direction and installed in an upright position or sideways to a maximum 90° from upright.

(v) Gate valves above ground to fit to copper pipes (65 mm NB and larger)

Gate valves shall be equipped with non-rising spindle, gunmetal bronze or dezincified brass body, gunmetal or dezincified brass gate and graphite asbestos packing in the gland.

The valve shall be fitted with a hand wheel to close in a clockwise direction and installed in an upright position or sideways to maximum 90° from upright.

(vi) Gate valves above ground for temperatures up to 100 °C (up to 50 mm NB)

The gate valves shall be of the dezincified brass type with brass gate, brass body, non-rising spindle and BSP threaded socket ends. The valve shall conform to SANS 776, Class 125.
The valves shall be able to withstand a working pressure of 1 600 kPa.

The valve shall be equipped with a hand wheel to close in a clockwise direction.

The valve shall be installed in an upright position or sideways to a maximum 90° from upright and shall be so placed with other fittings to be removable without cutting the pipework.

(vii) Ball-O-Stop valves (15 mm diameter - 25 mm diameter)

These valves shall be full-way ballcock type with BSP threaded ends. The valves shall conform to SANS 1056, Part 3, shall be rated for a test pressure of 2 000 kPa, and shall be chrome-finished when exposed.

(viii) Angle regulating valves

These valves shall be 15 mm chromium-plated angle regulating valves with a 350 mm chromium-plated copper tube and cap nuts where required.

(f) Strainers

(i) Strainers for connection to steel or UPVC pipes (65 mm NB and larger)

These strainers shall be of the Y-type with cast-iron body, stainless steel or bronze strainer element and shall be equipped with flanged ends to SANS 1123, table 16. The hole sizes of the strainer element shall be maximum 1 mm diameter and be removable without dismantling of pipework. The strainer shall be suitable for a temperature of up to 90 °C at a 1 000 kPa pressure rating and installed with the element facing downwards or a maximum of 45° sideways.

(ii) Strainers for connection to copper pipes (65 mm NB and larger)

These strainers shall be of the Y-type with bronze or dezincified brass body, stainless steel strainer element and must be equipped with flanged ends to SANS 1123, table 16. The hole sizes of the strainer element shall be maximum 1 mm diameter. The strainer element shall be removable without dismantling of pipework. The strainer shall be suitable for a temperature of up to 90 °C at a 1 000 kPa pressure rating and installed with the element facing downwards or a maximum of 45° sideways.

(iii) Strainers for connection to steel and copper pipes (up to 50 mm NB)

These strainers shall be of the Y-type with bronze or dezincified brass body, stainless steel strainer element and must be equipped with BSP threaded socket ends. The hole sizes of the strainer element shall be maximum 0.8 mm diameter. The strainer shall be suitable for a temperature of up to 90 °C at a pressure rating of 1 000 kPa and installed with the element facing downwards or a maximum of 45° sideways.
(g) Non-return valves

(i) Non-return valves for cold water (55 mm NB and larger)

The non-return valve shall be of the spring-loaded dual flap plate type fitted between two flanges (wafer).

The non-return valve shall be equipped with a cast-iron body, aluminium bronze plates, stainless steel springs and neoprene seals on the plates. The valves shall be suitable for a working pressure of 1 000 kPa.

(ii) Non-return valves for hot water (up to 100 mm NB) and cold water (up to 50 mm NB)

These non-return valves shall be of the spring-loaded piston type with bronze or dezincified brass body, stainless steel spring and bronze disc with neoprene seal fitted with BSP threaded socket ends. The valve shall be suitable for a working pressure of 1 000 kPa and a temperature of up to 90°C. All valves shall be installed as to be removable without extensive pipework removal.

(h) Air release valves and vacuum breakers

(i) Double orifice double-acting air release valves with sizes from 50 mm NB to 200 mm NB

This air release valve shall be fitted with small and large orifice. The air release valve shall be fitted with a cast-iron body, stainless steel or fibreglass ball, integral shut-off valve and flanged ends to SANS 1123, table 16.

The valve shall be suitable for maximum pressure of 1 000 kPa.

(ii) Single orifice air release valves for main water lines with sizes from 25 mm NB to 50 mm NB

This air release valve shall be fitted with a small orifice, cast-iron body, fibre glass or stainless steel ball float and BSP threaded inlet.

When the valve is installed a shut-off valve shall be installed on the inlet side.

The valve shall be suitable for maximum pressure of 1 600 kPa.

(iii) Single orifice double purpose air release valves for domestic water lines up to 15 mm NB

This air release valve shall be fitted with a stainless steel float, brass or cast steel body with an integral shut-off valve fitted.

The valve shall be capable to withstand a working pressure of 1 000 kPa at 110°C.

(iv) Vacuum breaker up to 40 mm diameter

The vacuum breaker shall be fitted with neoprene seal, spring-loaded disc in a dezincified brass or bronze body. The valve shall seal watertight and shall be designed to withstand a working pressure of 1 000 kPa and a temperature of 50°C.
(i) Pressure-reducing valves

(ii) Combination pressure-reducing stations

Where a high peak flow as well as a small flow can occur and the small flow is out of the range of the large pressure-reducing valve, a small pressure-reducing valve is installed in parallel with the large pressure-reducing valve. The two pressure-reducing valves in parallel shall be set according to the manufacturer’s Specification.

(iii) Large pressure-reducing valves (65 mm NB and larger)

This pressure-reducing valve shall be equipped with a cast-iron body, neoprene nylon-reinforced diaphragm, bronze seal disc washer, stainless steel shaft and flanged ends. The valve shall be pilot operated and shall be designed to handle high flows at a minimum head loss.

The valve must be adjustable to handle a wide range of incoming pressures at a constant downstream pressure.

The valve shall be equipped with flanged ends to SANS 1123, table 16.

(iv) Small pressure-reducing valves (15 mm NB to 50 mm NB)

This pressure-reducing valve shall be equipped with brass body, balanced single seat and integral strainer. The valve shall be able to handle a wide range of incoming pressures while the downstream pressure stays constant with maximum inlet pressure of 1 000 kPa and a maximum water temperature of 40°C.

The valve shall be equipped with BSP male threaded brass union couplings.

U) Water meters

(i) Combination water meters

Where high peak flow, as well as a small flow, can occur and the small flow is out of the registration range of the large water meter, a small water meter shall be installed in parallel with the large water meter to cater for the small flows with integral automatic change-over valves. These valves shall be designed to have a minimum pressure drop at operating point.

(ii) Water meters (50 mm NB and larger)

These water meters shall be of the dry type with all gears and transmission and roller counters in a dry head, and shall be equipped with flanged ends to SANS 1123, cast-iron body with high quality corrosion-proof coating. The meter shall be protected from magnetic fields and sealed to prevent tampering with adjustments. The meter must be able to work up to a pressure of 1800 kPa under a maximum water temperature of 40°C. The scale of meter must be in cubic metre (m³) and equipped with needle indicators reading in litres. Accuracy of meter shall be not less than 98%.

The meters shall be installed with leading and trailing lengths of pipes to the manufacturer’s Specification.
(iii) Water meters (up to 50 mm NS)

The meter shall be of the volumetric rotary piston type with brass body equipped with union couplers. The meter reading must be in kilolitres. The meter shall have an accuracy of not less than 98%. The meter shall be able to operate up to a water pressure of 1000 kPa at a water temperature of 40°C.

The meters shall be installed with leading and trailing lengths of pipes to the manufacturer’s Specification.

(k) Adjustable balancing valves

Adjustable balancing valves shall be supplied and installed as indicated on the applicable drawings. A portable differential pressure meter shall be used, with all the necessary pipes, shut-off valves and air release valves to set the balancing valves. A graph chart shall be supplied to indicate the flow units against the valve adjustment and as the pressure differential over the valve.

The pressure gauge shall be calibrated according to the current accepted SI units.

The calibrated adjustable balancing valves shall be of the angle valve type equipped with bronze valve body, bronze disc, internal seals with SSP threaded ends. The valve shall be fitted with stop-cock connection ends on inlet and outlet onto which the differential pressure gauge can be coupled. The valve shall be equipped with an indicator on the valve handle to show the position of the valve opening. The valve shall be suitable for operating at a temperature of 90°C against a pressure of 1000 kPa.

(l) Semi-conductive reheating tape for hot-water pipes

Semi-conductive reheating tape shall be strapped to the hot-water pipes under the thermal insulation. This reheating tape shall be installed strictly according to the manufacturer’s Specification.

The system shall be fitted with all the necessary end seals, tee splices, straps, etc. as required by the supplier.

The reheating tape shall be of the self-regulating type equipped with a parallel circuit, self-regulating conductive core, polyolefin jacket and tinned copper braid on the outside.

The reheating tape shall be sized to maintain an operating temperature of 60°C of water inside the pipe.

(m) Expansion bellows

(i) Expansion bellows for pipes (50 mm NS and larger)

Expansion bellows shall be of the rubber-lined type fitted between flanges. These bellows shall be suitable for an operating temperature of -10°C to 110°C at an operating pressure of 1500 kPa. The bellows shall be installed strictly in accordance with the manufacturer’s Specifications.
(ii) Expansion bellows for copper pipes (up to 40 mm NB)

These expansion bellows shall have a copper body with corrugated stainless steel lining and soldered capillary type couplings. The bellows shall be capable to withstand a working pressure of 600 kPa at a temperature of 140°C. Installation shall be strictly in accordance with the manufacturer’s Specifications.

(n) Lagging of hot-water pipes

(i) Preformed closed cell flame retarded flexible insulation sections

Where pipes are installed in service ducts, ceiling voids and where specified the pipes shall be insulated with Thermaflex preformed pipe insulation sections. This insulation shall be used with pipe systems where the maximum temperature is 80°C. For a temperature higher than 80 °C preformed fibreglass sections shall be used with galvanized sheet metal muffs.

All bends and T-pieces shall be cut in a 45° mitre box to form a neat joint. All joints shall be glued together with a contact adhesive supplied by the manufacturer. Pipe sizes larger than 50 mm diameter shall be insulated with preformed fibreglass sections with canvas covers glued together with cold wood glue.

Thermaflex thickness for various pipe sizes shall be as follows:

<table>
<thead>
<tr>
<th>PIPE SIZE (STEEL)</th>
<th>PIPE SIZE (COPPER)</th>
<th>THERMAFLEX THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mm dia</td>
<td>54 mm dia</td>
<td>20mm</td>
</tr>
<tr>
<td>40 mm dia</td>
<td>42 mm dia</td>
<td>20 mm dia</td>
</tr>
<tr>
<td>32 mm dia</td>
<td>35 mm dia</td>
<td>15 mm dia</td>
</tr>
<tr>
<td>25 mm dia</td>
<td>28 mm dia</td>
<td>15 mm dia</td>
</tr>
<tr>
<td>20 mm dia</td>
<td>22 mm dia</td>
<td>15 mm dia</td>
</tr>
<tr>
<td>15 mm dia</td>
<td>15 mm dia</td>
<td>15 mm dia</td>
</tr>
</tbody>
</table>

(ii) Preformed fibreglass sections with galvanized sheet metal muffs

All hot-water pipes in service tunnels, service corridors and where exposed to damage and/or weather shall be insulated with preformed fibreglass sections covered with galvanized sheet metal muffs in a watertight manner. Sheet metal muffs shall be installed with the joints overlapping at least 50 mm and the longitudinal overlap pointing downwards to prevent ingress of water. The sheet metal muff shall be strapped with 10 mm galvanized straps by means of a strapping tool with a minimum of 2 straps/section. All pipe bends, T-pieces, etc., shall be insulated with 25 mm diameter fibreglass rope covered with a 12 mm thick layer of self-setting fibre cement. A reinforcing gauge shall be wrapped over the fibre cement while wet and painted with mastic paint when dry.

Fibreglass section thickness for the various pipe sizes shall be as follows:
### SANITARY AND BRASSWARE EQUIPMENT

Repair work to the sanitary and brassware equipment is detailed in the Particular Specification and shall include but not be limited to the following:

(a) Damaged and/or broken irreparable sanitary and brassware equipment shall be replaced with equal Specification equipment or approved alternative. These shall be installed strictly to the manufacturers Specifications.

(b) Sanitary and brassware equipment that are unsuitable for the purpose and application they serve are to be replaced with suitable equipment.

(c) The quantity of sanitary and brassware equipment for the number of people and application they serve, shall be investigated in accordance with the current SANS 10400 application regulations. If found to be insufficient these facilities shall be upgraded only if approved by the Engineer.

(d) Loose sanitary ware shall be re-fixed and bracketed to structures in accordance with the manufacturers Specifications.

(e) Stained sanitary ware equipment shall be cleaned where possible, with approved cleaning agent in accordance with the manufacturers Specification.

(f) All cisterns are to be cleaned out and filling and flushing mechanisms shall be serviced and repaired. Where beyond repair status these items shall be replaced with equal Specification or approved alternatives.

(g) All worn-out and leaking flush valves are to be repaired by utilising the manufacturers replacement kits. Where flush valves are damaged beyond repair these shall be replaced with equal Specification or approved alternatives.

(h) All pillar taps, mixers, sink taps and other taps are to be serviced, utilising repair kits. Where equipment is beyond repair these items shall be replaced with equal Specification or approved alternatives Where equipment connections are loose these shall be properly secured to sanitary ware and other equipment.

(i) Leaking, corroded or damaged chromium-plated flush pipes to water-closets and urinals are to be replaced where required.

U> Replace missing and/or damaged shower gratings with equal Specification or approved alternatives.
(k) Service and repair water metering taps by utilising manufacturer's replacement kits where necessary. Where damaged beyond repair the complete item shall be replaced with equal Specification or approved alternative.

(l) Replace missing or damaged tap handles with matching handles from the manufacturer of the tap.

(m) Readjust all timing mechanisms on flush valves and metering taps in accordance with repairs and services to the correct flushing and flow times.

(n) Replace damaged or missing basin and/or sink mixer swivel arms with equal Specification or approved alternative.

(o) Replace missing or damaged toilet seats and covers with equal Specification or approved alternatives.

(p) Repair and service urinal syphonic valves with replacement kits from manufacturer. Where no spares are available or equipment is damaged beyond repair, these items are to be replaced with equal Specification or approved alternatives.

(q) Repair and clean out all bottle traps. Bottle traps that are damaged beyond repair are to be replaced with equal Specification or approved alternatives.

(r) Repair and service bath taps and mixers by utilising manufacturer's replacement kits. Where damaged beyond repair, the taps and mixers shall be replaced with equal Specification or approved alternatives.

AA 09.06 FIRE WATER PIPED RETICULATION NETWORKS

AA 09.06.01 General

Repair work to the fire water piped reticulation networks is detailed in the Particular Specification and shall include but not be limited to the work described below. This Specification only covers the water piped reticulation for the fire water protection system, while the equipment to this installation, such as fire hydrants, hose reels and extinguishers, are covered and detailed in Technical Specification JC: Conventional Fire Fighting Equipment. This Specification has to be read in conjunction with the afore-mentioned Specification.

(a) Replace damaged, broken, leaking, corroded above and underground pipework, fittings and equipment.

(b) Repair, replace and service valves which shall include new gaskets, gland packings, seals, bolt and nuts, etc.

(c) Where valves do not close properly, all these valves are to be refurbished, descaled and if necessary replaced.

(d) Repair, service and check the proper functioning of all non-return valves and backflow preventers.

(e) Repair, service, readjust and calibrate all pressure gauges.

(f) Repair bracketing systems including fixing and repair of existing brackets and the provision of additional brackets where required.

(g) Report all problems related to fire fighting equipment to the Engineer.
(h) Water storage tanks are to be emptied, cleaned out, repaired sealed and put back into operation Ball float and/or filling valves to these tanks are to be serviced and repaired where required.

(i) Pressure test and sterile repaired new installation and equipment.

(ii) Reinstate and make good walls, tiling, floors, concrete finishes, holes, chases, surfaces, etc. to an acceptable level where any repair, upgrade and/or service work have been executed.

(k) Record pressure readings on supply to installation.

AA 09.06.02 Material and equipment Specification for fire water piped reticulation networks

Materials and equipment to be used for repair items shall be suitable and/or adaptable to the existing installation and shall comply with the following:

(a) Galvanized steel pipe installation

(i) All galvanized steel pipes shall be medium gauge mild steel screwed and socketed pipes to SANS 62 and shall be normalised and marked as such by the manufacturer. Pipes shall be hot-dip galvanized to SANS 763.

(ii) All fittings shall be malleable cast-iron fittings to SANS 509 and galvanized to SANS 763.

(iii) All 80 mm diameter and larger pipes shall be joined with Class 16 flanged couplings to SANS 1123/1600. The bolts, nuts and spring washers to be used on these joints shall be cadmium-plated.

(iv) In pipe ducts and elsewhere pipes shall be fixed onto walls, soffits, etc. with approved type of supports, holdebars, clamps, etc. Brackets shall be designed to structurally support and fix the pipe system and shall have enough clearance from walls, soffits, etc. to maintain equipment.

(v) Pipes shall be supported according to the manufacturer's Specifications at the following maximum intervals:

<table>
<thead>
<tr>
<th>NORMAL SIZE (mm)</th>
<th>HORIZONTAL (mm)</th>
<th>VERTICAL (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 dia to 20 dia</td>
<td>1200</td>
<td>1830</td>
</tr>
<tr>
<td>32 dia to 40 dia</td>
<td>1830</td>
<td>2450</td>
</tr>
<tr>
<td>50 dia to 150 dia</td>
<td>2450</td>
<td>3050</td>
</tr>
</tbody>
</table>

(vi) All pipes shall be marked according to SANS 10140 or as specified by the Engineer. All surface pipes shall be painted.

(vii) Pipes shall be installed on the surface, unless otherwise specified.

(viii) Provision shall be made for thermal contraction and expansion.

(ix) The type of pipe joint compound shall be approved by the Engineer and used sparingly with good quality hemp. For pipes larger than 80 mm diameter a jointing compound such as Epidermix 32 shall be used.
(x) Any buried pipe shall have at least 900 mm cover and be coated and wrapped to SANS 1117 and tested in the presence of the Engineer.

(xi) All pipework and fittings shall be pressure tested as specified.

(b) uPVC underground pipe installations

(i) uPVC piping shall conform to SANS 986 with rubber ring type joints.

(ii) All bends shall be uPVC type fittings with rubber ring joints.

(iii) All other fittings such as T-pieces, reducers, flanges, etc. shall be bitumen-dipped cast-iron rubber ring jointed fittings to SANS 545.

(iv) No solvent weld type fittings will be allowed.

(v) All cast-iron fittings shall be coated and wrapped to SANS 1117.

(vi) All pipes shall be laid on a 100 mm sand bedding cradle and covered with 300 mm sand before backfilling.

(vii) Pipe trenching and bedding:

<table>
<thead>
<tr>
<th>AREA</th>
<th>MINIMUM COVER</th>
<th>BEDDING TYPE</th>
<th>MAIN FILL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle traffic</td>
<td>1100</td>
<td>Flexible pipe bedding as per SANS 1200 LB</td>
<td>Soilcrete</td>
</tr>
<tr>
<td>Under surface</td>
<td>800</td>
<td></td>
<td>Soilcrete</td>
</tr>
<tr>
<td>bed</td>
<td></td>
<td></td>
<td>90% of modified AASHTO density</td>
</tr>
<tr>
<td>Other areas</td>
<td>900</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(viii) All thrust blocks shall be cast between the pipe and the undisturbed trench material.

(ix) No concrete shall come into direct contact with the uPVC pipe. At the thrust blocks the bend shall be wrapped with Densopol 80 HT tape or similar approved.

(x) HOPE pipe connections to uPVC pipes up to 40 mm diameter can be done by means of SG Iron manufactured saddles with the appropriate gaskets and cadmium-plated bolts and nuts.

(xi) All pipe crossings under traffic areas shall be backfilled with soilcrete and compacted as specified.

(xii) All pipework shall be pressure tested with all joints uncovered to the satisfaction of the Engineer.

(xiii) Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipeline.

(xiv) Duckfoot bends shall be used to all fire hydrants at the foot of fire hydrants. This to be cast into thrust blocks.

(c) HOPE underground pipe installations

(i) All HOPE piping shall be Type 4 HOPE pipe to SANS 533.
(iii) All fittings shall be of Plaxson compression type and shall conform to ISODIS 3458.

(iv) All pipes shall be laid on a 100 mm sand bedding cradle and covered with 300 mm of sand or selected material.

(v) All backfilling shall be to the SANS 1200 DB and to the Engineer's approval.

(vi) Pipe trenching and bedding

<table>
<thead>
<tr>
<th>AREA</th>
<th>MINIMUM COVER</th>
<th>BEDDING TYPE</th>
<th>MAIN FILL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle traffic</td>
<td>1 100</td>
<td>Flexible pipe bedding as per SANS 1200 LB</td>
<td>Soikrete 90 % of modified AASHTO density</td>
</tr>
<tr>
<td>Undersurface bed</td>
<td>600</td>
<td>Soikrete</td>
<td></td>
</tr>
<tr>
<td>Other areas</td>
<td>900</td>
<td>SANS 1200 LB</td>
<td></td>
</tr>
</tbody>
</table>

(vii) No concrete shall come into direct contact with the HOPE pipe. At these points the fittings shall be wrapped with Densopol HT tape or similar approved.

(viii) All pipe crossings under traffic areas shall be backfilled with soilcrete and compacted as specified.

(ix) All pipework shall be pressure tested with all joints uncovered to the satisfaction of the Engineer.

(x) Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipeline.

(d) Valves

(i) Gate valves underground in valve chambers to connect to uPVC piping (65 mm NB and larger)

Gate valves are to be equipped with non-rising spindle, spherical graphite iron body to SANS 936 Grade 42, cast-iron nitrile butadiene rubber covered gate, stainless steel spindle, nitrile butadiene rubber a-rings and seals, cast-iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valves shall conform to SANS 664 and/or 665 and shall be capable of withstanding a working pressure of 1 600 kPa.

The valves shall be fitted with a square key spindle top to close the valves in clockwise direction and socket ends to SANS 665 to fit into uPVC.

Valves are to be provided with locking devices to lock valves in open position.

(ii) Gate valves underground in valve chambers to connect to uPVC Qi.Qi ng

The gate valves shall be of the dezincified brass type with brass gate, brass body, non-rising spindle and SSP threaded socket ends. The valves shall conform to SANS 776 Class 125. The valves shall be able to withstand a working pressure of 1 600 kPa. The valve shall be
fitted with a hand wheel on an extended spindle shaft of 700 mm to close in a clockwise direction and installed to detail.

(iii) Gate valves above ground to connect to steel (65 NB and larger)

Gate valves are to be equipped with non-rising spindle, spherical graphite iron body to SANS 936 Grade 42, cast-iron nitrile butadiene rubber covered gate, stainless steel spindle, nitrile butadiene rubber O-rings and seals, cast-iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valves shall conform to SANS 664 and/or 665, and shall be capable of withstanding a working pressure of 1600 kPa.

The valves shall be fitted with flanged ends to SANS 1123/1600 hand wheel to close the valves in a clockwise direction and installed in an upright position or sideways to maximum 90° from upright.

These valves shall be equipped with locking devices to lock valves in open position.

(iv) Gate valves above ground (up to 50 mm NB)

The gate valves shall be of the dezincified brass type with brass gate, brass body, non-rising spindle and BSP threaded socket ends. The valves shall conform to SANS 776 Class 125.

The valves shall be able to withstand a working pressure of 1600 kPa.

The valve shall be equipped with a hand wheel to close in a clockwise direction.

The valves shall be installed in an upright position or sideways to maximum 90° from upright and shall be so placed with other fittings as to be removed without cutting the pipework.

The valves shall be equipped with locking devices to lock valves in open position.

AA10 MAINTENANCE TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

AA 10.01 GENERAL

Monthly maintenance responsibilities for each installation including all units and components as specified, shall commence with access to the site. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.

Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period.

This part of the Contract shall include routine preventative maintenance, corrective maintenance and breakdown maintenance, as defined in Additional Specification SA: General Maintenance for the specified installations described under the section AA 01 of this document.
The maintenance work to be performed and executed shall be done strictly in accordance with the Specification, General Maintenance and as specified in the Particular Specification and this Specification. The said maintenance work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws and the manufacturer's specifications and codes of practice.

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor.

All new equipment, components and materials supplied and installed under the maintenance Contract shall be furnished with prescribed manufacturer's guarantees.

The maintenance work and items are to be categorised for each maintenance activity under the following headings:

(a) Rainwater disposal system
(b) Soil and wastewater drainage systems
(c) Domestic water distribution and reticulation systems
(d) Sanitary and brassware equipment
(e) Fire water piped reticulation networks

AA 10.02 ROUTINE PREVENTATIVE MAINTENANCE

This routine maintenance of the installations, systems and equipment shall be done in accordance with the Specification, General Maintenance and the Particular Specification related to this work.

The routine maintenance work to be performed and executed shall include, but not be limited to the items listed in tables AA 10.02/1, AA 1002/2, AA 10.02/3, AA 10.02/4 and AA 1010215 below under each heading.

These actions and findings shall be logged and reported on the relevant approved schedules and reports.

**TABLE AA 10.02/1 - RAINWATER DISPOSAL SYSTEM**

<table>
<thead>
<tr>
<th>NO</th>
<th>ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION</th>
<th>MAINTENANCE FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clean out and clear all rainwater gutters and full bores</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>2</td>
<td>Clean out and clear all catch pits, channel drains and floor outlets</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>3</td>
<td>Clean and unblock all drain pipes</td>
<td>Annually</td>
</tr>
<tr>
<td>4</td>
<td>Check alignments of gutters</td>
<td>Six-monthly</td>
</tr>
<tr>
<td>5</td>
<td>Check and inspect all rainwater outlet gratings and replace if necessary</td>
<td>Six-monthly</td>
</tr>
<tr>
<td>6</td>
<td>Check gutter and pipe bracketing system and repair and replace if necessary</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>7</td>
<td>Check and inspect manhole covers and frames for damages and replace if necessary</td>
<td>Six-monthly</td>
</tr>
<tr>
<td>8</td>
<td>Paint repairs to surface piping and equipment</td>
<td>Annually</td>
</tr>
<tr>
<td>9</td>
<td>Visually inspect and report on total system</td>
<td>Monthly</td>
</tr>
</tbody>
</table>
### TABLE AA 10.0212 - SOIL AND WASTEWATER DRAINAGE SYSTEM

<table>
<thead>
<tr>
<th>NO</th>
<th>ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION</th>
<th>MAINTENANCE FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Visually inspect and report on complete installation</td>
<td>Monthly</td>
</tr>
<tr>
<td>2</td>
<td>Check, service and clean out grease traps</td>
<td>Monthly</td>
</tr>
<tr>
<td>3</td>
<td>Check, service and clean out oil separators</td>
<td>Monthly</td>
</tr>
<tr>
<td>4</td>
<td>Check, inspect and clean out all floor drains</td>
<td>Monthly</td>
</tr>
<tr>
<td>5</td>
<td>Check, inspect and clean out all gullies</td>
<td>Monthly</td>
</tr>
<tr>
<td>6</td>
<td>Replace broken or missing gully gratings</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>7</td>
<td>Check, inspect, repair or replace all manhole covers and frames and builder's work to manholes</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>8</td>
<td>Check, inspect and repair manhole benches</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>9</td>
<td>Check, inspect, repair or replace all inspection eyes, end caps and cleaning eye covers</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>10</td>
<td>Check, inspect, repair or replace all bracketing systems</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>11</td>
<td>Check, inspect, report and unblock any blockage that occurs</td>
<td>Monthly</td>
</tr>
<tr>
<td>12</td>
<td>Check, inspect, repair/replace and clean out all equipment traps</td>
<td>Monthly</td>
</tr>
<tr>
<td>13</td>
<td>Paint repairs to surface piping and equipment</td>
<td>Annually</td>
</tr>
<tr>
<td>14</td>
<td>Video survey and resultant repairs and unblocking of all main sewer lines</td>
<td>At start of Contract</td>
</tr>
<tr>
<td>15</td>
<td>Check, inspect, service, repair/replace all vacuum and mo-way vents</td>
<td>Four-monthly</td>
</tr>
</tbody>
</table>

### TABLE AA 10.02/3 - DOMESTIC WATER DISTRIBUTION AND RETICULATION SYSTEMS

<table>
<thead>
<tr>
<th>NO</th>
<th>ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION</th>
<th>MAINTENANCE FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Visually inspect and report on complete system</td>
<td>Monthly</td>
</tr>
<tr>
<td>2</td>
<td>Log all water meter readings</td>
<td>Monthly</td>
</tr>
<tr>
<td>3</td>
<td>Log all pressure gauge readings</td>
<td>Monthly</td>
</tr>
<tr>
<td>4</td>
<td>Check inspect, report and repair leaks</td>
<td>Monthly</td>
</tr>
<tr>
<td>5</td>
<td>Replace all valve gaskets, gland packings and seals</td>
<td>Annually</td>
</tr>
<tr>
<td>6</td>
<td>Sample water supply and chemical analyses to be provided by approved company</td>
<td>Annually</td>
</tr>
<tr>
<td>NO</td>
<td>ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION</td>
<td>MAINTENANCE FREQUENCY</td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>7</td>
<td>Water storage tanks to be emptied, cleaned out, inspected, repaired and resealed where necessary</td>
<td>Annually</td>
</tr>
<tr>
<td>8</td>
<td>Check, inspect, service, repair and readjust all pressure-reducing valves</td>
<td>Annually</td>
</tr>
<tr>
<td>9</td>
<td>Check, inspect and test operation of all valves on site</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>10</td>
<td>Clean out all strainers</td>
<td>Monthly</td>
</tr>
<tr>
<td>11</td>
<td>Check, inspect, service test and repair/replace all safety and expansion release valves</td>
<td>Six-monthly</td>
</tr>
<tr>
<td>12</td>
<td>Check, inspect, repair or replace all bracketing systems</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>13</td>
<td>Check, inspect, service, repair/replace all air release valves and vacuum breakers</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>14</td>
<td>Check, service, repair or replace all ball float valves</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>15</td>
<td>Check, inspect, test, service, repair/replace all geyser installations</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>16</td>
<td>Check, inspect, test, service and repair/replace all non-return valves</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>17</td>
<td>Paint repairs to piping, fittings and equipment</td>
<td>Annually</td>
</tr>
</tbody>
</table>

**TABLE AA 10.02/4 - SANITARY AND BRASSWARE EQUIPMENT**

<table>
<thead>
<tr>
<th>NO</th>
<th>ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION</th>
<th>MAINTENANCE FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Visually inspect and report on complete installation</td>
<td>Monthly</td>
</tr>
<tr>
<td>2</td>
<td>Inspect, repair/replace WC seats and covers</td>
<td>Monthly</td>
</tr>
<tr>
<td>3</td>
<td>Replace all tap washers</td>
<td>Six-monthly</td>
</tr>
<tr>
<td>4</td>
<td>Replace all tap gland packings</td>
<td>Six-monthly</td>
</tr>
<tr>
<td>5</td>
<td>Check, inspect, repair, fix and where necessary replace sanitary ware mountings and brackets</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>6</td>
<td>Check, inspect, service, repair/replace all cistern flushing mechanisms</td>
<td>Monthly</td>
</tr>
<tr>
<td>7</td>
<td>Check, inspect, service, repair/replace all brassware</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>8</td>
<td>Check, inspect, service, repair/replace all sanitary ware</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>9</td>
<td>Check, inspect, service, repair, readjust all flushing valves</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>10</td>
<td>Replace all flushing valve internal parts with replacement kits</td>
<td>Once per Contract</td>
</tr>
<tr>
<td>NO</td>
<td>ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION</td>
<td>MAINTENANCE FREQUENCY</td>
</tr>
<tr>
<td>----</td>
<td>-------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>11</td>
<td>Stained equipment to be cleaned with approved manufacturer's cleaning agent</td>
<td>Six-monthly</td>
</tr>
<tr>
<td>12</td>
<td>Check, inspect, report and repair all leaks</td>
<td>Monthly</td>
</tr>
<tr>
<td>13</td>
<td>Check, inspect, repair/replace all shower gratings</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>14</td>
<td>Paint repairs to all equipment</td>
<td>Annually</td>
</tr>
<tr>
<td>15</td>
<td>Check, inspect, repair, service, replace all missing valves</td>
<td>Six-monthly</td>
</tr>
<tr>
<td>16</td>
<td>Replace missing tap handles</td>
<td>As occur</td>
</tr>
<tr>
<td>17</td>
<td>Re_Replace missing bath, basin, sink, etc. plugs</td>
<td>As occur</td>
</tr>
</tbody>
</table>

TABLE AA 10.02/5 - FIRE WATER PIPED RETICULATION NETWORKS

<table>
<thead>
<tr>
<th>NO</th>
<th>ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION</th>
<th>MAINTENANCE FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Visually inspect and report on complete system</td>
<td>Monthly</td>
</tr>
<tr>
<td>2</td>
<td>Report any failures/breakage of fire fighting equipment to the Engineer</td>
<td>Monthly</td>
</tr>
<tr>
<td>3</td>
<td>Log all pressure gauge readings</td>
<td>Monthly</td>
</tr>
<tr>
<td>4</td>
<td>Replace all valve gaskets, gland packings and seals</td>
<td>Annually</td>
</tr>
<tr>
<td>5</td>
<td>Water storage tanks to be cleaned out resealed/repair if necessary</td>
<td>Annually</td>
</tr>
<tr>
<td>6</td>
<td>Check, inspect, service, repair/replace all non-return valves and backflow preventers</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>7</td>
<td>Check, inspect, report and repair all leaks</td>
<td>Monthly</td>
</tr>
<tr>
<td>8</td>
<td>Inspect, service, readjust and calibrate all pressure gauges</td>
<td>Four-monthly</td>
</tr>
<tr>
<td>9</td>
<td>Paint repairs to piping, fittings and equipment</td>
<td>Annually</td>
</tr>
<tr>
<td>10</td>
<td>Check, inspect, repair or replace all bracketing systems</td>
<td>Four-monthly</td>
</tr>
</tbody>
</table>

AA 10.03 CORRECTIVE MAINTENANCE

The corrective maintenance of the installations, systems and equipment shall be done in accordance with Additional Specification SA: General Maintenance and the Particular Specification related to this work.

The Contractor shall inspect and check all equipment, materials, systems and installation for any pending breakdowns, maladjustments or anomalies of equipment.

The Contractor shall report and take actions to correct such deficiencies.
BREAKDOWN MAINTENANCE

Breakdown maintenance of the installations, systems and equipment shall be done in accordance with Additional Specification SA: General Maintenance.

All breakdown problems experienced shall be acted upon within the time limitations allowed in the General Maintenance documents.

All breakdown maintenance shall be done in accordance with the related Specifications, standards, regulations and codes.

The Contractor shall have access to the necessary spares, equipment and tools for the expected breakdowns.
PARTICULAR SPECIFICATION

PAA PLUMBING AND DRAINAGE INSTALLATION

CONTENTS

PAA01 SCOPE
PAA02 GENERAL DESCRIPTION OF INSTALLATION
PAA03 TECHNICAL DETAILS OF EXISTING INSTALLATION
PAA04 STATUS OF EXISTING INSTALLATION
PAA05 DETAILS OF REPAIR WORK
PAA06 MEASUREMENT AND PAYMENT
PAA07 DETAILS OF MAINTENANCE WORK

PAA01 SCOPE

This Specification covers the particulars of the servicing and maintenance work to the plumbing and drainage installations at the various sites. This particular Specification shall be read in conjunction with the Technical Specification AA: Plumbing and Drainage Installation, and all additional and technical Specifications compiled as part of this document, in particular the following Additional Specifications:

- SA: General Maintenance
- SC: General Decommissioning, Testing and Commissioning Procedures

The various sites consist of various facilities, as listed below, which form part of the maintenance contract for plumbing and drainage installation.

1. Maseru Bridge Port of Entry

<table>
<thead>
<tr>
<th>No.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>9 (No) x Lower Residential buildings with carports</td>
</tr>
<tr>
<td>02</td>
<td>11 (No) x Upper Residential buildings with garages</td>
</tr>
<tr>
<td>03</td>
<td>2 (No) x Buildings in Ladybrand (One is a pre-fabricated building)</td>
</tr>
<tr>
<td>04</td>
<td>1(No) x Single quarters three storey buildings</td>
</tr>
<tr>
<td>05</td>
<td>Swimming pool/ braai area</td>
</tr>
<tr>
<td>06</td>
<td>1 (No) x Community hall</td>
</tr>
<tr>
<td>07</td>
<td>1 (No) x Swimming pool with Braai area</td>
</tr>
<tr>
<td>08</td>
<td>1 (No) Operational buildings</td>
</tr>
<tr>
<td>09</td>
<td>1 (No) Upper residential area storerrooms</td>
</tr>
<tr>
<td>10</td>
<td>3 (No) x Residential mobile homes</td>
</tr>
<tr>
<td>11</td>
<td>5(No) x Operational mobile/park homes</td>
</tr>
<tr>
<td>12</td>
<td>Covered carports in Operational area</td>
</tr>
</tbody>
</table>
GENERAL DESCRIPTION OF INSTALLATIONS

The existing plumbing and drainage installations provide potable hot and cold water to the various buildings at Maseru Bridge Port of Entry. The potable cold-water installation is provided with supply paints from the underground reticulation networks outside the buildings to an above ground reticulation network via service ducts, ceiling voids and chased into walls to outlet paints. The potable hot-water installation is provided with supplies from various domestic geysers.

This contract also provides for repair and maintenance of the fire water piped reticulation network, excluding the fire fighting equipment, which is dealt with under Particular Specification PJC: Conventional Fire Fighting equipment.

Technical details of sanitary and brassware, as well as the plumbing and drainage installations are given in PAA 03.
### TECHNICAL DETAILS OF EXISTING INSTALLATIONS

At the time of compilation of this document the existing installations consisted of the equipment and plant listed below with their relevant technical details.

**PAA 03.01 SANITARY AND BRASSWARE: GENERAL**

<table>
<thead>
<tr>
<th>SANITARY WARE</th>
<th>BRASSWARE</th>
<th>TRAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCs (cistern)</td>
<td>Armitage Shanks/Naal white, floor-mounted, vitreous china</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Cistern (WC)</td>
<td>Wall-mounted, white, Cl. Wall-mounted, white, vitreous china; Wall-mounted, white, plastic</td>
<td>Ball-o-stop shut off valves and CP flexible connections</td>
</tr>
<tr>
<td>Urinals (flush)</td>
<td>Armitage Shanks, white wall-mounted, vitreous china; Chimeral stainless steel wall-mounted</td>
<td>Junior flush valve, exposed type, shut-off valves; Brass shut-off valves</td>
</tr>
<tr>
<td>WHBs</td>
<td>Armitage Shanks, white wall-mounted, white enamel; Wall-mounted stainless steel</td>
<td>Cobra 15 mm CP star handle pillar taps</td>
</tr>
<tr>
<td>Showers</td>
<td></td>
<td>15 mm CP under-tile stop-cocks</td>
</tr>
<tr>
<td>Wash troughs</td>
<td>Stainless steel, double bowl, wall-mounted</td>
<td>Cobra 15 mm, CP star handle wall type taps</td>
</tr>
<tr>
<td>Baths</td>
<td>Steel enamel, white, 2 m long</td>
<td>Cobra 20 mm, CP star handle wall type taps</td>
</tr>
<tr>
<td>Sinks</td>
<td>Stainless steel, cabinet-mounted</td>
<td>20 mm CP star handle taps, 20 mm Cobra taps CP sink mixer with over arm swivel outlet</td>
</tr>
<tr>
<td>Wash tubs</td>
<td>Concrete double bowl</td>
<td>CP wall type taps</td>
</tr>
</tbody>
</table>

**PAA 03.02 SANITARY DRAINAGE PIPING: GENERAL**

<table>
<thead>
<tr>
<th>PIPE</th>
<th>FITTINGS</th>
<th>EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gullies</td>
<td>VCP</td>
<td>CI or plastic grating</td>
</tr>
<tr>
<td>Waste pipes</td>
<td>GMS, uPVC</td>
<td>Brass uPVC</td>
</tr>
<tr>
<td>Soil pipes</td>
<td>S&amp;S Cl, uPVC</td>
<td>S&amp;S Cl, uPVC</td>
</tr>
<tr>
<td>Cleaning eyes</td>
<td>Cl (ABC), uPVC</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Vent pipes</td>
<td>S&amp;S Cl</td>
<td>S&amp;S Cl</td>
</tr>
</tbody>
</table>
DOMESTIC WATER PIPING: GENERAL

<table>
<thead>
<tr>
<th>PIPE</th>
<th>FITTINGS</th>
<th>EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold-water piping</td>
<td>Cu, GMS</td>
<td>Conex, soldered, GMS</td>
</tr>
<tr>
<td>Hot-water piping</td>
<td>Cu, GMS</td>
<td>Conex, soldered, GMS</td>
</tr>
</tbody>
</table>

FIRE WATER PIPING: GENERAL

<table>
<thead>
<tr>
<th>PIPE</th>
<th>FITTINGS</th>
<th>EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire water piping</td>
<td>GMS, Cu</td>
<td>GMS, Conex soldered</td>
</tr>
</tbody>
</table>

FIRE WATER INSTALLATION QUANTITIES

The fire fighting equipment currently installed is listed in Particular Specification PJC: Conventional Fire Fighting Equipment. The piped reticulation networks to these equipment items shall form part of this contract where applicable.

STATUS OF EXISTING INSTALLATION

The status of the equipment and installation at the time of compilation of this document is summarised below:

SANITARY AND BRASSWARE

The condition of sanitary and brassware varies between the different buildings and are therefore grouped as shown earlier:

(a) Cisterns: some cisterns need to be replaced;
(b) WHBs: numerous replacements, some are to be destained or re-enamelled;
(c) Baths: Some are to be replaced, some are to be destained or re-enamelled;
(d) Pillar, wall-mouthed and hose bip taps, sink mixers and under-tile stop cocks are to be serviced and replaced where necessary;
(e) Some of the shower heads are to be replaced;
(f) Domestic water geyser: those in working order are to be serviced and cleaned, some are to be replaced.

PLUMBING AND DRAINAGE INSTALLATION

(a) Some cleaning eyes to be replaced;
(b) A number gulley gratings are missing or broken;
(c) Some gullies are blocked and requires cleaning;
(d) Septic tanks are to be cleaned out;
(e) Sewer pipes are to be unblocked;
(f) Broken waste pipes are to be replaced;
(g) Ventilation pipes are to be shortened; roofs repaired and vent valves installed.
PAA05 DETAILS OF WORK

The following work shall form part of the repair work to Building Services. This work shall be done in accordance with the relevant regulations, codes, Specifications and Technical Specification for Plumbing and Drainage Installations, as set out in this document. The work to be included is set out in PM 05.01 and PM 05.02 below and shall be read in conjunction with the Schedule of Quantities and Technical Specifications.

The repair work shall be carried out in accordance with the REQUIREMENTS of Additional Specification SC General Decommissioning, Testing and Commissioning Procedures.

PAA 05.01 GENERAL DESCRIPTION OF WORK

PAA 05.01.01 The Contractor shall at the start of the Repair and Maintenance Contract inspect the items, systems, equipment, components and installations listed below. This inspection shall involve the determination of any defects, leaks, damages, shortfalls, structural soundness, repairs required, details of existing equipment, suitability of equipment for the purpose it serves, etc. The Contractor shall report back to the Engineer in writing on all the above and the following items. No repair work shall commence prior to approval by the Engineer:

(i) Sanitary and brassware, including traps, brackets, piping, pan connectors, etc;

(ii) Sanitary drainage installation, including fittings, traps, floor drains, gullies, cleaning eyes, manholes, grease and oil separators, etc;

(iii) Domestic water piped installation, including fittings, valves, strainers, lagging and cladding, non-return valves, safety valves, etc;

(iv) Fire water piped installation, including fittings, valves, non-return valves, pressure gauges, etc;

(v) Bracketing system;

(vi) Domestic geysers including valves, pressure reducing valves, strainers, vacuum breakers, safety valves, non-return valves, lagging and cladding, etc;

(vii) Industrial geysers including valves, pressure reducing valves, strainers, vacuum breakers, safety valves, non-return valves, lagging and cladding, etc.

PAA 05.01.02 The general scope of work at the time of going on tender is defined as follows:

(a) Replacing of irreparably damaged, missing and unsuitable sanitary and brassware, including the isolation, removal and stripping of the existing equipment;

(b) Replacing of irreparably damaged, corroded and unsuitable sanitary drainage piping, including fittings, brackets, traps, floor drains, oil and grease separators, cleaning eyes and gullies, etc;

(c) Replacing of irreparably damaged, corroded and unsuitable domestic water piping, including fittings, brackets, valves, strainers, water meters, lagging and cladding, etc;

(d) Replacing of irreparably damaged, corroded and unsuitable fire water piping, including fittings, brackets, valves, non-return valves, pressure gauges, etc.
(e) Replacing of irreparably damaged and corroded domestic or industrial geysers, including valves, pressure-reducing valves, air release valves, strainers, non-return valves, vacuum breakers and safety valves.

(f) Servicing, cleaning and repair of existing sanitary ware including removal of stains, repair of chipped enamel, replacing of damaged and missing seats and lids, de-scaling and cleaning of cisterns and servicing of filling and flushing mechanisms, fixing of loose fixtures and brackets, cleaning of traps, etc.

(g) Servicing, overhauling and cleaning of existing brassware, including dismantling, de-scaling, repair kits, replacing of washers, gland packing and gaskets, replacing of missing tap handles and flushing assemblies, etc.

(h) Servicing, cleaning and repair of existing domestic water and drainage pipe installations, including traps, floor drains, gullies, manholes, valve chambers, grease and oil separators, brackets, valves, vacuum breakers, strainers, pipe lagging and cladding, etc.

(i) Servicing and repair of existing fire water piped reticulation, including fittings, valves, pressure gauges, brackets, etc.

(j) Servicing, cleaning and repair of domestic geysers, including de-scaling, testing for leaks, replacing of elements, safety valves and thermostats if required, etc.

(k) Handing over of complete systems on completion of the repair work to the satisfaction of the Engineer, when the maintenance period shall commence.

(l) The supply and compilation of operating and maintenance manuals;

(m) The testing, adjusting and commissioning of all systems.

(n) The introduction of a maintenance control plan, including logging, recording and control procedures.

PAA 05.02 REPAIR WORK TO PLUMBING AND DRAINAGE INSTALLATION

The repair work to this installation shall at least include, but not be limited to the work listed below. Any items, components or installations not detailed in particular but found to be defective or inoperative during the inspection and report phase, shall be repaired or replaced as instructed by the Engineer.

PAA 05.02.01 Ports of Entry

(i) Service and repair domestic hot and cold-water installations, including pressure testing of existing systems, and replace items that are beyond repair. Where necessary, replace entire system with capillary soldered copper pipe system.

(ii) Service and repair drainage system, including rodding of system, and replace damaged or leaking pipes and fittings, manhole covers, cleaning and inspection eyes, gullies and gully gratings.

(iii) Service and repair brassware, such as taps, stop-cocks and flushing mechanisms with repair kits, and replace items that are missing or beyond repair.

(iv) Service and repair sanitary ware, including chip repair, de-staining and re-coating of baths, WASH bowls and wash hand basins, dent removal and de-staining of wash troughs and kitchen sinks and replacement of damaged or missing parts such as WASH seats and lids and cistern lids. Replace missing or irreparably damaged equipment. The following replacement items shall be installed where required:
(1) Ceramic and Plastic cisterns
(2) Steel enamel bathtubs
(3) Stainless steel wash troughs
(4) Ceramic wash hand basins

(v) Service and repair domestic geysers, including de-scaling, testing for leaks, replacement of electrical heating elements if required, servicing or replacement of valves, or replace leaking and corroded geysers where necessary

PAA06 MEASUREMENT AND PAYMENT

All new building work and repair work to existing structures and buildings necessitated by repairs to the plumbing and drainage services as scheduled shall be done in accordance with the structural and building section of the Technical and Particular Specifications. The costs of such building and repair works shall be deemed to be included in the tendered rates for the applicable items as scheduled in this section.

PAA.01 INSPECTION AND REPORT ON EXISTING INSTALLATIONS

The unit of measurement shall be the item reported on.

The tendered rate shall include full compensation for the inspection and written report on all items, systems, components, equipment and installations, including the establishment of defects, leaks, damage, shortfalls, structural soundness, repairs required, details of existing equipment and suitability of the equipment for the purpose it serves.

PAA.03 ISOLATION, STRIPPING, DISMANTLING AND REMOVAL OF EXISTING BRASSWARE, SANITARY WARE AND PIPING INSTALLATIONS

The unit of measurement shall be the number of each item of brassware and sanitary ware and metre of piping removed, including fixtures and fittings.

The tendered rates shall include full compensation for the isolation, dismantling and removal of irreparably damaged, broken and/or unsuitable brassware (flush valves, taps, mixers, shower roses, under tile stop-cocks, demand bib taps, hose bib taps, shut-off valves, etc) and sanitary ware (water closets, cisterns, basins, urinals, baths, wash troughs, sinks, etc) including all associated pipe work, brackets, traps, pan connectors, etc.

The tendered rates shall also include full compensation for the isolation, stripping, dismantling and removal of irreparably damaged, broken or unsuitable pipe work installed on surface, underground, chasied into walls, in ceiling voids and/or service ducts, as well as the plugging off of connections to this pipe work.

The tendered rate shall also include full compensation for the removal off site and/or to storage of all removed items as mentioned above.
PAA.04
ISOLATION, STRIPPING, DISMANTLING AND REMOVAL
OF EXISTING GEYSER INSTALLATIONS
Unit: number

The unit of measurement shall be the number of each geyser installation removed, including associated pipe work and fittings.

The tendered rates shall include full compensation for the isolation, stripping, dismantling and removal of irreparably damaged, broken and/or corroded domestic geysers, including shut-off valves, non-return valves, strainers, pressure-reducing valves, vacuum breakers, air release valves, safety valves, etc. and the removal off site.

PAA.05
SUPPLY AND INSTALLATION OF SANITARY WARE AND BRASSWARE
Unit: metre, number

The unit of measurement shall be the number of each item of sanitary and brassware supplied and installed, including all associated pipe work and fittings.

The tendered rate shall include full compensation for the supply, delivery, positioning, installation, testing, cleaning, commissioning and hand-over of sanitary and brassware including all necessary pipe work, traps, brackets, fittings, bends, junctions, cleaning eyes, etc. to connect the sanitary and brassware to the existing water supply and/or drainage installation.

The tendered rate shall also include full compensation for chasing and/or building into walls and the reinstating of existing surfaces such as floors, walls, ceilings, etc.

PAA.06
SUPPLY AND INSTALLATION OF DRAINAGE PIPING INSTALLATION
Unit: metre

The unit of measurement shall be the metre of each type of piping in the installation supplied and installed, including all fixtures and fittings.

The tendered rates shall include full compensation for the supply, delivery, installation, testing, cleaning, commissioning and handover of new drainage piping, installed on surface against walls or soffits, underground, in ceiling voids, chased or built into walls and/or service ducts, including all necessary bends, junctions, tees, cleaning eyes, covers, traps, floor drains, gratings, brackets, hangers, etc. to hand over a complete and effective installation that complies with local government regulations.

The tendered rates shall also include full compensation for the necessary underground works such as excavation, pipe bedding, fill blanket, backfilling and compaction and for the reinstatement of existing surfaces such as floors, walls, ceiling, roads, paving, etc. as well as connection to the existing drainage installation.

PAA.07
SUPPLY AND INSTALLATION OF DOMESTIC WATER PIPING INSTALLATION
Unit: metre

The unit of measurement shall be the metre of each type of piping in the installation supplied and installed, indicating all fixtures and fittings.

The tendered rates shall include full compensation for the supply, delivery, installation, testing, cleaning, sterilising, commissioning and hand-over of new water piping installed on surface against walls or soffits, underground, in ceiling voids, chased or built into walls and/or in service ducts, including all necessary bends, tees, reducers, elbows, valves, strainers, adapters, brackets, hangers, etc. to hand over a complete and effective installation that complies with local government regulations.

The tendered rates shall also include full compensation for the supply and installation of hot-water pipe insulation and cladding.
The tendered rates shall also include full compensation for the necessary underground works such as excavation, pipe bedding, fill blanket, backfilling and compaction and for the reinstatement of existing surfaces such as floors, walls, ceilings, roads, paving, etc, as well as connection to the existing domestic water installation.

**PAA.08** SUPPLY AND INSTALLATION OF DOMESTIC GEYSER INSTALLATION INCLUDING SHUT-OFF VALVES, STRAINERS, DRIFF TRAY, NON-RETURN VALVES, EXPANSION RELIEF VALVE, SAFETY VALVE, DRAIN PIPING AND ELECTRICAL CONNECTION: Unit: number

The unit of measurement shall be the number of each geyser installation supplied and installed, including all associated pipe work, valves and fittings.

The tendered rate shall include full compensation for the supply and installation of domestic geysers, including shut-off valves, non-return valves, strainers, vacuum breakers, air release valves, safety valves, etc, as well as connection to existing piping and electrical supply.

**PAA.09** SUPPLY AND INSTALLATION OF FIRE WATER RETICULATION PIPEWORK Unit: metre

The unit of measurement shall be the metre of each type of pipe work supplied and installed in the firewater reticulation, including all fixtures and fittings.

The tendered rate shall include full compensation for the supply, delivery, installation, testing, cleaning, commissioning and hand-over of new fire water reticulation pipe work installed on surface against walls or soffits and/or underground, including all necessary bends, tees, reducers, elbows, valves, adapters, brackets, hangars, pressure gauges, etc, to hand over a complete and effective installation that complies with local government regulations.

The tendered rates shall also include full compensation for the necessary underground work such as excavation, pipe bedding, fill blanket, backfilling and compaction and for the reinstatement of existing surfaces such as floors, walls, ceilings, roads, paving, etc, as well as connection to the existing fire water reticulation network.

**PAA.10** SERVICING, CLEANING AND REPAIR OF SANITARY WARE Unit: number

The unit of measurement shall be the number of each item of sanitary ware serviced, cleaned and repaired, including all associated pipe work and fittings.

The tendered rate shall include full compensation for the repair or replacement of all damaged or missing parts, servicing of all movable parts, cleaning of stained sanitary ware with approved cleaning agent, fixing of loose fixtures and brackets according to manufacturer's Specifications, de-scaling and cleaning of cisterns and servicing of filling and flushing mechanisms, cleaning of all traps, fixing or replacing of damaged or missing shower, urinal and channel outlet gratings and any other work or action required to hand over an effective system that complies with local government regulations.
PAA.11 SERVICING, OVERHAULING AND CLEANING OF BRASSWARE

The unit of measurement shall be the number of each item of brassware serviced, overhauled or cleaned, including all associated pipe work and fittings.

The tendered rate shall include full compensation for dismantling, cleaning and descaling, replacement of all gaskets, gland packing and seals on all valves, repair or replacement of all damaged or missing parts, replacement kits for worn or leaking flush valves, taps and mixers, repair or replacement of leaking, corroded or damaged flush pipes, readjusting of timing mechanisms on flush valves and metering taps and any other work or action required to hand over an effective system that complies with local government regulations.

PAA.12 SERVICING, CLEANING AND REPAIR OF DOMESTIC WATER AND DRAINAGE PIPE INSTALLATIONS

The unit of measurement shall be the metre of each type of pipe installation serviced, cleaned and repaired, including all fixtures and fittings.

The tendered rates shall include full compensation for inspection, sampling testing, servicing, cleaning and repair of existing piping and equipment such as:

(a) Video surveying of all underground drainage pipe work to establish root ingress, damaged and corroded pipe work, fat build-up, blockages, incorrect falls, sagging and to provide as-built information;

(b) Initial unblocking and cleaning of all drainage pipe work, traps, floor drains and gullies;

(c) Pressure testing of piping and taking of water piping samples to determine state of corrosion and scaling;

(d) Repair work to damaged manholes, gullies, cleaning eyes, valve chambers, etc. including builders’ work and benching;

(e) Repair of existing bracketing systems including fixing and repair of existing brackets and hangers, as well as the supply and installation of additional brackets where required;

(f) Emptying, cleaning, checking, testing and repair of oil and grease separators;

(g) Service and repair to all valves, strainers, pressure-reducing valves, water meters, non-return valves, air release valves and vacuum breakers, including new gaskets, gland packing and seals;

(h) Taking of water samples and bacteriological testing to determine the compliance with the relevant codes of practice;

(i) Repairing and/or replacement of damaged hot-water pipe lagging and cladding;

(j) Preparation, painting and repainting of pipe work and;

(k) Any other work or action to hand over an effective installation that complies with local government regulations.
PAA 13  SERVICING, CLEANING AND REPAIR OF DOMESTIC GEYSERS

The unit of measurement shall be the number of domestic geysers serviced cleaned and repaired, including all fixtures and fittings.

The tendered rate shall include full compensation for the isolation, servicing, cleaning and repair of domestic geysers in accordance with the manufacturer's Specifications, including de-scaling, testing for leaks, replacing of elements, replacement of safety valve and replacement of thermostat and set point, and replacement of connections if required and any other work or action to hand over an effective system that complies with local government regulations.

PAA 14  SERVICING AND REPAIR OF FIRE WATER PIPED RETICULATION NETWORKS

The unit of measurement shall be the metre of each type of piping in the firewater network serviced and repaired, including all fixtures and fittings.

The tendered rates shall include full compensation for the inspection, testing, servicing and repair of existing piping and equipment such as

(a) Pressure testing of piping and taking of pipe samples to determine the extent of corrosion and scaling

(b) Repair or replacement of damaged, leaking, broken and corroded pipe work or fittings;

(c) Repair and service to all valves, including new gaskets, gland packing and seals;

(d) Repair, service, adjustment and calibration of all pressure gauges;

(e) Repair and fixing of existing brackets and hangers and the installation of additional brackets and hangers where required;

(f) Any other work or action to hand over an effective system that complies with local government regulations.

PAA 15  CLEANING OUT SEPTIC TANKS AND DISPOSE OF CONTENTS OFF-SITE

The unit of measurement shall be the number of septic tanks thoroughly cleaned and pumping the waste into a tanker and disposing of all the waste off site at a wastewater dumping area.

PAA 16  SUPPLY AND INSTALLATION OF INDUSTRIAL GEYSER INSTALLATION

The unit of measurement shall be the number of each geyser installation supplied and installed, including all associated pipe work and fittings.

The tendered rates shall include full compensation for the supply and installation of industrial geyser installations including isolating lever-ball valves (from 22 to 50mm), 400 kPa expansion relief valve, drain connection, overflow pipe, inline circulating pump (25mm), Temperature and pressure safety valve, electrical control panel, bulk hot water vessel, pump supply cable, dual thermostat, hot water outlet, y-strainer, pressure gauge, non-return valve, temperature gauge, balanced cold water and expansion valve stand pipe.
SERVICING, CLEANING AND REPAIR OF INDUSTRIAL GEYSERS

The unit of measurement shall be the number of industrial geysers serviced, cleaned and repaired, including all fixtures and fittings.

The tendered rate shall include full compensation for the isolation, servicing, cleaning and repair of industrial geysers in accordance with the manufacturer's Specifications, including de-scaling, testing for leaks, servicing, checking or replacing of isolating lever-ball valves (from 22 to 50mm), 400kPa expansion relief valve, drain connection, overflow pipe, inline circulating pump (25mm), Temperature and pressure safety valve, electrical control panel, dual thermostat, Y-strainer, pressure gauge, non-return valve, temperature gauge, and any other work or action to hand over an effective system that complies with local government regulations.

DETAILS OF MAINTENANCE WORK

The Contractor shall be responsible for the complete maintenance of all the equipment, components, installations and systems forming part of this servicing and maintenance contract and as set out in PM 03.05. The Contractor shall strictly adhere to Additional Specification SA: General Maintenance, and Technical Specification M: Plumbing and Drainage Installations, With regard to the maintenance period, obligations, responsibilities, actions and activities, etc, which shall also include the following maintenance actions:

(a) Routine preventative maintenance. A guideline to the required actions is provided in Specification M. The actions will not be limited to these guidelines, but shall include all additional actions, work, materials, etc necessary to maintain this installation at an acceptable level.

(b) Corrective maintenance as described and defined in Additional Specification SA: General Maintenance.

(c) Breakdown maintenance as described and defined in Additional Specification SA: General Maintenance.

Emergency breakdown shall be defined as any equipment, components and systems preventing the provision of water and the drainage of the equipment to the consumer points due to a failure of part of this system at the particular point of incident.
# TECHNICAL SPECIFICATION

## AB   BUILDING ELECTRICAL INSTALLATIONS

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**AB 01   SCOPE**

**AB 01.01** This specification comprises all aspects regarding the repair and maintenance of building electrical systems of Maseru Border Post. Building electrical systems comprise:

(i) Distribution boards and low voltage cable  
(ii) Interior and exterior lighting of buildings  
(iii) Small power and fixed appliances  
(iv) Earthing and lightning protection system

**AB 01.02** This specification shall form an integral part of the repair and maintenance contract document and shall be read in conjunction with portion 3, the Additional Specifications included with this document.

## AB 02   STANDARD SPECIFICATIONS, REGULATIONS AND CODES

**AB 02.01** The latest edition, including all amendments up to date of tender of the following specifications, publication and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof.

**AB 02.02** SABS Specifications

<table>
<thead>
<tr>
<th>General</th>
<th>Distribution and meter boards</th>
<th>LV cables and conductors</th>
<th>Lighting system</th>
<th>Earthing and lightning protection system</th>
<th>Small power installation</th>
</tr>
</thead>
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<td>SABS 0150</td>
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<td>SABS 156</td>
<td>SABS 0198</td>
<td>SABS 163</td>
<td>SABS 0199</td>
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<td>SABS 0400</td>
<td>SABS 171</td>
<td>SABS 1411</td>
<td>SABS 1012</td>
<td>SABS 1084</td>
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<td>SABS 1222</td>
<td>SABS 172</td>
<td>SABS 1507</td>
<td>SABS 1084</td>
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<td>SABS 173</td>
<td>SABS 1250</td>
<td>SABS 1239</td>
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<td>SABS 1279</td>
<td>SABS 1197</td>
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<tr>
<td>SABS 1092</td>
<td>SABS 1777</td>
<td>SABS 1197</td>
<td></td>
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<tr>
<td>SABS 1180</td>
<td>SABS 1167</td>
<td>SABS 1167</td>
<td>SABS 1167</td>
<td>SABS 1167</td>
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</tbody>
</table>

**OCT 2019**

**MASERU BORDER POST**
AB 02.03 Department of Public Works Specifications PW 774 and PW 343.
AB 02.04 Occupational Health and Safety Act of 1993
AB 02.05 Manufacturer’s specifications and installation instructions.
AB 02.06 Additional requirements

Equipment and material installed shall be new and unused. Luminares, lamps, control gear, isolators and power outlets shall bear the SABS stamp. The Contractor shall ensure that all safety regulations and measures are applied and enforced during repair and maintenance work on cabling, wiring, distribution boards, luminaires, power points and fixed appliances.

AB 03 OPERATING AND MAINTENANCE MANUALS

AB 03.01 The Contractor shall be responsible for the compilation of a complete set of as-built drawings, inventory list and Operating-and-Maintenance manuals.

This shall be done in accordance with the Additional Specification SB – Operating and Maintenance manuals.

AB 03.02 Over and above what is specified in the Additional Specification – SB Operating and Maintenance manuals, the Operating and Maintenance Manual to be compiled shall be structured and shall at least include the following:

AB 03.02.01 Description of installation

(a) Distribution boards and cabling

The complete system description of the distribution boards and cabling shall be done for each installation individually. The system description shall be presented in a tabular format and shall contain, but not be limited to the following:

<table>
<thead>
<tr>
<th>Item</th>
<th>Distribution board description and location</th>
<th>Feed source</th>
<th>Type (Surface / Recessed)</th>
<th>No of ways</th>
<th>Size and kA rating of main circuit breaker</th>
<th>Description of sub-distribution boards</th>
<th>Size and type of supply cable</th>
<th>Minimum kA rating of circuit breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

(b) Lighting system

The complete system description of the lighting system shall be done for each installation individually. The system description shall be represented in a tabular format and shall contain, but not be limited to the following:
(c) Small power and fixed appliances

The complete system description of the small power and fixed appliances shall be done for each installation individually. The system description shall be represented in tabular format and shall contain, but not be limited to the following:

<table>
<thead>
<tr>
<th>Item</th>
<th>Circuit description</th>
<th>Source and type of supply</th>
<th>Switching arrangement</th>
<th>Description of appliance</th>
<th>Location of appliance</th>
<th>Rating of appliance</th>
<th>Type and rating of isolating switch</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

(d) Earthing and lightning protection

The complete system description of the earthing and lightning protection system shall be done for each installation individually. The system description shall be presented in tabular format and shall contain, but not be limited to:

<table>
<thead>
<tr>
<th>Item</th>
<th>Type of installation</th>
<th>Quantity and positions of earth electrodes</th>
<th>Type and size of earth electrode</th>
<th>Size and type of conductors</th>
<th>Type of joint</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

AB 03.02.02 Commissioning data

Complete commissioning, test and inspection data of all systems shall be provided for each building installation individually and shall comprise, but not be limited to the following:

(a) Distribution boards and cabling

<table>
<thead>
<tr>
<th>Item</th>
<th>DB descr.</th>
<th>Maximum load</th>
<th>Phase voltage</th>
<th>Earth leakage unit trip test</th>
<th>Earth bar resistance</th>
<th>Insulation resistance</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>
(b) Lighting system

<table>
<thead>
<tr>
<th>Item</th>
<th>Description of installation</th>
<th>Illumination levels</th>
<th>Luminaire type</th>
<th>Lamp</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Value (Lux)</td>
<td>Measuring instrument</td>
<td>Type</td>
</tr>
<tr>
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</tr>
</tbody>
</table>

(c) Small power and appliances

<table>
<thead>
<tr>
<th>Item</th>
<th>Description of installation</th>
<th>Circuit description</th>
<th>Earthing provided (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

(d) Earthing, bonding and lightning protection system

<table>
<thead>
<tr>
<th>Item</th>
<th>Installation description</th>
<th>Earth electrode</th>
<th>Fixed appliances</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Size and type</td>
<td>Resistance value (Ω)</td>
</tr>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

AB 03.02.03 Operating data

The complete operating data for each installation system shall be provided and shall include, but not be limited to the following:

(i) safety precautions to be implemented
(ii) system operation
(iii) system running check list and frequency of servicing required

AB 03.02.04 Maintenance instructions

The complete maintenance instructions for each installation system, shall comprise, but not be limited to the following:

(i) schedule of maintenance particulars
(ii) projected frequency of services and replacements
(iii) schedule of serviceable components per system
(iv) trouble shooting diagrams
(v) details of all replacement items and spares, including manufacturer’s brochures / pamphlets, order number, etc.
(vi) complete as-built circuit diagrams
AB 04  TESTS AND INSPECTIONS PRIOR TO PRACTICAL COMPLETION

AB 04.01 All systems are to be re-checked by the Contractor prior to re-commissioning. Copies of all checks for each installation shall be presented to the Engineer for approval before re-commissioning takes place.

AB 04.02 It is the responsibility of the Contractor to provide all labour, accessories and properly calibrated and certified measuring instruments necessary to record the following parameters:

AB 04.02.01 continuity of ring final circuit conductors
AB 04.02.02 continuity of protective conductors, including main and supplementary equipotential bonding
AB 04.02.03 earth electrode resistance
AB 04.02.04 insulation resistance
AB 04.02.05 polarity
AB 04.02.06 earth fault loop impedance
AB 04.02.07 operation of residual current devices
AB 04.02.08 phase voltage
AB 04.02.09 current per phase
AB 04.02.10 illumination levels in lux

AB 04.03 The Contractor is responsible for the arrangement of such tests. He shall give at least 72 hours notice to the Engineer prior to the test date.

AB 05  LOGGING AND RECORDING PROCEDURES

AB 05.01 The Contractor shall as part of this Contract institute a Recording system as part of his Maintenance Control Plan as defined in the Additional Specification SA – General Maintenance. This shall consist of a Record book which shall be utilised to log and record all faults, system checks, breakdowns, maintenance visits, inspections etc.

AB 05.02 The logbook shall be stored in a safe place inside the prison maintenance supervisor’s office and shall only be utilised by the Contractor and Engineer. A copy of the monthly entries and recordings into this logbook shall be submitted by the Contractor together with his monthly report to the Engineer.

This logbook shall be structured to at least include the following:

AB 05.02.01 Bi-annual inspection and testing of all systems.
AB 05.02.02 Monthly lamp inspection and maintenance actions.
AB 05.02.03 Annual earthing test report.
AB 05.02.04 Bi-annual inspection and testing of distribution boards.

AB 06  MAINTENANCE TOOLS AND SPARES

AB 06.01 On commencement of the Repair and Maintenance Contract, the Contractor shall supply and deliver certain tools and spares to the User Client. These tools and spares will be the property of the Department of Public Works. Any deficiencies or shortfall or damaged tools and spares during the contract shall be replaced with new equipment / material.

AB 06.02 The tools and spares shall be kept safe in a lockable store room on site. The Contractor shall provide his own lock for the designated store room. The inventory of the tools and spares shall be verified on a monthly basis. Any short fall shall be replaced by the Contractor as part of his responsibility under this contract.
The tools and spares shall at least include the following:

01: 58W Flourescent lamps
02: 36W Flourescent lamps
03: 18W Flourescent lamps
05: 1000W MH lamps
06: 400W HPS lamps
07: 400W MV lamps
08: 400W MH lamps
09: 250W HPS lamps
10: 250W MV lamps
11: 250W MH lamps
12: 150W HPS lamps
13: 125W MV lamps
14: 125W MH lamps
15: 70W HPS lamps
16: 80W MV lamps
17: 100W MH lamps
18: PL9 Watt lamps
19: PL18 Watt lamps
20: PL26 Watt lamps
21: 11W Energy Saver lamps
22: 15W Energy Saver lamps
23: 20W Energy Saver lamps
24: 50W 12V lamps
25: 50W 220V lamps
26: 16W 2D lamps
27: Distribution kiosks key
28: DB face plate - square key
29: DB face plate - triangular
30: Special spanner for cell tamper proof luminaires made from hardened steel.

Tools and Spares: Measurement and payment

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Supply of tools and spares</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of tools and spares supplied.

The tendered rate shall include full compensation for the supply and delivery of the tools and spares as specified.

QUALITY ASSURANCE SYSTEM

Following formal approval of his Quality Assurance system by Engineer, the Contractor shall implement the approved QA system.

Records of this QA system shall be kept throughout the duration of the contract and shall be submitted to the Engineer as required by the Department.

RE-COMMISSIONING OF INSTALLATION

On practical completion of the repair work, the contractor shall re-check and put all systems into operation.

All commissioning shall be performed by the Contractor, to the satisfaction of the Engineer. The Contractor shall confirm in writing that all systems have been repaired according to specification and are fully operational.
AB 08.03 All installations shall be energised for a minimum continuous period of 96 hours immediately prior to the Engineer’s Practical Completion inspection to verify lamp stability and reliability of power reticulation.

AB 09 REPAIR WORK TO LIGHTING INSTALLATIONS

AB 09.01 The various electrical systems shall be repaired during the first phase of the repair and maintenance contract.

AB 09.02 The scope of the repair work shall include, but shall not be limited to the activities listed below.

AB 09.03 The Contractor shall record the repair actions in tabular format before the Contractor’s responsibility for maintenance commences.

AB 09.04 Repair work shall be executed within the approved period for repairs.

AB 09.05 New equipment and material shall be supplied with a written guarantee confirming a defects liability period of 12 months from date of practical completion. These guarantees shall be furnished in favour of the Department of Public Works.

AB 10 INSTALLATION TECHNICAL DETAILS

AB 10.01 INSTALLATION DESCRIPTION

Repair and maintenance work of the building electrical systems shall be categorised under the following installations:

Distribution boards and cabling
Lighting installation
Power outlets and Equipment
Lightning Protection & Earthing

AB 10.02 SCOPE OF REPAIR WORK

The above mentioned repair work includes all the electrical installations of all the buildings

SCHEDULE OF DISTRIBUTION BOARDS ARE INDICATED AS follows from AB.8-AB.19
<table>
<thead>
<tr>
<th>BUILDING NR</th>
<th>BUILDING NAME</th>
<th>DB</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Entrance Exit Maseru</td>
<td>DB 7 &amp; DB UPS</td>
<td>Service</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Building 3: Water Purification Works</td>
<td>DB 8</td>
<td>Replace</td>
</tr>
<tr>
<td>4</td>
<td>Light vehicle inspection house Customs</td>
<td>DB 6</td>
<td>Service</td>
</tr>
<tr>
<td>5 &amp; 6</td>
<td>Public Ablutions No.3 &amp; 4:</td>
<td>DB 57</td>
<td>Service &amp; Replace</td>
</tr>
<tr>
<td>8</td>
<td>Water tank</td>
<td>DB ??</td>
<td>Service</td>
</tr>
<tr>
<td>9</td>
<td>Main Admin Building:</td>
<td>DB M1 (4)</td>
<td>Service</td>
</tr>
<tr>
<td>9</td>
<td>Main Admin Building:</td>
<td>DB M2 (2)</td>
<td>Service</td>
</tr>
<tr>
<td>9</td>
<td>Main Admin Building:</td>
<td>DB M3 (3)</td>
<td>Service</td>
</tr>
<tr>
<td>11</td>
<td>DHA Arrivals Office Park Home</td>
<td>DB 9</td>
<td>Service</td>
</tr>
<tr>
<td>12</td>
<td>Main LV: DB: Normal &amp; Emergency</td>
<td>Main LV DB:</td>
<td>Replace Switchgear</td>
</tr>
<tr>
<td>12</td>
<td>Main LV: DB UPS</td>
<td>Main LV: DB</td>
<td>Service</td>
</tr>
<tr>
<td>12</td>
<td>SAPS Admin_General room and Stores</td>
<td>DB 10</td>
<td>Service</td>
</tr>
<tr>
<td>12</td>
<td>SAPS Admin_General room and Stores</td>
<td>DB UPS</td>
<td>Service &amp; Repair</td>
</tr>
<tr>
<td>13</td>
<td>Light vehicle inspection house Customs</td>
<td>DB ??</td>
<td>Service</td>
</tr>
<tr>
<td>13</td>
<td>Light vehicle inspection house SAPS</td>
<td>DB 11</td>
<td>Service &amp; Repair</td>
</tr>
<tr>
<td>14 &amp; 15</td>
<td>Public Ablutions No.1 &amp; 2</td>
<td>DB 56</td>
<td>Service</td>
</tr>
<tr>
<td>18</td>
<td>Border Entrance gatehouse</td>
<td>DB ??</td>
<td>Service</td>
</tr>
<tr>
<td>22</td>
<td>Pedestrian public Ablutions</td>
<td>DB 13</td>
<td>Service</td>
</tr>
<tr>
<td>23</td>
<td>Scanner Room: DB Scanner</td>
<td>DB Scanner</td>
<td>Service and replace</td>
</tr>
<tr>
<td>24</td>
<td>Pedestrian walkway office:</td>
<td>DB 14 (Normal &amp; Emergency)</td>
<td>Service and replace</td>
</tr>
<tr>
<td>24</td>
<td>Pedestrian walkway office:</td>
<td>DB 14 UPS</td>
<td>Service</td>
</tr>
<tr>
<td>27</td>
<td>Public pedestrian toilets</td>
<td>DB ??</td>
<td>Service</td>
</tr>
<tr>
<td>BUILDING NR</td>
<td>BUILDING NAME</td>
<td>DB</td>
<td>DESCRIPTION</td>
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</tr>
<tr>
<td>28</td>
<td>Incinerator:</td>
<td>DB ??</td>
<td>Service</td>
</tr>
<tr>
<td>30</td>
<td>Main Pump Station</td>
<td>DB 17</td>
<td>Service</td>
</tr>
<tr>
<td>30</td>
<td>Main Pump Station</td>
<td>DB (Orange) &amp; (Replace E/L)</td>
<td>Service</td>
</tr>
<tr>
<td>30</td>
<td>Main Pump Station</td>
<td>DB (Electrical Fire Pump)</td>
<td>Service</td>
</tr>
<tr>
<td>34</td>
<td>Storage Electrical control sewer plant</td>
<td>DB ((Replace all C/B))</td>
<td>Service</td>
</tr>
<tr>
<td>40</td>
<td>Lower housing sewer pump</td>
<td>DB ?</td>
<td>Service</td>
</tr>
<tr>
<td>41</td>
<td>Sewerage Generator Room</td>
<td>DB ?</td>
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<td>43</td>
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<td>44</td>
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<td>45</td>
<td>SARS Kitchen Park Home</td>
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<td>Service and repair</td>
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<td>46</td>
<td>Parkhome 1</td>
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<td>47</td>
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<td>50</td>
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<td>51</td>
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<td>53</td>
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<td>64</td>
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<td>2</td>
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<td>29.05kl Fire Water Tank</td>
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<td>6</td>
<td>Upper House No 0 Garage</td>
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<td>7</td>
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<td>9</td>
<td>Upper House No 2</td>
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<tr>
<td>10</td>
<td>Upper House No 2 &amp; 3 Garage</td>
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<tr>
<td>11</td>
<td>Upper House No 3</td>
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<td>12</td>
<td>Upper House No 4</td>
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<td>13</td>
<td>Upper House No 4 &amp; 5 Garage</td>
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<td>14</td>
<td>Upper House No 5</td>
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<td>Upper House No 8</td>
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<td>23</td>
<td>Upper House No 8 &amp; 9 Garage</td>
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<tr>
<td>BUILDING NR</td>
<td>BUILDING NAME</td>
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<td>26</td>
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<td>27</td>
<td>Electrical Switch Room</td>
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<td>28</td>
<td>Eskom Transformer</td>
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<tr>
<td>29</td>
<td>Single Quarters</td>
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<td>Service</td>
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<tr>
<td>30</td>
<td>Single Quarters Carports</td>
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<tr>
<td>31</td>
<td>Dept of Home Affairs Park Home 1</td>
<td>DB</td>
<td>Service</td>
</tr>
<tr>
<td>32</td>
<td>Dept of Home Affairs Park Home 2</td>
<td>DB</td>
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<tr>
<td>33</td>
<td>Dept of Home Affairs Park Home 3</td>
<td>DB</td>
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<td>34</td>
<td>Dept of Home Affairs Park Home 4</td>
<td>DB</td>
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</tr>
</tbody>
</table>

**AB 10.02.01** Distribution boards and cabling

(a) Service distribution boards: inspect and clean the distribution boards, treat the enclosure for moisture ingress and corrosion and re-powder coat internal and external panel.

(b) Check for rigidity and fastening of equipment trays, panels, doors and handling devices.

(c) Check locking mechanism and fit padlock. All padlocks shall be of local manufacture with brass bodies and 75 mm chrome shackles. Three keys (with pvc labels) shall be provided for each lock.

(d) Replace damaged or missing faceplates, doors, mounting frames, handles, thumb catches, etc.

(e) Check operation of distribution board equipment and meters, replace if faulty or damaged with an approved type.

(f) Remove all obsolete equipment and meters.

(g) Check and fasten wiring and cable terminations.

(h) Re-arrange wiring and equipment to give a neat installation.

(i) Trace outgoing circuits.

(j) Fit labelling and blank face plate covers.

(k) Replace the distribution boards if required and replacement is approved by Engineer.

(l) Check earth bar and earth continuity, record.

(m) Label all wiring and cabling with Grafoplast Trasp PVC markers.

(n) Replace cabling as indicated.

(o) Rewire buildings as indicated.
## EXISTING LIGHTS SCHEDULE

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>HB50-MV</td>
<td><em>Existing surface/ceiling mounted industrial highbay light fitting with 125 / 250 / 400 watt lamp. Lamp type of MV, MH, HPS</em></td>
</tr>
<tr>
<td>B</td>
<td>B60</td>
<td><em>Existing surface/ceiling mounted industrial light fitting with 125 / 250 / 400 watt lamp. Lamp type of MV, MH, HPS</em></td>
</tr>
<tr>
<td>C</td>
<td>SPOTLIGHT</td>
<td><em>Existing surface/ceiling mounted industrial light fitting with 125 / 250 / 400 watt lamp. Lamp type of MV, MH, HPS</em></td>
</tr>
<tr>
<td>D</td>
<td>C10-258</td>
<td><em>Existing surface mounted vapour proof cold room fitting with 2 x 58 watt fluorescent lamps.</em></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>E</td>
<td>HL2-258-ECG</td>
<td>Existing surface mounted open channel fluorescent luminaire complete with control gear and 2 x 58 watt lamps.</td>
</tr>
<tr>
<td>F</td>
<td>B10-CLR-BLK-1PL9-DS</td>
<td>Existing surface mounted bulkhead luminaire complete with control gear and 1 x 9 watt compact fluorescent lamps</td>
</tr>
<tr>
<td>G</td>
<td>B40</td>
<td>Existing surface mounted industrial electric light fitting with 125 / 250 /400 watt lamp. Lamp type of MV, MH, HPS</td>
</tr>
<tr>
<td>H</td>
<td>B10-CLR-BLK-2PL9-DS</td>
<td>Existing surface mounted bulkhead luminaire complete with control gear and 2 x 9 watt compact fluorescent lamps</td>
</tr>
<tr>
<td></td>
<td><strong>POLICE LIGHT</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>---</td>
<td>------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>I</td>
<td>Existing wall mounted Police luminaire complete with control gear and 2x26 watt compact fluorescent lamps</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>J</th>
<th><strong>HL-GAL-8&quot;-PORC-11W ENERGY SAVER-ES-GLS-OPL</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing ceiling mounted 200mm dia. Bowl type bathroom luminaire complete with porcelain lamp holder and 1 x 11 watt energy saver BC lamp. The luminaire shall have an IP rating of 55.</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>K</th>
<th><strong>HL2-272 (8FOOT)</strong></th>
<th><strong>Description</strong></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Existing surface mounted open channel fluorescent luminaire complete with control gear and 2 x 72 watt lamps.</td>
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</table>

<table>
<thead>
<tr>
<th>L</th>
<th><strong>HL- SAFE-11W</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing wall mounted safe luminaire with 11 watt lamp.</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>SM31-258</td>
<td>Existing decorative prismatic mounted fitting with 2 x 58 watt fluorescent lamps.</td>
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<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>N</td>
<td>SPOTLIGHT</td>
<td>Existing surface/ceiling mounted industrial electric light fitting with 125 / 250 / 400 watt lamp. Lamp type of MV, MH, HPS</td>
</tr>
<tr>
<td>O</td>
<td>HL-EC02-11W ENERGY SAVER-ES-R80-WHT</td>
<td>Existing surface mounted spot light luminaire with 2 x 11 watt energy saver lamp.</td>
</tr>
<tr>
<td>P</td>
<td>HL-EC3-11W ENERGY SAVER-ES-R80-WHT</td>
<td>Existing surface mounted spot light luminaire with 3 x 11 watt energy saver lamp.</td>
</tr>
<tr>
<td>Q</td>
<td>BEKA BULK LED</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Existing ceiling/wall mounted die-cast aluminium Im 6 base, fitting, with led lamps.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>R</th>
<th>HL-WELL GLASS-11W-ENERGY SAVER-BC</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Existing surface mounted well glass fitting with 1 x 11 watt energy saver lamp BC.</td>
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</table>

<table>
<thead>
<tr>
<th>S</th>
<th>E10-M-2PL9-EXIT</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Existing surface mounted emergency escape route light, 8 watt cfl with signage, single sided wall mounted 1 way with low lumen output.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T1</th>
<th>GREY FRP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing 3.5m mounting height glass fibre reinforced polyester pole, with baseplate, glandplate, 1 x 5A 5kA circuit breakers and a heavy-duty access door. (exclude light fitting)</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>T2</td>
<td>SKY-H35-125W-GREY</td>
</tr>
<tr>
<td>U1</td>
<td>Scissors mask</td>
</tr>
<tr>
<td>U2</td>
<td>SPOTLIGHTS</td>
</tr>
<tr>
<td>U3</td>
<td>STREETPOLE</td>
</tr>
<tr>
<td>U4</td>
<td>BEKA LED STREETLIGHT</td>
</tr>
<tr>
<td></td>
<td>Description</td>
</tr>
<tr>
<td>---</td>
<td>-------------</td>
</tr>
<tr>
<td>U5</td>
<td><strong>SPOTLIGHTS &amp; WOODEN POLE</strong>&lt;br&gt;Existing 1000W MV/MH/HPS spotlights mounted on the existing 8 or 11m wooden pole</td>
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<tr>
<td>V</td>
<td><strong>STREETLIGHT</strong>&lt;br&gt;Existing streetlight fitting with 125 watt lamp. Lamp type of MV, MH, HPS</td>
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<tr>
<td>W1</td>
<td><strong>FRP POLE</strong>&lt;br&gt;Existing 3.5m mounting height glass fibre reinforced polyester pole, with baseplate, glandplate, 1 x 5A 5kA circuit breakers and a heavy-duty access door. (exclude light fitting)</td>
</tr>
<tr>
<td>W2</td>
<td><strong>Beka Ray</strong>&lt;br&gt;Existing Beka Ray</td>
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### NEW LIGHTS SCHEDULE

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<td>LEDBAY</td>
<td><img src="image1.png" alt="LEDBAY Image" /> 108W LEDbay midi - Replaces 250W High Bay</td>
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<tr>
<td>XB</td>
<td>OMNIstar</td>
<td><img src="image2.png" alt="OMNIstar Image" /> 108W OMNIstar midi - Replaces 250W</td>
</tr>
<tr>
<td>XC</td>
<td>OMNIstar</td>
<td><img src="image3.png" alt="OMNIstar Image" /> 108W OMNIstar midi</td>
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<tr>
<td>XD</td>
<td>Vapourline</td>
<td><img src="image4.png" alt="Vapourline Image" /> Vapourline 4FT 46W</td>
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<p>| | |</p>
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<thead>
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<tr>
<td>XE</td>
<td>Vapourline</td>
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<td></td>
<td><img src="image1" alt="Vapourline 4FT 46W" /></td>
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<td>XF</td>
<td>B10-CLR-BLK-1PL9-DS</td>
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<tr>
<td></td>
<td><img src="image2" alt="Series 31 9W LED" /></td>
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<tr>
<td>XG</td>
<td>nova 35W LED</td>
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<td></td>
<td><img src="image3" alt="nova 35W LED" /></td>
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<tr>
<td>XH</td>
<td>B10-CLR-BLK-2PL9-DS</td>
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<tr>
<td></td>
<td><img src="image4" alt="Retrofit existing surface mounted bulkhead luminaire to led" /></td>
</tr>
<tr>
<td>Code</td>
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<td>------------------------------------</td>
</tr>
<tr>
<td>XI</td>
<td>POLICE LIGHT</td>
</tr>
<tr>
<td>XJ</td>
<td>Series 31 9W LED - White in colour</td>
</tr>
<tr>
<td>XK</td>
<td>Vapourline</td>
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<tr>
<td>XL</td>
<td>HL- SAFE-11W</td>
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<tr>
<td>XM</td>
<td>BEKA Roughguard 4FT 55W</td>
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<tr>
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<td><img src="image1" alt="BEKA Roughguard 4FT 55W" /></td>
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<tr>
<td>XN</td>
<td>108W OMNIstar midi - Replaces 250W</td>
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<tr>
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<td><img src="image3" alt="surface mounted spot light luminaire with 2 x 11 watt energy saver lamp." /></td>
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<td><img src="image4" alt="surface mounted spot light luminaire with 3 x 11 watt energy saver lamp." /></td>
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<tr>
<td>XQ</td>
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<tr>
<td>XR</td>
<td>HL-WELL GLASS-11W-ENERGY SAVER-BC</td>
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<tr>
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<tr>
<td>XT1</td>
<td>GREY FRP</td>
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<tr>
<td>Code</td>
<td>Description</td>
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<td>-------------</td>
</tr>
<tr>
<td>XT2</td>
<td>BEKA Zela 55W LED</td>
</tr>
<tr>
<td>XU1</td>
<td>Scissors mask</td>
</tr>
<tr>
<td>XU2</td>
<td>SPOTLIGHTS</td>
</tr>
<tr>
<td>XU3</td>
<td>STREETPOLE</td>
</tr>
<tr>
<td>XU4</td>
<td>BEKA LED STREETLIGHT</td>
</tr>
</tbody>
</table>

- **XT2** BEKA Zela 55W LED
- **XU1** Scissors mask
- **XU2** SPOTLIGHTS: OMNIsat Maxi 463W 5121 optic
- **XU3** STREETPOLE: Streetlight pole 9m with baseplate, glandplate, 1 x 5A 5kA circuit breakers and a heavy-duty access door. (exclude light fitting)
- **XU4** BEKA LED STREETLIGHT: LEDflood maxi 279W
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Specifications</th>
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<tbody>
<tr>
<td>XU5</td>
<td>SPOTLIGHTS &amp; WOODEN POLE</td>
<td>OMNIsat Maxi 463W 5121 optic</td>
</tr>
<tr>
<td>XV</td>
<td></td>
<td>LEDlume mini XP 36W 5068 optic</td>
</tr>
<tr>
<td>XW1</td>
<td>FRP POLE</td>
<td>4m mounting height glass fibre reinforced polyester pole, with baseplate, glandplate, 1 x 5A 5kA circuit breakers and a heavy-duty access door. (exclude light fitting)</td>
</tr>
<tr>
<td>XW2</td>
<td>Beka Ray</td>
<td>BEKAray LED</td>
</tr>
</tbody>
</table>
AB 10.02.02  Lighting system

(a)  Indoor luminaires

(i)  Operational and complete luminaires

- Remove lamps and wash luminaire body with detergent. Clean polycarbonate diffusers with detergent. Clean polished pure aluminium diffusers / reflectors with benzine.
- Check condition of luminaire seal, entrance gland, lampholder and internal wiring.
- Ensure that earth stud and earth connection is sound.
- Replace missing screws, catches, bolts and plugs.
- Check condition of suspension cords of pendant luminaires.
- Re-lamp.

(ii) Damaged or incomplete luminaires

- Remove luminaire.
- Replace luminaire and reconnect.
- Fit new lamps.

(iii) Fluorescent luminaires 2400mm long

- Remove luminaire.
- Replace luminaire with 1500mm double fluorescent luminaire.
- Fit new lamps.

(iv) Bulkhead luminaires with incandescent lamps

- Remove luminaire.
- Replace luminaire with a bulkhead with 2 x 26 Watt lamps.
- Fit new lamps.

(b) Light switches

Note: All light switches shall have steel face plates with permanent glued Traffolite labels.

- Remove switch cover.
- Check continuity of earth connection.
- Check operation of switch and replace if suspect.

- Replace switch cover, fit new csk stainless steel screws if required.

- Replace light switches as indicated

(c) Photocells

- Wash translucent body with detergent.

- Cover photocell and verify operation.

- Check bypass manual switching circuit.

- Enclose all exposed wiring in 16 mm ø sprague.

(d) Floodlight and bulkhead luminaires

- Remove lens and lamp. Wash lens thoroughly.

- Wash luminaire body with detergent.

- Clean polished pure aluminium reflectors with benzine.

- Check condition of internal wiring, capacitor, ballasts and starters.

- Check condition of neoprene seal and replace if worn or damaged.

- Check condition of lampholder.

- Seal conduit and wiring entry with silicone to eliminate water ingress.

- Fit new lamp.

- Check condition of earth stud and luminaire earth connection.

- Replace all missing screws, lens catches, bolts.

- Close cover securely, check stirrup bolts.

- Replace luminaires as indicated

AB 10.02.03  Power outlets and fixed appliances

Note: All power outlets shall have steel face plates with permanent glued Traffolite labels.

(a) Inspect all power outlets and verify earthing.

(b) Check contact points and tighten screws.

(c) Replace missing screws and covers for outlet and draw boxes.

(d) Replace missing, faulty or damaged socket outlets and plugs.

(e) Check conditions and operation of local isolators and control switches for fixed equipment and replace if faulty, damaged or missing.
(f) Check earthing of fixed appliances and test for earth continuity.

(g) Inspect cable and wireways.

(h) Check for rigidity and fastening of the cable ducts, ladders, ducting, powerskirting and surface conduiting, fasten or replace if loose or damaged, check earthing and test for earth continuity.

(i) Replace equipment as indicated

AB 10.02.04 Earthing, bonding and lightning protection

(a) Check earthing and bonding of outlet points, equipment, cable and wireways, fixed appliances, water and gas pipes, etc.

(b) Check installation and termination of protective conductors and earth electrodes

(c) Test for earth continuity.

(d) Provide 6 mm² copper earth wire jumper between roof cladding and all gutter downpipes. Fasten with lugs and galvanized zinc bolts. Typically ten downpipes per housing unit. Earth at least two gutter downpipes by means of 16 mm² green insulated earth wire connected to 1.2 m earth electrode by means of cadwelding. Typically two downpipes per 25 m long housing unit.

(e) Supply and install lightning protection as indicated

AB 10.03 REPAIR WORK : MEASUREMENT AND PAYMENT

AB 10.03.01 Distribution boards and cabling

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.01</td>
<td>Service distribution board</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of distribution kiosks or boards opened and serviced.

The tendered rate shall include full compensation for the opening of the distribution board or kiosk, internal cleaning of the enclosure, cleaning of equipment and meters, removal of obsolete distribution board equipment, rearrangement of equipment and wiring, treatment of the enclosure for moisture ingress and corrosion and re-powder coating, vermin protection, fastening and / or replacement of wiring, tracing of outgoing circuits, labelling of outgoing wiring and mcb's and cable terminations and earth testing.

The tendered sum shall further include for replacement of damaged, missing or faulty distribution board switchgear, meters, face plates, mounting frames, handling devices, doors, circuit breaker blanks, test and labelling of all existing circuits and new circuits with a legend card in each board, etc.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.02</td>
<td>Replace distribution board</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of distribution boards removed and replaced if replacement is approved by Engineer.

The tendered rate shall include full compensation for the dismantling of the DB equipment, removal of the dilapidated enclosure, supply and installation of
an epoxy painted new enclosure, mounting frames, plates, equipment, meters, tracing of outgoing circuits, labelling etc.

The tendered sum shall further include for re-wiring of the board, cable termination, cable labelling, remedial builders work and earth testing.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Replace cabling</strong></td>
<td><strong>m</strong></td>
</tr>
<tr>
<td>The unit of measurement shall be the linear length of cable supplied and installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the removal of the existing cabling; supply, handling, installation and termination of the specified type of cable.</td>
<td></td>
</tr>
<tr>
<td>This rate shall further include for the supply of all cable ties, clamps and other material necessary to ensure that the installation conforms to the specification.</td>
<td></td>
</tr>
<tr>
<td><strong>Replace wiring</strong></td>
<td><strong>m</strong></td>
</tr>
<tr>
<td>The unit of measurement shall be the linear length of conductors supplied and installed.</td>
<td></td>
</tr>
<tr>
<td>All light circuits must be wired with 2,5mm² PVC insulated conductors plus 2,5mm² earth wires.</td>
<td></td>
</tr>
<tr>
<td>All socket circuits must be wired with 4mm² PVC insulated conductors plus 2,5mm² earth wires.</td>
<td></td>
</tr>
<tr>
<td>All air-conditioner and geyser circuits must be wired with 4mm² PVC insulated conductors plus 2,5mm² earth wires.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the removal of the existing conductors, the supply, handling, installation, pulling in conduit and termination of the specified type of conductor.</td>
<td></td>
</tr>
<tr>
<td>This rate shall further include for the supply of all cable ties, labelling, and other material necessary to ensure that the wiring conforms to the specification.</td>
<td></td>
</tr>
<tr>
<td><strong>Jointing and termination of cables</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td>The unit of measurement shall be number of cable joints or terminations.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the cost for providing the kits, complete with compound, ferrules and cable lugs, the cost for cutting the cable, handling and fitting kits and the cost of testing the joints and terminations. Position of joints shall be indicated on as-built drawings.</td>
<td></td>
</tr>
<tr>
<td><strong>Supply and install padlocks</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td>The unit of measurement shall be number of padlocks supplied and installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the ordering, supply and installation of the 75 m locally manufactured padlocks and locking devices as well as fitting each of the three keys with purpose-made PVC labels.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td><strong>.07</strong></td>
<td>Excavate in all materials for trenches, backfill, compact and dispose of surplus material</td>
</tr>
<tr>
<td>The unit of measurement shall be the cubic meter of material excavated in trenches.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for clearing and grubbing the trench areas, for excavating the trench, preparing the bottom of the trench, separating material unsuitable for backfill and dealing with any surface or subsurface water.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall furthermore cover the cost of installing the sand bed and sand cover, backfilling, compacting and disposing of the surplus material and for complying with the requirements of SABS 1200 DB and 1200 LB.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>.08</strong></td>
<td>Supply and install cable sleeves</td>
</tr>
<tr>
<td>The unit of measurement shall be the linear length in meter of the cable sleeve supplied and installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply, delivery, handling and installing the specified sleeves including all the required, couplings, steel draw wires and plugs.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>.09</strong></td>
<td>Supply and install plastic warning tape</td>
</tr>
<tr>
<td>The unit of measurement shall be the linear length in meter of the plastic warning tape supplied and installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply, handling and laying of the plastic warning tape.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>.10</strong></td>
<td>Termination of the low voltage cable</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of low voltage cable terminations.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for providing the cable glands and shrouds, and the cost of handling, fitting and cutting the cable.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>.11</strong></td>
<td>Supply and install earth continuity conductor</td>
</tr>
<tr>
<td>The unit of measurement shall be the linear length in meter of the earth continuity conductor supplied and installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for procuring, furnishing and laying the specified earth continuity conductor.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>--------</td>
<td>---------------</td>
</tr>
<tr>
<td>-.12</td>
<td><strong>Termination and connect earth continuity conductor</strong></td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of earth continuity conductors terminated and connected.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for supplying all the material required to terminate and connect the earth continuity conductors and the connecting thereof to the earth bars, including label tags.</td>
</tr>
<tr>
<td>-.13</td>
<td><strong>Supply and installation of circuit breakers</strong></td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of circuit breakers supplied and installed.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the supply and installation of the specified type and size of circuit breaker, including printed pvc labelling.</td>
</tr>
<tr>
<td>-.14</td>
<td><strong>Supply and installation of isolators</strong></td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of isolators supplied and installed.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the supply and installation of the specified isolator, including printed pvc labelling.</td>
</tr>
<tr>
<td>-.15</td>
<td><strong>Supply and install contactors</strong></td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of contactors supplied and installed.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the supply and installation of the specified type of contractor, including engraved labelling on rear tray.</td>
</tr>
<tr>
<td>-.16</td>
<td><strong>Supply and install switching timers</strong></td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of switching timers supplied and installed.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the supply and installation of the specified type of switching timer, including labelling.</td>
</tr>
<tr>
<td>-.17</td>
<td><strong>Supply and install earth leakage units</strong></td>
</tr>
</tbody>
</table>
The unit of measurement shall be the number of earth leakage units supplied and installed.

The tendered rate shall include full compensation for the supply and installation of the specified type of earth leakage units, including labelling.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.18</td>
<td>Supply and install fuses</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of fuses supplied and installed.

The tendered rate shall include full compensation for the supply and installation of the specified type of fuse, including engraved label indicating fuse rating.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.19</td>
<td>Supply and install surge arrestors</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of surge arrestors supplied and installed.

The tendered rate shall include full compensation for the supply and installation of the specified type of surge arrestors, with visual indication.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.20</td>
<td>Supply circuit breaker blank covers</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of specified blank covers supplied.

The tendered rate shall include full compensation for the procurement and delivery of the blank covers as specified.

**AB 10.03.02  Lighting system**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.01</td>
<td>Re-lamp luminaire</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of lamps replaced.

The tendered rate shall include full compensation for the supply and installation of the specified lamp according to the manufacturer's instructions. Replacement date must be written on lamp.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.02</td>
<td>Service luminaire</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of luminaires opened and serviced.

The tendered rate shall include full compensation for the servicing of the luminaire, including washing, checking of seals, glands, lamp holders, cleaning of diffusers, tightening of fixing screws and bolts, corrosion protection and the checking of earthing continuity and aiming angle if applicable. All external luminaire conduit entries are to be sealed with silicone, which cost is included in this payment item.
<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.03</td>
<td>Replace luminaire</td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of luminaires replaced.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the removal of the existing luminaire and for the supply and installation of the specified type of light fitting complete with lamp and control gear, if applicable, according to manufacturer's instructions.</td>
</tr>
<tr>
<td>.04</td>
<td>Replace light switch</td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of light switches replaced.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the removal of the existing light switch and for the supply and installation of the specified type of light switch to manufacturer's instructions. Light switch face plate shall be fitted with an engraved Traffolite label as per Nosa-standard, cost of which is included in rate.</td>
</tr>
<tr>
<td>.05</td>
<td>Replace photo-electric switch</td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be number of photocell units replaced.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the supply, connecting and testing of the switch.</td>
</tr>
<tr>
<td></td>
<td>The rate shall further include full compensation for the cost of providing and installing all hardware, screws, wall plugs, 16 mm Ø sprague and other material required to install the photo electric light switch in accordance with the manufacturer's specification.</td>
</tr>
<tr>
<td>.06</td>
<td>Replace luminaire diffuser</td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be number of luminaire diffusers replaced.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the supply and installation of the specified type of diffuser, including fixing screws and clips.</td>
</tr>
<tr>
<td>.07</td>
<td>Service light switch</td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of light switches opened and serviced.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the servicing of the light switch, internal cleaning of the enclosure, inspection of the contact points, switching mechanism, earthing, etc.</td>
</tr>
</tbody>
</table>
The tendered sum shall further include for replacement of any missing outlet covers and fixing screw and earth testing. Light switch face plate shall be fitted with an engraved Traffolite label as per Nosa-standard, cost of which is included in rate.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove, clean, store and reinstallion of luminaire</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of light fittings removed, cleaned, stored and reinstalled.

The tendered rate shall include full compensation for the removal, disconnect, cleaning, storage (4 weeks) reinstallation, reconnection and testing of the luminaire.

The rate shall further include full compensation for the installation of 2 x 700 mm supporting timber members above the ceiling (114 x 38 Par SA Pine) and the mounting of 63 mm ø round conduit outlet box complete with 2 x 4 x 60 mm galvanized screws.

**AB 10.03.03 Small power and fixed appliances**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace socket outlet</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of socket outlets replaced.

The tendered rate shall include full compensation for the removal of the existing socket outlet and the supply and installation of the specified type of socket outlet.

All socket outlets shall be supplied complete with cover plates and boxes where required. The tendered rate shall therefore include for the supply of the cover plates and fixing screws where applicable. Outlet face plate shall be fitted with an engraved, Traffolite label as per Nosa-standard, cost of which is included in the rate.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace isolator</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of isolators supplied.

The tendered rate shall include full compensation for the supply and installation of the specified type of isolator or control unit.

The tendered sum shall further include for the provision of 4 wire, 3 phase connections to the fixed appliance. Isolator face plate shall be fitted with an engraved Traffolite label as per Nosa-standard, cost of which is included in the rate.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace plug tops</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of plug tops replaced.

The tendered rate shall include full compensation for the supply and installation of the required type of plug top.
<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.04</td>
<td></td>
</tr>
<tr>
<td>Replace conduit</td>
<td>m</td>
</tr>
<tr>
<td>The unit of measurement shall be the linear meter of conduit supplied and installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply and installation of the specified type and size of conduit, including all fixing accessories.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>-.05</td>
<td></td>
</tr>
<tr>
<td>Replace wiring channel</td>
<td>m</td>
</tr>
<tr>
<td>The unit of measurement shall be number of linear meter of wiring channel replaced.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply and installation of the specified type of wiring channel with 6 x 60 mm fasteners, including the cover and all the necessary accessories.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>-.06</td>
<td></td>
</tr>
<tr>
<td>Supply and install connections to fixed appliances</td>
<td>No</td>
</tr>
<tr>
<td>The unit of measurement shall be number of connections made.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply and installing of the connections to the fixed appliances.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>-.07</td>
<td></td>
</tr>
<tr>
<td>Service socket outlet</td>
<td>No</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of socket outlets opened and serviced.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the servicing of the socket outlet, internal cleaning of the enclosure, inspection of the contact points, switching mechanism, if applicable, earthing, etc. Outlet face plate shall be fitted with an engraved, Traffolite label as per Nosa-standard, cost of which is included in the rate.</td>
<td></td>
</tr>
<tr>
<td>The tendered sum shall further include for replacement of any missing outlet covers and fixing screw and earth testing.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>-.08</td>
<td></td>
</tr>
<tr>
<td>Service isolator</td>
<td>No</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of isolators opened and serviced.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the servicing of the isolator, internal cleaning of the enclosure, inspection of the contact points, switching mechanism, earthing and connections to the fixed appliance. Isolator face plate shall be fitted with an engraved Traffolite label as per Nosa-standard, cost of which is included in the rate.</td>
<td></td>
</tr>
</tbody>
</table>
The tendered sum shall further include for replacement of any damaged or missing outlet covers and fixing screw, connections to appliances including earth continuity testing.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.09</td>
<td></td>
</tr>
<tr>
<td>Replace power skirting</td>
<td>m</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the linear metre of power skirting supplied and installed.

The tendered rate shall include full compensation for the removal of the existing power skirting, the supply and installation of the specified type and size of powerskirting including all accessories.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.10</td>
<td></td>
</tr>
<tr>
<td>Supply and install Pratley boxes</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of Pratley boxes supplied and installed.

The tendered rate shall include full compensation for the supply and installation of the specified type of Pratley box.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.11</td>
<td></td>
</tr>
<tr>
<td>Supply and install draw boxes</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of draw boxes supplied and installed.

The tendered rate shall include full compensation for supplying and installing the draw boxes including cover plates where no equipment is installed in the box.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.12</td>
<td></td>
</tr>
<tr>
<td>Supply and install draw box cover plates</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of draw box cover plates supplied and installed.

The tendered rate shall include full compensation for the supply and installation of the specified type and size of cover plates for draw boxes including the fixing screws.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.13</td>
<td></td>
</tr>
<tr>
<td>Replace “stop-start” local control panel</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of “stop-start” local control panels supplied and replaced.

The tendered rate shall include full compensation for the supply and installation of “stop/start” local control panel including emergency stop button and 32A 3 pole contactor in an IP55 polycarbonate enclosure. The rate shall include an engraved Traffolite label indicating load and supply DB.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.14</td>
<td></td>
</tr>
<tr>
<td>Test and service ceiling mounted fan</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of ceiling fans tested.
The tendered rate shall include full compensation for the servicing of the fan, disconnection, testing, inspection of the contact points, switching mechanism, earthing and re-connection of the ceiling fan.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-15</td>
<td></td>
</tr>
<tr>
<td>Replace ceiling mounted fan</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of ceiling fans supplied and installed.

The tendered rate shall include full compensation for the disconnection of the damaged ceiling fan and for the supply, installation and connection of the new ceiling fan.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-16</td>
<td></td>
</tr>
<tr>
<td>Service ceiling mounted fan control switch</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of control switches opened and serviced.

The tendered rate shall include full compensation for the servicing of the control switch, inspection of the contact points, switching mechanism, if applicable, earthing etc.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-17</td>
<td></td>
</tr>
<tr>
<td>Replace ceiling mounted fan control switch</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of control switches replaced.

The tendered rate shall include full compensation for the supply and installation of the control switch.

The tendered sum shall further include for the provision of connection to the ceiling fan.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-18</td>
<td></td>
</tr>
<tr>
<td>Supply and install new isolator outlets</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of the specific outlets.

The tendered rate shall include full compensation for the supply and installation of the complete outlet.

Supply and install outlet points as indicated, which must be wired with 2 x 4mm² PVC insulated copper conductors plus 1 x 2.5mm² PVC copper earth wire in a 20mm diameter conduit. A double-pole 30 Amp isolator complete with an indicator lamp in a box with a cover plate must be installed adjacent to the equipment. The connection between the equipment and the isolating switch must be done with a flexible cord complete with approved glands at the geyser.

The end of the conductors must be fitted with approved crimping lugs for connection to geyser terminals.

The tendered sum shall further include for the provision of connection to a new circuit.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>-19</td>
<td></td>
</tr>
<tr>
<td>Supply and install new socket outlets</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of the specific outlets.
The tendered rate shall include full compensation for the supply and installation of the complete outlet.

Socket outlets shall be installed in the positions as indicated. Socket outlets shall be similar or equal and approved to the “LUMEX CLIPSAL 2000” type. The sockets on the power skirting must be of the “LUMEX S2000 2002” sockets that are on a 45° cradle.

All socket outlets shall be of the combination switch-type, 16 A. 3 Pin. Only socket outlets of the same manufacturer will be accepted.

Switch socket circuits shall be wired by means of 4mm² PVC insulated copper conductors and a 2,5mm² copper earth in 20mm diameter conduit unless otherwise indicated.

Socket circuits shall be protected by means of earth leakage's units as detailed.

Socket outlets shall be mounted in power-skirtings and 400mm or 1400mm above finished floor level unless otherwise indicated.

The tendered sum shall further include for the provision of connection to the existing circuit or a new circuit.

**Earthing and bonding**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.01</td>
<td>SUPPLY AND INSTALL EARTHING AND BONDING FOR THE INSTALLATION</td>
</tr>
</tbody>
</table>

The tendered lump sum shall include full compensation for the provision of all material required for the earthing and bonding of the installation in accordance with the specification.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.02</td>
<td>TESTING OF THE EARTH INSTALLATION BY A SPECIALIST CONTRACTOR</td>
</tr>
</tbody>
</table>

The tendered lump sum shall include full compensation for the testing of the earth installation by a specialist contractor approved by the Engineer.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.03</td>
<td>SUPPLY AND INSTALL EARTH ELECTRODES</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of earth electrodes supplied and installed.

The tendered sum shall include full compensation for the supply and installation of the specified type and size of earth electrodes including termination by means of approved clamps.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.04</td>
<td>PROVIDE CADWELD JOINT</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of cadweld joints provided.

The tendered sum shall include full compensation for the supply and installation of the specified type and size of cadweld pyro joints.
item & unit

- .05

**Earth building roof structure**

The unit of measurement shall be the number of roof structures earthed.

The tendered sum shall include full compensation for the supply and installation of the specified type and size of earthwire and the termination thereof onto a 1.2 m Cu earth electrode driven into the soil 1.8 m deep.

**AB 11**

**MAINTENANCE OF THE INSTALLATION**

**AB 11.01**

Monthly maintenance responsibilities for each installation, each portion, including all units and components as specified, shall commence with access to the site. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.

Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period.

**AB 11.02**

The following maintenance actions will be required under this contract:

- routine preventative maintenance
- corrective maintenance
- breakdown maintenance

These actions are defined in the Additional Specification SA – General Maintenance.

**AB 11.03**

The maintenance schedules and frequency of maintenance activities shall be developed under the maintenance control plan which will be instituted by the Contractor. The Contractor’s responsibility in this regard is specified in the Additional Specification SA – General Maintenance.

**AB 11.04**

**SCOPE OF ROUTINE PREVENTIVE MAINTENANCE**

The routine maintenance work to be performed and executed shall include, but not be limited to the items listed below. These actions and findings shall be logged and reported on the relevant approved schedules and exports.

**AB 11.04.01**

Monthly maintenance

(a) Check operation of protective and monitoring devices.

(b) Verify operation of switching elements and meters.

(c) Check lamp operation

(d) Measure phase voltages and currents in distribution boards and record values in Record book

(e) Inspect and repair the following:

   (i) any visible damage to the installation
   (ii) setting of protective and monitoring devices
   (iii) ensure presence of diagrams, instructions and similar information
(v) ensure upkeep of the labelling of the distribution board, equipment, cabling and wiring
(vi) ensure presence of Nosa-type engraved labelling on face plates or bodies of light switches, socket outlets and isolators.

AB 11.04.02 Annual maintenance

(a) Service all luminaires, distribution boards, socket outlets, isolators, light switches, etc.
(b) Carry out all tests listed under section AB 04.02 above and record values in the Record book
(c) Witnessed testing of all earth leakage protection units on all socket outlet units.
(d) Visually inspect the following and repair if required:
   (i) connection of cables and conductors including earthing and bonding.
   (ii) presence of appropriate devices for isolation and switching.
   (iii) correct connection of socket outlets, light switches, isolators, lampholders, etc.

AB 11.05 MAINTENANCE WORK : MEASUREMENT AND PAYMENT

Refer to clause SA 06 of the ADDITIONAL SPECIFICATION : SA GENERAL MAINTENANCE
TECHNICAL SPECIFICATION

FC HOT-WATER GENERATING INSTALLATIONS

CONTENTS

FC 01 SCOPE
FC 02 STANDARD SPECIFICATIONS
FC 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS
FC 04 OPERATING AND MAINTENANCE MANUALS
FC 05 TRAINING OF OPERATORS FOR THE OPERATION OF THE INSTALLATION AND EQUIPMENT
FC 06 LOGGING AND RECORDING PROCEDURES
FC 07 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK
FC 08 QUALITY ASSURANCE SYSTEM
FC 09 COMMISSIONING AND RECOMMISSIONING OF PLANT AND INSTALLATION
FC 10 GUARANTEE OF INSTALLATION AND EQUIPMENT
FC 11 MAINTENANCE TOOLS AND SPARES
FC 12 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT
FC 13 MAINTENANCE TO INSTALLATIONS AND EQUIPMENT

FC 01 SCOPE

This specification covers the general repair and maintenance of hot-water generating installations, which include the following:

(a) Steam generated hot-water heating equipment
(b) Electrical generated hot-water heating equipment
(c) Primary and secondary pumps
(d) Hot-water storage vessels
(e) Lagging and cladding of vessels and piping systems
(f) Hot-water reheating vessels
(g) Corrosion protection linings to storage vessels and reheaters
(h) Hot, cold and drainage pipework to the plant room installation
(i) Electrical control systems, wiring and control panels
(j) Thermostats and safety equipment.

This specification also addresses the training of
- User Client and associates, and
- maintenance staff.

This specification shall form an integral part of the repair and maintenance contract document, and shall be read in conjunction with the additional and particular specifications compiled as part of this document.

This specification shall act as a guideline to the particular specification and, in the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.
FC 02  STANDARD SPECIFICATIONS

FC 02.01  GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

The latest edition, including all amendments up to date of tender of the following specifications, publications and codes of practice shall be read in conjunction with this specification and shall deemed to form part thereof:

FC 02.01.01  SABS and other specifications and codes

SABS 0400 - The applications of the building regulations
SABS 0142 - Code of practice for the wiring of premises
SABS 0140 - Identification colour marking
SABS 044  - Parts I to IV: Welding
SABS 460  - Copper tubes for domestic plumbing
SABS 0252 - Parts I and II
SABS 0103 - The measurement and rating of environmental noise with respect to annoyance and speech communications

SABS Specifications listed on page 3 of the DPW specification OW 371
Atmospheric Pollution Prevention Act, No 45 of 1965
BS 2790
BS 1740
BS 21
BS 1640
BS 5500

FC 02.01.02  Department of Public Works specifications

OW 371 - Specification of materials and methods to be used (Fourth revision, October 1993)
STD.PWD.VII - Standard Specification for steam boiler installations
Standard Specification for electrical installations and equipment pertaining to mechanical installations

FC 02.01.03  Occupational Health and Safety Act of 1993

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) shall be adhered to.

FC 02.01.04  Manufacturers’ specifications, codes of and practice and installation instructions

All equipment and materials shall be installed, serviced and repaired strictly in accordance with the manufacturers’ specifications, instructions and codes of practice.

FC 02.01.05  Municipal regulations, laws and by-laws

All municipal regulations, laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.

FC 03  VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

The following additional general specifications and requirements shall be read in conjunction with this specification and shall be adhered to unless otherwise specified in the Particular Specification.

OCT 2019  MASERU BORDER POST
GENERAL REPAIR AND INSTALLATIONS REQUIREMENTS

(a) All materials and equipment supplied and installed shall be new and of high quality and manufactured to the relevant specifications, suitable for providing efficient, reliable and trouble-free service.

(b) All work shall be executed in a first-class workman-like manner by qualified tradesmen.

(c) All equipment, component parts, fittings and materials supplied and/or installed, shall conform in respect of quality, manufacture, test and performance to the requirements of the applicable current SABS specifications and codes, except where otherwise specified or approved by the Engineer in writing.

(d) All materials and workmanship which, in the opinion of the Engineer, is inferior to that specified for the work, will be condemned. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer.

(e) The Contractor shall submit a detailed list of the equipment and material to be used to the Engineer for approval before placing orders or commencing installation.

(f) All new equipment, materials and systems shall be installed and positioned such as to not impede on access routes, entrances and other services. The Contractor shall coordinate these items taking other services and equipment into account.

(g) All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.

(h) The Contractor shall make sure that all safety regulations and measures are applied and enforced during the repair and construction periods to ensure the safety of the public and User Client.

(i) Repair work shall be programmed in accordance with Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures, to ensure the shortest possible down-time of any service and the least inconvenience to the User Client and public. The Contractor shall make sure that the necessary notifications and notices are timeously put into place for these activities.

OPERATING AND MAINTENANCE MANUALS

The Contractor shall be responsible for the compilation of an inventory list and operating and maintenance manuals.

This shall be done in accordance with Additional Specification SB: Operating and Maintenance Manuals.

All information shall be recorded and reproduced in electronic format, as well as three sets of hard copies to be supplied to the Department.
Over and above what is specified in Additional Specification SB: Operating and Maintenance Manuals, the operating and maintenance manual to be compiled shall be structured to include at least the following:

(a) **System description**

Complete system description and the working of the plant.

(b) **Commissioning data**

Complete commissioning, test and inspection data of systems and equipment.

(c) **Operating data**

(i) Systems and equipment running check list and frequency of servicing required;
(ii) Safety precautions to be implemented;
(iii) Operator's duties (logging requirements);
(iv) Lubricating oils and service instructions.

(d) **Mechanical equipment**

(i) Description of all major items with the make, model number, names, addresses and telephone numbers of the suppliers, manufacturers or their agents;
(ii) Design capacities of all equipment, including selection parameters, selection curves, capacity tables, etc;
(iii) Manufacturer's brochures and pamphlets;
(iv) Schedule of spares with part numbers recommended to be held as stock;
(v) Vessels pressure test and certification certificates.

(e) **Maintenance instructions**

(i) Schedule of maintenance particulars, frequency of services and replacements;
(ii) Trouble-shooting guide;
(iii) Part number of all replacement items and spares;
(iv) Capacity curves of all pumps;
(v) Serial numbers of all items of equipment.

(f) **Electrical equipment**

(i) Schedule of equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
(ii) Maintenance instructions;
(iii) Manufacturer's brochures and pamphlets;
(iv) Complete as-built circuit diagrams and diagrammatic representation of interconnections of all electrical equipment.

(g) **Instrumentation and control**

(i) Description of each control system;
(ii) Schedule of control equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
(iii) Maintenance instructions;
(iv) Manufacturer's brochures and pamphlets.
(h) **Drawings**
   
   (i) Paper prints of all as-built mechanical and electrical drawings;
   (ii) Wiring diagrams framed behind glass shall be mounted adjacent to each relevant control panel.

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**FC 05 TRAINING OF OPERATORS FOR THE OPERATION OF THE INSTALLATION AND EQUIPMENT**

In addition to the requirements of Additional Specification SD: General Training, the Contractor shall allow and provide for additional training of the User Client's representative(s) as specified and set out in this specification. The objective of this training will be to ensure that the following be achieved:

(a) The identification of pending faults and repairs at an early stage;
(b) Reducing the maintenance cost of the equipment to an acceptable level, and maintaining the cost at this level;
(c) Preventing maloperation of the systems and equipment.

The training course for the User Client's representative(s) shall include at least the following:

(a) Equipment and component recognition.
(b) How to operate the equipment including the following:
   
   (i) Starting the equipment;
   (ii) Manual and automatic controlling;
   (iii) Shut-down and isolating of equipment and systems;
   (iv) Cleaning of equipment.
(c) Emergency procedures to be followed in the case of breakages, system faults, steam cuts, etc.
(d) Safety precautions to be followed and implemented.
(e) The identification, reporting and recording of faults and operation of equipment.
(f) The logging of equipment operation, readings and settings.

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**FC 06 LOGGING AND RECORDING PROCEDURES**

The Contractor shall under this repair and maintenance contract institute a logging and recording system as part of his maintenance control plan as defined in Additional specification SA: General and Maintenance. This shall consist of a log and record book, which shall be utilised to log and record all operations, faults, system checks, breakdowns, maintenance visits, inspections, etc.

The logbook shall be kept in a safe place as agreed with the User Client and the Engineer and shall only be utilised by the maintenance personnel, the Contractor and the Engineer. Copies of the monthly entries and recordings into the logbook shall be submitted by the Contractor together with his monthly report to the Engineer.
The logbook shall be structured to include at least the following:

(a) Weekly inspection and maintenance actions;
(b) Monthly inspection and maintenance actions;
(c) Four-monthly inspection and maintenance actions;
(d) Annual inspection and maintenance actions;
(e) Breakdown reports;
(f) Daily system and equipment operating conditions, observations, recordings and measurements;
(g) Inspection and test comments and reports.

The Contractor shall also institute an attendance register, which shall be kept in a safe place as agreed with the User Client and the Engineer. This register shall be completed by all persons visiting the installation, including:

(a) Maintenance personnel
(b) Contractor
(c) Inspectors
(d) User client personnel
(e) Engineer.

The register shall state the date, time-in, time-out, name, company and reason for visit.

A copy of the register shall be submitted by the Contractor together with his monthly report.

**FC 07 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK**

Except where otherwise provided in the Contract, the Contractor shall provide all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out such tests. The Contractor shall make arrangements for such tests and he shall give at least 72 hours written notice to the Engineer before commencing the test.

In the event of the plant or installation not passing the test, the Employer shall be at liberty to deduct from the Contract amount all reasonable expenses incurred by the Employer or the Engineer attending the repeated test.

Whenever any installation or equipment is operated for testing or adjusting as provided for above, the Contractor shall operate the entire system for as long a period as may be required to prove satisfactory performance at all times in the occupied space served by that system for up to twenty-four hours a day continuously until the system is handed over.

The Contractor shall provide all labour and supervision required for such operation and the Department may assign operating personnel as observers, but such observation time shall not be counted as instruction time.

After completing the installation or system, all equipment shall be tested, adjusted and readjusted until it operates to the satisfaction and approval of the Engineer.

The Contractor shall submit certificates of tests carried out to prove the efficiency of all equipment, as well as certificates to be obtained from all relevant authorities and statutory bodies, etc.
FC 08 QUALITY ASSURANCE SYSTEM

The Contractor shall institute an approved quality assurance (QA) system that shall be submitted to the Engineer for approval. The records of this QA system shall be kept throughout the duration of the Contract and submitted to the Engineer at regular intervals as required.

FC 09 COMMISSIONING AND RECOMMISIONING OF PLANT AND INSTALLATION

FC 09.01 GENERAL

On completion of the repair work and/or the installation of new systems the plant and equipment shall be put into operation after all tests and adjustments have been carried out to the satisfaction of the Engineer. Where new plant is installed the Contractor shall run and operate the system for a period of time as specified by the Engineer and train the staff of the User Client to operate and maintain the system.

Logging of the operation of the installations shall commence immediately upon start-up.

The Contractor shall submit a full commissioning report.

FC 09.02 RECOMMISIONING OF HOT-WATER GENERATING INSTALLATION AND ANCILLARY EQUIPMENT

On completion of any repairs the Contractor shall recommission the systems, installation and/or equipment influenced by such repairs.

This operation shall be done strictly in accordance with the manufacturer’s specification and relevant standards, norms and specifications from the applicable body, authority and/or department. The operation shall include but not be limited to the following:

(a) All required precommissioning mechanical checks

   (i) Check all steam, water and drain connections (when applicable).

   (ii) Check all moving parts.

   (iii) Check seals, gaskets and joints.

   (iv) Reinstall all plugs and covers and check that they are properly secured.

   (v) Check and record that all lubrication to equipment and components has been done in accordance with manufacturer’s specification.

   (vi) Check and ensure that all valves and safety valves are correctly installed and in the correct operating position. Safety valves are to be set in accordance with the required blow-off pressure for the installation.

   (vii) Check and ensure that all control equipment such as pressure-reducing valves, heat control equipment, etc, are set and adjusted to the correct controlling value in accordance with the system parameters and manufacturer’s specification.
(viii) All steam and condensate precommissioning checks shall be done in accordance with Technical Specification FB (where applicable).

(ix) Check and confirm that all required tests and inspections to storage vessels, primary heater vessels and reheater vessels have been done and that all required certificates are in place.

(x) Check and ensure that the domestic hot-water and cold-water piping system is operational and that no leaks are present.

(xi) Check, test and inspect the correct installation and operation of all primary and secondary pumping systems (where applicable).

(xii) Check that all the required pressure testing to the repaired installations and/or new equipment has been done, witnessed and recorded in accordance with the relevant specifications.

(xiii) Check, test and inspect all bracketing and supports for the relevant installations and equipment to ensure that they are properly secured and installed in accordance with the manufacturer’s specifications and installation specification.

(xiv) Check, inspect and ensure that all lagging and cladding to the vessels and piping installation are installed and repaired in accordance with the applicable specifications from the relevant controlling authority.

(xv) Check, inspect and ensure that no leaks to equipment, systems and installations occur.

(b) All required precommissioning electrical checks

(i) Check all wiring connections for tightness and repair any hot connections.

(ii) Check that all electrical equipment has been properly reconnected in accordance with the manufacturer’s specification.

(iii) Perform and record all required electrical insulation tests on equipment.

(iv) Check and test all controls without livening up electrical equipment.

(v) Check all motor-driven equipment for correct rotational directions.

(vi) Check and test the operation of all indication and warning lights.

(vii) Check, set, record and readjust all equipment control and set points in accordance with manufacturer’s specifications.

(viii) Run all motor-driven equipment for a period to ensure free movement and correct operation.
(c) Commissioning of equipment

On completion of the precommissioning checks the Contractor shall proceed with the commissioning of the equipment. This shall be done strictly in accordance with the manufacturer’s specification and system parameters and shall include but not be limited to the following:

(i) During the commissioning process all safety and warning system checks are to be performed on the thermostatic control system where applicable.

(ii) During load conditions the equipment shall be readjusted and finally switched to automatic operation on completion of all automatic control functions for correct operation where applicable.

(iii) Check that steam pressure valves are readjusted where necessary to the correct set point under load conditions where applicable. This shall be done in accordance with Technical Specification FB: Steam Generating Installations.

(iv) Check the operation of all steam trap arrangements where applicable. This shall be done in accordance with Technical Specification FB: Steam Generating Installations.

(v) Check that water pressure-reducing valves are adjusted and set to the correct operating value for the specific system.

(vi) Check the correct operation of all systems. Readjust primary and secondary pumping control equipment where applicable.

(vii) Test and check for any leaks to the system, equipment and installation.

(viii) Check for any unnecessary strain to system, equipment and installation due to expansion and contraction.

(ix) Check the correct functioning of all heating temperature control equipment to ensure the correct switching levels and that all safeties are operational.

(x) Record temperatures and flow conditions.

The Contractor shall visit, inspect, test and readjust the systems, equipment and installation during the week following the recommissioning to ensure the correct functioning of the equipment and its associated components.

FC 10 GUARANTEE OF INSTALLATION AND EQUIPMENT

The Contractor shall provide guarantees obtained from the manufacturer(s) and/or supplier(s) to the effect that each piece of new equipment, supplied and installed under the repair contract, complies with the required performance and will function as part of the complete system.

All new equipment, including, the complete new installations and the systems as a whole shall be guaranteed for a period of 12 (twelve) months commencing upon the day of issue of a certificate of completion for the repair work of the installation.
FC 11  MAINTENANCE TOOLS AND SPARES

Each installation shall be equipped with the necessary maintenance tools and spares required by the specific type of equipment and installation for the daily operation and maintenance of the system. At the start of the repair and maintenance contract the Contractor shall in the presence of the User Client make an inventory of the existing tools and spares, and any shortfall or damaged tools and spares shall be replaced with new. All replacement tools and spares shall be as specified by the equipment manufacturers. These tools and spares shall be kept in a lockable room or cabinet of which the maintenance supervisor and the Contractor shall carry keys. The Contractor shall on a monthly basis take stock of these items in the presence of the User Client’s maintenance supervisor and record and report to the Engineer. Any shortfall shall be replaced by the Contractor as part of his responsibility under this Contract.

The tools and spares to be carried shall include but not be limited to at least the following:

(a) Tools
   (i) Grease and oil lubrication equipment;
   (ii) Equipment operating keys and tools.

(b) Spares
   (i) Spare sight glasses for sight glass indicators, seals and gaskets (where applicable);
   (ii) Spare seats, gaskets and gland packings for valves, etc;
   (iii) Spare steam traps, at least one of each type present on the installation (where applicable);
   (iv) Spare pressure gauges, at least one of each range and type;
   (v) Spare electrical elements (where applicable);
   (vi) Spare thermostats, at least one of each type present on the installation (where applicable);
   (vii) Spare pilot lights, contactors, circuit brackets, relays, thermal overloads, etc, for electrical control panels;
   (viii) Spare temperature gauges, at least one of each range and type.

FC 12  REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

FC 12.01  GENERAL

During the repair and maintenance contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but no be limited to the specified Particular Specification details.

All repair work shall be executed using approved materials and equipment suitable to the systems and/or installations they serve. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer’s specifications and codes of practice and all additional and particular specifications included in this document.

The repair work items are listed in the Particular Specification and Schedule of Quantities with all relevant details, such as capacity, size, manufacturer, model number, etc.
All repair work shall be executed within the specified durations listed in the Appendix to Tender. All new equipment, materials and systems shall be furnished with a written guarantee of a defects liability period of 12 months commencing on the date of issue of a certificate for completion of the repair work. These guarantees shall be furnished in favour of the Department of Public Works.

Repair work items for the steam generating installations shall be categorised under the following headings:

(a) General requirements for hot-water generating installations

(b) Steam and condensate pipework (where applicable)
    Refer to Technical Specification FB: Steam Distribution Installations.

(c) Hot-water storage vessels
    (i) Existing hot-water storage vessels
    (ii) Electrically driven storage vessels, new hot-water storage vessels
    (iii) Heating services for hot-water storage vessels.

(d) Lagging and cladding of vessels and piping
    (i) Vessel lagging and cladding
    (ii) Hot-water and hot-water return pipe lagging and cladding

(e) Pressure testing

(f) Corrosion protection linings

(g) Sterilisation of installation

(h) Heating control equipment
    (i) Steam heating equipment
    (ii) Electrical heating equipment

(i) Instruments and controls
    (i) Type of instrumentation and controls
    (ii) Instrumentation and controls, installation requests

(j) Primary and secondary pumping installations
    (i) Primary pumping equipment
    (ii) Secondary pumping equipment

(k) Domestic hot-water and cold-water pipe installations
    (i) Strainers
    (ii) Valves
    (iii) Air vents
    (iv) Thermostatic water flow control valve
    (v) Expansion equipment
    (vi) Flow meters
    (vii) Check valves
    (viii) Vacuum breakers
    (ix) Expansion release valve
    (x) Safety valves
(xi) Pressure gauges

(i) Electrical installations

   (i) Electrical control panels
   (ii) Wiring and cabling.

Any repair work, which may be required on the systems, equipment and installation, shall be executed using approved materials, equipment, methods and tooling suitable for the specific application. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, statutory regulations, manufacturer's specifications and codes of practice and as specified in all additional and particular specifications included in this document.

At the start of the repair and maintenance contract, the repair work specified in the Particular Specification shall be done in accordance with the items listed. Any repair work during the maintenance period shall also adhere to this specification.

FC 12.02 GENERAL REQUIREMENTS FOR HOT-WATER GENERATING INSTALLATIONS

All repair work and new installation of hot-water generating installations shall adhere to the standard specifications of the Department of Public Works and all relevant specifications, norms, standards and regulations applicable to this type of installation, including the following general requirements:

(a) The hot-water generating installation shall be repaired, installed and maintained as a complete functional unit, with all the responsibilities, functions and operating parameters taken into account to ensure the continuous supply of hot water to the consumer points.

(b) The hot-water generating installation shall be capable of providing ample supply of hot water to the consumer points by means of ensuring the correct sizing of the hot-water storage and production.

FC 12.03 STEAM AND CONDENSATE PIPEWORK

All steam and condensate installations shall be done in accordance with Technical Specification FB: Steam Distribution Installations.

FC 12.04 HOT-WATER STORAGE VESSELS

FC 12.04.01 Existing hot-water storage vessels

At the start of the maintenance and repair contract the Contractor shall inspect, repair, service, clean out and test all hot-water storage vessels.

The inspection shall include the following:

(a) Isolate drain, open manholes and clean out hot-water vessels.
(b) Inspect vessel welds.
(c) Inspect internal corrosion lining and check for any pit holes and damages to the vessel material and connections.
(d) Inspect lagging and cladding.
(e) Inspect condition of all elements, steam heating coils, controls, safety valves, etc.
During this inspection the Contractor shall notify the Engineer in advance to allow the Engineer to witness the Contractor’s findings. The Contractor shall submit a written report on the findings.

All manhole and pipe gaskets shall be replaced. No repair work shall be proceeded with prior to approval from the Engineer.

Should any welding repair work be required it shall be performed by a coded welder in accordance with acceptable practices, codes and norms.

Should the corrosion lining be damaged or corroded, thus necessitating the relining of the vessel, this shall be done with an approved lining suitable for the water quality and operating temperature under which this system is functioning.

For further details on repair to resisting linings and installation of new linings refer to FC12.06.

All safety valves shall be serviced, overhauled and readjusted to the correct safety pressure blow-off part.

All lagging and cladding shall be inspected, repaired and where necessary replaced.

On completion of all repair and service work the Contractor shall reinstate all equipment, fill the hot-water vessel with water and pressure test it to 1.5 times the permissible operating pressure or allowable test pressure.

On passing of the pressure test the Contractor shall recommission the hot-water vessels and put it back on line.

**FC 12.04.02  New hot-water storage vessels**

Where new hot-water storage vessels are to be installed it shall be done in accordance with the following specification and on approval of the necessary workshop drawings to be provided by the Contractor.

The storage vessels shall be of the vertical cylindrical type with dished ends on both sides, and shall be manufactured to BS 5500 Category II in mild steel for a working pressure as indicated for the three systems. A pressure test certificate for each vessel shall be supplied by the manufacturer.

The vessel shall be equipped with at least the following:

(a) Properly sized flanged manhole for easy access
(b) Flanged inlets and outlets to SABS 1123 Table 10
(c) Sparge pipe on the cold-water inlet
(d) Correctly sized thermometer
(e) Correctly sized temperature and pressure relief valve
(f) Air release valve
(g) Correctly sized pressure gauge
(h) BSP threaded sockets for thermostats
(i) 40 mm diameter BSP threaded socket at the lowest point of the storage tank for draining purposes
(j) 50 mm diameter boss element segments for auxiliary elements.

An expansion relief valve shall be installed on the inlet to the storage vessels for thermal expansion.

Where pipe connections to the storage vessel are done with dissimilar materials (such as copper), isolating flanges shall be used (dielectric coupling).
Before ordering and manufacturing of storage vessels a workshop drawing shall be submitted to the Engineer for approval.

The Contractor shall satisfy himself that access and plantroom sizes are to the dimensions on the drawings and that the equipment will fit into the space allowed.

FC 12.04.03 Heating sources for hot-water storage vessels

(a) Electrical elements

Where electrical immersion elements are used to heat the water inside the hot-water storage vessel, these elements shall be replaced at the start of the repair and maintenance contract.

All the thermostat controls and safety cut outs shall be cleared, inspected, tested, adjusted to the set point and where necessary replaced.

(b) Steam heating

Where steam heat exchangers are used to heat the water inside the storage vessel, these coils shall be removed together with the steam chest and associated equipment. The coils shall be descaled, cleaned, inspected and tested.

Where necessary the heat exchanger and/or coils shall be replaced.

FC 12.05 LAGGING AND CLADDING

All lagging and cladding to hot-water vessels, primary heaters, secondary heaters and hot and circulation water piping shall be inspected for defects, damages and shortages at the start of the repair and maintenance contract. The Contractor shall report his findings to the Engineer in writing.

All repairs to be done shall match the existing installation and the Contractor shall ensure that no sharp edges from the metal cladding pose a danger to anybody.

The following specification shall be adhered to:

(a) Vessel lagging and cladding

The storage vessels shall be insulated with a 80 mm thick layer of mineral glass wool with a density of 88 kg/m³ and finally covered with 0.6 mm thick galvanized sheet metal. The sheet-metal work has to be done by a specialist. (All edges are to be rolled and no sharp edges will be allowed.)

(b) Hot-water and return water pipe lagging and cladding

All hot water and hot-water return pipes shall be insulated with preformed fibreglass sections covered with galvanized sheet-metal muffs in a water tight manner. Sheet-metal muffs shall be installed with the joints overlapping at least 50 mm and the longitudinal overlap pointing downwards to prevent ingress of water. The sheet-metal muff shall be strapped with 10 mm galvanized straps by means of a strapping tool with a minimum of 2 straps/section. All pipe bends, T-pieces, etc, shall be insulated with 25 mm diameter fibreglass rope covered with a 12 mm thick layer of self-setting fibre cement. A reinforcing gauze shall be wrapped over the fibre cement while wet and then painted with mastic paint when dry.

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Table FC 12.05/1 below provides a guideline for the preformed fibreglass section thickness to be used.

The fibreglass sections shall have a density of 88 at least kg/m$^3$.

**TABLE FC 12.05/1: FIBREGLASS SECTION THICKNESS**

<table>
<thead>
<tr>
<th>PIPE SIZE (STEEL)</th>
<th>PIPE SIZE (COPPER)</th>
<th>THERMAFLEX THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mm dia</td>
<td>108 mm dia</td>
<td>50 mm</td>
</tr>
<tr>
<td>80 mm dia</td>
<td>76 mm dia</td>
<td>40 mm</td>
</tr>
<tr>
<td>65 mm dia</td>
<td>67 mm dia</td>
<td>40 mm</td>
</tr>
<tr>
<td>50 mm dia</td>
<td>54 mm dia</td>
<td>25 mm</td>
</tr>
<tr>
<td>40 mm dia</td>
<td>42 mm dia</td>
<td>25 mm</td>
</tr>
<tr>
<td>32 mm dia</td>
<td>35 mm dia</td>
<td>25 mm</td>
</tr>
<tr>
<td>25 mm dia</td>
<td>28 mm dia</td>
<td>20 mm</td>
</tr>
<tr>
<td>20 mm dia</td>
<td>22 mm dia</td>
<td>20 mm</td>
</tr>
<tr>
<td>15 mm dia</td>
<td>15 mm dia</td>
<td>15 mm</td>
</tr>
</tbody>
</table>

**FC 12.06 PRESSURE TESTING**

The Contractor shall at the completion of the repair contract arrange for a complete pressure test to be executed on the hot-water generating installation. This shall be done in collaboration with the User Client and Engineer to ensure the minimum down-time of the installation, as well as to establish a suitable period for this pressure test. All leaks shall be repaired and the system shall be tested at the cost of the Contractor. This test shall be witnessed by the Engineer.

The tests shall be performed on all hot-water storage vessels, primary heating vessels, secondary heater vessels and domestic water pipe systems.

All safety and expansion release valves shall be removed and plugged, and on completion these shall be reinstalled.

The systems shall be filled with water after all branches have been plugged, sealed or closed.

The systems shall be hydraulically pressure tested by means of a suitable manually operated or mechanically driven pressure pump.

A pressure of at least 1.5 times the working pressure of the class rating of pipes or fittings shall be applied for a period of time specified in the specifications or as recommended by the manufacturers. (Refer to SABS 1200 for minimum and maximum test pressures.)

Tests should not be performed against closed valves.

Leakage which occurs shall be measured, calculated and checked against the allowable losses, as specified in SABS 1200.
If the completed sections comply with all specifications and pass the tests and inspection, it can be approved and the Contractor may be instructed to recommission the plant.

**FC 12.07 CORROSION PROTECTION LININGS**

All vessel corrosion protection linings shall be inspected and repaired and/or replaced where necessary.

Repairs shall only be done to linings where the supplier and installer of these linings approve of such repairs. These repairs shall then be done strictly in accordance with the manufacturer's specification and shall be certified by an approved inspection authority.

Where new linings are to be installed, the required preparation work including sand blasting and removal of old lining shall be done in accordance with the recommendation of the supplier of the new lining.

Where new linings are to be introduced they shall be similar or equal to the following:

(a) Internally coated with a durable, high operating temperature glass flake lining with DTF of one millimetre, similar or equal to a Polygrass VE lining as supplied by Corrocoate, suitable for an operating temperature of 95 °C at the indicated working pressures.

The applications of these linings shall be witnessed and certified as being to the manufacturer's application standards by an approved inspection authority.

(b) Externally the vessels shall be coated with two coats of red oxide paint.

**FC 12.08 STERILISATION OF WATER SIDE OF INSTALLATION**

The Contractor shall at the completion of the repair contract sterilise the complete water side of the hot-water system including vessels and pipes.

This shall be done as described in the following guidelines.

(a) The complete system shall be filled with potable water chlorinated to a concentration of 15 mg of chlorine per litre of water which shall remain in contact with the inner surface of the pipeline for a period of not less than 24 hours. The pipeline shall be filled for sterilising in such a manner that no chlorine shock is created or air is trapped in the pipeline.

(b) The Contractor shall submit full details of the proposed method for sterilising the pipeline to the Engineer for approval at least 14 days before commencing sterilising.

(c) The cost of water for filling the pipeline for sterilising shall be borne by the Contractor.

(d) The Contractor shall provide all materials, tools, equipment and labour necessary to sterilise the pipeline. After sterilising the pipeline the Contractor shall, at no extra cost, empty the pipeline and dispose of the water in a manner approved by the Engineer.
(e) The Contractor may use the following products as a source of chlorine:

(i) Chloride of lime to SABS 295 yielding 33% free chlorine by mass;

(ii) Calcium hypochlorite to SABS 295 yielding 70% free chlorine by mass;

(iii) Chlorine gas applied by chlorinator.

(f) After sterilisation, an approved water quality test to a minimum number of 10% of the total water points, randomly selected, evenly spread and marked on drawings, shall be carried out. This test shall include a full bacteriological test as per SABS 241 and the results shall be submitted to the Engineer for inclusion in the Contract documents. Each abortive test shall be for the Contractor’s cost.

When tested the water shall comply with the limits given in column 2 or 3, as relevant, of table FC 12.08/1.

TABLE FC 12.08/1: BACTERIOLOGICAL REQUIREMENTS

<table>
<thead>
<tr>
<th>1 PROPERTY</th>
<th>2 RECOMMENDED MAXIMUM LIMIT</th>
<th>3 MAXIMUM ALLOWABLE LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total coliform bacteria count per 100 millilitre</td>
<td>Nil*</td>
<td>5</td>
</tr>
<tr>
<td>Faecal coliform bacteria count per 100 millilitre</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>Standard plate count per millilitre</td>
<td>100</td>
<td>Not specified</td>
</tr>
</tbody>
</table>

Note:

* If any coliform bacteria are found in a sample, take a second sample immediately after the tests on the first sample have been completed; this sample shall be free from coliform bacteria.

Not more than 5% of the total number of water samples (from any one reticulation system) tested per year may contain coliform bacteria.

FC 12.09 HEATING CONTROL EQUIPMENT

The Contractor shall at the start of the repair and maintenance contract inspect, test, repair, readjust, and if necessary replace heating controls for the hot-water system.
This shall include the following:

(a) Check for correct switching and/or control temperature operating points.
(b) Check, test and ensure that the safety cut-out mechanisms are in place and switch and/or control at the correct level.
(c) Ensure that equipment has been installed in accordance with the manufacturer's specification.
(d) Ensure that all pockets are descaled and free of any defects.

The following control equipment shall be serviced, repaired and where required replaced if damaged beyond repair.

**FC 12.09.01 Steam heating control equipment**

Where immersed type thermostatic steam control valves are utilised they shall be serviced and repaired as follows:

(a) Dismantle and strip down thermostatic control valve including removal of pocket.
(b) Descale and clean all equipment.
(c) Replace element subassembly if necessary.
(d) Replace cover joint, gland packing, heater joint, coupling joint and all gaskets where applicable.
(e) Check valve seat and if necessary reseat.
(f) Reassemble control valve and reinstall, test and adjust to correct level.

All other type of thermostatic heating control valves shall be serviced, repaired and overhauled in accordance with the manufacturer’s specification.

**FC 12.09.02 Electrical heating control equipment**

All electrical thermostat control equipment shall be serviced and repaired in accordance with the manufacturer’s specification.

This shall include the following:

(a) Dismantle, clean and descale thermostat pockets.
(b) Test switching actions for correct operation.
(c) Test safety cut-out switching points for correct operation.

Replace thermostat if the switching does not take place in accordance with the manufacturer’s specification.

**FC 12.10 PRIMARY AND SECONDARY PUMP INSTALLATIONS**

The Contractor shall at the start of the repair and maintenance contract inspect, test, service and if required replace primary and secondary circulating pumps.

The pumps are to be inspected, tested, serviced and repaired together with their associated equipment and pipework. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the pumps and equipment shall include at least the following:

(a) Inspect and test the pumps for correct operation.
(b) Replace gland packings, seals and gaskets.
(c) Inspect and test for any bearing noise and replace if necessary.

(d) Clean out pump strainers, check non-return valves, valves, etc.

(e) Test pump motor windings for balance phases, insulation test and check wiring.

(f) Inspect pump mountings and repair if necessary.

Where in-line glandless canned pumps are used, these shall be inspected, tested, serviced where possible, impeller inspected and cleaned and if found beyond repair, replace with a suitable replacement in accordance with the operating parameters.

**FC 12.11 DOMESTIC HOT AND COLD WATER INSTALLATIONS**

The Contractor shall at the start of the repair and maintenance contract inspect, tests, service, repair and if required, replace damaged items on the complete hot and cold-water piping installation inside the hot-water generating plant rooms.

The repair work specification shall be read in conjunction with Technical Specification AA: Plumbing and Drainage Installations.

Repair work to the domestic hot and cold-water installation networks shall be as detailed in the Particular Specification and shall include, but not be limited to the following:

(a) Replace damaged, broken, leaking and corroded above and underground pipework, fittings and equipment.

(b) Repair, replace and service valves, including new gaskets, gland packings, seals, bolt and nuts, etc.

(c) Test the proper closing of all valves and where valves do not close properly, the valves shall be refurbished, descaled and if necessary replaced.

(d) Repair, clean and service all strainers including replacement of strainer elements where corroded and installation of new gaskets.

(e) Repair, service, test and readjust pressure-reducing valves. Pressure gauges shall be recalibrated and checked. Up and downstream pressures are to be logged. Downstream pressure to be adjusted to an acceptable level taking the allowable working pressure of the system and its components into account.

(f) Repair, service and check the proper functioning of all non-return valves.

(g) Repair, service, readjust and calibrate all safety and expansion relief valves.

(h) Repair, service and clean out all air release valves and vacuum breakers.

(i) Do repair work to bracketing systems including fixing and repair of existing brackets and the introduction of additional brackets where required.
(j) Hot-water pipe lagging and cladding shall be inspected, repaired, sealed and replaced where required.

(k) Repair, service and log readings of watermeters including cleaning of integral strainers.

(l) Water pipes are to be sampled for corrosion and scaling. The Engineer shall evaluate the actions to be carried out if the outcome of this sampling requires attention.

(m) Water supply shall be sampled and chemically analysed for the suitability to the systems and materials it serves.

(n) Pressure test and sterilise repaired new installation and equipment.

(o) Reinstate and make good walls, tiling, floors, concrete, finishes, holes, chases, surfaces, etc, to an acceptable level where any repair, upgrade and/or service work has been executed.

**FC 12.12 ELECTRICAL INSTALLATION, WIRING AND CONTROL PANELS**

**FC 12.12.01 Instrumentation and controls**

All instrumentation and control equipment shall be inspected, tested, repaired, adjusted and where necessary replaced. All repair and service work shall be done strictly in accordance with the manufacturer’s specification.

The repair work to the instrumentation and control equipment shall include at least the following:

(a) Test all equipment for correct operation.

(b) Inspect, test, service, adjust setting and if necessary repair, and/or replace steam detector.

(c) Inspect, recalibrate and, if beyond repair, replace steam pressure gauge.

**FC 12.12.02 Electrical control panels**

All electrical control panels shall be inspected, tested, and repaired, including all equipment inside the control panel. All repair and service work shall be done strictly in accordance with the manufacturer’s specification.

The repair work to the electrical control panels shall include at least the following:

(a) Test all control equipment for correct operation.

(b) Check and test all MCBs, isolators, contactors, overloads, other type of motor drives, pilot lights, control switches, etc, and readjust all set points; where equipment is found to be faulty these shall be replaced with new approved equipment.

(c) Check all wiring and connections for proper conducting and replace where hot connections are found.

(d) Clean out panel interior and exterior, inspect panel body, fascias, doors, paintwork, etc, and repair where necessary.
FC 13 MAINTENANCE TO INSTALLATIONS AND EQUIPMENT

FC 13.01 GENERAL

Monthly maintenance responsibilities for each installation including all units and components as specified, shall commence with access to the site. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.

Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period. This part of the Contract shall include:

(a) Routine preventative maintenance;
(b) Corrective maintenance, and
(c) Breakdown maintenance,

as defined in Additional Specification SA: General Maintenance, for the specified installations described under FC 01 of this specification.

The maintenance work to be performed and executed shall be done strictly in accordance with Additional Specification SA: General Maintenance, and as specified in Particular Specification PFC and this specification.

The said maintenance work shall be executed in accordance with the relevant codes of practice, statutory regulations, standards, regulations, municipal laws and by-laws and the manufacturers’ specifications and codes of practice.

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor, as specified in Additional Specification SA: General Maintenance.

All new equipment, components and materials supplied and installed under the maintenance contract shall be furnished with a prescribed manufacturer's guarantee.

The maintenance work and items are to be categorised by the Contractor for each maintenance activity under the following headings:

(a) Steam and condensate pipework (where applicable)
(b) Hot-water storage vessels
(c) Heating equipment
(d) Lagging and cladding of vessels and piping
(e) Corrosion protection linings
(f) Circulating pumps
(g) Domestic hot and cold-water piping systems
(h) Electrical controls, panels and wiring.

The Contractor shall be remunerated monthly, based on his performance, for maintaining the complete installation in a perfect functional condition.

FC 13.02 ROUTINE PREVENTATIVE MAINTENANCE

The routine maintenance of the installations, systems and equipment shall be done in accordance with Additional Specification SA: General Maintenance and the Particular Specification related to this work.
The routine maintenance work to be performed and executed shall include but not be limited to the items listed in tables FC 13.02/1, FC 13.02/2, FC 13.02/3 and FC 13.02/4 below under the respective headings. These actions and findings shall be logged and reported on the relevant approved schedules and reports.

**TABLE FC 13.02/1: WEEKLY ACTIONS AND MAINTENANCE**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MAINTENANCE DESCRIPTION</th>
<th>ACTION RESPONSIBILITY</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inspect equipment, components and installations for any visible defects, leaks, damages and/or pending faults.</td>
<td>Contractor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>2</td>
<td>Check and record all pressure gauge temperature and flow meter readings, and readjust equipment if necessary.</td>
<td>Contractor</td>
<td>Adjust/Check/Record</td>
</tr>
<tr>
<td>3</td>
<td>Check operation of pumps, heating equipment and controls for correct functioning.</td>
<td>Contractor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>4</td>
<td>Check electrical control panels for any faults.</td>
<td>Contractor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>5</td>
<td>Report any faults, defects, leaks, damages, etc, to Engineer.</td>
<td>User Client</td>
<td>Check/Record/Report</td>
</tr>
</tbody>
</table>

**TABLE FC 13.02/2: MONTHLY ACTIONS AND MAINTENANCE**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MAINTENANCE DESCRIPTION</th>
<th>ACTION RESPONSIBILITY</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All as listed under table FC 13.02/1</td>
<td>Contractor/User Client</td>
<td>Check/Record/Adjust/Repair/Report</td>
</tr>
<tr>
<td>2</td>
<td>Blow down all dirt pockets and record.</td>
<td>Contractor</td>
<td>Service/Record</td>
</tr>
<tr>
<td>3</td>
<td>Clean out all stainers and record.</td>
<td>Contractor</td>
<td>Service/Record</td>
</tr>
<tr>
<td>4</td>
<td>Check all valve gland seals and packings for leaks and replace and repair if necessary.</td>
<td>Contractor</td>
<td>Check/Service/Repair/Record</td>
</tr>
<tr>
<td>5</td>
<td>Check, inspect and repair if necessary all expansion joints for leaks and damages.</td>
<td>Contractor</td>
<td>Check/Repair/Record</td>
</tr>
<tr>
<td>6</td>
<td>Check all safety devices for correct operation and repair and replace where necessary.</td>
<td>Contractor</td>
<td>Check/Service/Repair/Record</td>
</tr>
<tr>
<td>7</td>
<td>Check and test all electrical control functions and operations. Repair and report any faults and defects.</td>
<td>Contractor</td>
<td>Check/Service/Repair/Record</td>
</tr>
<tr>
<td>8</td>
<td>Complete logbook and report.</td>
<td>Contractor</td>
<td>Report</td>
</tr>
</tbody>
</table>
# TABLE FC 13.02/3: FOUR-MONTHLY ACTIONS AND MAINTENANCE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MAINTENANCE DESCRIPTION</th>
<th>ACTION RESPONSIBILITY</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All as listed under tables FC 13.02/1 and FC 13.02/2.</td>
<td>User Client/Contractor</td>
<td>Check/Record/Adjust/Repair</td>
</tr>
<tr>
<td>2</td>
<td>Service, repair, clean, replace seals gaskets, reset and/or replace worn parts as directed by the manufacturer of all steam traps (where applicable).</td>
<td>Contractor</td>
<td>Check/Service/Repair/Report</td>
</tr>
<tr>
<td>3</td>
<td>Service, repair, replace glasses and gaskets where necessary and clean all sight glasses.</td>
<td>Contractor</td>
<td>Check/Service, Repair, Report</td>
</tr>
<tr>
<td>4</td>
<td>Repair lagging and cladding where necessary.</td>
<td>Contractor</td>
<td>Check/Repair/Report</td>
</tr>
<tr>
<td>5</td>
<td>Repair all steam leaks.</td>
<td>Contractor</td>
<td>Check/Repair/Report</td>
</tr>
<tr>
<td>6</td>
<td>Repair all water leaks.</td>
<td>Contractor</td>
<td>Check/Repair/Report</td>
</tr>
<tr>
<td>7</td>
<td>Inspect and test all heating equipment. Repair where necessary.</td>
<td>Contractor</td>
<td>Check/Repair/Report</td>
</tr>
<tr>
<td>8</td>
<td>Inspect all hot-water storage vessels for any leaks and packing faults. Repair if necessary.</td>
<td>Contractor</td>
<td>Check/Repair/Report</td>
</tr>
<tr>
<td>9</td>
<td>Test, inspect and repair all pumps.</td>
<td>Contractor</td>
<td>Check/Service/Repair/Report</td>
</tr>
<tr>
<td>10</td>
<td>Lubricate all lubrication points in accordance with the manufacturer’s specification.</td>
<td>Contractor</td>
<td>Check/Service/Report</td>
</tr>
<tr>
<td>11</td>
<td>Complete logbook and report.</td>
<td>Contractor</td>
<td>Report</td>
</tr>
</tbody>
</table>

# TABLE FC 13.02/4: ANNUAL ACTIONS AND MAINTENANCE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MAINTENANCE DESCRIPTION</th>
<th>ACTION RESPONSIBILITY</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All as listed under tables FC 13.02/1, FC 13.02/2 and FC 13.02/3.</td>
<td>User Client / Contractor</td>
<td>Check/Record/Adjust/Repair</td>
</tr>
<tr>
<td>2</td>
<td>Drain, clean out, inspect and repair all defects and linings on hot-water storage vessels.</td>
<td>Contractor</td>
<td>Inspect / Test / Service / Repair</td>
</tr>
<tr>
<td>3</td>
<td>Inspect and repaint all equipment where required.</td>
<td>Contractor</td>
<td>Inspect / Test / Service / Repair</td>
</tr>
<tr>
<td>4</td>
<td>Remove, strip, service, repair, adjust and replace where necessary all pressure control and safety valve equipment.</td>
<td>Contractor</td>
<td>Service / Repair / Adjust / Report</td>
</tr>
<tr>
<td>5</td>
<td>Complete logbook and report.</td>
<td>Contractor</td>
<td>Report</td>
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FC 13.03  **CORRECTIVE MAINTENANCE**

This corrective maintenance of the installations, systems and equipment shall be done in accordance with Additional Specification SA: General Maintenance, and the Particular Specification related to this work.

The Contractor shall inspect and check all equipment, materials, systems and installation for any pending breakdowns, maladjustments or anomalies of equipment.

The Contractor shall report and take actions to correct such defects.

FC 13.04  **BREAKDOWN MAINTENANCE**

Breakdown maintenance of the installations, systems and equipment shall be done in accordance with Additional Specifications SA: General Maintenance.

All breakdown problems experienced shall be acted upon within the time limitations allowed in the General Maintenance specifications.

All breakdown maintenance shall be done in accordance with the relevant specifications, standards, regulations and codes.

The Contractor shall have access to the necessary spares, equipment and tools for any possible breakdowns.
TECHNICAL SPECIFICATION

FD HEATING, VENTILATION AND AIR-CONDITIONING SYSTEMS

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FD 13 MAINTENANCE TO INSTALLATION AND EQUIPMENT

FD 01 SCOPE

This specification covers the general repair and maintenance of heating, ventilation and air-conditioning systems, which include the following:

(a) Room air-conditioning units with air cooled condensers
(b) Refrigeration pipework
(c) Fans and attenuators
(d) Electric motors
(e) Air filters
(f) Canopies and grease eliminators
(g) Duct work
(h) Air terminals
(i) Noise and vibration
(j) Painting and cleaning
(k) Labelling and identification.

This specification also addresses the training of
- User Client and associates, and
- Maintenance staff.

This specification shall form an integral part of the repair and maintenance contract document, and shall be read in conjunction with the additional and particular specifications compiled as part of this document.

This specification shall act as a guideline to the Particular Specification and, in the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.
FD 02 STANDARD SPECIFICATIONS

FD 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

The latest edition, including all amendments up to date of tender of the following specifications, publications and codes of practice shall be read in conjunction with this specification and shall deemed to form part thereof:

FD 02.01.01 SABS and other specifications and codes

- SABS 046 - Copper tube manufacturing code of practice
- SABS 0400 - The applications of building regulations
- SABS 0103 - The measurement and rating of environmental noise with respect to annoyance and speech communication
- SABS 0139 - The prevention, automatic detection and extinguishing of fire in buildings
- SABS 0140 - Identification colour marketing
- SABS 0142 - Code of practice for the wiring of premises
- SABS 0147 - Refrigerating systems, including plants associated with air-conditioning systems
- SABS 0173 - Installation, testing and balancing of duct work
- SABS 0140 - Decorative high-gloss enamel paint for interior and exterior
- SABS 0140 - General coating thickness
- SABS 0173 - HVAC duct construction standards

FD 02.01.02 Department of Public Works Specifications

- OW 371 - Specification of materials and methods to be used (Fourth revision, October 1993)
- STD.PWD.VIII - Standard specification for refrigeration services

FD 02.01.03 Occupational Health and Safety Act of 1993

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) shall be adhered to.

FD 02.01.04 Manufacturers’ specifications, codes of practice and installation instructions

All equipment and materials shall be installed, serviced and repaired strictly in accordance with the manufacturers’ specifications, instructions and codes of practice.

FD 02.01.05 Municipal regulations, laws and by-laws

All municipal regulations, laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.

FD 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

The following additional general specifications and requirements shall be read in conjunction with this specification and shall be adhered to unless otherwise specified in the Particular Specification.
FD 03.01  GENERAL REPAIR AND INSTALLATION REQUIREMENTS

(a) All materials and equipment supplied and installed shall be new and of high quality and manufactured to the relevant specifications, suitable for providing efficient, reliable and trouble-free service.

(b) All work shall be executed in a first-class workman-like manner by qualified tradesmen.

(c) All equipment, component parts, fittings and materials supplied and/or installed, shall conform in respect of quality, manufacture, test and performance to the requirements of the applicable current SABS specifications and codes, except where otherwise specified or approved by the Engineer in writing.

(d) All materials and workmanship which, in the opinion of the Engineer, is inferior to that specified for the work will be condemned. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer.

(e) The Contractor shall submit a detailed list of the equipment and material to be used to the Engineer for approval before placing orders or commencing installation.

(f) All new equipment, materials and systems shall be installed and positioned such as to not impede on access routes, entrances and other services. The Contractor shall coordinate these items taking other services and equipment into account.

(g) All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.

(h) The Contractor shall make sure that all safety regulations and measures are applied and enforced during the repair and construction periods to ensure the safety of the public and User Client.

(i) Repair work shall be programmed in accordance with Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures, to ensure the shortest possible down-time of any service and the least inconvenience to the User Client and public. The Contractor shall make sure that the necessary notifications and notices are timeously put into place for these activities.

FD 03.02  TESTING OF REFRIGERATION PIPING AND EQUIPMENT

(a) All new refrigerant pipe installations shall be thoroughly tested to be sure that they are absolutely tight. Nitrogen must be used to pressure test the system at 1,5 times the working pressure. A pressure-reducing valve must be used to set the test pressure. A leak test must be carried out on the entire system.

(b) All new refrigerant pipe installations shall be vacuum pumped by means of a suitable vacuum pump. An absolute pressure of 2500 micron must be reached. Allow the system to stand under vacuum for a minimum of 12 hours. If no noticeable rise in pressure has taken place after 12 hours, the system may be charged.

(c) The dryness of the refrigeration system shall be indicated by an approved moisture indicator.

(d) Should moisture be present, the system shall be leak tested and the leak repaired. Should no leak be present, the system shall be flushed with dry nitrogen and vacuum pumped again as described above.
(e) If the completed system complies with all the Specifications and passes the test and inspection, it can be approved and the Contractor may be instructed to recharge the system with the correct refrigerant and refrigerant charge.

(f) Under no circumstances shall the refrigerant piping/installation be purged.

FD 03.03 REFRIGERANTS

(a) No CFC refrigerant shall be used in new installations.

(b) Equipment still running on CFC shall be maintained until such time that a leak occurs or the system has to be decanted. The system shall then be converted to a compatible HCFC or HFC as described in the Montreal Protocol and recommended by the compressor manufacturer.

(c) Any CFC refrigerant that has to be discharged, shall be decanted by means of an approved reclaiming system, and not discharged to the atmosphere. Should the Contractor not comply with this requirement, full action shall be taken contractually and statutory against him.

(d) Any refrigeration system not supplied with three-way service valves, shall be provided with Schreuder type service valves. These valves shall be installed on both suction and discharge lines of the compressors. Tap-o-line valves shall not be fitted or used on the systems.

(e) In the event of an electrical motor burn-out in a hermetic or semi-hermetic compressor, a burn-out drier shall be used. Purging only is prohibited. The burn-out drier shall be installed and removed as per the manufacturer’s instructions.

(f) No synthetic components or solutions shall be used to repair leaks in refrigeration piping, on coils or evaporators. Only approved gas welding shall be used. Should the leak be of such nature that repair is not possible, the item should be replaced.

FD 03.04 FANS AND ATTENUATORS

FD 03.04.01 General

(a) Requirements under this heading apply to fans that are not integral parts of complete units supplied by recognised suppliers. Selected fans shall be such that the operating point is as close as possible to maximum efficiency.

(b) Fan motors selected must be capable of supplying not less than 10 % above the specified air quantity without overloading.

(c) The system resistance must be calculated and the fan selected to meet the required static pressure, taking into consideration the site altitude, system air temperature and air density at which the system duty shall be met. The selection must be submitted to the Engineer for approval before ordering the equipment.

(d) Belt drives shall be designed for a minimum overload of 25 % and not less than two matched belts may be used. Belts shall be selected and installed according to BS 790.

(e) Pulleys shall be of the adjustable speed taper-lock type and shall be accurately keyed to the shafts and aligned before the system is put into operation.
Belt guards shall be supplied in accordance with Occupational Health and Safety Act, No 85 of 1993. The guards shall have an expanded metal front and shall allow oiling and the use of a tachometer without removal of the guard.

Bearings shall be selected for a minimum life expectancy of 200 000 hours at the given duty.

Lubrication points shall be readily accessible and shall be extended to the outside to permit lubrication without removal of the fan. Fan shafts shall be suitably protected from rust and corrosion.

FD 03.04.02  **Axial flow fans**

(a) Axial flow fans shall be in-line direct-driven type with the motor mounted inside the fan housing.

(b) Fans shall be of the multi-bladed aerofoil type of a non-ferrous construction. The number of blades vary according to the application. The fans shall be provided with adjustable blade pitch indexed to permit field adjustment.

(c) Fan casings shall be constructed of hot-dip galvanized mild steel with a minimum thickness of 3 mm and mild steel galvanized flanges on each side drilled for connections to matching flanges on ducting.

FD 03.04.03  **Sound attenuators**

(a) Sound attenuators shall be installed in the positions indicated on the drawings and shall be selected to provide the noise criteria levels as specified. All sound attenuators shall be products of an accredited manufacturer who publishes selection data on these products. Data shall be submitted to the Engineer for approval before ordering.

(b) Metalwork shall be galvanized steel and acoustic insulation shall be non-combustible material, properly bonded and covered so as not to permit particles to be eroded by air moving over it.

(c) Sound absorbing lining material shall have a density not less than 48 kg/m³ and thickness of not less than 50 mm.

FD 03.05  **CANOPIES AND GREASE ELIMINATORS**

(a) Kitchen canopies shall be connected to the extract fan by means of cuts of which the joints and seams are of the welded or soldered construction and shall be watertight. Cleaning openings shall be provided at such intervals on the ducting that the inside of the ducting can be reached for cleaning purposes. The fan shall be provided with a cleaning access door, as well as a drain point at the bottom.

(b) Fire dampers, operated with fusible links, shall be provided in each air outlet connection and shall form an integral part of the canopy construction.

(c) Lights shall be fitted into the canopy by the manufacturer. Access to the tube for tube replacement shall be through the face of the fittings without the use of tools.

(d) Grease filters shall contain a series of vertical baffles to change the direction of the air flow and efficiently divert grease particles out of the air stream by centrifugal action. Each filter bank shall contain a condensate trough and removable grease storage container.
FD 03.06 ELECTRIC MOTORS

(a) All electric motors shall be of one make, unless integral with the equipment, and shall not operate in excess of 1500 r/min unless previously approved by the Engineer for specific reasons. Motors, unless otherwise specified, shall be 380 volt, three-phase, 50 hertz for all sizes from and including 0.37 kW upwards. Smaller motors may be 220 volt, single-phase, 50 hertz.

(b) All motors shall be totally enclosed, fan-cooled and have metric frame dimensions. Motors shall be quiet in operation to the full acceptance of the Engineer.

(c) Three-phase motors shall all be squirrel cage induction type, special high torque motors being used on high inertia loads such as centrifugal fans, where otherwise excessively large motors, necessary to overcome driven equipment inertia, cause operation BHP to be less than 70 % of motor nameplate kW.

(d) Starting methods for three-phase motors shall be as follows:

   Motors up to 5,5 kW - DOL
   Above 5,5 kW - Star-delta started, provided that the starting current does not exceed three times the full load amps.

(e) Single-phase motors shall be capacitor started, induction run type with built-in manual reset overload protection.

(f) Nameplate rating of electric motors shall be at least 15 % larger than the required driven equipment brake drive losses duly accounted for, on motors below 15 kW. On larger motors a 10 % margin shall suffice.

(g) All switch panels shall have a phase failure and low voltage protection with automatic reset adjustable to a maximum period of 10 minutes.

FD 03.07 DUCT WORK

(a) This specification covers the air distribution system as shown on the drawings. Duct work shall be manufactured in accordance with the standard specification for air-conditioning duct work, SABS 1238. Duct work shall be erected in accordance with the code of practice for the installation, testing and balancing of duct work, SABS 0173.

(b) Fittings such as elbows, parallel flow branches, branch connections, off-sets and transitions shall be manufactured and installed in accordance with the SMACNA standards.

(c) All ducting shall be sufficiently airtight to ensure economical and quiet performance of the system, and joints shall be suitably sealed in accordance with the relevant SMACNA standard with suitable non-combustible filler compound.

(d) The Contractor shall provide all hangers and supports which are to be hot-dip galvanized after fabrication to SABS 193. No explosive fasteners to the building structure shall be allowed, only approved expanding bolts or clamps are permissible.

(e) The duct work shall be connected to the air terminals by means of flexible ducting. Flexible ducting shall be coated fibreglass fabric with a mineral base. Flexible ducting shall be installed with “easy” bends of not less than one duct diameter centre line and shall be supported to SMACNA specification to ensure
that the ducting does not kink. The length of the flexible duct shall be kept to a minimum and shall not exceed lengths of 1200 mm.

FD 03.08 AIR TERMINALS

(a) Air distribution shall be effected by means of the supply air grilles as indicated on the drawing. The finish of the grilles shall be epoxy powder-coated, the colour of which shall be advised and approved by the Engineer. Supply air grilles shall be of the double deflection type, consisting of two rows of individually adjustable aerofoil section vanes, front vanes horizontal rear vanes vertical, all vanes housed in a surrounding fixing flange with neat mitred joints in the corner.

(b) Supply air grilles shall be of steel construction and shall be provided with burglar bars. The inner section will be only accessible from above and the face plate of the grille is fixed from above. No screws or fixing devices are accessible from below.

(c) Supply grilles are supplied with a plenum box with spigot and connected to the ducting by means of flexible ducting.

(d) Transfer grilles shall be of steel construction and be provided with burglar bars. Standard door grilles may be installed with a burglar bar assembly in between.

FD 03.09 AIR FILTERS

FD 03.09.01 General

(a) Provide and install air filters in the positions as indicated on the drawings.

(b) Filters shall be standard products of a reputable manufacturer regularly engaged in the manufacture of the particular filter. The manufacturer shall submit evidence to the satisfaction of the Engineer that the filters have been tested by an independent authority and that they meet the minimum arrestance, efficiency and dust holding capacity.

(c) Filters shall be tested in accordance with ASHRAE test standard 52 - 76.

(d) A Megnahelic gauge calibrated from zero to 500 Pa shall be installed, connected with copper tubing to static pressure tips complete with isolating valves.

FD 03.09.02 Primary filters

(a) Primary filters shall, unless otherwise stated, be washable on woven polyester material, pleated to provide an extended surface with a dust spot efficiency of minimum 40 % and an arrestance of 85 %.

(b) Media shall be firmly held in place by rustproof wire screens to maintain pleat strength and spacing.

(c) Media and support screens shall be continuously bonded into aluminium support.

(d) Frames shall be folded to form a robust media support frame. The bonding between media and frame shall be continuous to prevent leakage.

(e) Each filter shall be provided with a factory made holding frame, constructed of not less than 1,0 mm thick galvanized mild steel provided with suitable seals.
and quick release spring type clips to securely hold the filter cell in place without permitting leakage of air.

(f) The holding frames of multiple cell filter banks shall be suitably joined and sealed so as to prevent leakage of air between the frames.

FD 03.10  LABELLING AND IDENTIFICATION

All equipment shall be labelled and identified using black Traffolite labels with 10 mm high white lettering on the labels. Labels will be secured using epoxy base glue.

The identification number used on these labels shall correspond with the equipment number on the complete inventory list.

FD 03.11  NOISE AND VIBRATION

(a) Particular care shall be taken in the selection, application and installation of all equipment used to ensure that the equipment will operate below the required noise level for public areas of NC 35 and with the least vibration possible, all to the satisfaction of the Engineer.

(b) Equipment shall be mounted on vibration isolators of the correct type and selection depending on deflection requirement and vibrating frequency.

(c) Anti-vibration connections shall be used on duct work where it joins vibrating equipment such as fans and air-conditioning units.

(d) Suitable sound attenuating devices shall be incorporated within the duct work to reduce airborne noise to acceptable levels as specified.

(e) The subcontractor shall provide sound level data to the Engineer on the completion of the installation detailing the noise levels in NC level for each separate area. No measurement shall be taken closer than 1 metre from any outlet.

FD 03.12  PAINTING AND CLEANING

(a) No untreated metal surfaces shall be allowed on the project. Items which are not galvanized or similarly protected against rust and corrosion shall be painted as detailed below. No equipment, hangers, brackets, etc, shall be delivered to site in unprotected condition; they shall be factory coated with an approved zinc-rich prime coat before being despatched.

(b) Painting shall comprise the following consecutive processes. Thoroughly clean, descale and degrease all surfaces, apply one coat of approved zinc-rich primer and one coat of universal undercoat, and finish off with two coats of quality high-gloss enamel. Final finish shall be to the full approval of the Engineer.

(c) Items with galvanized finish, such as cable trays, need not be painted but shall be properly cleaned with suitable galvanized iron cleaning fluid. Where galvanized finish is painted, it shall be primed with a calcium plumbate primer.

(d) It is not a requirement to paint duct work, conduits or pipework installed in roof voids and shafts, where they are not visible, if they are galvanized. Items as mentioned above shall be properly cleaned and painted as specified above.

(e) Visible sections of the inside of ducting through grilles shall be painted matt black after degreasing and priming as specified above.
(f) Plant and equipment shall be painted with the relevant colour in accordance with SABS.

**FD 03.13 SELF-CONTAINED AIR-CONDITIONING UNITS**

(a) The self-contained packaged unit shall be a fully catalogued product and documentation shall include performance curves and selection tables.

(b) Self-contained room air-conditioning units consist of unit casing, compressor, evaporator and fan, condenser and fan, refrigerant pipework with expansion device and the relevant controls. The condenser unit shall form an integral part of the unit or be separate for split applications.

(c) Unit casings shall be of sheet metal construction with a baked enamel finish to give a corrosion resistance. Units shall be suitably insulated to ensure quiet operation.

(d) Evaporator fans shall be of the double inlet centrifugal type with integral motor or belt-driven. The fan assembly shall be isolated from the unit by means of rubber mounts and the unit shall operate without vibration.

(e) Condensate trays shall be manufactured of non-corrosive materials and shall be insulated and condensate shall be piped to the nearest drain point.

(f) Washable WP 77 filters shall be provided and installed behind the inlet grille and shall be easily removable.

(g) Compressors shall be of the hermetically sealed dome type with crankcase heaters and suitable vibration isolators.

(h) Condenser coils shall be copper tubes with aluminium fins for inland use. Condenser fans shall be propeller fans or of the centrifugal type.

(i) Refrigerant piping shall be installed and repaired as specified in FD 03.

**FD 04 AS-BUILT INFORMATION AND OPERATING AND MAINTENANCE MANUALS**

The Contractor shall be responsible for the compilation of an inventory list and operating and maintenance manuals and system data sheets.

This shall be done in accordance with Additional Specification SB: Operating and Maintenance Manuals.

The Contractor shall allow for the required equipment and facilities to establish the correct as-built information.

All information shall be recorded and reproduced in electronic format, as well as three sets of hard copies to be supplied to the Department.

Over and above what is specified in Additional Specification SB: Operating and Maintenance Manuals, the operating and maintenance manual to be compiled shall be structured to include at least the following:

(a) **System description**

Complete system description and the working of the plant.
(b) **Commissioning data**

Complete commissioning, test and inspection data of plant.

(c) **Operating data**

(i) Plant running check list and frequency of servicing required;
(ii) Safety precautions to be implemented;
(iii) Manual and automatic operation;
(iv) Maintenance duties and logging required;
(v) Lubricating oils and service instructions;
(vi) Pre-start checklist for each system;
(vii) Starting and stopping procedures.

(d) **Mechanical equipment**

(i) Description of all major items with the make, model number, names, addresses and telephone numbers of the suppliers, manufacturers or their agents;
(ii) Design capacities of all equipment, including selection parameters, selection curves, capacity tables, etc;
(iii) Manufacturers’ brochures and pamphlets;
(iv) Schedule of spares with part numbers recommended to be held as stock.

(e) **Maintenance instructions**

(i) Schedule of maintenance particulars, frequency of services and replacements;
(ii) Trouble-shooting guide;
(iii) Part number of all replacement items and spares;
(iv) Capacity curves of pumps, fans and compressors;
(v) Serial numbers of all items of equipment.

(f) **Electrical equipment**

(i) Schedule of equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
(ii) Maintenance instructions;
(iii) Manufacturers’ brochures and pamphlets;
(iv) Complete as-built circuit diagrams and diagrammatic representation of interconnections of all electrical equipment.

(g) **Instrumentation and control**

(i) Description of each control system;
(ii) Schedule of control equipment indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
(iii) Maintenance instructions;
(iv) Manufacturers’ brochures and pamphlets.

(h) **Drawings**

(i) Paper prints of all as-built mechanical and electrical drawings;
(ii) Wiring diagrams framed behind glass shall be mounted adjacent to each relevant control panel.
FD 05 TRAINING OF OPERATORS FOR THE OPERATION OF THE INSTALLATION AND EQUIPMENT

In addition to the requirements of Additional Specification SD: General Training, the Contractor shall allow and provide for additional training of the HVAC maintenance staff as specified and set out in this specification. The objective of this training will be to ensure that the following is achieved:

(a) Understanding of equipment;
(b) High plant operating efficiencies to reduce operating costs;
(c) Reduce the maintenance cost of the plant to an acceptable level, and maintain the cost at this level in so far as they are affected by the operating conditions;
(d) Prevent the maloperation of the plant and its associated equipment.

In the event of the designated staff not achieving the set goals the Contractor shall be responsible to ensure that such personnel attend an approved maintenance course as available from the Department or manufacturer.

The Contractor shall, in collaboration with the Engineer, ensure that the maintenance personnel be re-evaluated on an annual basis by means of a set examination, to ensure the upkeep of skill level and knowledge.

The evaluation and training course to be utilised for the evaluation of the HVAC maintenance staff shall include at least the following:

(a) Equipment and component recognition;
(b) Emergency procedures to be followed in the event of power failure, water shortage, and accidents related to refrigerator systems;
(c) Safety precautions to be followed and implemented;
(d) The identification, reporting and recording of faults and operation of equipment;
(e) The logging of boiler plant operation, readings and setting;
(f) In the event of plant running on ammonia, the full SAIRAC course on handling ammonia as refrigerant shall be attended by the maintenance staff.

FD 06 LOGGING AND RECORDING PROCEDURES

The Contractor shall under this repair and maintenance contract institute a logging and recording system as part of his maintenance control plan as defined in Additional Specification SA: General Maintenance. This shall consist of a log and record book which shall be utilised to log and record all operations, faults, system checks, breakdowns, maintenance visits, inspections, etc.

The logbook shall be kept in a safe place at the maintenance section and shall only be utilised by the boiler house supervisor, the Contractor and the Engineer. A copy of the monthly entries and recordings into this logbook shall be submitted by the Contractor together with this monthly report to the Engineer.

The logbook shall be structured to include at least the following:

(i) Daily inspection and maintenance actions;
(ii) Monthly inspection and maintenance actions;
(iii) Six-monthly inspection and maintenance actions;
(iv) Breakdown reports;
(v) Statutory inspection and test comments and reports.
The Contractor shall also institute an attendance register, which shall be kept in a safe place at the maintenance section. This register shall be completed by all persons visiting the relevant plants, including:

(a) Contractor and maintenance personnel;
(b) Inspectors;
(c) User Client and associates;
(d) Engineer.

This register shall state the date, time-in, time-out, name, company and reason for visit. A copy of the register shall be submitted by the Contractor together with his monthly report.

On completion of repair work and/or the installation of new equipment the plant and equipment shall be put into operation after all tests and adjustments have been carried out to the satisfaction of the Engineer. Where new plant is installed the Contractor shall run and operate the system for a period of time specified by the Engineer and train the staff of the User Client to operate and maintain the system. This operation shall be done strictly in accordance with Clause SC 11 of the Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures.

Logging of the operation of the installations shall commence immediately upon start-up.

The Contractor shall submit a full commissioning report as per attached commissioning data sheet.

**FD 07 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK**

On completion of repair work the Contractor shall prior to recommissioning test the plant and its equipment. This operation shall be done strictly in accordance with Clause SC 08 of Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures.

Except where otherwise provided in the Contract, the Contractor shall provide labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out such tests. Arrangements for these tests shall be made by the Contractor and he shall give at least 72 hours written notice to the Engineer before commencing the test.

In the event of the plant or installation not passing the test, the Employer shall be at liberty to deduct from the Contract amount all reasonable expenses incurred by the Employer or the Engineer attending the repeated test.

Whenever any installation or equipment is to be operated for testing or adjusting as provided for above, the Contractor shall operate the entire system for as long a period as may be required to prove satisfactory performance at all times in the occupied space served by that system for up to twenty-four hours a day continuously until the certificate of practical completion of repair work is handed over.

The Contractor shall provide all labour and supervision required for such operation and the Department may assign staff as observers, but such observation time shall not be counted as instruction time.

After complete installation of the system all equipment shall be tested, adjusted and readjusted until it operates to the satisfaction and approval of the Engineer.

The Contractor shall submit certificates of tests carried out to prove the performance of all equipment, as well as certificates obtained from all the relevant authorities and statutory bodies, etc.
The Contractor shall only utilise Departmentally approved inspection authorities for all inspections and tests to be conducted. This will be done and approved in writing among the relevant parties.

FD 08 QUALITY ASSURANCE SYSTEM

The Contractor shall institute an approved quality assurance (QA) system, which shall be submitted to the Engineer for his approval. The records of this QA system shall be kept throughout the duration of the Contract and be submitted to the Engineer at regular intervals as required.

FD 09 COMMISSIONING AND RECOMMISSIONING OF PLANT AND INSTALLATION

FD 09.01 GENERAL

On completion of repair work and/or the installation of new equipment the plant and equipment shall be put into operation after all tests and adjustments have been carried out to the satisfaction of the Engineer. Where new plant is installed the Contractor shall run and operate the system for a period of time as specified by the Engineer and train the staff of the User Client to operate and maintain the system. This operation shall be done strictly in accordance with Clause SC 11 of Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures.

Logging of the operation of the installations shall commence immediately upon start-up.

The Contractor shall submit a full commissioning report as per attached commissioning data sheet.

FD 09.02 RECOMMISSIONING OF PLANT AND ANCILLARY EQUIPMENT

On completion of repair work the Contractor shall recommission the plant and its equipment. This operation shall be done strictly in accordance with Clause SC 11 of Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures. This operation shall also be carried out strictly in accordance with the manufacturer's specification and shall be witnessed by the Engineer.

Recommissioning checks to be carried out shall be categorised under the following headings:

(a) Mechanical checks
(b) Electrical and control checks.

On completion of repair work the Contractor shall recommission the plant and its ancillary equipment. This operation shall be done strictly in accordance with the manufacturer's specification and shall be witnessed by the Engineer. This shall include but not be limited to the following:

(a) All required recommissioning mechanical checks
   (i) Check system for leaks;
   (ii) Check rotation of all fans;
   (iii) Check mountings of all equipment.
(b) All required recommissioning electrical and control checks

(i) Check all wiring connections for tightness and repair any hot connections.

(ii) Check that all electrical equipment have been properly reconnected in accordance with the manufacturer’s specification.

(iii) Perform and record all required electrical insulation tests on equipment.

(iv) Check and test all controls with main circuits isolated.

(v) Check all motor-driven equipment for correct rotational directions.

(vi) Check and test the operation of all indication and warning lights.

(vii) Check, set, record and readjust all equipment control and set points in accordance with manufacturer’s specification.

(viii) Run all motor-driven equipment for a period to ensure free movement and correct operation. Feed pumps only to be operated for a short interval to check rotation.

FD 09.03 COMMISSIONING AND COMPLETION OF REPAIRS

On completion of the recommissioning checks the Contractor shall proceed with the commissioning. This operation shall be done strictly in accordance with Clause SC 11.02 of Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures. This operation shall also be carried out in accordance with the manufacturer’s specification and shall include but not be limited to the following for the different types of equipment:

FD 09.03.01 Self-contained air-conditioning unit

(a) Check evaporator and condenser pressures and superheat.

(b) If the unit needs charging, find leak, decant, repair leak and recharge unit.

(c) Check fans, fan speed control and fan motors.

(d) Check entering and leaving air temperatures over evaporator coil.

(e) Check operation of all safeties:

   (i) LP cut-out pressure
   (ii) HP cut-out pressure
   (iii) Low on-coil thermostat
   (iv) Set point of oil pressure safety
   (v) Oil pressure trip.

(f) Check anti-recycle timer.

(g) Check all running amps of fans and compressors.

(h) Check compressor unloading mechanism if applicable.

(i) Complete commissioning data sheet.
**FD 09.03.02 Ventilation system**

(a) Check fans, fan speed control and fan motors.

(b) Check running amps of fans.

(c) Check pressure drop over filters.

(d) Check air quantity over filters or canopy face velocity.

(e) Check outlet air quantities.

The Contractor shall visit, inspect, test and readjust the plant during the 30-day period following the recommissioning to ensure the correct functioning of the plant and its associated equipment.

**FD 10 GUARANTEE OF INSTALLATION AND EQUIPMENT**

The Contractor shall provide and obtain guarantees from the manufacturer(s) and/or supplier(s) to the effect that each piece of new equipment supplied and installed under the repair contract, will comply with the required performance and will function as part of the complete system.

All new equipment, including the complete new installations and the systems as a whole, shall be guaranteed for a period of 12 (twelve) months commencing on the day of issue of a certificate of completion for repair work of the installation.

**FD 11 MAINTENANCE TOOLS AND SPARES**

Each maintenance workshop shall be equipped with the necessary maintenance tools and spares as required by the specific type of plants and installation for the daily operation and maintenance of the plant. At the start of the repair and maintenance contract the Contractor shall make an inventory of the existing tools and spares in the presence of the User Client, and any shortfall or damaged tools and spares shall be replaced with new. All replacement tools and spares shall be as specified by the boiler and equipment manufacturers. These tools and spares shall be kept in a lockable room or cabinet of which the maintenance supervisor and the Contractor shall carry keys. The Contractor shall on a monthly basis take stock of these items in the presence of the maintenance supervisor and shall record and report to the Engineer. Any shortfall shall be replaced by the Contractor as part of his responsibility under this Contract.

The tools and spares to be carried shall include, but not be limited to at least the following:

(a) **Tools**

   (i) Electric welding (arc welder)
   (ii) Oxy-acetylene welding set
   (iii) Soldering iron
   (iv) Pipe cutter
   (v) Swaging tool set
   (vi) Flaring tool set
   (vii) Leak detector (electronic or leak torch or Spectro light)
   (viii) Vacuum pump
   (ix) Service valve ratchet
   (x) Refrigerant reclaim unit
   (xi) Flow measuring hood
   (xii) Pitot tube
   (xiii) Vacuum gauge
(xiii) Digital thermo anemometer
(xiv) Hygrometer
(xv) Tung tester
(xvi) Coil comb
(xvii) Multimeter
(xviii) Amp meter
(xix) Combination spanner set
(xx) Combination socket set
(xxi) Allen keys
(xxii) Screwdriver set
(xxiii) Drill set
(xxiv) Drilling (arc welder)
(xxv) Pop rivet gun
(xxvi) Tab and die set
(xxvii) Three-jaw gear pulley
(xxviii) Hacksaw
(xxix) Level
(XXX) Bench vice
(XXXI) Assorted files
(XXXII) Tape 5 m
(XXXIV) Torch.

(b) **Spares**

It is recommended that essential parts be maintained in inventory. Essential parts are those parts used frequently in responding to routine and urgent work requests. Consider the accessibility to spares and the time it takes to obtain them. The goal is to avoid stockpiling parts, as well as to avoid being without a needed part. The following parts are regarded as essential spares:

(i) Schreuder valves
(ii) Relevant refrigerants
(iii) Relevant refrigeration compressor oil
(iv) Filter/dryers
(v) Expansion valves
(vi) Filter sets
(vii) Relevant V-belts
(viii) Lubricants and greases.

FD 12  **REPAIR WORK TO INSTALLATION SYSTEMS AND EQUIPMENT**

FD 12.01  **GENERAL**

At the start of the repair and maintenance contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but not be limited to the specified Particular Specification details.

All repair work shall be executed using approved materials and equipment suitable to the systems and/or installations they serve. The said repair work shall be executed in accordance with the relevant codes of practice, standard, regulations, municipal laws and by-laws, manufacturer’s specifications and codes of practice and all additional and particular specifications included in this document.

The repair work items shall be listed in tabular form in the Particular Specification with all relevant details, such as capacity, size, manufacturer, model number, etc.

All repair work shall be executed within the approved period for repairs to be agreed at the start of the Contract period. All new equipment, materials and systems shall be furnished with a written guarantee of a defects liability period of 12 months from date of issue of a certificate for completion of the repair work. These guarantees shall be
furnished in favour of the Department of Public Works. On completion of the required and specified repair work the systems, installations and equipment shall be commissioned and handed over to the satisfaction of the Engineer.

Repair work items shall be categorised for the following installations:

(a) Ventilation systems including canopies
(b) Self-contained air-conditioning units.

FD 12.02 VENTILATION SYSTEMS

(a) Replace fresh air intake screen.
(b) Inspect and clean all duct work and canopy.
(c) De-rust, neutralise and touch up paint work on ducting and canopy.
(d) Check tightness of all securing bolts.
(e) Replace all canvas collars with new.
(f) Replace all filters.
(g) Check bearings of fan motors and lubricate.
(h) Check whether all duct supports are still in position and replace missing supports.
(i) Check duct work for leaks and repair defects.
(j) Replace all joint seal and gaskets with new.
(k) Check all fire dampers for correct operation and reset.
(l) Clean fan blades and check for unbalance.
(m) Check fans, speed control and fan motor.
(n) Check running amps of fan.
(o) Reseal penetrations through roof.

FD 12.03 SELF-CONTAINED AIR-CONDITIONING UNITS

(a) Clean air intake screen.
(b) Replace filters.
(c) De-rust, neutralise and touch up paintwork.
(d) Replace canvas collars.
(e) Clean housing, ensure all panels are properly secured and door panels close properly.
(f) Check setting and operation of all pressure switches, reset if required.
(g) Check setting and operation of all safety switches, ie LP and HP switches, oil pressure switch.
(h) Check setting and operation of thermostats.
(i) Check timers and reset if required.
(j) Check operation of seven-day timer.
(k) Check running current of fans and compressor and settings and operation of overloads.
(l) Check tightness of all electrical terminals.
(m) Ensure operation of local and remote isolators.
(n) Check condition of all cables and whether cables are neatly strapped and reposition and strap if required.
(o) Ensure correct operation of emergency stop.
(p) Carry out a leak test on all refrigeration piping and components inclusive of evaporator and condenser.
(q) All leaks shall be repaired. Should a leak on a component be of such a nature that it cannot be repaired, the component shall be replaced. The procedure to follow is as set out in FD 03.
(r) The superheat setting of the thermostatic expansion valve shall be checked and adjusted if required (setting approximately 8 °C).
(s) The filter dryer shall be replaced.
(t) Check compressor vibration mounts.
(u) Test oil acidity.
(v) Check refrigerant charge sight glass being clear or flashing.
(w) Check moisture indication being dry.
(x) Clean condensate tray and test drainage operation.
(y) Clean evaporator and condenser blades and check unbalance.
(z) Replace suction line insulation.
(aa) Check all service valves for full operation, replace caps if missing.

FD 13  MAINTENANCE TO INSTALLATION AND EQUIPMENT

FD 13.01  GENERAL

Monthly maintenance responsibilities for each installation including all units and components as specified, shall commence with commencement of the Contract. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.

Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period.

This part of the Contract shall include:

(a) Routine preventative maintenance;
(b) Corrective maintenance; and
(c) Breakdown maintenance,

as defined in Additional Specification SA: General Maintenance, for the specified installations described under FD 01 of this specification.

The maintenance work to be performed and executed shall be done strictly in accordance with Additional Specification SA: General Maintenance, and as specified in Particular Specification PFD and this specification.

The said maintenance work shall be executed in accordance with the relevant codes of practice, statutory regulations, standards, regulations, municipal laws and by-laws and the manufacturers’ specifications and codes of practice.

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor, as specified in Additional Specification SA: General Maintenance.

All new equipment, components and materials supplied and installed under the maintenance contract shall be furnished with prescribed manufacturer’s guarantees.

The maintenance work and items are to be categorised by the Contractor for each maintenance activity under the following headings:

(a) Ventilation systems
(b) Self-contained air-conditioning units.

The Contractor shall be remunerated monthly, based on his performance, for maintaining the complete installation in a perfect functional condition.
FD 13.02  DEFINITION AND QUALIFICATION OF ACTIONS

FD 13.02.01  Daily maintenance actions

Daily actions are the responsibility of the User Client. These checks are to be performed by staff responsible of the facility. The self-contained air-conditioning units and ventilation systems should run during working hours and/or continuously. The status of these systems can thus be monitored by observation on a daily routine.

(a)  Ventilation systems:
   - Are the systems running and is the operation quiet?
   - Is the kitchen hood removing vapour from the kitchen?

(b)  Self-contained air-conditioning units:
   - Does the unit perform and maintain temperature?
   - Is the temperature in the areas concerned satisfactory?
   - Is the condensate drain working properly?

These daily checks shall be logged at the facility, ie by the kitchen manager and the maintenance personnel.

FD 13.02.02  Monthly maintenance actions

TABLE FD 13.02.02/1: VENTILATION SYSTEMS

<table>
<thead>
<tr>
<th>REFERENCE NUMBER</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-1</td>
<td>Inspect air intake for blockages</td>
</tr>
<tr>
<td>V-2</td>
<td>Check all accessible duct work for leakages, damages, and damages supports</td>
</tr>
<tr>
<td>V-3</td>
<td>Clean filters</td>
</tr>
<tr>
<td>V-4</td>
<td>Check electric motor running temperature</td>
</tr>
<tr>
<td>V-5</td>
<td>Check electric connections for tightness</td>
</tr>
<tr>
<td>V-6</td>
<td>Check operation of relief air grilles and check that they are not blocked</td>
</tr>
<tr>
<td>V-7</td>
<td>Check for motor noise and check bearings</td>
</tr>
<tr>
<td>V-8</td>
<td>Check for leaks on canvas collars</td>
</tr>
</tbody>
</table>
TABLE FD 13.02.02/2: SELF-CONTAINED AIR-CONDITIONING UNIT

<table>
<thead>
<tr>
<th>REFERENCE NUMBER</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-1</td>
<td>Clean filters, replace if required</td>
</tr>
<tr>
<td>S-2</td>
<td>Inspect air intake and discharge for blockages</td>
</tr>
<tr>
<td>S-3</td>
<td>Check all refrigerant, drainage pipes for damaged and leaks</td>
</tr>
<tr>
<td>S-4</td>
<td>Check sightglass: clear or flash gas</td>
</tr>
<tr>
<td>S-5</td>
<td>Carry out visual inspection of condenser coil for blockages and</td>
</tr>
<tr>
<td></td>
<td>correct operation of fans</td>
</tr>
<tr>
<td>S-6</td>
<td>Carry out visual inspection of evaporator coil for blockages and</td>
</tr>
<tr>
<td></td>
<td>correct operation of supply fan</td>
</tr>
<tr>
<td>S-7</td>
<td>Check enclosure for damages</td>
</tr>
<tr>
<td>S-8</td>
<td>Check electric motor running temperatures</td>
</tr>
<tr>
<td>S-9</td>
<td>Check electric connections for tightness</td>
</tr>
<tr>
<td>S-10</td>
<td>Test thermostat and control operation</td>
</tr>
<tr>
<td>S-11</td>
<td>Clean condensate tray and test drainage for proper operation</td>
</tr>
<tr>
<td>S-12</td>
<td>Check cooling and heating cycle</td>
</tr>
</tbody>
</table>

Note: The monthly actions shall include the activities of the daily maintenance actions.

FD 13.02.03 Biannual maintenance actions

TABLE FD 13.02.03/1: VENTILATION SYSTEMS

<table>
<thead>
<tr>
<th>REFERENCE NUMBER</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-1</td>
<td>Inspect air intake for blockages</td>
</tr>
<tr>
<td>V-2</td>
<td>Check all accessible duct work for leakages, damages, and supports</td>
</tr>
<tr>
<td>V-3</td>
<td>Clean filters</td>
</tr>
<tr>
<td>V-4</td>
<td>Check electric motor running temperature</td>
</tr>
<tr>
<td>V-5</td>
<td>Check electric connections for tightness</td>
</tr>
<tr>
<td>V-6</td>
<td>Check operation of relief air grilles and check that they are not</td>
</tr>
<tr>
<td></td>
<td>blocked</td>
</tr>
<tr>
<td>V-7</td>
<td>Check for motor noise and check bearings</td>
</tr>
<tr>
<td>V-8</td>
<td>Check for leaks on canvas collars</td>
</tr>
<tr>
<td>V-9</td>
<td>Clean fan blades and check for unbalance</td>
</tr>
<tr>
<td>V-10</td>
<td>Clean exterior casing</td>
</tr>
<tr>
<td>V-11</td>
<td>Clean all grilles</td>
</tr>
<tr>
<td>V-12</td>
<td>De-rust, neutralise and touch up paint work</td>
</tr>
<tr>
<td>V-13</td>
<td>Check vibration mounts of fan and tightness of mounting bolts</td>
</tr>
<tr>
<td>REFERENCE NUMBER</td>
<td>ACTION</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>S-1</td>
<td>Clean filters, replace if required</td>
</tr>
<tr>
<td>S-2</td>
<td>Inspect air intake and discharge for blockages</td>
</tr>
<tr>
<td>S-3</td>
<td>Check all refrigerant, drainage pipes for damages and leaks</td>
</tr>
<tr>
<td>S-4</td>
<td>Check sight-glass: clear or flash gas</td>
</tr>
<tr>
<td>S-5</td>
<td>Carry out visual inspection of condenser coil for blockages and correct operation of fans</td>
</tr>
<tr>
<td>S-6</td>
<td>Carry out visual inspection of evaporator coil for blockages and correct operation of supply fan</td>
</tr>
<tr>
<td>S-7</td>
<td>Check enclosure for damages</td>
</tr>
<tr>
<td>S-8</td>
<td>Check electric motor running temperatures</td>
</tr>
<tr>
<td>S-9</td>
<td>Check electric connections for tightness</td>
</tr>
<tr>
<td>S-10</td>
<td>Test thermostat and control operation</td>
</tr>
<tr>
<td>S-11</td>
<td>Clean condensate tray and test drainage for proper operation</td>
</tr>
<tr>
<td>S-12</td>
<td>Check filter/dryer</td>
</tr>
<tr>
<td>S-13</td>
<td>Check superheat and functioning of expansion valve</td>
</tr>
<tr>
<td>S-14</td>
<td>Check operation of HP and LP switch</td>
</tr>
<tr>
<td>S-15</td>
<td>Check operation of controllers</td>
</tr>
<tr>
<td>S-16</td>
<td>De-rust, neutralise and touch up paint work</td>
</tr>
<tr>
<td>S-17</td>
<td>Check cooling and heating cycle</td>
</tr>
<tr>
<td>S-18</td>
<td>Clean evaporator and condenser coil chemically</td>
</tr>
<tr>
<td>S-19</td>
<td>Clean all filter frames and seals</td>
</tr>
<tr>
<td>S-20</td>
<td>Check fan motor and compressor current</td>
</tr>
<tr>
<td>S-21</td>
<td>Check and test overload settings</td>
</tr>
<tr>
<td>S-22</td>
<td>Lubricate all bearings</td>
</tr>
</tbody>
</table>

**Note:** The above biannual actions include the activities of the monthly maintenance actions.
# HVAC COMMISSIONING DATA SHEET - AIR CONDITIONING UNITS

**INSTALLATION:** .................................................................

**A/C MAKE** : ........................................................................

<table>
<thead>
<tr>
<th>Model number</th>
<th>Inside unit</th>
<th>Outside unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial number</td>
<td>Inside unit</td>
<td>Outside unit</td>
</tr>
</tbody>
</table>

**Voltage** :

**Starting amps** :

**Running amps** :

**COOLING**

**HEATING**

**System discharge gauge pressure:** (kPa and running)

**System suction gauge pressure:** (kPa and running)

**Condenser : cooling medium inlet temperature:**

**Condenser : cooling medium outlet temperature:**

**Evaporator : air inlet temperature:**

**Evaporator : air outlet temperature:**

**Room dry bulb temperature after 1 hour A/C operation:**

**Ambient dry bulb temperature:**

**COMMISSIONED BY:** .................................................................

**CONSULTANT:** .................................................................

**PRINT** .................................................................

**SIGNATURE** .................................................................

**DATE** .................................................................

**PRINT** .................................................................

**SIGNATURE** .................................................................

**DATE** .................................................................

OCT 2019  
MASERU BORDER POST
TECHNICAL SPECIFICATION

FE INCINERATOR INSTALLATION

CONTENTS

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FE 02 STANDARD SPECIFICATIONS
FE 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS
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FE 08 QUALITY ASSURANCE SYSTEM
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FE 01 SCOPE

(a) This specification covers the general repair and maintenance of incinerator installations which include the following methods of firing:

(i) Coal
(ii) Oil
(iii) Gas.

(b) This specification also covers the repair and maintenance to the following ancillary incinerator equipment:

(i) Coal handling equipment
(ii) Ash handling equipment
(iii) Grit collectors and chimneys
(iv) Oil or gas firing equipment
(v) Oil or gas storage facilities
(vi) Firing tools
(vii) Refractories
(viii) Instrumentation and controls
(ix) Electrical control panel.

(c) This specification also addresses the following:

(i) Training
(ii) Operating of incinerators.

(d) This specification shall form an integral part of the repair and maintenance contract document, and shall be read in conjunction with the additional and particular specifications compiled as part of this document.
This specification shall act as a guideline to the Particular Specification and, in the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.

FE 02 STANDARD SPECIFICATIONS

FE 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

The latest edition, including all amendments up to date of tender, of the following specifications, publications and codes of practice shall be read in conjunction with this specification and shall deemed to form part thereof:

FE 02.01.01 SABS and other specifications and codes

SABS 0400 - The applications of the building regulations
SABS 0142 - Code of practice for the wiring of premises
SABS 0140 - Identification colour marking
SABS 044 - Parts I to IV: Welding
SABS 460 - Copper tubes for domestic plumbing
SABS 0103 - The measurement and rating of environmental noise with respect to annoyance and speech communications
SABS 0248 - The handling and disposal of waste materials within health care facilities (1993)

SABS Specifications listed on page 3 of the DPW specification OW 371
Atmospheric Pollution Prevention Act, No 45 of 1965
BS 2790
BS 1740
BS 21
BS 164
BS 3316

FE 02.01.02 Department of Public Works specifications

OW 371 - Specification of materials and methods to be used (Fourth revision, October 1993)
Standard Specification for electrical installations and equipment pertaining to mechanical installations

FE 02.01.03 Occupational Health and Safety Act of 1993

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) shall be adhered to.

FE 02.01.04 Manufacturers’ specifications, codes of and practice and installation instructions

All equipment and materials shall be installed, serviced and repaired strictly in accordance with the manufacturers’ specifications, instructions and codes of practice.

FE 02.01.05 Municipal regulations, laws and by-laws

All municipal regulations, laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.
FE 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

The following additional general specifications and requirements shall be read in conjunction with this specification and shall be adhered to unless otherwise specified in the Particular Specification.

FE 03.01 GENERAL REPAIR AND INSTALLATIONS REQUIREMENTS

(a) All materials and equipment supplied and installed shall be new and of high quality and manufactured to the relevant specifications, suitable for providing efficient, reliable and trouble-free service.

(b) All work shall be executed in a first-class workman-like manner by qualified tradesmen.

(c) All equipment, component parts, fittings and materials supplied and/or installed, shall conform in respect of quality, manufacture, test and performance to the requirements of the applicable current SABS specifications and codes, except where otherwise specified or approved by the Engineer in writing.

(d) All materials and workmanship which, in the opinion of the Engineer, is inferior to that specified for the work will be condemned. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer.

(e) The Contractor shall submit a detailed list of the equipment and material to be used to the Engineer for approval before placing orders or commencing installation.

(f) All new equipment, materials and systems shall be installed and positioned such as to not impede on access routes, entrances and other services. The Contractor shall coordinate these items taking other services and equipment into account.

(g) All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.

(h) The Contractor shall make sure that all safety regulations and measures are applied and enforced during the repair and construction periods to ensure the safety of the public and User Client.

(i) Repair work shall be programmed in accordance with Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures, to ensure the shortest possible down-time of any service and the least inconvenience to the User Client and the public. The Contractor shall make sure that the necessary notifications and notices are timeously put into place for these activities.

FE 04 OPERATING AND MAINTENANCE MANUALS

The Contractor shall be responsible for the compilation of an inventory list and operating and maintenance manuals.

This shall be done in accordance with Additional Specification SB: Operating and Maintenance Manuals.
All information shall be recorded and reproduced in electronic format, as well as three sets of hard copies to be supplied to the Department.

Over and above what is specified in Additional Specification SB: Operating and Maintenance Manuals, the operating and maintenance manual to be compiled shall be structured to include at least the following:

(a) **System description**

Complete system description and the working of the plant.

(d) **Commissioning data**

Complete commissioning, test and inspection data of plant.

(e) **Operating data**

(i) Plant running check list and frequency of servicing required;
(ii) Safety precautions to be implemented;
(iii) Manual and automatic operation;
(iv) Operator's duties (logging requirements);
(v) Pre-start checklist for each system;
(vi) Starting and stopping procedures.

(f) **Mechanical equipment**

(i) Description of all major items with the make, model number, names, addresses and telephone numbers of the suppliers, manufacturers or their agents;
(ii) Design capacities of all equipment, including selection parameters, selection curves, capacity tables, etc;
(iii) Manufacturers' brochures and pamphlets;
(iv) Schedule of spares with part numbers recommended to be held as stock.

(g) **Maintenance instructions**

(i) Schedule of maintenance particulars, frequency of services and replacements;
(ii) Trouble-shooting guide;
(iii) Part number of all replacement items and spares;
(iv) Capacity curves;
(v) Serial numbers of all items of equipment.

(h) **Electrical equipment**

(i) Schedule of equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
(ii) Maintenance instructions;
(iii) Manufacturers' brochures and pamphlets;
(iv) Complete as-built circuit diagrams and diagrammatic representation of interconnections of all electrical equipment.

(i) **Instrumentation and control**

(i) Description of each control system;
(ii) Schedule of control equipment indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
(iii) Maintenance instructions;
(v) Manufacturer’s brochures and pamphlets.

(j) Drawings

(i) Paper prints of all as-built mechanical and electrical drawings;
(ii) Wiring diagrams framed behind glass shall be mounted adjacent to each relevant control panel.

FE 05 TRAINING OF OPERATORS FOR THE OPERATION OF THE INSTALLATION AND EQUIPMENT

In addition to the requirements of Additional Specification SD: General Training, the Contractor shall allow and provide for additional training of the incinerator operating staff as specified and set out in this specification. The objective of this training will be to ensure that the following be achieved:

(a) High standard of operator skills;
(b) Proper incineration of waste material,
(c) Reduce the maintenance cost of the plant to an acceptable level, and to maintain the cost at this level in so far as these costs are affected by the operating conditions;
(d) Prevent maloperation of the plant and its associated equipment;
(e) Correct method of waste and ash handling,
(f) Ensure and assist in achieving and maintaining the conditions as laid down by the Atmospheric Pollution Prevention Act, 1965.

The Contractor shall, in collaboration with the Engineer, ensure that the incinerator plant personnel be re-evaluated on an annual basis by means of a set examination, to ensure the upkeep of skill level and knowledge. Compilation of a set examination shall form part of the training responsibilities.

The evaluation and training course to be utilised for the evaluation of the incinerator operators shall include at least the following:

(a) Equipment and component recognition;
(b) How to operate the incinerator, including:
   (i) Waste handling
   (ii) Loading and starting the incinerator
   (iii) Operating and incineration temperature
   (iv) Draught controlling
   (v) Manual and automatic controlling of firing equipment
   (vi) Cleaning of incinerator equipment
   (vii) Ash removal and handling;
(c) Ash and grit removal procedures and methods;
(d) Control and operating of fuel firing equipment;
(d) Emergency procedures to be followed in the event of power failure, fuel leaks, burner failure, etc.
(e) Safety precautions to be followed and implemented;
(f) The identification, reporting and recording of faults and operation of equipment;
(h) The logging of incinerator plant operation, readings and settings.
FE 06 LOGGING AND RECORDING PROCEDURES

The Contractor shall under this repair and maintenance contract institute a logging and recording system as part of his maintenance control plan as defined in Additional specification SA: General and Maintenance. This shall consist of a log and record book which shall be utilised to log and record all operations, faults, system checks, breakdowns, maintenance visits, inspections, fuel delivery, ash removal, readings, etc.

The logbook shall be kept in a safe place and shall only be utilised by the operating staff, the Contractor and the Engineer. Copies of the monthly entries and recordings into the logbook shall be submitted by the Contractor together with his monthly report to the Engineer.

The logbook shall be structured to include at least the following:

(a) Daily inspection and maintenance actions;
(b) Monthly inspection and maintenance actions;
(c) Six-monthly inspection and maintenance actions;
(d) Annual inspection and maintenance actions;
(e) Breakdown reports;
(f) Type and quantity of waste incinerated;
(g) Daily plant operating conditions, observations, recordings and measurements;
(h) Statutory inspection and test comments and reports;
(i) Fuel delivery report, stating the date, type of fuel, quantity and delivery vehicle registration number;
(j) Ash waste removal report, stating the date and vehicle registration number.

The Contractor shall also institute an attendance register which shall be kept in a safe place. This register shall be completed by all persons visiting the incineration installation, including:

(a) Incinerator operators, cleaning staff and supervisor
(b) Contractor and maintenance personnel
(c) Inspectors
(d) Department personnel
(e) Engineer.

The register shall state the date, time-in, time-out, name, company and reason for visit.

A copy of the register shall be submitted by the Contractor together with his monthly report.

FE 07 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK

Except where otherwise provided in the Contract, the Contractor shall provide all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out such tests. The Contractor shall make arrangements for such tests and shall give at least 72 hours written notice to the Engineer, before commencing the test.

In the event of the plant or installation not passing the test, the Department shall be at liberty to deduct from the Contract amount all reasonable expenses incurred by the Employer or the Engineer attending the repeated test.
Whenever any installation or equipment is operated for testing or adjusting as provided for above, the Contractor shall operate the entire system for as long a period as may be required to prove satisfactory performance at all times in the occupied space served by that system for up to twenty-four hours a day continuously until the system is handed over.

The Contractor shall provide all labour and supervision required for such operation and the Department may assign operating personnel as observers, but such observation time shall not be counted as instruction time.

After completing the installation or systems, all equipment shall be tested, adjusted and readjusted until they operate to the satisfaction and approval of the Engineer.

The Contractor shall submit certificates of tests carried out to prove the efficiency of all equipment, as well as certificates to be obtained from all relevant authorities and statutory bodies, etc.

**FE 08 QUALITY ASSURANCE SYSTEM**

The Contractor shall institute an approved quality assurance (QA) system which shall be submitted to the Engineer for approval. The records of this QA system shall be kept throughout the duration of the Contract and submitted to the Engineer at regular intervals as required.

**FE 09 COMMISSIONING AND RECOMMISIONING OF PLANT AND INSTALLATION**

**FE 09.01 GENERAL**

On completion of the repair work and/or the installation of new systems the plant and equipment shall be put into operation after all tests and adjustments have been carried out to the satisfaction of the Engineer. Where new plant is installed, the Contractor shall run and operate the system for a period of time as specified by the Engineer and train the staff of the User Client to operate and maintain the system.

Logging of the operation of the installations shall commence immediately upon startup.

The Contractor shall submit a full commissioning report.

**FE 09.02 RECOMMISSIONING OF INCINERATOR INSTALLATION**

On completion of the statutory inspections and tests or major incinerator repairs the Contractor shall recommission the incinerator and its ancillary equipment. This operation shall be done strictly in accordance with the manufacturer’s specification and shall be witnessed by the Engineer. This shall include but not be limited to the following:

(a) **All required precommissioning mechanical checks**

   (i) Check that incinerator interiors are clean and free of any foreign matter.
   (ii) Ensure that new refractories are properly baked out in accordance with the manufacturer’s specifications.
   (iii) Check that all chambers are unobstructed and clean.
   (iv) Check the operation of all dampers for proper movement.
(v) Ensure that the grit collectors are clean.
(vi) Ensure that all oil or gas burners are properly mounted.
(vii) Check that all loading and ashing doors are properly installed and operate freely.
(viii) Check that the chimney is clean and securely supported and fixed.
(ix) Ensure that the oil or gas supplies are working and that no leaks are present.

(b) All required precommissioning electrical checks

(i) Check all wiring connections for tightness and repair any hot connections.
(ii) Check that all electrical equipment have been properly reconnected in accordance with the manufacturer's specification.
(iii) Perform and record all required electrical insulation tests on equipment.
(iv) Check and test all controls with main circuits isolated.
(v) Check all motor-driven equipment for correct rotational directions.
(vi) Check and test the operation of all indication and warning lights.
(vii) Check, set, record and readjust all equipment control and set points in accordance with manufacturer's specification.
(viii) Run all motor-driven equipment for a period to ensure free movement and correct operation, feed pumps only to be operated for a short interval to check rotation.
(ix) Check and test all solenoid, ignition and blower-fan operations.
(x) Test all temperature switching points and recalibrate to correct set points.

(c) Commissioning of the incinerator

On completion of the precommissioning checks the Contractor shall proceed with the commissioning of the incinerator. This shall be done strictly in accordance with the manufacturer's specification and shall include but not be limited to the following:

(i) Load incinerator with waste and close all ash and loading doors.
(ii) Ensure that the oil or gas supply to the burners are open.
(iii) Ensure that the electrical control panel is activated and all settings are in the ON-position.
(iv) Set damper controls to correct position.
(v) Activate burners and set temperature.
(vi) Allow burners to heat up chamber.
(vii) Set timers and record all cut-out points.
(viii) For coal-fired incinerators, load incinerator according to manufacturer's specification, light fire and load as directed.

The Contractor shall visit, inspect, test and readjust the incinerator over the 30-day period following the recommissioning to ensure the correct functioning of the incinerator and its associated equipment.

FE 10 GUARANTEE OF INSTALLATION AND EQUIPMENT

The Contractor shall provide guarantees obtained from the manufacturer(s) and/or supplier(s) to the effect that each piece of new equipment, supplied and installed under the repair contract, complies with the required performance and will function as part of the complete system.
All new equipment, including, the complete new installations and the systems as a whole shall be guaranteed for a period of 12 (twelve) months commencing upon day of issue of certificate of completion for repair work of the installation.

**FE 11 MAINTENANCE TOOLS AND SPARES**

Each incinerator installation shall be equipped with the necessary maintenance tools and spares required by the specific type of incineration installation for the daily operation and maintenance of the plant. At the start of the repair and maintenance contract the Contractor shall in the presence of the User Client make an inventory of the existing tools and spares, and any shortfall or damaged tools and spares shall be replaced with new. All replacement tools and spares shall be as specified by the incinerator and ancillary equipment manufacturers. These tools and spares shall be kept in a lockable room or cabinet of which the incinerator supervisor and the Contractor shall carry keys. The Contractor shall on a monthly basis take stock of these items in the presence of the incinerator supervisor and record and report to the Engineer. Any shortfall shall be replaced by the Contractor as part of his responsibility under this Contract.

The tools and spares to be carried shall include but not be limited to at least the following:

(a) **Tools**
   
   (i) Combination hoe/rake
   (ii) Poker
   (iii) Shovel
   (iv) All other necessary tools for the type of installation.

**FE 12 FUEL DELIVERY RECORDING AND CONTROL**

As part of this repair and maintenance contract, the Contractor shall, in collaboration with the User Client and fuel provider, institute a quality and delivery control plan for each incinerator installation. This control plan shall consist of a set of records to be completed with each fuel delivery, stating the following:

(a) Delivery note number
(b) Date of fuel delivery
(c) Quantity of fuel delivered
(d) Type of fuel delivered
(e) Fuel sample identification number
(f) Contractor's signature on acceptance of information and fuel sample
(g) Fuel deliverer's signature
(h) Incinerator supervisor's signature
(i) Comments by any party.

The type of fuel to be accepted shall comply with the specification to be agreed between the User Client and the Engineer.

Where coal-fired incinerators are installed the Contractor shall be responsible for taking a sample of each batch of delivered coal and sending it to an approved laboratory for confirmation that the coal samples conform to the agreed type of coal for the specific installation. The result of the tested sample shall contain the following:

(a) Various coal sampled mesh sizes
(b) Calorific value
(c) Moisture content
(d) Ash content
(e) Ash fusion temperature
(f) Volatile content.

The results of these tests shall be submitted to the Engineer.

The Contractor shall, in collaboration with the Engineer, institute the necessary measures to ensure the safe keeping and security of the fuel storage. All the relevant recorded information shall be submitted monthly together with Contractor's maintenance schedules to the Engineer.

**FE 13 INCINERATED WASTE ASH REMOVAL RECORDING AND CONTROL**

As part of this repair and maintenance contract, the Contractor shall, in collaboration with the User Client, ash removal company and the Engineer institute an ash removal control plan for each incinerator installation. This control plan shall consist of a set of records to be completed with each removal taking place and shall include the following:

(a) Date of contact of removal company for removal of ash;
(b) Date of actual ash removal;
(c) Approximate quantity of ash removed;
(d) Ash destination address, to be completed by removal company;
(e) Random samples of ash taken and recorded by Contractor;
(f) Contractor's signature on acceptance of information;
(g) Removal company signature;
(h) Incinerator supervisor's acceptance signature;
(i) Comments by any party.

The Contractor shall at random take samples of the ash and send it to an approved laboratory for analysis in order to determine if correct incineration is taking place.

The Contractor shall, in collaboration with the User Client and the Engineer, also institute a control plan to ensure safe handling and storing of the ash.

All the relevant recorded information shall be submitted, together with Contractor's maintenance schedules, monthly to the Engineer.

**FE 14 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT**

**FE 14.01 GENERAL**

During the repair and maintenance contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but no be limited to the specified Particular Specification details.

All repair work shall be executed using approved materials and equipment suitable to the systems and/or installations they serve. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer's specifications and codes of practice and all additional and particular specifications included in this document.
The repair work items are listed in tabular form in the Particular Specification with all relevant details, such as capacity, size, manufacturer, model number, etc.

All repair work shall be executed within the period specified in the Appendix to Tender. All new equipment, materials and systems shall be furnished with a written guarantee of a defects liability period of 12 months commencing on the date of issue of a certificate of completion of the repair work. These guarantees shall be furnished in favour of the Department of Public Works.

Repair work items for the incinerator installations are categorised under the following headings:

(a) All requirements as laid down in the Occupational Health and Safety Act No 85 of 1993.
(b) Incinerator casing
(c) Bracings
(d) Refractories
(e) Grit collector
(f) Loading and ashing doors
(g) Chimney
(h) Draught control equipment
(i) Emission control
(j) Oil burners
(k) Electrical and temperature controls
(l) Intensifier
(m) Paintwork
(n) Oil storage and piping system
(o) Incinerating plant room.

**FE 14.02**

**INSPECTION OF INCINERATOR EQUIPMENT AND INSTALLATION**

At the start of the repair and maintenance contract the Contractor shall decommission the incinerator installation, followed by an inspection and report to the Engineer on any defects, faults and repairs required, which shall include but not be limited to the following:

(a) **Incinerator casing**

   Clean and inspect incinerator casing for any defects, corrosion, weld failures, etc, and if necessary perform a material thickness test.

(b) **Bracings**

   Clean and inspect bracings for any defects, corrosion, weld failures and damages.

(c) **Refractories**

   Clean and inspect all refractory work to the loading door, hearth, walls, roof, etc, for defects, cracks, damage and failures.

(d) **Grit collector**

   Clean and inspect grit collector (if installed) for any defects and correct operation.
(e) **Loading and ashing doors**

Clean and inspect loading and ashing doors for any defects, damages and correct operation, including hinges, slides, slide guides, latches and handles.

(f) **Chimney**

Clean and inspect chimney stack, including mountings, welds, material, etc, for any defects, damage and repairs required.

(g) **Draught control equipment**

Clean and inspect all draught controls such as barometric damper, door-operated draught limiter, stack damper, etc, for any defects, damages repairs required and correct operation.

(h) **Emission control equipment**

Clean and inspect all emission control equipment such as refractory screen, grit settling chamber, arrestor screen, etc, for any defects, damages, repairs required and correct operation.

(i) **Fuel burners (if fitted)**

Clean and inspect all fuel burner equipment, including primary and after burners for any defects, damages, repairs required and correct operation.

(j) **Electrical and temperature controls**

Clean and inspect all electrical control equipment, including control panel, temperature sensors, pyrometer, timers, circuit breakers, switches, pilot lights, solenoids, etc, for any defects, damage, repairs required and correct operation.

(k) **Intensifier (if fitted)**

Clean and inspect intensifier blower for any defects, damages, repairs required and correct operation.

(l) **Paintwork**

Clean and inspect paintwork to casing doors and chimney stack for any defects and damages.

(m) **Fuel storage piping and pumping system**

Clean and inspect all fuel storage tanks, day tanks, piping and pumping systems and installations for any leaks, defects, damages and repairs required.

(n) **Incinerator housing**

Clean and inspect incinerator house, floor, roofing, ash bunker, coal bunker (if installed), etc, for suitability, defects, damages and repairs required.
INCINERATOR EQUIPMENT AND INSTALLATION

Any repair work which may be required on the incinerator plant installation shall be executed using approved materials, equipment, methods and tooling suitable for the specific application. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, statutory regulations, manufacturers' specifications and codes of practice and as specified in all additional and particular specifications included in this document. During the repair contract the following items are to be repaired and serviced as required by the Inspection Authority, incinerator manufacturer and this specification.

REPAIR WORK TO INCINERATOR AND ALCYILARY EQUIPMENT

(a) Incinerator casing

Any corroded sections, damages to mild metal steel casings and welds shall be repaired in accordance with the manufacturers specifications and the relevant SABS code for welding which shall include cutting, material, preparation, welding, welding material and equipment required to perform these repairs.

(b) Bracings

Any corroded sections and/or damages to the bracings and welds shall be repaired in accordance with the manufacturer's specification and the relevant SABS code for welding which shall include cutting, bracing material, preparation, welding, welding material and equipment required to perform these repairs.

(c) Refractories

Where refractories are found to be cracked, damaged and loose, these refractories shall be broken out, and the surfaces cleaned and prepared for new casting. The casting of new refractories shall be done in accordance with the manufacturer's specifications with the correct high temperature durable, high strength, high abrasion resistant monolithic castable material, mixed in the correct ratios, formed and applied to the correct thickness as specified by the manufacturer. Before the incinerator is recommissioned these refractories shall be baked out to ensure that there is no more trapped moisture.

(d) Grit collector (if installed)

Replace mountings if necessary to grit collector and clean of all foreign matter and dust. Where grit collector is concealed to such an extent that repairs are not possible, this unit shall be replaced with new in accordance with manufacturer's specification.

(e) Loading and ashing doors

Ensure the free movement of the loading door slides and guides. If damaged, provide required repairs to these slabs and guides, as well as repair of damages to the handles and door frame. If necessary, remove door refractories and recast with new as described in item (c) above. The hinges and latches to the ashing doors are to be cleaned and the Contractor shall make sure that they operate properly. If ashing doors are cracked or broken these are to be replaced with high grade cast-iron doors supplied by the manufacturer.
(f) **Chimney**

Any corroded sections of chimney stack shall be replaced with new chimney sections which shall be designed, manufactured, supplied and installed in accordance with the manufacturer's specification for the incinerator and the applicable site conditions.

New chimneys shall be manufactured of 3CR12 material. The Contractor shall ensure that all chimney mountings are replaced with new and are properly secured and fixed.

The Contractor shall reflash all roof penetration.

(g) **Draught control equipment**

All draught equipment shall be overhauled, and all damaged sections and equipment replaced with new original replacement parts as supplied by the manufacturer of the incinerator. This shall include the barometric damper, door-operated draught limiter and stack damper.

(h) **Emission control equipment**

All emission control equipment shall be repaired in accordance with the manufacturer's specification.

No equipment shall be changed from the original design.

Where equipment is found to be damaged these shall be replaced with new as supplied by the manufacturer of the incinerator.

This equipment shall include the stainless steel arrestor screen, refractory section and low-velocity grit settling chamber.

(i) **Fuel burner equipment**

All fuel burner equipment such as the primary and after burners shall be dismantled, stripped, cleaned, serviced, overhauled and repaired in accordance with the manufacturer's specification. This shall include replacement of fuel jets if required. The fuel solenoids shall be properly cleaned and tested.

All blower fans shall be tested and if required, bearings shall be replaced, and fan blocks and passages cleaned.

All gaskets and joint seals are to be replaced. The unit shall be reassembled, refitted, tested and adjusted in accordance with the manufacturer's specification.

(j) **Electrical and temperature controls**

(i) **Instrumentation and controls**

All instrumentation and control equipment shall be inspected, tested, repaired, adjusted and where necessary replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.
The repair work to the instrumentation and control equipment shall include at least the following:

(1) Test all equipment for correct operation.
(2) Inspect, test, service, adjust setting and if necessary repair and/or replace pyrometer.
(3) Inspect, recalibrate and if beyond repair, replace temperature sensors.
(4) Inspect, test, service, adjust and if necessary, replace timers.

(ii) General electrical power installation

The Contractor shall be responsible for the repair and maintenance work of the general power installation in the incinerator house. All repair work to this installation shall be done in accordance with the Standard Specification for Electrical Installations and Equipment pertaining to Mechanical Services of the Department of Public Works. This work shall include all repair work to the existing power sockets, cabling, wiring, lighting, and distribution boards.

(iii) Electrical control panels

All electrical control panels shall be inspected, tested, and repaired, including all equipment in the control panel. All repair and service work shall be done strictly in accordance with the manufacturer’s specification.

The repair work to the electrical control panels shall at least include the following:

(1) Test all control equipment for correct operation.
(2) Check and test all MCBs, isolators, contactors, overloads, other type of motor drives, pilot lights, control switches, etc, and readjust all set points. Where equipment is found to be faulty these shall be replaced with new approved equipment.
(3) Check all wiring and connections for proper conducting and replace where hot connections are found.
(4) Clean out panel interior and exterior, inspect panel body, fascias, doors, paintwork, etc, and repair where necessary.

(k) Intensifiers (if fitted)

Dismantle, strip, service, overhaul intensifier blower in accordance with the manufacturer's specification. Reassemble, test and fit to incinerator.

(l) Paintwork

The Contractor shall clean, prepare and repaint the incinerator casing and chimney stack with 400 °C heat resistant paint in accordance with the manufacturer’s specification.

The Contractor shall also be responsible for maintaining painted surfaces of the incinerator house and equipment. This paintwork shall be done in accordance with the Department’s specification OW 371.
(m) **Fuel storage, piping and pumping systems**

The Contractor shall inspect, clean, test, repair and where necessary, replace damaged equipment on the fuel storage, piping and pumping equipment. All equipment shall be serviced and repaired in accordance with the manufacturer's specification.

(n) **Incinerator housing**

The Contractor shall ensure that the incinerator house is kept clean and in a safe working condition.

**FE 15 MAINTENANCE TO INSTALLATIONS, SYSTEMS AND EQUIPMENT**

**FE 15.01 GENERAL**

Monthly maintenance responsibilities for each installation including all units and components as specified, shall commence with access to the site. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.

Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period.

This part of the Contract shall include:

(a) Routine preventative maintenance;
(b) Corrective maintenance, and
(c) Breakdown maintenance,

as defined in Additional Specification SA: General Maintenance, for the specified installations described under FE 01 of this specification.

The maintenance work to be performed and executed shall be done strictly in accordance with Additional Specification SA: General Maintenance, and as specified in Particular Specification PFE and this specification.

The said maintenance work shall be executed in accordance with the relevant codes of practice, statutory regulations, standards, regulations, municipal laws and by-laws and the manufacturers' specifications and codes of practice.

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor, as specified in Additional Specification SA: General Maintenance.

All new equipment, components and materials supplied and installed under the maintenance contract shall be furnished with a prescribed manufacturer's guarantee.

The maintenance work and items are to be categorised for each maintenance activity under the following headings:

(a) Incinerator
(b) Fuel firing equipment
(c) Fuel storage and handling equipment
(d) Waste handling and storage
(e) Incinerated waste and handling and removal
(f) Electrical installation and controls.
The Contractor shall be remunerated monthly, based on his performance, for maintaining the complete installation in a perfect functional condition.

**FE 15.02 ROUTINE PREVENTATIVE MAINTENANCE**

This routine maintenance of the installations, systems and equipment shall be done in accordance with Additional Specification SA: General Maintenance and the Particular Specification related to this work.

The routine maintenance work to be performed and executed shall include, but not be limited to the items listed in tables FE 15.02/1, FE 15.02/2, FE 15.02/3 and FE 15.02/4 below under the respective headings. These actions and findings shall be logged and reported on the relevant approved schedules and reports.

**TABLE FE 15.02/1: DAILY ACTIONS AND MAINTENANCE**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MAINTENANCE DESCRIPTION</th>
<th>ACTION RESPONSIBILITY</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type and quantity of waste</td>
<td>Incinerator supervisor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>2</td>
<td>Fuel quantity consumed</td>
<td>Incinerator supervisor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>3</td>
<td>Operation hours</td>
<td>Incinerator supervisor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>4</td>
<td>Operation comments</td>
<td>Incinerator supervisor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>5</td>
<td>Inspect fuel system for leakages and correct functioning.</td>
<td>Incinerator supervisor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>6</td>
<td>Clean interior and exterior of incinerator and keep incinerator plant room clean.</td>
<td>Incinerator supervisor</td>
<td>Clean/Record</td>
</tr>
<tr>
<td>9</td>
<td>Complete log book actions as specified in FE 06.</td>
<td>Incinerator supervisor</td>
<td>Check/Record</td>
</tr>
</tbody>
</table>
### TABLE FE 15.02/2: MONTHLY ACTIONS AND MAINTENANCE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MAINTENANCE DESCRIPTION</th>
<th>ACTION RESPONSIBILITY</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All as listed under table FE 15.02/1</td>
<td>Incinerator supervisor and Contractor</td>
<td>Check/Record Adjust/Repair</td>
</tr>
<tr>
<td>2</td>
<td>Test firing equipment as described by the manufacturer.</td>
<td>Contractor</td>
<td>Test/Record</td>
</tr>
<tr>
<td>3</td>
<td>Check the draught controls for correct operation in accordance with the manufacturer’s specification.</td>
<td>Contractor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>4</td>
<td>Inspect refractories and if found to be damaged it must be repaired.</td>
<td>Contractor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>5</td>
<td>Lubricate all required lubrication points.</td>
<td>Incinerator supervisor and Contractor</td>
<td>Check/Service/Record</td>
</tr>
<tr>
<td>6</td>
<td>Visual inspection of all incinerator house equipment and installations for any pending defects, faults, etc.</td>
<td>Incinerator supervisor and Contractor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>7</td>
<td>Inspect and test all control functions and readjust if necessary.</td>
<td>Contractor</td>
<td>Test/Record/Adjust</td>
</tr>
<tr>
<td>8</td>
<td>Inspect all seals and joints for leakages and replace if necessary.</td>
<td>Contractor</td>
<td>Check/Record/Replace</td>
</tr>
<tr>
<td>9</td>
<td>Sample and analyse fuel quality.</td>
<td>Incinerator supervisor, fuel supplier and Contractor</td>
<td>Check/Record/Test</td>
</tr>
<tr>
<td>10</td>
<td>Check waste ash removal implementation and report.</td>
<td>Incinerator supervisor, ash removal company and Contractor</td>
<td>Check/Record</td>
</tr>
<tr>
<td>11</td>
<td>Inspect, service, repair and replace where required all electrical equipment and installations.</td>
<td>Contractor</td>
<td>Test/Record Adjust/Repair</td>
</tr>
<tr>
<td>12</td>
<td>Inspect, service all fuel piping and equipment.</td>
<td>Contractor</td>
<td>Test/Record Adjust/Repair</td>
</tr>
</tbody>
</table>

### TABLE FE 15.02/3: SIX-MONTHLY ACTIONS AND MAINTENANCE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MAINTENANCE DESCRIPTION</th>
<th>ACTION RESPONSIBILITY</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All as listed under tables FE 15.02/1 and FE 15.02/2</td>
<td>Incinerator supervisor and Contractor</td>
<td>Check/Record Adjust/Repair</td>
</tr>
<tr>
<td>2</td>
<td>Inspect loading and ashing doors, repair and replace as required.</td>
<td>Contractor</td>
<td>Check/Record Service/Repair</td>
</tr>
<tr>
<td>3</td>
<td>Fully test, inspect, service, adjust, repair and replace as required draught control equipment.</td>
<td>Contractor</td>
<td>Check/Record Service/Repair</td>
</tr>
<tr>
<td>4</td>
<td>Inspect, clean out, repair and replace as required all fuel storage and firing equipment.</td>
<td>Contractor</td>
<td>Check/Record Service/Repair</td>
</tr>
<tr>
<td>5</td>
<td>Inspect, clean and repair chimney stacks.</td>
<td>Contractor</td>
<td>Check/Record Service/Repair</td>
</tr>
</tbody>
</table>
TABLE FE 15.02/4: ANNUAL ACTIONS AND MAINTENANCE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>MAINTENANCE DESCRIPTION</th>
<th>ACTION RESPONSIBILITY</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All as listed under tables FE 15.02/1, FE 15.02/2 and FE 15.02/3</td>
<td>Incinerator supervisor and Contractor</td>
<td>Check/Record Adjust/Repair</td>
</tr>
<tr>
<td>2</td>
<td>Annual survey by Occupational, Health and Safety Inspector.</td>
<td>Contractor, Department and Inspector</td>
<td>Inspect/Test Service/Repair</td>
</tr>
<tr>
<td>3</td>
<td>Inspect and repaint all equipment and building elements where required.</td>
<td>Contractor</td>
<td>Inspect/Test Service/Repair</td>
</tr>
<tr>
<td>4</td>
<td>Inspect, clean, repair refractories.</td>
<td>Contractor</td>
<td>Inspect/Test Service/Repair</td>
</tr>
<tr>
<td>5</td>
<td>Remove, strip, service, repair, adjust and repair fuel burners and associated equipment.</td>
<td>Contractor</td>
<td>Inspect/Test Service/Repair</td>
</tr>
</tbody>
</table>

FE 15.03  CORRECTIVE MAINTENANCE

The corrective maintenance of the installations, systems and equipment shall be done in accordance with Additional Specification SA: General Maintenance and the Particular Specification related to this work.

The Contractor shall inspect and check all equipment, materials, systems and installation for any pending breakdowns, maladjustments or anomalies of equipment.

The Contractor shall report and take actions to correct such defects.

FE 15.04  BREAKDOWN MAINTENANCE

Breakdown maintenance of the installations, systems and equipment shall be done in accordance with Additional Specification SA: General Maintenance.

All breakdown problems experienced shall be acted upon within the time limitations allowed in the General Maintenance specifications.

All breakdown maintenance shall be done in accordance with the relevant specifications, standards, regulations and codes.

The Contractor shall have access to the necessary spares, equipment and tools for any possible breakdowns.
TECHNICAL SPECIFICATION

FF KITCHEN EQUIPMENT INSTALLATION

CONTENTS

FF 01 SCOPE
FF 02 STANDARD SPECIFICATIONS
FF 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS
FF 04 OPERATING AND MAINTENANCE MANUALS
FF 05 TRAINING OF OPERATORS FOR THE OPERATION OF THE INSTALLATION AND EQUIPMENT
FF 06 LOGGING AND RECORDING PROCEDURES
FF 07 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK
FF 08 QUALITY ASSURANCE SYSTEM
FF 09 COMMISSIONING AND RECOMMISSIONING OF EQUIPMENT
FF 10 GUARANTEE OF INSTALLATION AND EQUIPMENT
FF 11 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT
FF 12 MAINTENANCE TO INSTALLATIONS AND EQUIPMENT

FF 01 SCOPE

This specification covers the general repair and maintenance of kitchen equipment, which include the following:

(a) Cooking pots
(b) Tilting frying pans
(c) Industrial stoves
(d) Convection ovens
(e) Deep fryers
(f) Potato peelers
(g) Vegetable shredders
(h) Meat saws
(i) Bread slicers
(j) Pressure cookers
(k) Dishwashers
(l) Bain-maries
(m) Kitchen worktops and shelving
(n) Food trolleys
(o) Bakery equipment
(p) Extract canopies

The following kitchen equipment is covered under other Technical Specifications as indicated:

- Cold/Freezer rooms, cabinet fridges, counter fridges: Technical Specification FG: Refrigeration Equipment;

This specification also addresses training of
- User Client's operators, and
- maintenance staff.
This specification shall form an integral part of the repair and maintenance contract document, and shall be read in conjunction with the additional and particular specifications compiled as part of this document.

This specification shall act as a guideline to the Particular Specification and, in the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.

**FF 02 STANDARD SPECIFICATIONS**

**FF 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES**

The latest edition, including all amendments up to date of tender of the following specifications, publications and codes of practice shall be read in conjunction with this specification and shall deemed to form part thereof.

**FF 02.01.01 SABS and other specifications and codes**

SABS 0400 - The applications of the building regulations
SABS 0142 - Code of practice for the wiring of remises
SABS 0140 - Identification colour marking
CKS 332 - Specifications for industrial V-belts
SABS 044 - Parts I to IV: Welding
SABS 0103 - The measurement and rating of environmental noise with respect to annoyance and speech communications

SABS Specifications listed on page 3 of the DPW specification OW 371
Atmospheric Pollution Prevention Act No 45 of 1965
SABS 153 - Cookers
SABS IE 60335-2-36 - Cooking appliances, commercial, electrical safety
SABS 153 - Cooking appliances, cookers
SABS IEC 60335-2-6 - Cooking appliances, electrical safety
SABS 158 - Cooking appliances, food warmers, liquids
SABS 447 - Cooking appliances, gas
SABS 154 - Cooking appliances, hobs, hotplates (cookers)
SABS 157 - Cooking appliances, toasters, performance
SABS IEC 60335-2-39 - Cooking pans, commercial, electrical safety
SABS 158 - Cooking vessels
CKS 115 - Cooking vessels, aluminium
CKS 86 - Cooking vessels, double boilers, aluminium
CKS 391 - Cooking vessels, frying pans, aluminium
CKS 392 - Cooking vessels, kettles, aluminium
SABS IEC 60335-2-58 - Dishwashing machines, commercial, electrical safety
SABS 1281 - Dishwashing machines, detergents, rinse aid
SABS IEC 60335-2-5 - Dishwashing machines, electrical safety
SABS 232 - Dishwashing machines, industrial, detergents
CKS 391 - Frying pans, aluminium
CKS 634 - Frying pans, electrical equipment
SABS IEC 60335-2-13 - Frying pans, electrical safety
SABS 153 - Grills (cooking)
SABS IEC 60335-2-38 - Grills (cooking), commercial, electrical safety
SABS IEC 60335-2-48 - Grills (cooking), electrical safety
SABS IEC 60335-2-9 - Grills (cooking), electrical safety
SABS IEC 60335-2-15 - Pressure cookers, electrical safety
SABS 1040 - Pressure cookers, household equipment
SABS 974-3 - Pressure cookers, sealing rings
SABS 1062 - Pressure gauges
SABS 1237  -  Pressure regulators, liquefied petroleum gas (LPG)
SABS 1243  -  Pressure stoves
SABS 0227-2 - Pressure vessels, inspectorates, certification (approval), modified or repaired pressure vessels.

**FF 02.01.02  Department of Public Works Specifications**

OW 371 - Specification of materials and methods to be used (Fourth revision, October 1993)

Standard Specification for electrical installations and equipment pertaining to mechanical installations

**FF 02.01.03  Occupational Health and Safety Act of 1993**

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) shall be adhered to.

**FF 02.01.04  Manufacturers’ specifications, codes of practice and installation instructions**

All equipment and materials shall be installed, serviced and repaired strictly in accordance with the manufacturers’ specifications, instructions and codes of practice.

**FF 02.01.05  Municipal regulations, laws and by-laws**

All municipal regulations, laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.

**FF 03  VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS**

The following additional general specifications and requirements shall be read in conjunction with this specification and shall be adhered to unless otherwise specified in the Particular Specification.

**FF 03.01  GENERAL REPAIR AND INSTALLATION REQUIREMENTS**

(a) All materials and equipment supplied and installed, shall be new and of high quality and manufactured to the relevant specifications, suitable for providing efficient, reliable and trouble-free service.

(b) All work shall be executed in a first-class workman-like manner by qualified tradesmen.

(c) All equipment, component parts, fittings and materials supplied and/or installed, shall conform in respect of quality, manufacture, test and performance to the requirements of the applicable current SABS specifications and codes, except where otherwise specified or approved by the Engineer in writing.

(d) All materials and workmanship which, in the opinion of the Engineer, is inferior to that specified for the work will be condemned. All condemned material and workmanship shall be replaced or rectified as directed and approved by the Engineer.
(e) The Contractor shall submit a detailed list of the equipment and material to be used to the Engineer for approval before placing orders or commencing installation.

(f) All new equipment, materials and systems shall be installed and positioned such as not to impede on access routes, entrances and other services. The Contractor shall coordinate these items taking other services and equipment into account.

(g) All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.

(h) The Contractor shall make sure that all safety regulations and measures are applied and enforced during the repair and construction periods to ensure the safety of the public and the User Client.

(i) Repair work shall be programmed in accordance with Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures, to ensure the shortest possible down-time of any service, and the least inconvenience to the User Client and the public. The Contractor shall make sure that the necessary notifications and notices are timeously put into place for these activities.

**FF 04 OPERATING AND MAINTENANCE MANUALS**

The Contractor shall be responsible for the compilation of an inventory list and operating and maintenance manuals and system data sheets.

This shall be done in accordance with Additional Specification SB: Operating and Maintenance Manuals.

All information shall be recorded and reproduced in electronic format as well as supplying the Department with three sets of hard copies.

Over and above what is specified in Additional Specification SB: Operating and Maintenance Manuals, the operating and maintenance manual to be compiled shall be structured to include at least the following:

(a) **System description**

   Complete description and the working of the equipment.

(b) **Commissioning data**

   Complete commissioning, test and inspection data of equipment.

(c) **Operating data**

   (i) Equipment running checklist and frequency of servicing required;
   (ii) Safety precautions to be implemented;
   (iii) Manual and automatic operation;
   (iv) Operator’s duties (logging requirements);
   (v) Lubricating oils and service instructions;
   (vi) Pre-start checklist for individual equipment;
   (vii) Starting and stopping procedures.
(d) **Mechanical equipment**

(i) Description of all major items with the make, model number, names, addresses and telephone numbers of the suppliers, manufacturers or their agents;

(ii) Design capacities of all equipment, including selection parameters, selection curves, capacity tables, etc;

(iii) Manufacturer’s brochures and pamphlets;

(iv) Schedule of spares with part numbers recommended to be held as stock.

(e) **Maintenance instructions**

(i) Schedule of maintenance particulars, frequency of services and replacements;

(ii) Trouble-shooting guide;

(iii) Part numbers of all replacement items and spares;

(iv) Capacity curves of pumps, fans and compressors, etc;

(v) Serial numbers of all items of equipment.

(f) **Electrical equipment**

(i) Schedule of equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;

(ii) Maintenance instructions;

(iii) Manufacturer’s brochures and pamphlets;

(iv) Complete as-built circuit diagrams and diagrammatic representation of interconnections of all electrical equipment.

(g) **Instrumentation and control**

(i) Description of each control system;

(ii) Schedule of control equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;

(iii) Maintenance instructions;

(iv) Manufacturer’s brochures and pamphlets.

(h) **Drawings**

(i) Paper prints of all as-built mechanical and electrical drawings;

(ii) Wiring diagrams of each individual control panel shall be put inside the panel, and a set provided to the maintenance supervisor.

**FF 05 TRAINING OF OPERATORS FOR THE OPERATION OF THE INSTALLATION AND EQUIPMENT**

In addition to the requirements of Additional Specification SD: General Training, the Contractor shall allow and provide for training of the kitchen equipment operators as specified and set out in this specification. The objective of this training will be to ensure that the following be achieved:

(a) High standard of operator skills;

(b) High equipment operating efficiencies to reduce operating costs;

(c) Reduce the maintenance cost of the equipment to an acceptable level, and maintain the cost at this level in so far as it is affected by the operating conditions;
(d) Prevent maloperation of the equipment.

The training course to be utilised for the evaluation of the kitchen operating staff shall include at least the following:

(a) Equipment and component recognition.

(b) How to operate the equipment, including the following:

(i) Starting the equipment;
(ii) Manual and automatic controlling;
(iii) Shut-down of equipment for short periods;
(iv) Cleaning of equipment;
(v) Normal shut-down.

(c) Emergency procedures to be followed in the case of power failure, water shortage, etc.

(d) Safety precautions to be followed and implemented.

(e) The identification, reporting and recording of faults and operation of equipment.

(f) The logging of equipment operation, readings and settings.

**FF 06 LOGGING AND RECORDING PROCEDURES**

The Contractor shall under this repair and maintenance contract institute a logging and recording system as part of his maintenance control plan as defined in Additional Specification SA: General Maintenance. This shall consist of a log and record book which shall be utilised to log and record all operations, faults, system checks, breakdowns, maintenance visits, inspections, readings, etc.

The logbook shall be kept in a safe place inside the kitchen supervisor's office and shall only be utilised by the supervisor, the Contractor and the Engineer. Copies of the monthly entries and recordings into this logbook shall be submitted by the Contractor together with his monthly report to the Engineer.

The logbook shall be structured to include at least the following:

(a) Daily inspection and maintenance actions;
(b) Monthly inspection and maintenance actions;
(c) Six-monthly inspection and maintenance actions;
(d) Breakdown reports;
(e) Daily equipment operating conditions, observations, recordings and measurements (including steam pressure, water meter readings and number of meals prepared);
(f) Statutory inspection and test comments and reports.

The Contractor shall also institute an attendance register, which shall be kept in a safe place inside the kitchen supervisor's office. This register shall be completed by all persons handling the kitchen equipment, including:

(a) Contractor and maintenance personnel
(b) Engineer
(c) User Client
(d) User Client associates.
The register shall state the date, time-in, time-out, name, company and reason for visit. A copy of the register shall be submitted by the Contractor together with his monthly report.

**FF 07 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK**

Except where otherwise provided in the Contract, the Contractor shall provide all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out such tests. The Contractor shall make arrangements for such tests and he shall give at least 72 hours written notice to the Engineer before commencing the test.

In the event of the equipment not passing the test, the Employer shall be at liberty to deduct from the Contract amount all reasonable expenses incurred by the Employer or the Engineer attending the repeated test.

Whenever any equipment is operated for testing or adjusting as provided for above, the Contractor shall operate the entire system for as long a period as may be required to prove satisfactory performance at all times in the occupied space served by that system for up to twenty-four hours a day continuously until the system is handed over.

The Contractor shall provide all labour and supervision required for such operation and the Department may assign operating personnel as observers, but such observation time shall not be counted as instruction time.

After completing the installation or system, all equipment shall be tested, adjusted and readjusted until it operates to the satisfaction and approval of the Engineer.

The Contractor shall submit certificates of tests carried out to prove the efficiency of all equipment, as well as certificates to be obtained from all relevant authorities and statutory bodies, etc.

The Contractor shall only utilise Departmentally approved inspection authorities for all inspections and tests to be conducted. This will be done and approved in writing between the relevant parties.

**FF 08 QUALITY ASSURANCE SYSTEM**

The Contractor shall institute an approved quality assurance (QA) system which shall be submitted to the Engineer for approval. The records of this QA system shall be kept throughout the duration of the Contract and submitted to the Engineer at regular intervals as required.

**FF 09 COMMISSIONING AND RECOMMISIONING OF EQUIPMENT**

**FF 09.01 GENERAL**

On completion of the repair work and/or the installation of new equipment the equipment shall be put into operation after all tests and adjustments have been carried out to the satisfaction of the Engineer. Where new equipment is installed the Contractor shall run and operate the equipment for a period of time as specified by the Engineer and train the staff of the User Client to operate and maintain the system.
Logging of the operation of the installations shall commence immediately upon start-up.

The Contractor shall submit a full commissioning report.

**FF 09.02 RECOMMISSIONING OF EQUIPMENT**

On completion of the inspections and tests of major repairs the Contractor shall recommission the equipment. This operation shall be done strictly in accordance with the manufacturer’s specification and shall be witnessed by the Engineer. The operation shall include but not be limited to the following:

(a) **All required precommissioning mechanical checks**
   
   (i) Check all steam, water and drain connections.
   
   (ii) Check all moving points.
   
   (iii) Check all seals.
   
   (iv) Reinstall all covers and doors and check that they are properly secured.
   
   (v) Check and record that all lubrication to equipment and components has been done in accordance with manufacturer’s specification.
   
   (vi) Check and ensure that all valves and safety valves are correctly installed and in the correct operating position. Safety valves are to be set in accordance with the required blow-off pressure for the installation.

(b) **All required precommissioning electrical checks**
   
   (i) Check all wiring connections for tightness and repair any hot connections.
   
   (ii) Check that all electrical equipment has been properly reconnected in accordance with the manufacturer's specification.
   
   (iii) Perform and record all required electrical insulation tests on equipment.
   
   (iv) Check and test all controls without livening up electrical equipment.
   
   (v) Check all motor-driven equipment for correct rotational directions.
   
   (vi) Check and test the operation of all indication and warning lights.
   
   (vii) Check, set, record and readjust all equipment control and set points in accordance with manufacturer's specifications.
   
   (viii) Run all motor-driven equipment for a period to ensure free movement and correct operation, feed pumps only to be operated for a short interval to check rotation.

(c) **Commissioning of equipment**

On completion of the precommissioning checks the Contractor shall proceed with the commissioning of the equipment. This shall be done strictly in accordance with the manufacturer's specification and shall include but not be limited to the following:

(i) During the commissioning process all level and warning system checks are to be performed on the water-level control system where applicable.

(ii) During load conditions the equipment shall be readjusted and finally switched to automatic operation on completion of all automatic control functions for correct operation where applicable.
The Contractor shall visit, inspect, test and readjust the installation during the 30-day period following the recommissioning to ensure the correct functioning of the equipment and its associated equipment.

**FF 10 GUARANTEE OF INSTALLATION AND EQUIPMENT**

The Contractor shall provide guarantees obtained from the manufacturer(s) and/or supplier(s) to the effect that each piece of new equipment, supplied and installed under the repair contract, complies with the required performance and will function as part of the complete system.

All new equipment including the complete new installations and the systems as a whole shall be guaranteed for a period of 12 (twelve) months commencing on the day of issue of a certificate of completion for repair work of the installation.

**FF 11 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT**

**FF 11.01 GENERAL**

During the repair and maintenance contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but not be limited to the specified Particular Specification details.

All repair work shall be executed with approved materials and equipment suitable to the systems and/or installations they serve. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer's specifications and codes of practice and all additional and particular specifications included in this document.

The repair work items are listed in tabular form in the Particular Specification with all relevant details such as capacity, size, manufacturer, model number, etc.

All repair work shall be executed within the specified durations as listed in the Appendix to Tender. All new equipment, materials and systems shall be furnished with a written guarantee of a defects liability period of 12 months from date of issue of a certificate of completion for the repair work. These guarantees shall be furnished in favour of the Department of Public Works. On completion of the required and specified repair work the systems, installations and equipment shall be commissioned and handed over to the satisfaction of the Engineer.

Repair work items for the kitchen equipment are categorised under the following headings:

(a) Cooking pots  
(b) Pressure cookers  
(c) Stoves  
(d) Convection ovens  
(e) Deep fryers  
(f) Bakery ovens  
(g) Dough mixers  
(h) Potato peelers  
(i) Vegetable shredders  
(j) Tilting frying pans  
(k) Kitchen worktops and shelving  
(l) Dishwashers
(m) Extract canopies.

**FF 11.02 COOKING POTS**

(a) Repair lid handles, hinges and catches.
(b) Repair leaking valves (steam, water, drain).
(c) Repair side panels.
(d) Repair leaks on pots.
(e) Repair oil (oil jacket pots).

**FF 11.03 PRESSURE COOKERS**

(a) Repair leaking seals on lids.
(b) Replace pressure gauges.
(c) Replace thermometers.
(d) Repair discharge flute seal.
(e) Reset/repair steam pressure-reducing valve to 290 kPa.
(f) Replace mountings and anti-vibration pads.

**FF 11.04 STOVES**

(a) Repair plate temperature controllers (electric and gas stoves).
(b) Repair oven doors.
(c) Repair Sprague tubing (electric stoves).
(d) Replace circuit breakers (electric stoves).
(e) Replace regulator (gas stoves).

**FF 11.05 CONVECTION OVENS**

(a) Replace blown elements.
(b) Repair door hinges and handles.
(c) Repair shelf stays.
(d) Replace blown indicator bulbs.

**FF 11.06 DEEP FRYERS**

(a) Repair temperature controllers.
(b) Repair frying baskets.
(c) Repair Sprague tubing.
(d) Replace circuit breakers.

**FF 11.07 BAKERY OVENS**

(a) Repair water and drain connections.
(b) Repair ventilation systems.
(c) Repair control panel.
(d) Repair door hinges and latch.

**FF 11.08 DOUGH MIXERS**

(a) Repair bowl and mixer drivers.
(b) Repair electrical wiring.
FF 11.09  POTATO PEELERS

(a) Repair water and drain connections.
(b) Repair mounting stand.
(c) Repair hatches.
(d) Repair peeling disk.
(e) Repair electrical connections.

FF 11.10  VEGETABLE SHREDDERS

(a) Repair water and drain connections.
(b) Repair mounting stand.
(c) Repair hatches.
(d) Repair shredding cutters.
(e) Repair electrical connections.

FF 11.11  TILTING FRYING PANS

(a) Repair tilting handle.
(b) Repair lid hinges.
(c) Repair temperature controllers.
(d) Repair electrical connections.

FF 11.12  KITCHEN WORK TOPS, SHELVING AND TROLLEYS

(a) Repair coasters on trolleys.
(b) Repair shelves (flatten) and stands.
(c) Repair work tops (flatten) and stands.

FF 11.13  DISHWASHERS

(a) Repair water supply and drainage connections.
(b) Repair dish baskets.
(c) Repair cutlery baskets.
(d) Repair door mechanisms.
(e) Repair electrical connections.
(f) Repair control panel.
(g) Repair washing system.

FF 11.14  EXTRACT CANOPIES

(a) Check and reset fire dampers.
(b) Clean filters/replace damaged filters.

FF 12  MAINTENANCE TO INSTALLATIONS AND EQUIPMENT

FF 12.01  GENERAL

Monthly maintenance responsibilities for each installation including all units and components as specified, shall commence with access to the site. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.
Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period.

This part of the Contract shall include:

(a) Routine preventative maintenance;
(b) Corrective maintenance, and
(c) Breakdown maintenance,

as defined in Additional Specification SA: General Maintenance, for the specified installations described under FF 01 of this specification.

The maintenance work to be performed and executed shall be done strictly in accordance with Additional Specification SA: General Maintenance, and as specified in Particular Specification PFF and this specification.

The said maintenance work shall be executed in accordance with the relevant codes of practice, statutory regulations, standards, regulations, municipal laws and by-laws and the manufacturers' specifications and codes of practice.

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor, as specified in Additional Specification SA: General Maintenance.

All new equipment, components and materials supplied and installed under the maintenance contract shall be furnished with a prescribed manufacturer's guarantee.

The maintenance work and items are to be categorised by the Contractor for each maintenance activity under the following headings:

(a) Cooking pots
(b) Pressure cookers
(c) Stoves
(d) Convection ovens
(e) Deep fryers
(f) Bakery ovens
(g) Dough mixers
(h) Potato peelers
(i) Vegetable shredders
(j) Tilting frying pans
(k) Kitchen worktops and shelving
(l) Dishwashers
(m) Extract canopies.

The Contractor shall be remunerated monthly, based on his performance, for maintaining the complete installation in a perfect functional condition.

**FF 12.02**  
**DEFINITION AND QUALIFICATION OF ACTIONS**

**FF 12.02.01**  
**Daily maintenance actions**

Daily actions are the responsibility of the User Client. These are to be performed by the responsible staff in the kitchens.
(a) **Operating checks**

(i) Check water connections and supply.
(ii) Check steam connections, supply and pressure.
(iii) Check drain connections.
(iv) Check operation of temperature controllers.
(v) Check operation of all doors, hatches, lids.
(vi) Check operations of mechanical movement.
(vii) Check operation of ventilation systems.
(viii) Do a visual check for steam leaks.

These daily checks shall be logged at the facility, ie by the kitchen supervisor.

**FF 12.02.02 Monthly maintenance actions**

Monthly maintenance actions are the responsibility of the Contractor.

(a) **General maintenance on all kitchen equipment**

(i) Check all safety valve settings and operation.
(ii) Check all steam traps, sight glasses and steam/condense piping including lagging and pipe supports.
(iii) Clean out all strainers.
(iv) Check all overload settings and safety devices on electric control panels.
(v) Lubricate all bearings, gear boxes and check oil levels and top up where required.
(vi) Check, and replace if worn or damaged, all seals on lids, hatches.
(vii) All daily maintenance schedules shall be included in the monthly schedules.

(b) **Cooking pots**

(i) Check lid handles, hinges and catches.
(ii) Check, and repair if required, all valves.
(iii) Check extract system on cooking pots, including the fan rotation, bearings, V-belts and pulleys.
(iv) Fasten all cover panels.
(v) Check all steam, water and drain connections.
(vi) Check for steam and water leaks.

(c) **Pressure cookers**

(i) Check all steam, water and drain connections.
(ii) Check all covers, lids, hatches for proper operation and sealing.
(iii) Check operation of all valves.
(iv) Check all electrical control panels.
(v) Check and lubricate all moving parts.
(vi) Check operation of outlet funnel.
(vii) Check operation of all pressure and temperature gauges.
(viii) Check operation of scale.

(d) **Stoves**

(i) Check operation of oven doors and latches.
(ii) Check the operation and calibration of temperature controllers (electric and gas).
(iii) Check the operation of plates.
(iv) Check the electrical connections including cables.
(v) Check the operation of the circuit breakers.
(e) **Convection ovens**
   
   (i) Check rotation and operation of thermo fans.
   (ii) Check all electrical elements.
   (iii) Check operation of door hinges and latches.
   (iv) Check operation of temperature controllers.
   (v) Check all electrical connections and cables.
   (vi) Check the operation of the control panel.

(f) **Deep fryers**

   (i) Check operation of the temperature controllers.
   (ii) Check operation of the heating elements.
   (iii) Check operation of the moving mechanical parts and lubricate where required.
   (iv) Check the condition of the oil pots.
   (v) Check the condition of the frying baskets.

(g) **Bakery ovens**

   (i) Check all water and drain connections.
   (ii) Check the operation of the humidifier.
   (iii) Check the operation of the rotating shelves.
   (iv) Check the operation of the extract fan and thermo fan.
   (v) Check the control panel.
   (vi) Check the electrical connections.

(h) **Dough mixers**

   (i) Check the operation of the mixers.
   (ii) Check the movement of the mixing bowl and tilt system.
   (iii) Check the electrical connections.

(i) **Potato peelers**

   (i) Check the water and drain connections.
   (ii) Check the peeling disk and peeling pads.
   (iii) Check the passageways.
   (iv) Check the peel strainer.
   (v) Check the electrical connections and cable.
   (vi) Check the rotation of the electric motor.
   (vii) Clear the air passageways of the electric motor.

(j) **Vegetable shredders**

   (i) Check the operation and rotation of the shredding cutters.
   (ii) Check the operation of the feeder.
   (iii) Check the electrical connections and cables.
   (iv) Check the passage ways.
   (v) Clear air passageways of electric motor.

(k) **Tilting frying pans**

   (i) Check operation and lubricate tilt wheel and worm.
   (ii) Check electric connections and cabling.
   (iii) Check temperature controller.
   (iv) Check operation and balance of lid.
(l) Kitchen work tops, shelving and trolleys

(i) Flatten all work tops.
(ii) Lubricate/service all casters on mobile equipment.
(iii) Set all tops level.
(iv) Straighten all shelves and tray guides.

(m) Dishwashers

(i) Check all water, drainage and electrical connections.
(ii) Check all detergent levels.
(iii) Clear all detergent feeder piping.
(iv) Clean out strainers.
(v) Lubricate covers and door hinges.
(vi) Check control panel.
(vii) Check all tray guides.

(n) Extract canopies

(i) Clean filters.
(ii) Check operation of fire dampers.
(iii) Check operation of extract fan.
(iv) Check control panel.
(v) Check all electrical connections.
(vi) Clean all grease cups.

FF 12.02.03 Biannual maintenance actions

Biannual maintenance actions are the responsibility of the Contractor.

(a) General

(i) Check all electric motor bearings.

(ii) Check all electric motor for phase balance (three-phase).

(iii) Check staking and running amps on all electrical equipment.

(iv) Check and reset overload, over and under voltage settings on control equipment.

(v) Check and reset all timers.

(vi) Rotating equipment inside ovens:
   (1) Clean equipment;
   (2) Lubricate bearings/lushes;
   (3) Realign.

(vii) Clean all strainers.

(viii) Check all connections (water, steam and drainage).

(ix) All electrical connections must be re-tightened.

(x) Reset and check all pressure-reducing valves and safety valves.

Note: The above annual actions shall include the daily and monthly actions.
(b) Specific equipment requirements

(i) Cooking pots: Check jackets for leaks.

(ii) Pressure cookers, reset and check blow-off valves and replace vessel seal.

(iii) Stoves and convection ovens: Clean ovens and deep fryers and tilting frying pans, surfaces and bakery ovens.
 TECHNICAL SPECIFICATION HA

MEDIUM AND LOW VOLTAGE EQUIPMENT

CONTENTS

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HA 01 SCOPE
HA 01.01 This specification covers the repair and maintenance of medium and low voltage distribution equipment. The equipment comprises of MV/LV distribution substations and miniature substations.
HA 01.02 This specification forms an integral part of the repair and maintenance contract document and shall be read in conjunction with Portion 3, the Additional Specification included with this document.

HA 02 STANDARD SPECIFICATIONS, REGULATIONS AND CODES
HA 02.01 The latest edition, including all amendments up to date of tender of the following specifications, publication and codes of practice shall be read in conjunction with this specification and shall deemed to form part thereof.
HA 02.02 SABS Specifications
   a) SABS 0400
   b) SABS 0142
   c) Refer to the repair and maintenance procedures for the specific standards applicable to each procedure.
HA 02.03 Department of Public Works Specifications
   a) PW 774
HA 02.04 Occupational Health and Safety Act of 1993
HA 02.05 Manufacturer’s specifications and installation instructions
HA 02.06 Additional requirements

a) Equipment and material installed shall be new and unused.
b) The Contractor shall ensure that all safety regulations and measures are applied and enforced during repair and maintenance work on medium and low voltage equipment.

HA 02.07 Additional standards, specifications, regulations and codes listed with the maintenance and repair procedures specified elsewhere in this document.

HA 02.08 The Contractor shall familiarise himself with site and equipment conditions to ensure that all work can be performed in a safe manner.

HA 03 OPERATING AND MAINTENANCE MANUALS

HA 03.01 PROCUREMENT OF AVAILABLE AS-BUILT INFORMATION

a) At the commencement of the contract, the Contractor shall obtain all available as-built documentation from the Engineer and from the various parties previously responsible for operations and maintenance tasks. These parties shall include employees of the Client, or external contracted personnel.
b) If this information is available the contractor shall attempt to obtain the internal wiring diagrams and associated operations and maintenance information from the manufacturers of all switchgear panels.
c) The contractor shall verify the correctness of all the abovementioned as-built information by surveying the installations. The surveying of the installation shall include the following:
   i) The tracing (by sight only) of all equipment indicated on as-built information, excluding the instrumentation and/or control wiring of distribution equipment.
   ii) The marking up of the as-built information to indicate the correctness or not of the as-built information. Equipment indicated on the drawings that are not installed on-site shall be indicated as non-existing, and equipment that exists on site but are not indicated on the as-built information shall be indicated as existing.
d) The contractor shall compile a complete single line or schematic diagram representation of the complete installations. This single line diagram shall indicate the distribution substations and miniature substations. The inter-connections between all the components of the distribution substation shall be shown, and the various components shall be labelled using names designated by the contractor.
e) All information that was verified and or compiled from existing sources as well as information that was compiled independently by the contractor shall be recorded in electronic format.
f) The contractor shall supply the Engineer with three sets of all the abovementioned information in electronic format, and three sets in hardcopy format. This information shall be compiled and completed during the repair phase of the contract, and shall be submitted not later than the end of the repair phase.

HA 03.02 Over and above what is specified in the Additional Specification – SB Operating and Maintenance manuals, the Operating and Maintenance Manual to be compiled shall include the following maintenance data:

a) A maintenance record of all materials and equipment replaced or worked on as part of this contract.
b) Summary maintenance data recording the frequency of replacement of consumables and replacement material such as luminaires.

**HA 04**

**TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK**

**HA 04.01**
Refer to the test and inspection requirements specified with each procedure.

**HA 04.02**
The Contractor shall perform the following tests on completion of any work on medium voltage cables or cable terminations:

a) Voltage tests

Each section of the cable installation between miniature substations shall be subjected to a preliminary voltage or insulation resistance test to prove the insulation resistance.

b) Continuity test

The resistance between each core and the lead sheath of the cable shall be measured for each section while the core and sheath is short circuited at the far end to ascertain if all connections have been correctly made.

All test instruments shall be of a high quality and shall, if required, be calibrated by the SABS or such body approved by the Engineer at the cost of the Contractor.

c) DC medium-voltage tests

Each cable circuit, including joints and terminations, shall be tested by means of a direct current voltage of 18kV between the different cores and between the cores and the lead sheath or copper tape screen for a period of 15 minutes. The voltage shall be gradually raised to 18kV and kept there for 15 minutes.

**HA 04.03**
The Contractor shall undertake all repairs and replacements at his own cost in the event of the installation failing the above-mentioned tests. The tests shall be conducted in the presence of the Engineer before the Engineer shall agree to accept any part of the installation. The Contractor shall furthermore undertake any other tests the Engineer may prescribe to satisfy himself that the work is of an acceptable standard.

**HA 04.04**
The Contractor shall upon request provide the Engineer with test and calibrating certificates to prove that the measuring and testing instruments have been tested and calibrated by an organisation that is acceptable to the Engineer.

**HA 05**

**MAINTENANCE TOOLS AND SPARES**

**HA 05.01**
On commencement of the Repair and Maintenance Contract, the Contractor shall compile an inventory of the existing Tools and Spares in the presence of the Client.

**HA 05.02**
The Contractor shall supply all tools and spares required to perform the specified maintenance tasks, and he/she shall ensure that adequate tools and spares are available at all times to enable efficient repair and maintenance.
HA 06 QUALITY ASSURANCE SYSTEM

HA 06.01 Following formal approval of his Quality Assurance system by the Engineer, the Contractor shall implement the approved QA system.

HA 06.02 Records of this QA system shall be kept throughout the duration of the contract and shall be submitted to the Engineer as required.

HA 07 RE-COMMISSIONING OF INSTALLATION

HA 07.01 On completion of the initial repair work the installation shall be commissioned by the Contractor.

HA 08 MEASUREMENT AND PAYMENT

HA 08.01 The following payment specifications apply to all the repair and maintenance procedures specified in this contract:

For each of the repair and maintenance procedures, the tendered rate shall include full compensation for the following:

a) All labour required to complete the procedure.
b) The supply, delivery, installation, testing and commissioning of all equipment and material required to complete the procedure. (Except where exclusions to this clause is specified in the remaining specifications that forms part of the specific procedure).
c) The prior arrangement by the contractor to obtain timely access to facilities, and the shutting down of equipment by the responsible persons as may be required to complete the procedure.
d) All costs associated with the transportation to and no site, the operation of, and the insurance and safekeeping by the contractor of all specialised and other plant and equipment that may be required for the completion of the procedure.
e) The execution of all site and other tests that may be required from the contractor to prove compliance with the specified standard specifications, regulations and codes. These tests shall be specified elsewhere as part of the procedure, or can be requested by the Engineer, or national and other laws, bylaws and regulations may require such tests.
f) The supply of indisputable proof in documented format that all the equipment and material supplied and installed in terms of the procedure complies with the specified standard specifications, regulations and codes.

HA 09 REPAIR WORK TO MEDIUM AND LOW VOLTAGE EQUIPMENT

HA 09.01 All components of the medium and low voltage network shall be repaired during the first phase of the repair and maintenance contract, except in cases where the repair actions are specified to require specific approval for execution.

HA 09.02 The scope of the repair work shall include, but not be limited to the activities listed below.

HA 09.03 The Contractor shall record the repair actions in tabular format before the maintenance phase commences.
HA 09.04 Repair work shall be executed within the approved period for repairs. This period shall be agreed at the start of the contract period.

HA 09.05 New equipment and material shall be supplied with a written guarantee confirming a defects liability period of 12 months from date of hand-over. These guarantees shall be furnished in favour of the Department of Public Works.

HA 09.06 The maintenance phase of this contract shall commence once the repair work on the installation has been commissioned and handed over to the satisfaction of the Engineer.

HA 09.07 The repair actions are specified in the form of work procedures. These procedures comprise of step-by-step instructions on how to perform each repair action.

HA 10 MAINTENANCE OF MEDIUM AND LOW VOLTAGE EQUIPMENT

HA 10.01 The electrical distribution network shall be maintained in accordance with Additional Specification SA – General Maintenance.

HA 10.02 The following maintenance actions will be required under this phase of the contract:

a) routine preventative maintenance
b) corrective maintenance
c) breakdown maintenance

HA 10.03 The maintenance schedules and frequency of maintenance activities shall be developed under the maintenance control plan which will be instituted by the Contractor. The Contractor’s responsibility in this regard is specified in the Additional Specification SA – General Maintenance.

HA 11 DISTRIBUTION NETWORK: TECHNICAL DESCRIPTION

HA 11.01 This section describes the electrical distribution network that will be repaired and maintained in terms of this contract.

HA 11.02 The electrical distribution network consists of the following components:

a) One Pole mounted Eskom transformers form part of the distribution operational network section:
b) One Pole mounted Eskom transformers form part of the distribution upper network section

HA 12  TECHNICAL DETAILS : INITIAL REPAIR PROCEDURES

HA 12.01 This section contains the specifications for the initial repair procedures that will be completed as part of the contract. The contractor should note that the tendered rate for each procedure shall include both the supply, delivery, installation, testing and commissioning of equipment and material, and the labour and other costs associated with the completion of the procedure.
HA 12.02 Scope of repair and maintenance work

The repair and maintenance procedures are the following:

RP01 Substation building cleanup
RP02 Installation of hasp-and-latch door lock mechanism
RP03 Replacement of glass windowpanes
RP04 Installation of window-louvres
RP05 Installation of ventilation-louvres
RP06 Installation of padlocks
RP07 Installation of steel cable trench cover plates
RP08 Installation of wooden cable trench cover planks
RP09 Equipment oil cleanup
RP10 Replacement of lighting equipment
RP11 Replacement of photocell and reinstallation of outdoor light fitting
RP12 Replacement of socket outlet cover plate
RP13 Cleanup of tar/bitumen spills
RP14 Replacement of MV switchgear fuses
RP15 Ring-main unit overhaul
RP16 Replace ring-main unit contacts and contact blades
RP17 Insulation oil sampling and analysis
RP18 On-site insulation oil reconditioning
RP19 Supply and installation of insulation oil
RP20 MV circuit breaker oil service
RP21 Replacement of a cover plate for medium voltage switchgear panel
RP22 Installation of a transformer earth conductor
RP23 Replacement of transformer oil gaskets
RP24 Reparation of transformer bushing insulation
RP25 Replacement of transformer dehydrating breather
RP26 Sealing of a low voltage cable trench and sleeve section
RP27 General repairs to low voltage wiring in distribution panels
RP28 Replacement of ammeters
RP29 Replacement of voltmeters
RP30 Replacement of instrumentation fuses
RP31 Secure LV panels to floor
RP32 Installation of LV cable clamps
RP33 Reinstallation of LV distribution board front panel
RP34 Replacement of DB board front cover panel
RP35 Replacement of LV circuit breaker
RP36 Reparation of insulation on low voltage busbar
RP37 Reparations and LV cable replacements
RP38 Replacement and or reparation of MV cable terminations
RP39 Replacement of MV cable sections and the terminating of the cable
RP40 Reinstallation of a LV cable in a distribution kiosk
RP41 Test, clean, service and repair battery tripping unit
RP42 Test, clean, service and repair MV and LV overhead lines

HA 12.03 The repair and maintenance tasks are specified in the following procedures:

1. Substation building cleanup
   1.1 Procedure Number RP01
   1.2 Scope
      This procedure covers the internal cleanup of a substation building.
   1.3 Standard Specifications, Regulations and Codes
      All work carried out and all equipment and material supplied in terms of
      this procedure shall comply with the original equipment manufacturer’s
      specifications, and operation and maintenance instructions.
1.4 Task Description
All tasks described in this procedure shall be carried out in all three rooms of the substation building (MV switchgear room, transformer room, LV room). Generator rooms are excluded from this task.

a) The contractor shall remove all loose refuse and other scrap materials and objects from the substation and dispose thereof off site at a suitable location (excluding any equipment, material or other objects which could be considered to be of value to the client).

b) The contractor shall clean the substation floors and remove all sand, dust and other loose particles.

c) The contractor shall wash all walls using a suitable cleaning agent (water alone shall not be acceptable) and sponges, cloths and other cleaning materials as may be required. All smudge markings and other removable dirt marks shall be removed from the walls as part of this task.

1.5 Measurement and Payment

a) The unit of measurement shall be the number of substations cleaned. All three rooms of a substation building shall be considered as one unit.

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the supply of all cleaning materials that may be required in the execution of this task.

2. Installation of hasp-and-latch door lock mechanism
2.1 Procedure Number RP02

2.2 Scope
This procedure covers the installation of steel clamping plates and a hasp-and-latch door lock mechanism, and the reinstallation of the existing door handles.

2.3 Standard Specifications, Regulations and Codes
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

2.4 Task Description

a) The contractor shall remove the existing door handle and locking latch mechanism from both of the double external doors of the substation.

b) The contractor shall supply and install two sets of clamping plates, one set on each of the two doors. Each set of clamping plates shall consist of two galvanised steel plates of minimum dimensions 2.5mm thickness x 200mm x 300mm. The clamping plates shall be installed in adjacent positions on the two adjacent double doors, and in a position such that it covers the area where the existing door handles are installed. Each set of clamping plates shall be installed at neatly aligned opposing sides of the door. The plates shall be secured with at least four bolts, washers and nuts, with a minimum bolt diameter of 8mm. The bolts shall be of the rounded head type and shall be installed with the rounded heads facing outdoors and the washer
and nut ends facing indoors. The plates shall be aligned such that the edges of the plates do not protrude beyond the edges of the door, thereby preventing injury to persons opening and closing the doors.

c) The contractor shall supply and install a hasp-and-latch combination onto the lower part of the clamping plates of the two doors. The hasp-and-latch unit shall be made of either stainless steel, galvanised steel, or chrome covered metal. The hasp-and-latch unit shall be of the type that closes onto itself, thereby completely covering all securing bolts and screws when in the closing position. The size of the hasp-and-latch unit shall be such that it is suitable for locking with no smaller than a 75mm shackle type Viro lock.

d) The contractor shall reinstall all the original door handles onto the upper part of the clamping plates of both doors. The contractor shall supply and install suitable fastening bolts and screws for this purpose.

2.5 Measurement and Payment

a) The unit of measurement and payment shall be a lump sum.

b) The lump sum shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the supply, delivery and installation of all material and equipment that is required for the completion of this task.

3. Replacement of Glass Windowpanes

3.1 Procedure Number RP03

3.2 Scope

This procedure covers the replacement of windowpanes in substation buildings.

3.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

3.4 Task Description

a) The contractor shall remove all broken glass particles and fixing putty from the frame where a windowpane has been broken.

b) The contractor shall install a new windowpane by installing the glass and the fixing putty. The fixing putty shall be worked off to a smooth and sloped finish.

c) The contractor shall measure the windowpane to determine the exact dimensions required.

d) The glass supplied shall have a minimum thickness of 5mm.

3.5 Measurement and Payment

a) The unit of measurement shall be number of windowpanes installed. The schedule of quantities shall specify the type of equipment in terms of the dimensions of the windowpane. The different types are the following:
i) 1.0m wide x 1.5m high
ii) 1.5m wide x 2.5m high
ii) 0.2 m wide x 0.3m high

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the measurement on site of the dimensions of the windowpanes prior to the ordering of any material.

4. Installation of Window-louvres

4.1 Procedure Number RP04

4.2 Scope

This procedure covers the supply, delivery and installation of steel window-louvres to cover the outdoor side of substation building windowpanes. The reason for the installation is to protect the windowpanes from vandalism.

4.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

4.4 Task Description

a) The contractor shall permanently install frame mounted louvres on the outside of the substation windows. The frames shall be attached to the walls by means of anchor bolts.

b) Each unit shall consist of a standard manufactured louvres arrangement and it (including the frame and fixing brackets) shall be manufactured from sheet metal painted with an anti-corrosive paint.

c) The contractor shall measure the dimensions of each window frame, and the frame shall be manufactured according to these measurements to completely cover the exposed windowpane.

d) The windowpane areas that shall be used to base the tender rates on shall be 1.0m wide by 1.5m high, and 1.5m wide by 2.5m high.

4.5 Measurement and Payment

a) The unit of measurement shall be the number of louvres installed. The schedule of quantities shall specify the type of equipment in terms of the dimensions of the windowpane. The different types are the following:

i) 1.0m wide x 1.5m high
ii) 1.5m wide x 2.5m high

5. Installation of Ventilation-louvres

5.1 Procedure Number RP05

5.2 Scope

This procedure covers the supply, delivery and installation of an inlet and outlet pair of wall mounted ventilation-louvres in the transformer room of a substation building. The installation shall include the breaking
of a hole in the wall and the installation and cementing up of the installed louvres.

5.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with original equipment manufacturer’s specifications, and operation and maintenance instructions.

5.4 Task Description

a) The contractor shall install an inlet and outlet pair of sheet metal or aluminium ventilation louvres in the walls of the transformer room. The contractor shall break a suitably sized opening in the wall using suitable equipment, and the louvres shall be permanently installed inside the wall. The louvres shall not be surface mounted. The contractor shall finish off the sides of the opening with an approved building plaster after completion of the installation.

b) The plaster work around the louvres shall be finished off to a smooth appearance, and shall be repainted with a similar paint to that on the existing wall sections.

c) The louvres installed shall be a Trox Model WKL Weather Louver or equivalent model. The louvres shall be medium sized and of the vermin proof type. The outlet louvre shall be a third size larger than the inlet louvre to enable efficient free air circulation.

d) The two louvres shall be installed in two walls opposite from each other. The outlet louvre shall be installed high in the wall and the inlet louver shall be installed at a suitably lower height to enable efficient free air circulation.

5.5 Measurement and Payment

a) The unit of measurement and payment shall be the number of ventilation-louvre pairs installed. (One unit rate shall apply to the combination of an inlet/outlet pair of louvres).

6. Installation of Padlocks

6.1 Procedure Number RP06

6.2 Scope

This procedure covers the supply, delivery and installation of padlocks to secure substation doors and metal enclosure doors such as those of miniature substations and low voltage distribution kiosks.

6.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

6.4 Task Description

a) The contractor shall remove the existing padlocks from the specified substation doors, or metal enclosure doors such as those of miniature substations and low voltage distribution kiosks. This shall be done using a suitable sized bolt cutter or other equipment. Care shall be taken not to damage the door handle. latch or other locking mechanism during the removal of the old locks.

b) The contractor shall install the new padlocks and close the lock on installation.
c) All padlocks supplied shall be of the 75mm shackle Viro type.

d) All padlocks supplied shall be of a single batch and shall be operated using a single master key.

e) The contractor shall retain a set of keys, and supply the Engineer with a set consisting of twenty spare keys.

6.5 Measurement and Payment

a) The unit of measurement shall be the number of padlocks supplied.

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the installation of the locks on the various substation and enclosure doors throughout the installations, and the removal of old locks in accordance with this procedure.

7. Installation of Steel Cable Trench Cover Plates

7.1 Procedure Number RP07

7.2 Scope

This procedure covers the supply, delivery and installation of steel cable-trench cover plates at sections of cable trenches in substation buildings where existing cable-trench cover plates have been removed.

7.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

7.4 Task Description

a) The contractor shall manufacture and install sections of cable-trench cover plates to fit the sections in substations where old cover plates have been removed. The contractor shall measure up the cable trenches and manufacture the plates to fit exactly in the required sections. The dimensions specified in this procedure shall only be used as a basis to determine the tendered rate.

b) The cover plates shall be manufactured from mild steel chequered plate with a base thickness of 4.5mm and a chequered stud thickness of 6.1mm. Each cover plate shall have two guiding lengths of angle iron welded to the bottom of the plate. The guiding angle irons shall be welded in positions parallel to the length of the cable trench. The guiding angle irons shall be positioned at the edges of the plate, and shall form a tight fitting stop against the edges of the cable trench. The angle irons shall be mild steel with dimensions 40mm x 40mm x 3mm.

c) Each cover plate shall be fitted with two mild steel lifting handles fitted at opposing ends of the plate (in line with the length of the cable trench). The handles shall be fitted through holes drilled in the plate, and shall be such that they form irremovable parts of the plate.

d) All metal edges shall be chamfered to remove all burrs so that the cover plates can be handled without injury.

e) Each cover plate and its handles shall be painted with a suitable anti-corrosive primer after all welding and chamfering has been completed. All metal surfaces shall be cleaned (prior to painting).
and painted in accordance with the paint manufacturer’s recommendations.

7.5 Measurement and Payment

a) The unit of measurement shall be the number of cable trench cover plates supplied, delivered and installed. The schedule of quantities shall specify the type of cover plate in terms of its dimensions. The following types shall be supplied:
   i) 0.6m wide x 0.5m long
   ii) 0.6m wide x 0.6m long
   iii) 0.6m wide x 0.8m long
   iv) 0.6m wide x 1.5m long
   v) 0.6m wide x 1.8m long
   vi) 0.7m wide x 0.3m long
   vii) 0.7m wide x 1.5m long

8. Installation of Wooden Cable Trench Planks

8.1 Procedure Number RP08

8.2 Scope

This procedure covers the supply, delivery and installation of wooden cable-trench cover planks at sections of cable trenches in substation buildings where existing cable-trench cover plates have been removed.

8.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

8.4 Task Description

a) The contractor shall manufacture and install sections of wooden plank trench cover plates to fit the sections in substations where old cover planks have been removed. The contractor shall measure up the cable trenches and manufacture the planks to fit exactly in the required sections. The dimensions specified in this procedure shall only be used as a basis to determine the tendered rate.

b) The planks shall be cut so that the length of the planks is equal to (or slightly less than) the width of the cable trenches inlet grooves. The planks shall be arranged at right angles to the length of the trench, with a number of parallel planks making up the cable trench covering.

c) Each plank shall be fitted with two finger-lifting holes of 20mm diameter at opposing ends of the plank.

d) The planks shall be made from newly cut Sa-pele wood with minimum thickness and width 38mm and 150mm respectively.

e) All planks shall be treated with an oil-based weather proofing substance.

f) Only one plank in any cable trench section may be narrower than the specified width, and this width shall be such that the trench cover section is properly and completely covered.
8.5 Measurement and Payment
   a) The unit of measurement shall be the number of cable trench sections covered. (The number of planks shall not be used as measurement). The schedule of quantities shall specify the dimensions of the cable trench sections. The dimensions of the cable sections are the following:
      i) 0.3m wide x 0.6m long
      ii) 0.3m wide x 1.5m long

9. Equipment Oil Cleanup
9.1 Procedure Number RP09
9.2 Scope
   This procedure covers the cleanup of oil on an indoor T3 or ring-main unit switchgear bank or on a transformer.
9.3 Standard Specifications, Regulations and Codes
   All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.
9.4 Task Description
   a) The contractor shall use a suitable solvent to remove the surface oil from the transformer or the three or four panels of the indoor ring-main unit or T3 switchgear bank.
9.5 Measurement and Payment
   a) The unit of measurement shall be the number of switchgear banks or transformers cleaned. The schedule of quantities shall specify the type of equipment components in terms of the type and size of the components. The different types are the following:
      i) Transformer cleanup
      ii) Switchgear bank cleanup

10. Replacement of Lighting Equipment
10.1 Procedure Number RP10
10.2 Scope
   This procedure covers the supply, delivery and installation of lighting equipment at various places.
10.3 Standard Specifications, Regulations and Codes
   All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:
   a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.
   b) SABS 0114
   c) SABS 163
   d) SABS 1012
   e) SABS 1084
   f) SABS 1250
   g) SABS 1279
h) SABS 1777

10.4 Task Description

a) The contractor shall remove the defective luminaires and or other equipment from their fittings.

b) The contractor shall in install and reconnect the circuits to the newly installed lighting equipment.

c) In cases where wiring defects are encountered, the contractor shall supply and install the required wiring and associated material to correct the defects.

d) In cases where a complete light fitting (bayonet type or fluorescent tube luminaire) is installed, the contractor shall also be responsible for reconnecting the new light fitting with the existing light switch. The contractor shall be responsible to ensure that the newly installed light can be switched on and off using the existing light switch, and in cases where the existing light switch is defective or not in place, the contractor shall supply and install the necessary light switch, wiring and other fixing equipment and materials as part of the light fitting.

10.5 Measurement and Payment

a) The unit of measurement shall be number of lighting equipment components supplied and installed. The schedule of quantities shall specify the type of equipment components in terms of the type and size of the components. The different types are the following:

i) Complete Light Fitting - Bayonet Luminaire Type
   This component consists of a complete bayonet type luminaire unit. It includes a base unit for installation against a bulkhead or ceiling, a bayonet type globe, and a round globe of the type that screws into the base unit.

ii) Complete Light Fitting - Fluorescent tube Type
   This component consists of a complete double tube fluorescent luminaire unit. It includes a base unit for installation against a bulkhead or ceiling (including a translucent cover unit to cover the luminaire tubes), two fluorescent tube luminaires (length 1.8m), and all the associated components such as starters and ballasts that form part of the luminaire unit.

iii) Fluorescent tube luminaire : Length 1.2m

iv) Fluorescent tube luminaire : Length 1.8m

v) Fluorescent tube luminaire : Length 2.4m

vi) Conventional size globe : 100W bayonet fitting

vii) Conventional size globe : 100W screw in fitting

viii) Fluorescent light starter : Length 1.2m

ix) Fluorescent light starter : Length 1.8m

x) Fluorescent light starter : Length 2.4m

xi) Fluorescent light ballast : Length 1.2m

xii) Fluorescent light ballast : Length 1.8m

xiii) Fluorescent light ballast : Length 2.4m
11. Replacement of photocell and reinstallation of outdoor light fitting

11.1 Procedure Number RP11

11.2 Scope

This procedure covers the replacement of a defective photocell, the reinstallation of an outdoor light fitting, and the reconnection of the light fitting and photocell to the internal distribution board of the substation building.

11.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

11.4 Task Description

a) The contractor shall replace the defective photocell with a new and unused photocell. The contractor shall install the new photocell in a position that will ensure that the photocell is exposed to natural light in such a way that will correctly operate when exposed to outdoor light.

b) The contractor shall reinstall the existing outdoor light fitting by means of the appropriate anchor bolts and/or other securing mechanisms.

b) The contractor shall reconnect the photocell and outdoor light to the substation's internal distribution board and light switch. The contractor shall use (supply and install) a 20m length of surfix or equivalent type conductor (4mm² copper conductor) between the outdoor light and the internal substation distribution board and light switch. The contractor shall ensure that the surfix conductor is secured against the wall in a manner that complies with wiring regulations.

c) The photocell shall comply with the following specifications:

i) The photocell shall be fitted with switch contacts able to carry no less than 5A.

ii) The photocell current shall not exceed 50mA during no-load conditions.

iii) The photocell shall be suited to 240V ± 6%, 50Hz single-phase alternating current.

iv) The units shall be weather proof and vibration-resistant.

v) The units shall be designed to withstand damage by either stone-throwers or hail. If the units do not possess this quality, separate wire screens shall be provided for this purpose.

vi) The units shall be supplied with a standard NEMA plug and socket. The socket shall have an arm for mounting on a pole.

viii) All parts shall be treated to be corrosion-proof.

ix) The units shall be capable of operating in dusty conditions between -5°C and +55°C.

x) The units shall switch on when the light intensity drops to 15 lux ± 20% and switch off when the light intensity reaches 40 lux ± 20%.
xi) When the unit is in the on position, there shall be a time delay of approximately one minute before it switches off due to a sudden increase in the light intensity.

xii) The design of the switch shall ensure a positive on and off switching at all times.

11.5 Measurement and Payment

a) The unit of measurement shall be the number of photocell and outdoor light units replaced and reconnected. One unit shall be considered a single combined photocell and outdoor light combination.

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the 20m length of surfix or equivalent conductor as specified in this procedure.

12. Replacement of socket outlet cover plate

12.1 Procedure Number RP12

12.2 Scope

This procedure covers the supply and installation of a conventional socket outlet cover plate.

12.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) SABS code covering socket outlet cover plates.

12.4 Task Description

a) The contractor shall supply and install a conventional socket outlet cover plate in the position where an existing cover plate is missing.

b) The cover plate shall be a new and unused unit made of steel in compliance with the appropriate SABS code.

12.5 Measurement and Payment

a) The unit of measurement shall be the number of socket outlet cover plates supplied and installed.

13. Cleanup of Tar/Bitumen Spills

13.1 Procedure Number RP13

13.2 Scope

This procedure covers the cleanup of tar/bitumen spills caused by leaking cable termination drums of indoor switchgear units.

13.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

13.4 Task Description

a) The contractor shall cleanup the spill caused by the leakage of a tar/bitumen insulating cable termination box. The cable
termination box as well as the floor underneath the cable termination box shall be cleaned.

b) A suitable solvent shall be used and all traces of the tar/bitumen shall be removed.

13.5 Measurement and Payment
a) The unit of measurement shall be the number of tar/bitumen spills cleaned.

14. Replacement of Switchgear Fuses
14.1 Procedure Number RP14
14.2 Scope
This procedure covers the replacement of fuses in ring-main units and T3’s in both standalone and miniature substation units.

14.3 Standard Specifications, Regulations and Codes
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.
b) BS 2692: Fuses for voltages exceeding 1000 V a.c.
c) BS 2692: Part 1 Current-limiting fuses
d) BS 2692: Part 2 1956 Expulsion fuses
e) BS 2692: Part 3 1990 Guide to the determination of short circuit power factor

14.4 Task Description
a) The contractor shall replace blown fuses with new unused fuses.
b) The fuse replacement procedure shall be done in strict accordance with the manufacturers operating and maintenance instructions.
c) The fuses supplied shall be new 11kV HRC fuses, and if the switchgear enclosure allows this, a spare set of fuses shall be mounted inside the equipment enclosure.
d) The fuse rating shall be determined on the basis of the rating of the transformer supplied via the fuse.

14.5 Measurement and Payment
a) The unit of measurement shall be the number of fuses replaced and installed. The same rate shall apply to all types of fuses.
b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the supply and installation of a suitably rated fuse.

15. Ring-Main Unit Overhaul
15.1 Procedure Number RP15
15.2 Scope
This procedure includes all tasks associated with the complete overhaul of all three units of a three-legged ring main unit or T3. This includes opening the oil chambers and servicing the normally immersed components of the equipment, and the replacement of the
This procedure applies to both the ring-main units of miniature substations and the standalone ring-main units or T3 units in the distribution substations.

15.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) BS 5730 : 1979 Codes of practice for Maintenance of Insulating Oil

c) BS 5263 : 1975. Method for sampling liquid dielectrics


15.4 Task Description

a) Replacement of Insulating Oil

i) The contractor shall drain the existing oil from all the oil chambers and remove the oil from site using suitable storage methods.

ii) The contractor shall clean the interior of each oil chamber by means of a chamois leather cloth. All sediments shall be removed from the bottom of the oil chamber.

iii) The oil chamber shall be filled to the recommended level with new insulating oil in compliance with the abovementioned specifications.

iv) Care shall be taken to handle, transport, and store insulation oil in accordance with the abovementioned specifications.

b) Overhaul of major ring-main unit parts

The following major overhaul tasks shall be completed in addition to the insulating oil service:

i) The switching equipment shall be cleaned using only materials that comply with BS 5730 : 1979, and thereafter the equipment shall be cleaned by means of blowing a dielectric cleaner onto the switching parts.

ii) The equipment shall be thoroughly inspected for signs of defects and or equipment damage. Should any defects be detected, these defects shall be reported to the Engineer in documented format. During the inspection specific attention shall be given to any signs of blade arcing.

iii) All moving parts (that are recommended by the original equipment manufacturer to be lubricated) shall be lubricated using a lubricant complying with the requirements of the original equipment manufacturer.

15.5 Measurement and Payment

a) The unit of measurement shall be the number of ring-main units overhauled. A single rate shall apply to standalone ring-main units or T3’s, and to the ring main units of miniature substations. All three or four switching components of a ring-main unit or T3 shall be considered one item in the schedule of quantities, and
the tendered rate shall include the work done on all three or four components.

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the following:

i) All work associated with the overhaul of each piece of equipment as specified in this procedure, excluding the reconditioning of insulating oil, which shall be considered another payment item.

ii) The supply, delivery and installation of the full volume of new insulating oil required to fill all three or four oil chambers of the switching unit to the recommended level.

16. Replace Ring-Main Unit Contacts and Contact Blades

16.1 Procedure Number RP16

16.2 Scope

This procedure covers the replacement of defective contacts and contact blades on ring-main unit and T3 switchgear units (standalone and miniature substation applications).

16.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

16.4 Task Description

a) The contractor shall replace defective contacts and contact blades if the inspection performed during the overhaul of the ring-main units proves that this replacement is required.

b) The contractor shall remove defective contacts and shall supply and install new contacts and contact blades.

c) The type of contacts and contact blades installed shall be as recommended by the original equipment manufacturer.

16.5 Measurement and Payment

a) The unit of measurement shall be the number of sets of contacts and contact blades installed.

17. Insulation Oil Sampling and Analysis

17.1 Procedure Number RP17

17.2 Scope

The scope of this procedure includes all tasks required to analyse the condition of insulation oil in transformers. The transformers include both standalone and miniature substation transformers, and they are free breathing, dehydrator breathing, or hermetically sealed in type. These tasks include taking insulating oil samples from each separate oil unit, having tests done on each sample, and reporting the test results to the Engineer. All preparation tasks required for and associated with this work (such as arranging for and doing switching of electrical equipment) will be considered part of this task.

17.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:
a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.
b) BS 5730 : 1979 Codes of practice for Maintenance of Insulating Oil
c) BS 5263 : 1975 Method for sampling liquid dielectrics

17.4 Task Description

a) The contractor shall take oil samples from each unit of oil-immersed equipment that forms part of the facilities.
b) Oil sampling shall be done in strict compliance with the operation and maintenance instructions of the manufacturers of the various units of equipment.
c) Oil samples shall be taken from every single and separate oil unit of every piece of equipment, and each sample shall be separately labelled in order to discriminate between the result of different samples.
d) Taking and handling of oil samples shall be done in strict compliance with the specifications outlined in BS 5263: Method for sampling liquid dielectrics.
e) All oil samples shall be tested at a reputable laboratory (not on the Client’s site) in accordance with the test procedures outlined in Appendix A of BS 5730.
f) The following insulating oil characteristics shall be tested for according to the methods outlined in Appendix A of BS 5730:
   i) Odour
   ii) Appearance
   iii) Colour
   iv) Electric strength
   v) Water content
   vi) Acidity (neutralisation value)
   vii) Resistivity (at 20ºC)
   viii) Sediment and/or precipitable sludge
   ix) Dissolved gas analysis (DGA)
g) The results of the tests shall be supplied to the Engineer in documented format.
h) The test result report shall contain at least the following information:
   i) Unique description of equipment from which of oil sample was taken.
   ii) Date of sample,
   iii) Name of person taking the sample.
   iv) Test results for the sample in terms of each of the specified oil characteristics.
   v) Recommendations on whether the oil from which the sample was taken should be replaced or reconditioned or not.
vi) Summary recommendation of the general condition of the oil samples tested.

vii) Name of person who conducted the tests.

viii) Name and contact details of the test laboratory.

ix) Certification by the test laboratory that these specific tests have been conducted in compliance with BS 5730.

i) The contractor shall make arrangements with the Engineer prior to taking samples in order to ensure that access can be gained to all required facilities, and that equipment may be switched off as is required.

j) The contractor shall supply the Engineer with proof of his proficiency and experience in taking and analysing insulating oil samples, and of the reputability of the laboratory that will do the tests.

k) The contractor shall, at his own expense familiarise himself with the type and manufacturer of the various equipment on site, as is required for the proper taking of samples in accordance with the manufacturer’s requirements.

17.5 Measurement and Payment

a) The unit of measurement shall be the number of transformers from which samples are taken and analysed. The same rate shall apply to all sizes of transformers.

18. On-site Insulating Oil Reconditioning

18.1 Procedure Number RP18

18.2 Scope

This procedure covers tasks that form part of the on-site reconditioning of insulating oil presently used in all transformer and switchgear equipment. The transformers include both standalone and miniature substation transformers of the free breathing, dehydrator breathing, or hermetically sealed in type. Oil immersed switchgear comprises of ring-main unit and or T3 units. In the case of transformers, the procedure also includes the servicing of the dehydrating breather of the transformer.

This task includes the supply (for the contractor’s own use only) of oil reconditioning equipment, and the completion of the oil reconditioning task itself. All preparation tasks required for and associated with this work (such as arranging for and doing switching of electrical equipment) will be considered part of this task.

18.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) BS 5730 : 1979 Codes of practice for Maintenance of Insulating Oil

c) BS 5263 : 1975. Method for sampling liquid dielectrics

18.4 Task Description

a) The contractors shall recondition the insulating oil of the equipment that has been confirmed in writing by the Engineer to require reconditioning (based on the results of insulation oil tests that will be conducted). The contractor shall supply and install insulation oil and top up the oil chamber of the equipment in cases where the present oil levels are below the maximum recommended oil level. The oil used for this purpose shall be in compliance with the insulation specifications as set out elsewhere in this document.

b) The contractor shall use his own equipment for insulating oil reconditioning.

c) The contractor shall submit details of the oil reconditioning equipment to the Engineer prior to commencing with any oil reconditioning. The contractor shall only be allowed to commence with oil reconditioning work once the Engineer has approved the equipment.

d) The contractor shall recondition the full volume of insulation oil contained in each unit of equipment to the specified requirements.

e) Oil reconditioning of transformers only shall be done on-load and without de-energising the transformer.

f) The contractor shall ensure that the oil reconditioning equipment is properly used to ensure the maximum improvement of the oil characteristics. The contractor shall be required by the Engineer to perform on-site tests in order to demonstrate the condition of the reconditioned oil.

g) The contractor shall ensure that the reconditioned oil conforms to the following minimum specifications:
   i) Electric strength (minimum) 50kV
   ii) Acidity (maximum) 0.1g KOH / mg of oil
   iii) Water content (maximum) 30 p.p.m. (parts per million)

h) The contractor shall familiarise himself with site conditions to ensure that an adequate electrical supply is available where required to operate the oil reconditioning equipment. The contractor shall be allowed to make use of the Client's facilities for this purpose provided that the contractor ensures safe operating practices for its own and the Client's personnel. Where no supply is available from the Client's electrical network, the contractor shall provide all generator equipment (including fuel and other consumable items) that is required for the oil reconditioning.

i) The contractor shall familiarise himself with site conditions to ensure that adequate space is available where required to temporarily install and operate the oil reconditioning equipment.

j) In the case of a transformer the contractor shall also do a complete service of the transformer's dehydrating breather. This service shall be done in accordance with the following specifications:
   i) The contractor shall check the quantity and colour of the dehydrating agent (typically silica gel) and shall reactivate or replace it where necessary.
ii) The silica gel shall be considered to require replacement if its colour is pink or if the breather is not filled to the required level, and it shall be considered not to need replacement if its colour is deep blue and the breather is filled to the required level.

iii) Silica gel used for replacement shall be new silica gel and shall comply with BS 3523.

iv) The oil seal or bath at the base of the dehydrating breather shall be removed, cleaned out, and refilled with new insulation oil. The insulation oil used for this purpose shall be new insulation oil in compliance with SABS 555. The dehydrating breather shall be refilled with insulation oil to the level as prescribed in the manufacturer’s maintenance instructions.

18.5 Measurement and Payment

a) The unit of measurement shall be the number of transformers and the number of ring-main units reconditioned. The schedule of quantities shall specify the type of equipment to be oil-reconditioned. A single rate shall apply to all sizes of transformers, and the tendered rates shall be based on an average transformer size of 200kVA. A single rate shall apply to all standalone ring-main units or T3’s, and this rate shall include full compensation for the reconditioning of all three or four oil chambers. The different types are the following:

i) Transformer

ii) Ring-main unit or T3

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. The supply of insulation oil used for topping up purposes shall be provided for elsewhere under a separate payment item. In addition to this, the tendered rate shall also include full compensation for the dehydrating agent, and or dehydrating agent reactivating equipment that may be required during this operation.

19. Supply and Installation of Insulation Oil

19.1 Procedure Number RP19

19.2 Scope

This procedure covers the supply, delivery and installation of insulating oil for use in switchgear insulation chambers or in power transformers.

19.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) BS 5730 Codes of practice for Maintenance of Insulating Oil

c) BS 5263 Method for sampling liquid dielectrics

d) SABS 555 Standard Specification for Mineral insulating oil for transformers and switchgear (uninhibited)

19.4 Task Description

a) The contractor shall supply, deliver and install insulation oil according to SABS 555.
b) The oil shall be installed in transformer and or switchgear equipment in accordance with the applicable procedures elsewhere in this document.

c) The contractor shall ensure that the transportation, handling, and storage of oil is done strictly in accordance with BS 5730.

d) Oil shall only be supplied in terms of this procedure on the instruction of the Engineer. Oil shall further only be supplied if the existing insulating oil in equipment has leaked out or is below the required level. The contractor shall not replace existing insulating oil with new oil unless instructed so in writing by the Engineer.

e) The oil chambers of the equipment being topped up shall be filled to the maximum level recommended by the original equipment manufacturer.

19.5 Measurement and Payment

a) The unit of measurement and payment shall be litres of oil supplied and installed in either transformer or switchgear equipment.

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation all costs associated with the proper transportation, handling, and storage of oil in accordance with this procedure.

20. MV Circuit Breaker Oil Service

20.1 Procedure Number RP20

20.2 Scope

This procedure covers the tasks associated with the oil servicing of medium voltage metal-clad oil insulated switchgear panels. The service includes the draining and cleaning of the oil chambers and the replacement of the insulation oil.

20.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) BS 5730 Codes of practice for Maintenance of Insulating Oil

c) BS 5263 Method for sampling liquid dielectrics

d) SABS 555 Standard Specification for Mineral insulating oil for transformers and switchgear (uninhibited)

20.4 Task Description

This procedure applies to indoor oil insulated medium voltage circuit breakers.

a) The contractor shall drain the existing oil and remove the oil from site using suitable storage methods.

b) The contractors shall clean the interior of the circuit breaker oil chamber by means of a chamois leather cloth. All sediments shall be removed from the bottom of the oil chamber.
c) The circuit breaker inside the oil chamber shall be serviced by means of blowing a dielectric cleaner onto the switching parts.

d) The circuit breaker shall be thoroughly inspected for signs of faults and or equipment damage. Should any faults be detected, these faults shall be reported to the Engineer in documented format. Specific attention shall be given to any signs of blade arcing.

e) All moving parts (that are recommended by the original equipment manufacturer to be lubricated) shall be lubricated using a lubricant complying with the requirements of the original equipment manufacturer.

f) The oil chamber shall be filled to the recommended level with new insulation oil in compliance with the abovementioned specifications.

 g) Care shall be taken to handle, transport, and store insulation oil in accordance with the abovementioned specifications.

h) The circuit breaker shall be closed and the circuit breaker trolley and panel shall be restored to the normal operational state.

20.5 Measurement and Payment

a) The unit of measurement and payment shall be the number of circuit breakers serviced in accordance with this procedure.

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for supply, delivery and installation of the volume of new insulating oil required to fill the oil chamber to the recommended level.

21. Replacement of cover a plate for a medium voltage switchgear panel

21.1 Procedure Number RP21

21.2 Scope

This procedure covers the supply and installation of a cover plate for a medium voltage switchgear panel.

21.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

21.4 Task Description

a) The contractor shall supply and install a rear cable termination box cover plate for a switchgear panel.

b) The cover plate shall be designed to fit perfectly onto the existing switchgear panel. The plate shall be made of the same type of steel as the original switchgear cubicle, and it shall be painted with an equal or higher quality anti corrosive paint. The steel cover plate shall be secured onto the existing switchgear cubicle using bolts and washers to suit the existing bolt and nut arrangement of the switchgear panel.

c) The contractor shall obtain the exact dimensions of the switchgear panel and shall manufacture the cover plate in accordance with these dimensions.
21.5 Measurement and Payment  
a) The unit of measurement shall be number of switchgear panels for which cover plates are supplied and installed.

22. Replacement of transformer earth conductor  
22.1 Procedure Number RP22  
22.2 Scope  
This procedure covers the supply and installation of an earth conductor between a transformer and the substation integral earth bar.

22.3 Standard Specifications, Regulations and Codes  
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) SABS 1063 Earth rods and couplers

22.4 Task Description  

a) The contractor shall supply, install and connect an earth conductor between the transformer and the substation integral earth bar.

b) The earth conductor used shall be a bare stranded copper conductor with a 70mm² cross sectional area.

c) The earth conductor shall be connected to the equipment and to the integral earth bar using properly sized connecting lugs.

22.5 Measurement and Payment  

a) The unit of measurement shall be the number of transformers that are connected to the substation integral earth bar.

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the following:

i) The supply and installation of a 15m length of earth conductor as specified in this procedure.

ii) The supply and installation of properly sized connecting lugs and connecting bolts, nuts and washers.

23. Replacement of Transformer Oil Gaskets  
23.1 Procedure Number RP23  
23.2 Scope  
This procedure covers the supply, delivery and installation of various types of insulating oil gaskets for power transformers. The existing oil gaskets shall be removed on site and replaced with new gaskets that shall be cut to suit the transformer.

23.3 Standard Specifications, Regulations and Codes  
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.
b) ASTM F104-95 : Standard Classification System for Non-metallic Gasket Materials

23.4 Task Description

a) Only personnel with proven experience of previous transformer oil gasket replacement tasks shall perform this procedure. The contractor shall supply the Engineer with proof of the experience on previous projects.

b) This procedures covers the replacement of the following types of gaskets on power transformers:
   - main top gasket
   - bushing gaskets (medium voltage)
   - bushing gaskets (low voltage)
   - sealing bolt / test plug gasket

The procedure for the replacement of the various types of gaskets are specified below. As part of this procedure (applicable to all types of gaskets specified) the contractor shall thoroughly clean the whole transformer and remove all oil spills and other dirt on the transformer's enclosure.

c) Main top gasket
   i) The top gasket shall be removed and care shall be taken not to damage the gasket so that it may be used to determine the dimensions of the new gasket.
   ii) The contractor shall supply and deliver new gasket material of sufficient quantity to cut a new gasket using a single sheet of gasket material. The contractor shall determine the dimensions of the transformer on site by means of measurement.
   iii) The metal surfaces on the transformer enclosure and top cover plate on which the gasket is bedded shall be thoroughly cleaned and inspected for defects that may cause oil leaks. The contractor shall report any such defects to the Engineer.
   iv) A new gasket shall be cut and installed to fit neatly on the transformer gasket area.
   v) The gasket material supplied shall be a nitrile rubber compound of the Corkrite TF72 or equal and approved equivalent type according to ASTM F104-95. The thickness of the nitrile rubber sheet shall be 4.5mm. The contractor shall select the nitrile rubber sheet with a cork granule size that is in accordance with the manufacturer's specifications.
   vii) The installation of the gasket shall be done strictly in accordance with the transformer and gasket material manufacturers' specifications.
   viii) The contractor shall ensure that the transformer's top cover plate fastening bolts are tightened to the torque and in the sequence specified by the transformer manufacturer's specifications.
   ix) The contractor shall familiarise himself with any requirements for the handling and or disconnection and reconnection of cables onto and from the transformer, and all such work shall be done as part of this procedure.

d) Bushing gasket (medium voltage)
This procedure applies to all three medium voltage bushings.

i) The same procedure shall be followed except that only the bushings shall be removed instead of other components as specified in the procedure for the main top gasket.

ii) The contractor shall be responsible for the removal of the conductors that are connected to the medium voltage bushings, and for the reconnection of these conductors on completion of the task.

e) Bushing gasket (low voltage)

This procedure applies to all four low voltage bushings.

i) The same procedure shall be followed except that only the bushings shall be removed instead of other components as specified in the procedure for the main top gasket.

ii) The contractor shall be responsible for the removal of the conductors that are connected to the low voltage bushings, and for the reconnection of these conductors on completion of the task.

f) Sealing bolt / test plug gasket

This procedure applies to sealing bolts and or test plugs on the transformer oil chamber that are sealed by means of oil gaskets.

i) The same procedure shall be followed except that only the sealing bolts and or test plugs shall be removed instead of other components as specified in the procedure for the main top gasket.

23.5 Measurement and Payment

a) The unit of measurement and payment shall be the number of sealing gaskets supplied and installed. In the case of bushing gaskets the unit of measurement shall be the number of three phase sets of bushings installed. (This means that one unit shall represent 2 three (in the case of medium voltage bushings) or all four (in the case of low voltage bushings) bushings of the transformer for which new gaskets were installed. The schedule of quantities shall specify the type of gaskets. The different types are the following:

i) Main top gasket

ii) Bushing gaskets (medium voltage)

iii) Bushing gaskets (low voltages)

iv) Sealing bolt / test plug gasket

b) The tendered rates shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the following:

i) All the work associated with the shutting down of the transformer, the removal of the existing gasket(s), the installation of the new gasket(s), and the re-installation of the transformer’s top cover plate and or other components.

ii) All the conductor handling work that may be required to complete this procedure.
24. Reparation of Transformer Bushing Insulation

24.1 Procedure Number RP24

24.2 Scope

This procedure covers the replacement of the covering insulation of transformer bushings with new insulating material.

24.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) SABS 122 Pressure sensitive adhesive tapes for electrical purposes.

24.4 Task Description

a) The contractor shall clean and remove all existing insulation material from the three medium voltage or low voltage bushings of the transformer, whichever is specified. The procedure shall apply to all the bushings in either the set of medium or the set of low voltage bushings whichever is specified.

b) The contractor shall install the following insulation material on all the bushings in the set:

i) After it has been cleaned and old insulating material removed, the bushings shall be taped with at least 1.5m of insulating putty. The insulating putty shall be on the Scotchfil Electrical Insulating Putty type or equal and approved equivalent. The tape thickness shall be 3.2mm and the width shall be 38mm. An oil-based insulating putty shall not be used.

ii) The insulation putty shall be covered with at least 4 layers of self fusing rubber tape of the Scotch No. 23 tape or equal and approved equivalent. Care shall be taken that this tape is not excessively stretched when applying it, as this may deform the insulation putty.

iii) The self fusing rubber tape shall be covered with at least 2 layers of adhesive colour coded PVC insulation take of the Scotch No. 35 type or equal and approved equivalent. The colour coding of the tape shall correspond to the bushing phases, and the colours used shall be red, white, blue and black (the latter colour for the earth conductor).

24.5 Measurement and Payment

a) The unit of measurement shall be the number of bushing sets (one set is equivalent to either three medium voltage bushings or four low voltage bushings) of which the insulation been restored. The sets shall be specified to be either one of the following:
i) Medium voltage bushings
ii) Low voltage bushings

25. Replacement of transformer dehydrating breather

25.1 Procedure Number RP25

25.2 Scope

This procedure covers the supply and installation of a new dehydrating breather on a power transformer.

25.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

25.4 Task Description

a) The contractor shall disassemble and remove the defective dehydrating breather from the transformer.

b) The contractor shall supply and install a complete new and unused dehydrating breather equal or equivalent to the existing unit of the transformer.

c) The contractor shall fill the new dehydrating breather with dehydrating agent and insulating oil to the levels specified by the manufacturer.

d) The replacement dehydrating breather shall be of the type specified as replacement by the original equipment manufacturer.

25.5 Measurement and Payment

a) The unit of measurement shall be the number of dehydrating breather units replaced.

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the supply and installation of the dehydrating agent and insulating oil that will be required as part of this task.

26. Sealing of a low voltage cable trench and sleeve section

26.1 Procedure Number RP26

26.2 Scope

This procedure covers the sealing of a low voltage cable trench and sleeve section on the side of a substation building.

26.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

26.4 Task Description

a) The contractor shall clean up the section of the cable trench inside the building by removing all ground and other material from around the existing cables. Sufficient ground and other material shall be removed to enable the back filling of the area around the cables and directly underneath the substation wall with the specified back filling material to be carried out.
b) After the cable trench has been cleaned up the cables shall be neatly laid out 50mm away from each other. If the cable trench dimensions do not allow such spacing then a lesser-optimised arrangement shall be used.

c) The area around the cables and directly underneath the substation wall shall be bricked up with a weak mortar mixture. The mortar shall be a sound, cement and water mixture. The contractor shall ensure that the mortar mixture is sufficiently weak to allow it to be easily broken up if additional cables are to be installed at a later stage.

d) The contractor shall not de-energise any of the cables during the process.

26.5 Measurement and Payment

a) The unit of measurement shall be the number of cable entry sections refurbished. One cable entry section refers to the collective set of holes/sleeves through one wall where cables enter a cable trench.

27. General repairs to low voltage wiring in distribution panels

27.1 Procedure Number RP27

27.2 Scope

This procedure covers the general repair of the wiring in the low voltage distribution kiosk of a substation.

27.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) SABS 1507 : Electric cable with extruded solid dielectric insulation for fixed installations (300/500V to 1900/3300V)

27.4 Task Description

a) The contractor shall reconfigure all cable termination in order to neaten the wiring arrangement and cable terminations in the distribution kiosk. This work shall include the disconnection of cables, the repositioning of the circuit breakers, isolators and other devices, the rerouting of cables where required, and the reconnecting of the cables.

b) The contractor shall insulate and seal all unused cable terminations using appropriate electrical insulation and shall tie these cable terminations in a neat manner inside the distribution kiosk.

c) The contractor shall disconnect, install cable glands, and reconnect all cable terminations that are not fitted with cable glands.

d) The contractor shall disconnect, install cable termination lugs, and reconnect all cable terminations that are not fitted with cable termination lugs.

i) The cable glands shall be of the adjustable type, equal or similar to the Pratley gland and shall be suitable for use with PVC SWA PVC cables complying with the latest edition of SABS 1507. All glands shall be installed with non-deteriorating neoprene
shrouds. For all gland installations on armoured cable, the outer sheath of the cable shall be cut back in accordance with the gland manufacturers’ recommendations, so that a minimum of armouring is exposed between the gland and the outer sheath after gland installation. The shroud shall seal on the outer sheath of the cable.

ii) All cable termination lugs shall be bi-metallic aluminium-copper lugs, equal to or similar to SIMEL type ACX.

27.5 Measurement and Payment

a) The unit of measurement shall be a lump sum.

b) The tendered sum shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered sum shall also include full compensation for the supply and installation of all cable glands, terminating lugs and other wiring materials that shall be required as part of this task.

28. Replacement of Ammeters

28.1 Procedure Number RP28

28.2 Scope

This procedure covers the replacement of low voltage instrumentation ammeters in low voltage panels in substations and in miniature substations.

28.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) BS 89 Part 9, Direct acting indicating analogue electrical measuring instruments and their accessories. Recommended test methods.


28.4 Task Description

a) Each faulty ammeter shall be disconnected and removed from the kiosk or enclosure. The contractor shall ensure that no secondary circuits are open-circuited during this procedure.

b) The replacement ammeter shall be installed in the same position from which the faulty ammeter was removed. All circuits shall be reconnected using appropriately sized lugs on all wire terminations.

c) All ammeters supplied shall be maximum demand and instantaneous reading ammeters with maximum demand slave indicators. Ammeters shall be rated for the appropriate secondary current (1A or 5A) and shall be able to indicate up to 20% over full current rating.

d) Ammeters shall comply with the following specifications:

i) Ammeters shall be rated for the supply voltage and frequency which is 400/230V and 50Hz respectively. All the ammeters supplied shall be from the range of a single reputable supplier and shall preferably have the same face.
dimensions as the original ammeters. All ammeters shall comply with BS 89 Part 9 and/or IEC 60051.

ii) Ammeters shall be screened against magnetic interference and shall have anti-static against magnetic interference.

iii) Ammeters shall have anti-static impact resistant glass or “Macrolon” faces.

iv) Ammeters shall be insulated to achieve a 2kV insulation resistance to earth.

v) All instruments shall be splash proof and dust-proof unless more stringent requirements are specified for hazardous locations.

vi) Instruments shall be sufficiently resistant to vibration that may be encountered in the specific application.

vii) For normal environmental and supply conditions, instruments shall be suitable for use inside the limits specified in Tables III and VI of IEC 60051.

viii) All instruments shall be capable of withstanding overloads of continuous or short duration in accordance with section 8.3 of IEC 60051.

ix) Instruments shall be provided with studs for rear connection. Shrouds shall be provided to prevent accidental contact where instruments are to be installed in hinged panels of switchboards.

x) Ammeters shall have a moving iron element to indicate instantaneous values.

xi) Direct reading ammeters up to a maximum rating of 60 A may be used. Current transformer operated ammeters shall be 5 A full scale, calibrated to read actual primary circuit currents. The current transformer ratio shall be indicated on the faceplate.

xii) A zero adjustment screw shall be provided.

xiii) Where combined maximum demand and indicating ammeters are specified, a bimetallic spiral element shall be provided in the same housing to indicate mean value over a 15 minute period.

xiv) The bimetal element shall drive a residual pointer to indicate maximum mean current between resettings. This pointer shall operate on the main scale and shall be of a distinctive colour. The pointer shall be resettable from the face of the meter.

xv) The bimetal element shall be designed to compensate for limits of ambient temperature between -20°C and 70°C.

xvi) Full load or rated current shall be clearly indicated, preferably with a red line. Unless specified to the contrary, a 100% condensed overscale shall be provided for instantaneous reading instruments and no overscale for combined maximum-demand ammeters.

xvii) The intrinsic error, expressed in terms of the fiducial value in accordance with IEC 60051, shall be class 1.5 for the instantaneous readings and class 2.5 for the mean maxima.
e) Each ammeter shall be supplied and installed with a faceplate with the correct current transformer scale ratio. The contractor shall verify the correct current transformer scale ratio prior to supplying and installing the ammeter.

f) The contractor shall do all modifications that may be required to fit the new ammeter in the existing space, including the supply and installation of fixing brackets and material.

28.5 Measurement and Payment

a) The unit of measurement shall be number of ammeters installed. The ammeter installation process shall be considered to include the removal of the existing ammeters.

29. Replacement of Voltmeters

29.1 Procedure Number RP29

29.2 Scope

This procedure covers the replacement of low voltage instrumentation voltmeters in low voltage panels in substations and in miniature substations.

29.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) BS 89 Part 9, Direct acting indicating analogue electrical measuring instruments and their accessories. Recommended test methods.


29.4 Task Description

a) Each faulty voltmeter shall be disconnected and removed form the kiosk or enclosure.

b) The replacement voltmeter shall be installed in the position from which the faulty voltmeter was removed. All circuits shall be reconnected using appropriate sized lugs on all wire terminations.

c) Voltmeters shall comply with the following specifications:

   i) Voltmeters shall be rated for the supply voltage and frequency which is 400/230V and 50Hz respectively. All the voltmeters supplied shall be from the range of a single reputable supplier and shall preferably have the same face dimensions as the original voltmeters. All voltmeters shall comply with BS 89 Part 9 and/or IEC 60051.

   ii) Voltmeters shall be screened against magnetic interference and shall have anti-static against magnetic interference.

   iii) Voltmeters shall have anti-static impact resistant glass or “Macrolon” faces.

   iv) Voltmeters shall be insulated to achieve a 2kV insulation resistance to earth.
v) All instruments shall be splash proof and dust-proof unless more stringent requirements are specified for hazardous locations.

vi) Instruments shall be sufficiently resistant to vibration that may be encountered in the specific application.

vii) For normal environmental and supply conditions, instruments shall be suitable for use inside the limits specified in Tables III and VI of IEC 60051.

viii) All instruments shall be capable of withstanding overloads of continuous or short duration in accordance with section 8.3 of IEC 60051.

ix) Instruments shall be provided with studs for rear connection. Shrouds shall be provided to prevent accidental contact where instruments are to be installed in hinged panels of switchboards.

x) Voltmeters shall have a moving iron element to indicate instantaneous values.

xi) A zero adjustment screw shall be provided.

d) Each voltmeter shall be supplied and installed with a faceplate with the correct voltage transformer scale ratio. The contractor shall verify the correct voltage transformer scale ratio prior to supplying and installing the voltmeter.

f) The contractor shall do all modifications that may be required to fit the new voltmeter in the existing space, including the supply and installation of fixing brackets and material.

29.5 Measurement and Payment

a) The unit of measurement shall be number of voltmeters installed. The voltmeter installation process shall be considered to include the removal of the existing voltmeters.

30. Replacement of Instrumentation Fuses

30.1 Procedure Number RP30

30.2 Scope

This procedure covers the replacement of instrumentation fuses as used in voltmeters and ammeters.

30.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

30.4 Task Description

a) The contractor shall replace the defective fuses with new unused fuses.

b) The fuses shall be of the type and rating as specified by the original equipment manufacturer.

30.5 Measurement and Payment

a) The unit of measurement shall be the number of fuses replaced.
31. Secure LV panels to floor

31.1 Procedure Number RP31

31.2 Scope
This procedure covers the securing of low voltage distribution panels to the floor of a substation building.

31.3 Standard Specifications, Regulations and Codes
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

31.4 Task Description
a) The contractor shall secure all the low voltage distribution panels of the substation to the floor by means of appropriately sized anchor bolts, or by means of attachment to the cable trench metalwork, whichever is the most practical.

b) The contractor shall supply and install all anchor bolts, brackets and all other materials that will be required as part of this task.

31.5 Measurement and Payment
a) The unit of measurement shall be a lump sum.

32. Installation of LV cable clamps

32.1 Procedure Number RP32

32.2 Scope
This procedure covers the supply and installation of two cable clamps for securing two low voltage cables at their points of entry into low voltage distribution kiosks.

32.3 Standard Specifications, Regulations and Codes
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

32.4 Task Description
This procedure applies to two low voltage power cables at the point of entry into low voltage distribution kiosks. The two cables are both PVC insulated four core copper conductors with a cross sectional area of 180mm$^2$. At present the cables or not clamped within the kiosks and the full weight of the vertical section of the cables rest on the termination bushings.

a) The contractor shall supply and install the two wooden cable clamps to support the weight of the cables by clamping onto the cable sleeve and securing onto the distribution kiosk. The clamps shall be shaped to facilitate the clamping onto the cable sleeves without damaging the sleeves.

b) The contractor shall ensure that the installation is done in such a manner that the weight of the two cables is carried by the clamps and not by the cable termination lugs and bushings.

32.5 Measurement and Payment
a) The unit of measurement shall be a lump sum.
33. Reinstallation of LV distribution board front panel

33.1 Procedure Number RP33

33.2 Scope

This procedure covers the reinstallation of the front cover panels of existing low voltage distribution boards. These panels have been removed from the distribution boards and the fastening bolts and screws are no longer in place.

33.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

33.4 Task Description

a) The contractor shall reinstall the front cover panels of the low voltage distribution board in the substation where these are missing.

b) The panels shall be secured by means of fastening bolts and brackets. Where possible the existing brackets, bolts and nuts of the original panels shall be used, however in cases where these are unusable the contractor shall manufacture, supply and install similar securing brackets, bolts, nuts and washers.

33.5 Measurement and Payment

a) The unit of measurement shall be a lump sum. The lump sum tendered shall include full compensation for the reinstallation of the cover panels in a single substation.

34. Replacement of DB board front cover panel

34.1 Procedure Number RP34

34.2 Scope

This procedure covers the replacement of a front cover panel for an existing wall mounted distribution board.

34.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

34.4 Task Description

a) The contractor shall supply and install a new cover panel for a twelve way wall mounted distribution board.

b) The contractor shall determine the exact dimensions of the front cover panel by measurement prior to the supply and installation thereof.

34.5 Measurement and Payment

a) The unit of measurement and payment shall be the number of replacement front cover panels supplied and installed.

35. Replacement of LV circuit breaker

35.1 Procedure Number RP35

35.2 Scope

This procedure covers the supply and installation of a three phase three pole moulded case circuit breaker.
35.3 Standard Specifications, Regulations and Codes
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

35.4 Task Description
a) The contractor shall remove the defective circuit breaker from the circuit.
b) The contractor shall determine the rating of the defective circuit breaker and shall replace it with a new moulded case circuit breaker with the same ratings as that of the defective circuit breaker. The contractor shall reconnect the circuit to the new circuit breaker.
c) The type of circuit breaker is a moulded case three phase three pole circuit breaker. The circuit breaker shall be in compliance with the relevant SABS code.

35.5 Measurement and Payment
a) The unit of measurement shall be the number of moulded case circuit breakers supplied and installed.

36. Reparation of insulation on low voltage busbar
36.1 Procedure Number RP36
36.2 Scope
This procedure covers the insulation of an exposed section of low voltage busbar conductor.

36.3 Standard Specifications, Regulations and Codes
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

36.4 Task Description
a) The contractors shall insulate the complete section of exposed busbar using the same procedure for the reparation of transformer bushing insulation (Procedure RP24).

36.5 Measurement and Payment
a) The unit of measurement shall be a lump sum.

37. Reparations and LV cable replacements
37.1 Procedure Number RP37
37.2 Scope
This procedure covers the reparation of a cable trench and the replacement of sections of exposed low voltage power cables that were damaged.

37.3 Standard Specifications, Regulations and Codes
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

37.4 Task Description
The cables to which this procedure applies is installed on ground level in an outdoor fenced off area. The cable trench section is not backfilled and the cables are therefore exposed. These cables have been
damage to the outer sleeves and possibly to the internal insulation as well. The length of the exposed section of cable trench is approximately 10m.

a) The contractor shall expose the damaged parts of the cables by removing backfilling material from the cable trench up to the full length required therefore.

b) The contractor shall disconnect the low voltage cables cut the exposed and damaged ends so that the damaged sections are completely removed.

c) The contractor shall supply and install four sections of replacement cable, four cable joints and four cable terminations for the jointing and reconnection of the four cable sections. The replacement cable sections shall be PVC insulated, PVC sleeved, steel wire armoured copper conductor cables with four cores and a cross sectional area equal to that of the existing cable sections.

d) The contractor shall backfill the cable trench with fine-grained sound in such a way that the cables are not damaged. The cables shall be completely covered by the backfilling material in order to prevent exposure to the atmosphere. The cables shall be installed at a minimum depth of 0.5m. The contractor shall excavate the cable trench if necessary to obtain this minimum cable depth.

e) The cable joints and cable terminations shall comply with the following specifications:

i) The cable joints shall be of the epoxy-resin type.

ii) The cable glands shall be of the adjustable type, equal or similar to the Pratley gland and shall be suitable for use with PVC PVC SWA PVC cables complying with the latest edition of SABS 1507. All glands shall be installed with non-deteriorating neoprene shrouds. The cable glands shall be fitted with a nipple gasket and inner seal kit, rendering the gland suitable for type "e" equipment (increased safety equipment).

iii) For all gland installations on armoured cable, the outer sheath of the cable shall be cut back in accordance with the gland manufacturers’ recommendations, so that a minimum of armouring is exposed between the gland and the outer sheath after gland installation. The shroud shall seal on the outer sheath of the cable.

iv) Bi-metallic aluminium-copper lugs, equal or similar to SIMEL type ACX, shall be used according to the manufacturer’s specifications, where solid aluminium conductors are terminated onto copper busbars.

37.5 Measurement and Payment

a) The unit of measurement shall be a lump sum.

38. Replacement and or Reparation of MV Cable Terminations

38.1 Procedure Number RP38

38.2 Scope

This procedure covers the replacement and or reparation of medium voltage cable terminations at both oil filled and tar/bitumen filled cable termination boxes of indoor switchgear equipment.
38.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

38.4 Task Description

This procedure applies to the cable terminations of indoor switchgear units (T3's and ring-main units). These units are either oil filled or tar/bitumen filled. Different procedures apply to the two cases, and these differences are specified in this procedure.

a) The following procedure applies to oil immersed cable terminations:

i) The contractor shall drain the insulation oil from the oil chamber and shall remove the oil from site.

ii) The contractor shall remove the cable from the cable termination box and shall clean the cable section in preparation for the reinstallation of the lead cable seal.

iii) The contractor shall reposition the cable and shall reinstall the lead cable seal in accordance with generally accepted lead cable sealing practices. The seal shall be tested to ensure that it forms a tight oil seal between the cable and the cable termination panel.

iv) The contractor shall reassemble the cable termination box and shall refill the oil chamber with new insulation oil. The insulation oil shall be in accordance with the insulation oil specifications as set out elsewhere in this document.

b) The following procedure applies to tar/bitumen immersed cable terminations:

i) The contractor shall remove the cable termination cover panel and shall remove the cable termination from the cable termination box.

ii) The contractor shall disassemble and remove the complete cable termination box.

iii) The contractor shall manufacture and supply a new cable termination box. The new cable termination box shall be manufactured to fit in the place of the removed cable termination box, and shall be made of the same steel and painted with the same or higher quality anti-corrosive paint as that of the rest of the switchgear metal work. The new cable termination box shall be manufactured to contain a Raychem/Systol heat shrink type cable termination. The cable termination box shall be equipped with a cover panel that can be removed by removing four fastening bolts, thereby offering access to the cable terminations without removing the complete cable termination box.

iv) The contractor shall cut off and remove a length of approximately 5m from the cable termination end of the cable.

v) The contractor shall supply and install a new section of cable of the same type and size as the original cable. The contractor shall also supply and install a cable joint and cable termination to join the new cable section to the old cable and to terminate the cable section onto the
switchgear bushings in the newly installed cable termination box.

vi) The contractor shall supply and install a wooden clamp onto the cable at the bottom of the cable termination box to carry the weight of the cable, thereby preventing this weight from being carried by the switchgear bushings.

vii) The contractor shall reinstall the cover plate of the new cable termination box.

viii) The cable joints and cable terminations shall be of Raychem/Systol or equal and approved type. The size of the cable joints and terminations shall be selected to suit the cable size.

ix) The manufacturer's installation procedures and instructions shall be strictly adhered to.

ix) In cases where earth continuity conductors are installed on existing cable sections, and where these sections are replaced in terms of this procedure, the Contractor shall supply and install a new earth continuity conductor of equal or larger cross-sectional area. The earth continuity conductor installed shall comprise stranded copper conductors.

x) The Contractor shall conduct all the tests as specified in subclause HA 04.3 of this specification on completion of the cable termination installation.

xi) Upon request all jointers shall produce proof of training in the performing of cable joints.

38.5 Measurement and Payment

a) The unit of measurement shall be the number of cable terminations replaced and or repaired. The schedule of quantities shall specify the type of task to be performed. The two types of tasks are the following:

i) Reparation of oil immersed cable termination

ii) Replacement of tar/bitumen immersed cable termination

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the following:
i) The supply of the lead and lead sealing equipment (in the case of oil immersed cable terminations only).

ii) The supply and installation of a cable joint and cable termination (in the case of tar/bitumen immersed cable terminations only).

iii) The supply and installation of five meter section of medium voltage cable (in the case of tar/bitumen immersed cable terminations only).

iv) The design, manufacture, supply and installation of a complete new cable termination box (in the case of tar/bitumen immersed cable terminations only).

39. Replacement of a MV cable sections and the terminating of the cable

39.1 Procedure Number RP39

39.2 Scope

This procedure describes the replacement of a cable section between the transformer and switchgear unit of a substation building. The cable shall be terminated and reconnected onto the equipment at both cable ends.

39.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) SABS 97: Electric cables - impregnated-paper-insulated metal-sheathed cables for rated voltages from 3,3/3,3 kV up to 19/33 kV

c) SABS 1339: Electric cables: Cross-linked polyethylene (XLPE) – insulated cables for voltages from 3,8/6,6 kV to 19/33 kV

39.4 Task Description

a) The contractor shall disconnect and remove the existing medium voltage cable from between the transformer and the switchgear unit. The contractor shall remove and dismantle the existing cable termination box of the tar/bitumen immersed cable termination switchgear unit. (This work shall be done in the manner specified as part of procedure RP38).

b) The contractor shall design, manufacture, supply and install a new cable termination box for the switchgear unit. (This work shall be done in the manner specified as part of procedure RP38).

c) The contractor shall supply and install a new section of medium voltage copper conductor XLPE cable of the same cross-sectional area as that of the existing cable. The contractor shall install two new and unused cable terminations on the two ends of this cable for connection onto the existing equipment.

d) The contractor shall reconnect to the two cable terminations onto the transformer and switchgear unit respectively. The contractor shall supply and install two wooden cable clamps to carry the weight of the two respective cable ends.

e) The cable terminations shall be of Raychem/Systol or equal and approved type. The size of the cable terminations shall be selected to suit the cable size.
f) The contractor shall conduct all the tests as specified in subclause HA 04.3 of this specification on completion of the cable termination installation.

g) Upon request the contractor shall produce proof of training in the performing of cable terminations.

h) The medium voltage cable shall be a three core, copper conductor, XLPE insulated individually copper tape screened, galvanised steel armoured, PVC served medium voltage cable.

39.5 Measurement and Payment

a) The unit of measurement shall be a lump sum.

b) The lump sum shall include full compensation for all aspects specified in clause HA 08. In addition to this, the lump sum shall also include full compensation for the following:

   i) The supply and installation of a 20m length of XLPE medium voltage cable.

   ii) The supply and installation of two cable joints.

   iii) The design, manufacture, supply and installation of a complete new cable termination box.

40. Reinstallation of a LV cable in a distribution kiosk

40.1 Procedure Number RP40

40.2 Scope

This procedure covers the removal of an externally installed loose low voltage cable, and the replacement thereof with a new low voltage copper conductor.

40.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer’s specifications, and operation and maintenance instructions.

40.4 Task Description

a) The contractor shall disconnect and remove the externally routed low voltage conductor.

b) The contractor shall supply and install a new conductor in the place of the existing conductor. The conductor shall be installed, routed and secured inside the distribution panel. The conductor shall be a four-core PVC insulated, PVC sleeved, copper conductor with a cross-sectional area of at least 50mm².

c) The conductor shall be terminated on both ends with appropriately sized cable glands and terminating lugs.

d) The cable glands shall be of the adjustable type, equal or similar to the Pratley gland and shall be suitable for use with PVC PVC SWA PVC cables complying with the latest edition of SABS 1507. All glands shall be installed with non-deteriorating neoprene shrouds. For all gland installations on armoured cable, the outer sheath of the cable shall be cut back in accordance with the gland manufacturers’ recommendations, so that a minimum of armouring is exposed between the gland and the outer sheath after gland installation. The shroud shall seal on the outer sheath of the cable.

e) All cable termination lugs shall be bi-metallic aluminium-copper lugs, equal to or similar to SIMEL type ACX.
40.5 Measurement and Payment
   a) The unit of measurement and payment shall be a lump sum.
   b) The lump sum shall include full compensation for all aspects specified in clause HA 08. In addition to this, the lump sum shall also include full compensation for the following:
      i) The supply and installation of a 5m length of copper conductor as specified in this procedure.
      ii) The supply and installation of cable glands and cable terminating lugs.

41. Test, clean, service and repair battery tripping unit
41.1 Procedure Number RP41
41.2 Scope
   This procedure covers the complete service and cleaning of the battery-charging unit, the replacing of the batteries and the testing of the unit.
41.3 Standard Specifications, Regulations and Codes
   All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.
41.4 Task Description
   a) The contractor shall clean and repaint the box of the charger.
   b) The contractor shall supply and install new batteries.
   c) The contractor shall test and repair the unit to full working condition.
41.5 Measurement and Payment
   a) The unit of measurement and payment shall be a lump sum.
   b) The lump sum shall include full compensation for all aspects specified in clause HA 08. In addition to this, the lump sum shall also include full compensation for the following:
      i) The supply and installation of new batteries.
      ii) The repairing to full working condition if it is not working.

42. Test, clean, service and repair MV and LV overhead lines
42.1 Procedure Number RP42
42.2 Scope
   This procedure covers the complete test, service, cleaning and repairing of all MV and LV overhead lines complete with all cabling, poles, etc.
42.3 Normative references
   SABS 753: 1994, *Pine poles, cross arms and spacers for power distribution, telephone systems and street lighting*.
   SABS 754: 1994, *Eucalyptus poles, cross arms and spacers for power distribution and telephone systems*.
   *SCSSCAAD7 : (latest revision) Specification for wood poles, cross-arms and spacer blocks*.
   *SCSSCAAU7 : Quality requirements for procurement of assets, goods and services*.
   *SCSPVABS6 : Technical evaluation of suppliers for products and / or services*.
42.4 Definitions

For the purpose of this standard the following definitions shall apply:

42.4.1 air/ground-line region: The critical area extending to 500mm above and 250mm below the ground-line.

42.4.2 approved supplemental treatment: An acceptable internal treatment consisting of chemicals designed to protect the ground-line are against fungal decay and insect attack.

42.4.3 crack: A crack in a pole is where the pole is split and where the split is parallel to the grain of the wood with a width greater than 7mm in width.

42.4.4 excessive cracks: Excessive crack are those where there are more than 3 cracks at any cross section on the pole, or where the length of an individual crack is greater than 10 X the diameter of the pole at the ground-line, or where an individual crack width is wider than 10mm but less than 15mm wide, or where the sum of the widths of the cracks at a particular point is greater than 40mm.

42.4.5 extreme cracks: Extreme cracks are those where there are more than 4 cracks at any cross section on the pole, or where the length of an individual crack is greater than 12 X the diameter of the pole, or where an individual crack width is wider than 16mm, or where the sum of the widths of the cracks at a particular point is greater than 50mm.

42.4.6 client: The Engineer region requesting the inspection and supplemental treatment of its utility poles.

42.4.7 contractor: The body conducting the inspection or supplemental treatment (or both) of in-service utility poles as agreed upon between the client and the contractor.

42.4.8 core sample: A sample consisting of either a cylindrical piece of wood extracted using an increment borer or shavings extracted using a drill bit.

42.4.9 drill bit: A twist type or screw drill bit consisting of a long shank with a maximum cutting diameter of 12mm.

42.4.10 dowel plug: A 13mm diameter wooden peg; the minimum length of the dowel rod shall be 80mm. The dowel rods shall be manufactured from pine wood and fully impregnated under pressure with creosote.

42.4.11 plastic plug: Used for plugging above ground inspection and treatment holes. The plug is screwed into a 12mm diameter hole drilled in the pole. It is manufactured from low density black Polyethylene containing 2% carbon black. The overall length is 43mm, the small tip diameter of 10mm and the large tip diameter is 19mm. The thread pitch is 5mm and thread depth of 0.5mm.

42.4.12 qualified inspector: An inspector of poles is considered qualified when he has inspected a minimum of 1000 poles under the direct supervision of a qualified inspector. Regional evaluation is required to approve qualified inspectors on a yearly basis, this is either done by trained personnel or an outside approved body such as SANAS as deemed necessary.

42.4.13 check scraper: A sharp instrument used to externally probe the outside layer of the pole.
42.4.14 shell thickness indicator: A tool designed specifically to extract wood fibre from the holes drilled, to probe for incipient decay and to measure the remaining sound shell thickness.

42.4.15 sound pole: A pole that has no apparent internal or external form of degradation. This shall be classified a class 1 pole.

42.4.16 serviceable pole: A pole that is classified a class 1, class 2 or class 3 pole. The pole may require stubbing to enable it to be serviceable.

42.4.17 stubbing of poles: The process whereby a pole is supported with a short stub wooden pole or an approved steel staking system, this to be approved by Distribution Technology, the approved stub is attached to the insitu pole and is capable of carrying the required load of a new pole.

42.4.18 unsound pole: A pole that has been rejected after assessment and that shall be replaced. An unsound pole is a class 4 pole or a class 3 pole that will not be stubbed by the region.

42.4.19 recorded poles: Poles that are recorded only in an inspection process due to non-wood pole or access problems.

42.5 Responsibilities

42.5.1 The relevant Responsible Person appointed in terms of the Occupation Health and Safety Act shall be responsible for ensuring compliance with this standard and that the correct inspection techniques and pole repairs as a result of the inspections are undertaken.

42.6 Planned inspection program

The purpose of a planned inspection program are:

a) To identify unserviceable poles in the system;

b) To identify poles where fungal and termite attack has occurred, at an early stage so that corrective action can be taken;

c) To extend the life of the pole through remedial treatment;

d) To identify poles that can be stubbed;

e) To identify poles that must be replaced with new poles.

42.7 Inspection procedures

42.7.1 All poles in a line shall be inspected and a internal chemical shall be applied to the pole.

42.7.2 An external chemical shall be applied to the pole below the ground-line when shell rot is present.

42.7.3 The inspection and test procedures detailed shall be used to determine the extent of degradation and whether a pole is sound, serviceable and unsound.

42.8 Visual aboveground inspection

42.8.1 Inspect the area above ground-line of the pole and cross arm.

a) the pole manufacturers name;

b) if no pole tag is visible that shall be recorded;
c) the year the pole was manufactured;
d) the pole number and, if no pole number is visible, the pole shall be numbered in accordance with the client’s numbering plan as agreed in the contract;
e) the specie of the pole, eg (E55, E75 or P55); (Eucalyptus pole, 55Mpa Ultimate Stress)
f) whether the pole was kiln or air dried (where indicated);
g) the length of the pole if indicated on the pole tag;
h) any lightning damage;
i) excessive and extreme cracks on the pole;
j) any poles leaning
k) any decay or rot visible above the ground;
l) any pole twisting (slight, medium or great): this is the degree the pole top has twisted in relation to the line of conductors (slight = up to 10°, medium = 10° to 20°, great = 20° to 50°); and
m) the compaction of the soil around the pole;
n) mechanical damage to stays or staywire;
o) mechanical damage to the pole in any way;
p) woodpecker damage on the pole or cross arm.

42.9 Excavation at the pole

The soil shall be removed around the pole to a depth of 250mm to enable an inspection and assessment to be made on the physical state of the pole below the ground.

Remove the soil that is stuck to the pole by cleaning the exposed area with a wire brush, taking care not to disturb any existing external degradation that still has to be assessed.

42.10 External inspection of ground-line region

This is the most critical area and it shall be thoroughly inspected in accordance with the following:

a) all the soil or softwood on or in the cracks or voids shall be scraped off; and

b) a check scraper shall be used to probe for external decay pockets and/or shell rot.

42.11 Internal inspection"

42.11.1 Drill two 12mm inspection holes. One hole drilled at the ground line and one 100mm below the ground-line, these two inspection holes to be drilled diagonally opposite to each other. The inspection holes are to be drilled towards the center of the pole using a “twist or screw type” drill bit. The holes shall be drilled at 45° to the horizontal 100mm below the ground-line. Drilling shall be directed towards the center of the pole to at least half the diameter of the pole.
42.11.2 Using the shell thickness indicator probe the hole for incipient decay, (spring wood decay) and termites, both dormant and active, and record the findings.

42.11.3 Where applicable measure the remaining sound wood (outer shell) and record the measurements.

42.12 Inspection of poles with cables

All poles with cables attached to the poles shall be excavated to 250mm deep around the pole and inspected. Extreme Care shall be taken when excavating around the pole to ensure the cable is not damaged. The pole shall be classified and treatment applied. The contractor is to take full responsibility for any damage to any cable above or below the ground which is at the pole inspected or at adjacent poles on a H pole structure.

Note:
Although the cable entry into the soil might be at one place, the cable might coil below the soil at varying depths and positions.
Extreme care should be exercised at H pole structures where cables come down one pole as the cable might pass the other pole of the H pole structure.

42.13 Classification

Each pole inspected shall be classified as being of the following:

42.13.1 Class 1 (Sound poles)
Utility poles where insect damage or decay of any sort, internal or external degradation or any other form of degradation are not apparent.

42.13.2 Class 2 (Minor ground-line damage)
Utility poles that have areas of biological degradation or physical damage, of such a nature that the pole can still be considered safe and serviceable. These poles will require internal remedial treatment. Damage shall be measured in accordance with the following criteria:

a) limited internal decay/heartwood rot, with the shell comprising sound wood in excess of 70mm around the pole;

b) external decay, affecting less than 3mm in depth of the outer shell;

c) small decay pockets smaller than 50mm in diameter on the outside of the pole;

d) other defects e.g., slight mechanical or slight lightning damage that cannot affect the integrity of the pole;

42.13.3 Class 3 (Major ground-line damage)
Utility poles that have ground-line areas of biological degradation or physical damage, of such a nature that the pole cannot still be considered safe and serviceable. These poles will require no internal chemical treatment below the ground, only internal treatment applied 300mm above the ground line and possibly an external treatment below the ground if there is shell rot present.
All class 3 poles to be stubbed shall have a further inspection hole drilled 300mm above the ground line at 45. This is to ensure the pole has no fungal attack or termite activity, the pole shall then be classified as a class 4 pole and shall be replaced. This inspection hole shall be plugged with a treated wooden dowel rod.

Damage shall be measured in accordance with the following criteria:

a) advanced internal decay/rot or termite damage that is inactive;
b) the remaining shell comprising not less than 40mm and not more than 70mm of sound wood at any point around the diameter of the pole below ground level;
c) external decay exceeding 3mm but less than 8mm in depth, determine the shell thickness at this point and if less than 30mm, then classify pole as a class 4 pole.
d) excessive cracks;
e) mechanical or lightning damage, and or untreated wood exposed.

42.13.4 Class 4 (Major damage)

Utility poles with advanced internal and external degradation that are considered as unsafe and not treatable. Damage shall be measured in accordance with the following criteria:

a) major internal and/or external rot or termite attach throughout the pole below the ground-line area;
b) the remaining shell comprising less than 40mm sound wood at any point around the pole below ground level;
c) external decay exceeding 8mm in depth;
d) extreme physical damage; mechanical, fire or lightning damage;
e) extreme cracks;
f) any termite activity within the pole.

42.14 Required action resulting from pole classification

42.14.1 Class 1 Pole required action

a) The poles shall be treated internally with an approved chemical. The approved internal chemical shall be applied to the pole through the three holes drilled at 20° to the vertical or any other method that is acceptable to Distribution Technology. These three holes shall be drilled at 50mm above the ground-line. Two chemical rods each 10mm diameter and 100mm long shall be applied to each hole. One approved chemical rod shall also be applied into each inspection hole at the ground line and 100mm below the ground-line. The inspection holes shall be plugged with a fully impregnated, 13mm diameter, 80 mm long creosote treated dowel rod. The three holes drilled 50mm above the ground for internal chemical application shall each be plugged with a removable plastic plug or a 13mm diameter 80mm long creosote treated dowel rod.
42.14.2 Class 2 Pole required action

a) The poles shall be treated internally with an approved chemical. (see annex E). The approved internal chemical shall be applied to the pole through the three holes drilled at 20° to the vertical (see annex B) or any other method that is acceptable to Distribution Technology. These three holes shall be drilled at 50mm above the ground-line. Two chemical rods each 10mm diameter and 100mm long shall be applied to each hole. One approved chemical rod shall also be applied into each inspection hole at the ground-line and 100mm below the ground-line. The inspection holes shall be plugged with a fully impregnated 13mm diameter, 80mm long creosote treated dowel rod (see annex B1). The three holes drilled 50mm above the ground for internal chemical application shall each be plugged with a removable plastic plug or a 13mm diameter 80mm long creosote treated dowel rod.

b) Where there is any signs of external shell rot, the pole shall be remedially treated externally with an approved chemical (see annex E) from 25mm above the ground-line to 250mm below the ground-line. A 0.25mm thick PVC plastic shield 300mm wide shall be wrapped around the treated area and stapled onto the pole to prevent the applied chemical leaching into the surrounding ground. The quantity of chemical applied externally shall be in accordance with the supplier's specification.

42.14.3 Class 3 Pole required action

a) All poles to be stubbed shall not be treated internally below the ground-line. They shall be treated internally with an approved chemical 300mm above the ground-line. (see Annex B2). The approved internal chemical shall be applied to the pole through the three holes drilled at 20° to the vertical. Two chemical rods each 10mm diameter and 100mm long shall be applied to each hole. The three holes drilled 300mm above the ground for internal chemical application shall each be plugged with a removable plastic plug or a 13mm diameter 80mm long creosote treated dowel rod. The inspection holes shall be plugged with a fully impregnated, 13mm diameter, 80mm long creosote treated dowel rod.

b) One approved chemical rod shall also be applied into the inspection hole, which is drilled at 300mm above the ground drilled at 45 degrees. The inspection hole shall be plugged with a fully impregnated, 13mm diameter, 80mm long creosote treated dowel rod.

c) Where there is any signs of external shell rot below the ground, the pole shall be remedially treated externally with an approved chemical (see annex E) from 25mm above the ground-line to 250mm below the ground-line. A 0.25mm thick PVC plastic shield 300mm wide shall be wrapped around the treated area and stapled onto the pole to prevent the applied chemical leaching into the surrounding ground. The quantity of chemical applied externally shall be in accordance with the supplier's specification.
d) Stubbing to poles shall be done **within 12 months** of the report sheets being received.

e) All stubbed class three poles shall be re-inspected at least within a 10-year cycle.

f) For H pole structures, any single pole deemed a class 3 shall make the structure a class 3 until the class 3 pole is stubbed or replaced.

42.14.4 Class 4 Pole required action

a) The pole shall be replaced with **six months** of being inspected and rejected.

b) For H pole structures any single pole deemed a class 4 shall make the structure a class 4 until the class 4 pole is replaced.

42.14.5 Leaning poles

All poles that are out of plumb by more than 500mm shall be straightened within one month after being reported.

42.15 Marking after inspection

Each pole shall be legibly and indelibly marked at a position 1.8m ± 50mm above the ground-line in one of the following ways:

42.15.1 Class 1 poles

A round aluminium tag shall be applied to each pole at 1.8m above the ground-line of the pole. The aluminium tag shall be 25mm in diameter. The tag shall have a hole in the middle of the tag to facilitate attachment. The tag shall be attached with a 15mm galvanized nail. The tag shall bear the following information:

a) the words “Treated Internally” to be stamped on the label;

b) the company identification, consisting of the name, trade name or trade mark of the contractor that undertook the inspection;

c) the month and year in which the inspection took place; and

d) the class of pole “class 1”.

42.15.2 Class 2 poles

A round aluminium tag shall be applied to each pole at 1.8m above the ground-line of the pole. The aluminium tag shall be 25mm in diameter. The tag shall have a hole in the middle of the tag to facilitate attachment. The tag shall be attached with a 15mm galvanized nail. The tag shall bear the following information:

a) the word “Treated Internally”;

b) the company identification, consisting of the name, trade name or trade mark of the contractor that undertook the inspection and treatment;

b) the month and year in which the inspection and treatment took place; and

d) the class of pole “class 2”;
Where poles are treated externally for shell rot.

### 42.15.3 Class 3 poles

A round aluminium tag shall be applied to each pole at 1.8m above the ground-line of the pole. The aluminium tag shall be 25mm in diameter. The tag shall have a hole in the middle of the tag to facilitate attachment. The tag shall be attached with a 15mm galvanized nail. The tag shall bear the following information:

a) the words “above ground treatment” (this only for poles to be stubbed);

b) the company identification, consisting of the name, trade name or trade mark of the contractor that undertook the inspection and treatment;

c) the month and year in which the inspection and treatment took place;

d) the class of pole “class 3”.

e) A single white line, 50mm shall be painted horizontally around the pole, the paint shall be an oil-based paint. This shall be painted on the pole 1.8m above the ground-line. *This is to indicate that the pole must be stubbed.*

f) If the pole is not to be stubbed, then the pole is to be rejected and classified as a class 4 pole.

g) Where poles are treated externally for shell rot.

### 42.15.4 Class 4 poles

A square aluminium tag shall be applied to each pole at 1.8m above the ground-line of the pole. The aluminium tag shall have 25mm sides. The tag shall have a hole in the middle of the tag to facilitate attachment. The tag shall be attached with a 15mm galvanized nail. The tag shall bear the following information:

a) the word “Rejected”, on the label;

b) the company identification, consisting of the name, trade name or trade mark of the contractor that undertook the inspection;

c) the year and month in which the inspection took place;

d) the class of pole “class 4”.

e) Two white lines, 50mm wide, shall be painted horizontally around the pole, the paint to be a oil-based paint. These lines being 100mm apart. The white lines shall be painted on the pole 1.8m above the ground-line. *This is to indicate that the pole must be replaced.*

### 42.15.5 Poles treated with External Treatment

Poles treated for shell rot with external treatment shall also be marked with an additional label stating “external treatment”. The aluminium tag shall be round and 25mm in diameter. The tag shall have a hole in the middle of the tag to facilitate attachment. The tag shall be attached with a 15mm galvanized nail.
42.16 Restoration of the inspection area

42.16.1 After the inspection and remedial treatment is completed the area around each pole shall be restored, using the following procedure:

a) Backfilling shall be done by replacing the excavated material in 250mm layers and compacting the soil by ramming the soil with stampers, taking care cables are not damaged.

b) excess excavated material shall form a mound at the base of the pole to cater for any subsidence that might occur.

c) the area surrounding the pole shall be left in a clean and orderly state and all debris shall be removed from the site.

42.17 Recording

Full details of every inspected pole in the utility line shall be recorded on line pole inspection report forms.

A copy of the reports concerned and a summary sheet of the line shall be given to the person concerned as indicated in the contract. The contractor shall keep a copy of the records for a period of 12 years.

HA 13 TECHNICAL DETAILS : SCHEDULED MAINTENANCE WORK

HA 13.01 This section contains the specifications for the scheduled maintenance procedures that are to be carried out during the three year contract period. The scheduled maintenance tasks shall commence at the specified frequency once the initial repair work has been completed. The contractor should note that the tendered rate for each procedure shall include both the supply, delivery, installation, testing and commissioning of equipment and material, and the labour and other costs associated with the completion of the procedure.

HA 13.02 Scope of scheduled maintenance work.

HA 13.02.01 Monthly Maintenance Tasks

The following maintenance tasks shall be performed on a monthly basis:

| SM01 | Standalone Power Transformer Service |
| SM02 | Miniature Substation Service |
| SM03 | Pole-mounted Transformer Service |
| SM04 | Distribution Substation Service |

HA 13.03 All the scheduled maintenance work is specified in the following procedures:

1. Standalone Power Transformer Service

1.1 Procedure Number : SM01

1.2 Scope

This procedure describes the periodical service of standalone power transformers of ratings up to 200kVA. This procedure does not include the servicing of miniature substation transformers. The service includes the servicing of the dehydrating breathers (including the oil seal or bath).
1.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

a) The original equipment manufacturer’s specifications, and operation and maintenance instructions.

b) SABS 555: Standard Specification for Mineral insulating oil for transformers and switchgear (uninhibited)

c) BS 3523: Specification for granular desiccant silica gel impregnated with cobalt chloride.

1.4 Task Description

a) General Service

The contractor shall complete the following actions:

i) The transformer shall be checked for visible defects, and any such defects shall be reported in documented format to the Engineer.

ii) The contractor shall maintain the transformer in a clean and dust-free condition using safe methods of cleaning and dusting.

iii) The contractor shall check for and record any indication of oil leaks.

iv) The contractor shall check for and record any indication of cracked bushings.

v) The contractor shall maintain all cable terminations (MV and LV) in a good condition. All defects and deteriorated cable terminations shall be corrected and or replaced where necessary. Cable terminations shall be done in accordance with procedure RP13.

b) Dehydrating Breather Service

i) The contractor shall check the quantity and colour of the dehydrating agent (typically silica gel) and reactivate or replace it where necessary.

ii) The silica gel shall be considered to require replacement if its colour is pink or if the breather is not filled to the required level, and it shall be considered not to need replacement if its colour is deep blue and the breather is filled to the required level.

iii) Silica gel used for replacement shall be new silica gel and shall comply with BS 3523.

iv) The oil seal or bath at the base of the dehydrating breather shall be removed, cleaned out, and refilled with new insulation oil. The insulation oil used for this purpose shall be new insulation oil in compliance with SABS 555. The dehydrating breather shall be refilled with insulating oil to the level as prescribed in the manufacturer’s maintenance instructions.

1.5 Measurement and Payment

a) The unit of measurement shall be the number of time a standalone power transformer is serviced. A single rate shall apply to all sizes of transformers, and the tendered rates shall be
based on a transformer size of 200kVA. The unit rates shall be compiled and submitted in the point system format as specified elsewhere in the document.

b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the following:
   i) All work associated with the service of standalone power transformers, excluding the replacement of cable terminations, which shall be considered a separate payment item
   ii) The supply of dehydrating breather and breather top up insulation oil as is required for the service of the dehydrating breather.

2. Miniature Substation Service

2.1 Procedure Number : SM02

2.2 Scope

This procedure describes the periodical service of miniature substations of ratings up to 630kVA.

2.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with original equipment manufacturer’s specifications, and operation and maintenance instructions.

2.4 Task Description

a) Metal Enclosure and Plinth
   i) The contractor shall check the enclosure and plinth for visible defects. All defects shall be recorded in documented format.
   ii) The contractor shall maintain all parts of the miniature substation in a clean and dust free condition.
   iii) The contractor shall check that the miniature substation is properly installed on its plinth and that it does not lean over in any direction.
   iv) The contractor shall check the condition of door hinges and that panel doors open and close correctly.
   v) The contractor shall ensure that padlocks are installed on all lockable panel doors.

b) Medium Voltage Compartment
   i) The contractor shall check the MV compartment for visible defects. All defects shall be recorder in documented format.
   ii) The contractor shall check all equipment components for looseness and bent or damaged brackets. All such defects shall be corrected.
   iii) The contractor shall maintain all MV cable terminations in a good condition. All defects and deteriorated cable terminations shall be corrected and or replaced where necessary. Cable terminations shall be done in accordance with procedure RP13.
iv) All miniature substation fuses shall be checked for condition and to ensure that they are correctly rated. Should any fuse be blown and or be incorrectly rated, it shall be replaced with the correct fuse. All fuse replacements shall be recorded, and used fuses that are not blown shall be handed over to the Engineer.

c) Transformer Compartment
   i) The transformer shall be checked for visible defects, and any such defects shall be reported in documented format to the Engineer.
   ii) The contractor shall maintain the transformer in a clean and dust-free condition using safe methods of cleaning and dusting.
   iii) The contractor shall check for and record any indication of oil leaks.
   iv) The contractor shall check for and record any indication of cracked bushings.
   v) The contractor shall maintain all cable terminations (MV and LV) in a good condition. All defects and deteriorated cable terminations shall be corrected and or replaced where necessary. Cable terminations shall be done in accordance with procedure RP13.

d) Low Voltage Compartment
   i) The transformer shall be checked for visible defects, and any such defects shall be reported in documented format to the Engineer.
   ii) The contractor shall check all equipment components for looseness and bent or damaged brackets. All such defects shall be corrected.
   iii) The contractor shall check all circuit breakers, isolators, fuse links and instrumentation for correct operation, and record and report all defects.

2.5 Measurement and Payment
   a) The unit of measurement shall be the number of times a miniature substation is serviced. A single rate shall apply to all sizes of miniature substation, and the tendered rates shall be based on a size of 630kVA. The unit rates shall be compiled and submitted in the point system format as specified elsewhere in the document.
   b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for all work associated with the service of miniature substations, excluding the replacement of cable terminations, which shall be considered a separate payment item.

3. Pole-mounted Transformer Service

3.1 Procedure Number: SM03

3.2 Scope

This procedure covers the service of pole-mounted transformers and the associated low voltage distribution kiosks.
3.3 Standard Specifications, Regulations and Codes
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

3.4 Task Description
a) The pole-mounted transformer installation shall be inspected for visible defects, and any such defects shall be reported in documented format to the Engineer.
b) The contractor shall maintain the low voltage distribution kiosk in a clean, vermin and dust-free condition using safe methods of cleaning and dusting.
c) The contractor shall check the transformer for and record any indication of oil leaks.
d) The contractor shall check for and record any indication of cracked bushings.
e) The contractor shall check the continuity of the low and medium voltage earth installations.

3.5 Measurement and Payment
a) The unit of measurement shall be the number of times a transformer installation is serviced. The unit rates shall be compiled and submitted in the point system format as specified elsewhere in the document.

4. MV/LV Distribution Substation Maintenance Inspection
4.1 Procedure Number: SM04
4.2 Scope
The procedure comprises of a general inspection of the various MV/LV distribution substations. These substations are all brick buildings comprising of three sections: a MV section, a transformer section, and a LV section. The purpose of this procedure is to perform a routine inspection of the complete substation to determine the condition and status of equipment, and at the same time performing minor routine maintenance tasks.

4.3 Standard Specifications, Regulations and Codes
All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

4.4 Task Description
The following items shall be inspected and serviced:

a) General defects inspection.
b) All rooms of the substation building shall be thoroughly cleaned using a broom to sweep the floor and other equipment to dust and clean equipment.
c) All luminaires and lamps and their fittings shall be maintained in a good working order. The contractor shall supply and install luminaires, lamps and their fittings as is required to have all this equipment operational at all times.
d) Low Voltage Distribution Board
The Low Voltage distribution board shall be kept in a clean and neat condition. The contractors shall inspect the low voltage distribution equipment and record all defects.

4.5 Measurement and Payment

a) The unit of measurement shall be the number of times a substation installation is serviced. The unit rates shall be compiled and submitted in the point system format as specified elsewhere in the document.
TECHNICAL SPECIFICATION HB

STANDBY POWER SYSTEMS

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HB 01 SCOPE

HB 01.01 This specification comprises all aspects regarding the repair and maintenance of standby power systems. The standby power sources consist of:

GENERATOR 1: 129 kW 3 PHASE AUTOMATIC CHANGE OVER AT BUILDING NR 12

NAME: VOLVO PENTA
TYPE: TAD 532 GE
CODE: D20C129
RPM: 1500
Voltage: 400 STAR
Pf: 0.8
Hz: 50
Phase: 3+N
kW: 129
HP: 173
Amp: 186
Ser No: 53 10642785
C Spec: 869364
### Generator 2: 20kVA 3 Phase Automatic Change Over at Building NR 41

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This specification shall form an integral part of the repair and maintenance contract document and shall be read in conjunction with the Additional Specifications included with this document.

**STANDARD SPECIFICATIONS, REGULATIONS AND CODES**

The latest edition, including all amendments up to date of tender of the following specifications, publication and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof.

SABS Specifications

- SABS 0400 : NATIONAL BUILDING REGULATIONS
- SABS 0142 : WIRING CODE

Department of Public Works Specification PW 774

Occupational Health and Safety Act of 1993

Manufacturer's specifications and maintenance instructions

Additional requirements

Equipment and material supplied and installed shall be new and unused. The Contractor shall ensure that all safety regulations and measures are applied and enforced during repair and maintenance work on cabling, wiring, fuel tanks, batteries and diesel engines.

**OPERATING AND MAINTENANCE MANUALS**

The Contractor shall be responsible for the compilation of a complete set of Operating-and-Maintenance manuals.

This shall be done in accordance with the Additional Specification SB – Operating and Maintenance manuals.

All information shall be recorded and reproduced in electronic format as well as supplying the Engineer with three sets of hard copies.

Over and above what is specified in the Additional Specification – SB Operating and Maintenance manuals, the Operating and Maintenance Manual to be compiled shall be structured and shall at least include the following:

**Description of installation**

- Complete system description of each standby power source. This shall be done for each installation individually. The system description shall contain detailed information regarding the supply configuration (cabling, distribution boards), the switching arrangement (change-over and override facilities) and the refuelling procedure as well as the earthing, fire and lightning protection arrangement.
- Service records

Commissioning Data

MASERU BORDER POST
a) Complete commissioning, test and inspection data of standby power system.

This shall be done for each installation individually. The commissioning data will comprise voltage and output current measurements, running hour meter readings, battery voltage during starting and engine compression tests.

03.02.03 Operating Data

a) Safety precautions to be implemented.
b) Operation of systems; automatic, manual and bypass switching.
c) Emergency starting and forced change-over procedure.

03.02.04 Maintenance instructions

a) Recommended service intervals with service descriptions.
b) Projected service life of:
   - diesel engine to next overhaul
   - diesel engine starter batteries
c) Trouble shooting diagrams.
d) Schedule of consumable spares.

HB 04 TEST AND INSPECTIONS PRIOR TO PRACTICAL COMPLETION OF REPAIR WORK

HB 04.01 It is the responsibility of the Contractor to provide all labour, accessories and properly calibrated and certified measuring instruments necessary to record the following parameters:

04.01.01 output phase voltages
04.01.02 output current per phase
04.01.03 insulation testing at 500V
04.01.04 system earthing resistance testing by means of wheat stone bridge instrument
04.01.05 load testing, utilising dummy loads

The Contractor is responsible for the arrangement of such tests. He shall give at least 72 hours notice to the Engineer prior to the test date.

HB 05 LOGGING AND RECORDING PROCEDURES

HB 05.01 The Contractor shall as part of this Contract institute a Recording system as part of his Maintenance Control Plan as defined in the Additional Specification SA – General Maintenance. This shall consist of a Record book which shall be utilised to log and record all faults, system checks, services, overhauls, breakdowns, maintenance visits, inspections, etc.

HB 05.02 The logbook shall be stored in a safe place inside each generator room and shall only be utilised by the Contractor and Engineer. A copy of the monthly entries and recordings into this logbook shall be submitted by the Contractor together with his monthly report to the Engineer.

This logbook shall be structured to at least include the following:

05.02.01 Monthly inspection and maintenance actions.
05.02.02 Scheduled services.
05.02.03 Breakdown / call out reports.
05.02.04 Major overhaul or battery replacements.
HB 06  MAINTENANCE TOOLS AND SPARES

HB 06.01 On commencement of the Repair and Maintenance Contract, the Contractor shall supply and deliver certain tools and spares to the user client. These tools and spares will be the property of the Department of Public Works. Any deficiencies or short fall or damaged Tools and Spares during the contract shall be replaced with new equipment / material.

HB 06.02 The Tools and Spares shall be kept safe in a lockable store room on site. The Contractor shall provide his own lock for the designated store room. The inventory of the Tools and Spares shall be verified on a monthly basis. Any short fall shall be replaced by the Contractor as part of his responsibility under this contract.

HB 06.03 The Tools and Spares shall at least include the following:

- Distribution Board key (3 off)
- Distribution Board face plate square key (3 off)
- Alarm panel key (3 off)
- Change-over contactor coil
- 20l HD diesel oil as per engine manufacturer’s specification
- Oil funnel
- 25l distilled water
- Battery hydrometer
- 12V diesel jockey pump
- 5m 20mm Ø diesel hose
- 10mm² battery jumper cables : 1 pair
- Wall mounted paper towel dispenser with paper cartridge per generator room

HB 07  QUALITY ASSURANCE SYSTEM

HB 07.01 Following formal approval of his Quality Assurance system by the Engineer to the Contractor shall implement the approved Quality Assurance system.

HB 07.02 Records of this Quality Assurance system shall be kept throughout the duration of the contract and shall be submitted to the Engineer as required by the Department.

HB 08  RE-COMMISSIONING OF INSTALLATION

On practical completion of the repair work, battery replacement and services, the installations shall be put into operation.

HB 09  REPAIR WORK TO STANDBY POWER INSTALLATIONS

HB 09.01 The various systems shall be repaired during the first phase of the repair and maintenance contract.

HB 09.02 The scope of the repair work shall include, but shall not be limited to the activities listed below.

HB 09.03 The Contractor shall record the repair actions in tabular format before the Contractor's responsibility for maintenance commences.

HB 09.04 Repair work shall be executed within the approved period for repairs.
HB 09.05  New equipment and material (e.g. batteries, fuel pumps, starter motor, etc) shall be supplied with a written guarantee confirming a defects liability period of 12 months from date of practical completion. These guarantees shall be furnished in favour of the Department of Public Works.

HB 10  STANDBY GENERATORS: TECHNICAL DETAILS

HB 10.01  Installation description

Refer to the enclosed schedule:

**GENERATOR DESCRIPTION:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Locality</th>
<th>Engine Description</th>
<th>Alternator Description</th>
<th>Output kVA</th>
<th>Auto/ Manual/ Switching</th>
<th>Operational Yes/No</th>
<th>Critical load</th>
<th>Last service</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BUILDING 12</td>
<td>VOLVO</td>
<td>Unknown</td>
<td>150</td>
<td>AUTO</td>
<td>YES</td>
<td>200Amp</td>
<td>Unknown</td>
</tr>
<tr>
<td>2</td>
<td>BUILDING 41</td>
<td>PERKINS</td>
<td>Leroy Somer</td>
<td>20</td>
<td>AUTO</td>
<td>YES</td>
<td>25Amp</td>
<td>Unknown</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HB 10.02  **Scope of repair work: generators**

HB 10.02.01  Clean plant room, clean and re-lamp luminaires. Seal all sleeves with chicken wire and builders foam. Put rodent poison inside cable trenches (2 x 500g). Paint floor with epoxy paint.

Service diesel engine and steam clean engine, alternator as well as day tank.

Inspect all rubber hoses and wiring; replace if required.

Service existing battery.

Do cold starting volt drop test on prime mover starter battery; replace starter battery if required.

Clean sliprings and inspect brushgear. Open alternator terminal box, clean and tighten terminations. Check and record earthing value as measured with resistance measuring instrument.
Service alarm panel and clean internally and externally. Simulate and verify all alarm and shut down conditions. Replace all inoperative lamps, sirens and meters.

Repair lagging on exhaust system and reseal room exit port.

Reinstall fuel shut off system with fusible link.

Fit new padlocks on plant room.

HB 10.02.02 Do witnessed dummy load test.

HB 10.02.03 Service change-over switchgear. Disassemble contactors and clean. Test operation following service.

HB 10.03 Generator repair work: measurement and payment

HB 10.03.01 Repair plant room

The unit of measurement shall be a lump sum.

The tendered rate shall include full compensation for the repair and upgrade of the plant room. This includes repair work on luminaires, doors, locks including the fitting of new padlocks.

Walls and ceilings shall be washed with sugar soap. Floors shall be washed and painted with grey 2-part industrial epoxy paint.

Cable trenches shall be cleaned and finally vacuumed. All cable sleeves shall be sealed with builders foam and chicken wire.

HB 10.03.02 Service genset

The unit of measurement shall be a lump sum.

The tendered rate shall include full compensation for the complete mechanical service of the generator installation according to the manufacturer's instructions, replacement of wiring and hoses as needed, opening and cleaning of alternator and alarm panel as well as the steam cleaning of the assembly.

HB 10.03.03 Diesel engine service

The unit of measurement shall be the number of mechanical services performed on diesel engines in the 75kW to 250kW range.

The tendered rate shall include full compensation for the execution of a full engine service as per the manufacturer's recommendations including air, fuel and oil filters, oil and other consumable items.

HB 10.03.04 Replace starter battery

The unit of measurement shall be the number of diesel starter batteries replaced.

The tendered rate shall include full compensation for the removal of the existing battery, the installation and reconnection of a new "Deltec Heavy-Duty Freedom"-type battery and final test of start up volt drop.
HB 10.03.05 Dummy load test

The unit of measurement shall be the number of on-site dummy load tests performed.

The tendered rate shall include full compensation for the opening of the alternator terminal box, connection of dummy load, 30 minute full load test, recording of test results and disconnection of load and reconnection of site load.

HB 10.03.06 Change-over switchgear service

The unit of measurement shall be the number of assemblies serviced.

The tendered rate shall include full compensation for the disassembly of the change-over contractor pair, cleaning and reinstallation as well as the testing following completion of the test.

HB 10.03.07 Supply and install padlocks

The unit of measurement shall be the number of 75mm padlocks installed.

The tendered rate shall include full compensation for the ordering, supply, engraving and installation of the plant room padlocks.

HB 10.03.08 Supply of diesel fuel

The unit of measurement shall be the quantity of diesel fuel supplied and transferred into day tanks.

The tendered rate shall include full compensation for the supply, transport and transfer of diesel fuel.

HB 10.03.09 Supply of Tools and Spares

The unit of measurement shall be a lump sum. The tendered rate shall include full compensation for the supply and delivery of the Tools and Spares specified.

HB 11 UPS UNITS : TECHNICAL DETAILS

HB 11.01 Installation description

UPS DESCRIPTION :

<table>
<thead>
<tr>
<th>Item No</th>
<th>Locality</th>
<th>Manufacture</th>
<th>Model</th>
<th>Output</th>
<th>Operation</th>
<th>Approx year of install</th>
<th>Critical load supplied</th>
<th>Last service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BUILDING 12</td>
<td>TOWER</td>
<td>1100</td>
<td></td>
<td>Yes</td>
<td>5A</td>
<td>Battery</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<td>4</td>
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</tbody>
</table>
HB 11.02  **Scope of repair work : UPS unit**

HB 11.02.1 Remove cabinet cover / doors. Clean unit internally and externally. Check operation of ventilating fan and replace air intake filter, if fitted. Check and record earthing value with prescribed resistance measuring instrument.

HB 11.02.02 Record output voltage, frequency and current in Record book. Record battery voltage.

HB 11.02.03 Clean battery cabinet and tighten terminals. Do witnessed dummy load test and submit report on condition of batteries.

HB 11.02.04 Replace UPS batteries upon instruction from Department.

HB 11.03  **UPS repair work: measurement and payment**

HB 11.03.01 **Service UPS electronic and battery cabinet**

The unit of measurement shall be the number of UPS systems opened and serviced.

The tendered rate shall include full compensation for the opening, cleaning, visual inspection of cable terminations, ventilating fans, battery links and the recording of earthing resistance.

HB 11.03.02  **Dummy load test**

The unit of measurement shall be the number of on-site UPS dummy load tests performed.

The tendered rate shall include full compensation for the connection of a UPS dummy load, 30 minute full load test recording of test results, including battery voltage and reconnection of site cabling as well as a written report on battery condition.

HB 11.03.03  **Replace UPS batteries**

The unit of measurement shall be a lump sum.

The tendered rate shall include full compensation for the disconnection and safe disposal of old batteries and supply, installation and connection of new sealed “Willard Vantage” UPS batteries.

HB 12  **MAINTENANCE OF THE INSTALLATION**

HB 12.01 Monthly maintenance responsibilities for each installation including all units and components as specified, shall commence with commencement of the Contract. A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.

Maintenance responsibilities of the completed installation shall commence upon the issue of a certificate of practical completion for repair work, and shall continue for the remainder of the 36-month contract period.

HB 12.02 The following maintenance actions will be required under the contract:

12.02.01 routine preventative maintenance
12.02.02 corrective maintenance
12.02.03 breakdown maintenance
These actions are defined in the Additional Specification SA – General Maintenance.

HB 12.03 The maintenance schedules and frequency of services and maintenance activities shall be developed under the maintenance control plan which will be instituted by the Contractor. The Contractor’s responsibility in this regard is specified in the Additional Specification SA – General Maintenance.

HB 12.04 Generator maintenance: scope of work.

HB 12.04.01 Monthly inspection

(a) The following activities shall be executed during the monthly generator inspections:
- check oil level and top up as required.
- check oil viscosity for dilution by water or fuel.
- check starter battery terminals and apply contact grease.
- check battery cables for damage and secure terminations.
- check battery electrolyte.
- check battery voltage and record.
- check battery voltage drop during engine cranking and record.
- check battery charger operation after cranking test.
- check starter motor for abnormal noise.
- check diesel engine while running for noise, vibration or loose components.
- check all flexible hoses for leaks, corrosion and ageing.
- check battery cables for damage and secure terminations.
- check all engine V-belts.
- monitor engine / alternator coupling for noise.

(b) Verify that alarm functions are operational by simulation:
- low oil pressure.
- high engine temperature.
- low engine coolant level.
- abnormal speed.
- synchronising failure (if applicable)
- cooling water pump failure.
- cooling tower fan failure (if applicable).
- low battery voltage.
- low fuel day tank.
- fuel pump failure.
- low fuel bulk tank (if applicable).

(c) Test that following alarms trigger correctly by creating the alarm condition:
- Unit not in auto : turn selector switch to manual or test
- Battery charger failure : switch off AC supply to battery charger
- Auxiliary supply failure : switch off auxiliary power supply

(d) Alternator shall be checked for accumulation of dust on the regulator and for any loose components.

(e) Test run shall be undertaken, if possible on load, and volt, ampere and frequency readings recorded.

(f) Alternator shall be cleaned and switched back into ‘auto’ mode.
HB 12.04.02 Annual inspection

The following activities shall be executed in addition to the monthly maintenance work after every twelve months.

(a) Drain an oil sample and submit for analysis to establish need for an oil change. Fix test report in Record book.

(b) Record output parameters while on load.

(c) Record running hours.

HB 12.04.03 Every two years: inspection and service

In addition to the annual service, the cooling system shall be drained, flushed and refilled with water and prescribed water conditioner.

HB 12.05 Generator maintenance: measurement and payment

Refer to Clause SA 06 of the ADDITIONAL SPECIFICATION: SA GENERAL MAINTENANCE.

HB 12.06 UPS maintenance: scope of work

HB 12.06.01 Two-monthly inspection

(a) The following activities shall be executed during each two-monthly inspection:

- record mains input voltage.
- record unregulated DC voltage.
- record battery charger voltage.
- visually check appearance of DC capacitors.
- visually inspect soft-start relays and resistors.
- record power supply output voltage on 5V and on 12V tops.
- measure “free running” frequency.
- check phase-lock loop.
- measure inverter output voltage and verify wave shape.
- check fan operation.
- check and record phase error voltage.

(b) The following must be measured and recorded:

- output voltage.
- load current.
- verify correct fuse ratings.

(c) Clean cabinets externally and internally.

HB 12.07 UPS maintenance: measurement and payment

HB 12.07.01 Two-monthly inspection

The unit of measurement shall be the number of two-monthly UPS inspections performed.

The tendered rate shall include full compensation for the execution of a two-monthly inspection as specified above. The rate shall also include the upkeep of the service documentation.
TECHNICAL SPECIFICATION

HC LOW VOLTAGE RETICULATION

CONTENTS
HC 01 SCOPE
HC 02 STANDARD SPECIFICATIONS, REGULATIONS, CODES AND ADDITIONAL SPECIFICATIONS
HC 03 AS-BUILT INFORMATION AND OPERATING AND MAINTENANCE MANUALS
HC 04 TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK
HC 05 LOGGING AND RECORDING PROCEDURES
HC 06 MAINTENANCE TOOLS AND SPARES
HC 07 QUALITY ASSURANCE SYSTEM
HC 08 RE-COMMISSIONING OF INSTALLATION
HC 09 REPAIR WORK TO INSTALLATIONS
HC 10 INSTALLATION MAINTENANCE
HC 11 LOW VOLTAGE DISTRIBUTION BOARDS: TECHNICAL DETAILS
HC 12 LOW VOLTAGE DISTRIBUTION KIOSKS: TECHNICAL DETAILS
HC 13 LOW VOLTAGE OVERHEAD DISTRIBUTION SYSTEM: TECHNICAL DETAILS

HC 01 SCOPE

HC 01.01 This specification comprises all aspects regarding the repair and maintenance of low voltage systems. Low voltage comprises:
- Low voltage distributions boards
- Low voltage kiosks
- Low voltage overhead distribution system

HC 01.02 This specification shall form an integral part of the repair and maintenance contract document and shall be read in conjunction with Part C, the Additional Specification included with this document

HC 02 STANDARD SPECIFICATIONS, REGULATIONS AND CODES

HC 02.01 The latest edition, including all amendments up to date of tender of the following specifications, publication and codes of practice shall be read in conjunction with the specification and shall deemed to form part thereof.

HC 02.02 SABS Specifications
- SABS 0142-1
- SABS 0142-2
- SABS 141
HC 02.03 Department of Public Works Specifications
- PW 774

HC 02.04 Occupational Health and Safety Act of 1993 (OHS-Act)

HC 02.05 Manufacturer’s specifications and maintenance instructions

HC 02.06 Additional requirements

Equipment and material installed shall be new and unused. All equipment shall bear the SABS stamp. The Contractor shall ensure that all safety regulations and measures are applied and enforced during repair and maintenance work on low voltage distribution boards and kiosks.

HC 03 AS BUILT INFORMATION AND OPERATING AND MAINTENANCE MANUALS

HC 03.01 No current as built information on the installation is available.

The Contractor shall be responsible for the compilation of a complete set of as-built drawings, inventory list and Operating- and Maintenance manuals. The Contractor shall be responsible for the verification of the correctness of all such information.

This shall be done in accordance with the Additional Specification SB Operating and Maintenance manuals.

The Contractor shall allow for the required tools and equipment to establish the correct as-built information.

All information shall be recorded and reproduced in electronic format as well as supplying the Engineer with three sets of hard copies.

HC 03.02 Over and above what is specified in the Additional Specification – SB Operating and Maintenance manuals, the Operating and Maintenance Manual to be compiled shall be structured and shall at least include the following:

- System Description
  - Complete system description of the low voltage system. This shall be done for each low voltage installation individually. The system description shall contain detailed information regarding the system configuration (system input, cabling system output), the installed components (circuit breaker ratings, meter configuration) as well as the earthing and lightning protection.
Complete details of L.V. distribution boards, panels and kiosks and overhead reticulation system.

- **Commissioning Data**
  - Complete commissioning, test and inspection data of the low voltage system.
  
  This shall be done for each low voltage system individually. The commissioning data will comprise of usual inspection sheets startup and running current measurements. Full data on equipment fitted with installation dates.

- **Operating data**
  - Safety precautions to be implemented.

- **Maintenance instructions**
  - Procedure to verify operation of circuit breakers.
  - Procedure to replace low voltage kiosk.
  - Trouble shooting diagram.
  - Equipment details, including manufacturer brochures/pamphlets. order number, list of components and equipment specifications.
  - Schedule of serviceable components per low voltage system.
  - Procedure to replace wooden poles for overhead reticulation.
  - Procedure to replace broken isolators for overhead reticulation.
  - Procedure to tension overhead conductors by adjustment of anchors.
  - Hoisting equipment specification, if applicable.

**HC 04 TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK**

HC 04.01 It is the responsibility of the Contractor to provide all labour, accessories and properly calibrated and certified measuring instruments necessary to record the following parameters:

- Phase voltages and current
- Earthing resistance testing

The Contractor is responsible for the arrangement of such tests. He shall give at least 72 hours notice to the Engineer prior to the test date.

**HC 05 LOGGING AND RECORDING PROCEDURES**

HC 05.01 The Contractor shall as part of this Contract Institute a Recording system as part of his Maintenance Control Plan as defined in the Additional Specification SA – General
Maintenance. This shall consist of a Record book which shall be utilized to log and record all faults, system checks, services, overhauls, breakdowns, maintenance visits, inspections, etc.

HC 05.02
The logbook shall be stored in a safe place inside the main substation and shall only be utilized by the Contractor and the Engineer. A copy of the monthly entries and recordings into this logbook shall be submitted by the Contractor together with his monthly report to the Engineer.

This logbook shall be structured to at least include the following:

- Monthly low voltage equipment inspection and maintenance actions.
- Bi-annual inspection and testing of low voltage systems.
- Annual earthing and insulation test report.
- Breakdown/call out reports

MAINTENANCE TOOLS AND SPARES

HC 06.01
On commencement of the Repair and Maintenance Contract, the Contractor shall compile an inventory of the existing Tools and Spares in the presence of the User Client. Any deficiencies or short fall or damaged Tools and Spares shall be replaced with new equipment/material, as part of the contract.

HC 06.02
The Tools and Spares shall be kept in a lockable store room on site. The Contractor shall provide his own lock for the designated store room. The inventory of the Tools and Spares shall be verified on a monthly basis. Any short fall shall be replaced by the Contractor as part of this responsibility under this contract.

HC 06.03
The Tools and Spares shall at least include the following:

- DB Key
- DB face plate square key

QUALITY ASSURANCE SYSTEM

HC 07.01
Following formal approval of his Quality Assurance system by the Engineer, the Contractor shall implement the approved QA system

HC 07.02
Records of this QA system shall be kept throughout the duration of the contract and shall be submitted to the Engineer as required.

RE-COMMISSIONING OF INSTALLATION

On completion of the repair work, the low voltage reticulation shall be put into operation.
**HC 09. REPAIR WORK TO LOW VOLTAGE RETICULATION**

**HC 09.01** The distribution boards, kiosks and overhead reticulation system shall be repaired as measured in the bills of quantities, during the first period of the repair and maintenance contract.

**HC 09.02** The scope of the repair work shall include, but shall not be limited to the activities listed below.

**HC 09.03** The Contractor shall record the repair actions in tabular format before the maintenance phase commences.

**HC 09.04** Repair work shall be executed within the approved period for repairs. This period shall be agreed at the start of the contract period.

**HC 09.05** New equipment and material shall be supplied with a written guarantee confirming a defects liability period of 12 months from date of hand-over. These guarantees shall be furnished in favour of the User Client.

**HC 09.06** The maintenance phase of this contract shall commence once the repair work on the installation have been commissioned and handed over to the satisfaction of the Engineer.

**HC 10 LOW VOLTAGE RETICULATION MAINTENANCE**

**HC 10.01** The various low voltage systems shall be maintained following the initial repair work. The maintenance contract shall run for the balance of the 36 month contract period.

**HC 11 LOW VOLTAGE DISTRIBUTION BOARDS: TECHNICAL DETAILS**

**HC 11.01** Installation description

This section describes the electrical distribution network that will be repaired and maintained in terms of the contract.

**Substations**

The low voltage supply is distributed from the low voltage room in substation.

This room contains floor standing low voltage panels that are installed over cable trenches. The enclosures contain low voltage circuit breakers and instrumentation equipment.

**HC 11.02** Scope of Repair Work
HC 11.02.01 General repair work

- Service low voltage distribution boards: clean, secure circuit breakers, secure terminations, label circuit breakers and cables.
- Move circuit breakers: Loosen circuit breakers move and secure in new position.
- Install circuit breaker.
- Re-paint front cover of emergency section.
- Disconnect and remove redundant switchgear.
- Replace circuit breakers.
- Disconnect and remove redundant street and security lighting control panel
- Disconnect and remove redundant cables.
- Replacement of undersized jumper cables.
- Installation of trench covers.

HC 11.03 Repair work: measurement and payment

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>Service low voltage distribution boards</td>
</tr>
<tr>
<td></td>
<td>The unit of measure shall be the number of low voltage boards serviced.</td>
</tr>
</tbody>
</table>

The tendered rate shall include full compensation for the opening and cleaning of low voltage board, vermin protection, secure MCBs and terminations, fitting of engraved labels and blank covers.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>Test ammeter and CT functionality.</td>
</tr>
<tr>
<td></td>
<td>The unit of measure shall be the number of ammeters and CT’s tested.</td>
</tr>
</tbody>
</table>

The tendered rate shall include full compensation for the removal, testing and replacement of meters.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(c)</td>
<td>Re-paint cover on panel</td>
</tr>
<tr>
<td></td>
<td>The unit of measure shall be the number of front covers of panels re-painted.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the removal, de-rusting and degreasing of panel and re-painting, fitting of engraved labels and re-installation of the cover with dimensions as specified in the Bill of Quantities.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(d)</td>
<td>Remove 5kA MCB’s on incoming section of Main Substation low voltage Distribution board.</td>
</tr>
</tbody>
</table>
The unit of measure shall be the sum for removal of the circuit breakers as specified.

The tendered rate shall include full compensation for the removal of the existing 5kA MCB’s on the incoming section of the main board.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e)</td>
<td></td>
</tr>
<tr>
<td>Removal of Fuchsware MCB’s on Main Substation Low Voltage distribution board (local section)</td>
<td></td>
</tr>
<tr>
<td>The unit of measure shall be a sum for the removal of the circuit breakers as specified.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the removal of the existing MCB’s and supply and installation of new MCB’s as specified and connection.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(f)</td>
<td></td>
</tr>
<tr>
<td>Removal of redundant switchgear on Main Substation low voltage distribution board</td>
<td></td>
</tr>
<tr>
<td>The unit of measure shall be a sum for removal of the equipment.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for disconnection and removal of redundant equipment and jumpers.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(g)</td>
<td>No</td>
</tr>
<tr>
<td>Removal of redundant security and perimeter light control panel in main Substation</td>
<td></td>
</tr>
<tr>
<td>The unit of measure shall be the number of panels removed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for locating and disconnection of all cables to this panel including removal of the panel from the substation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(h)</td>
<td>No</td>
</tr>
<tr>
<td>Remove redundant cable</td>
<td></td>
</tr>
<tr>
<td>The unit of measure shall be the number of cables removed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the complete removal of the cable site.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>No</td>
</tr>
<tr>
<td>Supply and install power outlets.</td>
<td></td>
</tr>
</tbody>
</table>
The unit of measure shall be the number of power sockets installed.

The tendered rate shall include full compensation for the removal, supply and installation of single power outlets.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(j)</td>
<td>Supply and install light switch</td>
<td></td>
</tr>
</tbody>
</table>

The unit of measure shall be the number of light switches installed. The tendered rate shall include full compensation for the removal supply and installation of a 1 way 1 lever light switch.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(k)</td>
<td>Label cables</td>
<td></td>
</tr>
</tbody>
</table>

The unit of measure shall be the number of labels installed.

The tendered rate shall include full compensation for the installation of cable markers on both ends of all cables with a minimum font height of 18mm. The marking system used should be of type Graftoplast or equal.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(l)</td>
<td>Install trench covers</td>
<td></td>
</tr>
</tbody>
</table>

The unit of measure shall be the number of covers installed.

The tendered rate shall include full compensation for the supply and installation of cable trench covers in sizes as specified.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(m)</td>
<td>Supply and install circuit breakers</td>
<td></td>
</tr>
</tbody>
</table>

The unit of measure shall be the number of circuit breakers installed.

The tendered rate shall include full compensation for the supply and installation and connection of circuit breakers as specified.

**HC 11.04**  
Scope of Maintenance work

**HC 11.04.01**  
Monthly Inspection

(a) Verify operation of volt and ammeters.

(b) Check that access covers are secure.
(c) Visually check distribution board.

(d) Check all connections.

(e) Check operation of switching timers.

HC 11.04.02 Annual inspection

(a) Service all low voltage boards.

(b) Measure phase voltages and line currents in low voltage distribution board.

(c) Record values in record book.

HC 11.05 Maintenance work: measurement and payment

Refer to clause SA 06 of the ADDITIONAL SPECIFICATION: SA GENERAL MAINTENANCE.

HC 12 DISTRIBUTION AND METERING KIOSKS: TECHNICAL DETAILS

HC 12.01 Installation description

This section describes the electrical distribution and metering kiosks that will be repaired and maintained in terms of this contract.

This part of the distribution network consists of freestanding low voltage outdoor kiosk. The kiosk contains breakers, switching and instrumentation equipment.

HC 12.02 Scope of repair work

1) Open distribution kiosk, check locks, door hinges, clean inside, provide rodent protection, secure circuit breaker and terminations: label all kiosks, label circuit breakers, label cables and provide warning notices.

2) Measure earth resistance.

3) Touch up kiosks: Remove all rust with an anti corrosion agent and repaint kiosks.

4) Replace handles and padlocks on distribution kiosks.

5) Remove and re-mount contractors.
6) Replace door hinges and latches.

7) Replace panel catches.

8) Repair burnt connections.

**HC 12.03  Repair work: measurement and payments**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Service distribution kiosk</td>
<td>No</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of distribution kiosks serviced.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the servicing of the distribution kiosk, vermin protection, cleaning of circuit breakers, general cleaning of the kiosk, earth testing, securing of MCB and terminations. The contractor shall submit a report on the general condition of the kiosk (damage, rust etc.)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b) Remove rust and paint kiosks</td>
<td>No</td>
</tr>
<tr>
<td>The unit of measurement shall be the total number of kiosks painted.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the removal of rust with a anti corrosion agent and the repainting of the whole kiosk.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(c) Label kiosk</td>
<td>No</td>
</tr>
<tr>
<td>The unit of measure shall be the total number of kiosks labeled.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the labeling of kiosks circuit breakers, cable and the warning notification to be installed.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(d) Supply and install padlocks</td>
<td>No</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of padlocks installed.</td>
<td></td>
</tr>
</tbody>
</table>
The tendered rate shall include full compensation for the ordering, supply, engraving and installation of the padlocks, locking devices and seals.

Lock shall be “key alike”

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e)</td>
<td>Replace distribution meter and stubby kiosks.</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of distribution kiosks replaced.

The tendered rates shall include full compensation for the removal, the ordering, supply and installation of the new meter boxes and stubbies.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(f)</td>
<td>Replace door hinges on meter and distribution kiosks.</td>
</tr>
</tbody>
</table>

The tendered rate shall include full compensation for the removal of damaged hinges, the supply, delivery and installation of new hinges.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(g)</td>
<td>Supply and install handles</td>
</tr>
</tbody>
</table>

(Perano type lockable turn catch door handle heavy duty)

The unit of measure shall be the total number of handles installed.

The tendered rate shall include full compensation for the removal of the old handle and ordering, supply and installation of a lockable turn catch handle.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(h)</td>
<td>Supply and install low voltage PVC/SWA/PVC Cu cable and bare copper earth wire.</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the total length of cable supplied and installed.

The tendered rate shall include the ordering and delivery to site of the cable.

(Excavations measured somewhere else).
(i) Termination of low voltage PVC/SWA/PVC Cu cables

The unit of measurement shall be the total number of terminations removed and new terminations made.

The tendered rate shall include full compensation for the supply and installation of cable glands and lugs.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

(j) Jointing of low voltage PVC/SWA/PVC Cu cable.

The unit of measurement shall be the total number of joints made.

The tendered rate shall include full compensation for the supply and installation of all material needed to complete the joints.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

(k) Excavations for cable trenches and meter boxes.

The unit of measurement shall be the total volume excavated and backfilled in dimensions as specified by the engineer.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m³</td>
</tr>
</tbody>
</table>

(l) Supply and installation bare copper earth conductor

The unit of measurement shall be the total length of cable supplied and installed. The tendered rate shall include the ordering and delivery to site of the cable (Excavations measured somewhere else).

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>meter</td>
</tr>
</tbody>
</table>

(m) Termination of bare copper earth conductor.

The unit of measurement shall be the total number of terminations removed and new terminations made.

The tendered rate shall include full compensation for the supply and installation of cable glands and lugs.
<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n)</td>
<td></td>
<td>Re-wiring of kiosk.</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>The unit of measure shall be number of kiosks re-wired.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The tendered rate shall include full compensation for removal of the existing wiring, re-wiring, labeling and commissioning of the kiosk.</td>
</tr>
<tr>
<td>(o)</td>
<td></td>
<td>Reposition contractors on kiosk.</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>The unit of measure shall be number of contractors repositioned.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The tendered rate shall include full compensation for removal of the existing wiring, removal of contractors, mounting in new positions re-wiring, labeling and commissioning of the kiosk.</td>
</tr>
<tr>
<td>(p)</td>
<td></td>
<td>Supply and install front covers</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>The unit of measure shall be number of covers supplied and installed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The tendered rate shall include full compensation for measuring, manufacturing painting and installation of front covers.</td>
</tr>
</tbody>
</table>

HC 12.04 Maintenance Work

HC 12.04.01 Monthly

a) Inspect and secure access doors and covers.

b) Inspect distributions kiosks.

HC 12.04.02 Annually

(a) Service all distribution and metering kiosks.
(b) Measure phase voltages and line currents in distribution and metering kiosks and record in book.

HC 12.05 Maintenance work measurement and payment

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Refer to clause SA06 of the ADDITIONAL SPECIFICATION: SA GENERAL MAINTENANCE.

Remuneration for the maintenance work shall form part of the overall Medium and Low voltage Installation (Installation F).

**HC 13 LOW VOLTAGE OVERHEAD DISTRIBUTION SYSTEM: TECHNICAL DETAILS**

**HC 13.01 Installation description**

This section describes the low voltage overhead distribution system that will be repaired and maintained in terms of this contract.

This part of the distribution network consists of wooden poles, bare low voltage overhead conductors in a horizontal system configuration with cable connections to houses.

**HC 13.02 Scope of repair work**

(a) Visual inspection of overhead conductors, insulators, securing of terminations and connections, adjustment to stay assemblies to re-tension conductors, labeling of cables and provision of warning notices.

(b) Measure earth resistance.

(c) Clearing of all vegetation within 1m distance from conductors.

(d) Replacement of rusted distribution boards.

**HC 13.03 Repair work: measurement and payments**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Service overhead distribution system</td>
<td>meter</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the linear length of three phase overhead distribution system network serviced.

The tendered rate shall include full compensation for visual inspection of conductors and insulators, clearing of vegetation, securing of connections and terminations. The contractor shall submit a report on the general condition of the overhead reticulation system.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b) Replace damaged insulators.</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the total number of insulators replaced.
The tendered rate shall include full compensation for isolation of the overhead reticulation system, temporary suspension of conductors if required, removal of damaged insulators, provision and installation of new insulators and securing of conductors.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(c)</td>
<td></td>
</tr>
<tr>
<td>Re-tensioning of overhead conductors</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measure shall be the total number of stays adjusted.

The tendered rate shall include full compensation for isolation of overhead conductors, attachment of wire tensioning equipment to stays and adjustment of stay wires.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(d)</td>
<td></td>
</tr>
<tr>
<td>Replacement of wooden pole</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of poles replaced.

The tendered rate shall include full compensation for isolation of overhead conductors, temporary suspension and disconnection of conductors and suspension assemblies, excavation, removal of existing pole, provision and plant of new pole, backfilling and compaction, re-installation of suspension assemblies and connection of conductors and re-tensioning of conductors if required.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e)</td>
<td></td>
</tr>
<tr>
<td>Replacement of overhead house connection</td>
<td></td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of house connections replaced.

The tendered rate shall include full compensation for isolation of overhead conductors, disconnection and removal of existing overhead house connection, excavation for new cable connection, supply and installation 16mm² 3 core Cu cables including all connections to existing meter and overhead supply line and backfilling of trench.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(f)</td>
<td></td>
</tr>
<tr>
<td>Replacement of existing distribution boards</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of distribution boards replaced.

The tendered rate shall include full compensation for disconnection of existing cabling, removal of old distribution board, supply and installation of new board as per specification excluding equipment.
(g) Supply and install low voltage circuit breakers

The unit of measurement shall be the number of circuit breakers supplied and installed.

The tendered rate shall include full compensation for supply of new circuit breaker with rating as specified, installation of breaker in distribution board and connection of breaker.

HC 13.04 Maintenance Work

HC 13.04.01 Monthly

a) Inspect overhead conductors, insulators and poles.

HC 13.04.02 Annually

a) Service overhead distribution system.
b) Measure phase voltages and line currents and record in book.
TECHNICAL SPECIFICATION HE

EXTERIOR LIGHTING SYSTEMS

CONTENTS

HE 01 SCOPED
HE 02 STANDARD SPECIFICATIONS, REGULATIONS, CODES AND ADDITIONAL SPECIFICATIONS
HE 03 OPERATING AND MAINTENANCE MANUALS
HE 04 TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK
HE 05 LOGGING AND RECORDING PROCEDURES
HE 06 MAINTENANCE TOOLS AND SPARES
HE 07 QUALITY ASSURANCE SYSTEM
HE 08 RE-COMMISSIONING OF INSTALLATION
HE 09 REPAIR WORK TO EXTERIOR LIGHTING INSTALLATIONS
HE 10 AREA LIGHTING: TECHNICAL DETAILS
HE 11 SECURITY LIGHTING: TECHNICAL DETAILS
HE 12 SPORT FIELD LIGHTING: TECHNICAL DETAILS
HE 13 STREET LIGHTING: TECHNICAL DETAILS
HE 14 MAINTENANCE OF EXTERIOR LIGHTING SYSTEMS

HE 01 SCOPED

HE 01.01 This specification comprises all aspects regarding the repair and maintenance of external lighting systems. External lighting comprises:

i) Area lighting
ii) Security lighting along perimeter fences
iii) Sports field lighting
iv) Street lighting

HE 01.02 This specification shall form an integral part of the repair and maintenance contract document and shall be read in conjunction with Portion 3, the Additional Specifications included with this document.

HE 02 STANDARD SPECIFICATIONS, REGULATIONS AND CODES

HE 02.01 The latest edition, including all amendments up to date of tender of the following specifications, publication and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof.

HE 02.02 SABS Specifications

<table>
<thead>
<tr>
<th>Code</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>02.02.01</td>
<td>SABS 0400 National Building Regulation</td>
</tr>
<tr>
<td>02.02.02</td>
<td>SABS 0142 Wiring code</td>
</tr>
<tr>
<td>02.02.03</td>
<td>SABS 0225 Lighting masts</td>
</tr>
<tr>
<td>02.02.04</td>
<td>SABS 1277 Read lighting luminaires</td>
</tr>
<tr>
<td>02.02.05</td>
<td>SABS 1088 Spigot entries</td>
</tr>
<tr>
<td>02.02.06</td>
<td>SABS 1749 Glass polyester poles</td>
</tr>
<tr>
<td>02.02.07</td>
<td>SABS 1250 Capacitors, ballasts &amp; lamps</td>
</tr>
<tr>
<td>02.02.08</td>
<td>SABS 1279 Floodlight luminaires</td>
</tr>
<tr>
<td>02.02.09</td>
<td>SABS 1777 Daylight switches</td>
</tr>
<tr>
<td>02.02.10</td>
<td>SABS 763 Galvanised coatings</td>
</tr>
<tr>
<td>02.02.11</td>
<td>SABS 1266 Discharge lamps</td>
</tr>
<tr>
<td>02.02.12</td>
<td>ARP 035 Streetlighting maintenance</td>
</tr>
</tbody>
</table>

HE 02.03 Department of Public Works Specification PW 774

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HE 04 Occupational Health and Safety Act of 1993

HE 05 Manufacturer’s specifications and installation instructions

HE 06 Additional requirements

Equipment and material supplied and installed shall be new and unused. Luminaires, lamps and control gear shall bear the SABS stamp. The Contractor shall ensure that all safety regulations and measures are applied and enforced during repair and maintenance work on cabling, wiring, luminaires, lighting poles and high masts.

HE 03 OPERATING AND MAINTENANCE MANUALS

HE 03.01 The Contractor shall be responsible for the compilation of a complete set of Operating-and-Maintenance manuals.

This shall be done in accordance with the Additional Specification SB – Operating and Maintenance manuals.

All information shall be recorded and reproduced in electronic format as well as supplying the Engineer with three sets of hard copies.

HE 03.02 Over and above what is specified in the Additional Specification – SB Operating and Maintenance manuals, the Operating and Maintenance Manual to be compiled shall be structured and shall at least include the following:

03.02.01 Description of Installation

Complete system description of the lighting system. This shall be done for each lighting installation individually. The system description shall contain detailed information regarding the supply configuration (Distribution board, cabling, distribution kiosks, pole mounted distribution board), the switching arrangement (timers, photocells, override facilities) and the lighting (luminaire detail, lamp detail) as well as the earthing and lightning protection arrangement.

03.02.02 Commissioning Data

Complete commissioning, test and inspection data of lighting system.

This shall be done for each lighting installation individually. The commissioning data will comprise start-up and running current measurements at each termination point e.g. distribution board, kiosk and mast. Full data on lamps fitted with installation dates.

03.02.03 Operating data

a) Safety precautions to be implemented.
b) Operation of lighting systems; automatic, manual and bypass switching.

03.02.04 Maintenance instructions

a) Projected frequency of lamp replacement per lighting system.
b) Procedure to verify operation of photocell – controlled circuits.
c) Procedure to verify operation of timer – controlled circuits.
d) Trouble shooting diagram.
e) Luminaire details, including manufacturers brochures / pamphlets, order number, list of components and lamp specification.
f) Schedule of serviceable components per lighting system. These schedules shall include lamps, starters, ignitors, ballasts, lenses, etc.
HE 04  TESTS AND INSPECTIONS PRIOR TO PRACTICAL COMPLETION OF REPAIR WORK

HE 04.01  It is the responsibility of the Contractor to provide all labour, accessories and properly calibrated and certified measuring instruments necessary to record the following parameters:

04.01.01  Phase voltages
04.01.02  Current per phase
04.01.03  Illumination levels in lux
04.01.04  Insulation testing at 500V
04.01.05  Earthing resistance testing by means of wheat stone bridge instrument

The Contractor is responsible for the arrangement of such tests. He shall give at least 72 hours notice to the Engineer prior to the test date.

HE 05  LOGGING AND RECORDING PROCEDURES

HE 05.01  The Contractor shall as part of this Contract institute a Recording system as part of his Maintenance Control Plan as defined in the Additional Specification SA – General Maintenance. This shall consist of a Record book which shall be utilised to log and record all faults, system checks, breakdowns, maintenance visits, inspections etc.

HE 05.02  The logbook shall be stored in a safe place inside the maintenance supervisor’s office and shall only be utilised by the Contractor and Engineer. A copy of the monthly entries and recordings into this logbook shall be submitted by the Contractor together with his monthly report to the Engineer.

This logbook shall be structured to at least include the following:

05.02.01  Monthly lamp inspection and maintenance actions.
05.02.02  Bi-annual inspection and testing of lighting systems.
05.02.03  Annual earthing test report.
05.02.04  Breakdown / call out reports.

HE 06  MAINTENANCE TOOLS AND SPARES

HE 06.01  On commencement of the Repair and Maintenance Contract, the Contractor shall supply and deliver certain Tools and Spares to the User Client. These Tools and Spares will be the property of the Department of Public Works. Any deficiencies or short fall or damaged Tools and Spares during the contract shall be replaced with new equipment / material.

HE 06.02  The Tools and Spares shall be kept safe in a lockable store room on site. The Contractor shall provide his own lock for the designated store room. The inventory of the Tools and Spares shall be verified on a monthly basis. Any short fall shall be replaced by the Contractor as part of his responsibility under this contract.

HE 06.03  The Tools and Spares shall at least include the following:

10 off 125W MV lamps
10 off 250W MV lamps
10 off 70 W HPS lamps
10 off 250 W HPS lamps
10 off 400 W HPS lamps
10 off 1500W Tungsten halogen lamps
10 off 100W Incandescent lamps
HE 07 QUALITY ASSURANCE SYSTEM

HE 07.01 Following formal approval of his Quality Assurance system by the Engineer, the Contractor shall implement the approved QA system.

HE 07.02 Records of this QA system shall be kept throughout the duration of the contract and shall be submitted to the Engineer as required by the Department.

HE 08 RE-COMMISSIONING OF INSTALLATION

HE 08.01 On practical completion of the repair work and lamp replacement, the lighting installations shall be put into operation.

HE 08.02 Lighting installations shall be energised for a minimum continuous period of 96 hours immediately prior to the Engineer’s Practical Completion inspection to verify lamp stability and reliability of power reticulation.

HE 09 REPAIR WORK TO EXTERIOR LIGHTING INSTALLATIONS

HE 09.01 The various lighting systems shall be repaired during the first phase of the repair and maintenance contract.

HE 09.02 The scope of the repair work shall include, but shall not be limited to the activities listed below.

HE 09.03 The Contractor shall record the repair actions in tabular format before the Contractor’s responsibility for maintenance commences.

HE 09.04 Repair work shall be executed within the approved period for repairs.

HE 09.05 New equipment and material shall be supplied with a written guarantee confirming a defects liability period of 12 months from date of practical completion. These guarantees shall be furnished in favour of the Department of Public Works.

HE 09.06 The following measurement and payment items shall apply for repair work:

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material</td>
<td>m³</td>
</tr>
</tbody>
</table>

This rate shall apply to all the excavations.

The unit of measurement shall be the cubic metre of material excavated in trenches, classified according to the depth and width specified listed. The width classification shall be in accordance with the authorised dimensions and
the depth classification in accordance with the total depth of the trench and
not with the depth range in which the material is situated before excavation.
The depth of excavation shall be measured to the underside of the bedding.

The tendered rate shall include full compensation for clearing and grubbing
the trench areas and the temporary removal of improvements from the line of
the trench, for excavating the trench, preparing the bottom of the trench,
separating material unsuitable for backfill, keeping the excavations safe,
dealing with any surface or subsurface water, measuring, classification and
keeping of all records and for separating topsoil and selected backfill material
where necessary.

The rate shall furthermore cover the costs of installing the sand bed and sand
cover, backfilling, compacting and disposing of the surplus material.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(b)</td>
<td>Extra over item HE 09.06(a) for excavating in hard material</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the cubic metre of material excavated and
classified as hard, in accordance with the classification set out hereunder.

The tendered rate shall be paid over and above the rate tendered for
excavation in respect of items HE 09.06(a) in full compensation for the
additional cost of excavating in hard material instead of soft.

The tendered rate shall include full compensation for any over break as well
as the additional backfilling required, reinstating the trench bottom, and for
any other incidentals resulting from over break.

The materials excavated shall be classified as follows for payment purposes:

Hard material:
Material which cannot be excavated efficiently except with the use of
pneumatic tools, blasting or wedging and splitting, and shall include boulders
exceeding 0.15 m³ in volume.

Soft material:
All material not classified as hard material.

Notwithstanding the above classification, all material excavated from
previously constructed fills, embankments, pavement layers and from above
existing services shall be classified as soft material.

The decision of the Engineer as to the classification of the material shall be
final and binding and any objection as to the classification shall be made
before the excavation has been backfilled.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
</table>
| HE 09.06(c) | Extra over item 3.10.1.1 for excavating by hand in all
materials | m³ |

The unit of measurement shall be the cubic metre of trench material
excavated by means of hand tools as instructed or authorised in writing by the
Engineer where the use of conventional excavating equipment is either
impractical or likely to cause damage to services, trees or property or where
the electrical Contractor has to excavate by hand where he cannot excavate
by machine.

The volumes of the trench excavation will be computed from the length and
the depth to the bottom of the specified bedding layer and the minimum base
widths specified in the drawings. The rate shall cover the cost of complying
with the safety and protection requirements specified except where particular
items are scheduled to cover particular costs for the excavation.
The tendered rate shall be paid extra over the rates tendered for item HE09.06(a).1 in full compensation for the additional expense of excavating by means of hand labour instead of conventional trenching equipment.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(d)</td>
<td>Extra over item HE09.06(a) for using backfill material obtained from sources provided by the Contractor</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the cubic metre of imported backfill material.

Item HE09.06(d) above will not be measured for payment unless importation has been ordered in writing. The volume will be computed from the trench width and the depth from ground level to the top of the sand bed cover as shown on the tender drawings. The rate shall cover the cost of excavation and selection of suitable material, the moving of the material to the backfilling site, and the disposal of the material that becomes surplus as a result of the importation.

The tendered rate for item HE09.06(d) paid extra over item HE09.06(a) shall cover the cost of the acquisition of the material and of the disposal of the surplus material resulting from the importation together with all the costs of transporting the material to the site regardless of distance.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(e)</td>
<td>Supply and Install Cable Sleeves</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the linear length in metre of cable sleeves supplied and installed.

The tendered rate shall include full compensation for the supply, delivery, handling and installing the cable sleeves including all the required couplings, steel draw wires and plugs.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(f)</td>
<td>Supply and Install Plastic Warning Tape</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the length in meter of plastic warning tape supplied and installed.

The tendered rate shall include full compensation for the supplying, handling and laying the plastic warning tape.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(g)</td>
<td>Supply and delivery of low-voltage cable</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the length of low-voltage cable supplied. The tendered rate shall include full compensation for the manufacture, supply and delivery of the specified cable to the site.

Separate items shall be scheduled under this payment item for each size and type of cable required.
<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(h)</td>
<td>Lay LV-cable</td>
</tr>
<tr>
<td>The unit of measurement shall be the linear length in meter of LV-cable installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the handling, inspecting, laying, cutting and testing the cable. Cables shall be measured linearly over all lengths laid. Separate items shall be scheduled for each size and each type of cable laid.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(i)</td>
<td>Termination of LV-cables</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of LV-cable terminations.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for providing the cable glands and shrouds, the cost of handling, fitting and cutting the cable. Separate items shall be scheduled for each size and type of cable.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(j)</td>
<td>Supply bare copper earth conductor</td>
</tr>
<tr>
<td>The unit of measurement shall be the length in meter of bare copper earth conductor supplied.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for procuring, furnishing and laying the specified earth continuity conductor.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(k)</td>
<td>Installation of bare copper earth conductor</td>
</tr>
<tr>
<td>The unit of measurement shall be the length in meter of bare copper earth conductor installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for procuring, furnishing and laying the specified earth continuity conductor.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(l)</td>
<td>Terminate and connect bare copper earth conductor</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of bare copper earth conductors terminated and connected.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for supplying all the material required to terminate and connect the bare copper earth conductors and the connecting thereof to the earth bars.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HE 09.06(m)</td>
<td>Jointing of low-voltage cable</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of LV-cables joints.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the cost of providing the kits, the cost of cutting the cable, handling and fitting the kits and the cost of testing the joints.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>----------------------</td>
<td>------</td>
</tr>
<tr>
<td>HE 09.06(n)</td>
<td>Re-lamp luminaire</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of luminaire lamps replaced.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply and installation of the lamp according to the manufacturer's instructions. Separate items shall be scheduled for each type of lamp.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>HE 09.06(o)</td>
<td>Supply and installation of internal luminaire components</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of internal luminaire components replaced.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply and installation of the components according to the manufacturer's instructions. Separate items shall be scheduled for each component.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>HE 09.06(p)</td>
<td>Internal wiring of luminaire</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of luminaires rewired with silicone insulated wiring.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply and wiring of a luminaire with silicone insulated wiring where the wiring are specified separately.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>HE 09.06(q)</td>
<td>Supply and install circuit breakers</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of circuit breakers supplied and installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply and installation of the circuit breakers where the circuit breakers are specified separately.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>HE 09.06(r)</td>
<td>Supply and install isolators</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of isolators supplied and installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply and installation of the isolators where the isolators are specified separately.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>HE 09.06(s)</td>
<td>Supply and install contactors</td>
</tr>
<tr>
<td>The unit of measurement shall be the number of contactors supplied and installed.</td>
<td></td>
</tr>
<tr>
<td>The tendered rate shall include full compensation for the supply and installation of the contactors where the contactors are specified separately.</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------</td>
</tr>
<tr>
<td>HE 09.06(t)</td>
<td>Supply and install of low tension fuses</td>
</tr>
<tr>
<td>HE 09.06(u)</td>
<td>Supply and install National photocell (plug-in type)</td>
</tr>
<tr>
<td>HE 09.06(v)</td>
<td>Supply and install Heinemann SAT-R-Clip in timer</td>
</tr>
<tr>
<td>HE 09.06(w)</td>
<td>Supply and install 0-30A HRC fuses</td>
</tr>
<tr>
<td>HE 09.06(x)</td>
<td>Supply and install end connectors and insulating sleeves</td>
</tr>
<tr>
<td>HE 09.06(y)</td>
<td>Supply of tools and spares</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of fuses supplied and installed.

The tendered rate shall include full compensation for the supply and installation of the fuses where the fuses are specified separately.

The unit of measurement shall be the number of photocells supplied and installed.

The tendered rate shall include full compensation for the supply and installing of the photocells where the photocells are specified separately.

The unit of measurement shall be the number of timers supplied and installed.

The tendered rate shall include full compensation for the supply and installing of the timers where the timers are specified separately.

The unit of measurement shall be the number of fuses supplied and installed.

The tendered rate shall include full compensation for the supply and installing of the fuses where the circuit breakers are specified separately.

The unit of measurement shall be the number of end connectors and insulating sleeves supplied and installed.

The tendered rate shall include full compensation for the supply and installation of the end connectors at the light pole or where cables forms a looping system.

The end connectors shall be similar or equal to Pratley No 2 end connectors and insulating sleeves.

The unit of measurement shall be a lump sum.

The tendered rate shall include full compensation for the supply and delivery of the tools and spares specified.
### AREA LIGHTING: TECHNICAL DETAILS

#### HE 10.01 Installation description

<table>
<thead>
<tr>
<th>AREA / STREET</th>
<th>POLE / MAST INFORMATION</th>
<th>LUMINAIRE INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MOUNTING HEIGHT</td>
<td>DESCRIPTION / MATERIAL</td>
</tr>
<tr>
<td>OPERATIONAL AREA</td>
<td>11m</td>
<td>WOODEN POLE</td>
</tr>
<tr>
<td>LOWER AREA</td>
<td>11m</td>
<td>WOODEN POLE</td>
</tr>
<tr>
<td>UPPER AREA</td>
<td>11m</td>
<td>WOODEN POLE</td>
</tr>
<tr>
<td>UPPER AREA</td>
<td>4.5m</td>
<td>FIBRE POLE</td>
</tr>
<tr>
<td>LOWER AREA</td>
<td>4.5m</td>
<td>GALVANIZED STEEL POLE</td>
</tr>
<tr>
<td>OPERATIONAL AREA</td>
<td>4.5m</td>
<td>WALL</td>
</tr>
</tbody>
</table>

#### EXISTING TYPE

<table>
<thead>
<tr>
<th>U5</th>
<th>SPOTLIGHTS &amp; WOODEN POLE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Existing 1000W MV/MH/HPS spotlights mounted on the existing 11m wooden pole</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T1</th>
<th>GREY FRP</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Existing 3.5m mounting height glass fibre reinforced polyester pole, with baseplate, glandplate, 1 x 5A 5kA circuit breakers and a heavy-duty access door. (exclude light fitting)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T2</th>
<th>SKY-H35-125W-GREY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Existing grey post top 70 / 125 watt lamp and diffuser. Lamp type of MV, MH, HPS</td>
</tr>
</tbody>
</table>
HE 10.02 Scope of repair work

Service mast distribution boards and supply kiosks: Clean, label, check terminations and earthing. Service each luminaire, open control gear enclosures and treat for moisture ingress and corrosion. Wash luminaires with detergent and clean lenses. Check and replace neoprene seals.

Re-lamp luminaires. Replace luminaires: Remove existing damaged luminaires, supply and install similar and approved luminaires complete with lamps and control gear, if applicable.

Check consistency of aiming angles and tighten mounting bracket bolts.

Check pole covers; measure earthing continuity and tighten foundation bolts. Replace all padlocks on distribution boards and kiosks.

HE 10.03 Repair work: Measurement and payment

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>Re-lamp luminaire</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of floodlight lamps replaced.

The tendered rate shall include full compensation for the supply and installation of the lamp according to the manufacturer's instructions.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>Service floodlight luminaire</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of floodlight luminaires opened and serviced.

The tendered rate shall include full compensation for the servicing of the luminaire, including washing, corrosion protection, checking of seals and glands, cleaning of the lenses, tightening of stirrup bracket bolts and the checking of earthing continuity and aiming angle.
Item | Service light distribution kiosk or DB | Unit
---|---|---
(c) | No

The unit of measurement shall be the number of distribution boards or kiosks serviced.

The tendered rate shall include full compensation for the cleaning and opening of kiosk or DB, vermin protection, checking of MCB’s, checking and tightening of wire terminations, fitting of labels and blank covers, etc.

Item | Supply and install padlocks | Unit
---|---|---
(d) | No

The unit of measurement shall be the number of 65mm padlocks installed.

The tendered rate shall include full compensation for the ordering, supply, engraving and installation of the padlocks, locking devices and seals.

Item | Service area light pole | Unit
---|---|---
(e) | No

The unit of measurement shall be number of area light poles opened and serviced.

The tendered rate shall include full compensation for the opening of pole cover, visual inspections, and straightening of pole.

Item | Replace floodlight luminaire | Unit
---|---|---
(f) | No

The unit of measurement shall be number of floodlight luminaires replaced.

The tendered rate shall include full compensation for the supply and installation of the specified floodlight luminaire complete with lamp and control gear according to manufacturer’s instructions.

| XT1 | GREY FRP | 4m mounting height glass fibre reinforced polyester pole, with baseplate, glandplate, 1 x 5A 5kA circuit breakers and a heavy-duty access door. (exclude light fitting) |
| XT2 | BEKA Zela 55W LED | Zela 55W LED |
HE.13

<table>
<thead>
<tr>
<th>XW1</th>
<th>FRP POLE</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="FRP Pole" /></td>
<td>4m mounting height glass fibre reinforced polyester pole, with baseplate, glandplate, 1 x 5A 5kA circuit breakers and a heavy-duty access door. (exclude light fitting)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XW2</th>
<th>Beka Ray</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image2.png" alt="Beka Ray" /></td>
<td>BEKAray LED</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XU5</th>
<th>SPOTLIGHTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Spotlights" /></td>
<td>OMNIsat Maxi 463W 5121 optic</td>
</tr>
</tbody>
</table>

HE 11 SECURITY LIGHTING: TECHNICAL DETAILS

HE 11.01 Installation description

<table>
<thead>
<tr>
<th>AREA /STREET</th>
<th>POLE / MAST INFORMATION</th>
<th>LUMINAIRE INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MOUNTING HEIGHT</td>
<td>DESCRIPTION / MATERIAL</td>
</tr>
<tr>
<td>OPERATIONAL AREA (X3)</td>
<td>40m</td>
<td>SCISSORS MASK</td>
</tr>
<tr>
<td>U2</td>
<td>SPOTLIGHTS</td>
<td><img src="image4.png" alt="Spotlights" /></td>
</tr>
</tbody>
</table>

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HE 11.02 Scope of repair work

Open distribution kiosk, check locks, clean inside, provide termite and rodent poison.

Open each pole cover and inspect fuse or circuit breaker, tray and shield plate as well as earthing connection. Check and replace cover seal if required. Wash luminaire and lens, replace neoprene seal and re-lamp luminaires.

Replace luminaires: Remove existing damaged luminaires, supply and install similar and approved luminaires complete with lamps and control gear, if applicable. Check aiming angle and adjust if necessary.

HE 11.03 Repair work: Measurement and payment

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>Service security light pole</td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of security light poles opened and serviced.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the opening of pole cover, visual inspections, straightening of poles, servicing of luminaires as specified.</td>
</tr>
<tr>
<td>(b)</td>
<td>Re-lamp luminaire</td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of security floodlight lamps replaced.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the supply and installation of the lamp according to the manufacturer's instructions.</td>
</tr>
<tr>
<td>(c)</td>
<td>Service distribution kiosk</td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of distribution kiosks or boards opened and serviced.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the opening of kiosk or distribution board, vermin protection, cleaning of circuit breakers, earth testing, etc.</td>
</tr>
<tr>
<td>(d)</td>
<td>Replace security floodlight luminaires</td>
</tr>
<tr>
<td></td>
<td>The unit of measurement shall be the number of security floodlight luminaires replaced.</td>
</tr>
<tr>
<td></td>
<td>The tendered rate shall include full compensation for the supply and installation of the luminaire complete with the lamp and control gear according to the manufacturer's instructions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XU5</th>
<th>SPOTLIGHTS</th>
<th>OMNIsat Maxi 463W 5121 optic</th>
</tr>
</thead>
</table>
HE 12  SPORTS FIELD LIGHTING: TECHNICAL DETAILS

HE 12.01  Installation description

<table>
<thead>
<tr>
<th>AREA /STREET</th>
<th>POLE / MAST INFORMATION</th>
<th>LUMINAIRE INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MOUNTING HEIGHT</td>
<td>DESCRIPTION / MATERIAL</td>
</tr>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

HE 12.02  Scope of repair work

Open upstream distribution board. Check and fasten cable terminations, fit labelling and blank face-plate covers. Check locking mechanism and fit padlock.

Open distribution kiosk. Clean inside and add termite and rodent poison. Fit circuit labelling. Check locking mechanism and fit padlock.

Open each mast distribution board and inspect. Check earth bar and earth continuity. Check and fasten cable terminations, fit labelling and blank face-plate covers. Check locking mechanism and fit padlock. Check mast foundation bolts and earth connection to electrode.

Service luminaires by washing with detergent and re-lamping where necessary. Clean lenses. Check condition of seals and glands and test for earth continuity. Replace luminaires: Remove existing damaged luminaires, supply and install similar and approved luminaires complete with lamps and control gear, if applicable.

HE 12.03  Repair work: Measurement and payment

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td></td>
</tr>
<tr>
<td>Service sports field light mast</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of sports field light mast inspected and serviced.

The tendered rate shall include full compensation for the opening of pole cover, visual inspections and including servicing of sports field luminaires as specified.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td></td>
</tr>
<tr>
<td>Re-lamp luminaire</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of sports field floodlight lamps replaced.

The tendered rate shall include full compensation for the supply and installation of the lamp according to the manufacturer’s instructions.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(c)</td>
<td></td>
</tr>
<tr>
<td>Service distribution kiosk or distribution board</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of distribution kiosks or boards opened and serviced.

The tendered rate shall include full compensation for the opening of kiosk, vermin protection, cleaning of circuit breakers, earth testing, etc.
HE.16

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(d) Service sports field light pole</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of light poles opened and serviced.

The tendered rate shall include full compensation for the opening of pole covers, visual inspections and servicing of luminaires as specified.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e) Replace luminaire</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of sports field floodlight luminaires replaced.

The tendered rate shall include full compensation for the supply and installation of the specified luminaire complete with the lamp and control gear according to the manufacturer’s instructions.

HE 13 STREETLIGHTING: TECHNICAL DETAILS

HE 13.01 Installation description

<table>
<thead>
<tr>
<th>AREA /STREET</th>
<th>POLE / MAST INFORMATION</th>
<th>LUMINAIRE INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MOUNTING HEIGHT</td>
<td>DESCRIPTION / MATERIAL</td>
</tr>
<tr>
<td>STREET LIGHTS: Caledon Bridge</td>
<td>9m</td>
<td>GALVANIZED STEEL POLE WITH SINGLE CROSS ARM</td>
</tr>
<tr>
<td>STREET LIGHTS: Caledon Bridge</td>
<td>wall</td>
<td>SINGLE CROSS ARM</td>
</tr>
</tbody>
</table>

**U3** STREETPOLE

Existing Streetlight pole 9m

**U4** BEKA LED STREETLIGHT

Existing Beka Streetlight led
HE 13.02 Scope of repair work.

Open distribution kiosk, check locks, clean inside, provide termite and rodent poison.

Open each mast cover and inspect fuse or circuit breaker, tray and shield plate as well as earthing connection. Check and replace cover seal if required. Wash luminaire, replace neoprene seal, clean lens and re-lamp luminaires if required. Replace luminaires: Remove existing damaged luminaires, supply and install similar and approved luminaires complete with lamps and control gear, if applicable. Assess aiming angle and adjust if necessary.

HE 13.03 Repair work: Measurement and payment

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Service streetlight pole</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of light poles opened and serviced.

The tendered rate shall include full compensation for the opening of pole cover, visual inspections, straightening of pole, servicing of street light luminaire as specified.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b) Re-lamp luminaire</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of street light lamps replaced.

The tendered rate shall include full compensation for the supply and installation of the lamp according to the manufacturer’s instructions.

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>(c) Service street light distribution kiosk</td>
<td>No</td>
</tr>
</tbody>
</table>

The unit of measurement shall be the number of distribution kiosks or boards opened and serviced.

The tendered rate shall include full compensation for the opening of kiosk, vermin protection, cleaning of circuit breakers, earth testing, etc.
Item | Unit
--- | ---
(d) Replace streetlight luminaire | No

The unit of measurement shall be the number of streetlight luminaires replaced.

The tendered rate shall include full compensation for the supply and installation of the luminaire complete with the lamp and control gear as per manufacturer’s instructions.

<table>
<thead>
<tr>
<th>XU3</th>
<th>STREETPOLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Streetlight pole 9m with baseplate, glandplate, 1 x 5A 5kA circuit breakers and a heavy-duty access door. (exclude light fitting)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XU4</th>
<th>BEKA LED STREETLIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LEDflood maxi 279W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XV</th>
<th>STREETLIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LEDlume mini XP 36W 5068 optic</td>
</tr>
</tbody>
</table>

**HE 14 MAINTENANCE OF THE INSTALLATION**

HE 14.01 The various lighting systems shall be maintained in perfect working order following the initial repair work. The maintenance contract shall run for the balance of the 36-month contract period.

HE 14.02 The following maintenance actions will be required under this phase of the contract:

14.02.01 Routine preventative maintenance
14.02.02 Corrective maintenance
14.02.03 Breakdown maintenance
These actions are defined in the Additional Specification SA – General Maintenance.

HE 14.03 The maintenance schedules and frequency of maintenance activities shall be developed under the maintenance control plan which will be instituted by the Contractor. The Contractor’s responsibility in this regard is specified in the Additional Specification SA – General Maintenance.

HE 14.04 The following shall be used as guidelines to ensure effective maintenance:

14.04.01 Scope of maintenance work on area lighting

a) Monthly
   i) Verify operation of switching element
   ii) Check lamps
   iii) Check mast door for weatherproof seal
   iv) Check earth connection at footing, record value

b) Annual
   i) Service all luminaires
   ii) Measure earth resistance of electrode
   iii) Measure earth resistance of trench earth
   iv) Record values in record book

14.04.02 Scope of maintenance work on security lighting

a) Monthly
   i) Verify operation of switching element.
   ii) Check lamps.
   iii) Check that all pole covers are secure.
   iv) Visually check distribution kiosk.

b) Annual
   Measure phase voltages and line currents in distribution kiosk or local distribution board. Record values in record book. Do vermin protection. Service all luminaires.

14.04.03 Scope of maintenance work on sports field lighting

a) Monthly
   i) Verify operation of switching element.
   ii) Check lamps.
   iii) Check that all pole covers are secure.
   iv) Visually check distribution kiosk and local mast distribution boards.

b) Annual
   Measure phase voltages and line currents in distribution kiosk. Record values in record book. Do vermin protection. Service all luminaires.

14.04.04 Scope of maintenance work on street lighting

a) Monthly
   i) Verify operation of switching element.
   ii) Check lamps.
   iii) Check that all pole covers are secure.
   iv) Visually check distribution kiosk.
b) Annual

Measure phase voltages and line currents in distribution kiosk. Record values in Record book. Do vermin protection. Service all luminaires.

HE.14.05 Maintenance shall include all repairs, replacing of components or materials, routine setting or any other actions necessary to ensure a perfect functional condition.

HE.14.06 Remuneration for the monthly maintenance of exterior lighting systems shall be deemed included in the tendered rate for ten points of the installation of which exterior lighting systems forms part.
PARTICULAR SPECIFICATION

PFC HOT-WATER GENERATING INSTALLATION

CONTENTS

PFC 01 SCOPE
PFC 02 GENERAL DESCRIPTION OF INSTALLATION
PFC 03 TECHNICAL DETAILS OF EXISTING INSTALLATION
PFC 04 STATUS OF EXISTING INSTALLATION
PFC 05 DETAILS OF REPAIR WORK
PFC 06 DETAILS OF MAINTENANCE WORK

PFC 01 SCOPE

(a) This specification covers the particulars of the repair and maintenance work to the hot-water generating installation at the Maseru Border. This Particular Specification shall be read in conjunction with the Technical Specification FC: Hot-water Generating Installations, and all additional and technical specifications compiled as part of this document, in particular the following Additional Specifications:

- **SA:** General Maintenance
- **SB:** Operating and Maintenance Manuals
- **SC:** General Decommissioning, Testing and Commissioning Procedures
- **SD:** General Training

The intended repair and maintenance work to this installation will restore the existing installation to a safe, efficiently functional system that complies with all statutory regulations and applicable standards, in the process repairing all defects and shortfalls. Monthly maintenance responsibilities for each installation shall commence with access to the site. A difference shall be made in payment for maintenance prior to and after practical completion of repair work. On completion of the repair work, the completed installation shall be maintained and serviced by the Contractor for the remainder of the 36-month Contract period.

(b) One of the installations to be repaired and maintained under this Contract includes the following systems and equipment:

- (i) Electric Geyser installations for the Operational Areas
- (ii) Electric Geyser installation for the Upper Houses Area
- (iii) Electric Geyser installation for the Lower Houses Area
- (iv) Electrical control equipment, wiring, cabling, panels and instrumentation associated with each installation.
**PFC 02  GENERAL DESCRIPTION OF EXISTING INSTALLATION**

The existing hot-water generating installations are situated in various plant rooms at the various prisons. These installations currently consist of electric geyser. These installations are equipped with in-line hot-water circulating pump sets.

These systems provide hot water for ablution facilities, consisting of wash-hand basins, wash troughs and showers.

**PFC 03  TECHNICAL DETAILS OF EXISTING INSTALLATION**

At the time of compilation of this document the existing installation consisted of the equipment and plant listed below with their relevant technical details.

**PFC 03.01  TECHNICAL DETAILS: ELECTRIC GEYSERS**

**PFC 03.01.01  Upper Residential Quarters (x2)**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Storage capacity</td>
<td>2200 litres</td>
</tr>
<tr>
<td>2.</td>
<td>Number of vessels</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Electric heaters</td>
<td>3</td>
</tr>
<tr>
<td>3.1</td>
<td>Manufacturer</td>
<td>Kwikot</td>
</tr>
<tr>
<td>3.2</td>
<td>Factory no</td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>Phase</td>
<td>3</td>
</tr>
<tr>
<td>3.4</td>
<td>Voltage</td>
<td>380V</td>
</tr>
</tbody>
</table>

**PFC 03.01.02  Upper Residential House (x10)**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Storage capacity</td>
<td>150 litres per geyser</td>
</tr>
<tr>
<td>2.</td>
<td>Number of vessels</td>
<td>231</td>
</tr>
<tr>
<td>3.</td>
<td>Electric heaters</td>
<td>1</td>
</tr>
<tr>
<td>3.1</td>
<td>Manufacturer</td>
<td>Kwikot</td>
</tr>
<tr>
<td>3.2</td>
<td>Factory no</td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>Phase</td>
<td>1</td>
</tr>
<tr>
<td>3.4</td>
<td>Voltage</td>
<td>240V</td>
</tr>
</tbody>
</table>

**PFC 03.01.03  Upper Residential House Garage (x10)**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Storage capacity</td>
<td>150 litres per geyser</td>
</tr>
<tr>
<td>2.</td>
<td>Number of vessels</td>
<td>231</td>
</tr>
<tr>
<td>3.</td>
<td>Electric heaters</td>
<td>1</td>
</tr>
<tr>
<td>3.1</td>
<td>Manufacturer</td>
<td>Kwikot</td>
</tr>
<tr>
<td>3.2</td>
<td>Factory no</td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>Phase</td>
<td>1</td>
</tr>
<tr>
<td>3.4</td>
<td>Voltage</td>
<td>240V</td>
</tr>
</tbody>
</table>
**PFC 03.01.04  Lower Residential House (x9)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Storage capacity</td>
<td>150 litres per geyser</td>
</tr>
<tr>
<td><strong>2.</strong> Number of vessels</td>
<td>231</td>
</tr>
<tr>
<td><strong>3.</strong> Electric heaters</td>
<td>1</td>
</tr>
<tr>
<td>3.1 Manufacturer</td>
<td>Kwikot</td>
</tr>
<tr>
<td>3.2 Factory no</td>
<td></td>
</tr>
<tr>
<td><strong>3.3</strong> Phase</td>
<td>1</td>
</tr>
<tr>
<td><strong>3.4</strong> Voltage</td>
<td>240V</td>
</tr>
</tbody>
</table>

**PFC 03.01.05  Operational Area (x20)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Storage capacity</td>
<td>150 litres per geyser</td>
</tr>
<tr>
<td><strong>2.</strong> Number of vessels</td>
<td>231</td>
</tr>
<tr>
<td><strong>3.</strong> Electric heaters</td>
<td>1</td>
</tr>
<tr>
<td>3.1 Manufacturer</td>
<td>Kwikot</td>
</tr>
<tr>
<td>3.2 Factory no</td>
<td></td>
</tr>
<tr>
<td><strong>3.3</strong> Phase</td>
<td>1</td>
</tr>
<tr>
<td><strong>3.4</strong> Voltage</td>
<td>240V</td>
</tr>
</tbody>
</table>

**PFC 03.01.06  Ladybrand Residential House (x10)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Storage capacity</td>
<td>150 litres per geyser</td>
</tr>
<tr>
<td><strong>2.</strong> Number of vessels</td>
<td>231</td>
</tr>
<tr>
<td><strong>3.</strong> Electric heaters</td>
<td>1</td>
</tr>
<tr>
<td>3.1 Manufacturer</td>
<td>Kwikot</td>
</tr>
<tr>
<td>3.2 Factory no</td>
<td></td>
</tr>
<tr>
<td><strong>3.3</strong> Phase</td>
<td>1</td>
</tr>
<tr>
<td><strong>3.4</strong> Voltage</td>
<td>240V</td>
</tr>
</tbody>
</table>

**PFC 03.01.03  Ladybrand Residential House Garage (x10)**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Storage capacity</td>
<td>150 litres per geyser</td>
</tr>
<tr>
<td><strong>2.</strong> Number of vessels</td>
<td>231</td>
</tr>
<tr>
<td><strong>3.</strong> Electric heaters</td>
<td>1</td>
</tr>
<tr>
<td>3.1 Manufacturer</td>
<td>Kwikot</td>
</tr>
<tr>
<td>3.2 Factory no</td>
<td></td>
</tr>
<tr>
<td><strong>3.3</strong> Phase</td>
<td>1</td>
</tr>
<tr>
<td><strong>3.4</strong> Voltage</td>
<td>240V</td>
</tr>
</tbody>
</table>
PFC 04  STATUS OF EXISTING INSTALLATION

At the time of compilation of this document the status of the existing installations was noted as follows:

(a) Existing installation:
- Leaks in most geysers
- Lagging and cladding damaged;
- Water piping system not providing balanced flow;
- Brackets in some geysers to be attended.
- Thermostats to be replaced
- Drain and other valves to be attended
- Safety valves to be tested

PFC 05  DETAILS OF REPAIR WORK

The following work shall form part of the intended repair work to the hot-water generating installations. This work shall be done in accordance with the relevant regulations, codes, specifications and Technical Specification FC: Hot-water Generating Installations, as set out in this document. The following work shall be included:

PFC 05.01  GENERAL

PFC 05.01.01 The Contractor shall at the start of the Repair and Maintenance Contract inspect the items, systems, equipment, components and installations listed below. This inspection shall include the establishing of any defects, leaks, conditions, damages, shortfalls, structural soundness, repairs required, details of existing equipment, suitability of equipment for the purpose they serve, etc. The Contractor shall report to the Engineer in writing on all the above and the following items. No repair work shall commence prior to approval by the Engineer:

(a) Electric geysers including lagging and cladding
(b) Domestic water piped installation, including fittings, valves, strainers, lagging and cladding, non-return valves, safety valves, etc;
(c) Bracketing system;
(d) Heating control equipment and instrumentation;
(e) Hot-water circulating pump sets if any;
(f) Electrical wiring to be checked

PFC 05.01.02 The general scope of work at the time of going on tender is defined as follows:

(a) Repair of existing electric geyser installation to the existing installations. This shall include the replacement of thermostats, valves, vacuum breakers, etc
(b) The repair and servicing of all electric geysers the operational area, upper and lower area
(c) All domestic water installations to the new electric geysers installations and the replacement of pipework where indicated;

(d) Preparation and painting of all exposed piping and equipment in accordance with the manufacturer's specification;

(e) The servicing, repair and where necessary replacing of existing hot-water circulating pumps to all the geysers installations, including all related electrical work;

(f) Handing over of complete systems, to the satisfaction of the Engineer, on completion of the repair work on which the maintenance period shall commence;

(g) The supply and compilation of operating and maintenance manuals;

(h) The testing, adjusting and commissioning of all systems;

(i) The introduction of a maintenance control plan, including logging, recording and control procedures.

**PFC 05.02 ELECTRIC GEYSERS INSTALLATION**

The existing installation shall be replaced with a new were necessary

The work to be done to this installation shall include the following:

(a) Dismantling, stripping down and removal of existing installation including the following:

   (i) Storage calorifiers;
   (ii) Domestic water pipe installation in plant room.

(b) testing and commissioning of a hot, cold, hot-water return and drainage pipe installation inside the plant room All hot water and hot-water return piping shall be lagged and cladded with fibreglass preformed sections and galvanised sheet-metal troffs.

(c) Supply, installation, testing and commissioning of steam and condensate installation as detailed

   (i) The supply and installation of two hot-water circulating pumps each with a capacity of 0,5 litre/second at a 6 metre head suitable for an operating temperature of 90 °C. The pumps shall be controlled by means of the existing electrical control personnel inside the plant room.

(d) The commissioning, testing and put into operation of the complete hot-water installation.

(e) Supply of as-built and operating manuals.

**PFC 05.03 STORAGE CALORIFIER INSTALLATION AT THE BOILER HOUSE**

The repair work to the existing installation shall be done in accordance with Technical Specification FC: Hot-water Generating Installations, and shall include the following:
(a) The storage calorifiers shall be isolated, one at a time, drained, opened, cleaned out, descaled on which an inspection shall be done in the presence of the Engineer to determine if any remedial work has to be done to the vessel and vessel lining.

(b) The existing Horne's valves shall be removed, cleaned, descaled, serviced, overhauled, adjusted, tested and reassembled and fitted in accordance with the manufacturer's specifications.

(c) The existing circulating pump shall be cleaned, inspected, tested and electrically connected from the boiler house distribution board. The pump shall then be put into operation.

(d) The storage vessel lagging and cladding shall be required to an acceptable level. This shall include repairing cracks, chipped-out pieces in the plaster insulation and repainting.

(e) The water safety valve on the hot-water storage calorifier shall be replaced with new one.

(f) On completion of the above the system shall be put back into operation.

PFC 06  DETAILS OF MAINTENANCE WORK

PFC 06.01  GENERAL

The Contractor shall be responsible for the complete routine and breakdown maintenance of all the equipment, components, installations and systems that form part of this repair and maintenance contract for Installation C. The Contractor shall strictly adhere to Additional Specification SAA: Routine Preventative and Breakdown Maintenance, Technical Specification FC and Particular Specification PFC: Hot-water Generating Installations, with regard to the maintenance period, obligations, responsibilities, actions and activities, etc. The maintenance work for this installation shall be performed only when directed by the Engineer and shall consist of the routine preventative and breakdown maintenance actions described below. The schedule of quantities for maintenance provides for a provisional schedule of quantities that shall be priced in full by the Contractor. Any routine preventative and/or breakdown maintenance required shall be performed on the instruction of the Engineer only.

PFC 06.01.01  Routine preventative maintenance

Routine preventative maintenance shall comprise the actions listed below for the various installations, and shall include all required work, overheads, site supervision, materials, equipment, labour, transport, and consumables necessary to perform these maintenance activities.

(a) Storage calorifier installations

   (i) Visually inspect electric geysers system for any water, steam leaks and panelling faults and report to Engineer.

   (ii) Clean out all strainers, tighten valve gland packings, adjust and test PRV stations, test and adjust safety valves, test and adjust to operate at correct temperature level,

   (iii) Inspect and repair any damaged or missing brackets to piping systems.
(iv) Isolate, dismantle, clean, service, inspect, clean

(v) Inspect, clean and provide all minor repairs to lagging and cladding of the electric geysers and hot-water piping.

(vi) Prepare and paint all damaged paintwork to piping, parts, equipment, etc.

(vii) On completion the system shall be put back on line and a full commissioning report submitted to the Engineer.

(b) **Electrical industrial type hot-water systems**

(i) Visually inspect hot-water system for any water and panelling faults and report to Engineer.

(ii) Isolate, open, drain, inspect, clean and descale hot-water storage vessels. Reassemble, replace gaskets, test, fill, readjust and recommission hot-water system.

(iii) Inspect and repair any damaged or missing brackets to piping systems.

(iv) Inspect, clean and carry out all minor repairs to lagging and cladding of the electric geysers and hot-water piping.

(v) Prepare and paint all damaged paintwork to piping, parts, equipment, etc.

(vi) On completion the system shall be put back on line and a full commissioning report provided to the Engineer.

**PFC 06.01.02 Breakdown maintenance**

All breakdown maintenance for this installation shall be performed where directed by the Engineer only. The schedule of quantities for maintenance provides for repair items that can be re-measured and the rates for these items shall include the Contractor's percentage mark-up, overheads, site supervision, labour, materials and consumables, but excludes travelling to site, which is measured separately.

This corrective maintenance shall comply with Additional Specification AA: Routine Preventative and Breakdown Maintenance.
PARTICULAR SPECIFICATION

PFD HEATING, VENTILATION AND AIR-CONDITIONING SYSTEMS

CONTENTS

PFD 01 SCOPE
PFD 02 GENERAL DESCRIPTION OF INSTALLATION
PFD 03 TECHNICAL DETAILS OF EXISTING INSTALLATION
PFD 04 DETAILS OF REPAIR WORK
PFD 05 DETAILS OF MAINTENANCE

PFD 01 SCOPE

(a) This specification covers the particulars of the repair and maintenance work to the heating, ventilation and air-conditioning systems at Maseru Border Post. This Particular Specification shall be read in conjunction with the Technical Specification FD: Heating Ventilation and Air-conditioning Systems, and all additional and technical specifications compiled as part of this document, and in particular the following Additional Specifications:

SA: General Maintenance
SB: Operating and Maintenance Manuals
SC: General Decommissioning, Testing and Commissioning Procedures
SD: General Training

The intended repair and maintenance work to this installation will restore the existing installation to a safe, efficiently functional system that complies with all the statutory regulations and applicable standards, in the process repairing all defects and shortfalls. Maintenance responsibilities for each installation shall commence with access to the site. A difference shall be made in payment for maintenance prior to and after completion of repair work. On completion of the repair work, the installation shall be maintained and serviced by the Contractor for the remainder of the 36-month Contract period.

PFD 02 DETAILS OF REPAIR WORK

PFD 02.01 GENERAL DESCRIPTION OF REPAIR WORK

PFD 02.01.01 The Contractor shall at the start of the Repair and Maintenance Contract inspect the items, systems, equipment, components and installations listed below. This inspection shall include the establishing of any defects, leaks, conditions, damages, shortfalls, structural soundness, repairs required, details of existing equipment, suitability of equipment for the purpose it serves, etc. The Contractor shall report to the Engineer in writing on all the above and the following items. No repair work shall commence prior to approval by the Engineer.

(a) Air-conditioning units;
(b) Ventilation systems, excluding kitchen extract canopies and fans;
(c) Steam and condensate installation to the equipment, including fittings, piping, valves, lagging and cladding, etc;
(d) Support and bracketing system;
(e) Domestic water and drainage installations to equipment;
(f) Electrical supply, wiring to and control of equipment.
PFD 02.01.02  The general scope of repair work to this installation shall at least include, but not be limited to the following. Any items, components, installations and systems not detailed in the Particular Specification shall be repaired and/or replaced if found to be defective or/and inoperative.

(a) All statutory inspections required for rotating equipment shall be carried out. The equipment shall be tested and certified by an approved third-party inspection authority where required by the Occupational Health and Safety Act as amended;

(b) Dismantle, strip, overhaul, repair, service, reassemble, test and commission all equipment that form part of this installation;

(c) Implement a maintenance control plan;

(d) Supply as-built information and drawings, as well as operating and maintenance manuals for all equipment that form part of this installation.

PFD 02.02  DETAILS OF REPAIR WORK TO EQUIPMENT

The following work shall form part of the repair work to the heating, ventilation and air-conditioning systems. This work shall be done in accordance with the relevant regulations, codes of practice, specifications and Technical Specification FD: Heating Ventilation and Air-conditioning, contained in this document. The following work shall be included:

PFD 02.02.01  Self-contained air-conditioning units

(a) Clean air intake screen.

(b) Replace filters.

(c) De-rust, neutralise and touch up paintwork.

(d) Replace canvas collars.

(e) Clean housing, ensure that all panels are properly secured and door panels close properly. Replace panel seals.

(f) Check setting and operation of all pressure switches; reset if required.

(g) Check setting and operation of all safety switches, ie LP and HP switches, oil-pressure switch.

(h) Check setting and operation of thermostats.

(i) Check timers and reset if required.

(j) Check operation of seven day timer.

(k) Check running current of fans and compressor and settings and operation of overloads.

(l) Check tightness of all electrical terminals.

(m) Ensure operation of local and remote isolators.

(n) Check condition of all cables, check whether cables are neatly strapped and reposition and strap if required.

(o) Ensure correct operation of emergency stop.
(p) Carry out a leak test on all refrigeration piping and components including evaporator and condenser.

(q) All leaks shall be repaired. Should a leak on a component be of such a nature that it cannot be repaired, the component shall be replaced. The procedure to follow is as set out in FG 03.02.03.

(r) Check the superheat setting of the thermostatic expansion valve and adjust if required (setting approximately 8°C).

(s) Replace the filter dryer.

(t) Check compressor vibration mounts.

(u) Test oil acidity.

(v) Check refrigerant charge sight glass being clear or flashing.

(w) Check moisture indication being dry.

(x) Clean condensate tray and test drainage operation.

(y) Clean evaporator and condenser fan blades and check unbalance.

(z) Replace suction line insulation.

(aa) Check all service valves for full operation, replace caps if missing.

PFD 02.02.02 **Outside air supply systems**

(a) Install supply air fan.

(b) Install duct system, inclusive of inlet plenum.

(c) Install hinged inlet lockable grille, complete with burglar bars.

(d) Install supply air grilles, complete with plenum boxes, flexible connection and burglar bars.

(e) Install relief grilles, complete with burglar bars and shutter louvres.

(f) Install starters and controls.

PFD 02.02.03 **Ventilation system**

(a) Inspect and clean all duct work and canopy.

(b) De-rust, neutralise and touch up paintwork of duct work and canopy.

(c) Check tightness of all securing bolts.

(d) Replace of all canvas collars with new.

(e) Replace all filters.

(f) Check bearings of fan motors and lubricate.

(g) Check whether all duct supports are still in position and replace missing supports.

(h) Check ductwork for leaks and repair defects.

(i) Replace all joint seal and gaskets with new.
Check for operation and reset all fire dampers.

Clean fan blades and check for unbalance.

Check fans, speed control and fan motor.

Check running amps of fan.

Reseal penetrations through roof.

PFD 03 DETAILS OF MAINTENANCE

PFF 03.01 GENERAL

The Contractor shall be responsible for the complete maintenance of all the equipment, components, installations and systems forming part of this Repair and Maintenance Contract for Installation A. The Contractor shall strictly adhere to Additional Specification SA: General Maintenance, and Technical Specification FD: Heating, Ventilation and Air-conditioning (HVAC) Systems with regard to the maintenance period, obligations, responsibilities, actions and activities, etc, which shall also include the following maintenance actions:

(a) Routine Preventative Maintenance. A guideline to the required actions is provided in Technical Specification FD. The actions will not be limited to these guidelines, but shall include all additional actions, work, materials, etc, necessary to maintain this installation at an acceptable level.

(b) Corrective Maintenance as described and defined in Additional Specification SA: General Maintenance.

(c) Breakdown Maintenance as described and defined in Additional Specification SA: General Maintenance.

(d) For this particular installation a fatal breakdown shall be defined as a breakdown resulting in non-operation of HVAC equipment.

(e) Emergency breakdown shall be defined as failures to any equipment, resulting in the room conditions exceeding the temperature norms as defined by the Occupational Health and Safety Act as amended.
PARTICULAR SPECIFICATION

PFE INCINERATOR INSTALLATION

CONTENTS

PFE 01 SCOPE
PFE 02 GENERAL DESCRIPTION OF INSTALLATION
PFE 03 TECHNICAL DETAILS OF EXISTING INSTALLATION
PFE 04 STATUS OF EXISTING INSTALLATION
PFE 05 DETAILS OF REPAIR WORK
PFE 06 DETAILS OF MAINTENANCE WORK

PFE 01 SCOPE

(a) This specification covers the repair and maintenance work to the incinerator installation at the Maseru Border Post. This Particular Specification shall be read in conjunction with Technical Specification FE: Incinerator Installation, and all additional and technical specifications compiled as part of this document, in particular the following Additional Specifications:

SA: General Maintenance
SB: Operating and Maintenance Manuals
SC: General Decommissioning, Testing and Commissioning Procedures
SD: General Training
SE: Development of Affirmable Business Enterprise.

The intended repair and maintenance work to this installation will restore the existing installation to a safe, efficiently functional system that complies with all statutory regulations and applicable standards, in the process repairing all defects and shortfalls. On completion of the repair work, the completed installation shall be maintained and serviced by the Contractor for the remainder of the 36-month Contract period.

(b) One of the installations to be repaired and maintained under this Contract includes the following systems and equipment and is referred to as Installation G:

(i) Electrical control equipment wiring, cabling, panels and general electrical installation at the incinerator houses;
(ii) Incinerators at the abattoir and sewage pump station;
(iii) Diesel-fired burners and ancillary equipment for each of these incinerators;
(iv) Diesel storage and piping systems for each of these incinerator installations;
(v) Incinerated waste ash removal system for each of these installations.
PFE 02 GENERAL DESCRIPTION OF INSTALLATION

The incinerator installations at this Prison facility comprise two installations, one situated at the abattoir where it serves the waste from the slaughtering process and the other situated at the sewage screen and pump installation where it is utilised to incinerate screened sewage waste prior to entering the sewage pump station.

The incinerator installation at the abattoir is currently catering for the waste generated from slaughtering approximately 30 pigs/week. Slaughtering takes place three times a week.

The installation at the sewage screen deals with the screened sewage from the total complex.

PFE 03 TECHNICAL DETAILS OF EXISTING INSTALLATION

At the time of compilation of this document the existing installation consisted of the equipment and plant as listed below with their relevant technical details.

PFE 03.01 TECHNICAL DETAILS: INCINERATION EQUIPMENT

<table>
<thead>
<tr>
<th></th>
<th>Make</th>
<th>SA Incinerator Co (Pty) Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Model</td>
<td>250LA Hospital</td>
</tr>
<tr>
<td></td>
<td>Fuel type</td>
<td>Diesel</td>
</tr>
<tr>
<td>4</td>
<td>Primary burner</td>
<td>1 x Lamborghini ECO15</td>
</tr>
<tr>
<td>5</td>
<td>Afterburner</td>
<td>1 x Lamborghini ECO15</td>
</tr>
<tr>
<td>6</td>
<td>Chimney size</td>
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</tr>
<tr>
<td>7</td>
<td>Chimney type</td>
<td>3.5mm mild steel</td>
</tr>
<tr>
<td>8</td>
<td>Performance capacity @ GRE 1.0</td>
<td>50 kg/hour</td>
</tr>
<tr>
<td>9</td>
<td>Type of waste</td>
<td>General Waste</td>
</tr>
<tr>
<td>10</td>
<td>Fuel tank size</td>
<td>2000 litre farm tank</td>
</tr>
<tr>
<td>11</td>
<td>Electrical control panel description</td>
<td>Standard as supplied by manufacturer</td>
</tr>
</tbody>
</table>
PFE 04  STATUS OF EXISTING INSTALLATION

At the time of compilation of this document the status of the equipment and installation was briefly as follows:

(a) Requires attention.

(b) The installation is was currently during site inspection not working.

(c) The incinerator casing and chimney shows visible signs of corrosion.

PFE 05  DETAILS OF REPAIR WORK

The following work shall form part of the repair work to the incinerator installation. This work shall be done in accordance with the relevant regulations, codes, specifications and Technical Specification FE: Incinerator Installation, as set out in this document. The work to be included is specified below:

The repair work shall be carried out in the following sequence in accordance with the requirements of Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures (SC 02 - Phased repairs and upgrading of the installation):

1. Decommission, repair, test and commission incinerator.

PFE 05.01  GENERAL DESCRIPTION OF REPAIR WORK

The repair work to the incinerator installation shall at least include, but not be limited to the work listed below. Any items, components, installations and systems not detailed in particular shall be repaired and/or replaced if found to be defective and/or inoperative.

(a) Required inspections and tests of incinerators and ancillary equipment;

(b) Dismantling, stripping, overhauling, repair, servicing and reassembling and commissioning of all equipment forming part of this installation;

(c) Testing and recommissioning of all equipment and installations;

(d) Implementation of control plans for fuel delivery, ash removal and incinerator operation by the Contractor;

(e) Supply of operating and maintenance manuals.

PFE 05.02  DETAILS OF REPAIR WORK

PFE 05.02.01 Incinerator at sewage screen

The loading door and hearth refractory work to this incinerator shall be broken down, removed and replaced with new in accordance with the manufacturer's specification.

The casing and chimney shall be cleaned, prepared and repainted in accordance with the manufacturer's specification.

The oil burner unit shall be serviced and overhauled in accordance with the manufacturer's specification.
The electrical control panel and control equipment shall be serviced, tested and recalibrated.

The temperature probe shall be replaced with new.

The installation shall be tested, recommissioned and put back into operation.

DETAILS OF MAINTENANCE WORK

GENERAL

The Contractor shall be responsible for the complete routine and breakdown maintenance of all the equipment, components, installations and systems that form part of this repair and maintenance contract for Installation C. The Contractor shall strictly adhere to Additional Specification SAA: Routine Preventative and Breakdown Maintenance, Technical Specification FE and Particular Specification PFE: Incinerator Installations, with regard to the maintenance period, obligations, responsibilities, actions and activities, etc.

The maintenance work for this installation shall be performed only when directed by the Engineer and shall consist of the routine preventative and breakdown maintenance actions described below. The schedule of quantities for maintenance provides for a provisional schedule of quantities that shall be priced in full by the Contractor. Any routine preventative and/or breakdown maintenance shall be performed on the instruction of the Engineer only.

Routine preventative maintenance

Routine preventative maintenance shall comprise the listed below for the various installations and shall include all required work, overheads, site supervision, materials, equipment, labour, transport, and consumables necessary to perform these maintenance activities.

(a) Incinerator casing

Clean and inspect incinerator casing for any defects, corrosion, weld failures, etc, and report to the Engineer. Prepare and repaint external casings where necessary.

(b) Bracings

Clean and inspect bracing’s for any defects, corrosion, weld failures and damages, and report to Engineer.

(c) Refractories

Clean and inspect all refractory work to the loading door, hearth, walls, roof, etc, for defects, cracks, damages and failures. The Contractor shall carry out minor repairs.

(d) Grit collector

Clean and inspect grit collector (if installed) for any defects and correct operation.
(e) **Loading and ashing doors**

Clean and inspect loading and de-ashing doors for any defects, damages and correct operation, including hinges, slides, slide guides, latches and handles. The Contractor shall repair all defects and damages.

(f) **Chimney**

Clean and inspect chimney stack, including mountings, welds, material, etc, for any defects and damages and report to Engineer. Prepare and repaint chimney where necessary.

(g) **Draught control equipment**

Clean and inspect all draught controls such as barometric damper, door-operated draught limiter, stack damper, etc, for any defects, damages, repairs required, correct operation, and report to the Engineer.

(h) **Emission control equipment**

Clean and inspect all emission control equipment such as refractory screen, grit settling chamber, arrestor screen, etc, for any defects, damages, correct operation, and report to the Engineer.

(i) **Fuel burners**

Clean and inspect all fuel burner equipment including primary and afterburners for any defects, damages, correct operation and perform full service in accordance with the manufacturer's specification.

(j) **Electrical and temperature controls**

Clean, test, adjust, recalibrate and inspect all electrical control equipment, including control panel, temperature sensors, pyrometer, timers, circuit breakers, switches, pilot lights, solenoids, etc, for any defects, damage, correct operation, and report to the Engineer. Replace blown and/or damaged pilot lights.

(k) **Fuel storage piping and pumping system**

Clean, test, service, adjust and inspect all fuel storage tanks, day tanks, piping and pumping systems and installations for any leaks, defects, damages and repairs required. Replace fuel filters with new.

(l) **Incinerator housing**

Clean and inspect incinerator house, floor, roofing, ash bunker, etc, for suitability, defects, damages and report to the Engineer.

**PFE 06.01.01 Breakdown maintenance**

Breakdown maintenance for this installation shall only be performed where directed by the Engineer. The schedule of quantities for maintenance provides for repair items that can be re-measured and the rates for these items shall include the Contractor's percentage mark-up, overheads, site supervision, labour, materials and consumables, but excludes travelling to site, which is measured separately.

This corrective maintenance shall comply with Additional Specification AA: Routine Preventative and Breakdown Maintenance.
PARTICULAR SPECIFICATION

PFF KITCHEN EQUIPMENT

CONTENTS

PFF 01 SCOPE
PFF 02 GENERAL DESCRIPTION OF INSTALLATION
PFF 03 TECHNICAL DETAILS OF EXISTING EQUIPMENT
PFF 04 STATUS OF EXISTING EQUIPMENT
PFF 05 DETAILS OF REPAIR WORK
PFF 06 DETAILS OF MAINTENANCE WORK

PFF 01 SCOPE

(a) This specification covers the particulars of the repair and maintenance work to the kitchen equipment at the Maseru Border Post: Upper House. This Particular Specification shall be read in conjunction with Technical Specification FF: Kitchen Equipment, and all additional and technical specifications compiled as part of this document, in particular the following Additional Specifications:

SA: General Maintenance
SB: Operating and Maintenance Manuals
SC: General Decommissioning, Testing and Commissioning Procedures
SD: General Training

The intended repair and maintenance work to this installation will restore the existing installation to a safe, efficiently functional system that complies with all statutory regulations and applicable standards, in the process repairing all defects and shortfalls. Monthly maintenance responsibilities for each installation shall commence with access to the site. A difference shall be made in payment for maintenance prior to and after practical completion of repair work. On completion of the repair work, the completed installation shall be maintained and serviced by the Contractor for the remainder of the 36-month Contract period.

(b) One of the installations to be repaired and maintained under this Contract includes the following equipment:

(i) Extract canopies

PFF 02 GENERAL DESCRIPTION OF INSTALLATION

PFF 02.01 The centralised kitchen is situated at the Maseru Border Post.

PFF 02.02 The majority of the kitchen equipment utilise steam as energy source, with stoves, frying pans, potato peelers, convection ovens, shredders, etc, provided with electrical supplies.

The steam installation, including all connections to and from the equipment, forms part of the steam distribution installation.
PFF 03  TECHNICAL DETAILS OF EXISTING EQUIPMENT

At the time of compilation of this document the existing kitchen equipment consisted of the equipment listed below with the relevant technical details available.  

Note: No technical data was available for the following existing equipment. The Contractor shall be responsible for obtaining the data in collaboration with the Engineer.

**PFF 03.12  EXTRACT CANOPIES**

<table>
<thead>
<tr>
<th>No</th>
<th>Manufacturer</th>
<th>Model</th>
<th>Serial No</th>
<th>Size</th>
<th>Extract fan size and duty</th>
<th>Voltage</th>
<th>Wattage</th>
<th>Filter size and quantity</th>
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<tr>
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<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
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<td>Unknown</td>
<td>4</td>
</tr>
</tbody>
</table>

**KITCHEN CANOPY:**

![Image of kitchen canopy](image1)

**EXTRACTOR FAN**

![Image of extractor fan](image2)
Note: Where no technical data are available for the existing equipment, it shall be the Contractor's responsibility to obtain the data in collaboration with the Department of Public Works.

PFF 04 STATUS OF EXISTING EQUIPMENT

At the time of compilation of this document the status of the equipment and installation was briefly as follows:

PFF 04.01 KITCHEN EXTRACT SYSTEM

(a) The systems are operational.
(b) All the filters need to be cleaned.
(c) The internal surfaces of the ducting were dirty.

PFF 05 DETAILS OF REPAIR WORK

The following work shall form part of the intended repair work to the kitchen equipment. The work shall be done in accordance with the relevant regulations, codes, specifications and Technical Specification FF: Kitchen Equipment Installation, as set out in this document.

PFF 05.01 GENERAL DESCRIPTION OF REPAIR WORK

PFF 05.01.01 The Contractor shall at the start of the Repair and Maintenance Contract inspect the items, systems, equipment, components and installations listed below. This inspection shall include the establishing of any defects, leaks, conditions, damages, shortfalls, structural soundness, repairs required, details of existing equipment, suitability of equipment for the purpose it serves, etc. The Contractor shall report back to the Engineer in writing on all the above and the following items. No repair work shall commence prior to approval by the Engineer:

(a) Kitchen equipment
(b) Extraction systems
(c) Support and bracketing system;
(d) Domestic water and drainage installations to equipment;
(e) Electrical supply, wiring to and control of equipment.

PFF 05.01.02 The general scope of repair work to this installation shall at least include, but not be limited to the following. Any items, components, installations and systems not detailed in the Particular Specification shall be repaired and/or replaced if found to be defective or/and inoperative.

(a) All statutory inspections required for steam-driven equipment shall be inspected, tested and certified by an approved third party inspection authority where required by the Occupational Health and Safety Act as amended;
(b) Dismantling, stripping, overhauling, repair, service, reassembling, testing and commissioning of all equipment that form part of this installation;
(c) Implementation of a maintenance control plan;
(d) Supply and compilation of operating and maintenance manuals for all equipment that form part of this installation.

**PFF 05.02 DETAILS OF REPAIR WORK TO EQUIPMENT**

The following work shall form part of the intended repair work to the kitchen equipment. The work shall be done in accordance with the relevant regulations, codes, specifications and Technical Specification FF.

**PFF 05.02.12 Extract canopies**

(a) Clean out exhaust ducting.
(b) Clean fan and fan motor.
(c) Clean sound attenuator.
(d) Clean all filters.
(e) Lubricate fan motor bearings.
(f) Replace broken light fittings.
(g) Service fan starters.

**PFF 06 DETAILS OF MAINTENANCE**

**PFF 06.01 GENERAL**

The Contractor shall be responsible for the complete maintenance of all the equipment, components, installations and systems forming part of this repair and maintenance contract for Installation D. The Contractor shall strictly adhere to Additional Specification SA: General Maintenance, and Technical Specification FF: Kitchen Equipment, with regard to the maintenance period, obligations, responsibilities, actions and activities, etc, which shall also include the following maintenance actions:

(a) Routine Preventative Maintenance. A guideline to the required actions is provided in specification FF. The actions will not be limited to these guidelines, but shall include all additional actions work materials, etc, necessary to maintain this installation at an acceptable level.

(b) Corrective Maintenance as described and defined in Additional Specification SA: General Maintenance.

(c) Breakdown Maintenance as described and defined in Additional Specification SA: General Maintenance.

For this particular installation there shall be no fatal breakdown definition. Emergency breakdown shall be defined as failures to any equipment, resulting in the prevention of the provision of food to the consumer points.
TECHNICAL SPECIFICATION

aa CARPENTRY AND JOINERY FOR ROOFS AND CEILINGS

CONTENTS
BB 01 SCOPE
BB 02 STANDARD SPECIFICATIONS
BB 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS
BB 04 DETAIL OF REPAIR WORK
BB 05 MAINTENANCE
BB 06 MEASUREMENT AND PAYMENT

BB 01 SCOPE

Carpentry and joinery shall mean the repair and maintenance of materials and components such as removal of existing timber roof trusses, purlins, ceilings, etc and the installation of new timber trusses and other timber roof members, structural beams, purlins, battens and ceilings. This Specification does not include work related to roof coverings and paintwork, which are specified elsewhere.

This Specification covers the repair of existing timber members in roof trusses, the removal and replacement of existing timber members from roof trusses and associated timber roof members and ceilings. This Specification also covers the supply, delivery and installation of new timber trusses, purlins, battens and beams for various types of timber related structures and ceilings.

The complete scope of repair work shall be as described in BB 04 Detail of repair work.

Maintenance of this part of the Installation shall be performed in accordance with Additional Specification SA: General Maintenance and the specific REQUIREMENTS included in this Technical Specification.

BB 02 STANDARD SPECIFICATIONS

BB 02.01 GENERAL STANDARD SPECIFICATIONS

The latest edition, including all amendments up to date of tender, of the following Specifications, publications and codes of practice shall be read in conjunction with this Specification and shall be deemed to form part thereof:

OW371 Specification of Materials and Methods to be used
(Fourth revision, October 1993)
SANS 10243 The design, manufacture and erection of timber trusses
SANS 286 Gypsum plasterboard
SANS 1783 - 2 - Stress-graded softwood: general structural timber
SANS 1783 - 4 - Softwood boarding and battens
SANS 803 Fibre-cement boards

BB 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BA: Roof coverings
Technical Specification BO: Walls
Technical Specification BJ: Paintwork
BB 03.01.04 Ceilings

New ceilings shall be installed in accordance with section 9 of OW 371.

(a) Brandering to ceilings

Brandering to ceilings shall be replaced where:

(i) Ceiling boards are replaced;
(ii) Brandering is broken, rotten and beyond any further use.

New brandering shall be provided in accordance with clause 9.4 of OW 371. The brandering shall continue over at least three bays and shall be staggered to ensure that splices do not all occur in one line. Brandering must be provided for light fitting support.

(b) Gypsum ceiling boards

Repairs to existing ceilings shall include the installation of new 6.4 mm thick gypsum ceiling boards with metal H-section jointing strips. The new ceiling boards shall be nailed to brandering with galvanised or cadmium-plated clout-headed nails.

Gypsum ceiling boards shall not be used in wet areas such as in ablutions, abattoirs, kitchens and bathrooms.

Ceiling boards shall be in long lengths, symmetrically arranged with smaller panels, closely butted and secured at 150 mm centres to brandering as specified.

Where it is necessary to replace ceiling boards onto existing brandering, new boards shall be installed by first drilling through and then securing with cadmium-plated flat headed wood screws, or alternatively by shot nailing to suit, to avoid unnecessary vibration or impact damage to adjacent elements.

Gypsum cove cornices 76 mm wide shall be provided where existing cornices are to be replaced.

Existing trap doors in ceilings shall be reused. If required, new 650 x 650 mm trap doors shall be installed.

No ceiling insulation must be provided unless specified.

Painting of the ceiling shall be done in accordance with Technical Specification BJ: Paintwork.

(c) Fibre cement ceiling boards

Fibre cement ceiling boards shall be installed in wet areas such as in ablutions, abattoirs, kitchens and bathrooms.

Fibre cement ceiling boards shall be 6 mm thick, complying with the REQUIREMENTS of SANS 503 and of the flat pressed type.

The boards shall be nailed to the brandering with 2 mm diameter galvanised or cadmium-plated clout-headed nails, spaced at 100 mm centres at edges of boards and 150 mm centres along the intermediate brandering. Ceiling boards shall be in long lengths, symmetrically arranged with smaller panels as required and closely butted.

Replacement of new ceiling boards onto existing brandering shall be done as described in SS 03.01.04(b) above.
BB 03.01.02 Purlins (for sheeted roofs, battens for tiled roofs)

(a) Replacing timber purlins

The Engineer shall inspect timber purlins for defects and possible reuse. The Engineer shall establish which timber purlins need to be replaced.

Reasons for replacing purlins will include but not be limited to the following:

(i) Decayed timber, particularly at gable overhangs;
(ii) Broken, warped and brittle timber;
(iii) Worn-out roof screw holes;
(iv) Inadequacy in design, e.g. structural strength and excessive deflection due to large spans;
(v) Inappropriate spacing of purlins for the specific roof covering

(b) Repair of timber purlins

Repair work shall include but not be limited to the following:

(i) For roof pitches under 45° the purlins shall be erected on edge (narrow edge).
(ii) All purlins shall be secured to rafters at each intersection in addition to nails. In roof voids a single 3.2 mm diameter galvanised wire tie bound twice with twisted ends or a galvanised bent plate connector shall be used for securing purlins to rafters. On roof overhangs only galvanised bent plate connectors shall be used for securing purlins to rafters.
(iii) Splices shall be staggered. Splices that do not conform to the REQUIREMENTS of clause 8.8 of OW 371, or clauses 8.5.1 and 8.5.2 of SANS 10234, must be repaired. Nailed galvanised plate connectors on either side of purlins are also acceptable.
(iv) Exposed portions of the purlins shall be painted to match existing appearance.

Skew nailing of purlins to trusses shall not be closer than 30 mm from the edge of the member.

BB 03.01.03 Structural timber

(a) Replacing structural timber

The Engineer shall inspect members of structural timber, i.e. beams and columns, for defects and shall establish which of these members must be replaced. Reasons for replacement will include but not be limited to the following:

(i) Deflection exceeding acceptable limits.
(ii) Inadequacy in design, e.g. structural strength, structural instability, load conditions;
(iii) Decay of a large portion of the member (defective timber);
(iv) Replacing of decayed timber, particularly at ends of beams.

(b) Repair of structural timber

Repair work shall include but not be limited to the following:

(i) Strengthening of members, connections, splices and anchorage at supports;
(ii) Strengthening of members due to unforeseen loads, notching and cutting for services by other contractors;
(iii) Exposed portions of structural timber shall be painted to match existing appearance;
(iv) Bolt connections shall be in accordance with the REQUIREMENTS of SANS 10163.
Fibrous plasterboard cove cornices to ceilings shall be of 100 mm girth, provided by an approved manufacturer. Gypsum cove cornices 75 mm wide can be used in kitchens and bathrooms of houses. Powder-coated wall angles 25 mm wide shall be used for cornices in abattoirs.

Existing trap doors in ceilings shall be reused if required new 650 x 650 mm trap doors shall be installed.

Painting of the ceiling shall be done in accordance with Technical Specification BJ: Paintwork.

(d) Exposed T-system suspended ceilings

Repairs to existing suspended ceilings will include but not be limited to the following:

(i) Replace damaged panels with new ceiling boards;
(ii) Replace sections of damaged T-strips or H-strips;
(iii) Replace cornices;
(iv) Tension, fix and realign existing hangers;
(v) Install new hangers as required;
(vi) Clean ceiling boards, including washing of the ceiling boards with a mixture of water and sugar soap and wiping dry or painting the ceiling boards.

(e) External gable fibre cement boards for side cladding

External tongued and grooved boarding shall be removed and replaced with 6 mm thick flat pressed fibre cement boarding. The boarding shall be fixed to new brandering as specified in this section. Provide painted 25 x 25 mm meranti quarter rounds at edges as required.

The boarding shall be painted in accordance with Technical Specification BJ: Paintwork.

BB 03.01.05 Fascia and barge boards

Repairs to fascia and barge boards shall include but not be limited to the following:

(a) Replace damaged and broken fibre cement fascia and barge boards.
(b) Replace missing, corroded and damaged H-profile jointing strips.
(c) Replace all nails with suitable length and diameter brass screws. Provide nylon plugs to timber where necessary.
(d) Align and fix existing fascia and barge boards.
(e) Paint fascia and barge boards in accordance with Technical Specification BJ: Paintwork. All sides including the edges must be painted.
(f) The roof covering shall cover the top edge of the fascia on gables.

BB 03.01.06 Timber trusses, purlins and batten

(a) Existing timber trusses and roof structure

(i) General

(1) The Contractor shall establish proper access and install adequate lighting to the roof voids to enable detailed inspections of structural deficiencies by the Engineer. Temporary scaffold planks shall be laid across bottom chords to allow access to all critical areas. After inspection, the extent of repairs is to be agreed with the Engineer.
(2) All completed work shall be inspected and approved by the Engineer.

(3) All new timber work shall comply with SANS 10183.

(4) Timber grade shall be S5 and replacement sizes are to match existing unless otherwise agreed.

(5) Repair details on attached sheets R1 to R3 shall form the basis for repairs. Any deviations from or variations to these details are to be approved by the Engineer. Any types of failure not covered by these details shall be discussed with the Engineer who will then issue the necessary repair instructions.

(ii) Procedures (watermarked and slightly rotten members)

(1) Watermarked and slightly rotten members need not be replaced or repaired if the following test indicate these members to be satisfactorily:

Using a 3.5 mm nail, make scratch marks in all these members to expose good unaffected timber. If scratch depth is 2 mm or less, it is acceptable and these members need only to be treated as described in (2) below.

(2) The members shall be wire-brush cleaned, free of any loose or deleterious material, then treated with 1 coat of creosote, or similar approved. Apply by brush to affected areas and 200 mm beyond, all to the manufacturers Specifications. Safety precautions shall be taken against possible health or fire hazards as specified by manufacturer.

(iii) Procedures (cracked and failed members)

(1) All members that are cracked right through will be regarded as failed members. Members with minor longitudinal cracks shall be repaired, following procedure 5 on sheet R3.

(2) The Contractor must allow for propping and/or bracing at failed members to ensure complete structural stability during repairs.

(3) Failed members as indicated in details 1 to 4 on sheets R1 to R3 shall be realigned by means of clamping with temporary backing pieces, after which repairs can proceed.

(4) Members that are damaged too badly to effect repairs will have to be replaced or doubled up to suit the circumstances.

(5) Once all repair work has been completed the Contractor must clean out the ceiling void, free of all rubbish, excess building material and all other foreign matter and make good any damage caused to ceilings, etc.

(6) Any alternative repair proposal shall be submitted in writing to the Engineer.
DETAIL OF REPAIR WORK

The detail of the work is described in the Schedule of Quantities.

MAINTENANCE

This Specification shall be read in conjunction with Additional Specification SA: General Maintenance.

All components forming part of this Specification for carpentry and Joinery for roofs and ceilings shall be maintained as part of the maintenance of installations as defined in Additional Specification SA: General Maintenance.

Maintenance shall include all repair work, replacing of components, routine inspections, fixing of defects or any other actions or rectifying measures necessary to maintain the perfect functional condition of carpentry and joinery for roofs according to the operation and maintenance manuals and as specified in this Specification.

All timber trusses and members of timber roofs shall be preserved in a good condition, i.e. failure free, free from insect attack and decay due to exposure to moisture.

Maintenance on the carpentry and joinery for roofs shall also include all other actions related to (or resulting from) maintenance, such as:

- Cleaning of the site and ceiling voids of rubbish and dirt;
- Replacing any element that has failed;
- Tightening, fixing or replacing of loose fasteners, premature corrosion of galvanised items like screws, nail plates, etc.

Remuneration for maintenance of the complete carpentry and joinery for roofs shall be deemed included in the tendered monthly payment for maintenance of the applicable installation.

MEASUREMENT AND PAYMENT

MEASUREMENT AND RATES

General inclusion of costs

Notes:

All material scheduled to be removed shall be deemed to be existing damaged materials in small or large sections. All such redundant material shall become the property of the Contractor and must be removed from site immediately.

All new material used for repair work shall be of approved equal quality colours, profiles, thickness, etc and shall in all cases match the existing materials and shall be fixed (internally or externally) to existing material or surfaces.

All replacement, removal and repair work shall be done carefully as to not damage any adjacent or other material or work. Any damage to other or adjacent materials or areas caused by the negligence of the Contractor shall be repaired by him free of charge.

All work scheduled to be removed or taken out shall be deemed to include the cleaning and preparation of the remaining sections, areas, or work to receive the new material or work specified.
Repair work shall also include all cutting, grinding, cutting into, welding, bending, strengthening, drilling, etc to repair or to improve the items or areas as new and to match the existing.

Work scheduled to be realigned and refixed shall be deemed to include all necessary new additional materials, brackets, connector plates, bolts, pop rivets, nails, screws, spacer blocks, clamps, timber, and labour, etc to leave the items as new and totally functional.

All new work are measured net and shall include all cutting, lapping, waste, bending, fixing, corners, mitres, fixing screws, pop rivets, nails, adhesive, grout, putty, etc, as well as cleaning and preparation of surfaces not already prepared as part of removed items, etc.

Unless scheduled otherwise, new ceilings and ceilings in patchwork shall be fixed to existing boarding and the Contractor must take special care not to damage the existing boarding when removing damaged ceiling boards.

**BB 06.02 SCHEDULED ITEMS**

**NEW WORK**

**BB.01 Structural timber:**

(a) Plates (sizes indicated)  \( \text{Unit: m} \)

(b) 8 bars (sizes indicated)  \( \text{Unit: m} \)

(c) Joists (sizes indicated)  \( \text{Unit: m} \)

(d) Rafters (sizes indicated)  \( \text{Unit: m} \)

(e) Purlins (sizes indicated)  \( \text{Unit: m} \)

(f) Roof trusses complete (drawing number indicated)  \( \text{Unit: number} \)

(g) Etc

The unit of measurement shall be the metre of individual types of timber elements or number of complete trusses installed.

The tendered rates shall include full compensation for the supply of all materials, manufacture, cutting, waste, jointing, scaffolding, temporary supports, hoisting facilities and installation of the timber as specified, scheduled or shown on the Drawings.

**BB.02 Ceilings:**

(a) Ceiling boards, trapdoors, cornices, cover strips, etc (type and/or thickness indicated):

(i) Thickness, shape and description of applications  \( \text{Unit: m}^2 \), \( \text{m} \), \( \text{number} \)

(ii) Etc for other thicknesses, shapes, etc

The unit of measurement shall be the number, metre or square metre of ceiling boards, trapdoors, cornices, etc installed complete as specified and scheduled.

The tendered rates shall also include full compensation for the construction of the ceilings, trapdoors, cornices, cover strips, etc including jointing strips, insulation blankets and boarding as specified.
Joinery:

(a) Items measured by number:

(i) Doors, etc (type and size indicated) \hspace{1cm} Unit number

(ii) Etc for other items measured by number

(c) Items measured by linear metre:

(i) Skirtings, rails, cover strips, quadrant beads, etc (size indicated) \hspace{1cm} Unit m

(ii) Etc for other items measured by length

(c) Items measured by area:

(i) Eaves covering, etc (type and thickness indicated) \hspace{1cm} Unit m²

(ii) Etc, for other items measured by area

The units of measurement shall be the number, metre or square metre of each type and/or size of joinery item specified and installed complete.

The tendered rates shall include full compensation for the supply of all materials, manufacture, cutting, waste, fixing, scaffolding, temporary supports, hoisting, facilities and installation of the joinery items.

Ironmongery to be included in the rates tendered for doors shall be as specified in the Technical Specification 8D. Walls.

New joinery, will except where otherwise specified, be fixed or hung to existing material or surfaces.

ALTERATION WORK

Alterations and repairs to existing structures:

(a) Indicate if repairs, alterations, removal or sealing, etc.

(i) Description of individual items to be repaired, replaced, altered, removed, sealed, etc \hspace{1cm} Unit m², m³, m number

The unit of measurement for items repaired, replaced, altered, removed, sealed, etc shall be cubic metre, square metre, metre or number as scheduled. No distinction between sizes or profiles will be made for the removal of structural timber elements.

The tendered rates shall include full compensation for all costs to repair, refix, remove, cutting into, re-align, taking off, handling, temporary store, scaffolding, temporary supports, hoisting, facilities and preparing existing remaining material or surfaces where applicable to receive new items as well as for credit for the redundant material becoming the property of the Contractor, etc as specified in the Standard and Technical Specifications and shall allow for all necessary labour, plant and new material needed for the repairs, replacement or alterations, etc to leave the scheduled items as new and to the approval of the Engineer. Refer also to the general inclusion of costs in 88.05.01.01.”
BB.05 Repairs to watermarked and slightly rotten timber roof members: Unit: m

The unit of measurement shall be the linear metre of timber roof members repaired as specified. No distinction will be made for size, type of member or position.

The tendered rate shall include full compensation for the complete repair work, wire brushing, creosote, etc as specified by the Engineer.

BB.06 Repairs to damaged masonry, plastering and surface finishes:

(a) Items measured by number:

(i) Description of item Unit: No

(ii) Etc Unit: m

(b) Items measured by linear metre:

(i) Description of item Unit: No

(ii) Etc Unit: m

The unit of measurement shall be the number or metre as applicable to each item.

The tendered rates shall include full compensation for the making good of masonry (stock or face bricks), beam-filling, plastering, painting, closing ends to troughs of sheet metal roof sheeting, repairs to structure at ends of rafters and purlins, protruding through brick walls, etc.

The tendered rate shall also cover the cost of cutting, notching and waste and of all scaffolding, temporary supports, etc.

BB.07 Painting to top cords of timber trusses in roof voids: Unit: m

The unit of measurement shall be the metre.

The tendered rate shall include full compensation to prepare existing top cords (where applicable) to receive one coat creosote. No distinction will be made for size, type, new or existing members. The rate shall also cover the cost for waste, all scaffolding, etc.

BB.08 Painting of existing members in overhangs: Unit: m

The unit of measurement shall be the metre.

Separate items will be listed for paint and/or creosote as specified.

The tendered rate shall include full compensation to prepare existing overhangs to receive paint or creosote as specified. No distinction will be made for size of existing members. The rate shall also cover the cost for waste, all scaffolding, etc.
TECHNICAL SPECIFICATION

BC WATERPROOFING OF CONCRETE ROOFS

CONTENTS

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BC 02 STANDARD SPECIFICATIONS
BC 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS
BC 04 DETAIL OF REPAIR WORK
BC 05 MAINTENANCE
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BC 01 SCOPE

This Specification covers the repair/replacement of existing cement screeds and waterproofing, including all sundries, the removal of waterproofing and the supply, delivery, installation of new cement screeds, waterproofing and sundries for various types of concrete roofs.

Waterproofing shall mean the work to be carried out to repair/replace and maintain waterproofing materials and components such as the repair/ removal and maintenance of existing cement screeds and waterproofing and the installation of new cement screeds and waterproofing. This Specification does not include work related to concrete work, plastering, gutters and down pipes specified elsewhere.

The complete scope of the repair work shall be as described in BC 04: Detail of repair work.

Maintenance of this part of the installation shall be performed in accordance with Additional Specification SA: General Maintenance, and the specific REQUIREMENTS included in this Technical Specification.

BC 02 STANDARD SPECIFICATIONS

BC 02.01 GENERAL STANDARD SPECIFICATIONS

The latest edition, including all amendments to date of the following Specifications, publications and codes of practice, shall be read in conjunction with this Specification and shall be deemed part to form part thereof.

OW 371 Specification of Materials and Methods to be used (Fourth revision, October 1993)
SANS 10021 SANS code of practice: Waterproofing of buildings.

BC 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BE: Floors
Technical Specification BF: Structural concrete

Oshoek Nerston, Josafsdal & Waverley follow on
BC 03 VARIATIONS AND ADDITIONS TO STANDARDS SPECIFICATIONS

BC 03.01 ADDITIONAL REQUIREMENTS FOR REPAIR OF WATERPROOFING ON CONCRETEROOF

BC 03.01.01 Introduction

Section 6 Parts 6.4.1, 6.4.2 and 6.4.4 of CW 371 shall be adhered to when open concrete roofs are waterproofed. Existing waterproofing that leaks shall be replaced.

BC 03.01.02 General

Waterproofing materials shall be transported, handled and stored with care and laid strictly in accordance with the manufacturer’s instructions. A clean, dry, smooth, firm and structurally adequate base with a fall of at least 1 in 50 (depending on the material selected) is required, with drainage to gutters and/or rainwater outlets on roof edges, as relevant. Attention shall be given to the detailed design of openings, projections, gutters, down pipes and finishes to make adequate provision for run-off water and to minimize blockages.

Corners and edges shall be covered or angle-rounded. Run-off over the edges of slabs shall be eliminated as this causes stains to the building. Fillets of 75 x 75 mm shall be provided at upstand corners.

The necessary gradient for waterproof membranes are normally provided on top of structures in low-density screeds and then finished, if necessary, with a cement/mortar topping. Screeds and toppings shall be of sufficient quality to provide a firm base. The following screed characteristics are suggested for waterproofing purposes:

(a) Compressive strength of at least 25 MPa at 28 days;
(b) Steel-trowel finish (light);
(c) Drying shrinkage of less than 0.2 % when tested in accordance with the testing conditions specified in SANS 836;
(d) Minimum screed thickness of 40 mm;
(e) Maximum moisture content of screeds:
   (i) Applications with a density of less than 500 kg/m³ 10 %
   (ii) Applications with a density exceeding 500 kg/m³ 7 %.

The screed should be cast or sawn into panels that do not exceed 9 m² to cater for drying shrinkage and to control cracking.

BC 03.02 MATERIALS

The more commonly used waterproofing materials are listed below, as well as some general comments on these materials. It is suggested that the manufacturers be consulted with regard to specific products. The Engineer’s approval of the selected product shall be obtained prior to ordering.

Be 03.02.01 Bituminous materials

(a) Polymer-modified bitumen membranes
(b) Reinforced bitumen emulsions
BC 03.02.02 Plastomeric membranes

Plastics such as polyvinyl chloride (PVC) are applied as single-layer systems and are loose-laid or fully bonded. A high degree of skill is required for the laying of these membranes.

BC 03.02.03 Reinforced liquid applied systems

Membranes based on acrylic polymer (or modified acrylic polymers) binders, reinforced with woven polyester or polypropylene fabrics perform well as waterproofing membranes and are durable. These fully bonded systems require detailed Specifications and strict supervision during application to prevent malpractice.

BC 04 DETAILS OF REPAIR/WORK

The Schedule of Quantities indicates approximate quantities of work. Detailed instructions will be issued during construction.

BC 05 MAINTENANCE

Note: There will be no maintenance work required for waterproofing of concrete roofs in this contract.

This Specification shall be read in conjunction with Additional Specifications SA, General Maintenance.

All components that form part of the waterproofing of concrete roofs shall be maintained during the maintenance phase of the Contract.

Maintenance shall include all repair work, replacing of components, routine inspections, repairing of defects or other actions or rectifying measures required to maintain the perfect functional condition of waterproofing on concrete roofs in accordance with the operation and maintenance manuals and as specified. All roofs shall be kept leak-free and watertight.

Maintenance of the waterproofed concrete roofs shall include all related actions such as replacing/repairing loose and blistering waterproofing, including cracked waterproofing membranes, loose seams, painting of waterproofing membranes, and cleaning and removing rubbish from waterproofed concrete roofs.

Remuneration for maintenance of the complete waterproofing of concrete roofs shall be deemed included in the tendered monthly payment for the maintenance thereof.

BC 06 MEASUREMENT AND PAYMENT

BC 01 MEASUREMENT AND RATES

BC 01.01 General inclusion of costs

Notes:

New waterproofing material scheduled shall be deemed to include all preparation of existing concrete or waterproofed areas and jointing of new to existing material. Where new material is to join existing material, the new material shall be of the same type and system as the existing waterproofing system. All waterproofing shall come with a ten year written guarantee for water-tightness and the cost of such guarantee shall be deemed to be included in the applicable tendered rates.

Oshoek, Nerslon Josafatdal & Wavenley follow-on
BC.02 SCHEDULED ITEMS

NEW WORK

BC.02.01 Approved waterproofing system to:

(a) Description of waterproofing system:

(i) Area of application or description of detailed item ... Unit: m², m³, number

The unit of measurement shall be the square metre, meter or number of areas or items waterproofed as specified and scheduled.

The tendered rates shall include full compensation for the supplying, delivering, storing on site, handling, moving, applying or installing and fixing the waterproofing system complete with all necessary sundry items such as formers, turn-ups or turn-downs, any flashing strips, dressing waterproofing around pipes and into outlets and channels.

The tendered rates shall also cover the cost for cutting and waste and for scaffolding, hoisting facilities, etc. All turn-ups and turn-downs will be deemed to be included in the area measured for the waterproofing and will not be paid for separately.

ALTERATION WORK

BC.02.02 Remove existing waterproofing and sundry items:

(a) Description of waterproofing material to be removed and location

Unit: m²

(b) Etc., for other material and locations

The unit of measurement shall be square metre of material removed.

The tendered rate shall include full compensation for the removing of existing waterproofing, flashing strips, sundry items, etc.

BC.02.04 Prepare existing surfaces:

(a) Prepare existing concrete surface to receive new screed as specified

Unit: m²

(b) Prepare existing concrete or screeded surface to receive new waterproofing system

Unit: m²

The unit of measurement shall be the square metre of the exposed surface prepared to receive the new screed or waterproofing material.

The tendered rates shall cover the cost for preparing the existing surfaces as specified and scheduled in (a) and (b) to receive new screeds or waterproofing.

BC.02.04 Roof screeds:

Unit: m²

The unit of measurement shall be the square metre of exposed surfaces to be screeded.

The tendered rate shall include all costs for supplying, delivering, storing on site, handling, etc., of the materials necessary for the screed, including mixing and laying of screeds to corrects and falls and forming of sundry items such as fillets, etc., complete.

The tendered rate shall also cover the cost for forming of screeds around outlets, waste, and of all scaffolding, temporary supports, hoisting facilities, etc.
BC 02.05  Repair bituminous based waterproofing system

The unit of measurement shall be the square metre of the horizontal and vertical surfaces of waterproofing repaired to the approval of the Engineer. All turn-ups and turn-downs will be deemed to be included in the area measured for the waterproofing and will not be paid for separately.

The tendered rate shall include all costs for supply, delivering, storing on site, handling, moving, installing and fixing the waterproofing system complete with all necessary sundry items, such as flashing strips, dressing waterproofing around pipes and into outlets and channels. The tendered rate shall also cover the cost of cutting and waste and for scaffolding, hoisting facilities, etc.
TECHNICAL SPECIFICATION

BO WALLS

CONTENTS

BD 01 SCOPE
BD 02 STANDARD SPECIFICATIONS
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BD 04 DETAIL OF REPAIR WORK
BD 05 MAINTENANCE
BD 06 MEASUREMENT AND PAYMENT

SO 01 SCOPE

This Specification covers the repair and maintenance of existing interior and exterior walls including all related building elements such as plastering, partitioning, wall tiling, windows, doors, etc. which form an integral part of an installation.

In determining the remedy for any repair work, the Engineer must take the climatic conditions in which all building elements have to function into consideration. Allowance should be made accordingly for the strength and durability of all components in relation to their purpose and application.

This Specification does not include any work related to paintwork as this is specified elsewhere.

The complete scope of repair work shall be in accordance with the section: Detail of repair work.

SO 02 STANDARD SPECIFICATIONS

SO 02.01 GENERAL STANDARD SPECIFICATIONS

The latest edition, including all amendments up to date of tender of the following Specifications, publications and codes of practice shall be read in conjunction with this Specification and shall be deemed to form part thereof. All other relevant and applicable SANS regulations are also to be considered as minimum requirements, and in particular SANS 10400: The Application of the National Building Regulations

OW 371 Specification of materials and methods to be used (Fourth revision, October 1993)
SANS 22 Glazed ceramic wall tiles and fittings
SANS 227 Burnt clay masonry units
SANS 545 Wooden doors
SANS 622 Gypsum cove cornice
SANC 680 Glazing putty for wood and steel sashes
SANS 727 Windows and doors made from rolled mill steel sections
SANS 10107 The fixing of glazed wall tiles
SANS 1236 Silvered glass mirrors for general use
SANS 1263 Safety and security glazing materials for buildings

SO 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BG: Metalwork
Technical Specification BH: Fittings
Technical Specification BJ: Paintwork
VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

ADDITIONAL REQUIREMENTS FOR REPAIR OF PLASTERED AND UNPLASTERED WALL SURFACES

Introduction

A detailed survey of all existing building elements may reveal the necessity for remedial work of varying degree. The Engineer shall make an assessment of all aspects that need to be addressed.

Plastering: General

All plaster shall comply with the REQUIREMENTS of SANS Standard Specification 523 and section 14 of OW 371. All plastering shall be painted in accordance with Technical Specification BJ · Paintwork, or tiled according to this Specification BD.

The Engineer shall inspect the plaster surfaces and establish which wall plastering must be repaired. Reasons for replacing existing plastering will include, but not limited to the following:

(a) Excessive plaster cracking
(b) Loose (delaminated) and spalling plaster
(c) Dusting
(d) Scaling and flaking
(e) Defective plaster mix

All chases shall be marked out in straight lines and neatly cut on either side of the recess for the pipe/conduit with an angle grinder. The width of the removed plastering must extend at least 30 mm beyond the edge of the chasing. Pipes or conduits shall be fixed before commencing grouting and plastering.

After the pipe has been put in place, the void shall be filled with a non-shrink cement grout of 60 MPa compressive strength at 28 days. The chases shall then be covered by fixing with shot-fired nails a weld mesh strip (30 mm longeway x 10 mm shortway x 0,5 mm thick expanded metal lath) before applying the final plaster.

Plastering: Wallsof wet areas

Where necessary, hack off and remove existing internal plaster to walls. The substrates must be prepared to be sound, free from cement, grout, laitance, loose or segregated materials, voids or flaws and substances that could interfere with bonding of the new plaster. This preparation work can be done by means of clipping away with a chisel, steel-wire brush and angle grinders to the satisfaction of the Engineer. Smooth concrete must be chipped mechanically to prepare for bonding of new plaster. Before plastering commences, the substrates must be well wetted with clean water.

Only approved ready-mixed or pre-mixed bagged plaster mortar with 10 MPa compressive strength or equivalent may be used for plastering. Mix a liquid waterproofing admixture in a dilution of one part by volume with ten parts by volume of clean water. The diluted admixture is added to the appropriate dry cement/sand mixture. The mortar shall be produced in such quantities that will be used within one hour after mixing. The finished plasterwork shall be of an even and smooth towel surface finish.

When dry, apply two coats of an approved water dispersed epoxy resin coating to the plastered surfaces of the walls that are to be painted.
SO 03.01.04 External plastering

The Engineer shall mark out areas that need to be renovated. The Contractor shall neatly cut with an angle grinder in straight lines the edges of the poor patches of plaster that must be removed.

The substrate of the brick walls must be prepared to be sound, free from cement grout, laitance, loose or segregated material, voids or flaws and substances that might interfere with the bonding of the new plaster.

The surface must not be powdery or crumbly, and must exhibit adequate tensile strength. The preparation work can be done by means of chipping away with a chisel, steel-wire brush and angle grinders to the satisfaction of the Engineer.

Smooth surfaces must be chipped to provide mechanical bonding for new plaster. Before plastering commences the substrate must be well wetted with clean water.

Only approved ready-mixed or pre-mixed bagged plaster mortar with 5 MPa compressive strength or approved equivalent may be used for plastering. The Contractor shall submit the design mix with the volume of water to be added to the mortar mix for approval by the Engineer. An approved bonding agent must be added to the mortar mix.

The mortar shall be produced in quantities that will be used within one hour after mixing. Care shall be taken not to mix old mortar into any new batch.

The finished plasterwork shall be of an even and smooth wooden trowel (surface finish with rounded edges at sharp corners) to the satisfaction of the Engineer. The plasterwork shall be cured for seven days by any approved method to prevent loss of moisture.

Three (3) test cubes per sampling shall be taken at a frequency for every 15 m² plaster area. Cube moulds for nominal size 100 mm complying with the REQUIREMENTS of SANS Method 863 must be used. Final instructions for sampling, moulding, cutting and testing will be issued to the Contractor on site.

SO03.01.05 Rough-cast plaster

Rough-cast plaster shall be applied in two coats. The undercoat shall be composed of one part cement and five parts sand finished with a wooden float. The finishing coat shall be composed of one part cement and three parts stone aggregate that will pass through a 4 mm sieve. The finishing coat shall be flicked on with a machine before the undercoat has set to obtain an even texture to match the existing rough-cast plaster.

Where the undercoat has already been plastered, the undercoat shall be prepared to receive the finishing coat. The surface of the undercoat plaster shall be chipped adequately to form a key and wetted before the finishing coat is applied.

SO03.01.06 Fine rough-cast plaster

Fine rough-cast plaster shall be as for rough-cast plaster but the finishing coat shall be composed of one part cement and three parts coarse sand.

SO03.01.07 Internal plastering

The surface of internal plaster shall be steel trowelled to a smooth, even and true finish. External plaster shall be finished to a true and even surface with a wood float. All plaster surfaces shall be free from blemishes, cracks, blisters or other defects. Plaster shall return into reveals and sofitts of openings, and all angles shall be true and straight with salient angles slightly rounded.
Plastering of a surface shall be executed in one operation, as no Joint marks will be allowed. Plaster on walls shall not be less than 12 mm or more than 20 mm thick and plaster on concrete shall be not less than 10 mm or more than 15 mm thick, except where specifically specified otherwise.

Only approved ready-mixed or pre-mixed bagged plaster mortar with 5 MPa compressive strength or approved equivalent may be used for plastering. The Contractor must submit the design mix with the volume of water that will be added to the mortar mix to the Engineer for approval.

SO 03.02 PARTITIONS

All internal non-load-bearing walls shall be inspected and the Engineer shall determine whether partitioning such as laminated plastic particleboard, polyester painted steel, vinyl clad gypsum panels or any other demountable partitioning should be replaced.

Where partitioning must be relocated or replaced, such new partitioning shall be non-combustible, provide acoustical privacy and comply with SANS 10400.

All new partitions shall assemble into a rigid structure and all units shall be readily removable from either side without disturbing adjacent units.

All exposed trims for doorframes, glazing and skirting are to be of aluminium, or alternatively be painted in accordance with Technical Specification 8J. Paintwork.

The type of boarding and jointing or cover strips shall be in accordance with the Schedule of Quantities.

SO 03.03 WALL CRACKS

Wall cracks shall be evaluated to determine the nature and severity of the occurrence of the cracks. The Engineer shall inspect all plastered and unplastered walls and identify the underlying factors causing cracks. Repairs shall be carried out in accordance with the Particular Specifications.

SO 03.04 FACE BRICKS

Face bricks shall be inspected for dirt, efflorescence, staining, oil, paint, lichens and mosses, water, smoke and soot, rust, or damage caused by chemical reaction.

Where efflorescence appears, light brushing and hosing down with clean water is recommended for most cases. The brickwork must be saturated with clean water before applying any chemical and washed down with clean water afterwards. Cleaning can also be achieved with scrubbing, water jetting with cleaning agents and soaps, etc. Staining caused by non-water-soluble salts, such as vanadium, manganese and iron, shall be treated as follows:

(a) Remove vanadium staining by washing the wall with a solution of 100 g to 1 litre of water using caustic soda. (Use the corresponding secondary potassium salts where available, as these will be less likely to cause visible secondary efflorescence.) If secondary efflorescence occurs, wash it off with clean water.

(b) Manganese stains must be removed using proprietary brand chemical compounds based on hydrochloric acid with modifiers and sodium fluoride. These solutions should be applied using full strength as recommended by the manufacturer.

(c) Where rusViron stains occur, wash the affected area with a solution of 50 g oxalic acid, 20 g sodium fluoride, 15 g citric acid in 1 litre of fresh, clean water. Apply the solution to a dry wall and leave it on the wall until the stain has
dissolved. Wash down using a solution of 50 g bicarbonate of soda in one litre of water.

External environmental stains and smears caused by soot, smoke, industrial pollution and spillage of oil, paint and other compounds, including micro-organic growths such as fungi, lichens and mosses on brickwork, must be identified and dealt with in an appropriate and approved way.

Care shall be taken to test the effect of some of the chemicals and compounds for possible harmful effects on the colours of the brickwork and on adjacent materials, as well as for possible toxicity to human, animal and plant life. All cleaning procedures shall be carried out with full knowledge of all the potential dangers to human and animal health, and the appropriate safeguarding and precautionary measures shall be put in place.

**APPLICATION OF SILANE SILOXANE BASED WATER REPELLENT IMPREGNATION**

The surface to be treated shall be clean, sound and dry. It should be free from dust, dirt, loose particles and oily or greasy deposits.

The surface shall be dry to allow maximum penetration. No application shall be made for at least four days after rain.

In order to remove any loose particles, the walls shall be pressure-cleaned with water before application of the silane / siloxane based water repellent. After pressure cleaning of the walls, the walls shall be left to dry in sunny conditions for at least 4 days, and where dagha (cement) has come loose in the joints and left a void, dagha (cement) joint filling shall be prepared to match the existing colour and shall be replaced to match the existing. The Contractor shall submit a mix design of the dagha (cement) joint filling for approval before application.

The contractor shall arrange for walls to be inspected by the Engineer's Representative before application of the water repellent, but after pressure cleaning of the walls.

The water repellent should be applied by brush or through a low pressure knapsack sprayer. Application should commence from the highest point of the surface and work down the surface. Some run-down of the coating is permissible but should not exceed 250-300 mm. A second coat may be given but only after at least two hours drying time between coats.

Avoid working in full sunshine to achieve maximum penetration. Confine activities to the shadow side of the structures.

Application temperature shall be +/- 50 to +300, and shall not be applied if rain is imminent.

The penetrating silane / siloxane based water repellent shall be applied to cover 3 - 5 m² per litre per coat. The water repellent shall be applied in two coats.

The penetrating silane / siloxane based water repellent shall be applied in accordance with the instructions of the supplier.
WALL TILING

BO03.05

General

Tiling shall comply with the REQUIREMENTS of SANS Standard Specification 22 and section 15 of OW 371. The code of practice for the fixing of glazed wall tiles, SANS 10107 and the recommendations of the South African Ceramic Tile Manufacturer's Association (SACTMA) must be adhered to.

All tiled areas must be checked for damaged surfaces or to determine where tile adhesion to subsurface proves to be of non-satisfactory standard. In cases where tiled surfaces need to be redone, proper care shall be taken in removing all damaged tiles, as well as any adhesive remains on the subsurface.

Matching of existing size and colour should be pursued wherever possible.

BO03.05.02 Glazed wall tiling

White glazed tiles 150 x 150 x 5 mm thick, first grade, must be laid in a cement-based powder adhesive, strictly in accordance with the manufacturer's Specification. Drying periods for backgrounds and substrates must be strictly adhered to. All tiles must be correctly bedded. This can be achieved by using a 6 mm square notched trowel to spread the fixative to the required thickness of 6 mm. Bed the tiles dry and move them firmly into position, ensuring that they are in proper overall contact with the bed and form an even surface.

A minimum of 2 mm grouting joints shall be allowed between tiles. Under no circumstances should the tiles be butt-jointed. Do not fill joints between tiles until at least 24 hours after the tiles have been bedded. Ensure that the joints are free of tile adhesive residue and any foreign matter. Fill joints with waterproofed white cement. Existing joints must be cleaned and refilled with new white cement.

BO03.05.03 Ceramic wall tiling

Glazed ceramic wall tiles 230 x 115 x 11.5 mm thick, with grade 1 acid resisting quality finish are to be used. Apply an approved epoxy grout into the tile joints and finish, off with a wetted nosing tool to a smooth glazed finish. Ceramic tiles include special tiles, such as bull nose and corner tiles. Repairs include replacing damaged tiles and pointing between tiles with an approved epoxy grout.

BO03.05.04 Corner protectors

Install 75 x 75 x 5 mm thick aluminium angle corner protectors to external vertical wall corners for protection with 8 mm diameter impact nails x 80 mm long @ 300 mm clc to a maximum height of 1.6 m. Seal the interface gap with approved silicone.

Install for abattoirs and dairy walls 75 x 75 x 3 mm thick stainless steel grade 304 angle corner protectors, polished to a No 2B finish with a grit 180, to external vertical wall corners. Fix the corner protectors with 8 mm diameter impact nails x 80 mm long @ 300 mm do to a height of 1.8 m. The interface gap must be sealed with an approved polyurethane sealant.

BO03.05.05 Expansion joints

Expansion joints for glazed wall tiling shall be provided at 3.5 m centres maximum (vertically and horizontally). The joints shall be 5 mm wide. Prepare the joints by cleaning them thoroughly. The joints shall be primed and sealed with an approved one component 5 x 5 mm white polyurethane joint sealant.

Expansion joints for ceramic wall tiling shall be provided at 4 m centres maximum (vertically and horizontally). The joints shall be 10 mm Wide maximum. Prepare the
joints by cleaning them thoroughly. The joints shall be primed and sealed with approved one component 10 x 10 mm white polyurethane joint sealant.

SO 03.06  WINDOWS

SO 03.06.01  General

All windows shall be inspected to assess the level of workability, paying special attention to hinges, handles, stays, catches, etc. Should any window be found unsuitable due to damage to the frame, opening section or any other part thereof, such window shall be replaced.

The Engineer shall take great care to make sure that the appropriate waterproofing details are applied strictly to ensure adequate protection against any water penetration.

EO 03.06.02  Steel windows

The Engineer shall inspect for any deficiencies in residential and industrial type steel windows and cell windows. Where necessary, windows shall be serviced and repainted in accordance with Technical Specification BJ: Paintwork.

BD 03.06.03  Burglar bars to steel windows

Where manganese bars are incorporated in the fixed mullions of the windows, this shall be done in such a way that the bars are not wider apart than 15 cm/centre. The bars shall have at least a section of 30 x 18 mm, penetrating at least 100 mm in the lintels and sills. Heavy duty burglar bars shall be 15 mm diameter or 12 mm square. Loose burglar bars shall be site welded to the window frames.

AO 03.06.04  Timber windows

All wooden Windows are to be inspected and treated according to the condition of the timber as stipulated in Technical Specification BJ: Paintwork.

Bo 03.06.05  Aluminium windows

When working with mortar or plaster great care shall be taken to protect all aluminium sections from staining by applying a film protector or motor oil on the aluminium surface.
BO 03.07 GLAZING

Cracked and broken glazing shall be replaced. The glazing and fixing of glass in buildings shall be carried out strictly in accordance with SANS Code of Practice 0132.

Care shall be taken to remove all chipped, flaked or damaged putty. The Engineer shall indicate on site which putty must be replaced.

All new putty shall comply with the requirements of the SANS Standard Specification 680. The putty shall be delivered on the site in sealed containers marked with the SANS mark.

Type I putty as specified shall only be used for glazing in wood sashes and Type II only in steel sashes.

Paintwork on putty shall not commence until putty has properly dried out, which may necessitate the addition of an accelerating agent. The Contractor shall therefore take programming of trades in Port of Entry areas into consideration.

BO 03.08 DOORS

General

All existing doors shall be inspected for the general condition and integrity of hinges, locking mechanisms, etc.

All steel doors shall comply with the requirements of SANS Standard Specifications 727 and 1129 and section 13 of OW 371.

All new external doors are to be fitted with 1Yz pair heavy duty hinges.

Door signage, such as door numbers, etc. shall be in accordance with Technical Specification BH: Fittings, and the Schedule of Quantities.

Special attention shall be given to the condition of striker plates and hinges that need to be replaced or properly secured where possible. Doors shall be painted to the requirements of Technical Specification BJ: Paintwork.

BO 03.08.02 Doors, sidelights and fanlights

All wooden stock doors shall comply with the REQUIREMENTS of SANS Standard Specification 545 and section B, clauses 8.33 and 8.34 of OW 371.

BO 03.08.03 Flush doors

The Contractor shall inspect all doors, internal and external. Where any door needs to be replaced, such door shall be a 40 mm thick solid laminated door as specified for interior or exterior use and shall be capable of withstanding the raking, deflection, puncture and moisture resistance tests for the desired application specified.

Unless otherwise specified, face veneer shall be rotary cut and shall be of the timber specified. Where doors are to be painted, shall be of timber suitable for painting. Painting shall be done in accordance with Technical Specification BJ: Paintwork, and the Schedule of Quantities.

Edge strips for concealing the vertical edges of doors shall be of the same timber as the face veneer, and for single doors and hinge edges of double doors not less than 10 mm thick, and for rebated meeting edges of double doors not less than 20 mm.
thick. The top and bottom edges of doors showing end grain shall be sealed with lacquer or other suitable material if the edges were disturbed in any way.

BD 03.08.04 Toilet doors in ablutions

Doors showing signs of erosion due to water penetration shall be either replaced or cut short 150 mm from finished floor level. If the existing semi-solid door panel is to be retained, it should be cut short 150 mm from the floor level. A 38 x 50 mm SAP insert must be glued and nailed in at the bottom edge. The steel frame must also be cut short and filled in with grout at the cut edges and fixed to the wall with 2 x 8 mm diameter heavy duty impact nails.

SO 03.09 IRONMONGERY

SO 03.09.01 General

All ironmongery shall comply with the REQUIREMENTS of section 11 of OW 371. All ironmongery shall be approved by the agent/representative before fixing. Articles shall be fixed with screws of similar metal and shall be eased, oiled, adjusted and left in perfect working order on completion.

All ironmongery shall be inspected to assess the level of workability, paying special attention to door handles, locks, door closers, door stops, door catches, fixing of these fittings, etc. Should any of these fittings be found unsuitable due to damage, corrosion, etc. they shall be replaced. Where existing holes in wood are worn out these holes must be plugged with wood to receive the screws.

Toilet doors in ablutions must be fitted with approved D-type natural anodised aluminium pull handles and 150 x 150 mm plate. Install 15 mm diameter concealed steel roller ball catch with chromium-plated striker plate with circular hole for roller ball catch. Fix this plate to door frame with two aluminium pop rivets.

BD 03.09.02 Door locks

Each lock shall be provided with two keys and no key shall pass a second lock. All mortice locks, mortice latches and night latches, rim and cylinder rim night latches, and escutcheon for locks shall comply with the REQUIREMENTS of the SANS. The Contractor shall supply all screws, etc. required for completion of the work.

BD 03.09.03 Cupboard doors

Where required according to the Schedule of Quantities, built-in cupboard doors in sleeping quarters are to be provided with 2 x angle iron sections of 35 x 80 x 3 mm thick X 10 mm diameter hole for a padlock that must be fixed to the inside of the cupboard door.

Locker doors shall be provided with a 50 x 50 x 5 mm thick mild steel angle x 10 mm diameter hole for a padlock site welded to the locker.

BD 04 DETAIL OF REPAIR WORK

The detail of the work is described in the Schedule of Quantities.

BD 05 MAINTENANCE

No maintenance will be required for walls under this contract.
BD 06 MEASUREMENT AND PAYMENT

BD 06.01 MEASUREMENT AND RATES

BD 06.01.01 General inclusion of costs and specific Specifications

Notes:

Where applicable, standard SANS 1200 measurement and payment items shall be used for Earthworks (Small Works) (1200 OA), Site Clearance (1200 C) and Concrete (Structural) (1200 G).

All material scheduled to be removed shall be deemed to be existing damaged materials in small or large sections. All such redundant material shall become the property of the Contractor and must be removed from site immediately.

All new material shall be deemed to be in patchwork and shall be of approved equal quality, colours, profiles, thickness, etc and shall in all cases match the existing materials and shall be fixed (internally or externally) to existing material, frames or surfaces.

All replacement, removal and repair work shall be done carefully as to not damage any adjacent or other material or work. Any damage to other or adjacent materials or areas caused by the negligence of the Contractor shall be repaired by him free of charge.

All work scheduled to be replaced shall be deemed to include for the careful removal of the damaged existing material as a whole or partly, as specified, for the cleaning and preparation of the remaining surface(s), frames, etc as well as for the new material scheduled or specified to replace the damaged material.

All work scheduled to be removed, hacked off, or taken out shall be deemed to include the cleaning and preparation of the remaining surfaces, areas where material were removed, or remaining work to receive new material or work specified.

Repair and service work shall also include all removing, cutting, grinding, cutting into, welding, bending, strengthening, drilling, tightening, fastening, oiling, greasing, adjusting and providing missing or damaged screws or bolts etc to repair and service or to improve the items or areas as new and to match the existing. The servicing of windows will be measured in number irrespective of the type of window or the amount of opening sashes present in the overall window size. The rates tendered for servicing of windows or similar items shall be deemed to include for servicing all opening sashes and the total overall frame. The rates tendered for servicing of doors or gates shall include the service of all locks, handles etc.

Work scheduled to be realigned and refixed shall be deemed to include all necessary new additional materials, brackets, connector plates, bolts, pipe rivets, nails, screws, spacer blocks, clamps, timber, and labour, etc to leave the items as new and totally functional.

All new work are measured net and shall include all cutting, lapping, waste, bending, fixing, corners, mitres, fixing screws, pipe rivets, nails, adhesive, grout, putty, etc as well as cleaning and preparation of surfaces not already prepared as part of removed items, etc. The supply and installation of new window handles, pegs, stays, etc as well as the service of windows shall include for sealing all bolts and screws of handles, stays, etc with epoxy after fixing or tightening into positions. The rates tendered for installation or replacement of burglar bars on window frames shall be deemed to include for installation or replacement of burglar bars on all opening windows on the total overall frame.
The removal of doors, gates or windows shall include for the removal of all existing locks, handles, striking plates, etc but exclude the hinges, etc which shall be used for the new replaced items. All repair work (excluding paintwork) around and in the thresholds of new door frames, gates or windows built into existing brickwork in new or existing positions shall be deemed to be included in either the rates tendered for the new replacement item or the removal payment item of the frame, window, etc.

The new doors to toilets and wet areas as specified shall be fitted with rubber door stops, D-profiled pull handle and backplate sets. 15mm roller ball catches with striking plates and all other ironmongery needed to install the doors complete. All new ironmongery shall be measured and paid for separately.

The new doors to offices, etc. as specified shall be fitted with rubber door stops, 4 lever mortice locksets with handle sets to match existing striking plates and all other ironmongery needed to install the doors complete. All new ironmongery shall be measured and paid for separately.

All ironmongery installed on the project shall bear the SANS approved trademark and codes. Samples of all ironmongery scheduled must be according to the samples of the Department of Public Works and samples must be handed to the engineer for approval before ordering the material.

All brickwork shall include for damp proofing membranes, galvanized brickwork reinforcement to every third course, wire ties and wall anchors as needed.

Tile work to walls shall include all cutting, spacers, waste, jointing mitres, corners, epoxy grout and joint filler.

Ordering of certain specified material i.e. NCI industrial type wall tiles needs special and urgent attendance and should be ordered timeously as to prevent any construction delays.

All new glass mirrors shall be silvered float glass copper backed mirrors with polished edges all round and shall, unless otherwise scheduled, be fixed to walls with chromium plated dome capped mirror screws with rubber buffers.

Specific Specification: Repairs to galvanised IBR roofs

Repairs to the workshops and store room roofs will include the following work and all work must be carried out in accordance with the Technical Specification SA. Roof Coverings.

(a) Inspect the roof for defects.

(b) Fasten loose nuts on hook bolts.

(c) Replace damaged and/or severely corroded washers (allow for ± 30% of all washers to be replaced). The remainder of the existing washers must be painted with an approved rust converter and a grey colour pure acrylic paint system.

(d) Insert sealer strips on all loose side laps.

(e) Stitch side laps together with Leak Plugs for ISR roof cladding (2 between every hook bolt: purlins are spaced at approximately 1.86 m c/c).

(f) Install new 0.8 mm thick apex trim at the workshops for the length of each bay size 616 mm girth (286 + 300 vertical + 20 + 10 vertical) with Craft-Lock type apex trim fixing brackets. The apex trim 4 x bend (1 is a shallow bend) and fixed to roof sheeting with stitching screws and washers, and to 250 mm vertical x 140 mm (at slope) x 25 mm wide x 2.5 mm thick with 25 mm lip galvanised bracket. The galvanised bracket to be screwed and fixed to roof cladding in.
trough with 2 galvanised gutter bolts. The spacing of the brackets is 1029 mm
150 mm overlap fixed and sealed with 2 rows of pop rivets and 2 rows of
silicone. Bend up trough to form dam

(g) Slide wall flashings. Inspect existing flashings. All loose flashings must be
sealed with two rows of silicone and stitched together with no 10 stitching
screws. Counter flashing to be sealed with silicone in brick wall. Existing sealant
to be removed. Prepare groove to manufacturer’s Specifications to receive new
joint sealant.

(h) Ridge flashings. Inspect existing flashings. All loose flashings must be sealed
with two rows of silicone and stitched together with no 10 stitching screws

(i) Holes (small diameter) in cladding to be sealed with Leak King plugs.

U) Replace existing galvanised gutters and down pipes with new 125 x 100 x 0.8
mm thick Chromadeck gutters with 100 x 100 x 0.8 mm thick Chromadeck
rainwater down pipes spaced at approximately 6 to 7 m intervals

Specific Specification: Repairs to concrete gutter at workshops

(a) The existing ± 305 mm x 400 mm deep concrete box gutters must be waterproofed
With a fully bonded waterproofing system to Technical Specification BC;
Waterproofing. Prepare the existing cement screed surface by cleaning it and
replacing decayed cement screed with new screed. The waterproofing
membrane must be draped over the top ends of the concrete upstand beams of
the gutters and down into down pipes. All sharp concrete corners must be
chamfered adequately to suit waterproofing membrane requirements.

(b) The existing expansion joints in the box gutter must be cleaned and prepared to
receive joint sealant. The edges of the concrete must be chamfered to comply
with waterproofing manufacturer’s requirements. Insert 35 mm diameter
“Cordex” or equivalent approved backing cord for 25 mm wide joint. Prime joint
and seal joints with 25 mm wide x 15 mm thick approved poly-urethane joint
sealant applied strictly according to manufacturer’s Specifications. The top-
surface of the joint sealant must be recessed adequately into joint to allow for a
closed cell polyethylene foam strip that will accommodate movement of the
waterproofing membrane.

Dressing to expansion joint will comprise of additional strips of reinforced
waterproofing membranes that are lapped and sealed to manufacturer’s
specifications. The Contractor must submit detail for approval to the Engineer
prior installation.

Specific Specification: Repairs to roller shutter doors

(a) Replace the whole bottom T-bar including the bottom ± 17 galvanised slats of the
existing roller shutter doors with a new galvanised T-bar (bottom rail) with
neoprene weather strip. The Contractor must measure the width of the door
(approximately 3000 mm) and the opening width of the shutter door prior
ordering the new bottom T-bar and new galvanised slats (± 76 mm high x 1.2
mm thick). When the new bottom T-bar has arrived on site, the Contractor must
remove the existing bottom T-bar and slats and slide in the new T-bar and slats.

(b) Provide and insert end locks on the ends of door curtains.

(c) Repairing shall include fixing of missing bracket bolts, screws and pins, brackets,
 fittings such as locks, loose ratchet and pawls, and brackets. Loose bracket bolts
that have broken out of walls shall be replaced with 175 mm long x 12 mm
diameter threaded rods that must be anchored to the walls with an approved
epoxy grout.
(d) Repairing bent and fixing of damaged steel plates of canopy covers
(e) Repairing gearbox, gear handle, drive shaft, pinions and bevel gears

Specific Specification: Servicing and adjustments to roller shutter doors

(a) All other door components shall be serviced, adjusted, repaired and replaced, but not restricted to for the full repair of the complete door installation to a smooth working condition. The door sizes is approximately 3000 mm wide x 3500 mm high. The existing interlocking slats are 76 mm wide.

(b) Servicing shall include cleaning and Oiling of hinges, rollers, bearings, gears, channel guides and locks. Interlocking slats of the roller shutter curtains shall only be washed with a high-pressure water jet and detergent to remove all dirt, grease, etc.

(c) Adjusting, fixing and realigning of door guides. The existing channel guides, approximately 76 mm wide shall be bent straight to allow free and smooth movement of the roller shutter door slats. The Engineer shall give the necessary instructions where severely damaged channel guides must be replaced.

(d) Adjusting and balancing torsion springs, barrel collar and counter balance

Specific Specification: Welding of thin steel plates

Thin steel plates covering the external side of doors must be welded to the door frame members. The existing paint must be removed from the welding areas prior to site welding. A coded or experienced welder must submit the proposed welding procedure to the Engineer for approval. The aim of the site welding is two fold, viz. to fix the steel plate to the frame and secondly, to prevent water ingress into the inside of the door. The perimeter of the individual plate sections of the door must be sealed with continuous impervious welds.

BD 06.02 SCHEDULED ITEMS

NEW WORK

BD.01 Doors and windows:

(a) (Type of doors, windows, locks, etc and material indicated):
   (i) Description of item...
      Unit number

The unit of measurement shall be the number of doors, windows, locks, etc installed complete as specified.

The tendered rates shall Include full compensation for the manufacturing and installation of the steel doors, windows, locks, frames, etc complete with hinges, handles, locks, barrel bolts, retaining devices, door stops, stays and any other work as specified necessary to complete the work scheduled or as shown on the Drawings. The tendered rates for windows shall also include full compensation for glazing, window sills and damp-proof sheeting as specified or to match existing.

Maseru Bridge Port of Entry: Technical and Particular Specification
BO.02 Wall panelling:

(a) Description of material to be used:

(i) Description of item and/or position to be fixed

Unit: m, m², number

The unit of measurement shall be the number, metre, etc for each item as scheduled.

The tendered rates shall include full compensation for all costs of material, waste, labour, plant, transport, delivery, access, scaffolding, fuel, etc to install the material as specified and to match the existing to the Engineer's approval.

BO.03 Joinery:

(a) Items measured by number:

(i) Doors, etc (type and size indicated)  Unit: number

(ii) Etc for other items measured by number

(b) Items measured by linear metre:

Unit: m

(i) Skirting, etc (type and size indicated).  Unit: m

(ii) Etc for other items measured by length

(c) Items measured by area:

(i) Eaves covering, etc (type and thickness indicated)

(ii) Etc, for other items measured by area

The units of measurement shall be the number, metre or square metre of each type and/or size of joinery item specified.

The tendered rates shall include full compensation for the supply of all materials, manufacture, cutting, waste, fixing and installation of the joinery items.

BO.04 Ironmongery, steelwork, glass, wall finishings, etc:

(a) Measured by number:

(i) (Description of item)  Unit: number

(ii) Etc

(b) Measured by linear metre:

(i) (Description of item)  Unit: m

(ii) Etc
(c) Measured by area

(i) (Description of item) Unit: m²

(ii) Etc
The unit of measurement shall be the number, metre or square metre as applicable to each item.

The tendered rates shall include full compensation for manufacturing, providing and installing each item to new or existing steel, wood or plaster complete as per Specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material, waste, plant, transport, delivery, access, scaffolding, fuel, etc to the Engineer’s approval.

ALTERATION WORK

BO.05

Alterations and repairs to existing structures:

(a) Indicate if repairs, replace, alterations, removal or sealing, etc:

(i) Description of individual items to be repaired.
   altered, removed, sealed, etc  ...  Unit: m³, m², m, number

The unit of measurement for items repaired, replaced, altered, removed, sealed, etc shall be the cubic metre, square metre, metre or number for each item as scheduled.

The tendered rates shall include full compensation for all costs to repair, replace, refix, remove, cutting into, re-align, taking off, temporary store, etc as specified in the Standard and Technical Specifications and shall allow for all necessary labour, plant and new material needed to do the specified work and to leave the scheduled items as new and to the approval of the Engineer. Refer also to the general inclusion of costs in SD 06.01.01.
TECHNICAL SPECIFICATION

FLOORS

CONTENTS
BE 01 SCOPE
BE 02 STANDARD SPECIFICATIONS
BE 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS
BE 04 DETAIL OF REPAIR WORK
BE 05 MAINTENANCE
BE 06 MEASUREMENT AND PAYMENT

BE 01 SCOPE

Floors shall mean the scope of work to repair and maintain materials and components such as removal of existing floors and installation of new floor coverings, skirting, screeds, concrete floors and paving. This Specification does not include work related to metalwork and paintwork, which are specified elsewhere.

This Specification covers the removal of existing floor coverings, screeds and concrete surface beds, the repair of existing floor coverings, screeds and concrete surface beds. This Specification also covers the supply, delivery and installation of new floor coverings, screeds and concrete surface beds for various types of buildings.

The complete scope of repair work shall as described in BE 04: Detail of repair work

BE 02 STANDARD SPECIFICATIONS

BE 02.01 GENERAL STANDARD SPECIFICATIONS

The latest edition, including all amendments up to date of tender of the following Specifications, publications and codes of practice shall be read in conjunction with this Specification and shall be deemed to form part thereof:

OW 371 Specification of Materials and Methods to be used (Fourth edition, October 1993)
SANS 281 Hardwood block and strip flooring
SANS 581 Semi-flexible vinyl floor tiles
SANS 786 Flexible vinyl flooring
SANS 978 Wood mosaic flooring
SANS 10070 The laying of thermoplastic and similar types of flooring
SANS 10043 The laying of wood floors
SANS 10186 The laying of textile floor coverings
SANS 1449 Ceramic wall and floor tiles

BE 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BF: Structural concrete
Technical Specification BG: Metalwork
VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

ADDITIONAL REQUIREMENTS FOR REPAIR OF FLOORS

Floor cove rings

Existing floors shall be inspected to determine the extent of any damaged floor areas. The existing floors and other building elements shall be protected from damage during the progress of any repair work and on completion shall be cleaned and handed over in a perfect condition. Only skilled workmen experienced in laying any type of floor finishes shall carry out the work.

Preparation of floor slab and surface beds for new floor screeds

The existing concrete screed shall be removed in patches designated by the Engineer.

All laitance on the surface of the existing surface bed must be removed completely. Mechanised plant such as scabblers or abrasive blasters must be used. The Contractor shall take all necessary precautions to keep dust pollution to a minimum inside the building during the breaking out and removing of existing concrete screeds, as well as during the preparation of the existing concrete surface bed.

After the mechanical cleaning of the slab surface to expose the coarse aggregate, all dust and debris must be removed, and the surface must be thoroughly wetted and kept wet for at least 12 hours before application of the new concrete screed.

Surface preparation of existing floor screeds for new floor coverings

The following procedure is suggested where vinyl tiles were laid with bitumen adhesive:

(a) The Engineer will specify the where existing vinyl tiles are to be removed.

(b) The bitumen must be removed mechanically and/or chemically. Remove as much bitumen and other contamination as possible by scraping. Bitumen can be heated to soften it.

(c) Sweep or vacuum sub-floor thoroughly to remove dust and grit.

(d) An approved solvent based degreasing and cleaning compound can be used to remove the bitumen chemically. The Contractor shall ensure the safety of the workers and the building against possible fire.

(e) The concrete surface must be smoothened. Even the surface with Pavelite or approved equivalent before laying the new vinyl tiles. The Pavelite must be applied in accordance with the manufacturer’s Specifications.

(f) Vacuum clean the floor surface again before the adhesive is applied to lay the vinyl tiles.

Cement screed

Cement screed shall be carried out in accordance with clause 14.18 of OW 371. The Engineer shall determine which existing cement screeds are to be replaced. The cement screed shall have a maximum thickness of 30 mm. Where required the cement screed shall be modified with an approved alkali compatible acrylic emulsion by preparing the cement screed with a mixture of the latex and water in the required ratio.
Before the new screed is applied, remove all surface water from the slab. Apply a bond coat to the slab/surface bed consisting of a 1:1 mix of cement and clean fine sand with just enough water to provide the consistency of slurry. Mix in equal parts an approved alkali compatible acrylic emulsion specially modified for use in cement mortars with water, and add Portland cement to form the slurry. Spread the bond coat evenly using a stiff fibre brush. Do not leave standing pools. Place screed in good time (before the bond coat dries out). The screed must be laid and compacted in one layer.

Curing should commence as soon as the finishing operations have been completed and should be continued for at least 7 days. The Engineer must approve the method of curing.

Joints must be formed in the screed at all existing contraction and expansion positions, as well as at intermediate positions at 3 m spacing maximum.

**BE 03.01.05 Concrete screeds**

(a) General

Concrete screeds shall have a minimum thickness of at least 50 mm. The Engineer shall determine the areas of which the concrete screeds need to be replaced.

Only ordinary Portland cement, CEM 1 42.5 in accordance with SANS ENV 197-1, shall be used.

Coarse aggregate maximum size: 10mm

28-day cube strength: 35 MPa

The use of an approved plasticizer is recommended to reduce the water content of the mix to the absolute workable minimum.

The mix design must be submitted to the Engineer in advance for approval.

Four sets of six test cube samples shall be taken for every factory for the testing of the compressive strength of the concrete.

(b) Concrete floor hardener

Concrete natural non-ferrous aggregate floor hardeners shall strictly be applied in accordance with the manufacturer’s Specification and under his supervision.

Note: The Contractor shall furnish a certificate of compliance, together with a written guarantee after completion.

(c) Compressivestrength

At 7 days: 50 MPa
At 28 days: 70 MPa

All other aspects of the construction of new concrete screeds shall be adhered to as specified in Technical Specification BF: Structural concrete.

**BE 03.01.06 Laying of material (ceramic excluded)**

The laying of vinyl and similar flooring material in tile and sheet form and the fixing of plastic skirting, nosing, etc., shall be carried out in accordance with SANS 1043 and section 10, clause 10.3 of OW 371.

The laying of wood block and wood mosaic flooring shall be carried out in accordance with SANS 1043 and section 10, clause 10.2 of OW 371.

The laying of textile floor coverings shall be done in accordance with SANS 10186.
Vinyl floor tiles shall be laid with continuous joints in both directions. Tiles shall be cut with a “jointer” at saw and expansion joints. Tiles laid over these types of joints will not be permitted. Only latex-resin type adhesive shall be allowed to glue tiles to the concrete screed or surface bed.

BE 03.01.07 Granolithic screed finish

Granolithic screed finish to floors, treads of steps, thresholds and similar surfaces, unless otherwise specified, shall not be less than 25 mm thick. The granolithic screed shall be composed of three parts granite, or other approved hard stone chips, or approved hard, coarse sharp washed granite or quartzite sand, half part clean sand and one part of cement, hand or mechanically troweled to a true and smooth surface. No dry cement powder, grout or wet slurry mix shall be applied to the surface.

New granolithic screed shall be laid before the concrete surface bed or floor matures in order to allow for proper binding. If this is not possible, then the top of the surface bed or floor shall be hammered, chipped and then cleaned with a wire brush and a coat of neat cement grout applied immediately before the granolithic is laid.

The granolithic shall be laid in panels not exceeding 6 m² in area and jointed to lines of panels with V-joints. The joints between the panels shall coincide with joints in the concrete surface bed or floor.

Granolithic finish to stair nosers, sides of curbs and other vertical surfaces shall, unless otherwise specified, not be less than 12 mm thick.

All granolithic work shall be done by experienced workmen only and shall be protected from damage caused by rain or other extreme weather for 12 hours after being laid. Protection shall be provided against too rapid drying whilst hardening by means of covering with wet sacks or other suitable material. The screed shall also be protected from damage and discoloration during the progress of the remaining work.

Edges of granolithic floor butting against different floor finishes and edges of margins, etc., shall be true and sharp and shall be protected by fixing temporary wood strips which shall remain in position until the laying of the adjoining floor has commenced.

Where a non-slip granolithic floor finish is required, the granolithic shall be laid as specified above. Alundum grit shall then be sprinkled over the surface at the rate of 1 kilogram per square meter, lightly tamped in and allowed to set.

BE 03.01.08 Vinyl floor finishes

Existing floors should be inspected and where vinyl tiles need to be replaced, such tiles shall comply with the REQUIREMENTS of SANS 786, and be 300 x 300 x 2 mm thick unless otherwise specified. The flooring shall be of marbled pattern and of an approved colour (to be specified by the Engineer).

Vinyl floor tiles or sheets shall be laid with an adhesive recommended by the manufacturer. All the preparation and work in connection with the laying and fixing of the specified flooring and vinyl skirting shall be done in accordance with SANS 1070 and to the satisfaction of the Engineer.

The flooring shall, where necessary, be cut and neatly fitted against adjoining floors, thresholds, etc. Where required the Contractor shall carefully remove existing timber floor skirting and/or quarter rounds for re-use where vinyl tiles are laid against walls. Reinstall skirting and/or quarter rounds.

Vinyl floor tiles shall, unless otherwise specified, be laid with continuous joints in both directions and vinyl floors shall, unless otherwise specified, be in standard widths with cut sheets at sides of floors as necessary, all to the entire satisfaction of the Engineer.
The vinyl flooring and skirting shall be covered up and protected from damage during the progress of remaining work and on completion be cleaned and, unless otherwise specified, polished with the type of polish recommended by the manufacturer of the vinyl flooring.

BE 03.01.09 Skirting

Loosened hardwood skirting must be cleaned and where necessary removed and/or replaced by 76 x 19 (or 25 mm) mm thick hardwood skirting with one rounded top edge plugged to the wall. Painting shall be in accordance with Technical Specification 8J: Painting.

In selected areas skirting shall be 100 mm high x 6 mm thick unglazed ceramic tiles glued to walls with an approved cement grout. The Engineer shall specify these areas.

Vinyl cove skirting shall be of approved manufacture and colour and unless otherwise specified be 70 mm high.

BE 03.01.10 Sealing of vinyl flooring

The newly laid tiles shall, after four days, be scrubbed with a diluted neutral detergent/stripper complying with SANS 825 and rinsed thoroughly. After the floor has dried, apply two coats polymer/ acrylic sealer combination containing a minimum of 22 % solids using an applicator pad. Ensure that the surface has set hard before allowing traffic on the floors.

BE 03.01.11 Wood block floors

(a) Replacement of wood block floors

Where required, wood blocks that must be replaced shall, unless otherwise specified be Clear Grade, Class H with nominal sizes of 75 mm wide, 225 mm long and 20 mm thick, and shall comply with the requirements of SANS 281. Wood blocks that are loose must be re-laid using an approved hot or cold adhesive after the old bitumen has been removed and the surface prepared.

The moisture content of the blocks shall be as specified in the above-mentioned Specification, and the blocks shall be treated with timber preservative as specified. The blocks shall, unless otherwise specified, be laid to a basket pattern with an approved hot or cold adhesive and shall be sanded on completion all in accordance with the SANS Code of Practice. SANS 1043 and to the satisfaction of the Engineer.

Wood block floors shall be covered up and protected from damage during the progress of the remaining work, and unless otherwise specified, a sealer shall be applied to the final sanded surface and then polished all in accordance with the above-mentioned Code of Practice.

(b) Partial repairs to parquet floors

Only severely loose wood blocks identified by the Engineer shall be repaired. The Contractor shall carefully remove the wood blocks for re-use. Scraping and any other suitable means shall be used to remove the old bitumen. The concrete surface bed or cement screed shall be cleaned from dust and bitumen residue as specified in BE 03.01.02. If the concrete or cement screed is in a poor condition the poor patches shall be removed according to BE 03.01.04. The Contractor will be allowed to use rapid hardening cement grouts to reduce drying time of concrete and cement screeds in order to suit the working programme. The screeds must be laid at such a level as to enable the workman to lay the cleaned wood blocks at the same level as the surrounding wood flooring blocks. The cleaned blocks shall be laid in a basket pattern (or
BE 03.01.12 Sealing of timber floors

Existing timber floors must be mechanically belt-sanded to remove all traces of existing sealer in strict compliance with SANS 1043. Where necessary, existing flooring, skirting and quarter rounds should be temporarily removed. Before applying the new wooden floor sealer, ensure that the surfaces are dry, sanded smooth and free from varnish or oil. Vacuum the dust from the prepared floor surfaces.

Apply three coats of clear, lead-free wooden floor sealer with preservative and anti-fungal properties according to the manufacturers’ specification.

Apply the first coat until an even glossy, wet surface is achieved. Leave to dry thoroughly. Apply at least two other coats in the same way, and finally a fourth and final coat. It is proposed that the Contractor first do a trial section to satisfy himself that he can handle this procedure. The final appearance of the wooden floor must be smooth and have a uniform non-gloss finish.

Reinstate skirting and quarter rounds.

BE03.01.13 Tiling (general)

Tiles shall be solidly bedded and jointed in cement mortar and, unless otherwise specified, joints shall be 6 mm wide.

The joints in all tiling are to be continuous in both directions. The pointing is to be carried out by well pressing in half-dry cement mortar. Under no circumstances may liquid cement grout be used for pointing.

All tiling shall be properly covered and shall be protected against any possibility of staining, discolouring or any other damage.

At completion, all tiling is to be exposed, checked for damage, repaired where necessary and cleaned off with soft soap and cold water and left in a perfect condition. The application of oil on tiling is not allowed.

BE03.01.14 Ceramic and quarry floor tiles

(a) General requirements

The Engineer shall determine which tiles need replacement. The existing floor screed and floor tiles must be removed in patches and/or areas as determined by the Engineer.

Ensure that the base for floor tiling is rigid, stable and level unless required to have a fall in one or more direction(s). The surface preparation and cement screed (if required) are described in BE 03.01.03 and BE 03.01.04 respectively. When proprietary brand adhesives are being used for fixing ceramic floor tiles it is essential that the surface to which the tiles are to be fixed is clean, dry, flat and true.

Lay approved unglazed ceramic split floor tiles (230 x 115 x 11.5 mm thick and of a selected or matching colour) in professional floor grouting with 8 - 10 mm wide joints. The floor grout must be applied with a 10 mm square notched floor trowel evenly over an area not exceeding 1 metre at a time. Coved skirting tiles including external and internal skirting corners must be laid against walls in abattoirs. Setting out must be done correctly. The finished installation must be level plumb and true unless specified otherwise. In abattoirs the floor tiles must be laid to specified falls.

Maseru Bridge Port of Entry: Technical and Particular Specification
Mortar beds for dust-pressed tiles and quarry tiles shall be formed with a slurry of 1:1 cement and clean fine sand to a thickness of about 3 mm on an area not exceeding 1 metre at a time. The joints will be 6 - 8 mm wide depending on the size of the tile.

The tiles must be laid in professional cement-based powder adhesive, strictly in accordance with the manufacturer's Specifications. The Code of Practice for the fixing of tiles in accordance with SANS 1449 and the recommendations of the South African Ceramic Tile Manufacturer's Association (SACTMA) shall be followed. Important points to be taken into consideration are summarised below:

(i) Sufficient time must be allowed between building operations.
(ii) Drying periods for backgrounds and substrates must be strictly adhered to.
(iii) No tiling may commence prior to the prescribed time.
(iv) All tiles must be correctly bedded. The tiles must be properly bedded into a fixative that is spread evenly to the required thickness using a square notched rubber mallet (10 mm for ceramic tiles). Bed the tiles dry and move firmly into position, ensuring that they are in proper overall contact with the bed, and form an even surface.
(v) A minimum of 6 - 10 mm grouting joints must be allowed between extruded and split tiles (3 mm minimum for pressed tiles). Ensure that the joints are free of tile adhesive and any foreign matter.
(vi) Tiling installation Setting out and finished installation must be done correctly.

(b) Filling of Joints

Do not fill joints between tiles until at least 24 hours after the tiles have been bedded. Before applying the joint epoxy grout ensure that the joints are free of tile adhesive residue and any foreign matter. Apply the approved epoxy grout into the tile joints. The finishing-off must be completed with a wetted nosing tool or spatula so that a smooth glazed surface finish can be achieved. Application of the epoxy grout must be done strictly in accordance with the manufacturer's Specifications. Finally, the tiles must be thoroughly cleaned.

BE03 01.15 Movement of Joints in tiling

(a) General REQUIREMENTS

Movement joints are to be provided in tile work due to moisture expansion, thermal expansion and contraction, and crack control at existing expansion joints in the surface bed.

(i) Provide movement joints in the tile work, screed and bedding down to the concrete surface bed or slab. The spacing of these joints depends on the position of existing joints, column and wall layouts and slab thickness. The maximum spacing of joints should be limited to 30 times the slab (surface bed) thickness or 4.5 m, whichever is the lesser. The length-to-width ratio of tile panels should be limited to between 1.0 and 1.5.
(ii) Provide isolation joints around the perimeter of the floor, around columns, walls and other fixed structural elements.
(iii) Joints shall be aligned with no offsets. Irregular shape tile panels must be avoided. Where included angles are unavoidable, it should be less than 60 degrees.
(iv) The width of the joint shall be 6 mm minimum and 10 mm maximum. Provide an approved closed-cell expanded polyethylene foam joint filler with a hinged temporary blocking piece in the movement joints. The size of the blocking piece must be the same as the joint width.
(b) Joint sealing

The joints shall be prepared and primed prior the application of the joint sealant.

The liquid sealant in joints shall be an approved one part grey polyurethane sealant with a shore hardness of A45 and an elongation of 400%. The manufacturers Specifications must be strictly followed.

(c) In abattoirs

Clean and dry all tile surfaces. All loose material must be removed by means of a wire brush or by water while all tile adhesives are cleaned from the edges of the tiles.

Ensure that all traces of release agents, curing compounds and existing joint sealant compounds are removed. Install a suitable closed-cell expanded polyethylene bond breaker cord in the expansion and isolation joints after which the complete substrate is primed with a component solvent free primer which penetrate into the tile and pull all dust particles with it. Proceed with the final application of an approved one part grey polyurethane sealant with a shore hardness of A45 and an elongation of 400%. The manufacturers Specifications must be strictly followed.

BE 02.02 PAVING

Repairs to paving shall include the improvement of existing paving, drainage channels and the replacement of paving that can not be repaired. Different paving types exist e.g., concrete, precast paving segmental and regular blocks, bricks and slasto. This Specification only covers pedestrian paving around buildings.

The Engineer shall identify the paving areas that are to be repaired. Defects to paving will include but not be limited to the following aspects:

(a) Failure of subbase material and subsidence of sub-soil due to excessive water erosion;
(b) Broken and severely damaged paving;
(c) Distorted and disturbed paving;
(d) Drainage problems, e.g., ponding of water on the paving and in drainage channels, incorrect falls, etc.
(e) The omission of edge restraint;
(f) Intrusion of weed or hostile root penetration

BE 03.02.01 Preparing foundation

If the subbase and/or subgrade have failed, this soft and unstable material shall be replaced. Existing paving must be carefully removed and stack for re-use. The new earth filling shall be of inert material, having a maximum plasticity of 10, free from large stones, etc. spread, leveled, watered and compacted in layers not exceeding 150 mm thick to a density of 95% of modified AASHTO density. Cement stabilization to improve the existing subgrade may be considered to improve the characteristics of the material. The blocks shall be laid true to line, levels and grade on a 25 mm thick layer of approved bedding sand. The bedding sand must not be used to fill hollows in an uneven subgrade or subbase surface. Where specified, plastic sheeting must be provided below the bedding sand layer. Refer also to BE 03 02 06.

The Contractor shall be responsible for carrying out all necessary process control tests on the density and moisture content of the completed subgrade, subbase, etc. to ensure that the required compaction is being attained.
Laying of segmental block paving

The existing blocks shall be pre-selected for re-use. Broken and severely damaged paving blocks shall be replaced. New paving blocks shall comply with SANS 1058 Class 30 compressive strength. All blocks shall be laid true to line and level. Care shall be taken to ensure that joint lines are straight and square. The blocks shall have a minimum thickness of 60 mm.

After laying the blocks, the paving shall be compacted by means of vibrating plate compactor with joints between the blocks filled in. After compaction, by sweeping in fine sand. The jointing sand shall have a pass of 1.18 mm sieve and contain 10-50% material passing the 75 micron sieve. The sand shall be free of all soluble salts or contaminants likely to cause efflorescence or staining.

Areas against curbs, manholes, etc. that require infilling and which exceed 25% of a full block unit shall be filled with units cut to size using a mechanical or hydraulic Guillotine, bolster or angle grinder. Infill areas constituting less than 25% of a full block area are of 25 mm minimum dimension shall be filled with 25 MPA concrete. Smaller areas shall be filled with 1:4 cement mortar.

Laying of block paving, precast concrete blocks and slasto

BE 03.02.03

The existing blocks shall be pre-selected for re-use. Broken and severely damaged paving blocks shall be replaced. All blocks shall be laid true to line and level. Care shall be taken that joint lines are straight and square. Slasto shall be laid in the same pattern to match existing.

After laying the blocks, the paving shall be compacted by means of vibrating plate compactor. Clean the top of the blocks before and after compaction. Thoroughly wet compacted area after compaction and leave 24 hours to dry. The joints between the blocks must be filled in. After compaction, with a 1:4 cement mortar. The joints shall be pointed with a steel tool to a smooth surface finish.

Laying of cast in situ concrete paving and drainage channels

BE 03.02.04

Severely cracked and/or damaged concrete paving and drainage channels shall be replaced. The Engineer shall indicate which panels and sections of drainage channels are to be removed. Cutting out will be done with an angle grinder or saw cutting machine. Concrete panels must be removed in sizes where the ratio of the sides does not exceed 1:1.5. The foundation material must be improved as specified in BE 03.02.01.

New concrete panels and drainage channels must be cast with a compressive strength of 25 MPA. Concrete paving to the specified thickness must be finished off with a smooth wood trowel surface finish or must match the existing surface finish. Edges must be finished off. With a steel nosing tool with a radius of 5 mm. Expansion joints must be provided where specified. Drainage channels must be cast in lengths not exceeding 1 metre. Channels must be finished off to have a smooth steel trowel finish.

Precast concrete edge beams, curbs and channels

BE 03.02.05

Edge restraints shall be installed before paving commences. Edge restraints may be cast in situ, or consist of precast units. Precast edge blocks shall have dimensions of 75 mm wide x 300 mm deep. Cast in situ beams with 25 MPA concrete shall have dimensions of 300 x 300 mm and cast in lengths exceeding 1 metre.

Precast concrete curbs and channels shall comply with SANS 927, generally in 1 metre lengths and finished smooth from the mould on exposed surfaces. Curbs and channels shall be bedded on and jointed in 1:3 cement mortar and pointed with keyed joints. Bases to curbs shall be Class B prescribed mix of unreinforced concrete.
BE 03.02.06 Weed control

Two types of weed killing shall be carried out:

(a) Mixing weed killer to subbase for rehabilitated paving.
(b) Spraying existing paving excluding concrete paving.

After the base course has been approved and the curbing completed, the prepared base must be treated with a weed killer similar or equal to HYVAR X at a rate of 4 kg/m². Plastic sheeting with a thickness of 375 micron shall be laid to prevent the penetration of grass underneath the segmental paving.

BE 03.02.07 Site clearance

Excess sand and all other debris shall be removed before the pavement is opened to traffic. The site shall be left in a tidy condition.

BE 04 DETAIL OF REPAIR WORK

The detail of the scope of work is described in the Schedule of Quantities.

BE 04 MAINTENANCE

No maintenance will be required for floors under this contract.

BE 06 MEASUREMENT AND PAYMENT

BE 06.01 MEASUREMENT AND RATES

BE 06.01.01 General inclusion of costs and specific Specifications

Notes:

Where applicable, standard SANS 1200 measurement and payment items shall be used for Earthworks (Small Works) (1200 DA), Site Clearance (1200 C) and Concrete (Structural) (1200 G).

All material scheduled to be removed shall be deemed to be existing damaged materials in small or large sections. All such redundant material shall become the property of the Contractor and must be removed from site immediately.

All new material shall be deemed to be in patchwork and shall be of approved equal quality, colours, profiles, thickness, etc. and shall in all cases match the existing materials and shall be fixed (internally or externally) to existing material or surfaces.

All replacement, removal and repair work shall be done carefully as to not damage any adjacent or other material or work. Any damage to other or adjacent materials or areas caused by the negligence of the Contractor shall be repaired by him free of charge.

All work scheduled to be removed, hacked off or taken out shall be deemed to include the cleaning, removing of contact glue or bitumen and preparation of the remaining surfaces, areas where material were removed, or remaining work to receive new material or work specified.

Repair work shall also include all cutting, grinding, cutting into, welding, bending, strengthening, drilling, etc to repair or to improve the items or areas as new and to match the existing.
Work scheduled to be realigned and relaid shall be cleaned to include all necessary new additional materials, brackets, connector plates, bolts, pin rivets, nails, screws, spacer blocks, clamps, timber, and labour, etc. to leave the items as new and totally functional.

All floor surfaces scheduled to be cleaned and sealed shall include for stripping the floors from any fats, grime, dirt, oil and other deposits. Replacement of grout to ceramic and clay floor tiles shall also be included where necessary as per the tendered rate. Sealing of existing vinyl floor tiles shall be done in accordance with Technical Specification BE 03.01.10.

All new work are measured net and shall include all cutting, lapping, waste, bending, fixing, corners, mitres, fixing screws, pin rivets, nails, adhesive, grout, putty, etc. as well as cleaning and preparation of surfaces not already prepared as part of removed items, etc.

Tile work to floors shall include all cutting, spacers, waste, jointing, mitres, corners, epoxy grout and joint filler.

Ordering of certain specified materials, i.e. NCI industrial type floor tiles needs special urgent attendance and should be ordered timeously as to prevent any construction delays.

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**BE 06.02**  
**SCHEDULED ITEMS**

**NEW WORK**

**BUILDING WORK**

**BE 01**  
Floor screeds:

(a) (Thickness indicated)  
Unit m²

(b) Etc. for other thicknesses

The unit of measurement shall be the square metre of floor screed laid, as specified, on floors, steps or areas shown on the Drawings or as designated by the Engineer.

The tendered rates shall include full compensation for the construction of the floor screeds, including the supply of all materials, mixing, laying, finishing, the forming of nosing, reading, skirting, etc.

**BE 02**  
Joinery:

(a) Items measured by number:

(i) Doors (type and size indicated)  
Unit: number

(ii) Etc. for other items measured by number

(b) Items measured by linear metre:

(i) Skirting (size indicated)  
Unit m

(ii) Etc. for other items measured by length

(c) Items measured by area:

(i) Eaves covering (type and thickness indicated)
(ii) Etc for other items measured by area

The units of measurement shall be the number, metre or square metre of each type and/or size of joinery item specified.

The tendered rates shall include full compensation for the supply of all materials, manufacture, cutting waste, fixing and installation of the joinery items.

**BE.03**

Floor tiling and finishes, etc:

(a) Measured by number:

(i) (Description of item) 
Unit: number

(b) Measured by linear metre:

(i) (Description of item) 
Unit: m

(c) Measured by area:

(i) (Description of item) 
Unit: m²

The unit of measurement shall be the number, metre or square metre as applicable to each item.

The tendered rates shall include full compensation for manufacturing, providing and installing each item complete as per Specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material waste, plant, transport, delivery, access, scaffolding, fuel, etc. to the Engineer’s approval.

**ALTERATION WORK**

**BE.04**

Alterations and repairs to existing structures:

(a) Indicate if repairs, alterations, removal or sealing, etc:

(i) Description of individual items to be repaired, altered, removed, sealed, etc 
Unit: m²; m³, m, number

The unit of measurement for items repaired, altered, removed, sealed, etc. shall be cubic metre, square metre, metre or number as scheduled.

The tendered rates shall include full compensation for all costs to repair, refix, remove, cutting into, realign, taking off, temporary store, etc. as specified in the Standard and Technical Specifications and shall allow for all necessary labour, plant and new material needed to leave the scheduled items as new and to the approval of the Engineer. Refer also to the general inclusion of costs in BE 08.01.01.
SUPPLEMENTARY SERVICES SPECIFICATION

PEST CONTROL

CONTENTS

SF 01 SCOPES
SF 02 STANDARDS
SF 03 SAFETY REQUIREMENTS
SF 04 INITIAL PEST CONTROL PROCEDURE
SF 05 MONITORING AND REPORTING OF PEST CONTROL STATUS
SF 06 PREVENTATIVE PEST CONTROL
SF 07 TRAINING OF EMPLOYER'S PERSONNEL
SF 08 LOGGING AND RECORDING
SF 09 NOTIFICATION OF INTENTION TO ADMINISTER PEST CONTROL
SF 10 PREPARATION OF THE AREA AFFECTED BY PEST CONTROL
SF 11 CLEARANCE AFTER PEST CONTROL
BF12 PERFORMANCE MEASUREMENT
SF13 MEASUREMENT AND PAYMENT

SF 01 SCOPES

This Specification covers the application of pesticides and herbicides in the facility(ies) set out in the Project Specification for the purpose of pest control. Pest control, in this instance, shall imply the eradication of pests which cause structural and other damage to buildings and installations at the facility in question.

Structural damage shall include:

- Damage to the structural elements of buildings.
- Damage to finishes of buildings.
- Damage to building electrical installation.
- Damage to building wet services (plumbing and drainage)

SF 02 STANDARDS

The following standards and publications contain provisions, which, through reference in this text, constitute provisions of this Specification. The most recent editions of the standards indicated below shall be used:

<table>
<thead>
<tr>
<th>CODE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SANS 10072</td>
<td>Code of practice for the safe use of household insecticides and agricultural remedies</td>
</tr>
<tr>
<td>SANS 10124</td>
<td>Code of practice for the application of certain soil insecticides for the protection of buildings.</td>
</tr>
<tr>
<td>SANS 10133</td>
<td>Code of practice for the application of pesticides in food handling, food processing, and catering establishments.</td>
</tr>
</tbody>
</table>
CODE | DESCRIPTION
--- | ---
SANS 10080 | Code of practice for the rodent proofing of buildings.
SANS 10206 | Code of practice for safety procedures for the disposal of surplus pesticides and associated toxic waste.
SANS 10204 | Code of practice for the application of fumigants.
National Departments of Agriculture Publication | A guide to the control of household and industrial pests.

**SF 03
SAFETY REQUIREMENTS**

No pesticide shall be used for any purpose other than that recommended on the manufacturer's label. All warnings and precautions set out on the manufacturer's label shall be adhered to. The manufacturer's label shall never be removed from the container.

A Pest Control Operator shall be appointed by the Contractor and the relevant certification, as specified in sub clause BE 08.03 below, shall be submitted to the Engineer before the first pesticide application.

The Pest Control Operator (PCO) will at all times ensure that pesticides are kept secure and out of reach of the general public. The PCO shall be responsible for the safe disposal of surplus pesticides as well as all empty pesticide containers.

The PCO will further ensure that no member of the general public is at any time in danger of being contaminated with the pesticide. Should a member of the general public be contaminated the PCO will immediately follow the first-aid and emergency treatment outlined in the standards.

**SF 04
INITIAL PEST CONTROL PROCEDURE**

**BF 04.01
COMPILING OF A PEST CONTROL PROGRAMME**

Before any pest control is to be administered the Contractor shall inspect the various buildings and installations at each facility and subsequently compile and submit a report to the Engineer, detailing the comprehensive preventative pest control programme to be implemented.

The report submitted to the Engineer shall include but shall not be limited to the following:

(a) The status of the pest infestation of the various buildings and installations at each facility.
(b) The initial "clean up" procedure to be implemented.
(c) The procedures of how to close off all entry points for rodents.
(d) The routine monitoring and reporting procedures.
(e) Estimated costs for the above.
SF 04.02 INITIAL "CLEAN up" AND RODENT PROOFING

The Contractor shall implement the initial "clean up" procedure and the rodent proofing of the various installations, as described in the pest control programme, buildings and only after instructions from the Engineer have been obtained.

SF 05 MONITORING AND REPORTING OF PEST CONTROL STATUS

The status of pest infestation shall be monitored. The Contractor shall compile a report on the condition as well as recommendations at the intervals specified in the Particular Specifications. The report shall include but shall not be limited to the following details:

(a) Report on the type and status of damage caused by pests
(b) Report on the visual observation of the presence of pests. (c) Report on the pest control monitoring results.
(d) Report on the standing of the preventative pest control.
(e) The recommended pest control procedure.

This report is to be submitted to the Engineer. Only upon instruction from the Engineer shall the recommended pest control procedures be implemented.

If, at any intermediate period, the need for pest control should arise the Contractor shall submit a report and recommendations to the Engineer and await his instructions.

SF 06 PREVENTATIVE PEST CONTROL

The Contractor shall administer preventative pest control as often as required but in accordance with the intervals specified by the manufacturer of the pesticide.

The Contractor shall report on the standing of pest activity and damage caused by the pests after each inspection as outlined in clauses PFE 02, PFE 03, PFE 04 and PFE 05 of Particular Specification PFE. The report is to be submitted to the Engineer (as in clause SF 05 above). The Contractor shall obtain the permission of the Engineer before any additional preventative pest control is to commence.

SF 07 TRAINING OF EMPLOYER'S PERSONNEL

Pests are attracted to areas where food and water are in abundance. Good housekeeping techniques can improve the likelihood of keeping an area pest free. It is therefore essential to train the Employer's relevant personnel in the essential housekeeping techniques. The objectives of the training shall be to ensure that the following be achieved:

(a) The identification of possible attractions for pests.
(b) The elimination of waste disposal situations which may attract pests. (c) Reducing the overall cost of pest control by keeping the areas as clean and pest free as achievable.
The training course shall be in accordance to the Additional Specification SO: General Training and shall furthermore include at least the following:

(a) The effective methods of waste disposal in order not to attract pests. (b) The effective methods of storing foodstuffs in order not to promote the nesting and infestation of pests.
(c) Cleaning of facilities to avoid attracting pests.

The Contractor is to develop a training syllabus in accordance with Additional Specification SO: General Training. The training syllabus shall include but shall not be limited to the following information:

(a) The effective methods of waste disposal in order not to attract pests. (b) The effective methods of storing foodstuffs in order not to promote the nesting and infestation of pests.
(c) Cleaning of facilities to avoid attracting pests.
(d) General information about the various pests which may be found at the facility.

SF 08
LOGGING AND RECORDING

The Contractor shall institute a logging and recording system as part of his management control plan. This shall consist of a file containing the particulars as described in detail below:

SF 08.01
PESTICIDE QUALITY

A sample of each batch of each type of pesticide used shall be taken and stored in a sealed clean glass container. The container shall be clearly marked. These samples are to be kept in safe and appropriate storage by the Contractor in case of a dispute arising from insufficient control of vermin or contamination of any sort.

SF 08.02
LOGGING OF PESTICIDE APPLICATIONS

After each application of pesticides a Pesticide Application Log Sheet (Form PC-1, that forms part of this specification) is to be completed and submitted to the Engineer. The Pesticide Application Log Sheet (Form PC-1) includes the following details:

- Name of the pest control operator
- Name and address where the pesticide application was administered
- Date of the pesticide application
- Manufacturer of the pesticide
- Pesticide name and active ingredient
- Batch identification of the pesticide
- Formulation and concentration of the pesticide
- The pest and type of control aimed at
- Type of application i.e. residual spray, fumigant, bait etc
- Area of application
- Quantity of product used
BE 08.03 RECORDS OF PEST CONTROL OPERATORS

All pest control operators shall be in possession of the National Certificate in pest control as approved by the Department of National Education. The Pest Control Operator (PCO) shall be in possession of a Registration Certificate issued by the Department of Agriculture in accordance with Act 36 of 1947.

The Pest Control Operator's details and certifications shall be made available for inspection by the Engineer prior to the application of pesticides.

A copy of the Pest Control Operator's details and certifications shall be submitted together with the Pesticide Application Log Sheet (Form PC-1) completed for each pesticide application.

BF 09 NOTIFICATION OF INTENTION TO ADMINISTER PEST CONTROL

Before pest control procedures may commence a notification shall be submitted to the Employer's representative responsible for the facility. The Notification of Intent to Administer Pest Control (Form PC-2, that forms part of this Specification) shall include the following details:

- The name and address of the person being notified
- The pest control procedure to be employed and the purpose of the pest control
- The pesticide to be employed
- The date and time of commencement

The pest control operator is to sign the notification to acknowledge responsibility for the precautions to be taken before, during and after operations.

The Employer's representative responsible for the facility is to sign the notification to acknowledge receipt of the notice.

Pest control procedures may only be implemented once the notification has been completed and signed by all relevant parties.

BF10 PREPARATION OF THE AREA AFFECTED BY PEST CONTROL

The PCO shall arrange, with the Engineer via the Contractor, a suitable time for the pest control area to be vacated and provide an approximate time for the completion of pest control.

The PCO shall provide the Employer's representative responsible for the facility with a written list of all materials and articles that must be removed from the facility before the administering of pesticides may commence.

After the PCO is satisfied that all materials, which might be damaged or contaminated during the application of pesticides, have been removed he will conduct a thorough inspection of the area before pest control application may commence.
BF 11  CLEARANCE AFTER PEST CONTROL

Upon completion of the application of pesticides the PCE shall ensure that the area is well ventilated and that the levels of harmful gases are safe for re-occupancy.

The area shall be checked for any damage or contamination caused by the application of the pesticides and all dead rodents shall be removed from the area.

The PCE shall deliver a written Clearance Notification (Form PC-3, that forms part of this technical Specification), declaring the area safe for re-occupancy, to the Employer's representative responsible for the facility.

BF 12  PERFORMANCE MEASUREMENT

The Contractor's performance shall be evaluated as follows:

BF 12.01  SCORE-CARD

The Engineer shall inspect each facility monthly after the commencement date of the Contract. The Engineer shall use a score-card to measure the quality of pest control service rendered by the Contractor during the preceding month. The score-card shall serve to evaluate ten performance indicators each month in the manner set out below.

BF 12.02  PERFORMANCE INDICATORS

The Contractor and the Engineer shall each have the opportunity to select five (5) performance indicators each month which shall focus on the measurement of the quality of pest control service rendered against the relevant clauses of this Specification for the month ahead. All ten (10) performance indicators are known to both the Engineer and the Contractor. The Contractor shall aim to perform satisfactorily on all ten performance indicators. All indicators shall be selected from the scope of his normal routine activities based on the pest control programme as specified in sub-clause SF 04.01. The work shall either be satisfactory or unsatisfactory and the Contractor shall score one (1) or zero (0) respectively per indicator.

BF 12.03  SATISFACTORY PERFORMANCE

The Engineer shall inspect the Site on an arbitrary day to measure the quality of the pest control against the 10 selected performance indicators. Should the Contractor score the maximum points (10) he shall receive his full payment that month under pay item SF 05 for providing a good-quality pest control service during the previous month. Should the quality of the service provided by him be unsatisfactory according to the score-card, the Contractor will not receive full payment that month due to a reduced service level. In this manner the Employer will be protected against a reduced or unsatisfactory service level.

A copy of the score-card including a guideline for the use thereof is included in this Specification.
BF13 MEASUREMENT AND PAYMENT

BF 01 Compiling Of The Pest Control Programme
For Each Location  Unit: Sum

The unit of measurement shall be the number of comprehensive pest
control programmes compiled for the different locations in each facility.
Each programme shall include initial steps to be taken as well preventative
pest control procedures.

The programme shall be subject to revision by the Engineer.

The tendered rate shall include full compensation for ascertaining the status
of the pest infestation, for all testing; including re-testing where applicable
as well as for the cost of providing all instrumentation, tools, equipment and
labour that may be required.

BF 02 Initial "Clean Up" And Rodent Proofing  Unit: Sum

The unit of measurement shall be a lump sum.

The sums tendered for the different locations in each facility shall include
full compensation for the preparation of the area affected by the pest
control procedure, for notifications as in clauses BE 09, BE 10 & BE 11 for
the supply, preparation, delivery and the application of the pesticides, for
the safe disposal of empty pesticide containers and for storage, transport
and handling.

The tendered sum shall include full compensation for the cost of all
materials required for the rodent proofing of the facility as well as for the
supply, delivery, storage, handling, transport and installation of such
materials.

The tendered sum shall also include full compensation for all testing,
including re-testing where applicable for all instrumentation, tools,
equipment and labour that may be required as well as for the logging and
recording of all required data as described this Specification.

BF 03 Monitoring And Reporting Of Pest Control Status  Unit: Number

The unit of measurement shall be the number of reports with
recommendations compiled and submitted for each location in each facility.

The tendered rate shall include full compensation for monitoring the pest
control status, for the supply of all equipment used during monitoring, for
delivery of relevant equipment, and for the cost of compiling the reports with
recommendations.

The tendered rate shall also include full compensation for all testing,
including re-testing where applicable, for all instrumentation, tools,
equipment and labour that may be required as well as for the logging and
recording of all required data as described in this Specification.

Masten Bridge. Port of Entry: Technical and
Particular Specification
BF .04 Preventative Pest Control  

The unit of measurement for the preventative pest control at each location in each facility for the period between inspections and for reporting as outlined in clauses PBF 02, PSF 03, PSF 04 and PBF 05, shall be a lump sum.

The tendered sum shall include full compensation for the preparation of the area affected by the pest control procedure, for notifications as in clauses SF 09, SF 10 & SF 11, for the preparation, supply, delivery, and the application of the pesticides, for the safe disposal of empty pesticide containers and for storage, transport and handling.

The tendered sum shall also include full compensation for all testing, including re-testing where applicable, for all instrumentation, tools, equipment and labour that may be required as well as for the logging and recording of all required data as described this Specification.

SF .05 Maintaining Quality Of Pest Control Service  

The unit of measurement shall be a point. Each month shall represent a maximum of 10 points and a minimum of zero points, depending on the performance of the contractor in providing quality service.

Ten points per month, determined by using the rate tendered per point, shall include full compensation for executing the work as specified and for all risks, liabilities and obligations described or implied in the Conditions of Contractor, this Specification, Portion 1 of the Project Specifications and in Particular Specifications SASS 1200A and 1200AS as amended in Portion 2 of the Project Specifications.

The combined tendered rate for 10 points shall also include full compensation for quality control, for all taxes, levies and insurances that may be applicable and for all other incidentals necessary to provide the service and for which no provision for payment has been made under other payment items.

The rate tendered for this item shall not be less than ten per cent (10%) of the total price tendered for the pest control service.
NATIONAL DEPARTMENT OF PUBLIC WORKS
PESTICIDE APPLICATION LOG SHEET

Name of Pest Control Company:

Name of Pest Control Operator:

Name and location of pesticide application:

Date:

Pesticide Manufacturer:

Name of applied pesticide:

Active Ingredient:

Batch identification:

Formulation and Concentration of pesticide applied:

Type of application:

Area of pesticide application (description and dimensions):

Quantity of products applied (verified by Engineer):

Engineer's name and signature:

Pest and type of control aimed at:
NATIONAL DEPARTMENT OF PUBLIC WORKS
NOTIFICATION OF INTENT TO ADMINISTER PEST CONTROL

TO:

LOCATION OF PEST CONTROL:

DATE:

DATE OF PEST CONTROL APPLICATION:

TIME:

PURPOSE OF PEST CONTROL:

TYPE OF PEST CONTROL:

PESTICIDE TO BE EMPLOYED:

The undersigned takes full responsibility for the precautions to be taken before, during and after the pest control application.

DATE:

SIGNED (Pest Control Operator):

The undersigned acknowledges receipt of this notice.

DATE:

SIGNED (Employer's Representative responsible for facility):
NATIONAL DEPARTMENT OF PUBLIC WORKS
CLEARANCE NOTIFICATIONS

TO:

LOCATION OF PEST CONTROL:

DATE:

DATE OF COMMENCEMENT OF
PEST CONTROL:

DATE OF COMPLETION OF PEST
CONTROL:

PURPOSE OF PEST CONTROL:

TYPE OF PEST CONTROL:

PESTICIDE EMPLOYED:

The undersigned confirms that the area in which pest control was conducted
is safe for re-occupancy and that all relevant checks and test have been
conducted.
DATE:
SIGNED (Pest Control Operator):

The undersigned acknowledges receipt of this notice of clearance
DATE:
SIGNED (Employer's Representative
responsible for facility):
PARTICULAR SPECIFICATION

PBF PEST CONTROL

CONTENTS

PBF 01 SCOPE
PBF 02 PESTS ATTACKING TIMBER
PBF 03 PESTS ATTACKING CARPETS & FABRICS
PBF 04 ANTS
PBF 05 RATS AND MICE

PBF 01 SCOPE

This Specification covers the application of pesticides for the specific purpose of eliminating pests which may cause structural damage. This Specification includes the breakdown of various buildings and installations included within the facility and the specific dimensions of each building.

PBF 02 PESTS ATTACKING TIMBER

PBF 02.01 PESTS

Pests that caused damage to timber shall include, but not be limited to the following:
- mould, blue stain, powder post beetle, shot-hole borer, brown house borer,
- Cossodid woodboring, drywood termite, subterranean wood-destroying termites,
- false furniture beetle, furniture beetle, Italian beetle, decay and discolouring fungi.

PBF 02.02 LIST OF LOCATIONS

<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>LOCATION</th>
<th>DESCRIPTION</th>
<th>DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>02.02.01</td>
<td>Operational Buildings</td>
<td>Wooden beams and planks used in the roof. Ceiling boards. Wooden skirting and cornices. All insulations.</td>
<td>m/m2/ml</td>
</tr>
</tbody>
</table>

PBF 02.03 PEST CONTROL PROGRAMME AND REPORTING

The pest control program submitted in terms of sub-clause BE 04.01 shall include but shall not be limited to:

(a) Initial inspection of all buildings and installations to ascertain the damage caused by the activity of the various pests.

(b) If pests are found an initial "clean up" process is to be conducted.

(c) Continuous monitoring of the activity of pests.

(d) A comprehensive quarterly inspection of the buildings and installations.

(e) Reporting on the damage caused by the activity of the pests together with recommendations (To follow quarterly inspection).

(f) Execution of the recommendations once approved by the Engineer.
PESTS ATTACKING CARPETS AND OTHER FABRICS

PESTS

Pests that cause damage to carpets and other fabrics shall include but not be limited to carpet beetles, clothes moths and fish moths.

LIST OF LOCATIONS

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>LOCATION</th>
<th>DESCRIPTION</th>
<th>DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>03.02.01</td>
<td>N/A</td>
<td>N/A</td>
<td>m/m²/ml</td>
</tr>
</tbody>
</table>

PEST CONTROL PROGRAMME & REPORTING

A thorough inspection of the buildings and installations at each facility shall be conducted with specific attention to the relevance of preventative pest control. The Contractor shall compile a comprehensive pest control programme to be submitted to the Engineer for review and approval.

The preventative pest control programme may only commence upon instruction from the Engineer.

The pest control programme shall include but shall not be limited to:

(i) Initial inspection of all buildings and installations to ascertain the damage caused to carpets and other fabrics by the activity of the various pests.

(ii) If pests are found an initial "clean up" process is to be conducted.

(iii) A comprehensive inspection is to be conducted at the intervals specified below:

• Bi-annually in residential units.
• Bi-annually in office facilities.
• Two monthly in cell units.
• Monthly in "a" food preparation areas.

(iv) Reporting on the damage caused by the activity of the pests together with recommendations (To follow inspection as above).

(v) Execution of the recommendations once approved by the Engineer.

ANTS

ANTS

Ants shall include all ants irrespective of size, colour or species.
PEST CONTROL PROGRAMME & REPORTING

A thorough inspection of the buildings and installations at each facility shall be conducted with specific attention to the relevance of preventative pest control. The Contractor shall compile a comprehensive pest control programme to be submitted to the Engineer for review and approval.

The preventative pest control programme may only commence upon instruction from the Engineer.

The pest control programme submitted in terms of sub-clause BE 04.01 shall include but not be limited to:

(a) Initial inspection of all the buildings and installations facilities to ascertain the damage caused by the activity of ants.

(b) If ants are found an initial "clean up" process is to be conducted.

(c) A comprehensive inspection is to be conducted at the intervals specified below:

- Bi-annually in residential units.
- Bi-annually in office facilities.
- Two monthly in cell units.
- Monthly in any food preparation area.

(d) Reporting on the damage caused by the activity of the ants together with recommendations (To follow inspection as above).

(e) Execution of the recommendations once approved by the Engineer.

RATS AND MICE

Rats and mice shall include but shall not be limited to house mice, Norway rats and roof rats.
PBF 05.02 LIST OF LOCATIONS

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>LOCATION</th>
<th>DESCRIPTION</th>
<th>DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>05.02.01</td>
<td>N/A</td>
<td>N/A</td>
<td>m/m²/m³</td>
</tr>
</tbody>
</table>

PBF 05.03 PEST CONTROL PROGRAMME & REPORTING

The pest control programme submitted in terms of sub-clause BE 04.01 shall include but not be limited to:

(a) Initial inspection of all buildings and installations to ascertain the damage caused by the activity of rats and mice.
(b) Closing off of all potential entry points for rats and mice.
(c) If rats and/or mice are found an initial “clean up” process is to be conducted.
(d) Continuous bating to assist in control and monitoring is to be conducted.
(e) A comprehensive inspection is to be conducted at the intervals specified below.

- Bi-annually in residential units.
- Bi-annually in office facilities.
- Two monthly in cell units.
- Monthly in any food preparation area.

(f) Reporting on the damage caused by the activity of mice and rats together with recommendations (To follow inspection as above).

(g) Execution of the recommendations once approved by the Engineer.

PBF 06 COCKROACHES

PBF 06.01 PESTS

Cockroaches shall include all roaches irrespective of size, colour or species.

PBF 06.02 LIST OF BUILDINGS AND INSTALLATIONS

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>LOCATION</th>
<th>DESCRIPTION</th>
<th>DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>06.02.01</td>
<td>Operational Buildings</td>
<td>Walls, storage areas, windows and all areas where entrance may be gained.</td>
<td>m/m²/m³</td>
</tr>
</tbody>
</table>
PEST CONTROL PROGRAMME & REPORTING

A thorough inspection of the buildings and installations at each facility shall be conducted with specific attention to the relevance of preventative pest control. The Contractor shall compile a comprehensive pest control programme to be submitted to the Engineer for review and approval.

The preventative pest control programme may only commence upon instruction from the Engineer.

The pest control programme submitted in terms of sub-clause BE 04.01 shall include but not be limited to:

(f) Initial inspection of all the buildings and installations facilities to ascertain the damage caused by the activity of cockroaches.

(g) If cockroaches are found an initial "clean up" process is to be conducted. (h) A comprehensive inspection is to be conducted at the intervals specified below:

- Bi-annually in residential units.
- Bi-annually in office facilities.
- Two monthly in cell units.
- Monthly in any food preparation area.

(i) Reporting on the damage caused by the activity of the ants together with recommendations (To follow inspection as above).

(j) Execution of the recommendations once approved by the Engineer.
TECHNICAL SPECIFICATION

BH FITTINGS

CONTENTS

BH 01 SCOPE
BH 02 STANDARD SPECIFICATIONS
BH 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS
BH 04 DETAIL OF REPAIR WORK
BH 05 MAINTENANCE
BH 06 MEASUREMENT AND PAYMENT

BH 01 SCOPE

Fittings shall mean the scope of work to repair materials and components related to cupboards, shelving, signage and counters.

The complete scope of repair work shall be as described in BH 04: Detail of repair work.

BH 02 STANDARD SPECIFICATIONS

BH 02.01 GENERAL STANDARD SPECIFICATIONS

The latest edition, including all amendments up to date of tender of the following Specifications, publications and codes of practice shall be read in conjunction with this Specification and shall be deemed to form part thereof:

- OW 371 Specification of Materials and Methods to be used (Fourth edition, October 1993)
- SANS 929 - Plywood and composite board
- SANS 1099 - Hardwood furniture timber
- SANS 1783-3 - Softwood timber for industrial use
- SANS 1385 - Kitchen cupboards of steel, composite board and timber

BH 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BD: Walls
Technical Specification BG: Metalwork
Technical Specification BJ: Paintwork

BH 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

BH 03.01 ADDITIONAL REQUIREMENTS FOR REPAIR OF FITTINGS

BH 03.01.01 Built-in cupboards

The Engineer shall inspect all cupboards for defects and shall establish which components are to be replaced or repaired. Reasons for replacement will include, but not be limited to:

(a) Severely chipped or damaged block board;
(b) Severely chipped or damaged decorative laminates;
(c) Inadequacy of design, e.g. strength of hinges, failure of door furniture, etc;
(d) Corroded steel elements.

Maseru Bridge Port of Entry: Technical and Particular Specification
Fixing of defects will include repairing or replacing damaged, corroded and worn-out fittings, e.g. door handles, knobs and hinges, door catches and holders, door locks, cupboard door vents, drawer slide rails, drawer handles, knobs and locks. Moving parts shall be serviced by cleaning, oiling, tightening loose screws, reinstating missing screws or aluminium pop rivets, etc. Refer to BD 03.08 and BD 03.09 of Technical Specification BD: Walls, for repairs or replacements of cupboard doors and ironmongery.

BH 03.01.02 Kitchen cupboards

Kitchen cupboards shall be inspected for defects. Defects will include repairing or replacing damaged, corroded and worn-out fittings, e.g. door handles, knobs and hinges, door catches and holders, door locks, cupboard door vents, drawer slide rails, drawer handles, knobs and locks. Moving parts shall be serviced by cleaning, oiling, tightening loose screws, reinstating missing screws or aluminium pop rivets, etc. Where the baked enamel of steel cupboards is scratched and worn off, the steel surface shall be sanded and painted with an approved gloss epoxy paint to match the existing colour. Severely corroded or damaged steel cupboards shall be replaced with approved new steel cupboards complying with SANS 1385, with the baked enamel complying with SANS 783 Type II.

Damaged kitchen cupboards manufactured from composite board with laminated plastic covering shall be repaired where possible by gluing loose laminated plastic covering or replacing components with new similar matching finished elements.

Damaged kitchen cupboards manufactured from timber shall be repaired by replacing cracked and broken timber components. Painted surfaces shall be varnished with water-resistant varnish (with matching stain) or painted with approved polyurethane paint. Refer to Technical Specification BJ: Paintwork.

All cupboards shall be properly screwed and fixed to walls and floors with suitable corrosion resistant screws and plastic plugs, washers, etc.

Work tops and sinks against walls shall be sealed with an approved white one part polyurethane sealant. The sealant shall be applied strictly according to the manufacturer’s Specifications. Old worn-out and damaged sealant shall also be replaced. Drop-in sink bowls shall also be sealed with this approved polyurethane sealant. Where the possibility exists that water can penetrate composite board, these joints in the worktop shall also be sealed.

BH 03.01.03 Shelving

The stability of shelves must be checked to determine the occurrence of sagging. Where required, provide adequate support for the specific application, e.g. steel tubing struts, additional timber bearers, steel brackets, etc.

Broken timber shelving shall be replaced with approved wrought hardwood or solid laminated pine varnished or painted to Specification. Composite board will not be permitted. Shelves shall be in single lengths. Heads of nails and brass countersunk screws in exposed faces of joinery shall be sunk and pelleted.

BH 03.01.04 Signage

Safety signs shall comply with the REQUIREMENTS of SANS 1186 (1997). The Engineer shall survey all signage and list those items that prove to be illegible. Signs that need to be replaced shall be done in the same fashion and material as to match similar signs in the same application. The size of the signs shall be as shown on the schedules.

Where required proper and appropriate signage must be provided for door numbers, room size and room description. The size, colour, position on the door, wall, etc.,
height above floor level of the lettering shall be instructed by the Engineer on site or shown on the schedules. The lettering must be stencilled on to the doors and walls.

All other fire protection signage will be provided for hydrants, hose reels etc. shall be provided under separate contract.

BH 03 01 05

Counters

The Engineer shall inspect all counters and counter tops for defects and shall establish which components are to be replaced or repaired. Special attention shall be given to the condition of hinges at service hatches.

All joinery liable to be damaged shall be covered with temporary coverings to the satisfaction of the Engineer and special care shall be taken to protect surfaces that are to be varnished.

Where necessary, timber counters shall be sanded down, uneven surface spots filled with an approved wood filler, all blemishes removed and then finished off in order to restore the wood to its original state.

Steel tops that have been damaged excessively shall be replaced.

BH 04

DETAIL OF REPAIR WORK

The detail of the scope of work is described in the Schedule of Quantities.

BH 05

MAINTENANCE

No maintenance will be required for fittings under this contract.

BH 06

MEASUREMENT AND PAYMENT

BH 06 01

MEASUREMENT AND RATES

BH 06 01 01 General inclusion of costs

Notes:

All material scheduled to be removed shall be deemed to be existing damaged materials in small or large sections. All such redundant material shall become the property of the Contractor and must be removed from site immediately.

All new material shall be deemed to be in patchwork and shall be of approved equal quality, colours, profiles, thickness, etc and shall in all cases match the existing materials and shall be fixed (internally or externally) to existing material or surfaces.

All replacement, removal and repair work shall be done carefully so as not to damage any adjacent or other material or work. Any damage to other or adjacent materials or areas caused by the negligence of the Contractor shall be repaired by him free of charge.

All work scheduled to be removed or taken out shall be deemed to include the cleaning and preparation of the remaining sections, areas, or work to receive the new material or work specified.

Repair and service work shall also include all removing, cutting, grinding, cutting into, welding, bending, strengthening, drilling, tightening, fastening, oiling, greasing, adjusting, and providing missing or damaged screws or bolts, etc. to repair or to
improve the items or areas as new and to match the existing. The service of cupboard doors and drawers shall be deemed to include for servicing all locks, hinges, glides, tracks, etc.

Work scheduled to be realigned and refixed shall be deemed to include all necessary new additional materials, brackets, connector plates, bolts, rivets, nails, screws, spacer blocks, clamps, timber, and labour, etc. to leave the items as new and totally functional.

All new work are measured net and shall include all cutting, lapping, waste, bending, fixing, corners, mitres, fixing screws, rivets, nails, adhesive, grout, putty, etc., as well as cleaning and preparation of surfaces not already prepared as part of removed items, etc.

The removal of doors, gates or windows shall include for the removal of all existing locks, handles, striking plates, etc. but exclude the hinges, etc., which shall be used for the new replaced items. All repair work (excluding paintwork) around and in the thresholds of new door frames, gates or windows build into existing brickwork in new or existing positions shall be deemed to be included in either the rates tendered for the new replacement item or the removal payment item of the frame, window, etc.

The new doors to toilets and wet areas as specified shall be fitted with rubber door stops. D-profiled pull handle and backplate sets, 15 mm roller ball catches with striking plates and all other ironmongery needed to install the doors complete. All new ironmongery shall be measured and paid for separately.

The new doors to offices, etc., as specified shall be fitted with rubber door stops, 4 lever mortice locksets with handle sets to match existing, striking plates and all other ironmongery needed to install the doors complete. All new ironmongery shall be measured and paid for separately.

All ironmongery installed on the project shall bear the SANS approved trademark and codes. Samples of all ironmongery scheduled must be according to the samples of the Department of Public Works and samples must be handed to the engineer for approval before ordering the material.

BH 06.02 SCHEDULED ITEMS

NEW WORK

BH 01 Joinery:

(a) Items measured by number:

(i) Timber cupboard doors, shelves, complete cupboards, etc (type and size indicated) Unit: number

(ii) Etc for other items measured by number

(b) Items measured by linear metre:

(vi) Timber rails, planks, frames, shelves, etc (size indicated) Unit: m

(ii) Etc for other items measured by length

(c) Items measured by area

(i) Pinning boards, shelves, work tops, etc (type and thickness indicated) Unit: m²

Maseno Bridge Port of Entry Technical and Particular Specification
(ii) Etc. for other items measured by area

The units of measurement shall be the number, metre or square metre of each type and/or size of joinery item specified.

The tendered rates shall include full compensation for the manufacturing and supplying of all materials, for transport, labour, cutting, waste, fixing, screws, bolts, clamps, etc and installation of the joinery items.

**BH.02 Steelwork:**

(a) Items measured by number:

(i) Steel cupboard or locker doors, shelves, complete cupboards, etc (type and size indicated) Unit: number or units

(ii) Etc, for other items measured by number

(b) Items measured by linear metre:

(i) Steel rails, shelves, frames, etc (size indicated) Unit: m

(ii) Etc, for other items measured by length

(c) Items measured by area:

(i) Shelves, plates, etc (type and thickness indicated) Unit: m²

(ii) Etc, for other items measured by area

The unit of measurement shall be the number, metre or square metre of each type and/or size of steelwork item specified.

The tendered rates shall include full compensation for the manufacturing, supplying of all materials and transport, and for all labour, cutting, welding, waste, fixing and installation of the steelwork items complete with a red oxide or equal approved steelwork primer or baked enamel paint finishing as specified.

(d) Supply and install Boltless rivet shelving. Unit: No

The unit of measurement shall be the number of bays of boltless rivet shelving complete with five shelves supplied and installed.

The unit of measurement shall include full compensation for the ordering, supply, delivery and installation of boltless shelving with a height of 2200mm x 800mm deep x 1200mm wide complete with five shelves and all the necessary accessories to form a neat installation. The minimum thickness of the steel shelves shall be 1.2 mm. The frame shall be manufactured of 1.6 mm steel and the angle upright's of 1.6 mm steel. All steel components shall be degreased, zinc phosphate and polyester epoxy powder coated process to comply with SABS standards for pre-treatment and finished in a grey colour (Colour to be confirmed on site).

The contractor shall provide the details. Specifications and proposed layout of the boltless rivet shelving to the Engineer for approval in writing before ordering.
ALTERATION WORK

BH.03 Alterations and repairs to existing fittings:

(a) Indicate if repairs, alterations, removal or sealing, etc

(ii) Description of individual items to be repaired.
    altered, removed, sealed, etc
    Unit: m³, m², m, number

The unit of measurement for items repaired, altered, removed, sealed, etc shall be cubic metre, square metre, metre or number as scheduled.

The tendered rates shall include full compensation for all costs to repair, refix, remove, cutting into, realign, taking off, temporary store, etc as specified in the Standard and Technical Specifications and shall allow for all necessary labour, plant and new material needed to leave the scheduled items as new and to the approval of the Engineer. Refer also to the general inclusion of costs in BH 06.01.01.
TECHNICAL SPECIFICATION

BJ PAINTWORK

CONTENTS

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BJ 01 SCOPE

This Specification covers the painting/repainting and maintenance of new and existing building components and maintenance thereafter for various types of buildings and structures.

Paintwork shall mean the scope of work related to the preparation, painting and maintenance of new and existing building components. This Specification does not include work related to galvanising of steelwork, which is specified elsewhere.

The complete scope of paintwork shall be as described in BJ 04: Detail of repair work.

BJ 02 STANDARD SPECIFICATIONS

BJ 02.01 GENERAL STANDARD SPECIFICATIONS

The latest edition, including all amendments up to date of tender of the following Specifications, publications and codes of practice shall be read in conjunction with this Specification and shall be deemed to form part thereof:

SANS 515 - Decorative paint with a non-aqueous solvent base for interior use
SANS 630 - Decorative high gloss enamel for interior and exterior
SANS 631 - Decorative oil gloss paint for interior and exterior use
SANS 633 - Emulsion paints for interior decorative purposes
SANS 634 - Emulsion paints for exterior use
SANS 678 - Primers for wood for interior and exterior use
SANS 681 - Undercoats for paints
SANS 683 - Roof paints (relevant sections)
SANS 723 - Wash primer (metal etch primer)
SANS 801 - Epoxy-tar paints
SANS 887 - Varnish for interior use
SANS 926 - Two-pack zinc-rich epoxy primer
SANS 1227 - Textured wall coatings, emulsion base, for interior and exterior use
SANS 1319 - Zinc phosphate primers for steel
SANS 10064 - Preparation of steel surfaces for coating
OW 371 - Specification of Materials and Methods to be used (Fourth edition, October 1993)' Section 18

BJ 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BG: Metalwork

Paint manufacturers’ Specifications. These Specifications shall take precedence over all others.
VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

ADDITIONAL REQUIREMENTS FOR PAINTWORK

General

a) Quality control

i) Application of all paints must be supported by the relevant paint manufacturer’s technical quality control systems with regard to preparation, application, film thickness, colour/pigmentation, mixing, etc.

ii) The Contractor must submit his programme to the Engineer well in advance, particularly where high-risk surface applications (sheet metal roofs, etc) are concerned, in order to keep the manufacturer’s technical personnel informed. Paint application may not commence until the manufacturer has inspected the surface preparation and given written approval thereof to the Engineer.

b) Paint systems

i) All paint shall be delivered to the site in the unopened containers on which the manufacturer’s name and trademark appear.

ii) All materials for paintwork shall comply with the requirements for standards from the country from which it originated and shall be approved by the Engineer.

iii) The Contractor shall submit copies of the paint manufacturer’s specifications, recommendations and data sheets to the Engineer for approval.

iv) The coating system shall be from one manufacturer unless otherwise specified. The paint manufacturer’s instructions shall be strictly adhered to.

v) Paints, etc. shall be suitable for application on the surfaces on which they are to be applied and various coats must be compatible with each other. Those paints used externally shall be of exterior quality or suitable for exterior use.

c) Guarantee

i) The Contractor must give a 3 year written guarantee for the quality and workmanship of the paint work (fair wear and tear excepted). The Contractor shall be liable for any peeling or flaking paint applied by the Contractor and shall execute a’ such work of repair, rectification and making good of painted surfaces as may be ordered in writing by the Engineer. The manufacturer must carry out inspections at regular intervals during the construction period. The Manufacturer must issue a certificate of acceptance and compliance on completion to the client.

BJ 03.01.02 General preparation of new and existing work

A” walls and ceilings, etc. shall be thoroughly cleaned prior to commencement of painting and the premises kept clean and free from dust during painting operations. Protect a” surfaces not to be painted against spattering and spilling. Clean down and make good as necessary locks, door handles and similar fittings or fixtures shall be removed (or masked) and refitted on completion of painting.

(a) Plaster

(i) All surfaces, sills, ceilings, etc. shall be thoroughly dry before painting operations are started. Porous surfaces must be sealed with the appropriate sealer, thinned if necessary, before applying the paint system.
(ii) Exterior surfaces. Any cracks shall be scraped out and filled with an approved filler or patching plaster and rubbed down flush, the whole surface shall be well brushed down to remove all loose dust and powdery material before applying the first coat of the specified paint system.

(iii) Interior surfaces. All cracks, blow holes, etc. shall be filled with suitable stopping and rubbed down flush. The whole surface shall be smoothed to an even finish and dusted down. Any grease marks, crayon marks, etc. shall be cleaned off with sugar soap and thoroughly rinsed with clean water. The surface shall be thoroughly dry before painting operations are started.

(iv) Ceilings. Ceilings shall be brushed down and free of all dust and powdery materials. Cover strips and cornices shall be stopped where necessary and rubbed down smooth. All nail heads shall be primed, stopped and rubbed down flush. The surface shall then be wiped or brushed free of all loose or powdery materials before applying the recommended paint system.

(v) Fibre cement. Fibre cement surfaces shall be cleaned down and primed with an approved sealer and undercoat.

(b) Metalwork

(i) Iron and steel. New iron and steel metalwork shall be cleaned with an approved degreaser and the most effective method available (shot or sandblasting, mechanical wire brushing, hand wire brushing) used to remove all rust and millscale. Any salt deposits resulting from a marine or industrial environment shall be removed by washing with water prior to priming.

(ii) Galvanised surfaces. New galvanised surfaces shall be well cleaned to remove all traces of oil and dirt with galvanised iron cleaner and rinsed with clean water.

(c) Woodwork

New woodwork shall be brushed down and the surface prepared as follows. Knots shall be given a coat of an approved patented knotting. The surface shall be primed overall and all holes shall be filled. The surface shall then be rubbed down with glass paper until smooth and even. Woodwork that needs to be oiled, stained or varnished shall be free of all stains, pencil marks and other surface discolorations and blemishes and shall be stopped with tinted stopping and rubbed down.

(d) General

(i) Colours. All colours and tints are to be submitted to the Engineer for approval. Sample colours are to be prepared in all cases for the final coat and all work must be finished to colour approved by the Engineer. Where necessary, universal undercoat must be tinted to a shade lighter than the finishing coat.

(ii) Doors and windows. All doors and opening sections of windows must be left ajar after painting or varnishing until the paint is perfectly dry.

(iii) Protection and cleaning off. All necessary precautions are to be taken for the protection of all finished work and other trades during painting, and all ironmongery shall be removed where possible prior to the commencement of painting and re-fixed after completion. All paint spots, stains, etc. are to be cleaned off floors, walls, glass, etc. after completion.
(a) Fibre cement (ceilings)

(i) New work

(1) Interior

Ceilings to wet areas (ablutions, kitchens and laundries):

- Polyurethane alkyd enamel:
  Prepare and apply one coat synthetic copolymer primer. Stop with interior crack filler, seal crack filler with above primer. Apply two coats of polyurethane alkyd enamel interior quality paint.
- Universal fungicidal additive
  To be added to above in proportions specified by the manufacturer. This additive will only be required in specific cases.

(2) Exterior

Preparation: Clean down to remove all dirt and grease, etc. Fill nail-heads with exterior crack filler and sand down to a smooth and even surface.

Finishing coat (emulsion): Apply two coats of super acrylic copolymer PVA emulsion or polyurethane alkyd enamel.

(ii) Renovation (existing) work

(1) Interior

Ceilings previously painted, in good condition:

Preparation: Clean down to remove all dirt and grease, etc. Fill nail-heads, cracks and defects with interior crack filler and sand down to a smooth and even surface.

Finishing coat (emulsion): Apply two coats of super acrylic copolymer PVA emulsion or polyurethane alkyd enamel.

Ceilings previously painted, in poor condition (to be finished in an emulsion system):

Preparation: Remove all loose and flaking paint, clean down to remove all dirt, grease, etc. Prime nail-heads with zinc phosphate primer for steel. Apply one coat of primer to existing ceiling boards diluted with 20 % turpentine. Fill nail-heads, cracks and defects with interior crack filler and sand down to a smooth and even surface. Seal all repaired areas with above-mentioned primer.

Finishing coat: Apply two coats of super acrylic copolymer PVA.

Ceilings to wet areas:

Preparation as above, but to be followed by one coat synthetic copolymer primer and two final coats polyurethane alkyd enamel interior quality paint (with fungicidal additive, only if specified).

In cases where fungicidal attack is prevalent the prepared surface must be washed down with antiseptic solution, followed by sodium hypochlorite and allowed to react for 15 minutes before washing down with water. Once dry primer and finishing coats may be applied.
(2) Exterior

Not applicable.

(b) Woodwork truss/rafters (overhangs)

(i) New work

(1) Interior

Not applicable.

(2) Exterior

- Egg-shell/High-gloss enamel:
  Prepare and touch up knots with spirit soluble resin type knotting. Apply one coat of primer for wood. Stop with wood filler where necessary. Apply one coat of universal undercoat. Apply two coats of enamel.

- Creosote coating:
  Prepare surface to be clean, dry and sound. Apply on coat of creosote wood treatment coating.

(ii) Renovation (existing) work

(1) Interior

Not applicable.

(2) Exterior

Woodwork truss/rafters (overhangs) previously painted, in good condition (to be painted in egg-shell/high-gloss enamel):

Preparation: Clean down and sand to a smooth finish. Spot prime where necessary with primer for wood. Allow 24 hours drying. Stop with wood filler.

Undercoat: Apply one coat of universal undercoat. Allow 24 hours drying.

Finishing coat: Apply two coats of enamel paint.

Woodwork truss/rafters (overhangs) previously painted, in poor condition (to be finished in egg-shell/high-gloss enamel):

Preparation: Remove existing paint and sand down thoroughly. Touch up knots and resinus areas with knotting.

Primer: Apply one coat of universal undercoat. Allow 24 hours drying. Stop with wood filler and sand to a smooth finish.

Undercoat: Apply one coat of universal undercoat. Allow 24 hours drying.

Finishing coat: Apply two coats of enamel paint.
Creosote coating:

Preparation: Prepare surface. Apply two coats creosote wood treatment coating.

(c) Metalwork - steelwork and miscellaneous metal work (including general pipework)

(i) New work

(1) Interior

Unpainted:

Prepare and apply one coat zinc phosphate primer for steel. Apply one coat of universal undercoat. Apply two coats of high gloss enamel paint.

Shop-primed:

Touch up damaged primer with zinc phosphate primer for steel. Apply one coat of universal undercoat. Apply two coats of high-gloss enamel paint.

Cast-iron waste pipes:

Prepare and remove as much bitumen as possible. Apply one coat of aluminium paint. Apply one coat of universal undercoat. Apply two coats of high-gloss enamel paint.

(2) Exterior

Unpainted:

Prepare and apply one coat zinc phosphate primer for steel. Apply one coat of universal undercoat. Apply two coats of high-gloss enamel or oleoresinous aluminium paint (where applicable).

Shop-primed:

Touch up damaged primer with zinc phosphate primer for steel. Apply one coat of universal undercoat. Apply two coats of high-gloss enamel or oleoresinous aluminium paint (where applicable)

Cast-iron waste pipes:

Prepare and remove as much bitumen as possible. Apply one coat of universal undercoat. Apply two coats of high gloss enamel or oleoresinous aluminium paint (where applicable).

(ii) Renovation (existing) work

(1) Interior

Previously painted metalwork, in good condition (steel windows, door frames, miscellaneous steelwork etc).

Preparation: Wash down with sugar soap and rinse with clean water. Sand lightly and apply one coat universal undercoat.

Finishing: Apply two coats high-gloss enamel.
Previously painted metalwork, in poor condition:

Preparation: Remove all existing paint by means of scraping or wire brushing and sanding. Tightly adhering paint that cannot be removed may remain and be overcoated. Remove all signs of rust back to bright metal by sanding with emery cloth. Wash down with an approved degreaser, rinse with clean water to remove all traces thereof and allow to dry. Treat rusted areas with a water-based rust converter.

Primer: Apply one coat of zinc phosphate primer for steel. Allow overnight drying.

Undercoat: Apply one coat of universal undercoat. Allow overnight drying.

Finishing coat: Apply two coats high-gloss enamel. Allow overnight drying between coats.

Previously painted metalwork, in good condition:

Preparation: Wash down with sugar soap, followed by light sandpapering. Rinse with clean water.

Undercoat: Apply one coat of universal undercoat. Allow 24 hours for drying.

Finishing coat: Apply two coats of high-gloss enamel or oleo-resinous aluminium paint (where applicable).

Previously painted metalwork, in poor condition:

Preparation: Remove all existing paint by means of scraping or wire brushing and sanding. Tightly adhering paint that cannot be removed may remain and be overcoated. Remove all signs of rust back to bright metal by sanding with emery cloth. Wash down with an approved degreaser, rinse with clean water to remove all traces thereof and allow to dry. Treat rusted areas with a water-based rust converter.
Primer: Apply one coat of zinc phosphate primer for steel. Allow for 24 hours drying.

Undercoat: Apply one coat of universal undercoat. Allow for 24 hours drying.

Finishing coat: Apply two coats of high-gloss enamal or oleoresinous aluminium paint (where applicable).

Previously painted metalwork, to remove all previous paint to original surface:

Preparation: Remove all existing paint by means of scraping or wire brushing, grinding and sanding. Remove all signs of rust back to bright metal by sanding with emery cloth. Wash down with an approved degreaser, rinse with clean water to remove all traces thereof and allow to dry. Treat rusted areas with a water-based rust converter.

Primer: Apply one coat of zinc phosphate primer for steel. Allow overnight drying.

Undercoat: Apply one coat of universal undercoat. Allow overnight drying.

Finishing coat: Apply two coats high-gloss enamal. Allow overnight drying between coats.

(3) Aggressive environments

Not applicable.

(d) Gypsum board (ceilings, etc)

(i) New work

(1) Interior (dry areas)

Super acrylic PYA:
Prepare and apply one coat synthetic copolymer primer for gypsum board diluted with 20% turpentine. Stop with interior crack filler, seal crack filler with above-mentioned primer. Apply two coats of super acrylic copolymer PYA paint.

(2) Exterior (dry areas)

Super acrylic PYA:
Prepare and supply one coat of synthetic copolymer primer for gypsum board diluted with 20% turpentine. Stop with interior crack filler, seal crack filler with above-mentioned primer. Apply two coats of super acrylic copolymer PYA paint.
(ii) Renovation (existing)

work (1) Interior:

Previously painted gypsum board with PVA in good condition.

Preparation: Wash down with sugar soap to remove all dirt, grease, etc., and rinse off with clean water. When dry, make good all cracks and defects with interior crack filler and sand to a smooth and even surface.

Finishing coat: Apply two coats super acrylic copolymer PVA.

Previously painted gypsum board, in poor condition.

Preparation: Clean down. Remove all paint by sanding and scraping.

Primer: Allow overnight drying. Make good cracks and holes with crack filler. Seal crack filler with above primer and allow to dry.

Finishing coat (emulsion): Apply two coats of super acrylic copolymer PVA.

(2) Exterior

Not applicable.

(e) Cement plaster (walls) and concrete surfaces

(i) New work

(1) Interior

Polyurethane alkyd enamel (in wet areas, kitchens, etc.):
Prepare and apply one coat bonding liquid, followed by one coat of synthetic copolymer primer for new plaster. Apply one coat of polyurethane alkyd enamel paint.

Acrylic emulsion:
Same as above, but apply acrylic emulsion with smooth velvet sheen interior quality paint

Gloss enamel:
Same as for polyurethane alkyd enamel, but apply two coats high-gloss enamel.

Super acrylic PVA.
Prepare and apply one coat of synthetic copolymer primer. Apply two coats of super acrylic copolymer PVA.

Semi-gloss pure acrylic finish
Prepare and apply one coat of synthetic copolymer primer. Apply one coat of pure acrylic paint.

(2) Exterior

Pure acrylic:
Prepare and apply one coat of alkali resistant synthetic resins bonding liquid. Stop with exterior crack filler. Apply one coat of copolymer primer. Apply one final coat of pure acrylic paint.

Pure acrylic with Teflon.
Preparation, priming and application as above.

Super acrylic PVA:
Prepare and apply one coat of synthetic copolymer primer. Apply two coats of super acrylic copolymer PVA.

Acrylic emulsion (external textured):
Preparation as above, followed by two coats textured exterior acrylic emulsion, allowing one hour drying time between coats.

(ii) Renovation (existing) work

(1) Interior

Previously distempered:
Preparation: Remove all distemper with a peeling agent. Rinse with clean water. Allow 48 hours to dry. Fill cracks and defects with interior crack filler. Sand down to a smooth and even surface.

Primer: Apply one coat of bonding liquid, allow a minimum of 24 hours and maximum of 72 hours for drying. Final primers as specified in BJ 03.01.03(e)(i)

Finishing coat: Apply similar paints to suit as specified in BJ 03.01.03(e)(i).

(2) Exterior

Previously painted cement plaster (walls) and surfaces, in good condition:
Prime with one coat bonding liquid

Finishing coat: Apply similar paints to suit as specified in BJ 03.01.03(e)(i).

Previously painted cement plaster (walls) and surfaces, in poor condition (i.e. peeling, crazing, etc. not previously limewashed):
Preparation: Remove all paint and fill with suitable exterior crack filler.

Priming coat: Prime with one coat bonding liquid, allow to dry for a minimum of 24 hours and a maximum of 72 hours.

Finishing coat: Apply similar paints to suit as specified in BJ 03.01.03(e)(i).
(f) Fibre cement board (fascias and ceilings)

(i) New work

(1) Interior

New and wet asbestos sheets shall be allowed to dry out before painting is commenced.

Ceiling boards must be well primed on both sides with an approved sealer/undercoat before fixing.

Super acrylic PVA.

Prepare and apply one coat of sealer/undercoat. Prime nail heads with metal primer. Stop with filler. Apply two coats of super acrylic copolymer PVA.

(2) Exterior

New and wet asbestos sheets shall be allowed to dry out before painting is commenced.

Fascia boards and barge boards shall be well primed on both sides and edges painted with sealer/undercoat before fixing.

All sides of fascia boards must receive final coatings

Super acrylic PVA.

Prepare and apply one coat sealer/undercoat. Prime nail heads with zinc phosphate metal primer. Stop with filler. Apply two coats of super acrylic copolymer PVA.

(ii) Renovation (existing) work

(1) Interior

Previously painted fibre cement board with emulsion paint, in good condition:

Preparation: Clean down thoroughly to remove any signs of dirt or grease. Fill all screw heads with a flexible resistant filler after screw heads have been primed.

Finishing: Apply two coats of super acrylic copolymer PVA paint.

Previously painted fibre cement board in poor condition

Preparation: Remove previous paint coatings with super paint stripper. Thoroughly wash down with sugar soap and rinse with clean water. Prime nail and screw heads with zinc phosphate metal primer. Allow to dry.

Primer: Apply one coat of synthetic copolymer primer to all surfaces including back and edges, allow to dry. Fill all screw heads with weather resistant filler, allow to dry, sandpaper smooth and touch up with primer.

Finishing: Apply two coats of super acrylic copolymer PVA paint.
(2) Exterior

Previously painted fibre cement board with emulsion paint in good condition:

Preparation: Clean down thoroughly to remove any signs of dirt or grease. Fill all screw heads with a flexible weather resistant filler after screw heads have been primed.

Finishing: Apply two coats of super acrylic copolymer PYA paint.

Previously painted fibre cement board, in poor condition:

Preparation: Remove previous paint coatings with super paint stripper. Thoroughly wash down with sugar soap and rinse with clean water. Prime nail and screw heads with zinc phosphate metal primer. Allow to dry.

Primer: Apply one coat of sealer/undercoat to all surfaces including back and edges, allow to dry. Fill all screw heads with weather resistant filler. Allow to dry and sandpaper smooth. Touch up with primer.

Finishing: Apply two coats of super acrylic copolymer PYA paint.

(g) Galvanised iron roof (also gutters and rainwater pipes)

(i) New work

(1) Interior

  Not applicable.

(2) Exterior

  Galvanised iron - roofs: Water-based pure acrylic emulsion paint:

  Scrub down thoroughly with degreaser, followed by a cleaner for galvanised iron. Rinse off thoroughly and ensure that all traces of cleaner have been removed and that the surfaces are free of any grease and oil. Apply one coat of galvanised metal primer. Allow to dry for 5 hours. (Must be overcoated within 24 hours maximum.) Apply one coat of water-based pure acrylic emulsion paint with non-fading pigment.

  Galvanised iron - roofs: Mat acrylic roof paint:

  Scrub down thoroughly with degreaser, followed by a cleaner for galvanised iron. Rinse off thoroughly and ensure that all traces of cleaner have been removed and that the surface is free of any grease and oil. Apply two coats of mat acrylic roof paint.

  Galvanised iron - gutters and rainwater pipes: Gloss enamel:

  Scrub down thoroughly with degreaser, followed by a cleaner for galvanised iron. Rinse off thoroughly and ensure that all traces of cleaner have been removed and that the surface is free of any grease and oil. Apply one coat of primer for galvanised iron. Allow to dry for 5 hours. (Must be overcoated within 24 hours maximum.) Apply two coats of gloss enamel paint with non-fading pigment.
(ii) Renovation (existing) work

(1) Interior

Not applicable.

(2) Exterior

Previously painted galvanised iron, in good condition.

Preparation: Thoroughly scrub down with fibre scrubbing brushes and sugar soap and rinse with clean water.

Finishing coat: Apply one coat of water-based pure acrylic emulsion paint with non-fading pigment.

Unpainted or previously painted galvanised iron, in poor condition (i.e. flaking, peeling and rusting):

Preparation: Remove all previous paint coatings with steel wire brushes, plumber's egg-shaped lead scrapers, and coarse floor sandpaper. Remove all traces of rust with emery cloth back to bright metal and apply approved rust converter. Thoroughly scrub down using galvanised iron cleaner and rinse with clean water.

Primer: Apply one coat of galvanised metal primer. Allow a minimum of 5 hours and a maximum of 72 hours for drying.

Finishing coat: Apply one coat of water-based pure acrylic emulsion paint with non-fading pigment.

(h) Timber (doors, cornices, window frames, counters, skirtings, etc)

(i) New work

(1) Interior

Polyurethane alkyd enamel (wet areas, kitchens etc):
Prepare knots with spirit soluble resin type knotting. Prime with primer (sanding sealer) for wood. Fill imperfections where necessary with wood filler. Apply one coat of universal undercoat. Apply two coats of polyurethane alkyd enamel.

High-gloss/egg-shell enamel:
Prepare knots with spirit soluble resin type knotting. Prime with primer (sanding sealer) for wood. Fill imperfections where necessary with wood filler. Apply one coat of universal undercoat. Apply two coats of enamel.

Gloss/suede varnish (interior quality solvent based):
Prepare knots with spirit soluble resin type knotting. Fill imperfections with wood filler. Sand surfaces to a smooth finish in grain direction and dust off. Thin first coat down in a ratio of 3 parts varnish to 1 part mineral turpentine and apply. Allow to dry for 24 hours. Apply two full-strength final coats with 24 hours drying time between applications.
(2) Exterior

High-gloss egg-shell enamel:
Prepare with spirit soluble resin type knotting. Apply one coat of primer for wood. Fill where necessary with wood filler. Apply one coat of universal undercoat. Apply two coats of high gloss enamel.

Gloss/suede varnish (exterior quality ultraviolet resistant solvent based):
Prepare knots with spirit soluble resin type knotting. Fill imperfections with wood filler. Sand surfaces to a smooth finish in grain direction and dust off. Thin first coat down in a ratio of 3 parts varnish to 1 part mineral turpentine and apply. Allow to dry for 24 hours. Apply two full-strength final coats with 24 hours drying time between applications.

(ii) Renovation (existing) work

(1) Interior

Previously painted woodwork, in good condition (to be finished in polyurethane alkyd enamel):

Preparation: Wash down with sugar soap to remove etc, then rinse off with clean water. Sand down to a smooth and mat surface. Make good cracks and defects with wood filler and after 24 hours drying, sand down again.

Finishing coat: Apply two coats of polyurethane alkyd enamel. Allow 24 hours for drying between coats.

Previously varnished woodwork in good condition (to be finished with interior quality varnish):

Repair defects with wood filler. Sand surfaces to a mat finish and apply two final coats varnish with 24 hours drying time between applications.

Previously painted woodwork in poor condition (to be finished with high-gloss egg-shell enamel):

Preparation: Remove all paint, varnish and stain with super paint stripper. Wash down thoroughly with sugar soap and rinse with clean water. When surface is completely dry, sand down and apply one coat of spirit soluble resin type knotting to all knots. Fill all cracks and defects with wood filler and after 24 hours of drying, sand down to a smooth and even surface. Apply one coat oleoresinous wood primer. Apply one coat universal undercoat.

Finishing coat: Apply two final coats enamel.

Previously stained and varnished or painted woodwork in poor condition (to be finished in polyurethane alkyd enamel):

Preparation: Remove all paint, varnish and stain with super paint stripper. Wash down thoroughly with sugar soap and rinse with clean water. When surface is completely dry, sand down and apply one coat of spirit soluble resin type knotting to all knots. Fill all cracks and defects with wood filler and after 24 hours of drying, sand down to a smooth and even surface. Apply one coat oleoresinous wood primer.

Finishing coat: Apply one coat polyurethane alkyd enamel.
Previously varnished woodwork in poor condition (to be finished with interior quality varnish).

Remove all varnish with paint stripper. Wash down to dry completely. Further preparation and applications as for BJ 03.01 03(h)(i) New work - interior.

(2) Exterior

Previously painted woodwork in good condition (to be repainted with high-gloss/egg-shell enamel):
Preparation: Clean down and sand to a smooth finish. Spot prime where necessary with oleoresinous wood primer. Allow 24 hours for drying. Stop defects with a flexible weather resistant wood filler.
Undercoat: Apply one coat of universal undercoat. Allow 24 hours drying.
Finishing coat: Apply two coats of enamel.

Previously varnished woodwork in good condition (to be finished with exterior quality ultraviolet resistant solvent based varnish):
Preparation and application as for similar interior item above.

Previously stained and varnished or painted woodwork in poor condition (to be finished in high-gloss/egg-shell enamel):
Preparation: Remove all paint varnish and stain with super paint stripper. Wash down thoroughly with sugar soap and rinse with clean water. When surface is completely dry, sand down and apply one coat of spirit soluble resin type knotting to all knots. Fill all cracks and defects with wood filler and after 24 hours drying, sand down to a smooth and even surface. Apply one coat oleoresinous wood primer. Apply one coat universal undercoat.
Finishing coat: Apply two final coats of enamel.

Previously stained and varnished or painted woodwork in poor condition (to be finished in polyurethane alkyd enamel).

As for similar interior item above.

Previously varnished woodwork in poor condition (to be finished with exterior quality ultraviolet resistant solvent based varnish):
Preparation and application as for similar Interior item above.

(i) Concrete and cement surfaces - floor paint

(i) New work

Exterior and interior

Preparation: Remove laitance, residual cement spillage, etc. by means of carborundum grinding and vacuum clean to remove all dust. Remove oil, grease or any other surface contaminants with degreaser and wash off with clean water. Allow to dry. The floor must have less than 5% moisture content before painting may be done.
Finishing coats: Apply two coats of an alkali resistant solvent based stoep (modified alkyd) paint. The first coat may be thinned with 25 % mineral turpentine. Sixteen hours drying time must be allowed between coats.

(ii) Renovation (existing) work

Exterior and interior

Previously painted concrete and cement surfaces. in good condition:

Preparation: Remove any loose and flaking paint by means of carborundum grinding, back to firm feathered edges. Remove any polish, grease, oil and other contaminants with degreaser, wash clean and allow to dry. Sand old paint to a mat finish and vacuum clean to remove all dust.

Finishing coats: Apply two coats as for new work above.

Previously painted concrete and cement surfaces. in poor condition:

Strip completely by suitable means and treat as for new work above.

U) Cement plaster or facebrick walls and concrete surfaces where damp penetration is evident

(i) Renovation Exterior

and interior

Preparation: Remove all damaged paintwork, efflorescence, loose friable material, etc. back to bare and sound substrate. Repair all damaged surfaces with suitable approved materials to match original surface.

Surfaces may remain damp and in some cases will require additional wetting, depending on the particular coating used.

Damp sealing coats: Apply two coats approved synthetic polymer modified water barrier coating in strict accordance with the particular product manufacturer’s Specifications. Allow 24 hours between coats unless otherwise specified.

Finishing coats: Apply decorative finishing coats to suit, as in BJ 03.01.03(e).

BJ 04 DETAIL OF REPAIR WORK

The detail of the scope of work is described in the Schedule of Quantities.

BJ 05 MAINTENANCE

No maintenance will be required for paintwork under this contract.
General inclusion of costs and specific Specifications

Notes:

All material scheduled to be removed shall be deemed to be existing damaged material. All such redundant material shall become the property of the Contractor and must be removed from site immediately.

All new material shall be deemed to be in patchwork and shall be of approved equal quality, colours, profiles, thickness, etc and shall in all cases match the existing materials and shall be applied (internally or externally) to existing material or surfaces.

All removal and repair work shall be done carefully as to not damage any adjacent or other material or work. Any damage to other or adjacent materials or areas caused by the negligence of the Contractor shall be repaired by him free of charge.

All work scheduled to be removed or taken out shall be deemed to include the cleaning and preparation of the remaining sections, areas, or work to receive the new material or work specified.

Repair work shall also include all cutting, grinding, cutting into, welding, bending, strengthening, drilling, etc to repair or to improve the items or areas as new and to match the existing.

Work scheduled to be realigned and refixed shall be deemed to include all necessary new additional materials, brackets, connector plates, bolts, pin rivets, nails, screws, spacer blocks, clamps, timber, and labour, etc to leave the items as new and totally functional.

All new work are measured net and shall include all cutting, lapping, waste, bending, fixing, corners, mitres, fixing screws, pin rivets, nails, adhesive, grout, putty, etc, as well as cleaning and preparation of surfaces not already prepared as part of removed items, etc.

All paintwork shall include for surface preparation, cleaning, primer(s), undercoat(s) and final coat(s) as specified by the manufacturers and in the Technical Specifications. Scheduled items in the Schedule of Quantities are mainly brief descriptions of the final coat(s) to identify the paint system as specified in the Specifications.

Most steel surfaces such as gratings, screens, gates, doors, mesh, louvres, burglar proofing, windows, etc are measured both sides on the net flat overall area of the item. Paint to roof covering and side cladding, etc are measured wet on the flat overall area of the items and not along the girth of the sheeting. All final re-measurements for payment purposes will be done on the same principles.

Rates tendered for paintwork shall be deemed to include for all “line cutting” between different colours of paint specified by the Engineer in dados, skirtings, etc.

Rates tendered for paintwork on ceilings and cornices shall be deemed to include for paint on cover and jointing strips.

Rates tendered for paintwork on ceilings, wall panelling, divisions, etc shall be deemed to include for timber door frames, jointing and cover strips, skirtings, cornices, quadrant beads, etc if painted with the same specified paint material and in the same colour schemes.
Where specified to be painted in contrasting colours, varnished or with a different paint material, the paintwork on the door frames, skirtings, cornices, beads, cover strips, etc. will be measured and paid for separately per linear metre.

**Specific Specification for floor paint**

**Preparation:**

The concrete floor must have less than 3% moisture before painting is attempted. Remove laitance, residual cement spillage, etc. by Carborundum grinding. Vacuum clean to remove all dust. Remove oil, grease, or any other surface contaminants with degreaser. Allow to dry thoroughly before painting.

**Paint system:**

Apply one coat of an alkali resistant solvent based stoep (modified alkyd) paint. The first coat may be thinned with approximately 25% mineral turpentine to aid penetration.

Apply one finishing coat of an alkali resistant solvent based stoep (modified alkyd) paint.

**Protection of existing furniture, carpets, finishings, cupboards, etc. during paint procedures:**

**Protection, sheets and screens:**

All existing finishings, carpets, floors, furniture, etc. shall be carefully handled, moved when instructed within the specific room, building or area to be painted, covered with sheets, screens or other approved methods to protect the items or finishings against damage or spilled paint spots or stains. Any damage caused to the mentioned existing items shall be rectified or replaced by the Contractor without additional payment.

The costs of sheets, covers, screens and all labour to address the above shall be deemed to be included in the tendered rates for the individual payment items or in the general preliminary cost items. No claims by the Contractor in this regard will be entertained.

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**BJ 06.02 SCHEDULED ITEMS**

**NEW UNPAINTED SURFACES:**

**BJ 01**

Paint to new unpainted surfaces:

(a) Description of surface:

(i) Brief description of final paint type:

(a) Description of application area or item to be painted

Unit: m²; m, number

(b) Etc. for other areas or items

The unit of measurement shall be the number, metre or square metre as applicable to each item.

The tendered rates shall include full compensation for manufacturing, providing and applying each item complete as per Specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material, preparation.
PREVIOUSLY PAINTED SURFACES:

BJ.02 Paint to previously painted surfaces:

(a) Description of surface:

(i) Brief description of final paint type:

(a) Description of application area or item to be painted Unit: m² m, number

(b) Etc. for other areas or items

The unit of measurement shall be the number, metre or square metre as applicable to each item.

The tendered rates shall include full compensation for manufacturing, providing and applying each item complete as per Specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material, preparation work, waste, plant, transport, delivery, access, scaffolding, fuel, miscellaneous items and material, etc to the Engineer’s approval.

PREVIOUSLY PAINTED SURFACES IN POOR CONDITION:

BJ.03 Paint to previously painted surfaces in poor condition:

(a) Description of surface:

(i) Brief description of final paint type:

(a) Description of application area or item to be painted Unit: m² m, number

(b) Etc. for other areas or items

The unit of measurement shall be the number, metre or square metre as applicable to each item.

The tendered rates shall include full compensation for manufacturing, providing and applying each item complete as per Specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material, preparation work, waste, plant, transport, delivery, access, scaffolding, fuel, miscellaneous items and material, etc to the Engineer’s approval.
PREVIOUSLY PAINTED SURFACES TO REMOVE ALL PREVIOUS PAINT TO ORIGINAL SURFACE:

BJ.04 Paint to previously painted surfaces to remove all previous paint to original surface

(a) Description of surface

(i) Brief description of final paint type

(a) Description of application area or item to be painted

Unit: m: m. number

(c) Etc, for other areas or items

The unit of measurement shall be the number, metre or square metre as applicable to each item.

The tendered rates shall include full compensation for manufacturing, providing and applying each item complete as per Specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material, preparation work, waste, plant, transport, delivery, access, scaffolding, fuel, miscellaneous items and material, etc to the Engineer’s approval.
TECHNICAL SPECIFICATION

BK STRUCTURAL CONCRETE (REPAIRS)

CONTENTS

SK 01 SCOPE
SK02 STANDARD SPECIFICATIONS
SK 03 REQUIREMENTS OF REPAIR WORK
SK04 MEASUREMENT AND PAYMENT

BK01 SCOPE

This Specification covers the repair of existing structural concrete elements and the supply, delivery and implementation of the repair procedures for the various types of buildings.

Structural concrete shall mean the scope of work to repair all structural concrete components such as walls, columns, stairs and suspended slabs. Joint repairs also form part of this Specification. This Specification does not include work related to metalwork and paintwork that are specified elsewhere.

The complete scope of repair work shall be according to the section SK 03: Detail of repair work.

BK 02 STANDARD SPECIFICATIONS

BK 02.1 GENERAL STANDARD SPECIFICATIONS

The latest edition, including all amendments up to date of tender of the following Specifications, publications and codes of practice shall be read in conjunction with this Specification and shall be deemed to form part thereof:

OW 371 Specification of Materials and Methods to be used (Fourth Edition, October 1993)
SASS 1200 G Concrete (structural) Concrete
SASS 1200 GA (small works) Concrete
SASS 1200 GB (ordinary buildings) Precast
SABS 1200 GE Concrete (structural)
SABS 1200 GF Prestressed concrete
SABS 0100 Structural use of concrete
SABS 110 Sealing compounds for the building industry, two-component, polysulphide base
SASS 1077 Sealing compound for the building and construction industry, two-component, polyurethane-base
SASS 1254 Sealing compounds for the building industry oleo-resinous base, for interior and exterior use
SABS 1305 Sealing compounds for the building industry, one-component, siliconed-rubber-base

BK 02.2 ADDITIONAL SPECIFICATIONS

Technical Specification BC:防水
Technical Specification BD: 墻
Technical Specification BE: Floor
Joint materials manufacturer's Specifications (they shall take precedence over others)
Concrete repair materials manufacturer’s Specification (they shall take precedence over others)

REQUIREMENTS FOR REPAIR OF STRUCTURAL CONCRETE

BK 02.3.1 Concrete repair

All existing structural concrete to be inspected to determine the extent of damage and repair work required. All remedial concrete work to be classified into the following categories by the Engineer/Department’s representative:

- Surface concrete repair
  
  Cosmetic repair of concrete surfaces where no reinforcing steel is exposed, where cover to reinforcement is not a problem (non-aggressive environment) and for non-structural repairs.

- Mild to moderate concrete repair
  
  When the reinforcing is exposed and the extent thereof is small compared to the size of the element under consideration.

- Severe concrete repair
  
  Where the front of the reinforcing is exposed in large areas or reinforcing is exposed totally. Generally when the defective areas have adverse structural implications.

The above categories do not apply to off-shutter concrete, which will be treated on merit.

Any structural concrete elements that are damaged to such an extent that they cannot be classified under severe concrete repair will be treated on merit. Detailed instructions will be issued during repair for the rehabilitation of such structural concrete elements.

BK 02.3.2 Surface concrete repair procedure

The following procedure, or similar approved by the Engineer/Department’s representative, to be used:

- Remove all loose and defective material and clean around affected area to expose aggregate.

- Saw-cut 10 mm vertically around edges of repair area and break out concrete within to avoid tapered feathering.

- Wet area well, approximately 30 minutes before commencement of repair.

- Apply an approved shrinkage compensated cementitious repair mortar in strict accordance with the manufacturer’s Specifications.

- The repaired surface to be cured by covering with plastic sheeting and keeping wet for 48 hours or as otherwise specified.
BK 02.3.3  Mild to moderate concrete repair procedure

The following procedure, or similar approved by the Engineer/Department’s representative to be used:

- Remove all loose and defective material and break out to a minimum depth of 10 mm.
- Saw-cut 10 mm vertically around edges of repair area and break out concrete within, to avoid tapered feathering.
- Ensure that concrete is free from laitance, oil, grease, etc. and is sound, firm and clean.
- Exposed reinforcing to be wire brushed clean and free of all rust and then coated with an approved single component epoxy zinc primer.
- The concrete to be thoroughly wetted and kept wet for a minimum of 12 hours before applying remedial product, loose standing water to be removed prior to application of repair mortar.
- Apply an approved shrinkage compensated cementitious repair mortar in strict accordance with the manufacturer's Specifications.
- The repaired surface to be cured by covering with plastic sheeting and keeping wet for 48 hours or as otherwise specified.

BK 02.3.4  Severe concrete repair procedure

The following procedure or similar approved by the Engineer/Department’s representative to be used:

- Propping of structure may be necessary during repair period.
- Chop around defective area removing all loose and suspect material taking care not to damage the existing reinforcing.
- Exposed reinforcing to be wire brushed clean and free of all rust and then coated with an approved single component epoxy zinc primer.
- The damaged area to be chopped rectangular in shape to expose the sound aggregate, and feathered edges to be saw-cut vertically and broken out to a minimum depth of 10 mm.
- Ensure that the cavity is clean, dry and free of any debris.
- Apply an approved epoxy resin repair compound strictly in accordance with the manufacturer's Specifications.
- In certain cases, which will be treated on merit, cementitious repair mortars as specified in BK 02.3.3, will be permitted.

BK 02.3.5  Concrete cracks

All existing concrete to be inspected to determine the extent and damage due to cracking of concrete. The cause of cracking is to be established to determine the correct remedial action to be taken. The Engineer/Department’s representative will determine the extent of repair work required, which will in most cases, require individual Specifications to suit.
BK 02.3.6  Concrete crack repair procedure
(Generally used where cracking could adversely affect the structure)

The following procedure, or similar approved by the Engineer/Department's representative to be used:

- The surface over the entire length of the crack should be wire brushed to remove laitance or any other deleterious materials from the concrete.
- If the surface of the concrete is unsound, chase a vee cut into the crack.
- All debris to be removed.
- Drill holes into the crack. The size, depth and centres etc. as specified for the crack injection product to be used. Blowout holes free of drill dust.
- Install injection nipples into the holes as specified. Allow for air release holes.
- Seal the face/s with an approved epoxy.
- Pump in approved epoxy liquid to suit crack size/width.
- The above repair system to be done strictly in accordance with the manufacturers Specifications and requirements, and must be carried out by approved specialists or suitably trained persons.

BK 02.3.7  Cleaning of concrete

Concrete surfaces which have been soiled, stained, marked, etc. and are aesthetically displeasing to the eye, must be cleaned to as close as possible to new condition. Approved water-soluble cleaners and/or acid etching cleaners must be used strictly in accordance with manufacturers Specifications.

BK 02.3.8  Expansion joints

Existing horizontal and vertical expansion joints to be inspected to determine the extent of damage to the joints. The existing expansion joints and other building elements shall be protected from damage during the progress of any repair work of expansion joints and on completion shall be cleaned and handed over in a perfect condition. Only skilled workmen experienced in the preparation for and application of the remedial products shall carry out the work.

The extent of the expansion joint remedial work to be determined by the site Engineer/Department's representative.

BK 02.3.9  Expansion joint remedial procedure

The following procedure to be used for remedial work to expansion joints. The site Engineer/Department's representative to confirm the remedial procedure required for each application and all workmanship is subject to his approval.

- Remove all damaged sealant from expansion joint.
- Joint former/filler to be inspected and if in poor condition, must be removed.
- Remove all loose materials mechanically to ensure a sound, clean and dry concrete surface.
Where required, the sides of the concrete joint to be cut smooth and straight with an angle grinder or diamond saw.

Where required, the edges of the expansion joints to be provided with a fillet. Engineer/Department's representative to determine on site.

Install a non-bituminous, non-extruding resilient jointfiller where existing joint formerfiller was removed.

Install a closed cell resilient foam cord or release film or bond breaking tape before applying sealant.

A primer coat to be applied to all surfaces, brushed well into the faces of the joint.

Install a single component fast curing polyurethane joint sealer strictly according to the manufacturer's specifications.

All materials to be submitted to the Engineer/Department's representative for approval prior to installation.

**BK03**

**DETAIL OF REPAIR WORK**

The Schedule of Quantities shows approximate quantities of work. Detailed instructions will be issued during construction.

**BK04**

**MEASUREMENT AND PAYMENT**

Refer to Technical Specification BE: Floors - Item BE OS Measurement and Payment.
TECHNICAL SPECIFICATION

CA ROADS

CONTENTS
CA01 SCOPE
CA02 STANDARD SPECIFICATIONS
CA03 OPERATING AND MAINTENANCE MANUALS
CA04 EXECUTION OF REPAIR WORK
CA05 MAINTENANCE
CA06 MEASUREMENT AND PAYMENT

CA 01 SCOPE

This Specification covers the materials, equipment, methods, testing and work required for the repair and maintenance of existing roadways, parking areas, miscellaneous areas subjected to vehicular traffic and other miscellaneous paved areas. It covers both surfaced and unsurfaced roadways and includes appurtenant works such as kerbing, road markings, road signs and traffic signals.

This Specification shall form an integral part of the maintenance and servicing contract document and shall be read in conjunction with portion 3. Additional Specifications included in this document.

This Specification shall act as a guideline to the Particular Specification and in the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.

The Contractor shall at all times adhere to this Specification, unless otherwise specified in the Particular Specification.

CA02 STANDARD SPECIFICATIONS

CA 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

The latest edition, including all amendments up to date of tender, of the following Specifications, publications and codes of practice shall be read in conjunction with this Specification and shall be deemed to form part thereof:

OW 371 Specification of Materials and Methods to be used, fourth edition, October 1993
SANS 1200 0 Earthworks
SANS 1200 OM Earthworks (roads, subgrade)
SANS 1200 M Roads (general)
SANS 1200 ME Subbase
SANS 1200 MF Base
SANS 1200 MG Bituminous surface treatment
SANS 1200 MH Asphalt base and surfacing
SANS 1200 MJ Segmented paving
SANS 1200 MK Kerbing and channelling
SANS 1200 MM Ancillary roadworks
COLTO Standard Specifications for Road and Bridge Works for State Road Authorities
SADC Road Traffic Signs Manual (latest edition)
OCCUPATIONAL HEALTH AND SAFETY ACT OF 1993

All regulations and statutory REQUIREMENTS as laid down in the latest edition of the Occupational Health and Safety Act of 1993: Construction Regulations, 2014 as promulgated in Gazette No 37305 of 7 February 2014 shall be adhered to.

MANUFACTURERS' SPECIFICATIONS, CODES OF PRACTICE AND INSTALLATION INSTRUCTIONS

All equipment and materials shall be installed, applied, serviced and repaired strictly in accordance with the manufacturers' Specifications, instructions and codes of practice.

MUNICIPAL REGULATIONS, LAWS AND BY-LAWS

All municipal regulations, laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.

OPERATING AND MAINTENANCE MANUALS

No operating and maintenance manuals will be developed for this section.

The contractor shall use the Maintenance Control Plan (see SA Maintenance) to schedule routine preventative maintenance activities.

EXECUTION OF REPAIR WORK

GENERAL

The Contractor shall investigate and inspect all areas of the installation to confirm the extent of the repair work required and shall report to the Engineer. The Engineer will thereafter demarcate any areas to be repaired and shall instruct the Contractor with regard to the repair work to be done.

At the start of the repair and maintenance contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but not be limited to the details specified in the Particular Specification.

All repair work shall be executed using approved materials and equipment suitable to the systems and/or installations they serve.

All materials and equipment shall comply fully with the REQUIREMENTS as specified for each installation.

The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer's Specifications and codes of practice and all additional and particular Specifications included in this document.

All new equipment, materials and systems shall be furnished with a written guarantee with a defects liability period of twelve (12) months from date of completion of repair work. These guarantees shall be furnished in favour of the Department of Public Works. On completion of the required and specified repair work the systems, installations and equipment shall be commissioned and handed over to the satisfaction of the Engineer.
Repair work items for the existing roadways, parking areas, miscellaneous areas subject to vehicular traffic and other paved areas shall be categorised under the following headings:

(a) Repair of gravel wearing course and shoulders
(b) Surface repairs of concrete pavements
(c) Pavement layers and surface repairs
(d) Surface patching of surfaced roads
(e) Repair of segmented paving
(f) Repair of kerbing
(g) Erection and repair of road traffic signs and traffic-control devices
(h) Erection and repair of traffic signals
(i) Road markings
(j) Chemical control of vegetation and eradication of undesirable vegetation.

CA 04.02 REPAIR OF GRAVEL WEARING COURSE AND SHOULDERS

This section covers the reprocessing or replacement of an existing gravel wearing course or road shoulder over part of or over the full road width or parking area.

CA 04.02.01 Construction

The Engineer will demarcate any areas to be repaired, and shall instruct the Contractor with regard to the repair work to be done.

The reshaped wearing course shall be constructed true to line, level and cross-section as shown on the drawings or as directed by the Engineer.

The reshaping process shall in general be carried out using the existing wearing course. This material shall be graded to form the correct road profile. If necessary, the Engineer shall instruct the Contractor to re-distribute and recompact the wearing course in order to achieve the correct road profile.

Unsuitable or excess material from the road prism shall be removed from the site to spoil. Any shortfall in material shall be made up by importing suitable material.

Material which is ripped or imported shall be placed, watered, mixed and compacted to a minimum of 93% of modified AASHTO density.

The Contractor’s attention is specifically drawn to the requirement that only material approved by the Engineer may be imported.

During the reshaping process, the roadside drains and cut and fill slopes shall be trimmed and finished true to line, level and cross-section. No additional payment will be made for trimming and finishing of cut and fill slopes.

CA 04.02.02 Quality standard

The gravel wearing course shall be constructed true to line, level and cross-section as shown on the drawings or as directed by the Engineer.

CA 04.02.03 Materials

The materials shall comply with SANS 1200 ME and the additional REQUIREMENTS detailed below:
Additional material REQUIREMENTS for wearing course - natural gravel

Maximum size  37.5 mm
Oversize index (loa)  ≤ 5 per cent
Shrinkage product (SpD)  100 - 365 (maximum of 240 preferable)
Grading coefficient (Gc)c  16 - 34
CBR: ~ 35 ~ at 95 per cent modified MSHTO compaction and OMC8

a) Oversize index (per cent retained on 37.5 mm sieve)
b) Linear shrinkage x per cent passing 0.425 mm sieve
c) (Per cent passing 26.3 mm - per cent passing 2.0 mm) x per cent passing 4.75 mm/100
d) Tested immediately after compaction

CA 04.03 SURFACE REPAIRS OF CONCRETE PAVEMENTS

This section covers the repair of spalled concrete at joints, the forming and sealing of new joints and the sealing or resealing of existing joints and random cracks in existing concrete pavements, and the patching of existing concrete.

Repairs to concrete are regarded as specialist work and shall be undertaken by approved subcontractors with relevant experience.

CA 04.03.01 Construction

Patching, resealing of joints and sealing of cracks in concrete pavements shall be done at the positions indicated by the Engineer.

(a) Resealing of joints and cracks

(i) Preparation of joints for resealing

The old deteriorated sealant in the top of the joint to be resealed shall be cut or scraped loose from each joint face with equipment that will not damage joint edges or the concrete surface. Care shall be taken not to damage, spall or bevel the joint edges.

The joints shall be initially cleaned to the full depth of the old sealant plus its backing material, as well as all foreign material in the joints. A vacuum process, and not compressed air, shall be used to remove all loosened material from the joints. The Contractor shall continuously remove debris from the road surface and keep the surface clean. After the removal of the old material has been completed, refacing of the joint planes shall be done with an abrasive wheel or a power-driven concrete saw to widen each face of the sealant reservoir portion of the joint by a minimum of 2.0 mm and a maximum of 5.0 mm. No sealant may be applied to other than freshly cut concrete faces. The freshly cut concrete faces shall be degreased to such extent that adhesion of the sealant to the concrete in every respect satisfies the sealant manufacturer’s guarantee.

Maseru Bridge
Port of Entry
Immediately after the sawing operation, the joint grooves shall be thoroughly vacuumed and washed out with a jet of clean water to remove all remaining loose material resulting from the sawing operation. Any slurry resulting from the wet sawing shall be removed from the road surface.

Sweeping up old joint material and other debris with hand brooms shall be a continuous process during joint preparation. The joints shall be finally cleaned again prior to resealing, but in no case shall the cleaning precede the sealant by more than 30 m of joint length.

(i) Preparation of cracks for sealing

Sealing shall be considered only for cracks that are open wide enough to permit entry of joint sealant or mechanical routing tools. The decision of whether a crack is to be sealed or not shall rest with the Engineer. Sealant in previously sealed cracks shall be removed as described in subclause CA.04.03.01(a)(ii) above.

A groove of at least 12 mm wide by 18 mm deep shall be made along the crack with a machine capable of closely following the path of the crack without causing excessive spalling or other damage to the adjacent concrete. Cleaning of the cracks after the grooving operation shall be done as described in subclause CA.04.03.01(a)(i) above.

(b) Patching of concrete

Patching of concrete shall be done where indicated by the Engineer.

Unless otherwise instructed by the Engineer, the patching shall have a neat rectangular shape with sides parallel to existing joints. The concrete within the area to be patched shall be broken up and removed to its full depth. The vertical face of the existing concrete adjacent to the patch shall be planed with an abrasive wheel or power-driven concrete saw, if necessary, to provide a smooth face.

Immediately prior to the placing of new concrete, the surface of the underlying pavement layer shall be compacted with either hand or mechanical equipment, depending on the space available, to ensure a firm foundation surface.

An isolation joint shall be constructed between all interfaces of existing and new concrete. The isolation joint shall consist of a joint filler, a bond breaking strip and a polysulphide sealant. The isolation joint shall only be sealed between 21 and 28 days after the casting of the concrete, at which time the uppermost portion of the joint filler shall be raked out. The bond breaking strip inserted and the polysulphide sealant applied.

As the patching of concrete will generally occur in trafficked areas, the Contractor shall allow fully in the relevant rates for accommodation of traffic to ensure safe construction conditions. No additional payment will be made over and above the tendered rates for the work.

No traffic shall be allowed over concrete patches for a period of seven (7) days after casting.
CA 04.03.02 Materials

(a) Polysulphide sealant

The polysulphide sealant shall be a two-component material that complies with the REQUIREMENTS of SANS 110.

(b) Additional materials for polysulphide sealant

The sealant shall be supported by a bond breaker backing strip and, unless otherwise recommended by the manufacturer and approved by the Engineer, the faces of the joint groove shall first be treated with a primer.

Supporting and priming materials shall be compatible with adjacent materials or surfaces in contact with the materials and shall be in accordance with the manufacturer’s recommendations and subject to approval by the Engineer.

Primer, bond breakers and back-up material shall comply with instructions and recommendations issued by the manufacturer of the approved liquid sealant used.

CA 04.03.03 Quality standard

Surface repairs shall be executed and finished strictly in accordance with the prescribed requirements.

Repair work shall be carried out in such a manner as to blend in colour, texture and finish with adjacent concrete surfaces as far as possible.

CA 04.04 PAVEMENT LAYERS AND SURFACE REPAIRS

CA 04.04.01 General

This section covers the work in connection with the repair of localised failures of the pavement layers.

The work comprises excavating the deformed areas and reconstructing the pavement and surfacing layers, including treatment of the floor of the excavation prior to backfilling.

CA 04.04.02 Execution of work

(a) Removal of distressed pavement layers

The Engineer will demarcate any failed areas to be repaired, and shall instruct the Contractor with regard to the repair work to be done. The Contractor shall provide assistance and temporary traffic control facilities for marking out failed sections of the road.

Unless otherwise instructed by the Engineer, the patching shall have a neat rectangular shape, at right angles to the direction of traffic. The existing material shall be excavated and removed to the specified depth. Asphalt layers and surfacing shall be cut with approved cutting equipment.

Excavation for patching shall be cut with side slopes of approximately 60° to the horizontal.

Excavated material from each pavement layer shall be placed in separate stockpiles adjacent to the patch. The stockpiled material shall be reused or removed from the site in accordance with the Engineer’s instructions.
After completion of the excavation to the specified depth, the Engineer shall be afforded the opportunity to examine the excavation. Where required, the floor of the excavation shall be compacted to the specified density for the layer concerned. These densities as percentages of modified AASHTO density are as follows:

- Subbase (150 - 300 mm below final base course level) 95%
- Selected (300 - 500 mm below final base course level) 93%
- Fill (Lower than 600 mm below final base course level) 90%

Materials excavated from the various pavement layers shall not be contaminated if the reuse of excavated material for backfilling is instructed by the Engineer.

Excavated material shall be removed from the site, unless re-use of material is instructed by the Engineer. Under no circumstances shall excess material be dumped in side drains or side banks.

(b) Backfilling

Prior to backfilling, the base and sides of the excavation shall be cleaned of all loose material. The top 150 mm of all excavations shall be regarded as base and all other backfill up to 500 mm below the final road level shall be regarded as subbase. Deeper excavations shall be backfilled with approved gravel to a density of 90% modified AASHTO density.

Backfilling of the excavation shall be done as follows:

(i) The Engineer may instruct the Contractor to use excavated material from the existing pavement, stabilised with cement, as backfilling, either for subbase layers only or for both subbase and base course layers.

Material shall be broken down and 60 kg/m³ of Portland composite cement (Cem 11.32.5) shall be added. Water shall be uniformly mixed into the material. The material shall then be returned to the road and compacted to at least 95% of modified AASHTO density for the subbase layers and to 97% of modified AASHTO density for the base layers.

(ii) Where required by the Engineer, backfilling for the base course layer shall be done with imported material of G3 or better quality, treated with bitumen emulsion. Portland composite cement (Cem 11.32.5) shall be added at a rate of 25 kg/m³ and mixed off the road by means of a concrete mixer or hand labour if approved by the Engineer. All mixing shall result in a homogenous mixture of additives and parent material which is to the satisfaction of the Engineer.

Thereafter the material shall be treated with a 60% anionic stable-grade bitumen emulsion diluted with five parts water to one part emulsion and added at a rate of 70 litres/m³ of crushed stone. All mixing shall result in a homogeneeous mixture of additives and parent material which is to the satisfaction of the Engineer.

The mixed material shall then be transported to the excavated area, placed and compacted, all within five hours of the commencement of the mixing process. Thereafter 0.8 litres/m² of the diluted 60% bitumen emulsion shall be applied to the base or layer to ensure a sealed surface.

The density of the backfilling of the base layer shall be at least 100% of modified AASHTO density.
(iii) Where required by the Engineer the backfilling of the base layer shall be done with continuously graded asphalt base compacted to at least 94% of Marshall density.

The excavated areas shall be tacked at a spray rate of 0.40 litre/m² using 60% cationic emulsion. The asphalt base material shall be spread and compacted so that the final surface is neat and uniform.

(iv) All the backfilling shall be completed in geometric patterns of squares or rectangles and in each case it shall be finished off neatly to 40 mm ± 10 mm below the levels of the surrounding sound road surface.

(c) Surfacing

A tack coat of 60% cationic bitumen emulsion shall be applied to the floor at top of base layer level at a rate of 0.55 litre/m² before backfilling is commenced or as otherwise instructed by the Engineer.

A layer of hot continuously graded medium asphalt shall be applied, compacted to 94% of Marshall density to bring the level of the patch up to final road level.

(d) Alternatives for application of surfacing layer for limited localised repair work:

(i) Where instructed by the Engineer, a cold premixed bituminous mixture may be used for application of the surfacing layer for minor repair works. The mixture shall either be an approved cold mix from commercial sources, or can be prepared and mixed in a suitable concrete or other type of mixer, and shall have the following mix proportions:

(i) 9.5 mm nominal sized aggregate: 1 part

(ii) 6.7 mm nominal sized aggregate: 1 part

(iii) Crusher sand (fine grade): 1 part

(iv) 60% stable mix-grade emulsion (prepared from 80/100 penetration grade between 75 and 90 litre/m³ aggregate mix bitumen)

Before spreading the mixture, the surface shall be prepared by painting it with one layer of bituminous emulsion at a rate of 0.6 litre/m² which must be allowed to dry. The mixture shall then be placed on the areas to be sealed and screeded off in a layer of uniform thickness. After the emulsion has broken and the layer has attained sufficient stability, it shall be rolled with a small steel-wheeled roller to obtain compaction. The thickness of the layer shall be the same as that of the adjacent seal.

(ii) Where instructed by the engineer, a commercially available prefabricated stone seal with a bitumen rubber binder may be used as final surfacing on minor repair works. The material shall consist of precoated stone chippings of the nominal size as directed by the engineer, held together by a layer of bitumen rubber binder on a workable surface, e.g. treated paper.

Backfilling of the underlying layer works shall be as described in CA 04.05.02 and the top of the base shall be repaired to such a level that the road surface shall be flush with the surrounding surface after repairs have been completed. The top of the base shall be prepared by painting it with one layer of bituminous emulsion at a rate of 0.6 litre/m².
which must be allowed to dry (or alternatively according to the supplier’s prescriptions).

The surfacing material shall be handled and placed according to the supplier’s prescriptions.

(e) Production limitations

As far as it is practically possible the size of the area to be repaired shall be limited to that which can be excavated, backfilled and opened to traffic within a single working day. Where this is impractical the Contractor shall consult with the Engineer regarding the signs REQUIREMENTS for controlling the traffic during night time. No area that is to be prepared, shall be left exposed if rain is imminent.

The asphalt base material shall be placed in layers not exceeding 80 mm and crushed stone material be placed in layers not exceeding 100 mm measured in the loose. The surfacing material shall be placed in one layer at a thickness of 40 mm ± 10 mm.

(f) Testing

Modified AASHTO densities shall be determined using TMH1 Method A16T (Preparationof Material) and Method A7 (Compaction of Material).

CA 04.04.03 Quality standard

The repaired area shall be rectangular in shape.

The edges of the completed surfacing shall not be more than 3 mm above the existing surface. Nowhere shall the edges be below the surrounding road surface.

The thickness of the asphalt surfacing at any point shall be 40 mm ± 10 mm.

The cross-fall of the completed area shall be equal to that of the adjacent surface to within a tolerance of ± 0.5% cross-fall.

When tested with a 3 metre straight edge laid parallel to or at right angles to the road centre line the surfacing of the area shall not deviate from the bottom of the straight edge by more than 7 mm.

The reconstruction of the pavement layers shall require a standard of workmanship to produce a patch that will not deteriorate within the contract period.

CA 04.04.04 Plant and equipment

All equipment shall be suitable for the specified use and size of working areas and shall be capable of obtaining the specified results.

Only approved cutting or sawing equipment may be used for cutting or sawing asphalt layers. The equipment must be capable of cutting asphalt layers to depths of 200 mm in one operation without fragmenting the material, and in straight lines within the required tolerances.

The following items of plant and equipment shall also be available and in good working order:

(a) A vibratory roller having a mass approximately equal to that of a Bomag 90 or similar vibratory roller, with an adjustable amplitude and frequency of vibration;

(b) A mobile compressor capable of producing at least 3 m³/minute compressed air at 750 kPa.
(c) Appropriate paving breakers.

(d) Manually-operated pneumatic compactors as required and

(e) Appropriate concrete mixers.

**CA 04.04.05 Materials**

(a) Crushed stone

Crushed stone for use as backfill in patches shall be of G3 or better quality, from an approved commercial source, and shall comply with SANS 1083 in general and the following in particular:

(i) Plasticity index (maximum) 6

(ii) Maximum flakiness index of the -26.5 mm, + 13.2 mm material 35

(iii) Maximum aggregate crushing value 29

(iv) The grading shall comply with the following grading envelope:

<table>
<thead>
<tr>
<th>Sieve size</th>
<th>Percentage passing (mass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.50</td>
<td>100</td>
</tr>
<tr>
<td>26.50</td>
<td>100</td>
</tr>
<tr>
<td>19.00</td>
<td>85 - 95</td>
</tr>
<tr>
<td>13.20</td>
<td>71 - 84</td>
</tr>
<tr>
<td>4.750</td>
<td>42 - 60</td>
</tr>
<tr>
<td>2.000</td>
<td>27 - 45</td>
</tr>
<tr>
<td>0.425</td>
<td>13 - 27</td>
</tr>
<tr>
<td>0.075</td>
<td>5 - 12</td>
</tr>
</tbody>
</table>

(b) Stabilising agent

The stabilising agent shall be Portland composite cement (Cem 11:32.5) or Portland blast furnace cement (PBFC complying with SANS 625) and shall comply with requirements of category ENV 197-1.

(c) Hot-mix asphalt base and surfacing mix requirements

The mix shall be a continuously graded asphalt and shall have the properties specified in table CA 04.04.05/1 below:

**Table CA 04.04.05/1: Properties for Continuously Graded Asphalt Base and Surfacing**

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marshall stability (kN)</td>
<td>8 - 16</td>
</tr>
<tr>
<td>Marshall flow (mm)</td>
<td>2 - 4</td>
</tr>
<tr>
<td>Stability/Flow (kN/mm)</td>
<td>3 minimum</td>
</tr>
<tr>
<td>Static creep modulus (MPa)</td>
<td>60 minimum</td>
</tr>
<tr>
<td>Indirect tensile strength @ 25°C (kPa)</td>
<td>1 000 minimum</td>
</tr>
<tr>
<td>Dynamic creep modulus (MPa)</td>
<td>16 minimum</td>
</tr>
<tr>
<td>% Air voids</td>
<td>3 - 6</td>
</tr>
<tr>
<td>Immersion index%</td>
<td>75 minimum</td>
</tr>
</tbody>
</table>

A 60/70 penetration grade bitumen shall be used and the binder type shall comply with the REQUIREMENTS of SANS 307.
Grading limits and mix proportions are given in table CA 04.05.0/2.

**TABLE CA 04.04.05/2**

<table>
<thead>
<tr>
<th>SIEVE SIZE (mm)</th>
<th>37.5 mm maximum</th>
<th>26.5 mm maximum</th>
<th>COARSE</th>
<th>MEDIUM</th>
<th>FINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>53,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>37,500</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>26,500</td>
<td>24 - 94</td>
<td>100</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>19,000</td>
<td>71 - 84</td>
<td>85 - 95</td>
<td>85 - 100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13,200</td>
<td>71 - 88</td>
<td>71 - 84</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9,500</td>
<td>50 - 67</td>
<td>62 - 78</td>
<td>62 - 76</td>
<td>82 - 100</td>
<td>100</td>
</tr>
<tr>
<td>6,700</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4,750</td>
<td>36 - 53</td>
<td>42 - 60</td>
<td>42 - 60</td>
<td>54 - 75</td>
<td>64 - 88</td>
</tr>
<tr>
<td>2,360</td>
<td>25 - 42</td>
<td>30 - 48</td>
<td>30 - 48</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1,180</td>
<td>17 - 34</td>
<td>22 - 38</td>
<td>22 - 38</td>
<td>27 - 42</td>
<td>35 - 54</td>
</tr>
<tr>
<td>0,600</td>
<td>16 - 28</td>
<td>16 - 28</td>
<td>16 - 28</td>
<td>18 - 32</td>
<td>24 - 40</td>
</tr>
<tr>
<td>0,300</td>
<td>10 - 22</td>
<td>12 - 20</td>
<td>12 - 20</td>
<td>11 - 23</td>
<td>16 - 23</td>
</tr>
<tr>
<td>0,150</td>
<td>8 - 15</td>
<td>8 - 15</td>
<td>7 - 16</td>
<td>10 - 20</td>
<td>-</td>
</tr>
<tr>
<td>0,075</td>
<td>5 - 12</td>
<td>6 - 10</td>
<td>4 - 10</td>
<td>4 - 10</td>
<td>4 - 12</td>
</tr>
</tbody>
</table>

**NOMINAL MIX PROPORTIONS BY MASS**

| Aggregate | 94.5% | 93.5% | 93.0% | 93.0% |
| Bitumen   | 5%    | 5.5%  | 6.0%  | 6.0%  |
| Active filler | 0.5% | 1.0%  | 1.0%  | 1.0%  |

(d) Tack coat

The tack coat shall be 60% cationic emulsion complying with SANS 548.

CA 04.04.06 Variation from specified nominal rates of applications or nominal mix proportions

The various sections of these Specifications specify nominal rates of applications or nominal mix proportions for materials such as bituminous materials, aggregates, fillers, stabilizing agents, paint and other relevant materials. Tenderers shall base their tenders on these nominal rates of applications and mix proportions.

Where such nominal rates of applications or mix proportions are specified, provision is made for deviations in the quantities of material in consequence of the rates of application or mix proportions prescribed by the Engineer in each particular case in consideration of the available materials and the site.

Where the actual rates of applications or mix proportions used in the works vary from the specified nominal rates and mix proportions, adjustment to compensation will be made as:

(a) payment to the Contractor in respect of any authorised increase in quantities which exceed those specified and where such increase has been ordered in writing by the Engineer.

or

(b) a refund to the Employer in respect of the decrease in quantities that are less than those specified, irrespective of whether such decrease results from an unauthorised decrease in the rates of applications or mix proportions, or from unauthorised reductions on the part of the Contractor.

Masera Bridge Port of Entry Technical and Particular Specification
Payment for a prescribed rate of application or mix proportion shall be based on the actual rate of application or mix proportion used, provided that this does not exceed the prescribed rate of application or mix proportion, plus any tolerance in the rate of application or mix proportion allowed. If the actual rate of application or mix proportion exceeds the prescribed rate or proportion, payment shall be based on the prescribed rate of application or mix proportion, plus any tolerance allowed. If the actual rate of application or mix proportion is below the prescribed rate of application or mix proportion specified or instructed by the Engineer, payment shall be based on the actual rate of application or mix proportion regardless of any tolerance allowed. Notwithstanding the above, the Engineer shall be entitled to reject work which has not been constructed in accordance with the Specifications or the rates of applications or mix proportions prescribed by him.

The Employer shall be refunded for any decrease in the specified rates of application or mix proportions at the same rate per unit of measurement as that tendered by the Contractor for additional materials required by an increase in the rates of applications or mix proportions.

CA 04.05 SURFACE PATCHING OF SURFACED ROADS

CA 04.05.01 General

This section covers the repair of potholes and edge breaks that have developed in the surface of surfaced roads, where there is no evidence of base failure. Potholes are local failures covering an area of less than 1 m². The repair of larger areas will be defined as surface repair. Edge break treatment is necessary for finishing off and/or repairing the edges of the paved road, and also for repairing the edges of the road so that they line up with the true edge of the original road or with other edges as may be required. Pay items CA04.01 and CA04.04 shall only apply to edge break widths of 200 mm or less. Edge breaks wider than 200 mm shall be classified as surface repair and paid for under items CA04.02 and CA04.03.

CA 04.05.02 Execution of work

Pothole and edge break repairs shall consist of trimming away ravelled edges and loose material to the full depth of the pothole or edge break and the backfilling thereof with asphalt.

(a) Excavation

Potholes: The existing material shall be removed in a neat rectangle to sound base, with a minimum dimension of 200 mm x 200 mm. All sides shall be at right angles or parallel to the direction of traffic. The minimum depth of excavation (layer thickness) is 30 mm and the maximum thickness of each layer shall be 50 mm.

Edge breaks: Loose and cracked edges shall be trimmed back in a neat rectangular shape as demarcated by the Engineer, parallel and at right angles to the centre line of the road to sound surrounding surfacing or base and excavated down to sound base. All edges shall be saw cut to a minimum depth of 30 mm below the road surface and the maximum thickness of each layer shall be 50 mm.

(b) Backfilling

After completion of the excavation, the Engineer shall be afforded the opportunity to inspect it. The exposed layer shall be trimmed of all undulations to ensure a firm flat base and sides and shall be tacked with 60% cationic stable-grade bitumen emulsion at a rate of 0.6 litres/m². Continuously graded medium asphalt shall be placed and compacted to the level of the existing surrounding surface. The asphalt shall be placed and well compacted in layers.

Maseru Bridge
Port of Entry
not exceeding 40 mm after compaction. The Contractor shall use suitable compaction equipment and shall ensure that 94% of Marshall density is obtained for the mix used, to produce a dense asphalt layer.

Where the excavation ends up deeper than 100 mm below the existing surface the Engineer may order the reinstatement to be executed in accordance with Section CA 04.04. Pavement layers and surface repairs.

Where instructed by the Engineer, a cold premixed bituminous mixture shall be used for limited localised surface patching, compacted level with the surface of the existing surrounding surface.

The mixture shall either be obtained from approved commercial sources or prepared and mixed in a suitable concrete or other approved type of mixer in the following proportions:

(i) 9.5 mm nominal sized aggregate: 1 part
(ii) 6.7 mm nominal sized aggregate: 1 part
(iii) Crusher sand (fine grade): 1 part
(iv) 60% stable mix-grade emulsion (prepared from 80/100 penetration grade) between 75 and 90 litres/m³ aggregate mix bitumen

Before spreading the mixture, the surface shall be prepared by painting it with one layer of bituminous emulsion at a rate of 0.6 litre/m², which shall be allowed to dry. The mixture shall then be placed on the areas to be sealed and screeded off in a layer of uniform thickness. After the emulsion has broken and the layer has attained sufficient stability, it shall be compacted with a steel wheeled roller. The thickness of the layer shall be the same as that of the adjacent seal.

CA 04.05.03 Quality standard

The repaired area shall be rectangular in shape.

The edges of the completed surfacing shall not be more than 3 mm higher than the existing surface. Nowhere shall the edges be below the surrounding road surface.

The thickness of the asphalt surfacing at any point shall be 40 mm ± 10 mm.

The cross-fall of the completed area shall be equal to that of the adjacent surface to within a tolerance of ± 0.5% cross-fall.

When tested with a 3 metre straight edge laid parallel to or at right angles to the road centre line the surface of the area shall not deviate from the bottom of the straight edge by more than 7 mm.

The reconstruction of the pavement layers shall require a standard of workmanship such that a patch will not deteriorate within the contract period.
"All asphalt mixes specified for use in the works, shall contain at least 1% by mass of hydrated lime filler."

**CA 04.06.03 Composition of asphalt base and surfacing mixtures (section 4203)**

Add the following:

"The nominal mix proportion (by mass) of the asphalt surfacing mixtures shall conform to the continuously graded medium mix as set out in Table 8420217, except for the limits of the percentage passing through the 2,360 sieve which should be changed to "38 - 57."

The active mineral filler to be used in the asphalt mixes shall be hydrated lime."

Add the following after "TRH8" in the first sentence of the last paragraph.

"...the new South African Hot Mix design guide..."

Add the following:

"The mix designs for continuously graded asphalt surfacing shall be executed to conform to the test REQUIREMENTS given in Table 84203/1 below, which replaces the REQUIREMENTS for these mix designs given in Table 4203/1 of the standard Specifications.

**TABLE 84203/1**

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability (kN)</td>
<td>8.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Flow (mm)</td>
<td>2.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Stability/flow (kN/mm)</td>
<td>2.5</td>
<td>-</td>
</tr>
<tr>
<td>Voids (%)</td>
<td>4.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Air permeability (cm²)</td>
<td>-</td>
<td>1 x 10-0</td>
</tr>
<tr>
<td>Film thickness (mm)</td>
<td>5.5</td>
<td>-</td>
</tr>
<tr>
<td>Immersion index (%)</td>
<td>75</td>
<td>-</td>
</tr>
<tr>
<td>VMA (%)</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>Dynamic Creep Modulus (MPa) at 40°C</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>Static Creep Modulus (MPa) at 40°C</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Indirect tensile strength at 25°C (kPa)</td>
<td>1000</td>
<td>1400</td>
</tr>
<tr>
<td>Bitumen ratio</td>
<td>1.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Additional testing as per "South African Hot Mix Design Guide"

Modified Lottman Test @ 7% voids TSR 0.7
Soilab wheel track test @ 5,000 passes < 1.25mm
Gyratory test @ 300 gyrations 1.5%
Other tests as instructed by the engineer
Number of Marshall compaction blows on each side of briquette = 75."

**CA 04.06.04 General limitations and requirements and the stockpiling of mixed material (section 4205)**

(c) Surface requirements

(iii) Tack coat

Replace the first paragraph with the following

Masero Bridge: Port of Entry Technical and Particular Specification
CA 04.05.04 Material

(a) Tack coat

The tack coat shall be 60% cationic emulsion complying with the REQUIREMENTS of SANS 548 and shall be applied at a rate of 0.8 litre/m2.

(b) Surfacing material

The asphalt shall be a continuously graded medium asphalt either mixed on site or obtained from commercial sources. The asphalt mix to be used shall have the mix properties as specified in table CA 04.04.05/1.

A 60/70 penetration grade bitumen shall be used and the binder type shall comply with the REQUIREMENTS of SANS 307.

Grading limits and mix proportions for continuously graded asphalt applying to asphalt surfacing as stated in table CA 04.04.05/2 shall apply to asphalt used for surface patching.

CA 04.06 ASPHALT SURFACING

CA 04.06.01 General

This section covers all work in connection with the construction of asphalt surfacing using paving equipment. It includes the procuring and furnishing of aggregate and bituminous binder, mixing at a central mixing plant, transporting, spreading and compaction of the mixture.

This section shall be read in conjunction with the relevant sections of the latest edition of the Standard Specifications for Road and Bridge Works for State Road Ammotites, issued by COLTO.

The following sections are additions to or alterations of the COLTO specifications as applicable to this contract.

CA 04.06.02 Materials (section 4202)

(a) Bituminous binders

(i) Conventional binders

Add the following:

"The bitumen binder to be used for the continuously graded asphalt surfacing shall be 80/100 penetration road grade bitumen.

(b) Aggregates

(viii) Grading

Add the following:

"The aggregate for continuously graded asphalt surfacing shall be as specified for a medium grading as per Table 4202/7 in the standard Specifications (COLTO).

(c) Fillers

Add the following:
Pavement layers of segmented paved areas under pedestrian traffic only, shall be excavated and replaced by natural gravel compacted to 93% modified AASHTO density. Damaged concrete edge beams and intermediate beams shall be replaced with class 30 concrete edge beams and intermediate beams similar in dimension to existing undamaged edge beams and intermediate beams in accordance with the relevant SANS Specifications or as directed by the Engineer. After the repair of the underlying pavement layers and when the concrete edge beams and intermediate beams have reached sufficient strength, segmented paving blocks, similar to the existing undamaged segmented paving blocks shall be replaced in accordance with the relevant SANS Specifications or as directed by the Engineer.

Unsuitable or excess material shall be removed from the site of to spoil. Any shortfall in material shall be made up by importing suitable material.

The Contractor’s attention is specifically drawn to the requirement that only material approved by the Engineer may be imported.

CA 04.07.02 Quality standard

The repaired segmented paving shall be constructed true to line, level and cross-section as shown on the drawings or as directed by the Engineer.

CA 04.08 REPAIR OF KERBING

This section covers the patching and replacing of damaged kerbs

CA 04.08.01 Construction

Where the damage to kerbs can be repaired satisfactorily by surface patching of the kerb units, the Engineer will authorize such work to be done. The contractor shall use products and material approved by the Engineer to repair the authorized kerbs to the satisfaction of the Engineer.

Where kerbs or channel units are severely damaged or have been moved out of position, such units will be replaced with similar undamaged units. Precast units and its installation will comply with the relevant SANS specifications and cast in situ concrete work will be done in accordance with the relevant SANS specifications.

CA 04.08.02 Quality standard

The repaired kerbing shall be constructed true to line, level and cross-section as shown on the drawings or as directed by the Engineer.

CA 04.09 ERECTION AND REPAIR OF ROAD TRAFFIC SIGNS AND TRAFFIC-CONTROL DEVICES

CA 04.09.01 General

This section covers the erection of permanent road traffic signs. It includes the repair and replacement of faded, damaged or not clearly visible existing signboards and reference marker boards.

Specifications relating to manufacturing of road signs are not included in this document. All relevant Specifications regarding manufacturing will be issued to a nominated subcontractor who shall be a recognised manufacturer of road signs.

The signs shall be the standard regulatory, guidance, warning and information signs and fabricated in accordance with the South African Road Traffic Signs Manual (July 1993) except where otherwise specified, indicated on drawings or directed by the Engineer.
"A tack coat shall in all cases be applied to the surface to be paved.

Add the following:

"Hand spraying shall only be allowed on areas approved by the engineer. Efficient spray equipment, capable of spraying an even layer of binder covering the whole area to the specified rate, shall be used."

CA 04 06.05 84214 Quality of materials and workmanship

(b) Coring of asphalt layers

Add the following:

"Cores may only be drilled when the road temperature is 20°C or below. Each core hole must be filled with hot asphalt and compacted within 12 hours of having been drilled.

Asphalt must be cored within 2 days of having been paved and the density results delivered to the engineer within 2 days of coring.

The engineer reserves the right to withhold payment for asphalt work until all test results for the section of work concerned have been received and the work fully approved."

(c) Routine inspection and tests

Add the following:

"Test results and measurements will be assessed in accordance with the provisions of section 8300: Quality control (Scheme 2)."

CA 04.07 REPAIR OF SEGMENTED PAVING

This section covers the replacement of an existing area of segmented paving as well as the reprocessing and/or replacement of the underlying pavement layers.

CA 04.07.01 Construction

The Engineer will demarcate any areas to be repaired and shall instruct the Contractor with regard to the repair work to be done.

The demarcated area shall be repaired true to line, level and cross-section as shown on the drawings or as directed by the Engineer.

The demarcated area of damaged segmented paving shall be removed unless otherwise instructed by the Engineer. The pavement layers shall be reinstated as follows:

(i) Selected layers shall be of at least a G5 quality and shall be compacted to at least 93% of modified AASHTO density.

(ii) Material for the subbase layers shall be stabilized with 3% cement and compacted to 95% of modified AASHTO density, and shall be of at least a G5 quality.

(iii) The material for the base layer shall be stabilized with 5% cement and compacted to at least 97% of modified AASHTO density, and shall be at least a G3 quality.
Road signs shall be erected strictly in accordance with the details and instructions on the drawings and as directed by the Engineer.

During erection the structural steelwork shall be firmly bolted and protected to prevent buckling or damage being caused during erection, or by the equipment used for erection.

Posts to which road signs are to be fixed shall be vertical and the undersides of road signs shall be horizontal after having been erected.

Where timber posts are used for erecting the signs, all holes that are drilled in the timber shall be retreated with the approved preservative. A road sign identification number (as indicated on the layout drawings) shall be painted with white enamel paint on the reverse side of the road sign board, above the month and year of manufacture, in 50 mm high letters and numbers on the side closest to the road shoulder as directed by the Engineer.

Any sign damaged during transit to the erection site or during the erection process shall be replaced or repaired to the satisfaction of the Engineer at no extra cost to the Employer.

(d) Field welding

All welding done during erection shall comply with the REQUIREMENTS for welding during manufacture.

(e) On-site painting

All painting done after the road signs have been erected shall comply with the REQUIREMENTS for painting during manufacture.

All places where the paintwork has been damaged during erection shall be repaired by the Contractor at his own cost to the satisfaction of the Engineer.

(f) Time of erection

Road signs shall be erected immediately prior to the road being opened to public traffic, unless otherwise decided by the Engineer.

(g) Attachment of overlays

The type of overlay to be used will be specified by the Engineer and will consist either of 1 mm thick Chromadek plate, "pop-riveted" onto the existing sign plate, or System 5 overlay or similar approved.

Before the application of the overlay to any structure, the existing sign board shall be thoroughly cleaned.

(h) Repair of signs

The Engineer may require that certain existing signs be dismantled for repair work or storage and later re-erected. The signs shall be repainted or repaired by replacing the 200 mm profiles or straightening the sheet metal as specified during the manufacturing process. New materials shall be used for part or all of the supporting structure. This work shall be done with as little damage as possible to the signs.
The erection and placement of any signs, whether temporary or permanent, shall be in accordance with the South African Road Traffic Signs Manual (June 1999).

CA 04.09.02 Storage and handling

All road signs or parts of road signs shall be transported, handled and stored in a weather-proof storeroom in such a manner as to prevent any damage and deformation. Sign boards shall be stored on blocks in the vertical position so that the signs are not in contact with the ground. There shall be sufficient space between the finished road sign boards to permit free air circulation and moisture evaporation. Contact of road sign boards with treated timber and diesel, or storage where road sign boards come into contact with dirt or water will not be permitted.

When required, existing or newly erected road signs shall be fully or partially covered with burlap or other approved adequately ventilated material to obscure destinations that are temporarily inapplicable or irrelevant. The covers shall be neatly and firmly fixed in position so that they will be able to withstand strong gusts of wind or eddies caused by passing traffic. The fixing shall be done in a way that will not cause any damage to the road sign face.

CA 04.09.03 Execution of the work

(a) Position

Road signs shall be erected in the positions shown on the drawings or indicated by the Engineer.

(b) Excavation and backfilling

Excavations for the erection of road signs shall be made according to the dimensions shown on the drawings. Where the excavations are to be backfilled with soil, a 1:1 cement-soil mixture (soilcrete) shall be prepared if instructed by the Engineer. The soil or soil-cement mixture shall then be placed at optimum moisture content in 100 mm thick layers in the excavation and shall be compacted to a minimum of 90% of modified AASHTO density.

Where posts or structures are to be fixed in concrete or where concrete footings are to be cast, the concrete, formwork and reinforcement shall comply with the relevant requirements. The holes shall be completely filled with concrete up to the level shown on the drawings or indicated by the Engineer. The upper surface of the concrete shall be neatly finished with sufficient fall to ensure proper drainage.

This subclause shall apply to ground-mounted signs only. Excavating and backfilling for the foundations of overhead steel structures are specified and regarded as specialised structural work.

Excavation in rock shall be paid for under item CA07.05.

Where material from the excavations is not suitable for backfilling or for the preparation of soilcrete, suitable material shall be obtained as instructed by the Engineer.

(c) Erection

Road sign boards must be inspected by the Engineer and approved in writing before the boards are taken from the camp site to the erection site. The Contractor shall notify the Engineer at least one (1) week before the said inspections are required.
- the controller;
- vehicle detector units;
- CCIU or modem;
- traffic lights;
- electrical switchgear and terminal blocks, and
- supporting structures, poles, brackets and method of fixing for traffic lights.

Only new plant and materials of merchantable quality and meeting acceptable industry standards shall be used. Plant and materials used shall conform to samples provided by the Contractor, or cited as examples, and approved by the Engineer.

All plant and materials shall be inspected and tested by the manufacturer at the manufacturer’s works before delivery.

(b) Environment and working conditions

Plant shall be manufactured, constructed and erected to withstand and operate within the full range of climatic and atmospheric conditions encountered in the relevant area. Electrical components modules wiring, printed circuit boards and terminals shall be protected against corrosion, the effects of extreme winds and the effects of extreme temperatures, all as applicable.

(c) Electricity supply

Nominal 230 V RMS 50 Hz electricity supplied by ESCOM is available on the site. The system shall also be connected to the emergency standby power generated on the site during interruptions in ESCOM supply. An electric power distribution board of at least 30 A capacity shall be supplied for each traffic signal.

(d) Electrical earthing

All traffic signal installations shall be earthed to an earth electrode or trench earth designed in accordance to SANS 0199. The earth electrode resistance shall not exceed 2 ohms.

The preferred method of earthing is to run a 16 mm² bare hard-drawn copper conductor with the supply cable. Where the supply cable is less than 30 m long, or where earth resistivity is high and the specific earth electrode resistance cannot be achieved by means of a trench earth only, two earth spikes shall be driven vertically into the ground in the trench bottom. One shall be as close as possible to the controller cabinet and the second shall be at least 6 m away. The two spikes shall be connected to each other by means of a trench earth conductor.

Earth conductors shall be copper-clad steel-cored or stainless steel of not less than 19 mm diameter and 2 000 mm length, complying with SANS 1063. The top of each spike and any bare earth conductor shall be at least 500 mm below ground level.
Road-marking paint shall comply with the REQUIREMENTS of SANS 731 for type 1, type 2 or type 4 paint.

The paint shall be delivered at the site in sealed containers bearing the name of the manufacturer and the type of paint. Marking shall be in accordance with SANS 731.

The viscosity of the paint shall be such that it can be applied without being thinned down.

(ii) Retro-reflective road-marking paint

Retro-reflective road-marking paint shall comply with the REQUIREMENTS of CKS 192 and SANS 731.

(iii) Colour

The colours to be used shall be bright white, yellow or red.

The colour of the yellow and red paint shall be as specified in SANS 731.

(iv) Retro-reflective beads

The retro-reflective beads shall be glass beads that comply with the REQUIREMENTS for glass beads specified in CKS 192.

The beads shall be delivered at the site in sealed bags, marked with the name of the manufacturer, the batch number and an inspection seal of the South African Bureau of Standards (SANS), confirming that the beads form part of a lot that has been tested by the SANS and complies with the REQUIREMENTS of CKS 192. If not, the Contractor shall at all times have an SANS certificate on the site, with details of the batches that make up a lot that has been tested by the SANS, complies with CKS 192 and to which the inspection seal applies.

CA 04.10.03 Weather limitations

Road-marking paint shall not be applied to a damp surface or at temperatures lower than 10 °C, or when, in the opinion of the Engineer, the wind strength is such that it may adversely affect the painting operations.

No road-marking paint may be applied when visibility is dangerously impeded by mist, smoke or smog.

CA 04.10.04 Mechanical equipment for painting

The equipment shall consist of an apparatus for cleaning the surfaces, a mechanical road-painting machine and all additional hand-operated equipment necessary for completing the work. The mechanical road-marking machine shall be capable of painting at least two lines simultaneously and shall apply the paint to a uniform film thickness at the rates of application specified hereinafter. The machine shall be so designed that it will be capable of painting the road markings everywhere to a uniform width with sides within the tolerances specified hereinafter, without the paint running or splashing. The machine shall further be capable of painting lines of different widths by adjusting the spray jets on the machine or by means of additional equipment attached to the machine.

The machine shall be provided with clearly visible amber warning flashing lights which shall always be in operation when the machine is on the road.
CA 04.09.04  Materials

(a)  Timber posts for road sign supports

Timber posts for road sign supports shall conform to the requirements of SANS 754, shall be equal to or better than strength group S timber posts and shall be stamped with the SANS mark. The exposed surface of the cut shall be given two coats of creosote. Any holes drilled in the timber posts after treatment with creosote shall be retreated.

(b)  Corrosion-protection tape

Corrosion-protection tape used between aluminium and steel shall be black PVC tape not less than 0.25 mm in thickness, shall be resistant to ultra-violet rays, and shall have an adhesive backing. The breaking strength of the material shall be not less than 3.5 kN/m.

CA 04.09.05  Protect ion and maintenance

The Contractor shall protect the completed road signs against damage until they have been finally accepted by the Employer, and he shall maintain the road signs until the maintenance certificate has been issued. Damage or defects caused by negligence or faulty workmanship shall be rectified by the Contractor at his own cost to the satisfaction of the Engineer.

CA 04.09.06  Dismantling, storing and re-erecting existing road signs

Where instructed by the Engineer, the Contractor shall dismantle existing road signs, store them, and re-erect them at new positions indicated. This work shall be done taking care to cause as little damage as possible to the signs.

The method applied for dismantling the existing signs and transporting and storing the signs shall be subject to the Engineer’s approval. No additional payment shall be made for any equipment or handling methods necessary to prevent damage to existing signs which are suitable for re-use, as instructed by the Engineer.

Where required by the Engineer, the signs shall be repainted or repaired and new materials shall be used for part or all of the supporting structure.

CA 04.10  TRAFFIC SIGNALS

CA 04.10.01  General

This section covers the installation and maintenance of traffic signals by specialist contractors.

The REQUIREMENTS of the Southern Africa Development Community Road Traffic Signs Manual shall apply to traffic signals provided under this Contract.

CA 04.10.02  Plant and materials

(a)  Quality

The Contractor shall provide full technical details and dimensions of the required items for approval by the Engineer before ordering, commencement, manufacture or construction of the following items, which shall bear the SASS mark:

Maseru Bridge
Port of Entry
The position and outlines of special markings shall be produced on the finished road in chalk and shall be approved by the Engineer before the markings are painted. Approved templates may be used on condition that the positioning of the marking is approved by the Engineer before painting is commenced.

The positions for the beginning and end of all barrier-line road-markings must be suitably indicated by the Engineer before the marking of the road commences.

CA 04.10.07 Applying the paint

The figures, letters, signs, symbols, broken or unbroken lines or other marks shall be painted as shown on the drawings or as directed by the Engineer.

Where the paint is applied by machine, it shall be applied in one layer. Before the road-marking machine is used on the permanent works, the satisfactory operation of the machine shall be demonstrated on a suitable site which is not part of the permanent works. Adjustments to the machine shall be followed by further testing. Only when the machine has been correctly adjusted and its use has been approved by the Engineer after testing, may the machine be used on the permanent work. The operator shall be experienced in the use of the machine.

After the machine has been satisfactorily adjusted, the rate of application shall be checked and adjusted if necessary before application on a large scale. The commencement.

Where two or three lines are required next to each other, the lines shall be applied simultaneously by the same machine. The paint shall be stirred before application in accordance with the manufacturer's instructions. Paint shall be applied without the addition of thinners.

Where, under special circumstances, painting is done by hand, it shall be applied in two layers, and the second layer shall not be applied before the first layer has dried out sufficiently. As most road-marking paint reacts with the bitumen surface of the road, the paint shall be applied with one stroke only of the brush or roller.

Ordinary road-marking paint shall be applied at a rate not less than 0.42 litres/m2. Unless otherwise instructed by the Engineer, the road-marking shall be completed before a particular section of the road is opened to traffic. Each layer of paint shall be continuous over the entire area being painted.

Control sheets with details of the order number, work dates, quantities of paint used and surface areas painted shall be completed by the Contractor for every section of road included in an order. One set of copies of these sheets shall be handed to the Engineer on completion of every individual order.

CA 04.10.09 Applying the retro-reflective beads

Where retro-reflective paint is required, the retro-reflective beads shall be applied by means of a suitable machine in one continuous operation, immediately after the paint has been applied. The rate of application of the beads shall be at least 0.8 kg/litre of paint or such other rate as may be directed by the Engineer. Machines that apply the beads by means of gravity only shall not be used. The beads shall be sprayed onto the paint layer by means of a pressure sprayer.

If specified or instructed by the Engineer, additional surface reflectorization of plastic road-markings shall be applied at a rate and according to the methods specified in BS 3262, 1987, part 3.

CA 04.10.10 Tolerances

Road-markings shall be constructed to an accuracy within the tolerances given below.
CA 04.10.02 Remedying defects

(a) Defects liability

The Contractor shall remedy any defect in the work, or malfunctioning of traffic signals, within the Defects liability Period. This period shall be 12 months from the date of issue of the Certificate of Completion, always provided that the period of the Contractor's liability for latent defects shall be unlimited.

In the event that a traffic signal or an item of plant is repaired or replaced during the Defects Liability Period, the Defects Liability Period for specific item shall be extended by an amount that, when added to the un-expired portion of the Defects Liability Period, totals 12 months from the date of such repair or replacement.

(b) Rectifying defects

The Contractor may, with the approval of the Engineer, effect temporary repairs, always provided such repair does not jeopardize safety and that a permanent repair is effected within 24 hours of the temporary repair having been completed.

(c) Replacement of defective plant and materials

Any defective controller, vehicle detector unit or traffic light shall be replaced in its entirety. Defective plant shall not be repaired. In the case of a defective controller, where the defect may be attributed to the malfunctioning of a replaceable plug-in module or PC board, the Contractor may, with the prior approval of the Engineer, replace the defective module or board.

(d) Recurring defects

In the event that a defective item or a module or PC board has been replaced and the replacement becomes defective or malfunctions any time afterwards, the Contractor shall make a thorough investigation into the cause of the defect or malfunction and report his finding to the Engineer, together with his recommendations for permanently rectifying the defect or malfunction and ensuring it will not re-occur in the item and any other items that are of a similar material or construction.

If the Contractor fails to make, what in the opinion of the Engineer is a conclusive recommendation or effect a permanent remedy, the Employer shall be entitled to take such steps as are necessary to replace the plant with plant from a different manufacturer. The reasonable costs of doing this shall be to the account of the Contractor.

CA 04.10 ROADMARK INGS

CA 04.10.01 General

This section covers the permanent marking and maintenance of white, yellow or red painted lines or symbols on the road surface by specialist contractors.

CA 04.10.02 Materials

(a) Plant

(i) Road-marking paint
After the paint has been applied, the road markings shall be protected against damage by traffic or other causes. The Contractor shall be responsible for erecting, placing and removing all warning boards, flags, cones, barricades and other protection measures that may be necessary in terms of any statutory provisions and/or as may be recommended in the South African Road Traffic Signs Manual and specified in Road Note 13.

CA 04.11 CHEMICAL CONTROL OF VEGETATION AND ERADICATION OF UNDESIRABLE VEGETATION

CA 04.11.01 General

This section covers the eradication of declared and undesirable vegetation, as well as the chemical control of vegetation growth through the application of herbicide.

CA 04.11.02 Execution of work

The eradication of undesired vegetation and chemical control of vegetation growth shall be executed where directed by the written instruction of the Engineer.

Herbicide shall normally only be applied in the spring or summer during the period when the vegetation to be killed is growing strongly.

The Contractor’s attention is drawn to the requirement that herbicides may only be applied by duly registered, competent contractors in possession of an AVCASA certificate. Proof of such registration shall be furnished on demand to the Engineer.

The Contractor shall ensure that no damage is caused to other plants inside or adjacent to the treated areas as a consequence of the application of herbicides.

Application shall not be carried out in high winds or wet weather.

The following herbicides may not be used:

- Agents of an explosive, flammable, volatile or corrosive nature
- Sodium chlorate
- Volatile low hormone type herbicides
- Agents which are not registered in the Republic of South Africa.

The Contractor shall state the brand name of the herbicide on which the tendered rate is based, which shall be subject to the approval of the Engineer prior to the application thereof.

The agent shall be guaranteed to kill at least 90% of the unwanted growth with one application and shall have a residual effect which controls the growth of such vegetation effectively for one growing season.

The herbicide should be strictly applied at the rate recommended by the manufacturer.

(a) Chemical control of vegetation growth

The type of herbicide to be used, the correct spray rate, the method of application and when applied, shall be as specified in the Particular Specifications.
Surface preparation

Road markings shall be applied to bituminous surfaces only after sufficient time has elapsed to ensure that damage will not be caused to the painted surface by volatiles evaporating from the seal. After completion of the seal no less than two weeks or such longer period as may be directed by the Engineer shall elapse before any road markings shall be applied. However, the Engineer may, in certain cases, require road markings to be painted without waiting for the seal to harden, in which case it shall be done as soon as possible after the instruction has been given.

Before the paint is applied, the surface shall be clean and dry and completely free from any soil, grease, oil, acid or any other material that will be detrimental to the bond between the paint and the surface. The surface where the paint is to be applied shall be properly cleaned by means of watering, brooming or compressed air if required.

Particular care shall be taken to ensure that the surface shall be clean, where roadstuds are to be fixed.

The Contractor shall take note of conditions which he is unable to rectify by himself and may affect the durability of the paint, and he shall point out these conditions to the Engineer in writing. Disputes arising from such conditions shall be referred to the relevant Regional Engineer for arbitration before road marking commences.

The Contractor shall protect the retro-reflective surfaces of roadstuds when paint is applied and remove the protection immediately after the paint has been applied.

On concrete and bituminous surfaces where polished aggregate is exposed, a tack coat shall be used. On new concrete surfaces any laitance and/or curing compound shall be removed before the markings are applied.

The material shall not be laid over loose debris, mud or similar extraneous matter or over old flaking markings of paint or thermoplastic material. If the road surface is at a temperature of less than 5°C, or if it is wet, it shall be warmed carefully by a road heater so that when the material is laid, the surface temperature is above 5°C and the surface dry.

Setting out the road markings

The lines, symbols, figures or marks shall be premarked by means of paint spots of the same colour as that of the final lines and marks. These paint spots shall be at such intervals as will ensure that the traffic-markings can be accurately applied, and in no case shall they be more than 1.5 m apart. Normally spots of approximately 10 mm in diameter should be sufficient.

The dimensions and positions of road-markings shall be as indicated by the Engineer, specified in the appropriate statutory provisions and the South African Road Traffic Signs Manual.

The repainting of a roadway after the application of a fog spray shall only be done once it is possible to determine the beginning and positions of individual broken line segments. Pre-marking of such a roadway shall entail the searching for and marking of such broken line segments. Painting shall thereafter be done to the same tolerances as prescribed in CA 04 1010.

After spotting, the positions of the proposed road markings such as broken lines and the starting and finishing points of barrier lines shall be indicated on the road. These pre-markings shall be approved by the Engineer prior to commencement of any painting operations.
This description of the road and paved areas to be maintained is not necessarily complete and shall not limit the maintenance work to be carried out by the Contractor under this contract.

Maintenance shall include all repair work, replacing of components, fixing of defects, or any other actions or rectifying measures necessary for complete and safe functioning of the road infrastructure.

Maintenance of the road infrastructure shall also include any other actions related to maintenance, such as temporary accommodation of traffic through and around work areas, and provision of temporary accesses to properties.

Remuneration for maintenance of the complete roadway infrastructure shall be deemed included in the tendered monthly payment for maintenance thereof, and shall be paid as detailed in Additional Specification SA General Maintenance.

**CA 05.01 ROAD INFRASTRUCTURE**

Routine maintenance on the road infrastructure shall be carried out as described in table CA 05.01/1.

<table>
<thead>
<tr>
<th>NO</th>
<th>ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION</th>
<th>MAINTENANCE FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Visually inspect and report on complete installation</td>
<td>Monthly</td>
</tr>
<tr>
<td>2</td>
<td>Check, inspect, repair a(^\ast) surface and kerb failures</td>
<td>Monthly</td>
</tr>
<tr>
<td>3</td>
<td>Check, inspect, repair a(^\ast) pavement failures</td>
<td>Six-monthly</td>
</tr>
<tr>
<td>4</td>
<td>Blade a(^\ast) gravel roads and parking areas</td>
<td>Annually</td>
</tr>
<tr>
<td>5</td>
<td>Inspect and repair gravel shoulders</td>
<td>Six monthly</td>
</tr>
<tr>
<td>6</td>
<td>Check, inspect, repair, replace road signs</td>
<td>Six monthly</td>
</tr>
<tr>
<td>7</td>
<td>Check, inspect, repair, repaint, replace road markings</td>
<td>Annually</td>
</tr>
<tr>
<td>8</td>
<td>Remove loose material from the surface of parking areas by means of mechanical brooming</td>
<td>Six monthly</td>
</tr>
</tbody>
</table>

Maseru Bridge Port of Entry: Technical and Particular Specification
(a) Width

The width of lines and other markings shall not be less than the specified width. nor shall it exceed the specified width by more than 10 mm.

(b) Position

The position of lines, letters, figures, arrows, retro-reflective roadstuds and other markings shall not deviate from the true position by more than 100 mm in the longitudinal and 20 mm in the transverse direction.

When an unbroken line and a broken line are painted alongside each other, the beginning and/or the end of the adjacent lines shall coincide.

When existing lines are repainted, the new marking shall not deviate more than 100 mm in the longitudinal direction and 10 mm in the transverse direction from the existing marking.

(c) Alignment of markings

The alignment of the edges of longitudinal lines shall not deviate from the true alignment by more than 10 mm in 15 m.

(d) Broken lines

The length of segments of broken longitudinal lines shall not be shorter than the specified length or deviate by more than 150 mm from the specified length.

CA 04.10.11 General

In broken lines the length of segments and the gap between segments shall be as indicated on the drawings. If these lengths are altered by the Engineer, the ratio of the lengths of the painted section to the length of the gap between painted sections shall remain the same.

Lines on curves, whether broken or unbroken, shall not consist of chords but shall follow the correct radius.

The Contractor shall provide temporary traffic control facilities at his own cost in accordance with Specifications to ensure traffic safety where work is being executed. Property and/or road signs damaged by the Contractor, his personnel or his agents shall be repaired or restored at his own cost to their condition as before the damage.

Only materials intended for use on this Contract may be stored on the site.

CA 04.10.12 Faulty workmanship or materials

If any material that does not comply with the REQUIREMENTS is delivered to the site, or is used in the works, or if any work of an unacceptable quality is carried out, such material or work shall be removed, replaced or repaired as required by the Engineer at the Contractor's own cost.

While work is in progress, tests shall be carried out on materials and/or the quality of work to ensure compliance with the specified requirements. The sampling methods are specified under the appropriate sampling and testing methods. The sampling methods described in TMH5 shall be followed where applicable. (TMH5 is published for the Committee of State Road Authorities by the National Institute for Transport and Road Research - presently the Division of Road and Transport Technology - as part of the series Technical Methods for Highways.)
CA.02  SURFACE REPAIRS OF CONCRETE PAVEMENTS

CA.02.01  Preparation and sealing or resealing of old joints and cracks in existing concrete pavements:

(a) Expansion joints  Unit: metre (m)

(b) Construction joints and weakened plane joints:

(i) (Width stated)  Unit: metre (m)

(ii) Etc for other widths  Unit: metre (m)

(c) Cracks:

(i) (Width stated)  Unit: metre (m)

(ii) Etc for other widths  Unit: metre (m)

The unit of measurement shall be the metre of each type of joint or crack prepared and sealed or resealed. No distinction will be made between joints or cracks through areas where the concrete has been repaired and other joints or cracks.

The tendered rates shall include full compensation for all labour, plant, equipment, tools and materials required for breaking out the existing concrete, disposing of the debris, saw cutting existing concrete, compaction of the exposed pavement layer, installation of new concrete, slab setting, and the necessary labour, plant, equipment, tools and materials required for breaking out the existing concrete, disposing of the debris, saw cutting existing concrete, compaction of the exposed pavement layer, supplying, placing, finishing off the new concrete, texturing and curing, and constructing isolation joints. The tendered rates shall also include full compensation for providing adequate accommodation of traffic where necessary.

CA.02.02  Patching of concrete:

(a) (Thickness stated)  Unit: square metre (m²)

(b) Etc for other thicknesses  Unit: square metre (m²)

The unit of measurement shall be the square metre of new concrete installed.

The tendered rates shall include full compensation for all the necessary labour, plant, equipment, tools and materials required for breaking out the existing concrete, disposing of the debris, saw cutting existing concrete, compaction of the exposed pavement layer, installing back-up material where required, installing the bond breaker, applying the primer and mixing and applying the sealant, ensuring acceptable bond with existing work, and for any other operation needed to complete the work as specified and shown on the drawings.

CA.03  PAVEMENT LAYERS AND ASPHALT SURFACE REPAIR

CA.03.01  Excavation in existing pavements for patching  Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of material excavated from the existing pavement irrespective of the type of material. The quantity shall be computed in accordance with the authorised dimensions of the excavation.

The tendered rate shall include full compensation for demarcating the excavation and excavating and disposing and/or stockpiling of the material, including haul over a free-haul distance of 1.0 km.

Payment will not distinguish between the different types of pavement material excavated.
(b) The eradication of weeds

The eradication of declared and undesirable vegetation shall take place during the contract period and may include localised patches of noxious weeds, invader plants and other undesired vegetation.

Subject to the Engineers approval, certain aspects, such as the treatment of the stumps of felled trees, may be carried out by the Contractor.

The Contractor shall ensure that no damage whatsoever is caused to any plants inside or adjacent to the areas treated as a consequence of the application of the herbicides, either during or after application. This also includes areas outside the road reserve.

The type of weedkiller to be used, the correct application rates and when applied, shall be as specified and according to the manufacturers instructions.

CA 04.11.03 Quality standard

Eradication of undesired vegetation shall be carried out as specified and to the satisfaction of the Engineer. The herbicide shall be applied at the correct rate to prevent regrowth and the application confined to the undesired vegetation.

Areas shall be left neat and tidy and all vegetation cuttings removed where instructed.

CA 04.11.04 Plant and equipment

Vegetation shall be eradicated using knapsacks or portable weedspray machines.

It is important that the equipment be in good working condition. The equipment shall distribute the herbicide evenly without spilling. The nozzle shall be able to move close to the ground in order to prevent mist spray blowing away and killing plants which have to remain. The equipment shall also be safe for the workers, as well as for the travelling public.

CA05

MAINTENANCE

This Specification must be read in conjunction with Additional Specification SA: General Maintenance.

All components of the roadway infrastructure, which includes the road surface, underlying layer works, kerbing, road markings, road signs, sidewalks and gravel shoulders, shall be maintained during the Contract.

The scope of the maintenance work for the road infrastructure includes the following:

Maseru Bridge Port of Entry:

(i) Maintenance of concrete block paving road
(ii) Maintenance of roads with bituminous surfacing
(iii) Maintenance of gravel roads
(iv) Maintenance of concrete pavement at the operational area and driveways to domestic residence

Maseru Bridge Port of Entry
CA.04.02 Pothole repair using hot-mix continuously graded asphalt. Unit: ton (t)

The unit of measurement for repairing surfacing shall be the ton of asphalt applied for the repair of the surfacing, irrespective of the thickness or number of layers.

The tendered rates shall include full compensation for procuring, furnishing, and storing of all materials, providing and transporting all plant, labour and equipment necessary for cutting back the edges, excavation, removing excavated and loose material and disposal thereof, priming, backfilling with the approved product, compaction and trimming as specified in this section.

The quantity shall be calculated by measuring the volume of material used multiplied by the density of the compacted material.

CA.04.03 Pothole repair using cold mix asphalt surfacing from the following sources:

(a) Commercial sources Unit: ton (t)
(b) Mixed on site as specified Unit: ton (t)

The unit of measurement for surfacing repair shall be the ton of cold mix asphalt applied for the repair of surfacing, irrespective of the thickness or number of layers.

The tendered rates shall include full compensation for procuring, furnishing, and storing of all materials, providing and transporting all plant, labour and equipment necessary for cutting back the edges, excavation, removing excavated and loose material and disposal thereof, priming, backfilling with the approved product, compaction and trimming as specified in this section.

The quantity shall be calculated by measuring the volume of material used, multiplied by the density of the compacted material.

CA.04.04 Repairing edge breaks using hot-mix continuously graded asphalt - medium grade Unit: ton (t)

The unit of measurement for repairing edge breaks shall be the ton of asphalt applied for the repair of edge breaks, irrespective of the thickness or number of layers.

The tendered rates shall include full compensation for compacting the surface on which the new edge is to be constructed, procuring, furnishing, and mixing all materials and compacting and trimming the asphalt to the required lines and levels. It shall also include full compensation for applying a tack coat of emulsion to the surface to be treated.

The tendered rates shall include full compensation for all transport, handling, labour material and all incidentals necessary to complete all the work as specified.

The quantity shall be calculated by measuring the volume of material used, multiplied by the density of the compacted material. No extra payment will be made in regard to this item for producing small quantities of asphalt.

CA.04.05 Mechanical brooming of road surfaces Unit: square metre (m²)

The unit of measurement for the mechanical brooming of the road surface shall be the area of road swept, measured in square metres.

The tendered rate shall include full compensation for the provision of all equipment, use and maintenance thereof and all labour costs.
MEASUREMENT AND PAYMENT

REPAIR OF GRAVEL WEARING COURSE AND GRAVEL SHOULDERS

Reshaping the wearing course by:

(a) Grading only  
(b) Ripping, redistributing and compacting  
(c) Importing, placing and compacting material from commercial sources

Unit: square metre (m²)
Unit: square metre (m²)
Unit: cubic metre (m³)

The unit of measurement for CA.01.01 (a) and (b) shall be the square metre surface area graded or ripped and recompacted to a depth of 150 mm, as instructed by the Engineer.

The unit of measurement for CA.01.01 (c) shall be the cubic metre of compacted material imported from commercial sources as instructed by the Engineer and measured in place.

The tendered rates shall include full compensation for providing all plant, labour, equipment and materials required and for reshaping and/or constructing the wearing course as instructed by the Engineer. The tendered rates shall also include full compensation for the cost of testing to ensure the finished wearing course complies with the specified requirements, and for disposing of surplus material.

Gravel shoulders constructed from gravel taken from cut or borrow, including free-haul up to 1.0 km:

(a) Compacted to 93% of modified AASHTO density (150 mm compacted layer thickness)

Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of compacted material and the quantity shall be calculated from the authorized dimensions of the completed layer.

The tendered rate shall include full compensation for procuring, as if from soft excavation or pits, breaking down, placing and compacting the material, including transporting the material for a distance of 1.0 km and its removal, disposal and transporting for a distance of 1.0 km, of up to 5% by volume of oversize material, and the protection and maintenance of the layer and the conducting of control tests, all as specified.

Overhaul on surplus material

Unit: cubic metre kilometer (m³.km)

The unit of measurement shall be the cubic metre of material hauled in excess of 1.0 km, the volume determined from the rated capacity of the truck multiplied by the overhaul distance. All trucks shall be fully loaded to their rated capacity.

The tendered rate shall include full compensation for hauling the material in excess of the free-haul distance.
CB 04.05  CLEARING OF CONCRETE DRAINS AND CHANNELS

This section covers the work in connection with the removal of silt, debris and vegetation causing obstruction to flow in drains and channels constructed from any type of material excluding earth drains and channels.

CB 04.05.01  Construction

Concrete channels shall be cleaned where instructed by the Engineer. Generally channels shall be cleaned when depth of silt in invert exceeds 100 mm, or when other foreign matter is present.

Material removed from channels shall either be loaded and removed from the site or disposed of adjacent to channels where it cannot be washed back into the channel as directed by the Engineer.

Where material is spoiled adjacent to channels the Contractor shall ensure that the material is spread neatly and well clear of the top of the channels where it will not wash back. Material removed from kerb and channel combinations, side drains or from other channels where directed by the Engineer shall be transported to spoil.

Vegetation growing in channel joints and cracks shall be removed with roots to prevent regrowth.

Vegetation growing over channels from the edges shall be slashed at the concrete edges and disposed of. Undesirable vegetation shall be removed with roots and spoiled where directed by the Engineer.

CB 04.05.02  Quality standard

Concrete drainage channels shall be clear of any obstruction such that the concrete surfaces are clearly visible.

CB 04.06  CLEANING OF EARTH CHANNELS

This section covers the work involved in cleaning of earth drains and channels, repairs to damaged earth drains and channels, as well as construction and repairs of banks and dykes.

CB 04.06.01  Execution of work

(a) Drains

Earth side drains and channels shall be cleaned of all debris, silt and vegetation when instructed by the Engineer.

Silt and debris excavated from the drains shall be deposited and spread neatly in close proximity of the drains where it will not wash back.

Scoured and eroded sections of drains shall be backfilled with suitable material obtained from the side of the road or from suitable sources indicated by the Engineer. The backfill material shall be compacted at the optimum uniform moisture content in layers not exceeding 100 mm after compaction. The Contractor shall use suitable compaction equipment to produce repairs that will not erode or scour again.

If in the opinion of the Engineer drains require protective covering against scouring and erosion, such work shall be executed in accordance with the relevant section of this Specification.
visual inspection of all pipes. Based on this inspection, the Engineer will instruct the Contractor as to which sections of the network require cleaning and where detailed inspections are required.

Material removed from the pipes shall be disposed of where instructed by the Engineer. Rubble and waste material shall be disposed of at the nearest appropriate solid waste disposal site, unless directed otherwise by the Engineer.

The Contractor shall ensure that all material is removed at the nearest accessible structure. No additional payment will be made for the removal of material from previously cleaned sections of the network.

CB 04.09.02 Quality standard

Pipes shall be cleaned of all silt and debris.

All spoil material shall be spread neatly to ensure that it will not return to the drainage trenches.

The pipe sizes for the different categories will be determined by diameter.

CB05 MAINTENANCE

This Specification must be read in conjunction with Additional Specification: General Maintenance.

All components of the stormwater drainage infrastructure, including surface as well as underground components, shall be maintained during the maintenance phase of the Contract.

The scope of the maintenance work for the stormwater drainage infrastructure comprises the following:

Lebombo Port of Entry:

(i) Maintenance of approximately 220 m of concrete-lined channels of varying sizes.
(ii) Maintenance of approximately 1000 m of pre-cast pipes, culverts and associated stormwater structures.

Lebombo Commercial facility

(i) Maintenance of approximately 250 m of side drains.

Komati Lodge.

(i) Maintenance of approximately 300 m of concrete-lined channels.
(ii) Maintenance of approximately 100 m of pre-cast pipes.

The above description of the stormwater drainage infrastructure to be maintained is not necessarily complete and shall not limit the maintenance work to be carried out by the Contractor under this contract.

Maintenance shall include all repair work, replacing of components, fixing of defects, cleaning, or any other actions or rectifying measures necessary for complete and safe functioning of the stormwater drainage infrastructure.

Maintenance on the stormwater drainage infrastructure shall also include all other actions related to maintenance, such as temporary drainage features and temporary accommodation of traffic.

Maseru Bridge: Port of Entry: Technical and Particular Specification
(d) Kerbing and channeling

Kerbing shall include barrier kerbs, mountable and semi-mountable types. All the elements shall be prefabricated units with cast in situ channeling unless otherwise specified by the Engineer.

Kerbing and channeling shall be laid on the approved bedding with close joints filled with 3:1 sand: cement mortar not exceeding 10 mm in thickness and neatly pointed with a pointing trowel. Kerbing shall be propped with class 15/19 in situ concrete at each joint (size: 300 mm long x 200 mm wide x 50 % of kerb height).

(e) Concrete cast against existing surfaced edges

Where concrete lining or concrete channeling in kerb and channel combinations is to be cast against existing surfacing the edge shall first be cut, before excavation, with approved sawing equipment to provide a neat straight edge. Care shall be taken during the placing of the concrete not to spill concrete onto the adjacent surfacing. Any concrete stains shall be removed by the Contractor at his own expense.

(f) Reinstatement of damaged existing structures

Damaged existing structures shall be demolished to the extent directed by the Engineer on site and the resulting debris shall be spoiled.

The reinstatement of damaged sections shall be carried out to the same standards prescribed for new construction and shall be paid for under the relevant items scheduled for new structures.

Provision shall be made for the reinstatement of existing damaged prefabricated concrete half round channels.

(g) Inlet and outlet structures

The structures shall be constructed in accordance with the REQUIREMENTS specified in the relevant section in this Specification.

CB 04.04.02 Quality standard

The drains shall be constructed neatly to the dimensions shown on the drawings and within the specified dimensional and alignment tolerances.

Repairs to drains shall be in uniformity with existing structures.

CB 04.04.03 Materials

(a) Concrete

Concrete for the various structural components shall comply with the class detailed on the drawings. Concrete in channel linings shall be class 20/19.

(b) Steel reinforcement

(i) Steel bars

Steel reinforcing bars shall comply with the REQUIREMENTS of SANS 920.

(ii) Welded steel mesh

Welded steel mesh shall comply with the REQUIREMENTS of SANS 1024.
The tendered rates shall include full compensation for all excavation (including around structures), levelling, temporary timbering, shoring and strutting for preparing the bottom of the excavation for the culvert beds, the disposal of unstable material unsuitable for backfilling, keeping the excavation safe, dealing with any surface or subsurface water and for any other operations necessary for completing the work as specified.

Payment shall distinguish between soft and hard material.

CB 01.02 Backfilling and reinstatement of pavement layers:

(a) In situ fill or cut material compacted to 90% of modified AASHTO density Unit cubic metre (m³)

(b) Selected layers compacted to 93% of modified AASHTO density Unit cubic metre (m³)

(c) Cement stabilized subbase layers compacted to 95% of modified AASHTO density Unit: cubic metre (m³)

(d) Cement stabilized base layers compacted to 97% of modified AASHTO density Unit: cubic metre (m³)

The unit of measurement for CB 01.02(a) and (b) shall be the cubic metre of gravel material placed and compacted according to authorised dimensions on drawings.

The unit of measurement for CB 01.02(c) and (d) shall be the cubic metre of stabilized material placed and compacted according to authorised dimensions.

The tendered rates shall include full compensation for procuring and furnishing, placing, compaction and finishing of materials, labour, tools and equipment for executing the work to the satisfaction of the Engineer.

CB 01.03 Prefabricated culverts:

(a) On class A bedding (type and diameter indicated) Unit metre (m)

(b) On class B bedding (type and diameter indicated) Unit metre (m)

(c) Portal culverts with prefabricated floor slabs (type and size indicated) Unit: metre (m)

The unit of measurement for prefabricated culverts shall be the metre of culvert laid. The length shall be measured along the soffit of the culvert.

The tendered rates shall include full compensation for providing, testing, loading, transporting and unloading the culverts, for providing and placing the bedding material where required, and for the installation, laying and jointing of the culverts as specified including cutting them on the site and removing any waste.

CB 01.04 Cast in situ concrete and formwork in stormwater structures:

(a) Class 20 concrete Unit: cubic metre (m³)

(b) Class 25 concrete Unit cubic metre (m³)
(b) Construction and repair of banks and dykes

Material for the construction and repair of banks and dykes shall be an approved soil or gravel obtained from sources approved by the Engineer. It shall be positioned in such a way that water will flow on the natural ground and against the bank.

Banks and dykes shall be properly compacted in layers not exceeding 150 mm in thickness. If approved by the Engineer, mitre banks may also be constructed of hand-packed stone, provided that the interstices are filled with an approved cohesive soil.

CB 04.07 CONSTRUCTION AND REPAIR OF BRICKWORK INLET STRUCTURES

CB 04.07.01 Reinstatement of damaged existing structures

Damaged existing structures shall be demolished to the extent indicated by the Engineer on site and the resulting debris spoiled.

The reinstatement of damaged sections shall be carried out to the same standards prescribed for new construction and shall be paid for under the relevant items scheduled for new structures.

CB 04.07.02 Lowering of inlet structures

Existing structures which are not functional due to the inlet being above the surrounding pavement level or ground level shall be demolished to the extent indicated by the Engineer and reinstated at the correct level to the same standard prescribed for new construction.

CB 04.08 PROVISION OF LOCKABLE STORMWATER GRID INLETS

Stormwater inlet structures within the Port of Entry fence shall be provided with lockable grids. These shall be in the form of a steel bar secured to the base of the catch pit and long enough to just protrude through the inlet grid. There shall be a hole in the end of the bar to allow a padlock to be positioned such that the grid will be immovable.

The steel bar shall be treated to avoid corrosion.

Padlocks shall be provided for all grid inlets. They shall be of a type suitable for outdoor use, or as specified in the Project Specifications.

CB 04.09 CLEANING OF PIPELINES

The work under this section involves the removal of silt and debris from pipelines, including the cleaning of inlet and outlet structures.

CB 04.09.01 Construction

Before cleaning any pipelines the Contractor shall arrange with the Engineer for an inspection of the stormwater network. The Contractor shall provide adequate equipment such as torches, lights, mirrors and TV surveillance equipment, etc. to enable a basic
CB.02 CLEANING OF PREFABRICATED CULVERTS

CB.02.01 Cleaning of prefabricated culverts and inlet structures (average depth of material removed not more than 100 mm):

(a) Prefabricated concrete pipes and portal culverts with maximum cross sectional dimension of:

(i) Up to and including 500 mm Unit: metre (m)
(ii) 501 mm to 750 mm Unit: metre (m)
(iii) 751 mm to 950 mm Unit: metre (m)
(iv) 951 mm to 1250 mm Unit: metre (m)
(v) 1251 mm to 1500 mm Unit: metre (m)
(vi) 1501 mm to 2100 mm Unit metre (m)

(b) Prefabricated corrugated metal culverts with maximum cross sectional dimension of:

(i) Up to and including 500 mm Unit: metre (m)
(ii) 501 mm to 750 mm Unit: metre (m)
(iii) 751 mm to 950 mm Unit: metre (m)
(iv) 951 mm to 1250 mm Unit: metre (m)
(v) 1251 mm to 1500 mm Unit: metre (m)
(vi) 1501 mm to 2100 mm Unit: metre (m)

The unit of measurement shall be the metre of culvert cleaned (depth of material removed is on average not more than 100 mm), measured once along the soffit of the culvert. For multiple culverts each individual culvert shall be measured separately.

The tendered rates shall include full compensation for removing the material, for disposing of the material in an appropriate manner and ensuring that the material will not wash into drainage trenches.

CB.02.02 Cleaning of prefabricated culvert and inlet and outlet structures (average depth of material removed is more than 100 mm):

(a) Prefabricated concrete pipes and portal culverts with maximum cross sectional dimension of:

(i) Up to and including 500 mm Unit: metre (m²)
(ii) 501 mm to 750 mm Unit: metre (m²)
(iii) 751 mm to 950 mm Unit: metre (m²)
(iv) 951 mm to 1250 mm Unit: metre (m²)
(v) 1251 mm to 1500 mm Unit: metre (m²)
(vi) 1501 mm to 2100 mm Unit: metre (m²)
The tendered rates shall include full compensation for procuring and furnishing all material and for all work necessary for mixing, placing and finishing the concrete to the authorised dimensions, including providing and erecting of formwork, for sawing of asphalt layers and for providing expansion and contraction joints as included on drawings or as instructed by the Engineer.

CB.03.03 Backfill below channels

The unit of measurement shall be the cubic metre of backfill as may be instructed by the Engineer to be placed below channels.

The tendered rate shall include full compensation for furnishing, procuring, placing and compacting concrete.

CB.03.04 Precast concrete kerbing:

(a) Supply and install (type indicated)  
Unit: metre (m)

(b) Install only (type indicated)  
Unit: metre (m)

The unit of measurement shall be the metre of precast kerbing complete as constructed, measured along the face of the kerb.

The tendered rate for CB 03.04(a) shall include full compensation for preparing of bedding, furnishing and installing all materials and supporting the kerb with in situ concrete, for backfilling behind kerbs, all complete as specified.

The tendered rate for CB.03.04(b) shall include full compensation for preparing of bedding, furnishing and installing all materials and reinstalling existing kerbing, all complete as specified.

CB.03.05 Steel reinforcement:

(a) Mild steel bars  
Unit: ton (t)

(b) High-tensile steel bars  
Unit: ton (t)

(c) Welded steel mesh  
Unit: kilogram (kg)

The unit of measurement for steel bars shall be the ton of reinforcing, and kilogram of welded steel in place in accordance with the drawings or as authorised. Ties, stools and other steel used for positioning the reinforcing steel shall be measured as steel reinforcement.

The tendered rate shall include full compensation for supplying, delivering, cutting, bending, welding, trial weld joints, placing and fixing the steel reinforcement including all tying wire, spacers and waste.

CB.03.06 Sealed joints in concrete lining open drains

(type indicated)  
Unit: metre (m)

The unit of measurement shall be the metre of completed joint of each size and type.

The tendered rate shall include full compensation for supplying all material and for all labour, tools, formwork and incidentals necessary for sealing the joint as shown on the drawings or specified in the Project Specifications.
The unit of measurement shall be the cubic metre of concrete in place. Quantities shall be calculated from the dimensions shown on the drawings or as authorised. The tendered rates shall include full compensation for procuring and furnishing all the materials, storing the materials, providing all plant, mixing, transporting, placing and compacting the concrete, forming the inserts, construction joints and contraction joints, curing and protecting the concrete, repairing defective surfaces and finishing the concrete surface as specified.

CB.01.05 Replacement of manhole covers, grid inlets, etc

(a) SANS 558 Type 4 - covers, grids, etc:
   (i) Maximum dimension up to and including 300 mm  Unit: number
   (ii) Maximum dimension 301 mm to 600 mm  Unit: number
   (iii) Maximum dimension 601 mm to 900 mm  Unit: number
   (iv) Maximum dimension over 900 mm  Unit: number

(b) SANS 558 Type 4 - frames only for covers, grids, etc:
   (i) Maximum dimension up to and including 300 mm  Unit: number
   (ii) Maximum dimension 301 mm to 600 mm  Unit: number
   (iii) Maximum dimension 601 mm to 900 mm  Unit: number
   (iv) Maximum dimension over 900 mm  Unit: number

(c) SANS 558 Type 2A - covers, grids, etc:
   (i) Maximum dimension up to and including 300 mm  Unit: number
   (ii) Maximum dimension 301 mm to 600 mm  Unit: number
   (iii) Maximum dimension 601 mm to 900 mm  Unit: number
   (iv) Maximum dimension over 900 mm  Unit: number

(d) SANS 558 Type 2A - frames only for covers, grids, etc:
   (i) Maximum dimension up to and including 300 mm  Unit: number
   (ii) Maximum dimension 301 mm to 600 mm  Unit: number
   (iii) Maximum dimension 601 mm to 900 mm  Unit: number
   (iv) Maximum dimension over 900 mm  Unit: number

The unit of measurement shall be the number of covers or frames installed. The classification of the size of each cover or frame will be based on the nominal dimensions of the unit and not on the actual dimensions.

The tendered rates shall include full compensation for procuring, furnishing and placing the new covers, grids and/or frames. The tendered rates shall also include full compensation for removing and disposing of the damaged covers, grids and/or frames.
The tendered rates shall also include for transporting the excavated material to spoil sites.

Where material is disposed of adjacent to the channels, the tendered rate shall include full compensation for removing the material from the channels, irrespective of the depth of silt and debris, spoiling and spreading the material adjacent to the channel where it cannot be washed back in to the channel.

CB.04.02 Overhaul of material hauled in excess of the free-haul distance of 1.0 km . Unit: cubic metre kilometer (m³-km)

The unit of measurement shall be the cubic metre of material hauled to spoil, the volume to be determined from the rated capacity of the truck multiplied by the average overhaul distance. All trucks shall be fully loaded to their rated capacity.

The tendered rate shall include full compensation for hauling the material the average overhaul distance to the designated spoil site.

CB.05 CLEANING AND MAINTENANCE OF EXISTING EARTH CHANNELS

CB.05.01 Cleaning earth drains and channels . Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of material cleaned out of the drain.

The tendered rate shall include full compensation for all labour and equipment required for removing the obstruction from drains, irrespective of depth of silt and debris and disposal of the excavated material as described.

CB.05.02 Repairing of earth drains and channels . Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of compacted material calculated from the dimensions measured in place.

The tendered rate shall include full compensation for trimming the eroded area to firm surrounding material, for procuring, transporting, placing and compacting the backfill material.

CB.05.03 Banks and dykes . Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of in place in banks or dykes, calculated in accordance with authorised dimensions.

The tendered rate shall include full compensation for procuring, transporting furnishing, placing, watering, compacting, shaping and trimming of material in the banks and dykes.

CB.05.04 Cleaning of vegetation at inlet and outlet structures (5 m x 5 m) ... Unit: square metre (m²)

The unit of measurement shall be the area measured in square metres, cleared of all vegetation blocking the inlet and outlet structures.

The tendered rate shall include for labour clearing of vegetation, removing spoil of vegetation and tools to complete the work to the approval of the Engineer.

CB.05.05 Overhaul of material in excess of the free-haul distance of 1.0 km . Unit cubic metre kilometre (m³-km)

The unit of measurement shall be the cubic metre of imported material, net volume of material compacted in place, multiplied by the average overhaul distance in excess of 1.0 km.

Maseru Bridge Port of Entry: Technical and Particular Specification
(b) Prefabricated corrugated metal culverts with maximum cross sectional dimension of:

(i) Up to and including 500 mm  
    Unit: metre (m²)

(ii) 501 mm to 750 mm  
    Unit: metre (m²)

(iii) 751 mm to 950 mm  
    Unit: metre (m²)

(iv) 951 mm to 1250 mm  
    Unit: metre (m²)

(v) 1251 mm to 1500 mm  
    Unit: metre (m²)

(vi) 1501 mm to 2100 mm  
    Unit metre (m³)

The unit of measurement shall be the cubic metre of material removed (depth of material removed is on average not more than 100 mm). The quantity of material to be removed shall be measured in place for each individual culvert.

The tendered rates shall include full compensation for removing the material from the culvert, for loading the material onto trucks, for transporting the material within a free-haul distance of 1.0 km and for spoiling the material as specified.

CB.02.03 Provision of equipment for visual inspection of underground culvert network  
Unit: lump sum

The tendered sum shall include full compensation for the provision of suitable equipment, such as torches, lights and mirrors, etc., to enable a basic visual inspection of the culvert network.

CB.02.04 Visual inspection of underground culvert network  
Unit metre (m)

The tendered rate shall include full compensation for all processes necessary to complete a thorough check of the culvert network, including lifting and replacing manhole covers, using relevant equipment and any clearing necessary to allow the visual inspection to proceed.

CB.03 CONCRETE CONSTRUCTION AND REPAIR

CB.03.01 Excavation:

(a) Soft material  
    Unit: cubic metre (m³)

(b) Hard material  
    Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of material excavated in accordance with the authorised dimensions measured in place.

The tendered rates shall include full compensation for all plant, labour and tools necessary for excavating the material to the required dimensions, including trimming the excavation before placing concrete, disposing of the material from the site.

CB.03.02 Cast in situ concrete:

(a) Class 20 concrete  
    Unit: cubic metre (m³)

(b) Class 30 concrete  
    Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of concrete placed in situ. The quantity shall be calculated in accordance with the authorised dimensions.
The unit of measurement for CA05.02 (b) and (c) shall be the cubic metre of stabilized material placed and compacted according to authorised dimensions.

The tendered rates shall include full compensation for procuring and furnishing, packing, compaction and finishing of materials including stabilizing agent and irrespective of the compaction method, labour, tools and equipment for executing the work to the satisfaction of the Engineer.

CA05.03

Cast in situ concrete and formwork in edge beams, intermediate beams and kerbing:

(a) Class 20 concrete

Class 30 concrete

Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of concrete in place. Quantities shall be calculated from the dimensions shown on the drawings or as authorised.

The tendered rates shall include full compensation for procuring and furnishing all the materials, storing the materials, providing all plant, excavation, mixing, transporting, providing and preparing a formwork, placing and compacting the concrete, forming the inserts, construction joints and contraction joints, curing and protecting the concrete, repairing defective surfaces and finishing the concrete surface as specified.

CA05.04

Breaking up and removing concrete edge beams, intermediate beams, etc

Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of concrete removed. Quantities shall be calculated from the dimensions shown on the drawings or as authorised.

The tendered rates shall include full compensation for providing all plant, breaking up and excavating the existing concrete, including free-haul of the excavated material up to and including 2 km.

CA05.05

Steel reinforcement in edge beams, intermediate beams and kerbing:

(a) Mild steel bars

(b) High-tensile steel bars

(c) Welded steel mesh

Unit: ton (t)

Unit: kilogram (kg)

The unit of measurement for steel bars shall be the ton of reinforcing, and kilogram of welded steel in place in accordance with the drawings or as authorised. Ties, stools and other steel used for positioning the reinforcing steel shall be measured as steel reinforcement.

The tendered rate shall include full compensation for supplying, delivering, cutting, bending, welding, trial weld joints, placing and fixing the steel reinforcement including all tying wire, spacers and waste.

CA05.06

Concrete block paving:

(a) class, type and thickness similar to existing pavement for areas carrying vehicular traffic

(b) class, type and thickness similar to existing pavement for areas carrying pedestrian traffic only

Unit: square metre (m²)
Backfilling of excavations for patching with:

(a) Chemically-stabilized gravel excavated from the existing pavement:

(i) Areas up to and including 10 m²

(ii) Areas larger than 10 m² up to and including 50 m²

(iii) Areas larger than 50 m²

Unit: cubic metre (m³)

(b) Asphalt surfacing (continuously graded medium)

Unit: ton (t)

The unit of measurement shall be the cubic metre of chemically stabilized gravel or the ton of asphalt placed in accordance with the specified requirements. The quantity will be computed in accordance with the authorised dimensions of the layer in the case of gravel or crushed stone and in accordance with the certified weighbridge tickets issued in the case of asphalt. Payment will not be made for wasted material.

The tendered rates shall include full compensation for providing all the material, irrespective of its origin, for all mixing, placing, compacting, including the floor, and finishing as specified in this section and other sections of the appropriate Specifications, for all transport, work in restricted areas, and also for all machinery, equipment, labour, tack coat, supervision and other incidentals for executing the work as specified.

The tendered rates for chemically stabilized gravel shall also include full compensation for stabilizing and providing the stabilizing agent.

Payment for hot-mixed asphalt will allow for priming.

Supply and apply proprietary brand bitumen rubber 9 mm single seal surface patches (Roadpatch or similar approved material)

The unit of measurement shall be the square metre of surface repaired in accordance with the specified requirements. No payment will be made for wasted materials.

The tendered rate shall include full compensation for providing all material, preparation, placing and finishing as specified in this section and other sections of the appropriate Specifications, for all transport, work in restricted areas, and also for all equipment, labour, tack coat, supervision and other incidentals for executing the work as specified.

SURFACE TREATMENT OF SURFACED ROADS

Trimming the edges and edge breaks of the existing surfacing

Unit: metre (m)

The unit of measurement for trimming the edges shall be a metre of pavement edge cut back and trimmed as specified, measured along the centre line of the road.

The tendered rate for trimming the edges shall include full compensation for cutting back the edges in accordance with instructions, excavating the material to the specified depth and removing all excavated and loose material. Payment for the backfilling of the edge breaks with hot-mix continuously graded asphalt will be made under item CA.04.04.

The tendered rates shall include full compensation for all transport, handling, labour, material and all incidentals necessary for completing all the work in accordance with the Specifications, and also for work in restricted areas.
ERECITION AND REPAIR OF ROAD TRAFFIC SIGNS AND TRAFFIC-CONTROL DEVICES

CA.07.01 Erection or reinstatement of road sign boards

(a) Area not exceeding 2 m² Unit: square metre (m²)

The unit of measurement shall be the square metre of completed road sign erected as required in the Project Specification, instructions or drawings issued by the Engineer.

The tendered rates shall include full compensation for attaching the road signboard to a road sign support structure, or to an overhead road sign support structure or to an overbridge and for all equipment, labour, supervision, nuts, bolts, transport, handling, etc., necessary for the installation of the road sign board.

CA.07.02 Road sign supports (overhead road sign structures excluded)

(a) Steel tubing of 76 mm diameter and 3 mm wall thickness ... Unit metre (m)

The unit of measurement shall be the metre of steel tubing used. Bolts and other accessories shall not be measured.

The tendered rates shall include full compensation for erecting the road sign supports, including all bolts, screws, rivets, welding and accessories, together with the painting and galvanizing required and the provision and treatment of breakaway holes in timber supports.

The tendered rates shall also include full compensation for tying up, cleaning, trimming, disposing of material at approved dumping sites provided by the Contractor, and finishing the area around each sign footing.

Overhead road sign supporting structures shall not be measured and paid for under this item, but shall be considered as specialised structural work.

CA.07.03 Excavation and backfilling for road sign supports Unit cubic metre (m³)

The unit of measurement shall be the cubic metre of excavation measured in place according to the neat dimensions of the footings or excavations as shown on the drawings or as directed by the Engineer. In the case of timber posts not in concrete, the plan area of the excavated hole shall be taken as 0.15 m², irrespective of the actual size of the excavated hole.

The tendered rate shall include full compensation for excavating, backfilling and compacting the backfill material, for the disposal of all surplus excavated material, and for providing the backfill material.

CA.07.04 Extra over item CA.07.03 for cement-treated soil backfill........ Unit cubic metre (m³)

The unit of measurement shall be the cubic metre.

The tendered rate shall include full compensation for the additional cost of providing and mixing in cement.

CA.07.05 Extra over item CA.07.03 for rock excavation Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre.

The tendered rate shall include full compensation for the additional cost of excavating in rock.
Cleaning of cracks with compressed air

The unit of measurement for cleaning the cracks with compressed air shall be the kilometre of road along which all cracks have been blown clean.

The tendered rate shall include full compensation for the provision of all equipment, labour, supervision and incidentals for blowing clean the cracks over the full width of the road.

Applying bituminous binders and herbicides for sealing cracks

(a) Herbicide

(b) MSP/1 or similar prime

(c) Anionic stable-grade emulsion mixed with synthetic modifiers

(d) Hot bitumen rubber

(e) Other specified agents (type indicated)

The unit of measurement shall be the litre of material applied as specified or instructed by the engineer.

The tendered rate shall include full compensation for providing, mixing, heating (where required) and applying all materials as specified, and for all equipment, labour, supervision and incidentals for completing the work. No additional payment will be made for multiple applications of material, and payment will not distinguish between the various types, widths or lengths of cracks.

REPAIR OF SEGMENTED PAVING

Excavation for repair of segmented paving:

(a) Discard paving blocks

(b) Stockpile and re-use paving blocks

The unit of measurement shall be the cubic metre of material excavated from the existing pavement irrespective of the type of material and including the volume of the removed paving blocks and bedding material. The quantity shall be computed in accordance with the authorised dimensions of the excavation.

The tendered rate shall include full compensation for demarcating the excavation and excavating and disposing and/or stockpiling of the material, including haul over a free-haul distance of 1.0 km.

Backfilling and reinstatement of pavement layers:

(a) Selected layers compacted to 93% of modified AASHTO density

(b) Cement stabilized subbase layers compacted to 95% of modified AASHTO density

(c) Cement stabilized base layers compacted to 97% of modified AASHTO density

The unit of measurement for CA05.02(a) shall be the cubic metre of gravel material placed and compacted according to authorised dimensions on drawings or as specified by the Engineer.
(iii) Traffic island markings white or yellow
  repainting existing markings
  
  The unit of measurement for subitem CA.08.01 (a) shall be the metre length of actual
  painted line at the specified width and in accordance with the instruction by the
  Engineer.

  The unit of measurement for subitem CA.08.01 (b) shall be the square metre of the
  actual surface area of the lettering, symbols, traffic island markings or lines completed
  in terms of an official order, measured to the nearest tenth of a square metre.

  The tendered rate shall include full compensation for procuring and providing all the
  necessary labour, constructional plant, tools, equipment and materials, including the
  retro-reflective beads. The tendered rate shall also include full compensation for
  surface preparation, for painting the road markings and applying the retro-reflective
  beads, for protection and temporary traffic control facilities and its maintenance, and
  for all incidentals necessary to complete the road markings in accordance with the
  provisions of the contract, including the setting-out of lettering, symbols and traffic
  island markings, but excluding setting out and pre-marking the lines.

CA.08.02 Setting out and pre-marking of lines
  (excluding traffic island markings, lettering
  and symbols) Unit: kilometre (km)

  The unit of measurement for setting out and pre-marking lines shall be a kilometre of
  line set out and pre-marked. If two or more parallel lines are in a strip with a maximum
  width of 1.0 m the setting out and pre-marking of the lines will be measured once only
  as if it is a single line.

  The tendered rate shall include full compensation for setting out and pre-marking the
  lines in accordance with an official order, including all materials, and measured to the
  nearest tenth of a kilometre.

CA.08.03 Removal of road markings:

  (a) Removal of markings by means of
      grit-blasting
      Unit: square metre (m²)

  (b) Removal of markings by other mechanical
      methods (The tenderer shall state the method
      he intends to use)
      Unit: square metre (m²)

  (c) Removal of markings by chemical methods
      (The tenderer shall state the method he intends
      to use)
      Unit: square metre (m²)

  The unit of measurement for the removal of road markings shall be a square metre
  and the quantity paid for is the actual surface area of the markings removed in terms
  of an official order, measured to the nearest tenth of a square metre.

  The tendered rate shall include full compensation for removing the markings, including
  all material.

CA.09 CHEMICAL CONTROL OF VEGETATION AND ERADICATION OF UNDESIRABLE
VEGETATION

CA.09.01 Chemical control of vegetation
  (The tenderer shall state the method he intends to use) Unit: square metre (m²)
The unit of measurement shall be the square metre of completed concrete block paving. The quantity shall be calculated from the dimensions shown on the drawings or authorized by the Engineer.

CA.05.07 Replacement of jointing sand

Unit: square metre (m²)

The unit of measurement for the replacement of jointing sand shall be square metre of existing paving area treated.

The tendered rate shall include full compensation for supplying, delivering, placing, and spreading of jointing sand, brooming into joints, compacting using a plate compactor as specified and removal of excess sand from the pavement. The tendered rate shall also include full compensation for all labour, transport, incidentals and equipment required to perform the work according to the Specifications.

CA.06 REPAIR OF KERBING

CA.06.01 Patching of kerbs

Unit: metre (m)

The unit of measurement shall be the metre of patched concrete kerbing where patched by an approved product. The quantity shall be calculated from the product of the number of kerb units patched and the length of each unit. Only units authorized by the Engineer will be paid for.

The tendered rate shall include full compensation for furnishing all material and for all work necessary to repair the kerbing as specified.

CA.06.02 Reinstalling pre-cast kerbs

Unit: metre (m)

The unit of measurement shall be the metre of precast kerbing complete as constructed, measured along the face of the kerb.

The tendered rate shall include full compensation for preparing of bedding, furnishing and installing all materials and reinstalling existing kerbing irrespective of the type of kerb, all complete as specified.

CA.06.03 Replacing of kerbing

(a) Barrier kerbs similar to existing undamaged barrier kerbs

Unit: metre (m)

(b) Semi-mountable kerbs similar to existing undamaged semi mountable kerbs

Unit: metre (m)

(c) Mountable kerbs similar to existing undamaged mountable kerbs

Unit: metre (m)

The unit of measurement shall be the metre of replaced precast concrete kerbing. The quantity shall be calculated from the product of the number of kerb units replaced and the length of each unit. Only units authorized by the Engineer will be paid for.

The tendered rate shall include full compensation for removing and carting away the damaged kerb units over a free-haul distance of 1 km and furnishing all material and for all work necessary to replace the kerbing as specified.

The replacing of kerbs by casting in situ concrete will be paid for under items CA.05.04 and CA05.05.
TECHNICAL SPECIFICATION

CB STORMWATER DRAINAGE

CONTENTS

CB 01 SCOPE
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CB03 OPERATING AND MAINTENANCE MANUALS
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CB06 MEASUREMENT AND PAYMENT

CB 01 SCOPE
This Specification covers the materials, equipment, methods, testing and work required for the maintenance of existing storm water drainage systems. It covers both surface and underground drainage systems.

CB02 STANDARD SPECIFICATIONS

CB 02.01 GENERAL STANDARD SPECIFICATIONS. REGULATIONS AND CODES

The latest edition, including all amendments up to date of tender, of the following Specifications, publications and codes of practice shall be read in conjunction with this Specification and shall be deemed to form part thereof:

- OW 371 Specification of Materials and Methods to be used (Fourth edition, October 1993)
- SANS 1200 DB Earthworks (pipe trenches)
- SANS 1200 OK Gabions and pitching
- SANS 1200 G Concrete (structural)
- SANS 1200 LB Bedding (pipes)
- SANS 1200 LE Stormwater drainage
- SANS 1200 MK Kerbline and channeling

CB 02.02 OCCUPATIONAL HEALTH AND SAFETY ACT OF 1993

All regulations and statutory REQUIREMENTS as laid down in the latest edition of the Occupational Health and Safety Act of 1993: Construction Regulations, 2014 as promulgated in Gazette No 37305 of 7 February 2014 shall be adhered to.

CB 02.03 MANUFACTURERS' SPECIFICATIONS. CODES OF PRACTICE AND INSTALLATION INSTRUCTIONS

All equipment and materials shall be installed, serviced and repaired strictly in accordance with the manufacturers' Specifications, instructions and codes of practice.

CB 02.04 MUNICIPAL REGULATIONS. LAWS AND BY-LAWS

All municipal regulations laws, by-laws and special REQUIREMENTS of the Local Authority shall be adhered to unless otherwise specified.
CA.07.06 Gravel drainage layer below road sign footings  Unit: cubic metre (m³)

The unit of measurement is the cubic metre of compacted gravel placed below road sign footings in accordance with the details on the drawings. The quantity will be calculated from the authorised dimensions, and gravel placed outside the authorised dimensions will not be measured for payment.

The tendered rate shall include full compensation for procuring, furnishing and placing the gravel.

CA.07.07 Hazard plates (600 x 150 mm)  Unit: number

The unit of measurement is the number of each size of hazard plate erected complete in accordance with the details on the drawings.

The tendered rate shall include full compensation for excavating, disposing of excavated material (including all haul), erecting and for placing and compacting the soilcrete backfilling.

CA.07.08 Repair of road sign faces  Unit: square metre (m²)

The unit of measurement shall be the square metre of sign face repaired on the instruction of the Engineer. Only the portion of the sign face actually repaired shall be measured for payment.

The tendered rate shall include full compensation for procuring and furnishing all the necessary material, labour and equipment and for repairing as specified.

CA.07.09 Movable New Jersey type barriers  Unit: metre (m)

The unit of measurement shall be the metre of movable New Jersey type barriers provided and shall include the cost of erection.

The tendered rates shall include full compensation for the supply and initial erection complete with all materials as may be required, for cleaning and maintenance. Units which become unserviceable or are damaged by vehicles shall be replaced upon the instruction of the Engineer.

CA.08 ROAD MARKINGS

CA.08.01 Retro-reflective road-marking paint

(a) Longitudinal lines:

(i) 100 mm wide broken or unbroken lines, white, yellow or red  Unit: metre (m)

(ii) 150 mm wide broken or unbroken lines, white, yellow or red  Unit: metre (m)

(iii) Broken or unbroken lines, white or yellow, other widths  Unit: metre (m)

(b) Transverse lines and other markings:

(i) Broken or unbroken lines, white or yellow  Unit: square metre (m²)

(ii) Lettering and symbols, white or yellow, repainting existing markings  Unit: square metre (m²)
CB 04.02 PREFABRICATED CULVERT INSTALLATION AND REPAIR OF EXISTING CULVERTS AND STRUCTURES

This section covers the work in connection with the construction of prefabricated pipe-and-portal culverts and stormwater structures such as manholes, grid inlets, and the like.

It also covers the removal and replacement of damaged and broken prefabricated culverts as well as repairs to existing culverts and stormwater structures.

CB 04.02.01 Construction

Prefabricated culverts shall be constructed or replaced in accordance with the Specifications at the locations indicated by the Engineer.

(a) Excavation

The width of the excavation shall be sufficient to allow the proper laying of bedding and backfilling of culverts. The widths of the excavation for each type and size of culvert shall be as set out in SANS 1200 DB.

The depth of the excavation for each type and size of culvert shall depend on site conditions and the amount by which the excavation is to exceed the proposed level of the invert of the culvert and shall be sufficient to allow the type and thickness of bedding material instructed by the Engineer.

Where excavation is to be carried out through asphalt premix or concrete the asphalt/concrete shall be cut neatly and vertically with approved sawing equipment before the asphalt/concrete is removed.

Excavations shall commence from the outlet end of culverts to be installed.

(b) Classification of excavation

All excavations shall be classified as follows for payment purposes:

(i) Hard material

Material which cannot be excavated except by drilling and blasting, or with the use of pneumatic tools or mechanical breakers, and boulders exceeding 0.10 m in size, shall be classified as hard material.

Where more than 40% of any material (by volume) consists of boulders each exceeding 0.10 m in size, the material shall be classified as hard material.

(ii) Soft material

All material not classified as hard material shall be classified as soft material.

Notwithstanding the above classification, all material excavated from previously constructed fills, subgrades and subbases shall be classified as soft material.

(c) Disposal of excavated material

Where excavated material does not comply with the REQUIREMENTS for backfilling material as specified or is surplus to backfilling requirements, such excavated material shall be removed from the site and disposed of.

Material suitable for use in the works, however, shall be used as prescribed.
Eradication of undesirable vegetation
(The tenderer shall state the method he intends to use). ..., Unit: square metre (m²).

The unit of measurement for item CA09.01 and CA09.02 above shall be the square metre of the area treated as described in these Specifications.

The tendered rate shall include full compensation for the supply of chemicals, plant, equipment and labour for the spraying of the chemical liquids in accordance with the manufacturer's Specifications.

The tendered rates shall be fully inclusive of any costs arising from restricted working conditions due to the nature of the site or traffic flow.

Payment will be made as follows:

(a) 60% will be payable after application

(b) The remaining 40% will be payable once 90% of the vegetation has been controlled to the satisfaction of the Engineer.
(i) Repairing of cracks and joints

Where instructed by the Engineer cracks in existing culverts and culvert joints which have opened shall be caulked with material specified in the Particular Specification.

U) Backfilling of prefabricated culverts

The backfill material shall be material selected from the excavation mixed with 30 kg Portland cement with every cubic metre of excavated material. Generally the backfill material shall be a sandy material, but may contain larger particles up to 38 mm and shall have a plasticity index not exceeding 12.

In the case of concrete pipe culverts on class B bedding the backfilling material shall be tamped in under the flanks of the culverts to provide a uniform bedding, all to the satisfaction of the Engineer.

Backfilling alongside and over the culverts to the underside of the pavement layers shall be placed at optimum moisture content and compacted to a minimum of 90 % of modified AASHTO density in layers not exceeding 150mm after compaction. Where approved by the Engineer, testing may be done with a dynamic cone penetrometer (DCP). The average penetration rate recorded after every 5 blows for each layer shall not exceed 60. The full depth of a layer shall be tested.

Backfilling shall be carried out simultaneously and equally on both sides of a culvert to prevent unequal lateral forces from occurring and the ends of culverts shall be protected to prevent the backfill material from spilling beyond the required levels.

(k) Reinstatement of pavement layers

Unless otherwise instructed by the Engineer the pavement layers shall be reinstated as follows.

(i) Selected layers shall be of at least a GS quality and shall be compacted to at least 93 % of modified AASHTO density.

(ii) Material for the subbase layers shall be stabilized with 3 % cement and compacted to 95 % of modified AASHTO density, and shall be at least a GS quality.

(iii) The material for the base layer shall be stabilized with 5 % cement and compacted to at least 97 % of modified AASHTO density, and shall be at least a G1 quality.

(iv) The surfacing layer shall consist of a medium continuously graded asphalt compacted to 94 % of Marshall density. The thickness of the surfacing layer shall be at least 25 mm. A 60 % cationic emulsion shall be applied at 0.4 litre/m2 to the top of the base layer before the surfacing layer is placed.

The soil cement shall be mixed on site with suitable concrete mixers and the water and cement contents shall be carefully controlled.

(f) Repair of stormwater manholes, grid inlets and the like

Repair work will be undertaken on the structures indicated on the drawings, or as directed by the Engineer. All repair work will comply with the construction and quality REQUIREMENTS of SANS 1200 LE.
CB 03 OPERATING AND MAINTENANCE MANUALS

No operating and maintenance manuals will be developed for this section.

The contractor shall use the Maintenance Control Plan (see SA Maintenance) to schedule routine preventative maintenance activities.

CB 04 EXECUTION OF REPAIR WORK

CB 04.01 GENERAL

The Contractor shall investigate and inspect all areas of the installation to confirm the extent of the repair work required and shall report to the Engineer. The Engineer will thereafter indicate any areas to be repaired and shall instruct the Contractor with regard to the repair work to be done.

At the start of the repair and maintenance contract all systems and installations shall be repaired as specified in the Particular Specification. This repair work shall include but not be limited to the details specified in the Particular Specification.

All repair work shall be executed using approved materials and equipment suitable to the systems and/or installations they serve. All materials and equipment shall comply fully with the REQUIREMENTS as specified for each installation.

The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer’s Specifications and codes of practice and all additional and particular Specifications included in this document.

All new, materials and systems shall be furnished with a written guarantee with a defects liability period of twelve (12) months from date of completion of repair work. These guarantees shall be furnished in favour of the Department of Public Works. On completion of the required and specified repair work the systems, installations and equipment shall be commissioned and handed over to the satisfaction of the Engineer.

Repair work items for the stormwater drainage systems shall be categorised under the following headings:

(a) Prefabricated culvert installation and repair of existing culverts and structures.
(b) Cleaning of prefabricated culverts.
(c) Concrete channel construction and repair of existing channels.
(d) Cleaning of concrete drains and channels.
(e) Cleaning of earth channels.
(f) Construction and repair of brickwork inlet structures.
(g) Provision of lockable stormwater grid inlets.
(h) Cleaning of pipelines.
(a) For pipe culverts - diameter
(b) For portal culverts - width

**CB 04 04** CONCRETE CHANNEL CONSTRUCTION AND REPAIR OF EXISTING CHANNELS

This section covers the construction of new concrete lined drains where required and the maintenance of existing concrete drains. It includes the construction of kerb and channel combinations and repairs where required.

**CB 04 04 01 Construction**

The Engineer will indicate the locations where new drains are to be constructed to improve drainage and shall instruct where repairs to existing drains are to be carried out.

Construction of the following type of concrete drains may be required:

(a) Concrete lining to open drains
(b) Concrete pipes
(c) Kerbing channeling combination.

Concrete drains shall be constructed in accordance with the details shown on the drawings or as directed by the Engineer.

(a) Excavation and preparation of bedding

The excavations shall be neatly trimmed to lines and levels so as to permit the accurate construction of the concrete linings. All loose material shall be well rammed at the optimum moisture content for the material used.

Where excavations are in hard material, overbreak shall be backfilled with concrete of the same class as specified for the lining.

In the case of kerbs and channels the trenches shall be excavated to the required depths and the bedding material shall be well rammed before placing the concrete.

Where wash-aways have occurred, any cavities or voids in the foundation material must be backfilled in layers not exceeding 150 mm in thickness and compacted to 90% of modified AASHTO density.

(b) Concrete linings

Concrete lining of open drains shall be cast in situ only and the exposed surfaces shall be given a class U2 (wood-floated) surface finish.

Sealed joints in concrete shall be in accordance with the details indicated on the drawings and joints shall be painted with a coat of approved bituminous emulsion containing 60% of pure bitumen by mass.

Expansion joints shall be made in accordance with the drawings.

(c) Half-round channels

Cast in situ half-round channels shall be constructed in accordance with the drawings, or to fit existing sections.
(d) Removal of damaged culverts

Where indicated by the Engineer damaged sections of prefabricated culverts shall be completely removed and replaced with new units.

Excavation shall be carried out as described for new culvert installation and the excavated material shall be, if suitable, preserved for backfilling. The damaged culvert units shall be disposed of.

(e) Laying of concrete pipe culverts

Concrete pipe culverts shall be laid on class A or B bedding as directed by the Engineer. The inside of the culverts shall be smooth and without any displacement and all pipes shall be laid true to line and level with a minimum slope of 2% or as directed by the Engineer.

(i) Class A bedding - see SANS 1200 LB

(ii) Class B bedding - see SANS 1200 LB

(iii) Rock foundation

Where rock, shale or hard material is encountered on the bottom of excavations a bed of fine material as required for class B bedding shall be placed before laying the pipe.

(iv) Concrete casing

Where ordered by the Engineer a pipe shall be encased in concrete according to the Engineer's instructions.

(f) Laying of concrete portal culverts

Portal culverts shall be laid on prefabricated floor slabs. A layer of fine-grained material of at least 75 mm thick shall be placed on the bottom of the excavation, levelled, compacted and trimmed to line and grade to form a bed to receive the precast slabs.

The portal portions of portal culverts shall be placed accurately and symmetrically on the floor slabs with a thin layer of mortar of one part of cement and six parts of sand between the contact surfaces to ensure a firm and uniform support.

(g) Extension of existing culverts

Where existing culverts require extension or where damaged sections are replaced the new sections shall be placed at the same grade and, where it joins the existing structure, at the same level as the existing structure.

Any sections of existing wing walls, approach slabs and head walls which may obstruct any new work shall be demolished and removed. The demolition and reconstruction of new inlet and outlet structures shall be paid for under the relevant sections in the Specification.

(h) Construction of culverts in half widths in existing roads

To allow the free flow of traffic at all times the culverts shall be constructed in half widths. The downstream section shall be constructed first and the end of the excavation adjoining the traffic lane shall be properly supported to prevent displacement from occurring.
Demolition and removal of damaged existing structures:

(a) Plain concrete
   Unit: cubic metre (m³)

(b) Reinforced concrete
   Unit: cubic metre (m³)

The unit of measurement for CB 03.07(a) and (b) shall be the cubic metre of existing material demolished, determined from 70% of the rated cubic metre capacity of the truck used to remove the material.

The tendered rates shall include full compensation for all labour, equipment and tools for removal of the damaged sections, trimming the bedding and for loading, transporting and disposing of the material from the site.

The reinstatement of damaged sections shall be paid for under the relevant items for constructing new structures.

Concrete side beams

Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of concrete in side beams constructed as instructed.

The tendered rate shall include full compensation for furnishing all material and labour including formwork as necessary, placing concrete and shaping all surfaces and all excavations required.

Overhaul on material for haul in excess of 1.0 km:

(a) Excavated material to spoil
   Unit: cubic metre kilometer (m³-km)

(b) Existing structures demolished
   Unit: cubic metre kilometer (m²-km)

The unit of measurement shall be the cubic metre of loose material hauled in excess of 1.0 km, measured according to the rated capacity of the truck used, multiplied by the average overhaul distance.

The tendered rate shall include full compensation for hauling the material in excess of the free-haul distance.

CLEANING OF CONCRETE DRAINS AND CHANNELS

Removal and dispose of material from:

(a) Drains and channels within the following invert width ranges:

(i) Less than 1.0 m
   Unit: metre (m)

(ii) 1.0 m up to and including 2.0 m
   Unit: metre (m)

(iii) Exceeding 2.0 m up to and including 3.0 m
   Unit: metre (m)

(iv) Exceeding 3.0 m
   Unit: metre (m)

The unit of measurement shall be the metre of channel cleaned, measured once along the invert of the channel.

The tendered rates shall include full compensation for all labour and equipment required for removing the material from channels irrespective of the depth of silt and debris and for loading, off-loading and spreading when material removed is intended for spoiling at designated spoil sites. The tendered rates shall also include full compensation for the removal of vegetation in channels and growing over the edges of channels.