public works
& infrastructure

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

BOOK 2 OF 2

LEBOMBO LAND PORT OF ENTRY: 36 MONTHS INFRASTRUCTURE MAINTENANCE AND REPAIRS OF BUILDINGS, CIVIL, MECHANICAL, ELECTRICAL, AND INSTALLATIONS (APPOINTMENT OF CONTRACTOR)

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THE DIRECTOR-GENERAL

Department of Public Works and Infrastructure

Central Government Offices

C/o Bosman & Madiba streets

Pretoria

0001

Name of tenderer:…….

BOOK 2 OF 2

REPAIR AND MAINTENANCE PROGRAME CONTRACT
DOCUMENT BREAKDOWN STRUCTURE

TECHNICAL & PARTICULAR SPECIFICATION

A BUILDING SERVICES
- AA & PAA: Plumbing and drainage installations
- AB: Building Electrical Installations

B STRUCTURAL ELEMENTS AND UNITS
- BA: Roof Covering
- BB: Carpentry and joinery for roofs and ceilings
- BC: Waterproofing
- BD: Walls
- BE: Floors
- BF: Pest Control
- BH: Fittings
- BJ: Paintwork
- BK: Structural Concrete

C CIVIL INFRASTRUCTURE
- CA: Roofs
- CB: Stormwater Drainage
- CC: Fencing and Gates
- CE: Water Distribution Networks
- CF: Sewerage Networks
- CG: Sold Waste Management
- CJ: Site Keeping and Cleaning

D RAW WATER WORKS
- DA: Borehole Pump Systems
- DC: Borehole Siting and Drilling
- DH: Operation of Potable Water Works
- DL: Chlorination Systems for the Disinfection of Drinking Water
- DW: Supply of Water

E WASTE WATER WORKS
- EA: Inlet Works
- EB: Pump Sytem
- EG: Septic tank and conservancy tanks and disposal fields
- EJ: Water Quality Testing
- EK: Valves and Sluice Gates
- EM: Operation of waste water works

F MECHANICAL AND ELECTRICAL EQUIPMENT AND SYSTEMS
- FD & PFD: Heating ventilation & Air-conditioning systems
- FN: Clear Water Systems

H SITE ELECTRICAL INFRASTRUCTURE
- HA: MV Switchgear systems
- HB: Standby Power
- HC: Low Voltage Reticulation
- HD: Substation Transformers
- HE: Exterior lighting systems

J FIRE FIGHTING AND SPECIALISED EXTINGUISHING SYSTEMS
- JC & PJC: Conventional fire fighting equipment

K WATER CONTROL PLAN
- KA: Water Audit

ADDITIONAL SPECIFICATION
- SA: General Maintenance
- SB: Operating and maintenance manuals
- SC: General decommissioning, testing and commisioning procedures
- SD: General Training
- SF: General Operation
- SH: HIV / AIDS requirements
- SI: Occupational Health and Safety
- SN: Implementation of Labour-intensive infrastructure projects under the Expanded Public Works Programme (EPWP)
- SL: Employment and training of youth worker on the expanded public works programme (EPWP) infrastructure projects: national youth service (NYS)

TECHNICAL SPECIFICATION

AA PLUMBING AND DRAINAGE INSTALLATIONS

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AA 10 MAINTENANCE TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

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.

AA 02 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 PW 371

AA 02.01.02 Department of Public Works Specifications

PW 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) 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 repaired 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 REPAIR AND 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 repair and maintenance work to ensure the safety of the public and the User Client.

(i) Repair 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 timeously put into place for these activities.

AA 03.02 **GENERAL REQUIREMENTS FOR REPAIR 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.

(j) 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 FOR REPAIR 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, holder bats, 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 WATER PIPES

(a) All new pipe installations under the repair 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 AA 03.05.01/1

PROPERTY	RECOMMENDED MAXIMUM LIMIT	MAXIMUM ALLOWABLE LIMIT
Total coliform bacteria count per 100 millilitre	Nil*	5
Faecal coliform bacteria count per 100 millilitre	Nil	Nil
Standard plate count per millilitre	100	Not specified

*(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 any one reticulation system) tested per year may contain coliform bacteria.

The Engineer shall witness the sterilising 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 X/BOU 2-34 shall be applicable to all air tests on new sewers and drains installed under the repair work 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

PIPE (DIAMETER (mm)	MINIMUM TIME (min - s)	CRITICAL LENGTH OF PIPELINE (m) ($58\ m^2$ INTERNAL SURFACE AREA)	MINIMUM TIME (S) FOR LONGER LENGTH (L) OF PIPELINE
100	1 - 58	184,6	0,640 L
150	2 - 57	123,1	1,439 L
200	3 - 56	92,3	2,559 L
225	4 - 26	82,1	3,239 L
250	4 - 55	73,8	3,998 L
300	5 - 54	61,5	5,757 L
375	7 - 23	49,2	8,996 L
450	8 - 51	41,0	12,954 L
525	10 - 20	35,2	17,632 L
600	11 - 49	30,8	23,030 L

AA 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 captured in electronic format as well as supplying the Department with three sets of hard copies.

AA 05 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' 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 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. 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 repair 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 for repair work of the installation.

AA 09 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

AA 09.01 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 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.

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 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 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 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.

AA 09.02.02 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 fitting 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 2,5° 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 6,8 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. Prefabrication 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 hangerrods.

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 763. All fittings are to be manufactured from the same material welded with flanged ends or rolled ends to fit clambon fittings. Fittings are only to be galvanized after manufacturing. All joints to be either flanged or equipped with clambon 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 HDPe pipe and fittings

Geberit HDPe pipes and fittings can be used for underground and above ground installations where specified. Pipes shall be plain ended and only Geberit HDPe bends and fittings shall be used. Jointing 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

(i) 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 1 600 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.

AA 10 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 Additional Specification SA: 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 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 AA 10.02/1, AA 10.02/2, AA 10.02/3, AA 10.02/4 and AA 10/02/5 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

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCEFR EQUENCY
1	Clean out and clear all rainwater gutters and full bores	Monthly
2	Clean out and clear all catch pits, channel drains and floor outlets	Monthly
3	Clean and unblock all drain pipes	Monthly
4	Check alignments of gutters	Six-monthly
5	Check and inspect all rainwater outlet gratings and replace if necessary	Six-monthly
6	Check gutter and pipe bracketing system and repair and replace if necessary	Four-monthly
7	Check and inspect manhole covers and frames for damages and replace if necessary	Six-monthly
8	Paint repairs to surface piping and equipment	Annually
9	Visually inspect and report on total system	Monthly

TABLE AA 10.02/2 - SOIL AND WASTEWATER DRAINAGE SYSTEM

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCEFR EQUENCY
1	Visually inspect and report on complete installation	Monthly
2	Check, service and clean out grease traps	Monthly
3	Check, service and clean out oil separators	Monthly
4	Check, inspect and clean out all floor drains	Monthly
5	Check, inspect and clean out all gullies	Monthly
6	Replace broken or missing gully gratings	Four-monthly
7	Check, inspect, repair or replace all manhole covers and frames and builder's work to manholes	Four-monthly
8	Check, inspect and repair manhole benching.	Four-monthly

9	Check, inspect, repair or replace all inspection eyes, end caps and cleaning eye covers	Four-monthly
10	Check, inspect, repair or replace all bracketing systems	Four-monthly
11	Check, inspect, report and unblock any blockage that occurs	Monthly
12	Check, inspect, repair/replace and clean out all equipment traps	Monthly
13	Paint repairs to surface piping and equipment	Annually
14	Rodding of all main sewer lines	At start of Contract
15	Check, inspect, service, repair/replace all vacuum and two-way vents	Four-monthly

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

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

TABLE AA 10.02/4 - SANITARY AND BRASSWARE EQUIPMENT

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY

1	Visually inspect and report on complete installation	Monthly
2	Inspect, repair/replace WC seats and covers	Monthly
3	Replace all tap washers	Six-monthly
4	Replace all tap gland packings	Six-monthly
5	Check, inspect, repair, fix and where necessary replace sanitary ware mountings and brackets	Four-monthly
6	Check, inspect, service, repair/replace all cistern flushing mechanisms	Monthly
7	Check, inspect, service, repair/replace all brassware	Four-monthly
8	Check, inspect, service, repair/replace all sanitary ware	Four-monthly
9	Check, inspect, service, repair, readjust all flushing valves	Four-monthly
10	Replace all flushing valve internal parts with replacement kits	Once per Contract
11	Stained equipment to be cleaned with approved manufacturer's cleaning agent	Six-monthly
12	Check, inspect, report and repair all leaks	Monthly
13	Check, inspect, repair/replace all shower gratings	Four-monthly
14	Paint repairs to all equipment	Annually
15	Check, inspect, repair, service, replace all missing valves	Six-monthly
16	Replace missing tap handles	As occur
17	Replace missing bath, basin, sink, etc, plugs	As occur

TABLE AA 10.02/5 - FIRE WATER PIPED RETICULATION NETWORKS

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

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.

AA 10.04 **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 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

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PAA 01 SCOPE

(a) This specification covers the particulars of the maintenance work to the plumbing and drainage installations at LEBOMBO , Land Ports of Entry. 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
SB: Operating and Maintenance Manuals
SC: General Decommissioning, Testing and Commissioning Procedures
SD: General Training

The intended maintenance work to this installation will restore the existing installations to safe, efficiently functional systems that comply with all statutory regulations and applicable standards, in the process repairing all defects and shortfalls. On completion of the repair work, the completed installations shall be maintained and serviced by the Contractor for the remainder of the 36-month contract period.

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

PAA 02 GENERAL DESCRIPTION OF INSTALLATIONS

The existing plumbing and drainage installations provide potable hot and cold water to the various buildings on these sites. The potable cold-water installation is provided with supply points 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 points. The potable hot-water installation is provided with supplies from various domestic or industrial geysers where applicable.

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.

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

	SANITARY WARE	BRASSWARE	TRAP
WCs (cistern)	Armitage Shanks/Vaal: white, floor-mounted, vitreous china	Brass shut-off valves	Not applicable
Cistern (WC)	Wall-mounted, white, CI; Wall-mounted, white, vitreous china; Wall-mounted, white, plastic	Brass shut-off valves	Not applicable

Urinals (flush)	Armitage Shanks, white, wall-mounted, vitreous china; Citimetal stainless steel wall-mounted.	Junior flush valve, exposed type, shut-off valves; Brass shut-off valves	CP bottle trap. Flexi P-trap; Flexi S-trap
WHBs	Armitage Shanks, white wall-mounted, white enamel; Wall-mounted stainless steel	Cobra 15 mm, CP star handle pillar taps	Flexi P-trap; Flexi S-trap
Showers		15 mm CP under-tile stop-cocks	
Wash troughs	Stainless steel, double bowl, wall-mounted	Cobra 15 mm, CP star handle wall type taps	Flexi P-trap
Baths	Steel enamel, white, 2 m long	Cobra 20 mm, CP star handle wall type taps	Not applicable
Sinks	Stainless steel, cabinet-mounted	20 mm CP star handle taps, 20 mm Cobra taps CP sink mixer with over arm swivel outlet	Flexi P-trap, lead P-trap
Wash tubs	Concrete double bowl	CP wall type taps	Lead P-trap

PAA 03.02 **SANITARY DRAINAGE PIPING: GENERAL**

	PIPE	FITTINGS	EQUIPMENT
Gullies	VCP	CI or plastic grating	Not applicable
Waste pipes	GMS, uPVC	Brass, uPVC	Not applicable
Soil pipes	S&S CI, uPVC	S&S CI, uPVC	Not applicable
Cleaning eyes	CI (ABC), uPVC	Not applicable	Not applicable
Vent pipes	S&S CI	S&S CI	Not applicable

PAA 03.03 **DOMESTIC WATER PIPING: GENERAL**

	PIPE	FITTINGS	EQUIPMENT
Cold-water piping	Cu GMS	Conex, soldered GMS	Brass gate shut-off valve Brass gate shut-off valve
Hot-water piping	Cu GMS	Conex, soldered GMS	Brass gate shut-off valve Brass gate shut-off valve

PAA 03.04 **FIRE WATER PIPING: GENERAL**

	PIPE	FITTINGS	EQUIPMENT
Fire water piping	GMS, Cu	GMS, Conex soldered	See specifications

PAA 03.06 **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.

PAA 05 **DETAILS OF REPAIR 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 AA: Plumbing and Drainage Installations, as set out in this document. The work to be included is set out in PAA 05.01 and PAA 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 REPAIR 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:

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

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

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

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

(e) Bracketing system;

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

(g) 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 Various Sites

(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, WC 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 WC 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.

PAA 06 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 ..... Unit: installation

The unit of measurement shall be the installation reported on.

The tendered rate for the installation 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 ..... Unit: number, metre

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, chased 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**..... Unit: number

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 domestic geysers, including shut-off valves, non-return valves, strainers, pressure- reducing valves, 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, hangers, 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** ..... Unit: number

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 de- scaling, 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** ..... Unit: number, metre, item

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**.....Unit: number

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**.....Unit: metre

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** ..... Unit: number

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 DOMESTIC GEYSER INSTALLATION**.....Unit: number

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), 400kPa 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.

PAA.17 **SERVICING, CLEANING AND REPAIR OF INDUSTRIAL GEYSERS**.....Unit: number

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.

PAA.18 **RE-INSTALLATION OF EXISTING GEYSER INSTALLATIONS AT LOCATION INDICATED BY ENGINEER**.....Unit: number

The unit of measurement shall be the number of each geyser re-installed including associated pipe work and fittings.

The tendered rates shall include full compensation for the re-installation of the isolated domestic geysers, including servicing, cleaning and repair of domestic geysers in accordance with the manufacturer's specifications scaling, testing for leaks, replacing of elements, and replacement of thermostat and set point, replacement of two shut-off valves, non-return valve, strainer, two vacuum breakers, safety valve and replacement pipe work not exceeding 10m from the previous location according to SANS specifications and any other work or action to hand over an effective system that complies with local government regulations.

PAA.19 **SUPPLY AND INSTALLATION OF DOMESTIC GALVANISED GEYSER DRIP TRAY**.....Unit: number

The unit of measurement shall be the number of each geyser drip tray installation supplied and installed, including isolation and re-installation of geyser.

The tendered rates shall include full compensation for the supply and installation of the geyser drip trays including isolation of geyser and re-installation of geyser on drip tray.

PAA 07 DETAILS OF MAINTENANCE WORK

PAA 07.01 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 and as set out in PAA 03.05. The Contractor shall strictly adhere to Additional Specification SA: General Maintenance, and Technical Specification AA: 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 AA. 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.

Fatal breakdown shall be defined as any equipment, components and systems preventing the supply of water to fire hydrants and fire hoses due to a failure of this system at the particular point of incident.

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

CONTENTS

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AB 01 SCOPE

AB 01.01 This specification comprises all aspects regarding the maintenance and servicing of building electrical systems. 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 maintenance and servicing 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 SANS Specifications

General	Distribution and meter boards	LV cables and conductors	Lighting system	Earthing and lightning protection system	Small power installation	
					Power outlets	Conduits, power skirting, cable trays and ducting
SANS 10142	SANS 152		SANS 10114	SANS 03	SANS 152	SANS 950
SANS 10160	SANS 156	SANS 10198	SANS 163	SANS	SANS 164	SANS 1065
SANS 10400	SANS 172	SANS 1411	SANS 1012		SANS 1084	SANS 1085
SANS 1222		SANS 1507	SANS 1084		SANS 1239	
			SANS 1250			
			SANS 1279			
			SANS 1777			
			SANS 10114			

AB 02.03 Department of Public Works Specifications PW 774 and PW 343.

AB 02.04 Occupational Health and Safety Act of 1993: Construction Regulations, 2014

AB 02.05 Manufacturer's specifications and installation instructions.

AB 02.06 Additional requirements

Equipment and material installed shall be new and unused.
Luminaires, control gear, isolators and power outlets shall bear the SANS 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 No operating and maintenance manuals shall be developed for this section.

The contractor shall use the maintenance control plan to schedule preventative maintenance actions.

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 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 short fall 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.

AB 06.03 The Tools and Spares shall at least include the following:

10 off PL 9W lamps
10 off 21W lamps
10 off 36W fluorescent lamps 10
off 58W fluorescent lamps 10 off
18W fluorescent lamps 10 off
250W HPS lamps
10 off 70W HPS lamps
Distribution kiosk key
DB face plate square key DB
face plate triangular key

AB 06.04 Tools and Spares: Measurement and payment

Item		Unit
(a)	**Supply of Tools and Spares**	No

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.

AB 07 QUALITY ASSURANCE SYSTEM

AB 07.01 Following formal approval of his Quality Assurance system by Engineer, the Contractor shall implement the approved QA system.

AB 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.

AB 08 RE-COMMISSIONING OF INSTALLATION

AB 08.01 On practical completion of the repair work, the contractor shall re-check and put all systems into operation.

AB 08.02 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 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:

- LEBOMBO Land Port of Entry,

AB 10.02 Scope of repair work

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.

(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 cover.

(k) Replace the distribution boards if required and replacement is approved by Engineer. Check earth bar and earth continuity, record.

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

(m) Replace all circuit breakers that are rated below 5 kA if damaged or show signs of wear and tear.

AB 10.02.02 Lighting system

(a) Indoor luminaires

(i) Operational and complete luminaires

- Remove lamps and wash luminaire body with detergent. Clean polycarbonate diffusors with detergent. Clean polished pure aluminium diffusors / reflectors with benzene.

- 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 if lamp is more than 1 year old or shows signs of damage.

(ii) Damaged or incomplete luminaires

- Remove luminaire.
- Replace luminaire with LED equivalent and reconnect.

(b) Light switches

Note: All light switches shall have steel faceplates with permanent glued Multi-layered phenolic plastic 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.

(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.

- Install photocell in a dummy bulkhead

(d) Floodlight and bulkhead luminaires

- Remove lens and lamp. Wash lens thoroughly.
- Wash luminaire body with detergent.
- Clean polished pure aluminium reflectors with benzene.
- Check condition of internal wiring, capacitor, ballasts and starters.
- Check condition of neoprene seal and replace if worn or damaged.
- Check condition of lamp holder.
- 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.

SCHEDULE OF LUMINAIRES

TYPE	DESCRIPTION
A	2 x 58W SANS OPEN CHANNEL FLUORESCENT LUMINAIRE – VOLTEX TYPE: R1-258 SS
B	2 x 36W SANS OPEN CHANNEL FLUORESCENT LUMINAIRE – VOLTEX TYPE: R1-236 SS
C	1 x 58W SANS OPEN CHANNEL FLUORESCENT LUMINAIRE – VOLTEX TYPE: R1-258 SS
D	1 x 36W SANS OPEN CHANNEL FLUORESCENT LUMINAIRE – VOLTEX TYPE: R1-236 SS
E	2 x 58W INDUSTRIAL, CORROSION PROOF & PROTECTED LUMINAIRE – VOLTEX TYPE: P20-N-265 SS
F	2 x 58W SANS IP 55 FLUORESCENT LUMINAIRE – VOLTEX TYPE: C2-258 SS WITH WATERTIGHT DIFFUSER
G	2 x 36W SANS IP 55 FLUORESCENT LUMINAIRE – VOLTEX TYPE: C2-236 SS WITH WATERTIGHT DIFFUSER
H	70W HPS B40 BRITELITE WALL MOUNTED BULKHEAD LUMINAIRE: VOLTEX TYPE B40-70W HPS
I	80W MV B40 BRITELITE WALL MOUNTED BULKHEAD LUMINAIRE: VOLTEX TYPE B40-80W MV
J	80W MV WALL MOUNTED LUMINAIRE BEKA TYPE: AZIMUTH 80W MV ACRYLIC
K	BULKHEAD LUMINAIRE - VOLTEX TYPE: B10 WITH 2XPL9 LAMPS
L	BULKHEAD LUMINAIRE - VOLTEX TYPE: B10 WITH 21 W DULUX EL ECO LAMP
M	BULKHEAD LUMINAIRE - VOLTEX TYPE: B20 WITH 2XPL9 LAMPS
N	DECORATIVE ROUND BULKHEAD WITH GRID – ILM TYPE: BHD/CMO/MO/GR
O	DECORATIVE ROUND BULKHEAD WITH EYELID – ILM TYPE: BHD/CMO/OVL/EL
P	125W FLOODLIGHT LUMINAIRE WITH GPR BODY: ILM TYPE: GAL/GPR/125/MV
Q	400W FLOODLIGHT LUMINAIRE: VOLTEX TYPE: L14TH-400 HPS
R	250W FLOODLIGHT LUMINAIRE: VOLTEX TYPE: L14TH-250 HPS
S	2X PL26W FLOODLIGHT LUMINAIRE VOLTEX TYPE: BEKA FLOOD
T	BOWL TYPE IP55 BATHROOM FITTING WITH CERAMIC LAMP HOLDER WITH DULUX EL ECO 21W/E27 LAMP
U	DÉCOR ROUND CHEESE BULKHEAD 250 MM GLASS BOWL – ILM TYPE: DEC/RND/CHS/250 WITH DULUX EL ECO LAMP
V	WALL MOUNTED DÉCOR SPOTLIGHT ILM TYPE: ACC/SPT/100

W	CEILING MOUNTED 3 LIGHT DECORATIVE LUMINAIRES WITH GLASS CUPS AND DULUX EL ECO 21W/E27 LAMPS
X	CEILING MOUNTED 2 LIGHT DECORATIVE LUMINAIRES WITH GLASS CUPS AND DULUX EL ECO 21W/E27 LAMPS
Y	CEILING MOUNTED SINGLE LIGHT DECORATIVE LUMINAIRE WITH GLASS CUPS AND DULUX EL ECO 21W/E27 LAMPS
Z	EXTERNAL WATERTIGHT FITTINGS (IP55) – COMPLETE WITH GLASS GALLERIE AND 100W GLS LAMP LITEMASTER TYPE: 8910
AA	BULKHEAD LUMINAIRE – BEKA TYPE SERIES 30: WITH 2XPL9W CFL LAMPS
AB	CEILING MOUNTED LUMINAIRE WITH STEEL DOME REFLECTOR AND 21W DULUX EL ECO LAMP
AC	CEILING FAN WITH 1 X GLASS CUPS AND 100W GLS LAMP

AB 10.02.03 Power outlets and fixed appliances

Note: All power outlets shall have steel faceplates with permanent glued Multi - layered phenolic plastic 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, power skirting and surface conduiting, fasten or replace if loose or damaged, check earthing and test for earth continuity.

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) Installation of 50 mm² aluminium roof conductor in galvanised conduit from the roof cladding against the building to the earth electrode.

AB 10.03 Repair work: measurement and payment

AB.01 Distribution boards and cabling

	Item	Unit
AB.01.01	**Service distribution board**	No

The unit of measurement shall be the number of distribution kiosks or boards opened and serviced as specified in Clause AB 10.02.

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, re-arrangement of equipment and wiring, treatment of the enclosure for moisture ingress and corrosion, 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, labelling with engraved Multi-layered phenolic plastic labels, neutral bars, earth bars etc. All downstream circuit breakers shall be rated at 6 kA fault level.

Item		Unit
AB.01.02	**Replace distribution board**	No

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.

Item		Unit
AB.01.03	**Replace cabling**	m

The unit of measurement shall be the linear length of cable supplied and installed.

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.

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.

Item		Unit
AB.01.04	**Replace wiring**	m

The unit of measurement shall be the linear length of conductors supplied and installed.

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.

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.

Item		Unit
AB.01.05	**Jointing and termination of cables**	No

The unit of measurement shall be number of cable joints or terminations.

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

Item		Unit
AB.01.06	**Supply and install padlocks**	No

The unit of measurement shall be number of padlocks supplied and installed.
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.

Item		Unit

AB.01.07 **Excavate in all materials for trenches, backfill, compact and dispose of surplus material** m³

The unit of measurement shall be the cubic meter of material excavated in trenches.

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.

The tendered rate shall furthermore cover the cost of installing the sand bed and sand cover, backfilling, compacting and disposing of the surplus material.

Item Unit

AB.01.08 **Supply and install cable sleeves** m

The unit of measurement shall be the linear length in meter of the cable sleeve supplied and installed.

The tendered rate shall include full compensation for the supply, delivery, handling and installing the specified sleeves including the all the required, couplings, steel draw wires and plugs.

Item Unit

AB.01.09 **Supply and install plastic warning tape** m

The unit of measurement shall be the linear length in meter of the plastic warning tape supplied and installed.

The tendered rate shall include full compensation for the supply, handling and laying of the plastic warning tape.

Item Unit

AB.01.10 **Termination of the low voltage cable** No

The unit of measurement shall be the number of low voltage cable terminations.

The tendered rate shall include full compensation for providing the cable glands and shrouds, the cost for handling, fitting and cutting the cable.

Item Unit

AB.01.11 **Supply and install earth continuity conductor** m

The unit of measurement shall be the linear length in meter of the earth continuity conductor supplied and installed.

The tendered rate shall include full compensation for procuring, furnishing and laying the specified earth continuity conductor.

Item Unit

AB.01.12 **Termination and connect earth continuity conductor** No

The unit of measurement shall be the number of earth continuity conductors terminated and connected.

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.

Item Unit

AB.01.13 **Supply and installation of circuit breakers** No

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

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.

Item Unit

AB.01.14 **Supply and installation of isolators** No

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

The tendered rate shall include full compensation for the supply and installation of the specified isolator, including printed PVC labelling.

	Item	Unit
AB.01.15	**Supply and install contactors**	No

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

The tendered rate shall include full compensation for the supply and installation of the specified type of contactor, including engraved labelling on rear tray.

	Item	Unit
AB.01.16	**Supply and install switching timers**	No

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

The tendered rate shall include full compensation for the supply and installation of the specified type of switching timer, including labelling.

	Item	Unit
AB.01.17	**Supply and install earth leakage units**	No

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.

	Item	Unit
AB.01.18	**Supply and install fuses**	No

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.

	Item	Unit
AB.01.19	**Supply and install surge arrestors**	No

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.

	Item	Unit
AB.01.20	**Supply wire marker kit**	No

The unit of measurement shall be the number of specified wire marker kits supplied.

The tendered rate shall include full compensation for the procurement and delivery of the cable marker kit as specified.

AB.02 **Lighting system**

	Item	Unit
AB.02.01	**Re-lamp luminaire**	No

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

The tendered rate shall include full compensation for the removal of the existing luminaire and for the supply and installation of **LED** Luminaires of similar light output and physical attributes as the original complete with lamp and control gear, according to manufacturer's instructions.

	Item	Unit
AB.02.02	**Service luminaire**	No

The unit of measurement shall be the number of luminaires opened and serviced in accordance with Clause AB 10.02.

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.

The tendered rate shall further include for replacement of the luminaires internal wiring where applicable and the tightening of all connections

	Item	Unit
AB.02.03	**Replace luminaire**	No

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

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, according to manufacturer's instructions.

	Item	Unit
AB.02.04	**Replace light switch**	No

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

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 Multi-layered phenolic plastic label as per Nosa-standard, cost of, which is included in rate.

	Item	Unit
AB.02.05	**Replace photo-electric switch**	No

The unit of measurement shall be number of photocell units replaced.

The tendered rate shall include full compensation for the supply, connecting and testing of the switch.
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.

The tendered rate shall further compensate for the supply and installation of the photocell inside a dummy B10 bulkhead.

	Item	Unit
AB.02.06	**Replace luminaire diffuser**	No

The unit of measurement shall be number of luminaire diffusers replaced.

The tendered rate shall include full compensation for the supply and installation of the specified type of diffuser, including fixing screws and clips.

	Item	Unit
AB.02.07	**Service light switch**	No

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

The tendered rate shall include full compensation for the servicing of the light switch, internal cleaning of the enclosure, spray painting, inspection of the contact points, switching mechanism, earthing, etc.

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 Multi-

layered phenolic plastic label as per Nosa-standard, cost of, which is included in rate.

	Item	Unit
AB.02.08	**Remove, clean, store and reinstallation of luminaire**	No

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 galvanised screws.

	Item	Unit
AB.02.09	**Replace Lamp Holder**	No

The unit of measurement shall be the number of lamp holders replaced.

The tendered rate shall include full compensation for the removal of the existing lamp holder and for the supply and installation of the specified type (ceramic) of lamp holder to the manufacturer's instructions.

	Item	Unit
AB.02.10	**Replace Luminaire internal components**	No

The unit of measurement shall be the number of SANS approved internal luminaire components replaced.

The tendered rate shall include full compensation for the removal of the defective component and for the supply, installation and testing of the specified type of component to the manufacturer's instructions.

AB.03 **Small power and fixed appliances**

	Item	Unit
AB.03.01	**Replace socket outlet**	No

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, Multi-layered phenolic plastic label as per Nosa-standard, cost of, which is included in the rate.

	Item	Unit
AB.03.02	**Replace isolator**	No

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 Multi-layered phenolic plastic label as per Nosa-standard, cost of, which is included in the rate.

	Item	Unit
AB.03.03	**Replace plug tops**	No

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.

	Item	Unit
AB.03.04	**Replace conduit**	m

The unit of measurement shall be the linear meter of conduit supplied and installed. The tendered rate shall include full compensation for the supply and installation of the specified type and size of conduit, including all fixing accessories.

	Item	Unit
AB.03.05	**Replace wiring channel**	m

The unit of measurement shall be number of linear meters of wiring channel replaced.

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.

	Item	Unit
AB.03.06	**Replace connection from isolator to fixed appliance**	No

The unit of measurement shall be number of connections made.

The tendered rate shall include full compensation for the removal of the existing old connection and the supply and installing of the connections to the fixed appliances.

	Item	Unit
AB.03.07	**Service socket outlet**	No

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

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, Multi-layered phenolic plastic label as per Nosa-standard, cost of, which is included in the rate.

The tendered sum shall further include for replacement of any missing outlet covers and fixing screw and earth testing.

	Item	Unit
AB.03.08	**Service isolator**	No

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

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 Multi-layered phenolic plastic label as per Nosa-standard, cost of, which is included in the rate.

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.

	Item	Unit
AB.03.09	**Replace power skirting**	m

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.

	Item	Unit
AB.03.10	**Supply and install Aluminium alloy cable junction box** No	

The unit of measurement shall be the number of Aluminium alloy cable junction box supplied and installed.

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

specified type of Pratley box.

	Item	Unit
AB.03.11	**Supply and install draw boxes**	No

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.

	Item	Unit
AB.03.12	**Supply and install draw box cover plates**	No

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.

	Item	Unit
AB.03.13	**Replace "stop-start" local control panel**	No

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 Multi-layered phenolic plastic label indicating load and supply DB.

	Item	Unit
AB.03.14	**Test and service ceiling mounted fan**	No

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.

	Item	Unit
AB.03.15	**Replace ceiling mounted fan**	No

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.

	Item	Unit
AB.03.16	**Service ceiling mounted fan control switch**	No

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.

	Item	Unit
AB.03.17	**Replace ceiling mounted fan control switch**	No

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.

	Item	Unit
AB.03.18	**Replace domestic stove components**	No

The unit of measurement shall be the number of stove components.

The tendered rate shall include full compensation for the supply and installation of the specified component.

The rate shall further include the disconnection and removal of the faulty component and the installation and testing of the new component.

	Item	Unit
AB.03.19	**Replace geyser components**	No

The unit of measurement shall be the number of geyser components.
The tendered rate shall include full compensation for the supply and installation of the specified component.

The rate shall further include the disconnection and removal of the faulty component and the installation and testing of the new component.

The rate shall also include the draining of the water from the geyser and refilling before testing.

	Item	Unit
AB.03.20	**Supply and Install Stove**	No

The unit of measurement shall be the number of electrical four plate stoves with oven and warm drawer supplied and installed.

The tendered rate shall include full compensation for the supply and installation of the stove including connection and testing after approval of the Engineer.

	Item	Unit
AB.03.21	**Provide Certificate of Compliance**	No

The unit of measurement shall be the number of Certificate of Compliance obtained from local authorities and issued to the Engineer for all the buildings under the installation.

The tendered rate shall include full compensation for the testing and all associated equipment to complete the Certificate of Compliance and certification thereof.

AB.04 **Earthing and bonding**

	Item	Unit
AB.04.01	**Supply and install earthing and bonding for the installation**	Lump sum

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.

	Item	Unit
AB.04.02	**Testing of the earth installation by a specialist contractor**	Lump sum

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

	Item	Unit
AB.04.03	**Supply and install earth electrodes**	No

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.

	Item	Unit
AB.04.04	**Provide cadweld joint**	No

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
AB.04.05	**Earth building roof structure**	No

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 there off onto a 1,2 m Cu earth electrode driven into the soil 1,8 m deep.

AB.05 Inspection of Electrical Installation

	Item	Unit
AB.05.01	**Inspection of building general electrical installation**	sum

The unit of measurement shall be the sum for the building inspected prior to commencement of the repair work phase.

The tendered sum shall include the visual and functional inspection and testing of all lights, switches, small power points and fixed appliances, to determine the extent of repairs or replacements required.
The rate shall further include the preparation of a schedule of items (report) requiring repairs or replacement, for approval by the engineer.

AB 11 MAINTENANCE OF THE INSTALLATION

AB 11.01 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. The contractor will as part of his maintenance obligations service all the equipment as part of his maintenance obligations at the start of the contract.

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:

AB 11.02.01 routine preventative maintenance
AB 11.02.02 corrective maintenance
AB 11.02.03 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 reports.

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
(iii) ensure upkeep of the labelling of the distribution board, equipment, cabling and wiring
(iv) 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, lamp holders, etc.

AB 11.05 Maintenance work: Measurement and payment

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

TECHNICAL SPECIFICATION

BA ROOF COVERINGS

CONTENTS

BA 01 SCOPE
BA 02 STANDARD SPECIFICATIONS BA 03 MEASUREMENT AND PAYMENT

BA 01 SCOPE

This specification covers the removal of existing roof coverings and waterproofing and the supply, delivery and installation of new roof coverings and water-proofing to various types of buildings.

Roof coverings shall mean the scope of work related to the removal of existing roof coverings, water-proofing and ancillary items, the supply and installation of new roof sheeting, roofing screws, purlins, flashings, rainwater goods, water-proofing, fascias and barge boards. This specification also includes minor work related to trusses, purlins, paintwork, minor plumbing work and water-proofing to concrete roofs.

BA 02 STANDARD SPECIFICATIONS

BA 02.1 GENERAL STANDARD SPECIFICATIONS

The latest edition, including all amendments 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:

PW 371 -	Specification of Materials and Methods to be used, fourth edition,
Oct 1993 SANS 1200HB -	Cladding and Sheeting
SANS 1783-4 -	Softwood brandering and battens
SANS 935 -	Hot-dip galvanised) zinc coatings
SANS 1273 -	Fasteners for sheet roof and wall coverings

BA 02.2 ADDITIONAL SPECIFICATIONS

Technical Specification BB: Carpentry and Joinery for Roofs and Ceilings Technical Specification BC: Waterproofing of Concrete Roofs

BA 02.3 ADDITIONAL REQUIREMENTS FOR REPAIR OF PROFILED ROOF SHEETING (NON-CONCEALED FIXING AND CONCEALED FIXING)

BA 02.3.1 Roof sheeting

Existing roof sheeting shall either be replaced or to a small extent be repaired according to the Schedule of Quantities and as instructed by the Engineer. Where new sheeting is specified, the existing roof sheeting must be removed. Each day's removed sheeting shall be fully covered with new roof sheeting at the end of the day. Plastic sheeting or equivalent approved protection to minimize damage possibilities due to rain, etc and to protect the personnel and occupied buildings. The new roof sheeting shall be 0, 6 mm thick galvanised baked silicone polyester enamel paint (baked enamel) IBR or equivalent approved for roof slopes exceeding 15º. Concealed fixed type Galvanised baked enamel roof sheeting will in general be used to cover roofs with slopes not exceeding 15º. The sheeting must be laid in long lengths without end overlaps. The broad flutes must be turned up at the apex to form a dam, and turned down at the eaves to form a drip. Metal closers 0,8 mm thick galvanised (baked enamel), complete with polyclosers set in one run of silicone sealant, are required at apexes, ridges, side and head walls, etc. The Contractor shall take all necessary dimensions and measurements on site prior to manufacturing and installation. Z275 galvanising spelter shall be used and the Contractor shall provide SANS certificates of compliance to the Engineer. Various standard dark colours will be used for baked enamel finished roof sheeting, flashings, gutters and down pipes. In all cases the roofing must be laid strictly in accordance with the manufacturer's specifications.

In certain cases, existing roof sheeting that is removed from buildings, will be re-used to repair similar types of structures.

The following paragraphs in specification PW 371 must be specifically read in conjunction with this technical specification:

Paragraph 7.6, excluding 7.6.1(i), 7.6.2(a) and 7.6.2(e)
Paragraph 7.7, excluding 7.7.1, 7.7.5 and 7.19.1(a).

BA 02.3.2 **Main fasteners to timber purlins: Galvanised/baked enamel IBR or equivalent approved sheeting**

90 mm x no. 14 hexagon head (H/H) carbon steel (C/S) cadmium plated Posidriv or equivalent approved roofing screws with 29 mm diameter x 1,0 mm thick galvanised conical washers and poly-isobutyl grommet assembly must be used. Main fasteners for steel purlins are to be 65 mm long. Fasteners to be provided at alternating ribs and all side laps.

BA 02.3.3 **Side lap fasteners: Galvanised/baked enamel IBR or equivalent approved sheeting**

Stitching will be done with 25 mm x no. 14 H/H C/S posidriv or equivalent approved roofing screws @ 600 c/c maximum with 29 mm diameter x 1,0 mm thick galvanised

conical washers and poly-isobutyl grommet assembly. Provide 10 x 1, 6 mm thick butyl rubber sealer strip between sheets.

BA 02.3.4 **Flashings**

0, 8 mm thick baked enamel/galvanised flashings at ridge caps, side and head walls, drips, corners, etc, as described elsewhere. The minimum length of an overlap between flashings is 150 mm. Apply two runs of silicone sealant between flashings. Flashings to be stitched together with 25 mm x no. 14 H/H C/S posidriv or equivalent approved roofing screws with 29 mm diameter x 1, 0 mm thick galvanised conical washers at end laps and longitudinally @ 400 c/c maximum at ribs, etc. The Contractor shall take all necessary dimensions and measurements on site prior to manufacturing and installation.

BA 02.3.5 **Sealant**
Silicone sealant with an amine cure system with primer shall be used to waterproof all flashings and rainwater goods, viz. gutters and down pipes. Two runs of silicone shall be provided at end overlaps.

BA 02.3.6 **Pipe flashings**

EPDM/silicone pipe-through-roof flashings to diameter or equivalent approved pipe flashings shall be used to waterproof pipe protrusions through the roof sheeting. Installation shall be done strictly in accordance with the manufacturer's specification and shall include the application of EPDM/silicone pipe through roof flashing and sealant and fastening of flashing to surface with TEKS or equivalent approved self-drilling fasteners.

BA 02.3.7 **Insulation**

No insulation repairs are required. In certain cases insulation may be necessary to reduce heat load or to comply with hygiene requirements as in abattoirs. Refer to section 7 part 7.6.3 of PW 371.

Specification for non-visible roof insulation material:

Heavy grammage double sided reflective aluminium foil (heavy grade) laid on 1,6 mm diameter galvanised straining wires at 300 mm centres to the manufacturer's specification. The insulation shall be laid longitudinally over the purlins and lapped 150 mm at joints.

Specification for visible roof insulation material:

White thermal insulation low density polyethylene bubble and Aluminium foil backing fire retardant grade laid on 1,6 mm diameter white plastic (PVC) coated straining wires at 383 mm centres to the manufacturer's specification. The insulation shall be laid longitudinally over the purlins and lapped at joints.

BA 02.4 **ADDITIONAL REQUIREMENTS FOR REPAIR OF PROFILED SIDE WALL CLADDING (NON-CONCEALED FIXING AND CONCEALED FIXING)**

BA 02.4.1 **Side wall cladding**

Existing side wall cladding shall either be repaired or replaced in accordance with the Schedule of Quantities. Where new cladding is specified, the existing side wall cladding must be removed. Each day's removed cladding shall be fully covered with new cladding at the end of the day. The new side wall cladding shall be 0,6 mm thick galvanised (or baked enamel) IBR or equivalent approved. The cladding must be laid in long lengths without end overlaps. Metal closers 0,8 mm thick galvanised (or baked enamel), complete with polyclosers set in one run of silicone sealant, are required at gables, ridges, side and head walls, etc. The Contractor shall take all necessary dimensions and measurements on

site prior to manufacturing and installation. Z275 galvanising spelter shall be used and the Contractor shall provide SANS certificates of compliance to the Engineer. Heavy duty profiled polycarbonate sheets shall be used for translucent sheeting. Various standard dark colours for baked enamel finished side wall cladding, flashings, gutters and down pipes will be used. In all cases the cladding must be laid strictly in accordance with the manufacturer's specifications.

BA 02.4.2 **Main fasteners to timber girts: Galvanised/Galvanised baked enamel IBR (or equivalent approved) and profiled translucent sheeting**

90 mm x no. 14 hexagon head (H/H) carbon steel (C/S) cadmium plated posidriv or equivalent approved roofing screws with 29 mm diameter x 1,0 mm thick galvanised conical washers and poly-isobutyl grommet assembly must be used. Main fasteners for steel girts are to be 65 mm long. Fasteners to be provided at alternating ribs.

BA 02.4.3 **Side lap fasteners: Galvanised/Galvanised baked enamel IBR (or equivalent approved) sheeting**

Stitching will be done with 25 mm x no. 14 H/H C/S posidriv or equivalent approved roofing screws @ 600 c/c with 29 mm diameter x 1,0 mm thick galvanised conical washers and poly-isobutyl grommet assembly. Provide 10 x 1,6 mm butyl rubber sealer strip between sheets.

BA 02.4.4 **End overlaps**

If unavoidable, the end overlap shall be 300 mm minimum between sheeting and sealed with two rows of silicone sealant between the sheets. Bolt the ribs in the overlap region with the profiled (polycarbonate) translucent sheeting with galvanised no. 14 gutter bolts, bonded washers and nuts through every alternative rib.

BA 02.4.5 **Side overlaps: Vertical profiled translucent sheeting**

Stitching will be done with 6 mm cadmium-plated cladding bolts and nuts x 25 mm long @ ± 300 c/c with 19 mm diameter x 1,0 mm thick galvanised conical washers and poly-isobutyl grommet assembly.

BA 02.5 **RAINWATER GOODS**

BA 02.5.1 **Gutters**

Standard size for houses:
100 x 75 x 0,8 thick standard baked enamel/galvanised non-supporting beaded gutter. Galvanised brackets to be provided at every truss. Brackets to be painted to specification in the Schedule of Quantities.
Alternatively standard 140 x 127 x 83 x 0,6 mm thick concealed fix profile sheeting baked enamel/galvanised fascia gutter with galvanised gutter clips can be used.

Typical size for other buildings:
125 x 100 x 0,8 thick standard baked enamel self-supporting beaded gutter.
Dark colours to Consultant's specification.
The following paragraphs in specification PW 371 must be read in conjunction with this technical specification:
7.15, 16.12 and 16.13.

The Contractor shall take all necessary dimensions and measurements on site prior to manufacturing and installation.

BA 02.5.2 **Joints in gutters, valleys, etc**

150 mm overlap sealed with an approved silicone and riveted together with 2 rows of sealed pop rivets. Linings to valleys and secret gutters, etc, shall have an overlap of 225 mm.

BA 02.5.3 **Gutter accessories and ancillary items**

End stops: 0,8 mm thick baked enamel/galvanised finished end stops joined to gutter on site and sealed as for joints in gutters.

Outlets: 0,8 mm thick baked enamel/galvanised finished outlets fixed to gutter with pop rivets and sealed with an approved silicone. Outlet to slip into down pipe.

Fascia straps: 25 mm wide x 1,0 mm thick galvanised straps at +/- 686 mm c/c.

Corner joints: Corner joints to be neatly mitred, pop riveted together and sealed with an approved silicone.

Sealant: Clear silicone sealant with amine cured system and primer shall be used to waterproof gutters and down pipes.

BA 02.5.4 Down pipes

Standard sizes:
100 x 75 x 0, 6 thick baked enamel/galvanised down pipes 100 x 100 x 0,8 thick baked enamel/galvanised down pipes

Dark colours to Consultant's specifications.

Down pipes to have double-seamed joints. Down pipes, shoes, offsets, etc, shall be joined together by means of 100 mm slip joints and pop riveted together.

The Contractor shall take all necessary dimensions and measurements on site prior to manufacturing and installation.

BA 02.5.5 Down pipe acessories

Brackets: Standard galvanised brackets shall be spaced at centres not exceeding 2,4 metres. Brackets to be primed and painted with 2 coats of high gloss enamel.

Shoes, offsets and spreaders: Manufactured from 0,8 mm thick bakedenamel/galvanised material, cut and mitred to suit. All joints to be sealed with an approved silicone sealant.

BA.02.5.6 General

The Contractor will be responsible for the stability of the supporting structure during and after removal of existing roof cladding and sheeting.

SANS 1200 HB "Cladding and Sheeting" will be applicable for the erection of all new roofs.

The Contractor must give a minimum 3 year guarantee for the watertight roof and workmanship. **The manufacturer must carry out inspections at regular intervals during the construction period. He must issue a certificate of acceptance and compliance on completion to the client.**

BA 03 MEASUREMENT AND PAYMENT

BA.03.1 DETAILS OF MATERIAL TO BE USED

For detail descriptions of materials, thicknesses, dimensions and ancillary items to be used, as specified in the various payment items of roof sheeting, cladding, flashings, etc; refer to the scheduled list below:

Flashings: Refer to Technical Specifications BA	
Roof:	
0,8 mm thick Galvanised baked enamel Ridge Flashing	462 mm girth (231 + 231), 3 x bends (2 are shallow bends). Fix flashing to roof sheeting with posidriv screws and washers. 150 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone; 2 rows of broad flute polyclosers bedded in silicone, 2 rows x 0,6 mm thick Galvanised baked enamel broad flute metal closers. Bend up trough to form a dam.
0,6 mm thick Galvanised baked enamel Eaves Closer	Fix standard serrated narrow flute eaves closer to timber purlin. Patch plaster and touch up paint work.

0,8 mm thick Galvanised Apex Trim	462 mm girth (231 + 231 vertical), 3 x bends (2 are shallow bends). Fix flashing to roof sheeting with posidriv screws and washers. 150 mm overlap fixed and sealed with 2 rows of pop rivets and 2 rows of silicone. 1 row of broad flute polycloser bedded in silicone, 2 rows x 0,6 mm thick galvanised broad flute metal closers. Bend up trough to form a dam.
0,8 mm thick Galvanised baked enamel Headwall Flashing	385 mm girth (231 + 154 vertical) headwall flashing, 2 x bends (1 is a shallow bend). Fix flashing to roof sheeting with posidriv screws and washers. 150 mm overlap fixed and sealed with 2 rows of pop rivets and 2 rows of silicone. 1 row of broad flute polycloser bedded in silicone, 1 row x 0,6 mm thick Galvanised baked enamel broad flute metal closer. Bend up trough to form a dam. 154 mm girth (114 + 25 + 15 lip @ 15º) Galvanised baked enamel counter flashing, 3 x bends (1 is a shallow bend). Counter flashing to overlap with headwall flashing with at least 75 mm. Cut 6 mm wide groove into brick wall for counter flashing. Prime joint and seal with an approved 6 x 6 mm poly-urethane sealant.
Extra over for cutting into brick wall	6 mm wide groove x 30 mm deep into brick wall. Clean groove from dust and prime groove.
0,8 mm thick Galvanised baked enamel Hip Flashing	462 mm girth (231 + 231), 3 x bends (2 are shallow bends). Fix flashing to roof sheeting with posidriv screws and washers. 150 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone. 2 rows of broad flute polyclosers bedded in silicone, 2 rows x 0,6 mm thick Galvanised baked enamel broad flute metal closers on rake. Bend up trough to form a dam.
0,8 mm thick Galvanised baked enamel Apron Flashing	462* mm girth (308 + 154* vertical, girt position determines final upstand length on site), 3 x bends (2 are shallow bends). Fix flashing to roof sheeting with posidriv screws and washers. 150 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone. 2 rows of broad flute polyclosers bedded in silicone, 1 row x 0,6 mm thick Galvanised baked enamel broad flute metal closer. Bend up trough to form a dam.
0,8 mm thick Galvanised baked enamel Eaves Flashing	462* mm girth (154 vertical + 308*, girt position determines final upstand length), 3 x bends (2 are shallow bends). Fix flashing to roof sheeting with posidriv screws and washers. 150 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone. 1 row each of broad and narrow flute polyclosers bedded in silicone, 1 row each x 0,6 mm thick Galvanised baked enamel broad and narrow flute metal closers. Turn down trough to form a drip. Overhang length of roof sheeting to be determined on site.
0,8 mm thick Galvanised baked enamel Gable Flashing (residential type)	308 mm girth (262 + 46 vertical), 3 x bends (2 are shallow bends). Fix flashing to roof sheeting with posidriv screws and washers. 150 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone. Flashing to be fitted tightly over gable fascia board. Provide one row of continuous silicone on rib.
0,8 mm thick Galvanised baked enamel Gable Flashing (industrial type)	462 mm girth (262 +200 vertical), 3 x bends (2 are shallow bends). Fix flashing to roof sheeting with posidriv screws and washers. 150 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone. 1 row x 0,6 mm thick Galvanised baked enamel broad flute metal closer on side wall cladding. Provide one row of continuous silicone on rib.
0,8 mm thick Galvanised baked enamel Side Wall Flashing	385 mm girth (231 + 154 vertical) side wall flashing, 2 x bends (1 is a shallow bend). Fix flashing to roof sheeting with posidriv screws and washers. 150 mm overlap fixed and sealed with 2 rows of pop rivets and 2 rows of silicone. 1 row of broad flute polycloser bedded in silicone (only for vertical side wall cladding). 154 mm girth (114 + 25 + 15 lip @ 15º) Galvanised baked enamel counter flashing, 3 x bends (1 is a shallow bend). Counter flashing (side wall is a brick wall) to overlap with side wall flashing with at least 75 mm. Cut 6 mm wide groove into brick wall parallel to roof sheeting for counter flashing. Prime joint and seal with an approved 6 x 6 mm poly-urethane sealant.
0,8 mm thick Galvanized Roof Overhang Barge Flashing	616 mm girth (286 + 300 vertical + 20 + 10 vertical) standard Craft-Lock barge flashing, 4 x bends (1 is a shallow bend). Fix flashing to roof sheeting with posidriv screws and washers, and to 250 x 25 wide x 2,5 thick with 25 mm lip galvanised bracket. The galvanised bracket to be screwed to rafter ends with 2 countersunk brass screws. 150 mm overlap fixed and sealed with 2 rows of pop rivets and 2 rows of silicone. 1 row of broad flute polycloser bedded in silicone, 1 row x Galvanised baked enamel broad flute metal closer bedded in a row of silicone. Bend up trough to form a dam.
0,8 mm thick Galvanised baked enamel Side Roof Overhang Flashing (carports)	616 mm girth (286 + 300 vertical + 20 + 10 vertical), 4 x bends (1 is a shallow bend). Fix flashing to roof sheeting with posidriv screws and washers, and to 250 x 25 wide x 2,5 thick with 25 mm lip galvanised bracket. The galvanised bracket to be screwed to timber rafter ends with 2 countersunk brass screws or to be site welded to steel purlins. 150 mm overlap fixed and sealed with 2 rows of pop rivets and 2 rows of silicone.

0,8 mm thick Galvanised Valley Flashing	770 mm girth (308 + 27 vertical + 100 wide gutter + 27 vertical + 308), 6 x bends (2 x shallow bends). Fix valley gutter to top of valley rafters with posidriv screws and washers (seal with silicone). Cut and bend valley gutter at main gutter with 25 mm down lip. 225 mm overlap fixed and sealed with 2 rows of pop rivets and 2 rows of silicone. 2 rows of narrow flute polyclosers in ribs bedded in silicone.
0,8 mm thick Galvanised Valley Side Wall Flashing	616 mm girth (308 + 27 vertical + 140 wide gutter + 141 vertical), 4 x bends (1 is a shallow bend). Fix valley gutter to top of valley rafter with Posidriv screws and washers (seal with silicone) and impact nails (6 mm dia x 60 long @ 200 c/c) to brick wall. Cut and bend valley gutter at main gutter with 25 mm down lip. 225 mm overlap fixed and sealed with 2 rows of pop rivets and 2 rows of silicone. 1 row of narrow flute polyclosers in ribs bedded in silicone. 154 mm girth (114 + 25 + 15 lip @ 15º) galvanised counter flashing, 3 x bends (1 is a shallow bend). Counter flashing (side wall is a brick wall) to overlap with side wall flashing with at least 75 mm. Cut 6 mm wide groove into brick wall parallel to roof sheeting for counter flashing. Prime joint and seal with an approved 6 x 6 mm poly-urethane sealant.
0,8 mm thick Galvanised baked enamel Flat Back Flashing	1200* mm wide (25 mm lips on sides bend down to angle of rib) x 925 mm girth, * width of roof monitors determine the final width of flat back flashing. Flat back flashing for full length between monitor and ridge. Fix flashing to roof sheeting with posidriv screws or sealed type Aluminium blind pop rivets. 150 mm overlap fixed and sealed with 2 rows of pop rivets and 2 rows of silicone. 1 row of broad flute polycloser bedded in silicone at bottom end of flat back flashing.
0,8 mm thick Galvanised baked enamel Wall Gutter	616 mm girth (154 vertical x 462 at slope), 1 x bend. Fix boundary/side valley gutter to top of valley rafter with posidriv screws and washers (seal with silicone) and impact nails (6 mm dia. x 60 long @ 200 c/c) to brick wall. 225 mm overlap fixed and sealed with 2 rows of pop rivets and 2 rows of silicone. 1 row x 0,6 mm thick galvanised narrow flute closers in ribs fixed to purlins with posidriv screws and washers; seal with silicone. 154 mm girth (114 + 25 + 15 lip @ 15º) Galvanised baked enamel counter flashing, 3 x bends (1 is a shallow bend). Counter flashing (side wall is a brick wall) to overlap with side wall flashing with at least 75 mm. Cut 6 mm wide groove into brick wall for counter flashing. Prime joint and seal with an approved 6 x 6 mm poly- urethane sealant.
0,8 mm thick Galvanised baked enamel Corner Piece Flashing (for monitors)	231 wide x 77 vertical x 462 long, shallow bend for horizontal portion. Fix flashing to roof sheeting with Posidriv screws or sealed type Aluminium blind pop rivets. Seal overlap with 2 rows of pop rivets and 2 rows of silicone. Provide broad flute polyclosers bedded in silicone in troughs.
Walls: (m)	
0,8 mm thick Galvanised baked enamel External Vertical Flashing	462 mm girth (231 + 231), 3 x bends (2 x shallow bends). Fix flashing to roof sheeting with Posidriv screws and washers. 150 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone.
0,8 mm thick Galvanised baked enamel Internal Vertical Flashing	462 mm girth (231 + 231), 3 x bends (2 x shallow bends). Fix flashing to roof sheeting with Posidriv screws with washers. 150 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone.
0,8 mm thick Galvanised Internal Vertical Flashing	462 mm girth (231 + 231), 3 x bends (2 x shallow bends), fix flashing to roof sheeting with Posidriv screws with washers. 150 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone.
0,8 mm thick Galvanised Drip	154 mm girth (64 vertical + 50 + 20 vertical + 20) standard drip flashing, 3 x bends. Fix flashing to girts or roof sheeting with sealed type Aluminium blind
Flashing	pop rivets or Posidriv screws with washers. 50 mm overlap sealed with one row of silicone and stitched together with sealed blind type pop rivets.
0,8 mm thick Galvanised baked enamel Window Flashings	154 mm girth 3 x bends. Different flashing details for sill, jamb and top of window. Contractor to provide details to Engineer for approval. One row of narrow flute polyclosers bedded in silicone above and below window frame. Fix flashings to girts or roof sheeting with Posidriv screws and washers or sealed type Aluminium blind pop rivets. 100 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone. Seal around window frame with silicone to waterproof flashings. 1 row x 0,6 mm thick Galvanised baked enamel broad flute metal closer for sill flashing.
0,8 mm thick Galvanised baked enamel Door Flashings	154 mm girth 3 x bends. Different flashing details for sill, jamb and top of window. Contractor to provide details to Engineer for approval. One row of narrow flute polyclosers bedded in silicone above and below window frame. Fix flashings to girts or roof sheeting with Posidriv screws and washers or sealed type Aluminium blind pop rivets. 100 mm overlap sealed with 2 rows of pop rivets and 2 rows of silicone. Seal around window frame with silicone to waterproof flashings. 1 row x 0,6 mm thick Galvanised baked enamel broad flute metal closer for sill flashing

0,8 mm thick Galvanised baked enamel Bull Nose Flashing	462 mm girth (262 +200 vertical), 3 x bends excluding curving (2 are shallow bends), Fix flashing to roof sheeting with Posidriv screws and washers. 300 mm max. overlaps (run outs) sealed with 2 rows of pop rivets and 2 rows of silicone. 1 row x 0,6 mm thick Galvanised baked enamel broad flute metal closer on side wall cladding. Provide one row of continuous silicone on rib. Contractor to measure radius on site prior manufacturing.
Roof Insulation: (m^2)	
White Bubble Foil on white straining wires (abattoirs only)	Lay insulation strictly to manufacturer's specifications. Use 1,6 mm diameter white PVC coated straining wires @ 300 mm c/c max. Refer to clause 2.3.7 of Technical Specification BA: Roof Coverings.
420 RSA heavy duty reinforced reflective Aluminium foil	Lay insulation strictly to manufacturer's specifications. Refer to clause 2.3.7 of Technical Specification BA: Roof Coverings.
Rainwater Goods:(m)	
100 x 75 x 0,8 mm thick Galvanised baked enamel beaded non-supporting box gutter	Provide 25 x 1 mm thick galvanised fascia straps @ 686 c/c to support fascia of gutters; fix with 6 mm galvanised gutter bolts, nuts and washers. All accessories and ancillary items included. Roof sheeting troughs to be have drip bend.
100 x 75 x 0,6 mm thick Galvanised baked enamel down pipes; height < 5 m	Provide one down pipe for every 6 m of gutter length. For gutter length of 3 to 6 m, provide two down pipes. All accessories and ancillary items included.
125 x 100 x 0,8 mm thick Galvanised baked enamel self-supporting box gutter	Gutter to be braced back to the roof sheeting with a 25 x 1 mm thick galvanised fascia straps @ 686 c/c. The detail can only be applied to sheeting with a max. cantilever of 450 mm from first purlin. Roof sheeting troughs to be have drip bend.
125 x 100 x 0,8 mm thick Galvanised baked enamel down pipes	Provide one down pipe for every 6 m of gutter length. For gutter length of 4,5 to 6 m, provide two down pipes. All accessories and ancillary items included.
100 x 100 x 0,8 mm thick Galvanised baked enamel down pipes	Provide one down pipe for every 6 m of gutter length. For gutter length of 4,5 to 6 m, provide two down pipes. All accessories and ancillary items included.
Pipe Flashings: (No. and Dia.)	
EPDM/silicone pipe-through-roof flashings to diameter pipe flashings to diameter	For all residential type of buildings, pipe protrusions through roof sheeting will be eliminated by re-routing existing pipe work. For all other pipe protrusions: Use EPDM/silicone pipe-through-roof flashings to diameter no. 2 for pipe diameters 40 - 80 mm and EPDM/silicone pipe-through-roof flashings to diameter no. 4 for pipe diameters 80 - 150 mm. EPDM/silicone pipe-through-roof flashings to diameter flashings are made of E.P.D.M. rubber compound of a carbon black colour.
0,8 mm thick Galvanised baked enamel Cravat and Cowl Flashing to diameter	Refer to roof and wall details no 1 and 2. (Bound into the back of this document).
Pipework: (No.)	

Re-route existing pipes; diameter and number	Re-routing of roof void geyser pipework: Disconnect and remove existing overflow pupe from Latco - and or Safety Valve, supply and connect new 15-28mm dia polycop pipe to existing Latco - and or Safety Valve including all necessary fittings, adaptors, brackets, etc and re-route pipework in ceiling or roof void to protrude through external wall, including making good of external wall, irrespective of finish. Allow approximately 7m horizontal and 3m vertical pipework to ground level per geyser, complete with standard primer, one undercoat and two coats of super acrylic paint to exposed pipework to match existing paint system and colour. Ventilation pipework: Remove existing 100mm dia ventilation pipe section protruding through roof covering. Install 90° bend below roof level and re-route ventilation pipe to clear overhang. Install 90° reducing 100 x 50 bend and rise with 50mm dia pipe to 600mm. Install standard sewer pipe ventilation cowl on top of ventilation pipework. Pipe material must adapt to existing material of ventilation pipework. The bracketing and supports of the ventilation pipework shall be as per manufactuers specifications. Standard primer, one coat undercoat and two coats of super acrylic paint to exposed pipework to match existing paint system and colour.

BA.03.01 **DETAILS OF ROOF PAINT REPAIR WORK**

Specification of paint shall be an extremely durable weather and UV resistant coating system for Galvanised iron roofs or previously painted galvanised iron roofs.

A two coat system shall be used consisting of a two component recoatable polyurethane acrylic finish.

The mixing ratio of the dual pack enamel system shall be as per the manufacturer's specifications. Both components shall be stirred with a power mixer until homogeneous. The dual pack enamel system shall always be applied over a suitable primer and/or intermediate coats within the manufacture's specified over-coating intervals.

Contractor must ensure that the work is done by a competent person and must be approved by the Engineer before work may commence

SURFACE PREPARATION – PREVIOUSLY PAINTED

Remove all peeling paint by sanding, scraping or water cooled grinders fitted with reversible knotted wire brush. Care must be taken not to remove any sound galvanizing. Any unsound paint will fail at a later stage. Wash roof with Aquasolv degreaser, scotch brite pads and rinse thoroughly with clean water to ensure soluble chloride content <75mg per m^2. Ensure that all degreaser is properly washed off.

SURFACE PREPARATION - UNPAINTED GALVANISED

Wash roof with degreaser, scotch brite pads and rinse thoroughly with clean water. Ensure that all degreaser is properly washed off, to ensure soluble chlorine content <75m g per m^2.

APPLICATION

Apply one coat of a two component anti-corrosive strontium chromate epoxy primer by using airless spray. Allow 4 hours drying time. Apply a second coat if necessary to achieve the specified DFT of 25 – 35 microns.

Apply one coat of a dual pack polyurethane enamel system with acrylic finish by airless spray to achieve complete obliteration. Ensure that a single coat of wet film application of 88 – 135 microns is achieved. This will give a DFT of 50 – 75 microns. Application in high humidity environments (75% RH) may cause surface bloom.

GUARANTEE

The Contractor must give a written 5 year guarantee for the quality and workmanship of the paint work (fair wear and tear excepted). The Contract or shall be liable for any peeling or flaking paint applied by the Contractor and shall execute all 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. He must issue a certificate of acceptance and compliance on completion to the client.

BA 03.2 SCHEDULED ITEMS

BA.01 Supply and install cladding and sheeting: Unit: m²

The area measured will be that of the exposed surface of the finished building as specified in, Subclause 8.1.1 of SANS 1200 HB.

Separate items will be scheduled for roof sheeting and side cladding, subdivided for each type of sheeting, cladding and finish, each profile and straight or curved sheets.

The rate shall cover the cost of supplying, delivering, storing on Site, handling, moving, installing and fixing the sheeting or cladding (finished or prepainted as scheduled) complete with all necessary fasteners (all sheeting, cladding and accessories are to be supplied by a South African based manufacturer and are subject to a three year written guarantee for water tightness and workmanship). The rate shall also cover the cost of cutting, notching, waste, all scaffolding, temporary supports, hoisting facilities and safety precautions (see Subclause 8.1.1 of SANS 1200HB).

BA.02 Forming cranks, bullnoses, etc: Unit: m

Cranks, bullnoses, etc will be measured by length, with bullnoses to a maximum of 600mm radius and bend to maximum of 90°.

Separate items for cranks, bullnoses, etc, will be scheduled for each different type of sheeting, profile and finish.

The rate shall cover the cost of supplying, delivery, storing on Site, handling, moving, installing and fixing of cranks, bullnoses, etc and shall be measured as an extra over the specified roof sheeting. The rate shall also cover the cost of cutting, notching, waste, all necessary scaffolding, temporary supports, hoisting facilities and safety precautions (see Subclause 8.1.2 of SANS 1200 HB).

BA.03 Carefully remove existing cladding and sheeting: Unit: m²

The area measured will be that of the exposed surface of finished building (see Subclause 8.1.1 of SANS 1200 HB).

Separate items will be scheduled for roof covering and side cladding, without differentiating amongst different profiles, etc.

The rate shall cover the cost of removing of existing roof sheeting or side cladding inclusive of flashings and sundry items from timber or steel purlins, and the removal from site of all such material. The rate shall also cover the cost of any scaffolding, temporary supports, hoisting facilities etc as well as credit for the redundant material becoming the property of the Contractor.

The rate shall also cover all temporary necessary dust screens, sheets, plastic linings, etc laid horizontal or vertical inside existing roof spaces or voids on top of ceilings, trusses, etc to protect all contents inside the buildings while replacing or repairing the roof coverings.

BA.04 Carefully remove and store existing cladding and sheeting: Unit: m²

The area measured will be that of the exposed surface of finished building (see Subclause 8.1.1 of SANS 1200 HB).

Separate items will be scheduled for roof covering and side cladding without differentiating amongst different profiles etc.

The rate shall cover the cost of removing of existing roof sheeting or side cladding inclusive of flashings and sundry items from timber or steel purlins, the temporary storage of the removed sheeting or cladding at a store area (position of store area to be indicated on site). The rate shall also cover the cost of any scaffolding, temporary supports, hoisting facilities etc.

The rate shall also cover all temporary necessary dust screens, sheets, plastic linings, etc laid horizontal or vertical inside existing roof spaces or voids on top of ceilings, trusses, etc to protect all contents inside the buildings while replacing or repairing the roof coverings.

BA.05 Re-erect: Stockpilled cladding and sheeting: Unit: m²

The area measured will be that of the exposed surface off the finished building (see Subclause 8.1.1 of SANS 1200 HB).

Separate items will be scheduled for roof covering and side cladding without differentiating amongst different profiles, etc..

The rate shall cover the cost of preparing, re-erecting, handling, moving, installing existing stockpiled sheeting and cladding including new fixing fastners, etc complete. The rate shall also cover the cost of cutting, notching, waste, all scaffolding, temporary supports, hoisting facilities and safety precautions (see Subclause 8.1.1 of SANS 1200HB).

BA.06 **Supply and install sundry items, etc: Unit: m**

Flashing, ridging, etc will be measured by length.

Separate items will be scheduled for each type, finish and shape of sundry item.

The rate shall cover the cost of supplying, delivery, storing on Site, handling, moving, installing and fixing the relevant item complete with all fasteners and sundry items as stipulated in BA.02.3.4.

The rate shall also cover the cost of cutting, notching, waste and of all scaffolding, temporary supports, hoisting facilities and safety precautions (see Subclause 8.1.1 of SANS 1200 HB).

BA.07 **Supply and install roof insulation: Unit: m^2**

The area measured will be that of the exposed surface, no deductions being made for openings left or cut for protrusions such as those specified in Subclause 5.7 of SANS 1200 HB, or for ventilators and the like. Deductions will be made for windows and other openings of similar dimensions.

The rate shall cover the costs of supplying, delivery, storing on Site, handling, moving, installing and fixing complete with all necessary fasteners as specified in BA.02.3.7, and shall also cover cost of cutting, notching, waste and of all scaffolding, temporary supports, hoisting facilities and safety precautions (see Subclause 8.1.1 of SANS 1200 HB).

BA.08 **Supply and install rainwater goods: Unit: m**

Rainwater goods and similar lengths of constant profile will be measured by length.

Sundry items such as stop-ends, bends, shoes, etc are deemed to be included in the tendered rate per metre.

Separate items will be scheduled for each type, finish, shape and when relevant, profile of rainwater goods. The rate shall cover the cost of supplying, delivery, storing on Site, handling, moving installing and fixing the relevant goods complete with all necessary fasteners, etc as specified in BA.02.5 (all complete and subject to a three year written guarantee on watertightness and workmanship). The rate shall also cover the cost of cutting, notching and waste, and of all scaffolding, temporary supports, hoisting facilities and safety precautions (see Subclause 8.1.1 of SANS 1200 HB).

BA.09 **Carefully remove existing rainwater goods: Unit: m**

The length measured will be that of the exposed length of finished building.

No separate items will be scheduled for size, thickness, material, profile, galvanized or Galvanised baked enamel finished items.

The rate shall cover the cost of removing of existing rainwater goods inclusive of brackets and sundry items from timber or steel purlins and trusses, the cost of any scaffolding, temporary supports, hoisting facilities etc and the allowance of credit for material to become the property of the Contractor and to be removed from the site.

BA.10 **Miscellaneous items:**

(a) Measured by number:

(i) (Description of item)_____Unit: No

(ii) Etc.

(b) Measured by linear metre:

(i) (Description of item)_____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 manufacturing or providing and installing each item complete as per BA.03.1.

BA.11 **Roof rehabilitation: Unit: m^2**

The area measured will be that of the exposed surface of building as specified in Subclause 8.1.1 of SANS 1200 HB. Separate items will be scheduled for roof sheeting and side cladding, without differentiating between different profiles, finishings, fixing methods, etc.

The rate shall cover the cost for inspecting, removing existing and supplying and fixing new posidriv screws and mechanisms, sealants, sealer strips, etc complete.

The rate shall also cover the cost of cutting, waste, all scaffolding, temporary supports, etc all to the approval of the Engineer.

BA.12 **Supply and install additional fixing screws, etc: Unit: No**

The unit of measurement will be the number of additional screws installed.

The rate shall cover the cost for removing defective fixing screws as indicated by the Engineer, and replacing aforesaid with new posidriv or equivalent approved fixing screws in similar previous positions.

No separate items will be scheduled for roof sheeting, side cladding or different profiles. Payment under this item shall not include the screws to be replaced under the roof rehabilitation item above.

BA.13 **Carefully remove and re-erect ventilation units: Unit: No**

The unit of measurement will be number of ventilation units removed, temporarily stored and resized to similar positions.

The rate shall cover the cost for carefully removing existing ventilation units approximately 2,5m^2 in area from existing roof structures, temporary storage, servicing of existing ventilation units, cleaning, re-erecting later onto new roof sheeting (irrespective of type or profile of sheeting), new ventilation flashings and counter flashings, sealants, fixing screws, fasteners, etc complete. The rate shall also cover the cost for cutting openings into new sheeting for ventilation units, waste, all necessary scaffolding, temporary supports, hoisting facilities and safety precautions (see Subclause 8.1.1 of SANS 1200 HB).

BA.14 **Carefully remove and re-erect birdproofing: Unit: m^2**

The area measured will be that of the exposed surface to be covered with bird-proofing.

The rate shall cover the cost for carefully removing chicken wire bird-proofing stapled to each roof truss tie beam at roof overhang between beam-filling and fascia board, temporary storage, cleaning of bird-proofing, re-erecting later into similar previous position. The rate shall also cover the cost for cutting, fixing staples, waste, scaffolding, etc.

BA.15 **Prepare existing roof sheeting and repaint: Unit: m^2**

The area measured will be that of the exposed surface of roof sheeting painted (measured on flat area as for roof coverings.)

The rate shall cover the cost for removing existing paint and cleaning surfaces with an approved degreaser and scotch brite pads and rinsing thoroughly by means of pressure washing to receive one new primer coat and one coat dual pack poly-urethane enamel system with acrylic finish roof paint, supplying, delivery and applying new primer and finishing coat, etc., without distinguishing between roof sheeting, side cladding, profile, finish, etc., as specified in BA 03.02

The rate shall also cover the cost of waste, all necessary scaffolding, etc.

BA.16 **Replacement of existing roof tiles in patchwork: Unit: number**

The unit of measurement will be number of roof tiles removed, installation of new roof tiles similar to existing roof tiles.

The rate shall cover the cost for carefully removing existing roof tiles approximately 350mm x 350mm in area from existing roof structures, installation of new roof tiles and ridge flashings, sealants, fixing screws, fasteners, etc complete. The rate shall also cover the cost, waste, all necessary scaffolding, temporary supports, hoisting facilities and safety precautions.

TECHNICAL SPECIFICATION

BB CARPENTRY AND JOINERY FOR ROOFS AND CEILINGS

CONTENTS

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BB 01 SCOPE

Carpentry and joinery shall mean the 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 corrective maintenance repairs 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:

PW 371 -	Specification of Materials and Methods to be used (Fourth revision, October 1993)
SANS 10243 -	The design, manufacture and erection of timber trusses
SANS 266 -	Gypsum plasterboard
SANS 1783 - 2 -	Stress-graded softwood: general structural timber
SANS 1783 - 4 -	Softwood brandering and battens
SANS 803 -	Fibre-cement boards

BB 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BA: Roof coverings Technical Specification BD: Walls Technical Specification BJ: Paintwork

BB 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

BB 03.01 ADDITIONAL REQUIREMENTS FOR REPAIR OF TIMBER ROOF STRUCTURES

BB 03.01.01 Timber trusses

(a) Replacing timber trusses

The Engineer shall inspect timber trusses for defects and establish which timber trusses must be replaced.

Reasons for replacing trusses 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 large portions of truss members (defective timber);

(iv) Large portions of truss members having so many defects e.g. cracked timber, corroded connector nail plates, etc, that it will be uneconomical to repair the defects.

(b) Repair of timber trusses

Repair work shall include but not be limited to the following:

(i) Strengthening of truss members, connections, splices and anchorage at supports;
(ii) Strengthening of truss members due to unforeseen loads, notching and cutting for services by other contractors;
(iii) Repair of truss members where large knots and wanes occur;
(iv) Replacing metal plate connectors in cases of corrosion, incorrect application of connector plates, incorrect size of connector plates, unsymmetrically fitted connector plates, connector plates with teeth flattened, minimum bite of less than 65 mm of a connector plate on a truss member;
(v) Replacing of decayed timber, particularly rafter ends at roof overhangs and at roofing screws. Timber subjected to insect attack and fungal decay should be treated with an appropriate preservative. Where there is a low risk of decay or insect attack, two coats of Creosote may be applied to the timber. Refer to clauses 8.1 and 8.2 in PW 371 for the preservation of wood in high-risk regions;
(vi) Replacing and/or repair of cracked timber members. Galvanised connector plates and metal straps may be considered;
(vii) Maximum slenderness ratio must be less than 180 for compression members that carry forces resulting from dead and live loads. Compression members 36 mm thick and longer than 1,8 m must have a continuous longitudinal runner centrally placed (or T-bracing) and properly connected and braced. For members that resist loads caused by wind, the slenderness ratio must be less than 250;
(viii) Plumb of trusses should not exceed 100 mm or total span/20 whichever is the least;
(ix) Exposed portions of the trusses shall be painted to match existing appearance.

The roof trusses shall be fully braced. The Engineer shall give instructions regarding the provision of bracing members to the roof system.

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 45º 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 PW 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.

BB 03.01.04 Ceilings

New ceilings shall be installed in accordance with section 9 of PW 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 PW 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 803 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 BB 03.01.04(b) above.

Fibrous plasterboard cove cornices to ceilings shall be of 100 mm girth, provided by an approved manufacturer. Gypsum cove cornices 76 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 battens

(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 10163.

(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 manufacturer's 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.

BB 04 DETAIL OF REPAIR WORK

The detail of the work is described in the Schedule of Quantities.

BB 05 MAINTENANCE

Note: There will be no maintenance work required for carpentry and joinery for roofs and ceilings in this contract.

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.

BB 06 MEASUREMENT AND PAYMENT

BB 06.01 MEASUREMENT AND RATES

BB 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 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, pip 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, pip 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 brandering and the Contractor must take special care not to damage the existing brandering when removing damaged ceiling boards.

BB 06.02 SCHEDULED ITEMS

NEW WORK

BB.01 Structural timber:

(a) Plates (sizes indicated)..... Unit: m

(b) Beams (sizes indicated)..... Unit: m

(c) Joists (sizes indicated)..... Unit: m

(d) Rafters (sizes indicated) .....Unit: m

(e) Purlins (sizes indicated)..... Unit: m

(f) Roof trusses complete (drawing number indicated) .....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..... Unit: m^2, m, 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 brandering as specified.

BB.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:

(i) Skirtings, rails, cover strips, quadrant beads, etc (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) ..... Unit: m^2

(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 BD: Walls.

New joinery, will except where otherwise specified, be fixed or hung to existing material or surfaces.

ALTERATION WORK

BB.04 **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..... Unit: m^3, m^2, 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 BB.06.01.01."

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

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BC 01 SCOPE
BC 02 STANDARD SPECIFICATIONS
BC 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS
BC 04 DETAIL OF REPAIR WORK
BC 05 MAINTENANCE
BC 06 MEASUREMENT AND PAYMENT

BC 01 SCOPE

This specification covers the corrective maintenance repairs 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 downpipes 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:

PW 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

BC 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

BC 03.01 ADDITIONAL REQUIREMENTS FOR REPAIR OF WATERPROOFING ON CONCRETE ROOFS

BC 03.01.01 Introduction

Section 6 Parts 6.4.1, 6.4.2 and 6.4.4 of PW 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 rood 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 up stand 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/m^3 : 10 %
    (ii) Applications with a density exceeding 500 kg/m^3 : 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.

BC 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.

De

tailed 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.

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, m, 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 forming 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: m^2

(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.02.03 Prepare existing surfaces:

(a) Prepare existing concrete surface to receive new screed as specified..... Unit: m^2

(b) Prepare existing concrete or screeded surface to receive new waterproofing system ..... Unit: m^2

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: m^2

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 currents 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..... Unit : m²

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 supplying, 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

BD WALLS

CONTENTS

BD 01 SCOPE
BD 02 STANDARD SPECIFICATIONS
BD 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS
BD 04 DETAIL OF REPAIR WORK
BD 05 MAINTENANCE
BD 06 MEASUREMENT AND PAYMENT

BD 01 SCOPE

This specification covers the corrective maintenance repairs 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.

BD 02 STANDARD SPECIFICATIONS

BD 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.

PW	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

BD 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BG: Metalwork
Technical Specification BH: Fittings
Technical Specification BJ: Paintwork

BD 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

BD 03.01 ADDITIONAL REQUIREMENTS FOR REPAIR OF PLASTERED AND UNPLASTERED WALL SURFACES

BD 03.01.01 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.

BD 03.01.02 Plastering: General

All plaster shall comply with the requirements of SANS Standard Specification 523 and section 14 of PW 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 longway x 10 mm shortway x 0,5 mm thick expanded metal lath) before applying the final plaster.

BD 03.01.03 **Plastering: Walls of 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.

BD 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.

BD 03.01.05 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.

BD 03.01.06 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.

BD 03.01.07 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 soffits 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.

BD 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 BJ: Paintwork.

The type of boarding and jointing or cover strips shall be in accordance with the Schedule of Quantities.

BD 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.

BD 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 rust/iron 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.

BD03.04.01 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 +/- 5o to +30o, 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.

BD 03.05 WALL TILING

BD 03.05.01 General

Tiling shall comply with the requirements of SANS Standard Specification 22 and section 15 of PW 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.

BD 03.05.02 **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 wall 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.

BD 03.05.03 **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.

BD 03.05.04 **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 c/c to a maximum height of 1,6 m. Seal the interface gap with approved silicone.

Install for abattoirs and dairies 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 c/c to a height of 1,8 m. The interface gap must be sealed with an approved polyurethane sealant.

BD 03.05.05 **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.

BD 03.06 **WINDOWS**

BD 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.

BD 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 16 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.

BD 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.

BD 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.

BD 03.07 **GLAZING**

BD 03.07.01 **Glass**

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 0137.

BD 03.07.02 **Putty**

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.

BD 03.08 **DOORS**

BD 03.08.01 **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 PW 371.

All new external doors are to be fitted with 1½ 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.

BD 03.08.02 **Doors, sidelights and fanlights**

All wooden stock doors shall comply with the requirements of SANS Standard Specification 545 and section 8, clauses 8.33 and 8.34 of PW 371.

BD 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.
Unless otherwise specified, face veneer shall be rotary cut, and shall be of the timber specified, or 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 be 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.

BD 03.09 IRONMONGERY

BD 03.09.01 General

All ironmongery shall comply with the requirements of section 11 of PW 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 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, 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, pip 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, pip 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 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.

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 ie 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 BA: 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 IBR 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 260 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) Side 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.

(j) Replace existing galvanised gutters and down pipes with new 125 x 100 x 0,8 mm thick Chromadek gutters with 100 x 100 x 0,8 mm thick galvanized baked enamel 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 dressed 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 low density, non-cross-linked, closed cell, expanded poly-ethylene foam 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 at workshops

(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 wicket 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 rachet 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.

Specific specification : Repairs and replacements to agricultural kraals

Replace diamond mesh fence:

Existing diamond mesh shall, where indicated by the Engineer, be removed and replaced with new diamond mesh fence. The new galvanized diamond mesh shall be stretched and properly tied to the fencing wire. The diamond mesh or wire netting shall be secured by means of soft binding wire at 1,2 m centres along the top and bottom straining wires and at 3 m centres along each of the other fencing wires unless otherwise specified.

Diamond mesh

(a) Diamond mesh (chain-link) fencing shall comply with the requirements of SANS 1373. The edge-finish shall be both sides clinched or barbed.
(b) The nominal diameter of the wire shall be 2,5 mm and the mesh size shall be 40 mm x 40 mm.

(c) The wire shall be fully galvanized

Tensioning fence wires:
All fencing wire shall be carefully strained and hung without sag, and with true alignment, care being exercised not to strain the wire so tightly that it will break, or that end, corner, straining or gate posts will be pulled up. Each strand of fencing wire shall be securely fastened in the correct position to each post with soft galvanised binding wire.

Smooth wire:

(a) Smooth wire shall comply with the requirements of SANS 675 and shall be of the types specified below:

(b) Straining wire shall be 4,0 mm diameter and fully galvanized.

(c) Fencing wire shall be high tensile grade, 2,24 mm diameter wire fully galvanized.

(d) Tying wire shall be 2,5 mm diameter, mild steel, galvanized wire for tying fencing wire to standards and droppers, and 1,6 mm diameter, mild steel, galvanized wire for tying netting and mesh wire to fencing wire.

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 or natural anodised aluminium doors, windows, locks, frames, etc complete with hinges, handles, locks, barrel bolts, retaining devices, door stops, stays and any other work necessary to complete the work as specified, 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.

BD.02 **Wall panelling:**

(a) Description of material to be used:

(i) Description of item and/or position to be fixed..... Unit m, m^2, 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.

BD.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:

(i) Skirtings, 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)..... Unit: m^2

(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.

BD.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: m^2

(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

BD.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: m^3, m^2, 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 BD 06.01.01.

TECHNICAL SPECIFICATION

BE FLOORS

CONTENTS

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BE 01 SCOPE

Floors shall mean the scope of work to maintain materials and components such as removal of existing floors and installation of new floor coverings, skirtings, 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:

PW 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

BE 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

BE 03.01 ADDITIONAL REQUIREMENTS FOR REPAIR OF FLOORS

BE 03.01.01 Floor coverings

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.

BE 03.01.02 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.

BE 03.01.03 **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.

BE 03.01.04 **Cement screed**

Cement screed shall be carried out in accordance with clause 14.18 of PW 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: 10
mm 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) Compressive strength

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 skirtings, nosings, etc, shall be carried out in accordance with SANS 1043 and section 10, clause 10.3 of PW 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 PW 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 granitic or quartzite sand, half part clean sand and one part of cement, hand or mechanically trowelled 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 risers, 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 skirtings 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 skirtings and/or quarter rounds for re-use where vinyl tiles are laid against walls. Reinstate skirtings 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 skirtings 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 **Skirtings**

Loosened hardwood skirtings 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 BJ: Painting.

In selected areas skirtings 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 skirtings 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 workmen 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 the same existing pattern) with approved hot or cold bitumen at the same level as the surrounding blocks. Missing blocks must be replaced.

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, skirtings 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-fungicidal properties according to the manufacturer's 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 skirtings and quarter rounds.

BE 03.01.13 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.

BE 03.01.14 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.

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 is 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.

BE 03.01.15 Movement 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 manufacturer's 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 sub-base 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, eg 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 sub-base and/or sub-grade 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 sub-grade 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 sub-grade or sub-base 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 sub-grade, sub-base, etc, to ensure that the required compaction is being attained.

BE 03.02.02 **Laying of segmental block paving**

The existing blocks shall be preselected 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 and are of 25 mm minimum dimension shall be filled with 25 MPa concrete. Smaller areas shall be filled with 1:4 cement mortar.

BE 03.02.03 **Laying face brick pavers, precast concrete blocks and slasto**

The existing blocks shall be preselected 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.

BE 03.02.04 **Laying of cast in-situ concrete paving and drainage channels**

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.

BE 03.02.05 **Precast concrete edge beams, curbs and channels**

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 on exceeding 1 meter.

Precast concrete curbs and channels shall comply with SANS 927, generally in 1 meter 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 sub-base 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 soil applied herbicide with long residual action for the control of broad leaf weeds and grasses, containing active ingredient Bromacil, 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 re-fixed shall be deemed to include all necessary new additional materials, brackets, connector plates, bolts, pip 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 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, pip 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 ie industrial type extruded/split ceramic floor tiles needs special and urgent attendance and should be ordered timeously as to prevent any construction delays.

BE 06.02 SCHEDULED ITEMS

NEW WORK

BUILDING WORK

BE.01 Floor screeds:

(a) (Thickness indicated) .....Unit: m^2

(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 nosings, readings, skirtings, 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) Skirtings (size indicated). .....Unit: m

(ii) Etc. for other items measured by length

(c) Items measured by area:

(i) Eaves covering (type and thickness indicated).....Unit: m^2

(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:m^2

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, cleaning or sealing, etc:

(i) Description of individual items to be repaired, altered, removed, sealed, etc.....Unit: m^3, m^2, 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, clean and seal, 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 06.01.01.

SUPPLEMENTARY SERVICES SPECIFICATION

BF PEST CONTROL

CONTENTS

BF 01 SCOPE
BF 02 STANDARDS
BF 03 SAFETY REQUIREMENTS
BF 04 INITIAL PEST CONTROL PROCEDURE
BF 05 MONITORING AND REPORTING OF PEST CONTROL STATUS
BF 06 PREVENTATIVE PEST CONTROL
BF 07 TRAINING OF EMPLOYER'S PERSONNEL
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BF 10 PREPARATION OF THE AREA AFFECTED BY PEST CONTROL
BF 11 CLEARANCE AFTER PEST CONTROL
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BF13 MEASUREMENT AND PAYMENT

BF 01 SCOPE

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)

BF 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:

CODE	DESCRIPTION
SANS 10072	Code of practice for the safe use of household insecticides and agricultural remedies.
SANS 10124	Code of practice for the application of certain soil insecticides for the protection of buildings.
SANS 10133	Code of practice for the application of pesticides in food handling, food processing, and catering establishments.
SANS 10080	Code of practice for the rodent proofing of buildings.
SANS 10005	Code of practice for the preservation treatment of timber.
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.

BF 03 SAFETY REQUIREMENTS

No pesticide shall be used for any purpose other than that recommended on the manufacturer's label of the pesticide container. 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.

BF 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.

BF 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.

BF 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.

BF 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 BF 05 above). The Contractor shall obtain the permission of the Engineer before any additional preventative pest control is to commence.

BF 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 SD: 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 SD: 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.

BF 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:

BF 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.

BF 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

BF 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.

BF 10 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 PCO 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 PCO 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:

BF12 .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.

BF12 .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 BF 04.01. The work shall either be satisfactory or unsatisfactory and the Contractor shall score one (1) or zero (0) respectively per indicator.

BF12 .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 BF.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.

BF 13 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 BF 09, BF 10 & BF 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.

BF .04 **Preventative Pest Control** **Unit: Sum**

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, PBF 03, PBF 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 BF 09, BF 10 & BF 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.

BF .05 **Maintaining Quality Of Pest Control Service** **Unit: Point**

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 SABS 1200A and 1200AB 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):

_____

BH FITTINGS

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BH 01 SCOPE

Fittings shall mean the scope of work to perform corrective maintenance repairs to 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:

PW 371- Specification of Materials and Methods to be used (Fourth edition, October 1993)
SANS 929 - Plywood and compositeboard
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, eg strength of hinges, failure of door furniture, etc;
(d) Corroded steel elements.

Fixing of defects will include repairing or replacing damaged, corroded and worn-out fittings, eg 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, eg 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 worktops 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, eg 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 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 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, pip 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, pip 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:

(i) 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: m^2

(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 : m^2

(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.

ALTERATION WORK

BH.03 **Alterations and repairs to existing fittings:**

(a) Indicate if repairs, alterations, removal or sealing, etc:

(i) Description of individual items to be repaired, altered, removed, sealed, etc.....Unit: m^3, m^2, 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.

BJ PAINTWORK

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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
PW 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.

BJ 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

BJ 03.01 ADDITIONAL REQUIREMENTS FOR PAINTWORK

BJ 03.01.01 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 datasheets 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 all 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

All 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 all surfaces not to be painted against spotting 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 sand blasting, 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 discolourations 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.

BJ 03.01.03 **Paint specifications for various components**

(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 hyperchlorite 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 resinous 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 rise 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, 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 enamel. Allow overnight drying between coats.

(2) Exterior

Previously painted metalwork, in good condition:

Preparation: Wash down with sugar soap, followed by light sand- papering. 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 oleoresinous 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 enamel 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 enamel. Allow overnight drying between coats.

(3) Aggressive environments

Not applicable.

(d) Gypsum board (ceilings, etc)

(i) New work

(1) Interior (dry areas)

- Super acrylic PVA:
  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 PVA paint.

(2) Exterior (dry areas)

- Super acrylic PVA:
  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 PVA 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:

Preparation: Wash down thoroughly with sugar soap. Rinse with clean water. Fill with suitable exterior crack filler. Sand smooth.
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 (ie 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 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 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 PVA 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 water-based pure acrylic emulsion paint with non-fading pigment.

Unpainted or previously painted galvanised iron, in poor condition (ie 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 sown with sugar soap to remove all dirt, grease, 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.

(j) 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.

BJ 06 MEASUREMENT AND PAYMENT

BJ 06.01 MEASUREMENT AND RATES

BJ 06.01.01 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, pip 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, pip 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 Carborandum 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.

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: m^2, 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:

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: m^2, 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: m^2, 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^2, 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 FOR CONCRETE CONSTRUCTION

BK STRUCTURAL CONCRETE

BK 01 SCOPE
BK 02 STANDARD SPECIFICATIONS
BK 03 PROJECT SPECIFICATION
BK 04 DETAIL OF REPAIR WORK

BK 01 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 structures.

Structural concrete shall mean the scope of work to repair all structural concrete components such as walls, columns, stairs and suspended slabs and floors. Joint repairs also form part of this specification. This specification does not include work related to metalwork and paintwork that are specified elsewhere.

BK 02 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:

PW 371 - Specification of Materials and Methods to be used (Fourth Edition, October 1993)
SABS 1200 G - Concrete (structural)
SABS 1200 GA - Concrete (small works)
SABS 1200 GB - Concrete (ordinary buildings)
SABS 1200 GE - Precast 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
SABS 1077 - Sealing compound for the building and construction industry, two-component, polyurethane- base
SABS 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 PROJECT SPECIFICATION

This Project Specification takes precedence over the Standard Specification, except in the case where an aspect is not covered by the Project Specification, in which case the Standard Specification will apply.

BK 02.01 CONCRETE MATERIALS

SANS standards: All concrete materials shall comply with the relevant SANS standards.

BK 02.01.01 Concrete mix designs

All mix designs for 20MPa and higher grades of concrete shall be tabled and approved by the Engineer in writing, before these mix designs may be used. Each mix design shall clearly state the type, origin and quantity per cubic metre of concrete for each constituent material.

The mix design and constituent materials shall be such so as to produce **low shrinkage, crack-free concrete**.

BK 02.01.02 Cement types

Only cements of type CEM I and CEM IIA as per SANS 50197-1 may be used. In addition, only cements of strength class 42,5MPa and higher may be used. Cement shall not be stored for more than 4 weeks before it is used.

BK 02.01.03 Cement extenders

Cement extenders such as fly-ash and slag may not be used in conjunction with CEM IIA. Should the Contractor wish to use cement extenders with CEM I, then he shall obtain the Engineer's prior approval. The Engineer might approve cement extenders of up to 15% in the warmer months of the year, but excluding May, June, July and August.

BK 02.01.04 **Minimum cement content**

The minimum cement content of CEM I or CEM IIA cements are: 280 kg/m^3 for 25MPa, 300 kg/m^3 for exposed 25MPa, 310 kg/m^3 for 30MPa and 330 kg/m^3 for 35MPa concrete.

BK 02.01.05 **Water**

The maximum water / cement ratio is as follows: 0,67 for 25MPa, 0,60 for 30MPa and 0,53 for 35MPa concrete. Admixtures such as water-reducing agents or plasticizers may be used, but then only strictly according to the manufacturer's instructions.

BK 02.01.06 **Aggregates**

The coarse aggregate (stone) shall be 19mm natural stone unless otherwise specified. The total mass of coarse aggregate (stone) shall exceed the total mass of fine aggregate (sand) per cubic metre of concrete. Aggregates used in concrete for sewage treatment works, channels and tunnels shall be dolomitic aggregate. A non-dolomitic filler sand may be used.

BK 02.02 **REINFORCING STEEL MATERIALS**

SANS standards: All reinforcing steel shall comply with the relevant SANS standards.

BK 02.02.01 **Steel types**

Mild steel (R-steel) shall not be replaced by high tensile steel (Y-steel).

BK 02.02.02 **Steel bar dimensions**

Steel bars shall be cut and bent strictly to the dimensions and radii stipulated on the project's bending schedules.

BK 02.03 **FORMWORK CONSTRUCTION**

BK 02.03.01 **Formwork design**

a) All formwork shall be designed by a competent person or a competent company, and the requirements for continuous propping and / or multi-level propping shall be calculated to a theoretical model acceptable to the Engineer. Design loads will be supplied by the Engineer on request. The Contractor shall make provision for the continued support of slabs and beams while the formwork pans / panels are being removed. No back-propping is allowed.

b) Wall formwork ferrules: The lay-out and positioning of ferrules shall be approved by the Architect / Engineer. In the case of water-retaining structures ferrules shall be of a type which does not leave holes through the walls.

c) Formwork quality: All formwork shall be sturdy, leak-proof and lightly oiled.

d) Formwork finish: All formwork finishes shall be at least of class SMOOTH to Degree of Accuracy II, or class SPECIAL to Degree of Accuracy I when so specified on the concrete drawings. Top surfaces of wood- and steel-trowelled concrete floors are to be class SPECIAL.

e) Upward cambers: All beams, bands and slabs shall have the following upward cambers, unless otherwise indicated on the concrete drawings: Cantilever spans: span ÷ 200 and other spans: span ÷ 500.

f) Construction joints: Positions of construction joints in beams and slabs shall be discussed with, and approved by the Engineer, and shall be formed using planks or well-supported chicken wire.

g) Cast-in items: The Contractor shall ensure that all cast-in items, eg conduits, sleeves, pockets, etc, of all the various building disciplines are accurately placed and secured before concrete is cast.

BK 02.03.02 **Removal of formwork**

Formwork and props may only be removed after "n" 24h days:

Walls and columns:	2 (hot / normal)	3 (cold) Slabs
with props left underneath:	4	7
Beams with props left underneath:	7	12
Slab props:	10	17
Beam props:	14	21

BK 02.04 **REINFORCING STEEL FIXING**

a) Steel shall be fixed using the specific project's fixing plans and bending schedules.

b) Steel must be inspected and approved in writing by the Engineer before concrete may be cast. The Contractor shall give the Engineer at least 2 day's notice of inspections.

c) Steel must be properly fixed in position, and purpose-made plastic or concrete spacer blocks must be in position before inspections.

d) The concrete cover to reinforcing bars shall be as specified on the plans and schedules, but under no circumstances shall the cover be less than: 20mm for plastered and internal slabs and beams; 30mm for exposed concrete surfaces and concrete columns; 40mm in the case of water-retaining structures; 75mm for concrete cast against soil.

e) No welding of reinforcing steel bars is allowed.

BK 02.04 CONCRETE CONSTRUCTION

a) Concrete shall be discharged in the position needed and not moved sideways with vibrators.

b) Concrete shall be properly vibrated using an adequate number of mechanical vibrators.

c) Concrete may only be cast when the ambient temperature is between 5ºC and above 32ºC. No concrete may be cast during rain and hail, or shortly before a rain storm.

d) All concrete elements shall be cured with either, tight wrapping with plastic, or a 50mm layer of wet sand, whichever appropriate, for the following durations: 5 days when hot / normal and 7 days when cold.

e) Other curing methods must be approved.

BK 02.05 CONSTRUCTION TOLERANCES

a) All concrete shall at least be constructed to Degree of Accuracy II (SMOOTH finish), and Degree of Accuracy I (SPECIAL finish) when so specified on the concrete drawings, as well as in the case of precast concrete elements.

b) Each permissible deviation is binding in itself, no cumulative effect will be allowed.

c) Permissible deviation (PD) of dimensions. Some selected values are:

PD:	DoA II:	DoA I:
Cross-section dimensions	-5 / +15 mm	-5 / +5 mm
Flatness of a plane surface	5 mm	3 mm
Abrupt change in continuous surface	5 mm	2 mm
Linear dimension (not cross-sections)	-20 / +20 mm	-
10 / +10 mm Verticality (per metre height)	5 mm	2
mm		
Wood- / steel-trowelled top surfaces	-3 / + 3 mm	-3 / +3 mm

BK 02.06 CONCRETE TESTING

a) A set of concrete test cubes shall be made for every 50m3 of concrete produced, and at least one set of each day's concrete produced. Cubes shall be made strictly according to the SABS prescribed method, and shall be cured and tested by an independent laboratory.

b) A set of test cubes comprises 6 cubes, 3 to be tested on 7 days, and 3 on 28 days.

c) When ready-mixed concrete is used, the Contractor must still make cubes on site. Process cube results from a ready-mix plant are not acceptable.

d) A set of 3 cubes tested at 28 days passes when the average strength is at least 2MPa higher than the specified strength, and when no single cube tests lower than 3MPa below the specified strength.

BK 02.07 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 cements of type CEM I and CEM IIA as per SANS 50197-1 may be used. In addition, only cements of strength class 42,5MPa and higher may be used. Cement shall not be stored for more than 4 weeks before it is used.
Coarse aggregate maximum size: 10 mm
28-day cube strength: 30 MPa OR 35 MPa. (as specified)

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. Refer to BK 02.06 for the testing requirements of concrete.

(b) Preparation

All laitance on the surface of the slabs must be removed, using mechanical equipment such as scabblers, so as to expose the coarse aggregate of the concrete.

Before commencement of the screed, remove all loose material and dust, and keep the slabs thoroughly wet for eight hours, before placement of the screed.

(c) Placement of the screed

Remove all surface water from the slab. Apply a grout to the slab surface, which consists of a 1:1 mix of cement and clean fine sand, with just enough water to provide the consistency of a slurry. Vigorously brush the grout into the scabbled surface of the slabs using brooms. Strike off all surplus grout, leaving a thin layer of grout.

Place the screed concrete in one layer, in a checker board pattern, while the grout layer is still visibly wet. Compact the concrete very well using small mechanical vibrators.

(d) Finishing

The surface finish shall be SPECIAL as per SABS 1200G attained by steel trowelling.

Power floating should not commence until such time as the concrete surface, has lost its sheen and barely shows footprints.

All laitance on the surface of the fresh concrete screed resulting from the compaction of concrete, must be struck off prior to mechanical trowelling. Over-trowelling, causing excessive cement-water paste to come to the surface, must be strictly avoided.

(e) Joints

The screed shall have construction joints and expansion joints, in all the exact same positions as the underlying concrete slab.

In addition the screed shall be divided into panels of no larger than 3 x 3m. The length to width ratio of these panels shall not exceed 1.5.

All joints shall be formed with side formwork. An expansion joint former specifically developed for the intended applications must be used as specified by the Engineer.

Joints must be sealed with an approved 1-part polyurethane joint sealer for the intended purpose according to the Engineer's specification.

(f) Curing

Curing of the screed concrete shall commence directly after the finishing operation stops, and shall continue for 7 days. The method of curing shall be by means of well held down plastic sheeting and with the daily adding of water.

BK 03 MOVEMENT JOINTS

BK 03.01 Joint Former

Ensure all concrete surfaces are free from base grit and dust. Apply glue in vertical strips ± 100 mm wide and 25 mm from the top to avoid the tear-off strip from sticking to the concrete face.

Allow the glue to dry (according to manufacturer's instructions) and then stick the joint former onto the glued concrete face.

Cast the next section of concrete as required. Take care not to let the wet concrete get behind joint former as this will result in a wavy joint.

When the joint sealant is about to be applied, simply peel the tear-off strip out of the formed joint, leaving an even groove of uniform depth for filling with sealant.

BK 03.02 **Joint Sealant**

Joints < 10 mm are normally designed for crack control and therefore they are not movement / expansion joints. The joint width to depth ratio is important at the time of the application of the sealant (guide value of +10°C).

BK 03.03 **Application Method /Tools**

After suitable joint and substrate preparation, insert Backing Rod to required depth and apply primer if necessary. Insert cartridge into sealant gun and firmly extrude joint sealant into joint, making sure that it is full contact with the side of the joint. Fill the joint, avoiding air entrapment. The joint sealant must be tooled firmly against joint sides to ensure good adhesion.

Masking tape must be used where sharp exact joint lines or exceptionally neat lines are required. Remove the tape whilst the sealant is still soft. Sleek joint with smoothing liquid for a perfect sealant surface.

BK 03.04 **REQUIREMENTS FOR REPAIR OF STRUCTURAL CONCRETE**

BK 03.04.01 **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 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 03.04.02 **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 pre-mixed ready to use single-component polymer modified, 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 03.04.03 **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 pre-mixed ready to use single-component polymer modified, 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 03.04.04 **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.
- Apply an approved shrinkage compensated pre-mixed ready to use single-component polymer modified, cementitious repair mortar in strict accordance with the manufacturer's specifications.

BK 03.05 **EXPANSION JOINT REMEDIAL PROCEDURE**

The following procedure to be used for remedial work to expansion joints.

- Remove all damaged sealant from expansion joint.
- Joint former/filler 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 joint filler where existing joint former/filler 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 manufacturers specifications.
- All materials to be submitted to the Engineer/Department's representative for approval prior to installation.

BK 03.06. **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 03.06.01 **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/grind 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. Blow out 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 03.06.01 **Concrete crack repair procedure**
(Generally used for small cracks and where cracking could cause leaking thought the concrete)

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/grind a vee cut into the crack.
- All debris to be removed.
- Inject in an approved polyurethane 1-part joint sealant to suit crack size/width. The width of the crack must be 1.25 times the depth of the crack or in accordance with the manufacturer's specification.
- The above repair system to be done strictly in accordance with the manufacturer's specifications and requirements, and must be carried out by approved specialists or suitably trained persons.

BK 04 **DETAIL OF REPAIR WORK**

The Schedule of Quantities shows approximate quantities of work. Detailed instructions will be issued during construction.

TECHNICAL SPECIFICATION

CA ROADS

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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 and road signs.

This specification shall form an integral part of the repair and maintenance 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.

CA 02 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:

PW 371 - Specification of Materials and Methods to be used, fourth edition, October 1993
SANS 1200 D - Earthworks
SANS 1200 DM - 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

CA 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

CA 02.03 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.

CA 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 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.

CA 04 EXECUTION OF REPAIR WORK

CA 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 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) Construction of thin bituminous surfacings
(f) Repair of segmented paving
(g) Repair of kerbing
(h) Erection and repair of road traffic signs
(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 rip, redistribute 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 (Io)[a]	≤ 5 per cent
Shrinkage product (Sp)[b]	100 - 365 (maximum of 240 preferable)
Grading coefficient (Gc)[c]	16 – 34
CBR: ≥ 35 ≥ at 95 per cent modified AASHTO compaction and OMC[d]	

a) Io = Oversize index (per cent retained on 37,5 mm sieve)
b) Sp = Linear shrinkage x per cent passing 0,425 mm sieve
c) Gc = (Per cent passing 26,5 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 of 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.

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.

(ii) 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)(i) 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 planted 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 enable 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.

Primers, 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 ofwork

(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 sideslopes 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 densityare as follows:

Subbase	(150 - 300 mm below final base course level)	95%
Selected	(300 - 600 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 instructedby 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 cement-stabilized material excavated from the existing pavement as backfilling, either for subbase layers only or for both subbase and base course layers.

Material shall be broken down and 60 kg/m^3 of Portland composite cement (Cem II: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 II:32,5) shall be added at a rate of 25 kg/m^3 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/m^3 of crushed stone. All mixing shall result in a homogeneous 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 0,6 litres/m^2 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/m^2 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/m^2 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: 1part

(ii) 6,7 mm nominal sized aggregate: 1part

(iii) Crusher sand (fine grade): 1 part

(iv) 60% stable mix-grade emulsion (prepared from 80/100 penetration grade: between 75 and 90 litre/m^3 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/m^2, 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 pre- fabricated 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/m^2, 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 ± 10mm.

(f) Testing

Modified AASHTO densities shall be determined using TMH1 Method A16T (Preparation of 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 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 to produce a patch that will not deteriorate within the contract period.

CA 04.04.04 Plant andequipment

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 m^3/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:

Sieve size	Percentage passing (mass)
37,50	100
26,50	100
19,00	85 - 95
13,20	71 - 84
4,750	42 - 60
2,000	27 - 45
0,425	13 - 27
0,075	5 - 12

(b) Stabilising agent

The stabilising agent shall be Portland composite cement (Cem II:32,5) or Portland blast furnace cement (PBFC complying with SANS 626) 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

PROPERTY	RANGE
Marshall stability (kN) Marshall flow (mm) Stability/Flow (kN/mm) Static creep modulus (MPa)	8 - 16 2 - 4 3 minimum 60 minimum
Indirect tensile strength @ 25 ^{o}C (kPa)	1 000 minimum
Dynamic creep modulus (MPa)	16 minimum
% Air voids	3 - 6
Immersion index%	75 minimum

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 04.04.05/2.

TABLE CA 04.04.05/2: GRADING LIMITS AND MIX PROPORTIONS FOR CONTINUOUSLY GRADED ASPHALT BASE AND SURFACINGS

PERCENTAGE PASSING THROUGH SIEVE BY MASS					
SIEVE SIZE (mm)	**ASPHALT BASE**		**ASPHALT SURFACING**		
	37,5 mm maximum	**26,5 mm maximum**	**COARSE**	**MEDIUM**	**FINE**
53,000	-	-	-	-	-
37,500	100	-	-	-	-
26,500	84 - 94	100	100	-	-
19,000	71 - 84	85 - 95	85 - 100	-	-
13,200		71 - 86	71 - 84	100	
9,500	50 - 67	62 - 78	62 - 76	82 - 100	100
6,700			-	-	-
4,750	36 - 53	42 - 60	42 - 60	54 - 75	64 - 88
2,360	25 - 42	30 - 48	30 - 48	-	-
1,180	17 - 34	22 - 38	22 - 38	27 - 42	35 - 54
0,600		16 - 28	16 - 28	18 - 32	24 - 40
0,300	10 - 22	12 - 20	12 - 20	11 - 23	16 - 28
0,150		8 - 15	8 - 15	7 - 16	10 - 20
0,075	5 - 12	5 - 10	4 - 10	4 - 10	4 - 12
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 areless than those specified, irrespective of whether such decrease results from an authorised decrease in the rates of applications or mix proportions, or from unauthorised reductions on the part of the Contractor.

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 byhim.

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 mixproportions.

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 m^2. 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 CA.04.01 and CA.04.04 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 CA.04.02 and CA.04.03.

CA 04.05.02 Execution ofwork

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 litre/m^2. 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 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 nominalsized aggregate:	1 part
(ii)	6,7 mm nominalsized aggregate:	1 part
(iii)	Crusher sand (fine grade):	1 part
(iv)	60% stable mix-grade emulsion 90 (prepared from 80/100 penetration grade bitumen):	Between 75 and litre/m^3 aggregate mix

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/m^2, 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 adjacentseal.

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.

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 0,6 litre/m².

(b) Surfacingmaterial

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 THIN BITUMINOUS SURFACINGS - SINGLE SEAL

CA 04.06.01 General

This section covers the construction of a bituminous seal consisting of the application of a bituminous tack coat and the spreading and rolling of aggregate as specified, including the required preparation of the existing road surface.

The information contained in this section deals with matters relating to COLTO Section 4300 : Seals : Materials and general requirements, and Section 4400 : Single seals. This section also contains information relevant to where reference is made in the relevant sections of the COLTO specifications to the project specifications, i.e. where a choice of materials or application rates are allowed. Also included in this section are additional requirements applicable to this contract.

The nominal rates of application are for tendering purposes only and will not necessarily be used in construction. The actual rates of application to be used on the site shall in all cases be as instructed by the engineer.

CA 04.06.02 Materials (COLTO B4302)

(a) Bituminous binders

The binder used in the construction of the single seal under this contract shall be a conventional 80/100 penetration grade bitumen complying with SANS 307.

The binder used in the application of a diluted bitumen emulsion shall be an anionic spray grade bitumen emulsion containing 30% by mass of bitumen.

The binder used in the texture correction slurry shall be an anionic stable grade bitumen emulsion containing 60% by mass of bitumen.

(b) Aggregates for seals

The aggregate used for construction of the single stone seal shall be a 9,5 mm nominal size (Grade 1).

CA 04.06.03 Rates of application (COLTO 4308)

(a) Tack coat

The nominal rate of application of the conventional bitumen as tack coat for the singel seal shall be taken as 1,0 ℓ/m^2 for tendering purposes.

(b) Stone chips

The nominal rate of application of the 9,5 mm stone chips shall be 140 m^2/m^3 for tendering purposes.

(c) Texturecorrection slurry

The application of the texture correction slurry shall be taken as 500 m^2/m^3 for tendering purposes.

(d) Diluted bitumen emulsion

The nominal rate of application of the diluted bitumen emulsion shall be taken as 0,6 ℓ/m^2 for tendering purposes.

CA 04.06.04 Precoating of aggregate (COLTO 4403)

All chippings used in the construction of single seals shall be precoated with an approved bitumen-based precoating fluid. The precoating shall be executed as described in clause 4302(d) of the standard specifications and at the rates asspecified by the supplier. Precoating of aggregate shall be undertaken adequate time ahead of sealing operations to allow the aggregates to dry out properly before application. No free precoating fluid shall be observed when the aggregate is inspected by hand.

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.

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, as

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.

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 1:12 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 CA.07.05.

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.

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.

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 B 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 Protection 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 ROAD MARKINGS

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

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 ºC, 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 04.10.05 **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 ºC, 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 ºC and the surface dry.

CA 04.10.06 **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 fogspray shall only be done once it is possible to determine the beginning and positions of individual broken line segments. Premarking 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 04.10.10.

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 premarkings shall be approved by the Engineer prior to commencement of any painting operations.

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 is commenced.

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 litre/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:

(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 04.10.13 **Protection**

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 protective 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.

(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 Engineer's 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 manufacturer's 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.

CA 05 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.

LEBOMBO Port of Entry

The scope of the maintenance work for the road infrastructure includes the following:

(i) Vegetation control to approximately 12 000 m² of tar to Port of Entry entrance road and truck parking area.

(ii) Maintenance of approximately 4 000 m^2 of concrete block paving to residential areas, including vegetation control.

(iii) Maintenance of approximately 30 000 m^2 of concrete block paving for vehicular traffic to operational areas, including vegetation control.

(iv) Maintenance of approximately 5 000 m² of concrete block paving for pedestrian traffic to operational areas including vegetation control.

Waver

CA 05.01 ROAD INFRASTRUCTURE

Routine maintenance on the road infrastructure shall be carried out as described in table CA 05.01/1.

TABLE CA 05.01/1

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY

1	Visually inspect and report on the complete installation	Monthly
1	Broom, clean and inspect for pavement failures	Monthly
2	Check, inspect, repair all surface and kerb failures	Two monthly
3	Check, inspect, repair all pavement failures	Six-monthly
4	Blade all gravel roads and parking areas	Six-monthly
5	Inspect and repair gravel shoulders	Six monthly
6	Check, inspect, repair, replace road signs	Six monthly
7	Check, inspect, repair, repaint, replace road markings	Annually
8	Remove loose material from the surface of parking areas by means of mechanical brooming	Six monthly
9	Remove loose material from the road surfaces of by means of mechanical brooming	Six monthly

CA 06 **MEASUREMENT AND PAYMENT**

CA.01 **REPAIR OF GRAVEL WEARING COURSE AND GRAVEL SHOULDERS**

CA.01.01 **Reshaping the wearing course by:**

(a) Grading only ..... Unit: square metre (m^2)
(b) Ripping, redistributing and compacting ..... Unit: square metre (m^2)
(c) Importing, placing and compacting material from commercial sources ..... Unit: cubic metre (m^3)

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.

CA.01.02 **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 (m^3)

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.

CA.01.03 **Overhaul on surplus material** ..... Unit: cubic metre kilometer (m^3.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.

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, removing old sealant, backing material and any foreign material, refacing or enlarging the faces by sawing, routing of cracks to the specified dimensions, disposing of all debris, all cleaning work involved, 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.02.02 **Patching of concrete:**

(a) (Thickness stated) ..... Unit: square metre (m^2)
(b) Etc. for other thicknesses ..... Unit: square metre (m^2)

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 old concrete, compacting the exposed pavement layer, supplying, placing and 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.03 **PAVEMENT LAYERS AND ASPHALT SURFACE REPAIR**

CA.03.01 **Excavation in existing pavements for patching** ..... Unit: cubic metre (m^3)

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.

CA.03.02 **Backfilling of excavations for patching with:**

(a) Cement-stabilized gravel excavated from the existing pavement:

(i) Areas up to and including 10 m^2 ..... Unit: cubic metre (m^3)

(ii) Areas larger than 10 m^2 up to and including 50 m^2..... Unit: cubic metre (m^3)

(iii) Areas larger than 50 m^2 ..... Unit: cubic metre (m^3)

The unit of measurement shall be the cubic metre of chemically stabilized gravel placed in accordance with the specified requirements. The quantity will be computed in accordance with the authorised dimensions of the layer. No payment shall be made for wastedmaterial.

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 cement.

(b) Asphalt surfacing (continuously graded medium) ..... Unit: ton (t)

The unit of measurement shall be the ton of asphalt placed in accordance with the specified requirements. The quantity shall be computed in accordance with the certified weighbridge tickets issued in the case of asphalt. No payment shall be made for wasted material.

The tendered rates shall include full compensation for providing all the material, placing, compacting and finishing as specified, for work in restricted areas, and also for all machinery, equipment, labour, priming (if specified), tack coat, supervision and other incidentals for executing the work as specified. Unless specified, transportation cost will be included in the rate.

CA.03.03 **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.

CA.04 **SURFACE TREATMENT OF SURFACED ROADS**

CA.04.01 **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.

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 (m^2)

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.

CA.04.06 **Cleaning of cracks with compressed air**.....Unit: kilometre (km)

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.

CA.04.07 **Applying bituminous binders and herbicides for sealing cracks**

(a) Herbicide..... Unit: litre (ℓ)

(b) MSP/1 or similar prime..... Unit: litre (ℓ)

(c) Anionic stable-grade emulsion mixed with synthetic modifiers. ..... Unit: litre (ℓ) (d) Hot bitumen rubber..... Unit: litre (ℓ) (e) Other specified agents (type indicated) ..... Unit: litre (ℓ)
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.

CA.05 REPAIR OF SEGMENTED PAVING

CA.05.01 Remove concrete paving blocks:

(a) Discard paving blocks ..... Unit: square metre (m^2)

(b) Stockpile and re-use paving blocks ..... Unit: square metre (m^2)

The unit of measurement shall be the square metre of paving blocks removed from the existing pavement, including the bedding sand. The quantity shall be computed in accordance with the authorised dimensions of the affected area.

The tendered rate shall include full compensation for demarcating the affected area and excavating and disposing and/or stockpiling of the material, including haul over a free- haul distance of 1,0 km.

CA.05.02 Excavation for the repair of segmented paving:

(a) Discard paving blocks ..... Unit: cubic metre (m^3)

(b) Stockpile and re-use paving blocks ..... Unit: cubic metre (m^3)

The unit of measurement shall be the cubic metre of material excavated from the existing pavement irrespective of the type of material and excluding 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.

CA.05.03 Backfilling and reinstatement of pavement layers:

(a) Selected layers compacted to 93% of modified AASHTO density — Unit: cubic metre (m^3)

(b) Cement stabilized subbase layers compacted to 95% of modified AASHTO density — Unit: cubic metre (m^3)

(c) Cement stabilized base layers compacted to 97% of modified AASHTO density — Unit: cubic metre (m^3)

The unit of measurement for CA.05.02(a) shall be the cubic metre of gravel material placed and compacted according to authorised dimensions on drawings or as specified by the Engineer.

The unit of measurement for CA.05.02 (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, placing, 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.

CA.05.04 Cast *in situ* concrete and formwork in edge beams, intermediate beams and kerbing:

(a) Class 20 concrete ..... Unit: cubic metre (m^3)

(b) Class 30 concrete ..... Unit: cubic metre (m^3)

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 all 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.

CA.05.05 **Breaking up and removing concrete edge beams, intermediate beams, etc.** .....Unit: cubic metre (m^3)

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.

CA.05.06 **Steel reinforcement in edge beams, intermediate beams and kerbing:**

(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.

CA.05.07 **Concrete block paving:**

(a) class, type and thickness similar to existing pavement for areas carrying vehicular traffic.....Unit: square metre (m^2)

(b) class, type and thickness similar to existing pavement for areas carrying pedestrian traffic .....Unit: square metre (m^2)

(c) re-use stockpiled paving blocks (80 mm interlocking on 20 mm bedding sand).....Unit: square metre (m^2)

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.

The tendered rate shall include full compensation for supplying, transporting, delivering and placing of all materials, including spreading and levelling of bedding sand, spreading of jointing sand and 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.05.08 **Replacement of jointing sand**..... Unit: square metre (m^2)

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 CA.05.05.

CA.07 **ERECTION 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 m^2 ..... Unit: square metre (m^2)

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 overbridged 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, clearing, 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 (m^3)

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 m^2, 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 (m^3)

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 (m^3)

The unit of measurement shall be the cubic metre.

The tendered rate shall include full compensation for the additional cost of excavating in rock.

CA.07.06 **Gravel drainage layer below road sign footings** ..... Unit: cubic metre (m^3)

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 (m^2)

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.07.10 **Supply and install Sign boards** ..... Unit: metre (m)

The unit of measurement is the number of each sign erected or installed complete in accordance with the details on the drawings.

The tendered rates shall include full compensation for erecting the signs, 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.

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 (m^2)

(ii) Lettering and symbols, white or yellow, repainting existing markings ..... Unit: square metre (m^2)

(iii) Traffic island markings, white or yellow repainting existing markings..... Unit: square metre (m^2)

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 premarking the lines.

CA.08.02 **Setting out and premarking of lines (excluding traffic island markings, lettering and symbols)**.....Unit: kilometre (km)

The unit of measurement for setting out and premarking lines shall be a kilometre of line set out and premarked. If two or more parallel lines lie in a strip with a maximum width of 1,0 m the setting out and premarking 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 premarking 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 (m^2)

(b) Removal of markings by other mechanical methods (The tenderer shall state the method he intends to use) .....Unit: square metre (m^2)

(c) Removal of markings by chemical methods (The tenderer shall state the method he intends to use) ..... Unit: square metre (m^2)

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 (m^2)

CA.09.02 **Eradication of undesirable vegetation (The tenderer shall state the method he intends to use):** .....Unit: square metre (m^2)

The unit of measurement for item CA.09.01 and CA.09.02 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.

CA.10 **Remounting of D-Shape rubber loading dock bumper:**

…..... Unit: number

The unit of measurement for item CA.10 above shall be the number of loading dock bumpers as described in these specifications.

The tendered rate shall include full compensation for the preparation of surfaces, the supply of fixing material, plant, equipment and labour for the use of fixing material 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.

CA.11 **Supply and install Armco Quadguard crash cushion cartridge:**

…..... Unit: number

The unit of measurement for item CA.11 above shall be the number of cartridges as described in these specifications.

The tendered rate shall include full compensation for the preparation of surfaces, the supply of fixing material, plant, equipment and labour for the use of fixing material 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.

TECHNICAL SPECIFICATION

CB STORMWATER DRAINAGE

CONTENTS

CB 01 SCOPE
CB 02 STANDARD SPECIFICATIONS
CB 03 OPERATING AND MAINTENANCE MANUALS
CB 04 EXECUTION OF REPAIR WORK
CB 05 MAINTENANCE
CB 06 MEASUREMENT AND PAYMENT

CB 01 SCOPE

This specification covers the materials, equipment, methods, testing and work required for the corrective maintenance and servicing of existing stormwater drainage systems. It covers both surface and underground drainage systems.

CB 02 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:

PW 371 - Specification of Materials and Methods to be used
SANS 1200 DB - Earthworks (pipe trenches)
SANS 1200 DK - Gabions and
pitching SANS 1200 G - Concrete
(structural) SANS 1200 LB - Bedding
(pipes) SANS 1200 LE - Stormwater
drainage
SANS 1200 MK - Kerbing and channelling

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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

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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.

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 SAMaintenance) toschedule 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 the 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 storm water grid inlets;

(h) Cleaning of pipelines.

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, 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 m³ shall be classified as hard material.

Where more than 40 % of any material (by volume) consists of boulders each exceeding 0,10 m³ 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.

(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.

(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.

(j) Backfilling of prefabricated culverts

The backfill material shall be material selected from the excavation mixed with 80 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 150 mm 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 50. 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 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 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.

(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.

(l) 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 04.02.02 Quality standard

Culverts shall be constructed true to lines and levels with the inside smooth and without any displaced joints.

CB 04.02.03 Materials

The prefabricated culvert units shall be factory produced by a reputable manufacturer of these units and shall comply with the following requirements:

(a) Prefabricated concrete pipe culvert units

Prefabricated concrete pipe culvert units shall comply with the requirements of SANS 677. Pipes with ogee joints shall be provided, unless otherwise specified. Pipes subjected to traffic loadings shall be class 100 D; all other pipes shall be class 50 D.

(b) Portal prefabricated concrete culvert units

Portal prefabricated concrete culvert units shall comply with the requirements of SANS 986.

(c) Other types of prefabricated culverts

If required, other types of prefabricated culverts will be specified in the Particular Specification.

(d) Manhole covers, grid inlets, etc

Manholes, grid inlets, etc, shall have covers and frames complying with SANS 558.

CB 04.03 CLEANING OF PREFABRICATED CULVERTS

The work involved under this section is the removal of silt and debris from prefabricated culverts including the cleaning of inlet and outlet structures.

CB 04.03.01 Construction

Prior to cleaning any prefabricated culverts, 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, etc, to enable a basic visual inspection of all the culverts. Based on this inspection, the Engineer will instruct the Contractor as to which sections of the network require cleaning.

Material removed from the culverts shall be disposedof whereinstructedby the Engineer. Rubble and waste material shall be disposed of at the nearest appropriate solid waste disposal site, unless otherwise directed by the Engineer.

The Contractor must ensure that all material being removed is removed before or at the nearest accessible downstream structure. No additional payment will be made for the removal of material which, as a result of cleaning operations, find its way into a previously clean section of the culvert network.

CB 04.03.02 Quality standard

Prefabricated culverts shall be cleaned of all silt and debris such that all surfaces are clearly visible and accessible for inspection.

All spoil material shall be spread neatly and shall not wash back into drainage trenches.

The size of the culverts for the different categories will be determined as follows:

(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 materialshall 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) Kerbing and channelling

Kerbing shall include barrier kerbs, mountable and semi-mountable types. All the elements shall be prefabricated units with cast in situ channelling unless otherwise specified by the Engineer.

Kerbing and channelling 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 80 % of kerb height).

(e) Concrete cast against existing surfaced edges

Where concrete lining or concrete channelling 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.

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 all 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.

(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 approvedcohesive soil.

CB 04.06.02 Quality standard

Drainage channels shall be clear of any obstructions and no scouring, erosion or pooling shall be evident.

Existing fill and cut slopes and invert grades of drains shall be maintained.

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 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.

CB 05 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.

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The scope of the maintenance work for the stormwater drainage infrastructure comprises the following:

(i) Maintenance of approximately 400 m of concrete-lined channels of varying sizes.

(ii) Maintenance of approximately 1 000 m of pre-cast pipes, culverts and associated stormwater structures.

(iii) Maintenance of all lined channels and earth side drains of varying sizes.

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 the complete and safe functioning of the stormwater drainage infrastructure.

Maintenance on the stormwater drainage infrastructure shall also includeall otheractions related to maintenance, such as temporary drainage features and temporary accommodation of traffic.

Remuneration for maintenance of the stormwater drainage 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.

CB 05.01 STORMWATER DRAINAGE SYSTEM

Routine maintenance on the stormwater drainage system shall be done as described in table CB 05.01/1.

TABLE CB 05.01/1

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete installation.	Monthly
2	Check, inspect, repair or replace all manhole or inlet covers, grids and frames and builder's work to manholes.	Four-monthly
3	Check, inspect and repair manhole and inlet benching.	Four-monthly
4	Check, inspect, report and unblock any blockage that occurs.	Monthly

CB 06 MEASUREMENT AND PAYMENT

CB.01 PREFABRICATED CULVERT INSTALLATION AND REPAIR OF EXISTING CULVERTS AND STRUCTURES

CB.01.01 Excavation:

(a) Excavation of soft material within the following depth ranges below the

surface level:

(i) 0 m up to and including 1,5 m.....Unit: cubic metre (m^3)

(ii) Exceeding 1,5 m up to and including 3,0 m..... Unit: cubic metre (m^3)

(iii) Exceeding 3,0 m up to and including 4,5 m..... Unit: cubic metre (m^3)

(iv) Etc in increments of 1,5 m

(b) Excavating hard material irrespective of depth.....Unit: cubic metre(m^3)

The unit of measurement shall be the cubic metre of material excavated within the specified dimensions, authorised by the Engineer in each case. Excavation in

excess of widths specified or authorised shall not be measured for payment.

Irrespective of the total depth of the excavation, the quantity of material in each depth range shall be measured separately.

When measuring excavation for the removal of existing culverts, the volume occupied by the culvert shall not be subtracted from the calculated volume of excavation.

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 (m^3)

(b) Selected layers compacted to 93 % of modified AASHTO density.....Unit: cubic metre (m^3)

(c) Cement stabilized subbase layers compacted to 95 % of modified AASHTO density .....Unit: cubic metre (m^3)

(d) Cement stabilized base layers compacted to 97 % of modified AASHTO density Unit: cubic metre (m^3)

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 (m^3)

(b) Class 25 concrete.....Unit: cubic metre (m^3)

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 authorized.

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.

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 (m^3)

(ii) 501 mm to 750 mm ..... Unit: metre (m^3)

(iii) 751 mm to 950 mm ..... Unit: metre (m^3)

(iv) 951 mm to 1250 mm ..... Unit: metre (m^3)

(v) 1251 mm to 1500 mm ..... Unit: metre (m^3)

(vi) 1501 mm to 2100 mm ..... Unit: metre (m^3)

(b) Prefabricated corrugated metal culverts with maximum cross sectional dimension of:

(i) Up to and including 500 mm. ..... Unit: metre (m^3)

(ii) 501 mm to 750 mm ..... Unit: metre (m^3)

(iii) 751 mm to 950 mm ..... Unit: metre (m^3)

(iv) 951 mm to 1250 mm ..... Unit: metre (m^3)

(v) 1251 mm to 1500 mm ..... Unit: metre (m^3)

(vi) 1501 mm to 2100 mm ..... Unit: metre (m^3)

The unit of measurement shall be the cubic metre of material removed (depth of material removed is on average 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 (m^3)

(b) Hard material ..... Unit: cubic metre (m^3)

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 (m^3)

(b) Class 30 concrete.....Unit: cubic metre (m^3)

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 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** ..... Unit: cubic metre (m^3)

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.

CB.03.07 **Demolition and removal of damaged existing structures:**

(a) Plain concrete .....Unit: cubic metre (m^3)

(b) Reinforced concrete .....Unit: cubic metre (m^3) 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.

CB.03.08 **Concrete side beams** ..... Unit: cubic metre (m^3)

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.

CB.03.09 **Overhaul on material for haul in excess of 1,0 km:**

(a) Excavated material to spoil..... Unit: cubic metre kilometer (m^3-km)

(b) Existing structures demolished ..... Unit: cubic metre kilometer (m^3-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.

CB.04 **CLEANING OF CONCRETE DRAINS AND CHANNELS**

CB.04.01 **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.

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 (m^3-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 (m^3)

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 (m^3)

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 (m^3)

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 (m^2)

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 to 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 (m^3-km)

The unit of measurement shall be the cubic metre of imported material, nett volume of material compacted in place, multiplied by the average overhaul distance in excess of 1,0 km.

The tendered rate shall include full compensation for hauling the material the distance from the designated source in excess of 1,0 km.

CB 06 **REPAIR AND CONSTRUCTION TO EXISTING BRICKWORK INLETS**

CB.06.01 **Demolition and removal of existing structures**..... Unit: cubic metre (m^3)

The unit of measurement shall be the cubic metre of existing material demolished. The tendered rates shall include full compensation for all labour, equipment and slabs for the removal of the section, trimming the bedding and for loading, transporting and disposing of the material from the site.

CB 06.02 **Repair of brickwork inlet structures** ..... Unit: number

The unit of measurement shall be the number of inlet structures repaired.

The tendered rate shall include full compensation for furnishing all material and labour necessary for restoring the inlet structure to an as new state.

CB.06.03 **Reconstruction of brickwork inlet structures** ..... Unit: number

The unit of measurement shall be the number of inlet structures completely rebuilt.

The tendered rate shall include full compensation for furnishing all material and labour necessary for rebuilding the inlet structure to a complete state.

CB.07 **LOCKABLE GRID INLETS**

CB.07.01 **Provision of lockable grid inlets**..... Unit: number

The unit of measurement shall be the number of grid inlets fitted with a steel bar suitable for locking the inlet cover down.

The tendered rate shall include full compensation for all labour, equipment and tools, rust protection and any other function necessary for the secure installation of the bar.

CB.07.02 **Provision of padlocks** ..... Unit: number

The unit of measurement shall be the number of padlocks provided for lockable grid inlets.

The tendered rate shall include purchasing and installation of all padlocks, as well as providing a full set of labeled keys to the User Client.

CB 08 **CLEANING OF PIPELINES**

The cleaning of pipelines will be measured and paid for under the payment items listed under CB.02 cleaning of prefabricated culverts. Pipelines and related structures will be regarded as pre-fabricated culverts and related structures for this purpose.

TECHNICAL SPECIFICATION

CC FENCING AND GATES

CONTENTS

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CC 01 SCOPE

This specification covers the repair and maintenance of fencing and gates.

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

Where a particular specification has been included in the documents to supplement Technical Specification CC: Fencing and gates, this technical 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 technical specification, unless otherwise specified in the applicable Particular Specification.

CC 02 STANDARD SPECIFICATIONS

CC 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:

SANS 935 - Hot-dip (galvanised) zink coatings (other than on continuously zinc coated sheet and wire) (1988)
SANS 675 - Zinc-coated fencing wires (plain and barbed) (1993)
SANS 1373 - Chain-link fencing and its wire accessories (1983)

CC 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

CC 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.

CC 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.

CC 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.

CC 04 EXECUTION OF WORK

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.

Any fencing work identified either by the Contractor or during inspection by the Engineer shall be carried out on the instruction of the Engineer.

The Contractor shall ensure that the necessary materials, skilled personnel, tools and equipment are available at all times to maintain the fences in a state of good repair.

The Engineer shall indicate where existing fences are to be moved to new locations, where new fences are to be erected, or where other repairs are necessary.

Whenever a part of the fence is taken down to repair/replace it, it will be replaced on the same day it has been taken down.

Unless otherwise instructed by the Engineer, similar type fencing material to that in the existing fence line shall be used where fences are to be repaired.

CC 04.01 SCOPE OF WORK

The scope of work has been divided into the following sections:

(a) Perimeter fences at the various sites;
(b) Residential fences of the residential areas, and
(c) Other internal fences at the various sites..

CC 04.02 CLEARING THE FENCE ROUTE

The fence route shall be cleared over a width of at least 0,5 m on each side of the centre line of the fence and surface irregularities shall be levelled so that the fence will follow the general contour of the ground.

The bottom of the fence shall be located at a uniform distance above the ground line, but no more than 50 mm.

CC 04.03 INSTALLATION OF POSTS AND STANDARDS

Posts shall be accurately set in holes and be provided with concrete bases to the dimensions specified.

Holes shall be dug to their full specified depth.

Posts shall be firmly planted into the ground at the same spacing as the existing posts or as instructed by the Engineer. The spacing of posts between any two straining posts shall be uniform.

CC 04.04 ERECTING FENCE WIRES

All fencing wire shall be wired to the sides of posts in order to prevent the wires from being displaced or becoming loose. The wire shall be carefully strained and hung without sag, and with true alignment, care being exercised not to strain the wire so tightly that it will break or that end, corner, straining or gate posts will be pulled up.

Each strand of fencing wire shall be securely fastened in the correct position to each post with soft galvanised binding wire.

Splices in the fencing wire shall be permitted if made in the following manner using a splice tool. The end of each wire at the splice shall be carried at least 75 mm past the splice tool and wrapped snugly around the other wire for not less than six complete turns, the two separate wire ends being turned in opposite directions. After the splice tool is removed, the space left by it in the splice wire shall be closed by pulling the wire ends together. The unused ends of wire shall be cut close so as to leave a neat splice.

CC 04.05 ERECTING DIAMOND MESH OR WIRE NETTING

Wire netting or diamond mesh shall be stretched against the fence and properly secured to the fencing wire. The diamond mesh or wire netting shall be secured by means of soft binding wire at 1,2 m centres along the top and bottom wires and at 3 m centres along each of the other fencing wires unless otherwise specified.

CC 04.06 CLOSING OPENINGS UNDER FENCES

At ditches, drainage channels or other hollows where it is not possible to erect the fence so that it follows the general contour of the ground, the Contractor shall cover the openings with wire netting or diamond mesh fixed to the fence.

CC 04.07 EXISTING FENCES

Where a new fence joins an existing fence, whether in line or at an angle, the new fence shall be erected with a new straining post positioned at the terminal of the existing fence.

Existing fences that require to be taken down or moved to a new location shall be dismantled. Material not required for re-erection or declared unsuitable for re-use shall be neatly stacked at approved locations in accordance with the Engineer's instructions.

CC 04.08 GATES

Gates shall be hung on gate fittings in accordance with the requirements specified. The gates shall be so erected that they swing in a horizontal plane at right angles to the gateposts, clear of the ground in all positions.

Double swing gates shall not leave a gap of more than 25 mm between them when closed and other gates shall not be further than 25 mm from the gatepost when closed. The clearance below the gates shall not exceed 75 mm with the gates closed.

CC 04.09 REPAIRS TO FENCES

In the case of fences that require repairing, the Contractor shall use new material as may be required to re-erect the fence to the standard specified.

CC 04.10 ERECTING NEW FENCING MATERIAL

All new material used to replace old material shall be similar to the old material replaced unless new material is specified by the Engineer.

CC 05 QUALITY STANDARD

The completed fences shall be plumb, taut, true to line and ground contour, with all posts, standard and stays firmly set.

The Contractor shall, on completion of each section of fence, remove all cut-offs and other loose wire or netting so as not to create a hazard to grazing animals or a nuisance to the owners of the ground.

CC 06 MATERIALS

CC 06.01 POSTS

CC 06.01.01 Steel posts

New posts or posts that need to be replaced shall be of the same type and size as the existing posts. Tubular posts shall be galvanised in accordance with SANS 763 for Class B1 articles.

Tubular stays shall have a minimal bore of at least 60 mm and a wall thickness of at least 2.95 mm. These stays shall be galvanised as specified In SANS 763.

CC 06.01.02 Wooden posts

New posts or posts that need to be replaced shall be of the same type and size as the existing posts. Wooden posts shall be treated in accordance with SANS 457 (Hazard class H4 articles), or as specified and shall have a minimum diameter of 50 mm.

CC 06.02 WIRE

CC 06.02.01 Barbed wire

Barbed wire shall comply with the requirements of SANS 675 and shall be one or more of the following types:

(a) High-tensile grade, oval shaped, single-strand wire, 3.15 mm x 2.50 mm (2.81 mm equivalent diameter), and fully galvanised;

(b) High-tensile grade, oval shaped, single-strand wire, 2.80 mm x 1.90 mm (2.31 mm equivalent diameter), fully galvanised (first class coating). This wire shall not be used less than 500 mm above ground where there is danger of grass fires;

(c) Mild-steel grade, double strand, unidirectional twist wire, each strand 2.50 mm diameter, for use at any height above ground. The wire shall be fully galvanised;

(d) Barbs shall be manufactured from 2.0 mm galvanised wire and shall be spaced at not more than 150 mm.

CC 06.02.02 Barbed tape coil

The product shall be fully galvanised and of high-tensile grade.

CC 06.02.03 Smooth wire

Smooth wire shall comply with the requirements of SANS 675 and shall be of the types specified below:

(a) Straining wire shall be 4.0 mm diameter and fully galvanised.

(b) Fencing wire shall be high-tensile grade, 2.24 mm diameter wire fully galvanised.

(c) Tying wire shall be 2.50 mm diameter, mild steel, galvanised wire for tying fencing wire to standards and droppers, and 1.60 mm diameter, mild steel, galvanised wire for tying netting and mesh wire to fencing wire.

CC 06.03 DIAMOND MESH

(a) Diamond mesh (chain-link) fencing shall comply with the requirements of SANS 1373. The edge finish shall be both sides clinched or barbed.

(b) The nominal diameter of the wire shall be 2.5 mm and the mesh size shall be 64 x 64 mm.

(c) The wire shall be fully galvanised.

CC 06.04 WELDED MESH

Wire netting shall be fully galvanised with mild steel wire with a minimum diameter of 1.8 mm and 75 mm mesh.

CC 06.05 RAZOR MESH

Razor mesh shall be welded with reinforcing shoulders and blade strips 8 mm wide galvanised steel, on 2.5 mm dia. galvanised wire.

Standard diamond aperture size shall be 150 mm x 300 mm centre to centre. High density diamond aperture size shall be 75 mm x 150 mm centre to centre. Standard panel length shall be 6 m.

CC 06.06 MANUFACTURING TOLERANCES FOR WIRE

The actual diameter of wire supplied shall nowhere be less than the specified diameter by more than the following tolerances:

Specified diameter	Tolerance
1.00 – 1.8 mm	0.05 mm
2.00 – 2.8 mm	0.08 mm
3.15 – 4.0 mm	0.10 mm

CC 06.07 GATES

New gates or gates that need to be replaced shall be the same type and size as existing gates. Gates shall be galvanised in accordance with SANS 763 for class B1 articles.

CC 07 MAINTENANCE

This specification must be read in conjunction with Additional Specification: General Maintenance.

All components of the fencing and gates infrastructure shall be maintained during the maintenance phase of the Contract.

The scope of the maintenance work for the fencing and gates infrastructure comprises the following:

LEBOMBO Port of Entry:

a) Maintenance of approximately 2 600 m of perimeter fence and gates comprising 1.8 m high diamond mesh with 45° angle barbed wire.
b) Maintenance of approximately 2 300 m of 1.2 m high diamond mesh fence and gates around the residential area.
c) Maintenance of approximately 300 m of perimeter fences and gates comprising 3.0 m high welded mesh.

The above description of the fencing and gates 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.

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.

Maintenance implies and shall include monthly routine preventative maintenance, corrective maintenance, as well as breakdown maintenance on all components of the specified installation. Maintenance shall include all repair work, replacing of components, fixing defects or any other actions or rectifying measures necessary for

complete operation of the fencing installation, keeping the installation free of litter and any growth or any other element interfering with the function or integrity of the system. Remuneration for maintenance of fencing will be deemed included in the monthly remuneration based on the point system, as tendered for maintenance of Installation: Fencing and Gates.

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. 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.

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 reports.

Monthly maintenance

(a) Clearing the 1.0 m wide fence route.

(b) Cleaning fire 5.0 m wide fire break areas.

(c) Inspect and report on the installation.

(d) Inspect and repair any visible damages to the installation.

(e) Corrosion protection on fencing, gates and tubular posts.

(f) Inspect fence for tightness to straining wire and redress or repair if necessary.

(g) Inspect tension of straining wires and repair if necessary.

(h) Inspect gate hinges and repair or replace if necessary.

Annual maintenance

(a) Paint all previously painted posts, stays, gates, and mesh fences.

(b) Tighten all straining wires.

(c) Tighten all straining bolts.

(d) Ensure alignment of all gates.

CC 08 MEASUREMENT AND PAYMENT

CC.01 CLEARING THE FENCE ROUTE:

CC.01.01 1.0 m wide strip ..... Unit: metre (m)

CC.01.01 5.0 m wide strip ..... Unit: metre (m)

The unit of measurement for the clearing of the fence route shall be the metre of fence line measured along each fence line.

The tendered rate shall include full compensation for the clearing of the fence line as specified, including the removal of trees, stones, growth in the fences itself and other obstructions in the fence route and the disposal as directed of all material resulting from clearing operations.

CC.01.02 Extra over CC.01.01 for cleaning the area between double fences and road shoulders in residential areas (up to 2.5 m wide) Unit: square metre (m^2)

The unit of measurement shall be the square metre of the area cleared between the two parallel fences of a double fence line, or between the edge of the road and the fence in residential areas. The measured area shall not include the 0,5m strips on the inside of each fence line of the double fence measured as part of CC.01.01

The tendered rate shall include full compensation for the clearing of the area as specified, including the removal of trees, stones and other obstructions and the disposal as directed of all material resulting from the clearing operations.

CC.02 SUPPLY AND ERECTION OF NEW FENCING MATERIAL TO REPLACE OLD MATERIAL:

(a) Barbed wire ..... Unit: metre (m)

(b) Smooth wire..... Unit: metre (m)

(c) Diamond mesh ..... Unit: square metre (m^2)

(d) Barbed tape coil ..... Unit: metre (m)

(e) Posts ..... Unit: number

(f) Gates ..... Unit: number

(g) Y-standards ..... Unit: number

The quantity of material used shall be determined by measuring the quantities of individual items of material installed in the completed fence. No linear measure of completed fence shall be applicable. Clearing of the fence line will be paid for under item CC.01.

The payment for the installation of the fencing material shall include for the removal of the existing fencing material including removal of concrete footings for fence posts.

The applicable units of measurement are as follows:

(a) Fencing wire

The unit of measurement shall be the metre of each type of fencing wire measured in place and between end posts. Binding wire and wire used for bracing and anchoring of posts shall not be measured for payment.

(b) Diamond mesh

The unit of measurement shall be the linear metre of diamond mesh replaced and the quantity shall be calculated using the prescribed length between straining posts or gate posts, or the length of strips for covering openings under fences, or the length used for the covering of gates.

(c) Posts

The unit of measurement shall be the number of posts, as follows:

All straining posts erected in accordance with the maximum specified spacing or such lesser spacing as authorised by the Engineer, all corner and gateposts authorised by the Engineer and all end posts. Gateposts for new gates shall not be measured for payment.

(d) Gates

The unit of measurement shall be the number of each type of gate repaired or replaced.

CC.03 **REPAIR OF FENCES**.....Unit: metre (m)

The unit of measurement shall be the metre of each type of existing fence repaired as instructed by the Engineer.

The tendered rate shall include full compensation for all overheads and transporting all labour, tools and materials from the Contractor's base to the point of repair.

The tendered rate shall also include full compensation for all labour, tools, binding and tying wire for repairing the fence.

The cost for procurement of materials needed shall be paid for under item CC.02.

CC.04 **REDRESS, TREAT AND PAINTING OF FENCE** ..... Unit: metre (m)

The unit of measurement for the redressing, treating and painting the fence line shall be the metre of fence line measured along each fence line.

The tendered rate shall include full compensation for performing minor repairs, treating the existing fence with an approved rust remover/inhibitor and then applying cold galvanising as specified by the Engineer.

CC.05 **TREATING AND PAINTING OF POSTS AND STANDARDS**.....Unit: Number

The unit of measurement shall be the number of posts and standards treated and painted along the fence line.

The tendered rate shall include full compensation for predetermining minor repairs, including sanding, treating the existing posts and standards with an approved rust remover/inhibited and then applying cold galvanising as specified by the Engineer.

CC.06 **REPAIR, RE-FIXING, PAINTING AND ALIGNING OF GATES**.....Unit: number

The unit of measurement shall be the number of each type of existing gate repaired as instructed by the Engineer.

The tendered rate shall include full compensation for all overheads and transporting all labour, tools and materials from the Contractor's base to the point of repair.

The tendered rate shall also include full compensation for all labour, tools, binding and tying wire for repairing the fence.
The tendered rate shall also include full compensation replacement of hinges, bolts, catches, wheels, reconstruction of guide rails and all other fixtures necessary to repair and refix gates into the original position including aligning the gate to ensure proper opening and closing of the gate.

TECHNICAL SPECIFICATION

CE WATER DISTRIBUTION NETWORKS

CONTENTS

CE 01 SCOPE
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CE 01 SCOPE

This specification covers the materials, equipment, methods, testing and work required for the repair and maintenance of existing water distribution networks. Such distribution networks may comprise:

(a) Primary and secondary distribution pipelines
(b) Irrigation pipe networks and sprinklers
(c) Valves
(d) Bulk water meters
(e) Domestic water meters
(f) Chambers
(g) Pumping stations
(h) Borehole installations
(i) Reservoirs.

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.

CE 02 STANDARD SPECIFICATIONS

CE 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:

SANS 1200 D - Earthworks
SANS 1200 DB - Earthworks (pipe trenches)
SANS 1200 G - Concrete (structural)
SANS 1200 L - Medium-pressure pipelines SANS 1200 LB- Bedding (pipes)

CE 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

CE 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.

CE 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.

CE 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.

CE 04 EXECUTION OF REPAIR WORK

CE 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 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 specified Particular Specification details.

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 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 if the satisfaction of the Engineer has been obtained.

Repair work items for the water distribution systems shall be categorised under the following headings:

(a) Repair of existing pipelines
(b) Cleaning of existing pipelines
(c) Repair of fittings
(d) Repair of existing structures.

CE 04.02 REPAIR OF EXISTING PIPELINES

This section covers the requirements for the repair of the water distribution pipelines for defects such as pipe breaks and leakage for distribution pipelines.

CE 04.02.01 General

Repair work to the water distribution system is detailed in the Particular Specification and may include but not be limited to the following:

(a) Replacement of damaged, broken, leaking, corroded surface and underground pipework and fittings;

(b) Replacement of damaged, broken and missing manhole covers and frames;

(c) Repair work to damaged manholes;

(d) Initial unblocking and clearing of all water distribution pipes and manholes;

(e) Repair and upgrading of the water distribution system where necessary;

(f) Introduction of additional connections to the water distribution system;

(g) Removal of unauthorised connections;

(h) Reinstatement and making good of walls, concrete, road surfaces, etc, to an approved acceptable level where any repair, upgrade and/or service work has been executed;

(i) 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;

(j) Test pipe system for leakage;

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

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

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

(n) 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;

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

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

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

(r) Repair, service and log readings of water meters including cleaning of integral strainers;

(s) 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;

(t) Water pipes are to be sampled for corrosion and scaling. The Engineer will evaluate the actions to be followed if the outcome of this sampling requires attention;

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

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

(w) 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.

CE 04.02.02 **Construction**

The Engineer will indicate the pipeline sections in need of repair and shall instruct the Contractor with regard to the repair work to be done.

(a) Excavation

The width of the excavation shall be sufficient to allow the proper laying, bedding and backfilling of the pipelines. The width of the excavation for each type and size of pipeline shall be as set out in SANS 1200 DB.

The depth of the excavation for each type and size of pipeline shall depend on site conditions and the amount by which the excavation is to exceed the proposed level of the invert of the pipeline 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.

Cutting, breaking out and replacing of concrete pavements will be paid under Subclause CA.02.

Excavations shall extend such that, where possible cut in may be reduced by lifting adjacent pipes.

(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 m³ shall be classified as hard material.

Where more than 40 % of any material (by volume) consists of boulders each exceeding 0,10 m³ 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.

Material suitable for use in the works, however, shall be used as prescribed.

(d) Removal of damaged pipelines

Where indicated by the Engineer damaged sections of pipelines shall be completely removed and replaced.

(e) Pipe couplings

Repair sections will be joined, utilising existing pipe sockets and collars where possible.

Repair couplings shall be used with the approval of the Engineer.

(f) Laying of uPVC pipelines

New sections of uPVC pipelines shall be laid on a granular bed suitable for flexible pipelines as directed by the Engineer. The inside of the pipes 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.

Refer to SANS 1200 LB: Bedding (pipes), for the specification on bedding.

(g) Laying of asbestos cement, concrete or galvanised mild steel pipelines

New sections of the pipelines shall be laid on class A or B bedding as directed by the Engineer. The inside of the pipes 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.

Refer to SANS 1200 LB: Bedding (pipes), for the specification on bedding.

(h) 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.

(i) Concrete encasement

Where instructed by the Engineer pipes shall be encased in concrete. All such encasing shall be done in accordance with the Engineer's instructions and sufficient allowance shall be made for movement joints.

(j) Extension of existing pipelines

Where existing pipelines require extension or where damaged sections are replaced the new sections shall be placed at the same grade and, where they join the existing service, at the same level as the existing pipeline.

Existing chambers or other structures which may obstruct any new work shall be demolished and removed. The demolition and reconstruction of new structures shall be paid for under the relevant sections in the specification.

(k) Construction in existing roads

Road crossings shall either be constructed utilising sufficient provision of bypass roads

or utilising the half width of the road. At all times a through route shall be maintained for all traffic.

(l) Repairing of leaks

Where leaks occur at pipe sockets or collars the affected section shall be cut from the pipeline and repaired using repair couplings.

Where obvious leaks occur due to displaced sealing rubbers, the rubbers shall be replaced if the replacement can be done economically by lifting adjacent pipes.

(m) Replacement of pipes damaged by exposure to extensive ultraviolet light

Pipes damaged as a result of excessive exposure to sunlight shall be replaced where indicated by the Engineer.

CE 04.02.03 Quality standard

Pipelines shall be laid at even gradients within the points of correction, to the satisfaction of the Engineer and the applicable specifications.

CE 04.02.04 Materials

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) Supercast cast-iron pipes and fittings

Supercast cast iron pipes can be used for underground and above ground installations. Plain ended cast iron pipes and fittings shall be used, manufactured from 150, Grade A, grey iron in accordance with SANS 1034. 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's of the pipe system. The coupling shall be installed according to the manufacturer's specification and is to be tightened with a torque wrench to a torque of 6,8 Nm.

(b) uPVC pipe and fittings under 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. Prefabrication 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 is to be supported and bracketed with properly sized and designed brackets consisting of two half sections clamped over the pipe and hung with two hanger rods.

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

(c) Prefabricated galvanised steel piping and fittings above ground

The pipe to be used shall be plain-ended medium gauge uncoated pipe to SANS 62, galvanised to SANS 763 and shall be approved by the Galvanising Association of South Africa. All fittings are to be manufactured out of the same material, welded with flanged ends or rolled ends to fit clambon fittings. Fittings are only to be galvanised after manufacturing. All joints are to be either flanged or equipped with clambon couplings. All fittings and junction to be 45° sections.

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

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

(d) HDPE pipe and fittings

HDPE pipes and fittings can be used for underground and above ground installations where specified in accordance with SANS 8770:2008 only pipes manufactured using an extrusion

process and tempered in a hot bath shall be used. Pipes shall be plain ended and only moulded HDPE bends and fittings shall be used. Jointing 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 industry approved installers and the Contractor shall furnish a certificate to this effect. Pipes and fittings shall be installed strictly according to the manufacturer's application technique.

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

(e) Galvanised steel pipe installations

(i) All galvanised 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-dipped galvanised to SANS 763 and shall be approved by the Galvanising Association of South Africa.

(ii) All fittings shall be malleable cast-iron fittings to SANS 509 and galvanised to SANS 763 and shall be approved by the Galvanising Association of South Africa.

(iii) All 80 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, holderbats, 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:

NORMAL SIZE (mm)	HORIZONTAL (mm)	VERTICAL (mm)
15 dia to 20 dia	1 200	1 830
32 dia to 40 dia	1 830	2 450
50 dia to 150 dia	2 450	3 050

(vi) Pipes shall be installed in such a manner as to prevent airlocks. 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 80 mm diameter a jointing compound such as Epidermix 32 shall be used.

(xi) Any pipes buried shall have at least 900 mm cover and be coated and wrapped to SANS 11 17 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 cocks, sink mixers, cistern type WCs and other fittings.

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

(f) 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 to the Engineer's specification and approval.

(viii) Pipe trenching and bedding shall be as follows:

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

(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 Densopol 80 HT Tape or approved equivalent.

(xi) DPE pipe connections to UPVC pipes up to 50 mm diameter 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.

(g) <u>HDPE underground pipe installations</u>

(i) HDPE piping shall be Type 4 HDPE pipe to SANS 533.

(ii) All fittings shall be of Plasson compression type, conforming to ISO/DIS 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 to the Engineer’s specification and approval.

(v) Pipe trenching and bedding shall be as follows:

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

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

(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.

(h) 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 butadine rubber-covered gate, stainless steel spindle, nitrile butadine rubber O-rings and seals, cast iron bonnet and gunmetal thrust collar to BS 1400 LG2.

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

The valve shall be fitted with a square key spindle top to close the valve in a 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 HDPE 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 valve shall conform to SANS 776 Class 125. The valve 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 for temperatures up to 40 °C to connect to steel piping (65 mm NB and larger)

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

The valve 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 flanged ends to SANS 1123/1600, hand wheel to close the valve in a clockwise direction and installed in an upright position or side ways to a maximum 90° from upright.

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

Gate valve shall be equipped with non-rising spindle, spherical graphite iron body to SANS 963 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 valve shall conform to SANS 665 and shall be capable of withstanding a working pressure of 1 600 kPa and a temperature of 90 °C.

The valve shall be fitted with flanged ends to SANS 1123/1600, 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, 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.

The valve shall be equipped with flanges to SANS 1123/1600, hand wheel to close the valve in a clockwise direction and installed in an upright position or sideways to a 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 776-1965 Class 125.

The valve 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)

This valve shall be a full-way ballcock type with BSP threaded ends. This valve shall conform to SANS 1056 Part 3, 1985, shall be rated for a test pressure of 2 000 kPa, and shall be chrome-finished where exposed.

(viii) Angle regulating valves

This valve shall be a 15 mm diameter chromium-plated angel regulating valve with a 350 mm chromium-plated copper tube and cap nuts where required.

(i) 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 1123/1600. The whole size 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 steel and copper pipes (up to 50 mm NB)

The 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 whole size 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.

(j) Non-return valves

(i) Non-return valves for cold water (65 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 diameter) and cold water (up to 50 mm NB)

The non-return valve 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.

(k) Air release valves and vacuum breakers

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

The air release valve shall be fitted with small and large orifice. The air release valve shall be fitted with a cast-iron or stainless steel body, stainless steel or fibreglass balls, integral shut-off valve and flanged ends to SANS 1123/1600. The valve shall be equipped with an anti-shock facility.

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

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

The air release valve shall be fitted with a small orifice, cast-ron or stainless steel 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 equipped with an anti-shock facility.

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

The air release valves 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 breakers 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 90 °C.

(l) Pressure-reducing valves

(i) Combination pressure reducing stations

Where a high peak flow can occur as well as a small flow and the small flow is out of the range of the large pressure-reducing valve, a small pressure- reducing valve shall be 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.

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

The 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 pressure at a constant downstream pressure.

The valve shall be equipped with flanged ends to SANS 1123/1600.

(iii) Small pressure-reducing valves (15 mm NB - 50 mm NB)

The 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 pressure 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.

(m) Water meters

(i) Combination water meters

Where high peak flow as well as a low flow can occur, and the low flow is out of the registration range of large water meter, a small diameter water meter shall be installed in parallel with the large water meter to cater for the low flows with integral automatic change-over valves. These valves shall be designed to have a minimum pressure drop at the 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 must be protected from magnetic fields and sealed to prevent tampering with adjustments. The meter must be able to work up to a pressure of 1600 kPa under a maximum water temperature of 40 °C. The scale of meter must be in cubic metre (m^3) and equipped with needle indicators reading in litres. The accuracy of the 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 NB)

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 must 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.

CE 04.03 FIRE WATER PIPED RETICULATION NETWORKS

CE 04.03.01 General

Repair work to the fire water piped reticulation networks is detailed in the Particular Specification and shall include but no be limited to the work described below. This specification only covers the water piped reticulation for the fire water protection system, whereas 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 must be read in conjunction with the afore-mentioned specification.

Repair work to the fire water piped reticulation networks may include the following:

(a) Replacement of damaged, broken, leaking, corroded above-ground and underground pipe work, 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 work to bracketing systems including fixing and repair of existing brackets and the introduction of additional brackets where required;

(g) Report all related problems 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 or/and filling valves to these tanks are to be serviced and repaired where required;

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

(j) Reinstatement and making good of 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.

CE 04.03.02 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 relevant specification.

CE 04.04 CLEANING OF PIPELINES

The work under this section involves the removal of silt, debris and lime deposits from within the pipelines and the general cleaning in areas resulting from leakage.

CE 04.04.01 Construction

Prior to the cleaning of any pipeline sections, the Contractor shall arrange with the Engineer for an inspection of the pipe route. Based on the inspection, the Engineer will instruct the Contractor as to which sections of the network require cleaning.

Visual inspections utilising check circuit TV cameras will not be required unless deemed essential on large diameter pipelines.

Sections of the pipeline may be removed for a more detailed inspection. Such sections will be repaired as specified in Subclause CE 04.02. Sections will only be cut from the pipeline where specifically instructed by the Engineer.

The method to be applied for the cleaning of the pipelines will be chemical or mechanical and shall be followed by disinfection of the related section. The method to be applied for each section of the pipeline will be instructed by the Engineer.

Material removed from the pipelines shall be disposed of as instructed by the Engineer. The Contractor shall discuss the method proposed for the scouring of the pipelines where insufficient scour valves are present with the Engineer prior to implementation.

CE 04.04.02 Quality standard

Pipelines shall be cleaned such that head losses along the pipe route are negligible under simulated fire flow, when measured at convenient points along the route.

CE 04.05 REPAIR OF FITTINGS

CE 04.05.01 Construction

The Engineer will indicate the fittings that are to be repaired.
The repair of the following fittings may be required:

(a) Gate valves
(b) Fire hydrants
(c) Viking Johnson couplings
(d) Pressure-reducing valves
(e) Ferrules
(f) Domestic water meters
(g) Bulk water meters
(h) Stop-cocks
(i) Tees
(j) Bends
(k) End caps
(l) Saddles
(m) Sprinklers.

CE 04.06 REPAIR OF STRUCTURES

The Engineer will indicate the structures that are to be repaired or cleaned from debris.

Damaged existing structures shall be demolished to the extent directed by the Engineer on site and the resulting debris and other debris spoiled at designated sites.

The reinstatement of damaged structures shall be carried out to the same standards prescribed for new construction.

CE 05 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 notice to the Engineer, in writing, prior to commencement of 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 price 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 Employer may assign operating personnel 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 quality and proper functioning of all equipment and also certificates to be obtained from all relevant authorities and statutory bodies, etc.

CE 06 QUALITY ASSURANCE SYSTEM

The Contractor shall institute an approved quality assurance (QA) system which shall be submitted to the Employer or 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.

CE 07 MAINTENANCE TO INSTALLATION SYSTEMS AND EQUIPMENT

CE 07.01 GENERAL

This part of the Contract shall include routine preventative maintenance, corrective maintenance and breakdown maintenance as described in Additional Specification SA: General Maintenance.

The maintenance work to be performed and executed shall be done strictly in accordance with Additional Specification SA: 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 implemented by the Contractor.

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

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

(a) Repair of water distribution pipelines (see table CE 07.02/1)
(b) Cleaning of existing pipelines (see table CE 07.02/2)
(c) Repair of fittings (see table CE 07.02/3)
(d) Repair of existing structures (see table CE 07.02/4)
(e) Fire water piped reticulation structures (see table CE 07.02/5).

The scope of the external water network and bulk water network is indicated in the drawings in the Contract.

CE 07.02 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 following items listed in the tables below under each heading.

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

TABLE CE 07.02/1 REPAIR OF WATER DISTRIBUTION PIPELINES

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete system	Monthly
2	Log all water meter readings	Monthly
3	Log all pressure gauge readings	Monthly
4	Check, inspect, report and repair leaks/replace rotten pipes where required	Monthly
5	Sample water supply and chemical analyses to be provided by approved company	Monthly
6	Bulk Water storage tanks to be emptied, cleaned out, inspected, repaired and resealed where necessary	Annually
8	Clean out all strainers	Monthly
9	Check, inspect, repair or replace all bracketing systems	Four-monthly
10	Paint repairs to piping, fittings and equipment	Annually

TABLE CE 07.02/2 CLEANING OF EXISTING PIPELINES

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete system	Monthly
2	Remove silt, debris and loose lime deposits from within pipelines where required by scouring	Annually
3	Do general cleaning in areas where leakage has occurred	Six-monthly

TABLE CE 07.02/3 REPAIR OF FITTINGS

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Replace all valve gaskets, gland packings and seals	Annually
2	Check, inspect, service, repair and readjust all pressure reducing valves	Annually
3	Check, inspect and test operation of all valves on site	Four-monthly
4	Check, inspect, service, test and repair/replace all safety and expansion release valves	Six-monthly
5	Check, inspect, service, test and repair/replace all air release valves and vacuum breakers	Four-monthly
6	Check, service, repair or replace all ball float valves	Six-monthly
7	Check, inspect, test, service and repair/replace all non-return valves	Four-monthly

TABLE CE 07.02/4 REPAIR OF EXISTING STRUCTURES

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Visually inspect and report on all water distribution related structures	Monthly
2	Clean out structures of debris	Six-monthly

TABLE CE 07.02/5 FIRE WATER PIPED RETICULATION STRUCTURES

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete system	Monthly
2	Report any failures/breakage of fire fighting equipment to the Engineer	Monthly
3	Log all pressure gauge readings	Monthly
4	Replace all valve gaskets, gland packings and seals	Annually
5	Clean out water storage tanks and reseal/repair if necessary	Annually
6	Check, inspect, service, repair/replace all non-return valves and backflow presenters	Four-monthly
7	Check, inspect, report and repair all leaks/replace rotten pipes where required	Monthly
8	Inspect, service, readjust and calibrate all pressure gauges	Four-monthly
9	Paint repairs to piping, fittings and equipment	Annually
10	Check, inspect, repair or replace all bracketing systems	Four-monthly

CE 07.03 <u>CORRECTIVE MAINTENANCE</u>

This corrective maintenance of the installations, systems and equipment to 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.

CE 07.04 **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 specification.
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.

CE 08 MEASUREMENT AND PAYMENT

CE.01 WATER DISTRIBUTION PIPELINES

CE.01.01 **Repair of existing pipelines** ..... Unit: metre (m)

The unit of measurement shall be per metre length of pipe replaced. In each case the Contractor shall agree on the length of pipe to be replaced and the method of coupling the pipes.

The tendered rate shall include full compensation for cleaning and grubbing, excavation, removal of existing pipeline, dealing with water logged conditions, provision of bedding and additional backfill, logging and backfilling of replacement pipeline, finishing, repair of kerbs, road surfaces, accommodation of traffic, excavation in all materials, removal of unsuitable material from the trench, disposal of surplus materials.

Separate items will be scheduled for house connections and distribution pipes. The provision of the materials will be measured separately under CE 01.02.

CE.01.02 **Provision of materials**

(a) Pipelines .....Unit: metre (m)

The unit of measurement shall be the metre of pipe replaced.

(b) Fittings.....Unit: number
The unit of measurement shall be the number of fittings installed.

The tendered rates shall include full compensation for all transport to the place of installation, storage, labour costs.

Separate pay items shall be listed for the pipe materials and fittings per diameter and class.

CE.01.03 **Replacement of manhole covers, grid inlets and the like**

(a) SANS 558 Type 4 - covers, grids, etc, only:

(i) Maximum dimension up to 300 mm ..... Unit: number
(ii) Maximum dimension 301 mm - 600 mm ..... Unit: number
(iii) Maximum dimension 601 mm - 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 300 mm ..... Unit: number
(ii) Maximum dimension 301 mm - 600 mm ..... Unit: number
(iii) Maximum dimension 601 mm - 900 mm ..... Unit: number
(iv) Maximum dimension over 900 mm ..... Unit: number

(c) SANS 558 Type 2A - covers, grids, etc, only:

(i) Maximum dimension up to 300 mm ..... Unit: number
(ii) Maximum dimension 301 mm - 600 mm ..... Unit: number

(iii) Maximum dimension 601 mm - 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 300 mm ..... Unit: number
(ii) Maximum dimension 301 mm - 600 mm ..... Unit: number
(iii) Maximum dimension 601 mm - 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 from the site.

CE.01.04 **Repair of corrosion protection**

Corrosion protection of pipes with diameters of:

(a) Up to 100 mm dia ..... Unit: metre (m)
(b) 101 to 200 mm dia..... Unit: metre (m)
(c) 201 to 300 mm dia..... Unit: metre (m)
(d) 301 to 400 mm dia..... Unit: metre (m)

The unit of measurement shall be meter length of pipe painted with corrosion protection in accordance with Specification LB: Corrosion protection.

The tendered rate shall include full compensation for preparation of pipe fittings, application of corrosion protection and curing of corrosion protection.

Separate items shall be scheduled for different types of pipework.

CE.01.05 **New Pipelines: Preparation and Finishing** ..... Unit: metre (m)

The unit of measurement shall be per metre length of pipe being replaced. In each case the Contractor shall agree on the length of pipe to be replaced.

The tendered rate shall include full compensation for cleaning and grubbing, all excavations to the specified depth, removal of existing pipeline, dealing with water logged conditions, provision of bedding and additional backfill, logging and backfilling of replacement pipeline, finishing, repair of kerbs, road surfaces, accommodation of traffic, excavation in all materials, removal of unsuitable material from the trench, disposal of surplus materials and pressure testing of the completed pipeline.

The provision of the pipeline materials will be measured separately under CE 01.02.

CE.02 **REPAIR OF FIRE WATER PIPE RETICULATION NETWORK**

Measurement and payment items from CE.01, CE.03, CE.04 and CE.05 will be utilised for work done on the external fire water pipe reticulation. Additional payment items for specialist fittings shall be paid under Specification JC.

CE.03 **CLEANING OF PIPELINE**

CE.03.01 **Cleaning of deposits in pipeline by mechanical means for pipes of diameters of:**

(a) Up to 100 mm dia ..... Unit: metre (m)
(b) 101 to 200 mm dia..... Unit: metre (m)
(c) 201 to 300 mm dia..... Unit: metre (m)
(d) 301 to 400 mm dia..... Unit: metre (m)

CE.03.02 **Scouring of pipeline to remove trapped debris for pipes of diameters of:**

(a) Up to 100 mm dia ..... Unit: metre (m)
(b) 101 to 200 mm dia..... Unit: metre (m)
(c) 201 to 300 mm dia..... Unit: metre (m)
(d) 301 to 400 mm dia..... Unit: metre (m)

The unit of measurement shall be metre length of pipe cleaned or scoured.

The unit rate of measurement for item CA.03.01 shall include full compensation for the

emptying of the pipeline, cleaning, refilling and reporting on the condition of the pipe after cleaning. The rate shall also include the disposal of waste material in and appropriate manner.

The unit of measurement for item CA.03.02 shall include full compensation for the scouring of the pipeline and refurbishing of the pipeline. The unit of measurement shall be the total length of filled pipeline from which the water is scoured. The length shall be agreed with the Engineer prior to scouring.

The provision of additional scour points shall also be included in the rate.

CE.04 **REPAIR OF FITTINGS**

CE.04.01 **Servicing of valves**.....Unit: number

The unit of measurement shall be the number of valves serviced.

The tendered rate shall include full compensation for cleaning, removing rust, scale or other solids from surfaces or moving parts, proper greasing of all moving parts, preparation for corrosion protection coating and painting of valves.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

CE.04.02 **Reconditionvalves**..... Unit:number

The unit of measurement shall be the number of valves reconditioned.

The tendered rate shall include full compensation for dismantling, cleaning, removing rust, removing scale or other solids from surfaces and moving parts, replacing components such as hinges, spindles, hard wheels or gates, swing axles, swing gates, replacing or repair of seals, skimming of seal surfaces, proper greasing of all moving parts, preparation for corrosion protection, painting or any other action or cost necessitated to recondition a value to a perfect functional drop tight condition.
Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

CE.04.03 **Decommission and remove valves**.....Unit: number

The unit of measurement shall be the number of valves decommissioned and removed.

The tendered rate shall include full compensation for all labour and equipment required to decommission and remove valves, such as installation of temporary isolating valves or blank flanges, removal of unserviceable valves, loosening and removal of bolts and nuts, or any other related action required. Excavation to exposed partially buried valves shall also be included in the rate.

Separate items will be scheduled in the Schedule of Quantities for different types and sizes of valves.

CE.04.04 **Repair of house connections** .....Unit: number

The unit of measurement shall be the number of house connections repaired.

The tendered rate shall exclude the provision of new fittings measured under CE. 01.02 but shall otherwise include full compensation for appurtenant fittings, excavation, backfilling and other necessary work to repair existing house connections.

All connections to the distribution pipelines, up to a diameter of 32 mm shall be measured as "house connections".

CE.05 **REPAIR OF STRUCTURES**

CE.05.01 **Demolition and removal of damaged existing structures**

(a) Plain concrete .....Unit: cubic metre (m^3)
(b) Reinforced concrete.....Unit: cubic metre (m^3)
(c) Brickwork.....Unit: square metre (m^2)
(d) Precast concrete manhole sections..... Unit: number

The unit of measurement for CE.05.01(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 unit of measurement for CE.05.01(c) and (d) shall be the square metre length of brickwork and the number of precast concrete manhole sections.

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. Excavation and backfill shall also be included for constructing the precast concrete manholes inclusive of all work required to complete the work as shown on the drawings.

The reinstatement of damaged sections shall be paid for under the relevant items for constructing new structures.

CE.05.02 **Cleaning of existing manholes, chambers and other structures** ..... Unit: cubic metre (m^3)

The unit of measurement shall be the cubic metre of debris and other material to be disposed, removed from manholes, chambers and other structures.

The tendered rates shall include full compensation for all labour, equipment and tools for removal of the material, trimming the bedding and for loading, transporting and disposing of the material.

CE.05.03 **Overhaul on material for haul in excess of 1,0 km**

(a) Excavated material to spoil ..... Unit: cubic metre kilometre (m^3-km)
(b) Existing structures demolished ..... Unit: cubic metre kilometre (m^3-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. 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.

CE.05.04 **Repair of structures**

(a) Brickwork ..... Unit: square metre (m^2)
(b) Concrete ..... Unit: cubic metre (m^3)
(c) Precast concrete manhole sections ..... Unit: number

The unit of measurement shall be the cubic metre of brickwork or concrete constructed.

The tendered rate shall include full compensation for the provision of materials, transport, preparation and placing of foundations, labour and all other associated work to complete the work required.
Separate items will be scheduled for specific installations.

CE.05.05 **Marker posts** ..... Unit: number

The unit of measurement shall be the number of marker posts installed.

The tendered rate shall include full compensation for the manufacture and installation complete as shown on the drawings.

CE.05.06 **Sample testing**

(a) Extract sample to determine lime deposition, corrosion and general condition for pipes of:

(i) Up to 100 mm dia ..... Unit: number
(ii) 101 to 200 mm dia ..... Unit: number
(iii) 201 to 300 mm dia ..... Unit: number
(iv) 301 to 400 mm dia ..... Unit: number

The unit rate of measurement shall be the number of sample tests carried out.

The tendered rate shall include full compensation for cutting into pipe and extraction of sample, visual inspection and reporting on condition of pipe. The tendered rate shall also include full compensation for the appropriate disposal of the sample and for the repair of the section pipeline.

Compensation for provision of new pipes and fittings, shall be measured under CE 01.

CE.05.07 **New structures**

Precast concrete manhole sections ..... Unit: number

The unit of measurement shall be the number of new pre-cast manholes constructed complete with precast top, manhole frame, cover and finishing.

The tendered rate shall include full compensation for the provision of materials, transport, preparation and placing of foundations, labour and all other associated work to complete the work required.

CE.06 TESTS AND INSPECTIONS OF REPAIR WORK

CE.06.01 Pressure testing

(a) Pressure test pipeline in sections of pipes with diameter of:

(i) Up to 100 mm dia.....Unit: metre (m)
(ii) 101 to 200 mm dia.....Unit: metre (m)
(iii) 201 to 300 mm dia.....Unit: metre (m)
(iv) 301 to 400 mm dia.....Unit: metre (m)

The unit of measurement shall be the metre length of pipe tested.

The tendered rate shall include full compensation for isolation of test section, filling of section with water, testing for required duration and reporting on performance of pipes, the provision of any additional water shall also be included in the rate. The rate shall also include the provision of all equipment, labour and supervision necessary for the completion of the pressure test.

CE.06.02 Provision of equipment for visual inspection of underground pipeline 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 pipeline network.

CE.06.03 CCTV inspection of underground pipework

(a) Pipes of diameter:

(i) Up to 300 mm dia.....Unit: metre (m)
(ii) 301 to 600 mm dia.....Unit: metre (m)

The unit of measurement shall be the metre length of pipe inspected.

The tendered rate shall include full compensation for all inter-pipe relocations required to conduct a thorough check of the pipework where indicated by the Engineer.

CE.07 LOCATE AND CONNECT INTO THE EXISTING WATER NETWORK

(a) Locate and connect into the existing water network pipeline .....Unit: number
The tendered rate shall include the provision of all equipment, labour, fittings and material required to locate the existing water network pipeline, excavate and expose the existing pipe, blank off any unnecessary connections, and connect to the new pipeline.

TECHNICAL SPECIFICATION

CF SEWERAGE NETWORKS

CONTENTS

CF 01 SCOPE
CF 02 STANDARD SPECIFICATIONS
CF 03 OPERATING AND MAINTENANCE MANUALS
CF 04 EXECUTION OF REPAIR WORK
CF 05 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK
CF 06 QUALITY ASSURANCE SYSTEM
CF 07 MAINTENANCE TO INSTALLATION SYSTEMS AND EQUIPMENT
CF 08 MEASUREMENT AND PAYMENT

CF 01 SCOPE

This specification covers all aspects regarding the general maintenance of sewerage networks which may include the following installations:

(a) Sewer pipelines and manholes
(b) Open sewerage channels
(c) Conservancy tanks.

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.

CF 02 STANDARD SPECIFICATIONS

CF 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:

SANS 1200 D - Earthworks
SANS 1200 DB - Earthworks (pipe trenches)
SANS 1200 L - Medium-pressure pipelines
SANS 1200 LB - Bedding (pipes)
SANS 1200 LC - Cable ducts
SANS 1200 LD - Sewers

CF 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

CF 02.03 MANUFACTURER'S SPECIFICATIONS, CODES OF PRACTICE AND INSTALLATION INSTRUCTIONS

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

CF 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.

CF 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.

CF 04 EXECUTION OF REPAIR WORK

CF 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 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 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 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.

CF 04.02 **REPAIR OF EXISTING PIPELINES AND STRUCTURES**

This section covers the work in connection with the construction of sewerage networks and associated sewerage structures such as manholes, cleaning eyes and the like. It also covers the removal and replacement of damaged and broken pipes and sewerage structures, as well as repairs to existing pipes and structures.

CF 04.02.01 **General**

Repair work to the soil and wastewater drainage system shall be detailed in the Particular Specification and may include the following:

(a) Replacement of damaged, broken, leaking, corroded above-ground 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 of eye covers, screws and bolts, end caps and vent cowls;

(c) Repair work to damaged manholes, gullies, cleaning eyes, etc, including builder's work and benching;

(d) Initial unblocking and cleaning of all drainage pipework, traps and gullies;

(e) Repair of sewerage system where necessary;

(f) Provision of additional connections to the sewerage system;

(g) Reinstatement and making good of walls, concrete, road surfaces, etc, to an approved acceptable level where any repair and/or service work have been executed;

(h) 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;

(i) Test pipe system and equipment for leakage;

(j) Sewerage pipes are to be sampled for corrosion and scaling. The Engineer will evaluate the actions to be followed if the outcome of this sampling requires attention;

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

CF 04.02.02 **Construction**

The Engineer will indicate the location at which sections of pipeline are in need of repair after the appropriate surveys have been completed by the Contractor.

(a) Excavation

The width of the excavation shall be sufficient to allow the proper laying, bedding and backfilling of the pipelines. The width of the excavation for each type and size of pipeline shall be as specified in SANS 1200 DB.

The depth of the excavation for each type and size of pipeline shall depend on site conditions and the amount by which the excavation is to exceed the proposed level of the invert of the pipeline and shall be sufficient to allow for the type and thickness of bedding material as 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 extend such that, where possible, cut in may be reduced by lifting adjacent pipes.

(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^3 shall be classified as hard material.

Where more than 40 % of any material (by volume) consists of boulders each exceeding 0,10 m^3 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.

Material suitable for use in the works, however, shall be used as prescribed.

(d) Removal of damaged pipelines

Where indicated by the Engineer damaged sections of pipelines shall be completely removed and replaced.

Excavation shall be carried out as described for new pipeline installation and the excavated material shall be, if suitable, preserved for backfilling. The damaged pipe materials shall be disposed of where instructed by the Engineer.

(e) Pipe couplings

Repair sections shall be joined utilising existing pipe sockets and collars where possible.

Repair couplings shall be used with the approval of the Engineer.

(f) Laying of vitrified clay pipes and fittings

New sections of vitrified clay pipes shall be laid on granular bed as directed by the Engineer. The inside of the pipes 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.

(g) 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.

(h) Concrete encasement

Where instructed by the Engineer pipes shall be encased in concrete. All such encasing shall be done in accordance with the Engineer's instructions and sufficient allowance shall be made for movement joints.

(i) Extension of existing pipelines

Where existing pipelines require extension or where damaged sections are replaced the new sections shall be placed at the same grade and, where they join the existing service, at the same level as the existing pipeline.

Existing chambers or other structures which may obstruct any new work shall be demolished and removed. The demolition and reconstruction of new structures shall be paid for under the relevant sections in the specification.

(j) Construction in existing roads

Road crossings will either be constructed utilising sufficient provision of bypass roads, or they will be done utilising the half width of the road. At all times a through route shall be maintained for all traffic.

(k) Repairing of leaks

Where leaks occur at pipe sockets or collars the effected section will be cut from the pipeline and repaired using repair couplings.

Where obvious leaks occur due to displaced sealing rubbers they will be replaced if the replacement can be done economically by lifting adjacent pipes.

(l) Sewer manholes

All manhole cover frames shall be cast into the concrete cover slabs.

Manholes in trafficable areas shall be provided with heavy duty covers and frames and surrounded by concrete slabs.

(m) Steep sewers

Sewer pipes in the ground with a slope steeper than 1:5 and under surface beds shall be encased in concrete.

(n) External sewers

The sewer outside the boundary of the building complex shall be constructed strictly in accordance with the details and specifications of the Local Authority.

(o) As-built services

Existing drainage invert levels and positions are to be checked against invert levels given on the drawings before work commences. The Engineer must be informed immediately of any discrepancy.

The Contractor shall be responsible for the compilation of as-built plans of sewerage network, showing all pipes, pipe diameters, invert levels and associated structures.

All existing services are to be located and opened before the proposed work commences.

(p) Testing

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

(q) Ingress of foreign material

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

(r) CCTV surveys

Modern technology video surveying equipment and detection equipment shall be utilised to establish blockage problems and positions of such problems.

(s) Proximity to buildings

Any drainage pipe within the 45° range below building foundations shall be encased in concrete or soilcrete as specified.

(t) Repair to existing structures

Damaged existing structures shall be demolished to the extent directed by the Engineer on site and the resulting debris shall be spoiled at designated sites.

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.

(u) Repair to existing channels

Existing channels shall be cleaned. Broken sections of lined channels shall be repaired. Such repair work shall comprise patching of concrete and replacement of precast sections.

CF 04.02.03 Quality standard

Pipelines shall be laid at even gradients to the satisfaction of the Engineer and the applicable specifications.

CF 04.02.04 Materials

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) Manhole covers

Manhole covers, etc, shall have covers and frames complying with SANS 558.

(b) Vitrified clay pipe and fittings

Vitrified clay pipe shall only be used for underground installations. The pipes and fitting 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 EN 295: Vitrified clay pipes and fittings and pipe joints for drains and sewers, allowing up to 2,5° angular movement per joint and 5 mm line displacement per joint. The joint shall retain an affective water seal with respect to above conditions with a 6 m water head.

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

All fittings underground shall consist of vitrified clay and shall comply with SANS 559.

The piping system shall be tested according to the NBRI information sheet X/BOU 2-34.

CF 04.02.05 Air test for sewer and drains

The following air test as specified in the NBRI information sheet X/BOU 2-34 shall be applicable to all air tests on new sewers and drains installed under the repair Contract, and shall be executed by the Contractor and witnessed by the Engineer.

(a) 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 the table below, it means that the pipeline is leaking 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:

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

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

(iii) The testing equipment shall be shielded from the direct rays of the sun.

(iv) 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.

(v) 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 specialised equipment.

(vi) If the pipeline is below the water table and subjected to external water pressure, the test method should be modified by the Engineer to ensure that the final pressure value is higher than that of the external water pressure acting on the lowest part of the installation.

The minimum times for pressure drop of 250 mm to 125 mm water gauge are given in table CF 04.02.05/1 below.

TABLE CF 04.02.05/1

PIPE DIAMETER (mm)	MINIMUM TIME (min - s)	CRITICAL LENGTH OF PIPELINE (m) (58 m^2 internal surface area)	MINIMUM TIME(s) FOR LONGER LENGTH (L) OF PIPELINE
100	1 to 58	184,6	0,640 L
150	2 to 57	123,1	1,439 L
200	3 to 56	92,3	2,559 L
225	4 to 26	82,1	3,239 L
250	4 to 55	73,8	3,998 L
300	5 to 54	61,5	5,757 L
375	7 to 23	49,2	8,996 L
450	8 to 51	41,0	12,954 L
525	10 to 20	35,2	17,632 L
600	11 to 49	30,8	23,030 L

CF 04.03 **CLEANING OF SEWERAGE NETWORK**

The work involved under this section is the removal of silt, debris and vegetation from within the pipelines and manholes and the general cleaning of areas where leakage has occurred. This can be done either mechanically or chemically according to the more appropriate method as specified by the Engineer.

CF 04.03.01 **Construction**

The Contractor shall arrange with the Engineer for an inspection of the pipe route before the cleaning of any pipeline sections is carried out.. Based on the inspection, the Engineer will instruct the Contractor as to which sections of the network require cleaning.

Visual inspections utilising closed-circuit TV cameras will not be required unless deemed essential and will be specifically requested by the Engineer.

Sections of the pipeline may be removed for a more detailed inspection. Such sections

shall be repaired as specified in Subclause CF 04.02.02. Sections shall only be cut from the pipeline where specifically instructed by the Engineer.

The method to be applied for the cleaning of the pipelines shall be chemical or mechanical. The method to be used for each section of the pipeline will be instructed by the Engineer.

Material removed from the pipes shall be disposed of as instructed by the Engineer.

Where insufficient scour values are present, the method for scouring of the pipelines shall be discussed and agreed with the Engineer prior to implementation.

CF 04.04 REPAIR OF FITTINGS

CF 04.04.01 Construction

The Engineer will indicate the fittings that are to be repaired, but these fittings shall not be limited to those specifically indicated by the Engineer.

Repair of the following fittings may be required:

(a) Cleaning eyes

(b) Permanent plug stoppers

(c) Channel sections.

CF 05 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 notice to the Engineer, in writing, prior to commencement of 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 price 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 Employer may assign operating personnel 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 quality and proper functioning of all equipment and also certificates to be obtained from all relevant authorities and statutory bodies, etc.

CF 06 QUALITY ASSURANCE SYSTEM

The Contractor shall institute an approved quality assurance (QA) system which shall be submitted to the Employer or 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.

CF 07 MAINTENANCE TO INSTALLATION SYSTEMS AND EQUIPMENT

CF 07.01 GENERAL

This part of the Contract shall include routine preventative maintenance, corrective maintenance and breakdown maintenance, as described in Additional Specification SA: General Maintenance, for the specified installations described under the Clause CF 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 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 implemented by the Contractor.

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

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

(a) Sewerage network systems
(b) Wastewater treatment systems.

CF 07.02 **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 table CF 07.02/1. The tendered rate shall include full compensation for all material, plant and labour required in order to perform such maintenance to the satisfaction of the engineer.

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

TABLE CF 07.02/1 – SEWERAGE NETWORK SYSTEM

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete installation	Monthly
2	Check, inspect, repair or replace all manhole covers and frames and builder's work to manholes	Four-monthly
3	Check, inspect and repair manhole benching.	Four-monthly
4	Check, inspect, repair or replace all inspection eye, end caps and cleaning eye covers	Four-monthly
5	Check, inspect, report and unblock any blockage that occurs	Monthly
6	Check, inspect, repair/replace and clean out all equipment traps	Monthly
7	Paint repairs to surface piping and equipment	Annually
8	Survey and resultant repairs and unblocking of all main sewer lines	At start of Contract
9	Check, inspect, repair/replace sewer pipes where necessary to maintain good working condition at all times	Four-monthly

CF 07.03 **CORRECTIVE MAINTENANCE**

This corrective maintenance of the installations, systems and equipment to 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.

CF 07.04 **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 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.

CF 08 MEASUREMENT AND PAYMENT

CF.01 SEWERAGE NETWORKS

CF.01.01 Repair of existing pipelines ..... Unit: metre (m)

The unit of measurement shall be per metre length of pipe replaced. In each case the Contractor shall agree on the length of pipe to be replaced and the method of coupling the pipes.

The tendered rate shall include full compensation for cleaning and grubbing, excavation, removal of existing pipeline, dealing with water logged conditions, provision of bedding and additional backfill, bedding and back filling of replacement pipeline, cutting to length, finishing, repair of kerbs, road surfaces, accommodation of traffic, excavation in all materials, removal of unsuitable material from the trench and disposal of surplus materials.

The tendered rate shall include full compensation for all material, plant and labour required to temporarily by-pass (if required) the pipe section being replaced.

The provision of the materials will be measured separately under CF. 01.02.

CF.01.02 Provision of materials

(a) Pipelines .....Unit: metre (m)

The unit of measurement shall be the metre of pipe replaced.

(b) Fittings.....Unit: number

The unit of measurement shall be the number of fittings installed.

The tendered rates shall include full compensation for all transport to the place of installation, storage, labour costs.

Separate pay items shall be listed for the pipe materials and fittings per diameter and class and for the class of bedding to be used.

CF.01.03 Replacement of manhole covers, grid inlets and the like

(a) SANS 558 Type 4 - covers, grids, etc, only:

(i) Maximum dimension up to 300 mm ..... Unit: number
(ii) Maximum dimension 301 mm - 600 mm ..... Unit: number
(iii) Maximum dimension 601 mm - 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 300 mm ..... Unit: number
(ii) Maximum dimension 301 mm - 600 mm ..... Unit: number
(iii) Maximum dimension 601 mm - 900 mm ..... Unit: number
(iv) Maximum dimension over 900 mm ..... Unit: number

(c) SANS 558 Type 2A - covers, grids, etc, only:

(i) Maximum dimension up to 300 mm ..... Unit: number
(ii) Maximum dimension 301 mm - 600 mm ..... Unit: number
(iii) Maximum dimension 601 mm - 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 300 mm ..... Unit: number

(ii) Maximum dimension 301 mm - 600 mm ..... Unit: number
(iii) Maximum dimension 601 mm - 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 cover/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 from the site.

CF.01.04 **Manholes and inspection chambers**

CF.01.04.01 Raising or lowering of existing manholes or inspection chambers of all types:

(a) Raise/lower 0 m up to and including 0,5 m ..... Unit: number
(b) Raise/lower exceeding 0,5 m up to and including 1 m ..... Unit: number

The unit of measurement shall be the number of manholes/inspection chambers raised/lowered within the specified dimensions.

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 manhole beds, the disposal of material, dealing with subsurface or surface water, benching and for other operations necessary for completing the work as specified.

Payment shall distinguish between soft and hard material. The tendered rates shall include full compensation for transporting the excavated material from the site.

CF.01.04.02 **Breaking into existing sewer and building a new manhole**

(a) Pre-cast concrete manhole:

(1) Depth exceeding 0,5 m up to and including 1,0 m ..... Unit: number

(2) Depth exceeding 1,0 m up to and including 1,5 m ..... Unit: number

(3) Depth exceeding 1,5 m up to 2,0 m Unit: number

The unit of measurement shall be the number of manholes constructed within the specified dimensions.

The tendered rate shall include full compensation for excavation, building a new manhole over the sewer, breaking into the existing sewer, building the channelization under wet conditions, ensuring the water tightness of the new connection, supplying all the necessary materials, removing surplus material, all labour and equipment required to make the connection, and liaison with the local authorities. Provision for manhole covers shall be made under CF 01.03 payment.

CF.01.04.03 **Connecting to existing sewer** ..... Unit: sum

The tendered sum shall include full compensation for excavation, making an opening in the existing manhole, installing new pipes in the new opening, for breaking out and modifying the channelization inside the manhole to suit the new pipe layout, ensuring the water tightness of the new connection, supplying all the necessary materials, removing surplus material and debris all labour and equipment required to make the connection, and liaison with the local authorities.

CF.01.04.04 **Repair of channels** ..... Unit: metre (m)

The unit of measurement shall be the length of channel section repaired.

The tendered rate shall include full compensation for cleaning, patching, repairing of existing channels, irrespective of diameter and position. The rate shall also include all necessary materials, equipment and labour required.

CF.02 **CLEANING OF SEWERAGE NETWORK**

CF.02.01 **Mechanical cleaning of sewer pipes and structures:**

(a) Up to 150 mm ..... Unit: metre

(b) 151 mm to 300 mm ..... Unit: metre
(c) 301 mm to 450 mm ..... Unit: metre
(d) More than 450 mm ..... Unit: metre

The unit of measurement shall be the metre of pipe cleaned, measured once along the soffit of the culvert. For multiple pipes each individual pipe shall be measured separately.

The tendered rates shall include full compensation for removing the material, for disposing of the material in an approved manner and ensuring that the material will not wash into drainage trenches.

CF.02.02 **Chemical cleaning of sewer pipes and structures:**

(a) Up to and including 150 mm ..... Unit: metre
(b) 151 mm to 300 mm ..... Unit: metre
(c) 301 mm to 450 mm ..... Unit: metre
(d) More than 450 mm ..... Unit: metre

The unit of measurement shall be the metre of pipe cleaned, measured once along the soffit of the culvert. For multiple pipes each individual pipe shall be measured separately.

The tendered rates shall include full compensation for supply of chemical agents, equipment, labour and the effective application of the cleaning process.

CF.02.03 **Provision of equipment for visual inspection of underground pipe networks** ..... Unit: lump sum

The tendered sum shall include full compensation for the provision of suitable equipment, such as TV surveillance equipment, torches, lights and mirrors, etc, to enable a thorough visual inspection of the pipe network.

CF.02.04 **Use of CCTV surveillance equipment** ..... Unit: metre (m)

The unit of measurement shall be the metre of pipe inspected.

The rate shall be fully inclusive of all associated equipment and interpipe moves and recording equipment.

CF.02.05 **Visual inspection of underground pipe network** ..... Unit: sum

The tendered sum shall include full compensation for all processes necessary to complete a thorough check of the sewer network including lifting and replacing manhole covers, using relevant equipment and any clearing necessary to allow the visual inspection to proceed.

CF.02.06 **Demolition and removal of damaged existing structures:**

(a) Plain concrete ..... Unit: cubic metre (m^3)

(b) Reinforced concrete ..... Unit: cubic metre (m^3)

(c) Kerbing and channelling ..... Unit: metre (m)

(d) Pipework ..... Unit: metre (m)

The unit of measurement for CF.02.06(a) and (b) shall be the cubic metre of existing material demolished, determined from 70 % of the rates cubic metre capacity of the truck used to remove the material.

The unit of measurement for CF.02.06(c) and (d) shall be the metre length of kerbing and channelling or pipework removed.

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.

The reinstatement of damaged sections shall be paid for under the relevant items for constructing new structures.

CF.03 **TESTS AND INSPECTIONS**

(a) Pressure testing of pipelines ..... Unit: metre The unit of measurement shall be the length of sewer pipeline tested.
(b) Testing of manholes ..... Unit: number

The unit of measurement shall be the number of manholes tested after repair.

The tendered rates shall include full compensation for all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out relevant tests as per SANS 1200. Submission of certificates from tests and equipment and any costs involved in obtaining such from relevant authorities shall also be included in the tendered sum.

TECHNICAL SPECIFICATION

CG SOLID WASTE

CONTENTS

CG 01 SCOPE
CG 02 STANDARD SPECIFICATIONS
CG 03 OPERATING AND MAINTENANCE MANUALS
CG 04 DETAIL OF REPAIR WORK
CG 05 MAINTENANCE
CG 06 MEASUREMENT AND PAYMENT

CG 01 SCOPE

This specification covers the requirements for maintenance work related to solid waste site and solid waste management.

Monthly maintenance responsibilities for Solid Waste (which forms part of installation A4, Fencing, Cleaning and Site Keeping) including all units and components as specified, shall commence with access to the site (site handover).

CG 02 STANDARD SPECIFICATIONS

CG.02.01 GUIDELINES

This specification shall be read in conjunction with the guidelines on solid waste and landfill sites as stipulated by DWAF which shall be deemed to form part of these specifications.

CG 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.

CG 04 DETAIL OF REPAIR WORK

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.

Any work related to solid waste identified by the Contractor or during inspection by the Engineer shall be carried out on the instruction of the Engineer.

The Contractor shall ensure that the necessary materials, skilled personnel, tools and equipment are available at all times to perform his duties.

The work shall include the collection and removal of litter, rubble and other solid waste across the entire site.
Apart from informal dumps, the Contractor shall be responsible for removing all scattered waste in order to clean the entire site to a clean and healthy state. Collection of solid waste shall be performed under the guidance of the Engineer.

The Contractor shall transport solid waste collected across the entire site to a central container for removal to a disposal site off site. Removal of solid waste from the central container to a disposal site off site shall be the responsibility of the Contractor.

CG 04.01 LITTER COLLECTION

All litter and rubble shall be collected within the perimeter fences of the various Port of Entry and Border line bases (as reflected on the layout diagrams) and removed and disposed of as specified.

CG 04.02 WASTE COLLECTION

Waste bins shall be provided at each residential unit. Additional waste bins shall be provided at the offices and service buildings. The waste bins at all residential units shall be cleaned out on a weekly basis. Waste bins in public areas shall be cleaned out daily. The storage of the solid waste at the solid waste disposal area until such time as it is removed from site will be the responsibility of the Contractor in a skip at a central location within the site.

The disposal area shall be prepared and managed by the Contractor. The site shall be

fenced-off (1,8 m high diamond mesh) and the entrance gate shall be locked at all times.

CG 04.03 **REMOVAL OF SOLID WASTE**

Removal of solid waste from the central solid waste container (skip) to a formal solid waste facility shall be the responsibility of the Contractor.

The existing waste disposal site shall be de-commissioned and backfilled. All waste located at the disposal site shall be relocated to the nearest off site waste disposal site. All waste collected at the Port of Entry shall be relocated to the nearest off site waste disposal site on a weekly basis.

CG 05 MAINTENANCE

This specification must be read in conjunction with Additional Specification SA: General Maintenance.

The whole of the site within the perimeter fences of the LEBOMBO , Land Ports of Entry (as reflected on the layout diagrams) shall be kept free of litter, rubble and other solid waste. Litter and rubble (solid waste) shall be collected, stored by the Contractor and removed from the site as frequently as necessary, but at least weekly by the Contractor.

Storage of the collected solid waste until such time as it is removed from site shall be the responsibility of the Contractor. Solid waste shall be removed from the residential units to the waste disposal site at least weekly. Solid waste shall be removed from the central solid waste container (skip) provided by the contractor as frequently as necessary, but at least weekly.

Removal of household solid waste to the municipal/approved dump site will still be carried out by the Contractor. The cleanliness of the site, excluding all areas included within residential fences, will be the responsibility of the Contractor.
Garden refuse are amongst the litter and rubble to be collected and disposed of by the Contractor.

Solid waste maintenance forms part of Installation A4. The tendered monthly payment for maintenance of Installation A4 as based on the point system and listed in the schedule of quantities, shall be deemed to include all labour, material, tools, equipment and transport required to continuously collect litter and rubble across the entire site, placing it in a central solid waste container (skip) provided by the contractor and removing it off-site to a formal solid waste facility at least weekly.

TABLE CG 05/1: SUMMARY OF MAINTENANCE RESPONSIBILITY

NO	ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Cleaning out of all waste bins in public areas	Daily
2	Cleaning out of all waste bins at residential units	Weekly
3	Collect litter, rubble and other waste across the entire site within the perimeter fences of the Port of Entry and place in central solid waste container (skip)	Continuously
4	Remove waste from skip to external approved waste disposal site	Weekly

CG 06 MEASUREMENT AND PAYMENT

CG.01 **DISPOSAL OF LITTER** ..... Unit: cubic metre (m^3)

The unit of measurement shall be the cubic metre of litter, building rubble and other waste material removed from the site, irrespective of the type of material. The quantity shall be determined from 70 % of the rated cubic metre capacity of the truck used to remove the material.

Only litter, building rubble and other waste removed on instruction from the Engineer shall be measured for payment.

The tendered rates shall include full compensation for all labour, equipment and tools for collecting, loading, transporting and disposing of the material from the site to an approved dumping site, off site.

CG.02 **LEVELLING OF SITE** ..... Unit: m^2

The unit of measurement shall be the surface area of the site to be graded. The importation of additional material shall be paid under CG.03.

CG.03 **IMPORTATION OF FILL MATERIAL** ..... Unit: m^3

The unit of measurement shall be cubic metres of fill measured as the transported volume. The rate shall be inclusive of excavation, transport ,and the distribution of the material at the disposal site.

CG.04 **COVERING OF DUMPING SITE**

(a) Lime cover..... Unit: m^2

The unit of measurement shall be the square metre of area covered with lime.

The tendered rate shall include provision of lime, spreading and finishing of the lime to a minimum depth of 20 mm.

(b) Topsoilcover ..... Unit:m^2

The unit of measurement shall be the square metre of area of topsoil placed.

The tendered rate shall include provision of topsoil, spreading and finishing of the material to a depth of 300 mm.

CG.05 **SUPPLY OF WASTE BINS** .....Unit: number

The unit of measurement shall be the number of waste bins supplied as described in the schedule of quantities.

The tendered rates shall include full compensation for the supply, transportation and placing of the waste bins.

CG.06 **WASTE COLLECTION SKIP** ..... Unit: sum

The unit of measurement shall be a sum for the provision of a single skip at a central location within the site.

The tendered rate shall be fully inclusive of supply and installation of the skip to the site required including 1.8m high diamond fence around the skip with a lockable gate.

CG.07 **OVERHAUL ON MATERIAL FOR HAUL IN EXCESS OF 1,0 km:**
. ..... Unit: cubic metre per kilometre (m^3-km)

The unit of measurement shall be the cubic metre of 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.

TECHNICAL SPECIFICATION

CJ SITE KEEPING AND CLEANING

CONTENTS

CJ 01 SCOPE
CJ 02 STANDARD SPECIFICATIONS
CJ 03 EXECUTION OF REPAIR WORK
CJ 04 MAINTENANCE
CJ 05 MEASUREMENT AND PAYMENT

CJ 01 SCOPE

This specification covers the cleaning and site keeping of the facilities at the various installations. The scope of work has been divided into:

- Site keeping; and
- Cleaning of offices and support facilities

CJ 01.01 SITE KEEPING

The area where site keeping is to be performed is the area included within the perimeter fence of the applicable installation and all areas falling within fenced-in residential properties (See Table CJ 01.01). Site keeping will include removal of rubble, removal of weeds, shrubs and other objects and cutting of the grass.

CJ 01.01.01 TABLE: OPEN AREAS

TABLE CJ 01.01.01: AREAS

NO	LOCATION	AREA	DESCRIPTION
1	LEBOMBO Port of Entry Open areas (Site Keeping)	59 000 m^2	All areas included within the perimeter fence and all areas falling within fenced in residential properties. Waste and Rubble control 20 m around the outside perimeter of the Port of Entry.

CJ 01.02 CLEANING OF OFFICES AND SUPPORT FACILITIES

All offices, ablutions and support buildings are to be cleaned and maintained in a sanitary condition at all times.

IMPORTANT: All Public Ablutions Facilities to consist of full time cleaning staff during operational hours (minimum. of 2 staff members per ablution, consisting of male and female cleaning staff). **All Public Ablutions Facilities must be kept neat and clean at all times with special attention during festive seasons.**

NB. Building and facilities inventory shall be issued to the appointed contractor

CJ 01.03 ABLUTION EQUIPMENT AND CLEANING AGENTS

All offices, ablutions and support buildings are equipped with sanitizing and ablution equipment which must be maintained at all times. The following indicates the equipment that must be maintained in working order as well as providing of consumables such as toilet paper, hand-wash soap, air fresheners refills, sanitizer refills and plastic refuse bags for all waste bins and sanitary bins which will be the responsibility of the Contractor.

The contractor should include in his tendered rate for all the consumable as listed above for the number of personnel that are employed at the Port of Entry as well as Customs Commercial facility and the number of travellers that commutes through the port of entry on

a monthly basis:

- **All Public Ablutions Facilities must be kept neat and clean at all times with special attention during festive seasons – see Clause CJ 01.02 for moredetail.**

CJ 02 STANDARD SPECIFICATIONS

CJ 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.

CODE	DESCRIPTION
CKS 285-1971	Dispensers for paper towels
CKS 340-1979	Plastic Refuse Bags (Disposable)
SANS 1344:2009	Medium duty solvent detergent
SABS 1868	Gel detergent cleaner (non-abrasive)
SANS 1887-1:2008	Tissue paper Part 1: General requirements
SANS 1887-2:2008	Tissue paper Part 2: Toilet paper
SANS 1887-4:2008	Tissue paper Part 4: Paper towels
SANS 1924:2007	Toilet soaps intended for use in dispensers
SANS 60335-1:2007	Household and similar electrical appliances – Safety Part 1: General requirements
SANS 60335-2-67:2003	Household and similar electrical appliances – Safety Part 2-67: Particular requirements for floor treatment and floor cleaning machines, for industrial and commercial use

CJ 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

CJ 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 manufacturer's specifications, instructions and codes of practice.

CJ 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.

CJ 03 EXECUTION OF WORK

CJ 03.01 GENERAL

The Contractor shall ensure that the necessary materials, skilled personnel, tools and equipment are available at all times to accommodate the site keeping and cleaning of the facilities.

The Contractor shall be responsible for cleaning ablution facilities as frequently as necessary to maintain them in a clean and healthy condition. The actions outlined serve only as a benchmark for the cleaning and maintaining of the facilities.

The ablution facilities and operational buildings will be kept clean during the operational periods of the Port of Entry as indicated below:

(i) Skilpadshek Port of Entry is operational for 24 hours a day 7 days a week.

Cleaning activities will include providing all cleaning agents and equipment necessary for cleaning.

Providing of consumables such as toilet paper, hand-wash soap, air fresheners refills, sanitizer refills and plastic refuse bags for all waste bins and sanitary bins will be the

responsibility of the Contractor.

CJ 03.02 ABLUTIONS

Each ablution facility shall be equipped with the following equipment:

1) Hand Dryer
2) Stainless steel air freshener
3) Stainless steel toilet paper dispenser units
4) Stainless steel she bins
5) Stainless steel hand soap dispensers
6) Stainless steel sanitizer
7) Stainless steel paper towel dispenser
8) Stainless steel wall bin

CJ 03.02.01 Hand Dryer

The hand dryer unit shall comply with at least the following specifications:

- Blower Output: 450 Watt @ 20,000 rpm
- Air Heater Output: 900 W
- Air Flow Rate: 81 meters per second @ 100 mm from the air outlet nozzle
- Air Temperature: 55 °C @ 100 mm from the air outlet nozzle

The hand dryers units shall be of the wall mounted kind and shall be installed in accordance with the manufacturer's specifications.

CJ 03.02.02 Air Freshener Doser

The stainless steel air freshener dosing units shall be battery operated, wall mounted and lockable. The device shall possess an adjustable automatic timer between at least 5 to 30 minutes and the aerosol spray shall be metered.

CJ 03.02.03 Toilet Paper Dispensing Unit

The stainless steel toilet paper dispensing units shall be able to accommodate two standard size 500 sheet single-ply toilet paper rolls and shall be lockable. The device shall be wall mounted.

CJ 03.02.04 She Bin

One stainless steel she bin shall be supplied for each of the female ablutions. The she bins shall possess a self-closing lid and shall accommodate for plastic bag liners which can be removed and replaced with a new liner.

CJ 03.02.05 Hand Soap Dispenser

There shall be at least one stainless steel liquid hand soap dispenser per ablution. The liquid soap dispenser shall be of the wall mounted kind. The dispenser shall dispense a metered amount of liquid soap.

CJ 03.02.06 Urinal Sanitiser Dispenser

There shall be one stainless steel, battery operated, wall mounted, urinal sanitiser dispenser per urinal.

CJ 03.02.07 Paper Towel Dispenser

The paper towel dispenser shall comply with CKS 285-1971. The unit shall be a Type 2, closed dispenser designed to dispense paper towels in sheets.

There shall be at least one stainless steel wall mounted paper towel dispenser per ablution.

CJ 03.02.08 Wall Bin

There shall be one stainless steel wall bin per ablution. The wall bin shall possess a self-closing lid and shall accommodate for plastic bag liners which may be removed and replaced with a new liner. The device shall be wall mounted.

CJ 04 MAINTENANCE

CJ 04.01 GENERAL

The maintenance work to be performed under site keeping and cleaning shall be done strictly in accordance with Additional Specification SA: General Maintenance, and as specified in this specification.

Maintenance implies and shall include routine cleaning (which is the equivalent of routine preventative maintenance), routine preventative maintenance of site keeping and cleaning equipment, corrective cleaning (which is the equivalent of corrective maintenance), corrective maintenance of site keeping and cleaning equipment as well as breakdown maintenance of all site keeping and cleaning equipment.

The maintenance scope in terms of site keeping is set out in table CJ 01.01.01. The maintenance scope in terms of cleaning is set out in table CJ 01.02
The maintenance scope in terms of equipment is set out in table CJ 01.03.

Monthly maintenance responsibilities for site keeping and cleaning of installations shall commence with access to the site. The maintenance schedules and frequency shall be developed under the maintenance control plan to be implemented by the Contractor.

Remuneration for maintenance of site keeping and cleaning will be deemed included in the tendered monthly payment for maintenance based on the point system, as described in Additional Specification SA: General Maintenance and in accordance with installation: A4: Cleaning and Site Keeping.

CJ 04.02 **ROUTINE PREVENTATIVE MAINTENANCE**

The tasks related to routine preventative maintenance work shall include but not be limited to the general actions listed in table CJ 04.02.01 and CJ 04.02.01 and CJ 04.02.03 below.

Please note that the operational times for the Port of Entry is from as follows

(i) Skilpadshek Port of Entry is operational for 24 hours a day 7 days a week.

TABLE CJ 04.02.01: SITE KEEPING

No	ROUTINE PREVENTATIVE MAINTENANCE TASKS	FREQUENCY
1.	Cleaning out of and supply of black refuse bags to all waste bins in public areas.	At least daily
2.	Watering of plants, shrubs, grass and trees	Weekly
3.	Removal of weeds	Weekly
4.	Clearing of weeds and grass along the edges of paved areas.	Weekly
5.	Cutting of grass. *No grass to exceed the length of 50 mm.*	Monthly
6.	Cutting of grass at residential units. *No grass to exceed the length of 30 mm.*	Weekly
7.	Restore lawns	Monthly
8.	Trimming of dense shrubs.	2 Monthly
9.	Fertilisation of lawns	Quarterly
10.	Fertilisation of flower beds and trees	Quarterly
11.	Removal of undesirable shrubs	Quarterly
12.	Trimming of trees where branches cause obstruction.	Quarterly
13.	Collecting of litter and foreign objects.	Continuous

TABLE CJ 04.02.02: CLEANING OF OFFICES AND SUPPORT FACILITIES

	ACTION	FREQUENCY
1.	Cleaning of floors in public areas and open plan offices	Daily (before opening of port of entry)
2.	Cleaning of counter tops and under counter shelves in public areas and open plan offices.	Daily (before opening of port of entry)
3.	Emptying of waste baskets in offices and service buildings	Daily
4.	Cleaning of office floors	Daily
5.	Vacuum carpets	Weekly
6.	Clean carpets	Six Monthly
7.	Washing of windows and dusting of window sills and ledges	Weekly
8.	Clean and polish all fittings	Weekly

9.	Washing of interior and exterior walls	Monthly
10.	Dusting of interior of the building to remove dust and spider webs	Weekly
8.	Clean and polish all vinyl floors	Monthly

TABLE CJ 04.02.03: CLEANING OF ABLUTION FACILITIES

	ACTION	FREQUENCY
1.	Cleaning and ensuring that the ablution facilities are in a sanitary condition	Continuous
2.	Washing and cleaning of floors	Daily
3.	Empty and clean all waste receptacles	Daily
4.	Clean all bowls, basins and urinals	Daily
5.	Clean and polish all fittings and mirrors	Daily

	ACTION	FREQUENCY
6.	Washing and cleaning out of she bins	Twice weekly
7.	Washing of windows and dusting of window sills, ledges, pipes and fittings	Weekly
8.	Washing of walls	Weekly
9.	Dusting of interior of the building to remove dust and spider webs	Weekly

CJ 04.03 **SITE KEEPING AND CLEANING EQUIPMENT**

All site keeping and cleaning equipment will be supplied by the Contractor and shall be maintained in a perfect working order for the duration of the Contract period. Remuneration for provision of cleaning equipment will be deemed included in the monthly tendered monthly payment for maintenance based on the point system, as described in Additional Specification SA: General Maintenance.

CJ 04.03.01 **Grass, Shrub and Tree Cutting Equipment**

Distinction will be made amongst 4 different types of grass, shrub and tree cutting equipment:

1. Light duty grass and shrub cutter (Weed Eater)

   The light duty grass and shrub cutter shall be similar to a light duty Brushcutter and comply with the following:

   Nylon or blade head;
   Minimum displacement of 40.2 cm^3;
   Minimum power output of 1.6 kW; and
   Length of 1.77 m.

2. Heavy duty shrub and tree cutter

   The heavy duty shrub and tree cutter shall be similar to a heavy duty Brushcutter and comply with the following:

   Blade head;
   Minimum displacement of 51.7
   cm^3; Minimum power output of 2.4
   kW; Length of 1.69 m.

3. Lawn mower for small lawns

   The lawn mower for small lawns to be used at the residential areas shall comply with at least the following:

   Walk behind 4 stroke petrol self propelled rotary mower;
   Power output of 4 kW;
   422 mm cutting width;
   200 mm heavy duty sealed ball bearing wheels; and
   54 liter polymer catcher with metal lining.

4. Lawn mower for large lawns

The lawn mower for large lawns shall comply with at least the following:

Walk behind 4 stroke petrol self propelled rotary mower;
Power output of 12 kW;
750 mm cutting
width; Rubber
wheels.

CJ 04.03.02 **Vacuum Cleaner**

Vacuum cleaners shall be wet and dry and comply with at least the following:

Tank capacity: 25 liter
Cable length: 10 m
Airflow rate: 56 liter per second

CJ 04.03.03 **Carpet Cleaner**

Carpet cleaners shall comply with at least the following:

Tank capacity fresh water: 40
liter Tank capacity dirty water: 25
liter Cable length: 10 m
Suction motor: 2 x 1250 W;
Airflow rate: 2 x 60 liter per second
Pump delivery: 2.8 liter per minute @ 3 bar

Carpet cleaners shall be similar to Wetrok's Extravac 400.

CJ 04.03.04 **Mop and bucket system**

A two bucket mopping system shall be provided and be fitted with metal wringers. The mops provided shall be suitable for use with the buckets provided.

Mop and bucket systems shall be similar to Wetroks Socar L40.

CJ 04.03.05 **Window cleaning kit**

Window cleaners shall have a telescopic handle with a length of 0.5 to 3 m. It shall be possible to fit squeegees and brushes to the telescopic handle as required in order to clean windows. A bucket with capacity of at least 10 liter shall be provided that is suitable for use with the window cleaning kit.

CJ 04.03.06 **Sign boards**

Sign boards shall be yellow in colour, free standing and printed on both sides. It shall clearly indicate the dangerous situation.

CJ 04.04 **CONSUMABLES FOR SITE KEEPING AND CLEANING**

Provision of consumables will be the responsibility of the Contractor. Remuneration for provision of consumables will be deemed included in the monthly tendered monthly payment for maintenance based on the point system, as described in Additional Specification SA: General Maintenance.

CJ 04.04.01 **Refuse Bags**

Refuse bags shall comply with CKS 340-1979.

CJ 04.04.02 **Toilet Paper**

Toilet paper shall comply with SANS 1887 Part 1 & Part 2.

Toilet paper provided shall be single-ply, soft with a nominal number of 500 sheets per roll and a nominal outside diameter of 125 mm.

CJ 04.04.03 **Toilet soap for hand soap dispensers**

Toilet soap shall comply with SANS 1924:2007 – Toilet soaps intended for use in dispensers.

Toilet soap shall be Type 1, liquid toilet soap and shall be perfumed. The toilet soap shall be

suitable for use in the hand soap dispensers provided.

CJ 04.04.04 **Biological detergent for urinal dispenser**

The urinal dispenser detergent may not contain any disinfectants. A biological detergent shall be used. The biological detergent shall have an EU ECO-LABEL accreditation and shall be endorsed by Indalo Yethu (South Africa's official environmental campaign)

The biological detergent shall be similar to nu flush from innu-science.

CJ 04.04.05 **Air freshener**

Air freshener shall be supplied that is suitable for use in the air freshener doser.

Air fresheners shall be similar to Technical Concepts Neutralle Metered Aerosols (available from Steiner Hygiene).

CJ 04.04.06 **SHE bin liners**

She bin liners shall be provided that is suitable for use in the she bins.

CJ 04.04.07 **Paper towels**

Paper towels shall comply with SANS 1887 Part 1 & Part 4.

Paper towels provided shall be supplied in packets of folded towels that can be dispensed from the supplied paper towel dispenser without sticking or other undue difficulty.

CJ 04.04.08 **Wall bin liners**

Wall bin liners shall be provided that is suitable for use in the wall bins.

CJ 04.04.10 **Biological detergents for cleaning of ablutions and public areas**

Disinfectants and Detergent-disinfectants shall not be allowed to clean ablutions and public areas. A biological detergent shall be used. The biological detergent shall have an EU ECO-LABEL accreditation and shall be endorsed by Indalo Yethu (South Africa's official environmental campaign)

The biological detergent shall be similar to nu kleen smell from innu-science.

CJ 04.04.11 **Medium duty solvent detergent**

Medium duty solvent detergents shall comply with SANS 1344:2009 Medium duty solvent detergent. It shall be used in cases where surfaces, walls and floors are soiled with oil, grease or similar soils.

A biological detergent may be used as an alternative where surfaces are soiled with oil, grease or similar soils. The biological detergent shall have an EU ECO-LABEL accreditation and shall be endorsed by Indalo Yethu (South Africa's official environmental campaign)

CJ 04.04.12 **Other**

Brooms, dusters and muslin cloths shall be seen as consumables.

The Contractor shall furthermore be responsible for the supply of batteries for all battery operated equipment, e.g. the urinal sanitizer and the air freshener dozer.

CJ 04.05 **SOLID WASTE MANAGEMENT**

All solid waste that is generated as a result of site keeping and cleaning shall be managed in accordance with specification CG Solid Waste.

CJ 05 **MEASUREMENT AND PAYMENT**

		Unit
CJ.05.01	**HAND DRYERS**	No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

		Unit
CJ.05.02	**AIR FRESHENER DOSERS**	No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

		Unit
CJ.05.03	**TOILET PAPER DISPENSING UNITS**	No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

		Unit
CJ.05.04	**SHE BINS**	No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

		Unit
CJ.05.05	**HAND SOAP DISPENSER**	No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

		Unit
CJ.05.06	**URINAL SANITIZER**	No

The tendered rate shall include full compensation for the supply, delivery, labour and installation and commissioning of the urinal sanitizer. The unit shall be installed in accordance with the manufacturer's instructions.

		Unit
CJ.05.07	**PAPER TOWEL DISPENSER**	No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

		Unit
CJ.05.08	**WALL BIN**	No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

TECHNICAL SPECIFICATION

DA BOREHOLE PUMP SYSTEMS

CONTENTS

DA 01	SCOPE
DA 02	STANDARD SPECIFICATIONS
DA 03	OPERATING AND MAINTENANCE MANUALS
DA 04	EXECUTION OF REPAIR WORK
DA 05	GENERAL SPECIFICATION FOR ELECTRIC MOTORS DA
06	TESTING AND COMMISSIONING
DA 07	MAINTENANCE
DA 08	MEASUREMENT AND PAYMENT

DA 01 SCOPE

This specification covers the decommissioning, removal, repair and reconditioning, installation, testing, commissioning and maintenance of borehole pumping equipment, motor control devices and low-voltage cables. It also includes the pump testing of all boreholes to determine the borehole yield and optimum use of each borehole. The function of borehole pump systems shall be delivery of raw water at a specified flow rate and head to the required location.

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.

DA 02 STANDARD SPECIFICATIONS

DA 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:

BS 5316, Part 1	- Acceptance tests for centrifugal, mixed flow and axial pumps
SANS 948	- Three-phase induction motors
SANS 1222	- Enclosures for electrical equipment (classified according to the degree of protection that the enclosure provides)
BS 4999	- General requirements for rotating electrical machines
ISO 281/1	- Rolling bearings – dynamic load ratings and rating life.

DA 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

DA 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.

DA 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.

DA 03 OPERATING AND MAINTENANCE MANUALS

The Contractor shall at the start of the Contract be given all available 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.

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

Maintenance Manuals.

DA 04 EXECUTION OF REPAIR WORK

DA 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 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 work required shall include, but not be limited to the following:

(a) Removal of existing equipment;
(b) Installation of temporary pumps;
(c) Pump testing to determine safe yield;
(d) Ground-water sampling;
(e) Compilation of borehole recommendation report.

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 borehole pump systems shall be categorised under the following headings:

(a) Pump testing of boreholes
(b) Repair of existing structures
(c) Repair/replacement of electrical components.

DA 04.02 CLASSIFICATION OF BOREHOLES

The boreholes shall be inspected by the Contractor and the Engineer to confirm the classification of the boreholes in accordance with the guidelines below:

CLASS I	CLASS II	CLASS III	CLASS IV
Existing pump and motor in working order Has connecting pipework	Existing pump and motor require repair Has connecting pipework	Not equipped Has connecting pipework	Not equipped No connecting pipework
REPAIR WORK			
Routine maintenance	Repair pump and motor	Pump test Replace pump and motor	Abandon borehole

The above classification shall be used to determine the degree of repair work required.

DA 04.03 PUMP TESTING OF BOREHOLES

This section covers the requirements of the pump testing of the boreholes.

DA 04.03.01 Construction

It will be the responsibility of the Contractor to arrive on site with all equipment and materials required to complete the work without interruption.

The Contractor shall provide suitable plant to enable the installed pumping equipment to be removed and reinstalled. This includes the removal and reinstallation of motorised pumps and may also include the recovery of existing pumping equipment previously lowered into a borehole.

(a) Arrival-on-site actions

The Contractor shall firstly establish whether or not the borehole is equipped. If so, the Contractor will be required to:

(1) Remove the equipment, taking care not to damage either the equipment or the installation,

(2) inspect the equipment for defects, and

(3) note down all particulars regarding the equipment and the installation.

The latter shall include but not be limited to the make and type of pump (and motor if motorised), the depth to which the pump was installed, the power rating of the motor and the diameter, length and quantity of pump column sections.

The Contractor shall next establish whether there are any other boreholes in the vicinity that need to be tested. Should this be the case, the following information shall be gathered and recorded for each borehole:

(1) The straight-line distance (in metres) between each such borehole to be tested;

(2) whether the borehole is equipped, open or sealed and, if equipped,

(3) whether the installation is operational or not.

Depending on the degree of access available to such a borehole, the Contractor shall improve the access until it is adequate to reach the borehole and establish whether there is water in the borehole and if so, measure and record:

(1) The depth to the ground-water rest level;

(2) the height of the borehole collar above ground level, and

(3) the depth of the borehole.

The final activities to be carried out prior to the actual installation of the test pump into the borehole to be tested shall comprise measuring and recording:

(1) The diameter of the borehole;

(2) the depth of the borehole as determined by means of a weighted line or plumb bob, and

(3) the depth to the ground-water rest level in the borehole, with reference to a date level.

(b) Test pump installation

The conduit tube shall be attached and secured to the first section of pump column behind the pump element and the test pump installed to the required depth, attaching and securing the conduit tube to the riser main every 2 to 3 metre. If the pump installation depth has not been specified by the Engineer beforehand, then the depth must be determined on the basis of the guidelines provided in table DA 04.02.01/1.

The Contractor will be remunerated for the installation of a test pump per linear metre of depth installed at the rate tendered as set out in the Schedule of Quantities.

TABLE DA 04.02.01/1 GUIDELINES FOR TEST PUMP INSTALLATION DEPTH IF NOT SPECIFIED

DEPTH OF WATER IN BOREHOLE	TEST PUMP INSTALLATION DEPTH
Less than 5 m	Do not install the test pump
Between 5 m and 30 m	± 2 m above the bottom of the borehole
Between 30 m and 60 m	± 3 m above the bottom of the borehole
Between 60 m and 90 m	± 4 m above the bottom of the borehole
More than 90 m	± 5 m above the bottom of the borehole
NOTE: 1. Depth of water in borehole is calculated as the difference between the total depth of the borehole and the depth to the ground-water rest level as measured. 2. ± denotes a variation of not more than 0,5 m either way.	

(c) Equipment set-up and pre-test actions

Where possible, the discharge pipe must be laid in a downhill direction from the borehole to be tested, provided this will take the pipe in the direction of or past another borehole located in the vicinity of the borehole to be tested. In such instances, lay the discharge pipe in a downhill direction that will take its furthest end as far as possible away from any other borehole in the vicinity.

In field situations where the terrain is extremely flat, the length of the discharge pipe shall be extended from 50 m to at least 300 m if any possibility exists that the discharged water may infiltrate to the ground- water resource within the radius of influence of the test. The dip meter should be inserted into the installed conduit tube and run down this tube to the bottom. Make sure that it passes freely down the full length of the tube. If the dip meter used is not graduated to an accuracy of 0,01 m, the position is to be marked on the dip meter cable indicating the depth to the ground-water rest level, and the end of the graduated tape attached at this position on the cable ensuring that the zero mark of the graduated tape corresponds exactly to this mark. Slowly lower the dip meter and graduated tape down the conduit tube, in the process securing the tape to the dip meter cable every 2 to 3 metre. Ensure that there is no slack between each point where the tape is secured to the dip meter cable. Also make sure that the dip meter cable and graduated tape combination passes freely along the full length of the conduit tube.

The Contractor will be remunerated for this work per set-up at the rate tendered for one such activity as set out in the Schedule of Quantities.

(d) Final pre-test measurements

The Contractor shall ensure that all the basic information required on the field data sheet is collected and recorded as completely as possible. The basic information data entry fields can be used as a checklist for information to be measured/collected and recorded. The Contractor shall not guess any information which has not been measured.

Payment for this work shall be incorporated into the payment for data recording as described below.

(e) Data recording

(i) Discharge measurements

The measurement of discharge (yield or pumping rate) must be consistently accurate and reliable and shall be appropriate to meet this requirement. Where volumetric calculation methods are applied, time will be measured using a stopwatch and the container volume must be accurately known. The volumetrically measured yields recorded on the field data sheets shall be based on the average obtained from a set of three sequential measurements. Guidelines for the number and periodicity of discharge rate measurements for

each type of test are given in table DA 04.02.01/2.

TABLE DA 04.02.01/2 NUMBER OF PERIODICITY OF DISCHARGE RATE MEASUREMENTS

TYPE OF TEST	DISCHARGE RATE MEASUREMENTS	
	NUMBER	PERIODICITY
Calibration test	2 per step	At ± 5 and ± 10 minutes into each step
Stepped discharge test	5 per step	At ± 5, ± 15, ± 30, ± 60 and ± 90 minutes into each step
Constant discharge test	See periodicity column	At ± 5, ± 15, ± 30, ± 60, ± 90 and ± 120 minutes into test and every 60 minutes thereafter for the full duration of pumping

(ii) Water-level measurements

Rigid guidelines for the periodicity of water-level measurements for each type of test are given in table DA 04.02.01/3. This information can be found duplicated on the field data sheets which must be filled in as a record of all data collection activities carried out for a pumping test. The type of water-level measurement values required to be recorded on the field data sheets are the actual (or true) draw down values. These values represent measurements which reflect the depth of the water level below the ground-water rest level depth, ie which already take into account the ground-water rest level depth below the reference measuring point. It shall be noted that the more basic type of measurement which reports the depth of the dynamic water level as a distance below the reference measuring point, ie which combines the depth of the water level below the ground-water rest level depth and the depth of the ground-water rest level below the reference measuring point, gives only an apparent (or false) draw down value. All water-level measurements must be measured to an accuracy of at least 0,01 m (10 mm). The water-level data shall be plotted on the semi-logarithmic graph paper provided with each set of field data sheets. The plotting of the data shall be done as the test proceeds, ie each water-level measurement shall be plotted on the graph as soon as possible after measuring. The field data sheets and accompanying water-level graphs shall be shown to authorised supervisory personnel at request and shall be up-to- date at the time of such request.

(iii) Other information

The Contractor shall also record any extraordinary observations made during the test. These may include:

(1) Changes in the colour of the discharged water;

(2) changes in the turbidity of the discharged water;

(3) the presence of air in the discharged water, and

(4) rainfall events which occur during a test.

Remuneration for all data collection and recording activities by the Contractor in the course of a pumping test shall be incorporated into an hourly rate as set out in the Schedule of Quantities.

TABLE DA 04.02.01/3 PERIODICITY (IN MINUTES) OF WATER-LEVEL MEASUREMENTS DURING PUMPING TESTS

CALIBRATION TEST	STEPPED DISCHARGE TEST	CONSTANT DISCHARGE TEST	RECOVERY TEST
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4

5	5	5	5
7	7	7	7
9	9	9	9
12	12	12	12
15	15	15	15
	20	20	20
The above periodicity (measured in minutes	25	25	25
after the start of each increased pumping	30	30	30
rate) must be followed for each step of the	40	40	40
calibration test	50	50	50
	60	60	60
	70	70	70
	80	80	80
	90	90	90
	100	120	120
		150	150
	The above periodicity (measured in minutes	180	180
	after the start of each increased pumping rate)	210	210
	must be followed for each step of the stepped	240	240
	discharge test	Every 60 minutes to end of pumping	Every 60 minutes to end of recovery

(f) Test pumping of boreholes

The Contractor may be required to test existing "older" boreholes which may or may not already be equipped with pumping installations.

Test pumping serves two primary objectives. The first of these is an assessment of the productive capacity (yield potential) of the borehole. The second objective addresses the productivity of the ground-water resource. These objectives are met by various types of borehole tests performed separately and often sequentially. These tests are identified as:

(i) the slug test
(ii) the calibration test
(iii) the stepped discharge test
(iv) the constant discharge test
(v) the recovery test.

Factors determining which of these tests shall be performed include:

- The potential yield of the borehole, and
- the amount of water which it will be required to supply.

(i) The slug test

The slug test provides a rapid means of assessing the potential yield of especially low yielding (less than 1 litre/s) boreholes (Vivier *et al,* 1995). The results may indicate whether it is feasible and warranted to perform other tests on the borehole. As with any of the other tests, a slug test can be executed in any borehole and not necessarily only newly drilled boreholes.

The test involves measuring the water-level response in a borehole to the rapid displacement of water therein. This displacement might cause either -

(1) a rise in water level, as would result from the introduction of a slug

below the rest water level, or

(2) a drop in water level, as would be caused by the removal of a quantity of water from the borehole.

In instances where a slug is introduced, the water level will recede to its original level. The sudden removal of a quantity of water from the borehole will cause the water level to rise to its original level. The rate of recession or rise provides an indication of the yield of the borehole. In qualitative terms the more rapid this is, the higher the potential yield of the borehole.

(ii) The calibration test

A calibration test requires that water be pumped from the borehole at three or more different rates over short (15 minutes) sequential periods. The response of the water level to each known pumping rate is measured and recorded. The calibration test provides a means of assessing the yield potential of borehole according to the magnitude of the water-level decline associated with each pumping rate. This information is used to select appropriate pumping rates at which to perform a stepped discharge test or a pumping rate at which to perform a constant discharge test.

(iii) The stepped discharge test

Also known as a step draw down test, this test is performed to assess the productivity of a borehole. It also serves to more clearly define the optimum yield at which the borehole can be subjected to constant discharge testing if required. The test involves pumping the borehole at three or more sequentially higher pumping rates, each maintained for an equal length of time, generally not less than 60 minutes and seldom longer than 120 minutes. A step length of 100 minutes is recommended. The magnitude of the water-level draw down in the borehole in response to each of these pumping rates must be measured and recorded in accordance with a prescribed time schedule. The actual pumping rate maintained during each "step" must also be measured and recorded. As a rule, the rate of water-level recovery for a period of time immediately following the period of pumping should also be monitored according to the same time schedule as during pumping.

(iv) The constant discharge test

A constant discharge test is performed to assess the productivity of the aquifer according to its response to the abstraction of water. This response can be analysed to provide information in regard to the hydraulic properties of the ground-water system and arrive at an optimum yield for the medium to long-term utilisation of the borehole. This test entails pumping the borehole at a single pumping rate which is kept constant for an extended period of time. The test duration shall not be less than 12 hours and, in some instances, might last up to 72 hours or more. The duration is generally determined by the importance which is attached to the borehole and ground-water resource not only in terms of its yield potential but also in terms of its intended application.

The pumping rate is set at a yield which it is considered the borehole and ground-water system will be able to maintain for the entire planned duration of the test and, in the process, utilising better than 70 per cent but not exhausting the available draw down. It is critical that the pumping rate during the entire duration of the test be kept as constant as possible. The draw down in water level in the borehole during the course of the test is again measured and recorded according to a prescribed time schedule. In the case of this type of test, it is imperative that water-level measurements be made during the recovery period following the end of pumping.

(v) The recovery test

This test provides an indication of the ability of a borehole and ground-water system to recover from the stress of abstraction. This ability can again be analysed to provide information with regard to the hydraulic properties of the ground-water system and arrive at an optimum yield for the medium to long-term utilisation of the borehole. Although referred to as a test, it rather represents a period of monitoring activity following a period of pumping. The rate at which the water level in the tested borehole (or any other borehole affected by the abstraction) recovers towards its starting level (the ground-water rest level before pumping started) is monitored in this period. The duration of this monitoring is generally equal to that of the preceding period of pumping unless the rate of recovery is sufficiently rapid so that the starting water level is

reached in a shorter period of time.

(g) General approach and methodology

The Engineer will formulate a test pumping schedule for each borehole. The flow diagram presented overleaf provides an indication of the considerations which determine the scope of test pumping based on a logical decision-making process.

All project-related test pumping activities will also be carried out under the direct supervision of the Engineer. The execution of a pumping test in accordance with established scientific protocols must be undertaken by a suitably experienced and equipped testing contractor. The South African Bureau of Standards (SANS) is finalising a Standard Code of Practice titled *The test-pumping of water boreholes*. A draft of this Standard has been considered in the compilation of this document. It will be the task of the Engineer to evaluate and analyse the data, draw conclusions with regard to the productivity of the borehole and the aquifer, and make recommendations with regard to a suitable operating schedule for the borehole and the optimum exploitation of the ground-water resource.

Both the practical and analytical aspects of test pumping benefit greatly from prior information regarding the borehole and the aquifer which it taps into. This information is gleaned during the drilling and the construction of the borehole. It includes knowledge of:

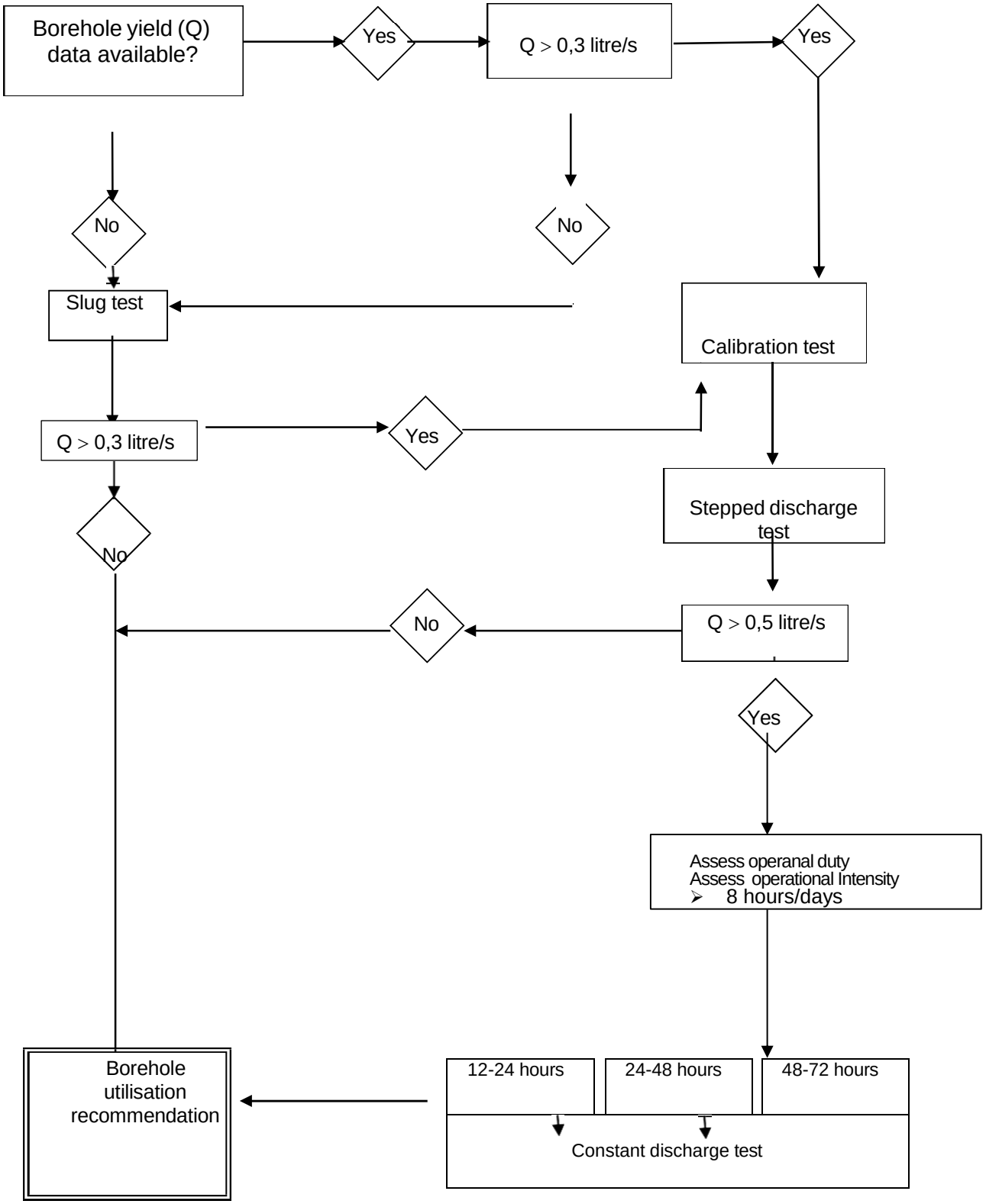
(1) The amount of water blown out of the borehole during drilling operations;

(2) the depth(s) at which water was struck in the borehole;

(3) the construction of the borehole in terms of the setting of especially perforated (slotted) casing, and

(4) the nature of the rock formation at the depth(s) where water was struck.

This information will be communicated to the testing contractor by the Engineer prior to the testing of any borehole.


Borehole yield (Q) data available?
Yes
Q > 0,3 litre/s
Yes
No
No
Slug test
Calibration test
Q > 0,3 litre/s
Yes
No
Stepped discharge test
No
Q > 0,5 litre/s
Yes
Assess operanal duty
Assess operational Intensity
➢ 8 hours/days
Borehole utilisation recommendation
12-24 hours
24-48 hours
48-72 hours
Constant discharge test

The Contractor shall keep a full record of the test pumping which is undertaken and submit the record on completion of the test. This record must include the following basic information:

(1) The depth to water level before the start of testing;

(2) the depth at which the test pump was installed;

(3) the type, make and model of the test pump used;

(4) the pumping rate as measured at regular intervals during the test, and

(5) the water level in the borehole as measured according to a prescribed time schedule both during and after pumping.

The Contractor must be sufficiently well-equipped to gather this information with acceptable accuracy.

The rationale behind the flow diagram is explained as follows. A slug test should be performed on a borehole in instances where there is no prior indication of its possible yield. The result of the slug test will indicate whether additional test pumping is warranted. A slug test shall also be performed in instances where the possible yield of a borehole from prior information is indicated to be less than 0,3 litre/s. The result of the slug test will again indicate whether additional test pumping is warranted. In instances where the possible yield of a borehole from prior information is indicated to be equal to or greater than 0,3 litre/s, then a calibration test followed by a stepped discharge test shall be performed.

The result of the stepped discharge test will indicate whether further test pumping in the form of a constant discharge test is warranted or whether the borehole is judged to be sufficiently weak (potential production yield less than 0,5 litre/s) to make a utilisation recommendation without further testing. Should the result of the stepped discharge test indicate that a constant discharge is warranted, then the Engineer will need to make an assessment of the possible operational duty to which the borehole might be subjected.

The operational duty describes the number of hours per day for which the borehole must operate in order to meet the local water demand. By implication, the potential production yield of the borehole must be compared to the water demand. In qualitative terms, a lower yielding borehole would need to operate for a longer period per day to meet a given demand than a higher yielding borehole would need to. Further, the water demand is often too great for even a high yielding borehole pumping continuously to meet. The flow diagram indicates, however, that any borehole which reveals the potential to yield more than 0,5 litre/s and which will operate for a period in excess of 8 hours per day must be subjected to a constant discharge test of 48 to 72 hours duration. A borehole which does not fit this category requires an assessment of its possible operational intensity.

The operational intensity describes the yield at which a higher yielding borehole must operate in order to meet a water demand in a pumping period of eight hours or less per day. By implication, a high operational intensity requires the borehole to be pumped at a yield approaching its maximum, whereas a low operational intensity will place less stress on the borehole. These considerations will indicate whether a 24 to 48 hour or a 12 to 24 hour duration constant discharge test respectively will be performed.

The final step in the flow diagram requires the Engineer to make a borehole utilisation recommendation.

DA 04.02.02 **Equipment and materials**

This represents the test unit and all ancillary equipment and materials required to accurately and efficiently perform borehole testing. Details are provided below.

(a) Test unit

The test unit shall comprise a positive displacement (PD) type pump element and a pump head driven by a motor fitted with an accelerator, gearbox and clutch. The unit must be in good working order and capable of maintaining a minimum of 72 hours of continuous operation.

The unit must be capable of delivering water at a rate in excess of the expected

maximum yield of the borehole to be tested. It may be acceptable under certain circumstances to employ a submersible pump for testing purposes. This must, however, be identified in the tender enquiry document. It is imperative that any submersible pump used for testing purposes be equipped with a non-return valve fitted at the bottom of the pump column (rising main).

(b) Discharge piping

Discharge piping comprises both the pipe (rising main or pump column) which brings the water to surface and the pipe (discharge hose) used to lead the pumped water away from the borehole being tested. The Contractor shall supply sufficient rising main to set the test pump at a depth of at least 100 m below the surface. It may, however, be required under certain circumstances to set the test pump at a greater depth in the borehole. Where necessary it shall be discussed with the Engineer prior to the installation of the test pump. The pump column must be of uniform diameter throughout. The Contractor shall also provide at least 50 m discharge piping. This must be free of leaks for its entire length. It may again, under certain circumstances, be required to discharge the pumped water at a point further away than 50 m (possibly in excess of 300 m) from the borehole being tested. In such instances, a similar procedure to that discussed above in regard to the rising main must be followed.

(c) Discharge measuring equipment/Instrumentation

This equipment/instrumentation must be adequate to accurately measure the pumping rate within the range of yields expected from successful project boreholes. If volumetric methods are used, a stopwatch for measuring time to an accuracy of at least one-tenth of a second is required. The full capacity of each container shall be determined accurately. The Contractor shall also ensure that a container stands level when used for discharge measurements. Guidelines regarding the use of different size containers for volumetric discharge rate measurements in specific yield ranges are given in table DA 04.02.02/1. Other acceptable instruments that may be used for discharge measuring are: (1) an orifice weir and (2) a flow meter. The use of these instruments is subject to various application criteria.

(i) Orifice weirs

These must be installed in a horizontal position at the end of the discharge pipe. The orifice plate opening must be sharp, clean, bevelled to 45 degrees and have a diameter less than 80 per cent of the diameter of the approach tube to which it is fixed. The

orifice plate must be vertical and centred on the end of the approach tube. There must be no leakage around the perimeter of the orifice plate mounting. The piezometer tube must not contain entrained air bubbles at the time of pressure head measurement. The latter measurement must be at least three times the diameter of the orifice.

TABLE DA 04.02.02/1 YIELD RANGE VERSUS CONTAINER SIZE FOR VOLUMETRIC MEASUREMENTS

YIELD RANGE	CONTAINER SIZE
Less than 2 litre/s	20 litre
2 litre/s to 5 litre/s	50 litre
5 litre/s to 20 litre/s	210 litre
20 litre/s to 30 litre/s	500 litre
30 litre/s to 50 litre/s	1000 litre
More than 50 litre/s	Other suitable methods

The orifice weir equipment must be calibrated for various combinations of approach tube and orifice diameters so that pressure head readings can be converted to accurate discharge measurements.

(ii) Flow meters

Flow meters must be calibrated and of similar diameter to that of the

discharge pipe. The latter must be straight and of uniform diameter for a distance of four times the diameter of the pipe before the position of the meter. There must be no turbulent flow or entrained air in the discharge pipe before the meter. The discharged water must be free of solid material carried in suspension.

It is recognised that some water leakage will generally occur especially at the borehead during pumping. This is acceptable provided that: (1) such leakage does not interfere with any water- level monitoring and (2) the total amount of leakage to the end of the discharge pipeline does not exceed one per cent of the pumping rate as measured at the end of this pipeline.

(d) Water-level measuring equipment/instrumentation

The Contractor shall provide at least three water-level measuring devices which are each capable of providing an accuracy of at least 0,01 m (10 mm) and are of sufficient length to match the pump installation depth. If ungraduated electrical contact meters (dip meters) are used for this purpose, each such instrument must be equipped with a measuring tape of an acceptable length and approved standard and which is graduated to an accuracy of at least 0,01 m (10 mm). These instruments must be in good working order and number at least one spare for each two on site.

The Contractor shall further provide conduit tubing of sufficient length to match the pump installation depth. The diameter of this tube must be large enough (minimum 15 mm) to allow free movement of the dip meter probe and cable therein. The tubing must be made of material strong enough to withstand reasonable pressure on its sidewall which might

cause a constriction. The tube must be open at its lower end to allow the free entrance of water into the tube. This is facilitated by perforating the bottom section of the conduit tube sidewall. Precautions shall also be taken to prevent the dip meter probe from passing beyond the bottom end of the conduit tube and, as a result of entanglement, not able to be withdrawn.

(e) Other materials

No pumping test should commence without field data sheets on which to record all data and information relevant to the test pumping activities in an acceptable format. These can either be provided by the Contractor or the Engineer.

DA 04.02.03 Ground-water sampling

(a) Sampling for macro-element analysis

The Institute for Water Quality Studies of the DWAF, in conjunction with the Department of Health, commenced in May 1996 with the compilation of guidelines addressing all aspects of water sample collection aimed at routinely establishing the quality thereof for drinking purposes. Until such time as these guidelines become available, the following recommendations in this regard should be followed.

A water sample shall be collected from the end of the discharge pipeline no sooner than 15 minutes before the scheduled end of a pumping test, whether of a calibration, stepped discharge or constant discharge nature. This will ensure that a water sample is collected in case testing does not proceed to include either one or both of the latter two types of test. The standard amount of sample normally collected is in a clean, sterilised plastic bottle of capacity 240 millilitre or larger and equipped with a watertight screw-on cap. This is the standard issue sample bottle provided by the DWAF. Depending on the analysing laboratory's requirements, however, a sample of up to two litres in volume may have to be collected. The Engineer will advise on this matter in instances where the Contractor is required to collect samples, in which case the Engineer will provide ampoules containing preservative chemicals if required. All other materials such as sample bottles, tie-on labels and sample custody forms are to be provided by the Contractor. The mandatory sample custody form DW45 must be completed for each sample collected. Note that the code MACRO1 in Instruction 8 ("analyse for") of form DW45 defines the macro-element analysis.

(i) Sampling procedure

Wash hands thoroughly and rinse the sample bottle three times with the water to be sampled, ie the water being pumped from the borehole. Fill

the bottle so that a space of five to ten millimetres is left at the top. Add the preservative as instructed in (ii).

(ii) Sample preservation

Gently tap the bottom of an ampoule of preservative on a firm surface so that all the chemical flows to below the constriction. Hold the ampoule firmly upright with thumbs placed either side of the constriction, flex off the neck, turn the ampoule upside down and place it in the bottle together with the broken-off neckpiece. Firmly screw on the cap of the sample bottle after rinsing it well with water from the borehole. Shake the capped sampled bottle well. **Caution shall be exercised when handling the preservative, since this chemical is poisonous.**

(iii) Sample custody

Fill in the information requested on the tie-on label and attach this securely to the neck of the sample bottle. Place the sample bottle in a cooler or ice-box and keep it stored under chilled conditions. Complete the sample custody form (DWAF form DW45). The water sample and its custody form will be collected by the Engineer. The above procedures shall be adhered to and complied with to the satisfaction of the Engineer.

(b) Sampling for environmental isotope analysis

Use a new, clean, one-litre polyethylene bottle with watertight screw-on cap for routine stable (hydrogen and/or oxygen) isotope and tritium analysis. Take the same basic precautions as for macro-element analysis. Ensure that the water is as clean as possible, but do not filter or add anything. Turbidity does not matter. Rinse the bottle three times with the water to be sampled, fill till overflowing and tighten cap well. Turn bottle upside down and squeeze to test for tightness. Clearly label the bottle by waterproof marking pen on the bottle shoulder or tie-on label.

In special cases of confined to semi-confined (older) water, where tritium values $< 0,5$ TU are observed, or where it is specifically requested, samples for radiocarbon analysis may be required. Since this involves special procedures of field extraction of larger quantities of water, the Engineer shall contact experts in this field for the procedures and materials required.

This test shall only be conducted when requested by the Engineer.

The standards of isotopic measurement for hydrological applications are defined as follows:

(i) Minimum detectable values

Tritium:	0,3 TU (tritium units)
Radiocarbon:	2 pMC (per cent modern carbon)

(ii) Maximum analytical error

Tritium:	$\pm$ 0,3 TU (0 - 3 TU); otherwise $\pm$ 10 %
Radiocarbon:	$\pm$ 2 pMC ($>$ 40 pMC); $\pm$ 1 pMC ($<$ 40 pMC)
Oxygen-18:	$\delta^{18}0$; $\pm$ 0,15 $^0/_{00}$
Deuterium:	$\delta^{2}H$; $\pm$ 1,5 $^0/_{00}$

DA 04.02.04 **Aborted tests and breakdowns**

The Engineer may at any stage during the execution of a pumping test request the testing contractor to abort a test if, in the opinion of the Engineer, continuation of the test is not in the interests of the project. Factors which may contribute to such a decision by the Engineer are:

- Sufficient data having been collected for an adequate scientific evaluation thereof;
- the execution of the test not meeting project criteria and requirements (such as for constancy of yield, accuracy of yield measurements or accuracy of water-level measurements, sufficiency of discharge line length, etc), or
- a mechanical breakdown occurring during pumping which causes a test to be interrupted or aborted.

(a) Tests aborted due to sufficiency of data

The Engineer will fully motivate his decision to abort the test in a written statement to the User Client. In such instances, the testing contractor will be remunerated for the actual duration of testing (including recovery testing) at the hourly rates set out in the Schedule of Quantities.

(b) Tests aborted due to incorrect execution

The testing contractor will be required to remedy the cause(s) for an abort decision by the Engineer. The test shall be restarted, as if it were the first attempt, after the water-level has recovered to within five per cent of the pre-test rest water-level or the contractor is instructed thereto by the Engineer. The testing contractor shall not be entitled to remuneration for any test which is aborted under these circumstances irrespective of the time elapsed up to receipt of the instruction to abort.

(c) Tests aborted due to breakdowns

The following procedures are recommended when a mechanical breakdown occurs during pumping which causes a test to be interrupted or aborted.

(i) Calibration test

Start immediately with the measurement and recording of the water-level recovery rate according to the periodicity given in table DA 04.02.04/1. Irrespective of how long after the start of pumping the breakdown occurs or how rapidly the breakdown can be fixed, continue with water-level recovery measurements until the water level is within five per cent of the pre-test rest water level or, at the discretion of the Engineer, may be discontinued. Restart the calibration test as if it is the first attempt. The Testing Contractor shall not be entitled to remuneration for a calibration test which is aborted under such circumstances.

(ii) Stepped discharge test

Record the time of the breakdown and start immediately with the measurement and recording of the water level recovery according to the periodicity given in Table 4-9. If the breakdown occurs during the first or second steps of the test, continue with water- level recovery measurements until the water-level is within five per cent of the start rest water level and then restart the stepped discharge test as if it is the first attempt. If the breakdown occurs during the third step of the test, can be fixed and the pump restarted to produce the same yield (as before the breakdown) within five minutes of the breakdown occurring, continue with the test at this yield after measuring and recording the water level immediately before restarting the pump. Only one such breakdown event is allowed.
If a second breakdown occurs, proceed as described for a first step breakdown. If the breakdown occurs during the fourth or later step of the test, can be fixed and the pump restarted to produce the

same yield (as before the breakdown) within five minutes of the breakdown occurring, continue with the test and complete it at this yield after measuring and recording the water level immediately before restarting the pump. If a breakdown at this stage can not be fixed within five minutes, continue with water-level recovery measurements as if the test has been fully completed. The Contractor shall not be entitled to remuneration for a stepped discharge test which is aborted: (1) within the first or second step, or (2) within the third step and can not be restarted within the time allowed for repair.

(iii) Constant discharge test

Note the time of the breakdown and start immediately with the measurement and recording of the water-level recovery according to the periodicity given in table DA 04.02.04/1. If the breakdown occurs within the first two hours after the start of pumping, continue with water-level recovery measurements until the water- level is within five per cent of the pre-test (start) rest water level and then restart the test. If the breakdown occurs later than two hours into the test, can be fixed and the pump restarted to produce the same yield as before the breakdown within the time periods (after the breakdown occurring) given in table DA 04.02.04/1, continue with the test at this yield after measuring and recording the water level immediately before restarting the pump.

If the breakdown can not be fixed and the pump started within one hour of the breakdown occurring, continue with water-level recovery measurements until the water level is within five per cent of the pre-test rest water level and then restart the constant discharge test as if it is the first attempt unless the following condition has been met. If the breakdown occurs after approximately 80 per cent of the planned duration of the constant discharge test has been successfully completed, continue with water-level recovery measurements as if the test has been fully completed. The allowable elapsed time (in hours) with regard to selected constant discharge test total durations in order for this specification to be acceptable is given in table DA 04.02.04/2.

TABLE DA 04.02.04/1 PERIOD ALLOWED FOR BREAKDOWN REPAIR AND CONTINUATION OF TESTING

TIME BREAKDOWN AFTER START OF TEST	PERIOD ALLOWED FOR REPAIR
2 hours to 4 hours	6 minutes
4 hours to 6 hours	12 minutes
6 hours to 8 hrs hours	18 minutes
8 hours to 10 hours	24 minutes
10 hours to 12 hours	30 minutes
12 hours to 14 hours	36 minutes
14 hours to 16 hours	42 minutes
16 hours to 18 hours	48 minutes
18 hours to 20 hours	54 minutes
Longer than 20 hrs	60 minutes

TABLE DA.04.02.04/2 PERIOD AFTER WHICH A CONSTANT DISCHARGE TEST MAY BE CONSIDERED COMPLETED IN THE EVENT OF A BREAKDOWN

CONSTANT DISCHARGE TEST DURATION	ALLOWABLE TIME ELAPSED TO BREAKDOWN
24 hours	20 hours (equivalent to 80 % of total time)
36 hours	30 hours (equivalent to 83 % of total time)
48 hours	38 hours (equivalent to 79 % of total time)
72 hours	60 hours (equivalent to 77 % of total time)

The Contractor shall not be entitled to remuneration for a constant discharge test which is aborted under circumstances which preclude its restart within the time allowable for repair and continuation. The contractor will, however, be entitled to remuneration for a constant discharge test which is aborted after approximately 80 per cent of the planned duration of the constant discharge test (refer to table DA.04.02.04/2) has been successfully completed, payment being made for the actual duration of the test (including the recovery test) at the hourly rates set out in the Schedule of Quantities.

DA 04.03 REPAIR OF EXISTING STRUCTURES

This section covers the requirements for the repair of the associated structures at the borehole installation.

DA 04.03.01 General

The work required shall include but not be limited to the following:

(a) Repair existing concrete base slabs around boreholes;
(b) Cast concrete base slabs at boreholes without base slabs;
(c) Clear around the borehole an area 20 m x 20 m.

DA 04.03.02 Detail of work

(a) Brickwork structures

Where instructed by the Engineer, existing minor brickwork buildings shall be renovated.

(b) Concrete base slabs

Where instructed by the Engineer, existing concrete base slabs shall be broken up and removed from existing boreholes.

Concrete base slabs shall be constructed as instructed by the Engineer.

(c) Clear area

An area of 20 m x 20 m shall be cleared of bushes, building rubble and other foreign matter as instructed by the Engineer. The area shall in addition be levelled.

DA 04.04 REPAIR/REPLACEMENT OF ELECTRICAL AND MECHANICAL EQUIPMENT

This section covers the requirements for the repair of the mechanical equipment associated with the boreholes.

The requirements for the repair of the electrical equipment associate with the boreholes are specified in Technical Specification GB: Electrical installation for mechanical and pumping equipment.

DA 04.04.01 General

The work required shall include but not be limited to the following:

(a) Reconditioning of MCC panel and housing

(b) Testing of electrical mechanical equipment

(c) Reconditioning of borehole pumping equipment

(d) Borehole information register

(e) Commissioning.

DA 04.04.02 Detail of work

(a) Testing electrical and mechanical equipment

All electrical and mechanical equipment shall be inspected and tested at the start of the Contract to establish which items need to be repaired, reconditioned or replaced.

(b) Borehole pumping equipment

The Contractor shall remove or extract the submersible pumps and inspect. Reconditioning or repair of pumps shall be carried out if necessary on the instruction of the Engineer. The difference between reconditioning and repair is defined in the payment items.

(c) Borehole information register

A data register containing the following information shall be compiled during the repair contract and further developed during the maintenance contract:

(i) Borehole pumping equipment and maintenance tasks, records, etc

(ii) Borehole utilisation (rate of discharge and duration of discharge)

(iii) Borehole water-level.

(d) Commissioning

All components at each borehole will be fully commissioned after reconditioning or replacement as described in Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures.

This Specification covers the supply, delivery and installation of submersible centrifugal

pumps. Testing and commissioning is covered in Clause DA 05 and in Additional Specification SC: General Decommissioning, Testing and Commissioning Procedures.

DA 04.05.01 **General**

Centrifugal pumps supplied under this Contract shall be suitable for vertical installation in submerged conditions, shall consist of a submersible motor coupled directly to a multistage centrifugal pump and shall be suitable for pumping water for domestic use.

The details of the existing installation were unknown at the time of tender. Allowance has been made for the servicing of pumping equipment.

Should it become apparent during the servicing that components need to be replaced such as bearings, shafts, etc., a payment item for the reconditioning of the pumping equipment has been allowed. The “reconditioning” payment item will replace the “servicing” payment item in this event.

No orders shall be placed for any pumping equipment until the boreholes have been tested and the report submitted to the Engineer. The Engineer shall then provide the pump requirements to the Contractor for ordering of equipment.

Preference will be given to pumps of the self-regulating type and where the power consumption characteristic is such that with an increase in delivery to beyond a certain limit, the power consumption decreases, thereby ensuring that the motor is not overloaded in the event of a large reduction in pumping head.

Preference will be given to locally manufactured pumps and motors, with a reliable and efficient after sales service and readily available spares.

DA 04.05.02 **Depth of installation**

The most suitable depth of installation and safe pumping rate shall be confirmed by an experienced borehole contractor by virtue of the supplied borehole record, test and calculated information. All costs involved in confirming the most suitable depth of installation and safe pumping rate shall be deemed included in payment item DA.01.

DA 04.05.03 **Material**

All parts of the pump shall be manufactured from material most capable of withstanding wear. Full specification in this respect shall accompany the Tender and the Tenderer's advice in this respect will be considered.

DA 04.05.04 **Speed**

The pump shall have a rotational speed not exceeding 1 450 rpm. If a higher rotational speed is required, this shall be motivated in a covering letter or in the technical data sheets.

DA 04.05.05 **Design**

All working parts of the pumps shall be removable and serviceable and shall under no circumstances be integrated into the body of the pumps.

DA 04.05.06 **Turbine bowls**

Turbine bowls shall be manufactured from high-grade cast steel and shall be finished off smoothly before a high-quality corrosion protection system is applied. Grey Iron No 30 turbine bowls may be approved by the Engineer, or if so stated in the Project Specifications. The bowls shall be selected for a minimum of 2 500 kPa or 1,5 times the maximum discharge pressure, whichever is the greater. The casing, suction strainer, cable shield and all fastenings, nuts and bolts shall be manufactured from stainless steel.

DA 04.05.07 **Pump shaft**

The shaft shall be manufactured of stainless steel. Where the shaft passes through stuffing boxes it shall be fitted with renewable sleeves of high-quality, wear-resistant alloy.

The shaft shall be so designed that the running speed is well below the first critical speed, and the complete rotor shall be accurately balanced after assembly.

The rotating elements shall be accurately balanced statically and dynamically to eliminate noise and vibration when running.

DA 04.05.08 **Pump impellers**

Impellers shall be manufactured of stainless steel or bronze and shall be carefully bored

and keyed. All parts inaccessible to machining shall have a smooth finish. Balancing of impellers shall not be done by means of drilling balancing holes, but rather by accurate and careful machining of impellers.

DA 04.05.09 **Seals and bearings**

Pumps shall be fitted with mechanical seals with sand deflectors. Pump bearings and thrust collars shall be bronze and shall be lubricated by the fluid handled. The pump and motor shall not be adversely affected by suspended sand concentrations of up to 25 g/m^3.

DA 04.05.10 **Rising pipe**

The rising pipe shall have threaded or approved bolted couplings at a spacing of approximately 6 m intervals. The rising pipe shall have a minimum internal diameter of 50 mm and shall internally and externally be protected against corrosion by a fusion-bonded powder epoxy coating to a minimum thickness of 250 micron. All bolts used shall be stainless steel. The couplings shall not totally obstruct the borehole, but shall allow for sufficient clearance between the coupling and borehole casing to prevent any damage to the drop cable set and earth wire. The pump and rising pipe shall be centered in the borehole by means of approved centralisers at a preferred spacing of not more than 3 m. The centralisers shall be manufactured of an approved corrosion-resistant material and shall assist in eliminating any vibration that may occur in the borehole/rising pipe installation.

DA 04.05.11 **Borehole vents**

The borehole shall be adequately vented to prevent the build-up of pressure or vacuum. All borehole vent openings shall be piped watertight to the atmosphere outside of any enclosure and not less than 200 mm above any low ground level or the highest recorded flood level. Such vent openings shall be at least 12 mm in diameter. The terminal of the vent shall be suitably shielded and screened so as to prevent the entrance of foreign matter and insects.

DA 04.05.12 **Pump motor**

Unless otherwise specified, each pump shall be supplied complete with an electrical motor. Each electrical motor shall comply with the requirements as specified in Specification GB: Electrical installation for mechanical and pumping equipment and Clause DA 05 of this specification and Specification PF: Acceptance tests for pumps.

The depth setting shall be such that an up-flow of water past the motor is created. If insufficient up-flow of water past the motor is available, a suitable flow induced tube shall be fitted to the pump and motor to ensure sufficient cooling of the motor.

DA 04.05.13 **Base plate**

A suitable base plate shall be used to effectively close the top of the borehole to prevent any foreign matter from entering. The rising pipe shall be effectively bolted to the base plate. The base plate shall further be provided with the necessary openings for the drop cable site, earth wire and water-level monitoring device.

DA 04.05.14 **Accessories**

Over and above any reflux valves installed and specified above ground level, the pump shall be fitted with a non-slam type reflux valve situated at the pump outlet. The reflux valve shall be a matched component supplied and tested by the pump manufacturer for efficient and troublefree operation.

DA 04.05.15 **Pump technical details**

The pump shall be a currently catalogued product. Documentation shall include performance curves or selection tables, indicating flow, head, NPSH required, power absorbed, speed and efficiency for the expected range of operational conditions.

Performance curves and selection tables shall be based on a reproducible and certified test carried out in an approved laboratory. Certified detail selection shown on these performance curves or tables shall be submitted.

The flow rate at break-off point of the curve for the impeller selected shall be at least 1,5 times that of the maximum flow rate specified.

The head at zero delivery of the curve for the impeller selected shall be at least 1,2 times the operating head.

The efficiency of the pump shall not be less than 95 % of its maximum efficiency at the

selected duty point. The efficiency of the pump at the selected duty point as stipulated in table DA 04.05.01/1 shall not be less than 75 %.

The possible percentage variation of data measured on Site by the supplied and/or installed instrumentation when compared with the catalogued performance data must be submitted.

All calculations for static and dynamic heads are to be based on an atmospheric pressure above mean sea level of approximately 1 410 m, which is the site elevation of the borehole site.

The pump shall be installed in accordance with the manufacturer's instructions and shall be maintained in "as new" condition at start up.

Details of the equipment shall include the following:

(a) Operating, testing and commissioning instructions

(b) Trouble analysis guide.

Full details of periodic and annual maintenance and service to be undertaken by the maintenance staff in accordance with a preventive maintenance programme shall be submitted.

The Contractor shall state in the technical data sheets the minimum selected service life for which the pump has been engineered and the components selected when operated under normal working conditions with optimum servicing and maintenance.

The minimum acceptable service life is 15 years with 8 500 operating hours per annum.

The Engineer reserves the right to call for -

(a) Test certificates and reports from the manufacturer's quality control laboratory or an independent test laboratory such as SANS, and/or

(b) site inspection, customer reports/references and user's interviews, and/or

(c) full engineering, design and component selection details, in order to check the correctness of the service life claimed.

DA 04.06 SUBMERSIBLE PROGRESSING CAVITY PUMPS

This Specification covers the supply, delivery and installation of belt-driven submersible progressing cavity pumps. Testing and commissioning is covered in Clause DA 05 and Additional Specification SC: General decommissioning, testing and commissioning procedures.

DA 04.06.01 General

The pumps supplied under this Contract shall be of the progressing cavity type with a stator and a rotor, similar to Mono, Orbit or approved equivalent pumps.

The pumps shall be belt-driven and suitable for vertical installation in submerged conditions and shall be suitable for pumping water for domestic use.

Preference will be given to locally manufactured pumps, with reliable and efficient after sales service and readily available spares.

DA 04.06.02 Depth of installation

The most suitable depth of installation and safe pumping rate if not required in the detail specification shall be confirmed by an experienced borehole contractor by virtue of the supplied borehole record, test and calculated information. All costs involved in confirming the most suitable depth of installation and safe pumping rate shall be deemed included in payment item DA.01.

DA 04.06.03 Material

The Contractor shall take cognisance of the operating environment and the properties of the pumped liquid when selecting the materials of manufacture for the pump components to ensure that the components are resistant to corrosion.

All parts of the pump shall be manufactured from material most capable of withstanding wear. Full specification in this respect shall accompany the Tender and the Tenderer's advice in this respect will be considered.

DA 04.06.04 **Pump speed**

The pump shall have a rotational speed not exceeding 1 500 rpm. If a higher rotational speed is required this shall be motivated in a covering letter or in the technical data sheets.

DA 04.06.05 **Design**

All working parts of the pumps shall be removable and serviceable and shall under no circumstances be integrated into the body of the pumps.

DA 04.06.06 **Pump shaft and rotor**

The pump shaft and rotor shall be manufactured from stainless steel.

The shaft shall be so designed that the running speed is well below the first critical speed.

The rising shaft shall be supported by a bobbin bearing every 1,5 metres.

The shaft supporting bearings shall be made of stainless steel with a vulcanised rubber outer sleeve and rubber linings with bushes of a synthetic material and shall be lubricated by the fluid handled.

DA 04.06.07 **Pump stator**

The stator of the pumps shall be manufactured from a suitable wear-resistant rubber and shall be formed by moulded-to-metal construction. The rubber shall be resistant to wear and heat caused by the occasional dry running of the pumps and the maximum permissible time span during which the pumps can run dry without any damage caused to the pumps, shall be indicated in the covering letter at tender stage.

DA 04.06.08 **Rising pipe**

The rising pipe shall withstand a 1 600 kPa working pressure.

The rising pipe shall have threaded or approved bolted couplings at a spacing of approximately 3 m intervals. The rising pipe shall have a minimum internal diameter of 50 mm and shall internally and externally be protected against corrosion by a fusion-bonded powder epoxy coating to a minimum thickness of 250 micron. All bolts used shall be stainless steel. The pump shaft shall run inside the rising pipe.

The pump and rising pipe shall be centred in the borehole by means of approved centralisers at a preferred spacing of not more than 6 m. The centralisers shall be manufactured of an approved corrosion-resistant material and shall assist in eliminating any vibration that may occur in the borehole/rising pipe installation.

DA 04.06.09 **Borehole vents**

The borehole shall be adequately vented to prevent the build-up of pressure or vacuum. All borehole vent openings shall be piped watertight to the atmosphere outside of any enclosure and not less than 200 mm above any low ground level or the highest recorded flood level. Such vent openings shall be at least 12 mm in diameter. The terminal of the vent shall be suitably shielded and screened so as to prevent the entrance of foreign matter and insects.

DA 04.06.10 **Pulley head and base plate**

A pulley head which includes the pulleys, shaft seals, bearings and pump delivery flange shall be mounted on a suitable base plate.

The pulley head and base plate shall effectively close the top of the borehole to prevent any foreign matter from entering.

The rising pipe shall be effectively bolted to the pulley head.

A double bearing configuration shall be installed where the shaft exits the pulley head frame. The bearing configuration shall consist of a lower thrust bearing and an upper sealed ball or roller locating bearing.

The pulley head shall be fitted with a stuffing box and shall have gland packings of adequate depths for sealing around the shaft, where the shaft exits the pump casing.

The gland packing shall be designed to permit high speed rotation without the possibility of seizing and charring the packing material or shaft. An automatic water seal shall be provided to prevent the entry of air into the pump.

DA 04.06.11 **Belt drives**

This clause only deals with V-belts, but full details of alternatives may be submitted to the Engineer for approval.

The Contractor shall install at least two belts per coupling.

The coupling (the belts, pulleys, shafts and keys) shall be selected such that it can safely transfer 200 % of the design starting torque and can operate up to a rotational speed of 150 % of the nominal duty speed.

The motor/engine and driven equipment shall be aligned and installed such that misalignment and stagger is within 60 % of the safe allowable limits specified by the supplier of the driving and/or driven equipment. Radial run-out on pulleys shall not be more than 1 % of the pulley diameter.

If the driving and driven pulleys are not in the same plane a maximum of a quarter twist turn between the driving and driven pulleys is allowed with a suitable belt length to prevent damage to the V-belts or pulleys.

Keys and keyways for load transfer to and from shafts shall comply with BS46 Part 1 and BS 4235 Part 2.

Suitable and accessible methods for adjusting the tension of the belts shall be provided.

The driving and driven pulleys and belts shall be enclosed in a single sturdy guard which allows visual inspection of the belt condition with the guard fitted. The guard shall be easily removable for belt maintenance.

Pulley sizes and ratios shall be selected such that operational belt speeds never exceed 25 m/s and are never less than 10 m/s.

The arc of contact on the small pulley shall be more than 120E. The pulley ratio shall not be less than 2,25:1, unless prior approval is obtained from the Engineer.

Belts shall be easily removed and installed for maintenance purposes and shall be to the approval of the Engineer.

The required belt tension to transfer the required load, including starting, shall not result in side trusts in the prime mover and pump head pulley bearing which exceed 60 % of the manufacturer's specified maximum allowable side thrusts.

DA 04.06.12 **Accessories**

Each pump discharge line shall be fitted with the fittings and accessories as indicated by the Engineer.

Each pump shall be fitted with a suitably calibrated pressure relief valve fitted in the delivery pipework immediately downstream of the outlet flange.

Each pump shall be fitted with a non-slam type reflux valve situated at the pump outlet. The reflux valve shall be a matched component supplied and tested by the pump manufacturer for efficient and troublefree operation.

DA 04.06.13 **Pump efficiency**

The efficiency of the pumps shall not be less than 75 %. The normal operational efficiency of the pumps shall not be less than 3 % below the peak efficiency of the pumps.

DA 04.06.14 **Pump technical details and installation**

The pump shall be a currently catalogued product. Documentation shall include performance curves or selection tables, indicating flow, head, power absorbed, speed and efficiency for the expected range of operational conditions.

Performance curves and selection tables shall be based on a reproducible and certified test carried out in an approved laboratory. Certified detail selection shown on these performance curves or tables shall be submitted.

The Contractor shall state in the technical data sheets, the minimum selected service life for which the pump has been engineered and the components selected when operated under normal working conditions with optimum servicing and maintenance.

The minimum acceptable service life is 15 years with 8500 operating hours per annum.

The pumps required shall be determined by the Engineer after the borehole yield testing to ensure the optimum use of each borehole.

The Engineer or his representative reserves the right to call for -

(a) Test certificates and reports from the manufacturer's quality control laboratory or an independent test laboratory such as SANS, and/or

(b) site inspection, customer reports/references and user's interviews, and/or

(c) full engineering, design and component selection details, in order to check the correctness of the service life claimed.

The pump shall be installed in accordance with the manufacturer's instructions and shall be maintained in "as new" condition at start up.

Details of the equipment shall include the following:

(a) Operating, testing and commissioning instructions

(b) Trouble analysis guide.

Full details of periodic and annual maintenance and service to be undertaken by the maintenance staff in accordance with a preventive maintenance programme shall be submitted.

DA 04.06.15 **Prime mover**

The pump shall be belt-driven by either an electric motor or diesel engine as specified in the schedule of quantities.

The prime mover and the pump pulley head shall be mounted on separate base frames.

DA 05 GENERAL SPECIFICATION FOR ELECTRIC MOTORS

DA 05.01 SCOPE, REFERENCE SPECIFICATIONS, STANDARDS AND CODES

This specification covers all aspects related to electric motors that may be incorporated in any of the items of equipment to be supplied under the contract.

DA 05.02 GENERAL REQUIREMENTS

(a) Electric motors shall be manufactured in South Africa and shall comply with the requirements of SANS 948.

(b) Where imported motors are offered they shall be submitted to the South African Bureau of Standards to be tested in accordance with the requirements of SANS 948 and the Engineer shall be provided with the appropriate certificate obtained from the South African Bureau of Standards stating that such motors do comply, prior to the installation of the motors. However, where tests reveal that motors do not comply, it shall be the responsibility of the Contractor to supply alternative motors which comply with the requirements of SANS 948 and which are acceptable to the Engineer. Where imported motors are not normally kept in stock in South Africa, written proof shall be provided of the availability of replacement parts as well as the delivery period of the parts after placing the orders.

(c) All motors shall be standard catalogue models and shall be readily available.

(d) All motors shall, where possible, be from the same manufacturer and shall have the same interchangeable frames. Variations in type and size shall, where possible, be limited to prevent stocking a variety of special spares.

DA 05. 03 WORKING VOLTAGE AND SUPPLY SYSTEMS

(a) The motors shall be capable of operating within ± 10 % of the nominal voltage supply without risk of damage. All motors shall be suitable for operating continuously at the specified 3-phase voltage under actual service conditions, including the ± 10 % system voltage tolerance, without exceeding the specified temperature rise determined by the resistance on a basic full load heat run.

(b) All motors shall be capable of operating continuously under actual service conditions

at any supply frequency between 48 and 51 Hz together with any voltage between plus and minus 5 per cent of the nominal supply voltage.

(c) The slip-in speed of any motor at 80 per cent of the nominal voltage at 50 Hz shall not exceed a percentage agreed on by the Engineer, and the motors shall be capable of operating at this voltage for a period of five minutes without deleterious heating.

DA 05.04 **TEMPERATURE RISE**

The temperature rise, as determined by resistance, of all motors, shall not exceed the following derated values:

Insulation class	E	B	F	H
Temperature rise (K)	50	60	80	100

DA 05.05 **EFFICIENCY AND POWER FACTOR**

(a) The efficiency of all motors shall be guaranteed by the Contractor. Deviations from the guaranteed efficiency shall be within the limits specified in SANS 948.

(b) The guaranteed efficiency of each size and rating of motor shall be as determined in accordance with BS 4999: Part 102. A basic test certificate of efficiency will be accepted for a motor of identical size and rating or a basic test of efficiency shall be conducted if no certificate is available.

(c) The power factor of motors with a capacity of 20 kW or more shall not be less than 0,9 under all operating conditions.

DA 05.06 **VIBRATION**

(a) Motors shall be statically and dynamically balanced.

(b) All motors shall be checked for vibration without load, and at full rated voltage at the manufacturer's works, and the vibration amplitude as measured shall be in accordance with BS 4999: Part 142, quality grade 'Normal'.

(c) The ratio of axial to radial vibration shall not exceed 0,5.

DA 05.07 **NOISE LEVEL**

Unless otherwise specified motors shall be of 'normal sound power', in compliance with BS 4999.

DA 05.08 **ENCLOSURE AND FRAME**

(a) Each motor shall be protected to the degree required by its application, and its enclosure shall be designed for the system of cooling associated therewith.

(b) Notwithstanding the requirements of DA 05.08 above, the minimum degree of protection shall be IP55 to SANS 1222 and, unless otherwise required, motors shall preferably be of the totally enclosed fan-cooled (TEFC) type.

(c) All motors of the vertical-spindle type and exposed to the weather, shall be provided with a robust canopy of approved design.

(d) Medium-length motors are preferred but short-length motors may be accepted where space is limited and written permission has been granted by the Engineer.

DA 05.09 **MOTOR TYPE**

Motors shall be of the squirrel-cage induction motor type. Slip-ring induction motors or other approved types will be considered if the Contractor is of the opinion that better results could be obtained by using such motors. Full electrical and mechanical details of each alternative shall be submitted with the tender documents.

DA 05.10 **RATING AND STARTING REQUIREMENTS**

(a) Motors shall be adequately rated for the service for which they are intended, and due allowance shall be made for the temperature, altitude, climatic conditions and

variations in the supply voltage. Motors shall, however, not exceed 120 % of the required capacity without prior approval having been obtained from the Engineer.

(b) Not only shall motors be based on the full load requirements, but the motor capacity and starting characteristics shall be compatible with the requirements of the driven equipment.

(c) Where motors are required to drive high inertia loads, the starting torque of the motor and the torque curve of the driven load shall be submitted to the Engineer for approval prior to manufacture. Such motors shall be capable of three starts per hour, with two consecutive starts from normal operating temperature, or more frequently if required by the Engineer.

(d) Motors shall be of the continuously running duty class S1 unless otherwise specified in the detailed specification or if a more onerous duty is dictated by the drive requirement.

(e) All squirrel-cage induction motors shall be suitable for direct-on-line starting at full voltage. Single-speed motors shall conform to BS 4999 part 41, Design B characteristics unless otherwise approved by or dictated by the drive requirements.

(f) All motors shall be capable of starting its associated load with a minimum accelerating torque of not less than 5 per cent of full-load torque when the voltage at the motor terminals during starting is reduced to 80 per cent of the nominal value.

(g) Unless otherwise approved, the -15 per cent tolerance on locked-rotor torque permitted by BS 4999: Part 69 will not be accepted and shall be limited to -10 per cent.

(h) Documentation shall include performance curves to suit the expected working conditions.

DA 05.11 **BEARINGS**

(a) All motors shall, wherever possible, be provided with prelubricated sealed bearings.

(b) Regreasable bearings shall require only one lubrication per year. Grease lubrication of ball or roller bearings, where approved, shall be by means of hexagonal button-type grease nipples to BS 1486: Part 2, Nos. 21A or 21B (industrial type).

(c) Grease-lubricated bearings shall have relief holes to ensure that the bearings have been correctly packed, which holes shall be positioned so that the excess grease can be easily removed. Cups shall be fitted to contain excess grease.

(d) Bearings shall be protected against eddy currents and shall be capable of withstanding vibrations caused by unbalanced loads.

(e) All bearings shall be designed for a life of 100 000 hours at B10 rating.

DA 05.12 **EARTHING**

All motors shall be provided with a machined or spot-faced boss tapped to receive a bolt of not less than 10 mm in diameter for earthing purposes, which is located on one side between the mounting feet.

DA 05.13 **HEATERS AND DRAINAGE**

Non-submersible motors which will be located out of doors or in a damp location such as in a drainage sump, shall be provided with suitable means of drainage to prevent the accumulation of water due to condensation. They shall also be fitted with anti-condensation heaters suitable for a 220V AC supply if considered advisable by the manufacturer.

Where specified in the project specifications, motors shall be supplied with anti-condensation heaters to keep the motor temperature at 23 °C when the motor is not operational to prevent moisture from condensing in the motor.

Heater terminal boxes shall be fitted on the motor frame and shall be of robust design, liberally sized and complete with suitable terminal block and mechanical cable gland or conduit entry.

DA 05.14 **TERMINAL ARRANGEMENTS**

(a) The line connections of each motor shall be brought out to a terminal box located in an approved position. In the case of two-speed motors, separate terminal boxes

shall be provided for each speed.

(b) Terminal boxes shall be of the totally enclosed type designed to exclude the ingress of dust and moisture and sealed from the internal circuit of the motor, and shall be manufactured from sand-cast metal. The wall thickness of the terminal boxes and the dimension of the cable inlet shall be as specified in SANS 948. The terminal box shall be so designed that the cable entry may be made in any one of four positions placed at right angles to one another.

(c) Terminal boxes shall be of ample size to allow the cable to be terminated in the box. Under no circumstances will the cable be allowed to be in contact with the inside of the box or lid.

(d) Terminals shall be of a substantial design and shall be suited to receive cable lugs. Pinch-screw connections will not be accepted.

(e) The terminal arrangement shall permit the motor to be disconnected from its supply cable without damaging the cable tails and shall allow the supply cable and motor windings to be tested separately.

(f) The electrical clearance and creepage distances, with the correct cable terminations in position, shall comply with the requirements of BS 4999.

(g) Terminal markings shall be clear and permanent and shall comply with BS 4999. Irrespective of the direction of rotation required on the site, the connections shall be such that, when the supply leads L1-L2-L3 are connected to the motor terminals U-V-W respectively, the motor shall rotate in a clockwise direction when viewed from the driving end.

(h) Motors suited for only one-directional rotation, shall be clearly marked as such by an arrow fixed to the motor frame at the driving end.

DA 05.15 MOTOR/LOAD COUPLING

(a) Motors shall be coupled direct to the equipment to be driven, by means of approved couplings. Vee-belt and chain drives shall be considered only if direct coupling of the motor to the equipment is impossible or impracticable. Motors driving vee-belt or chain drives shall be fitted with heavy-duty bearings suited to the full side thrust at 120 % of full load torque and short- term overloads of up to 250 % of the full load torques during starting. The stiffness of the rotor shaft shall be checked to ensure that resonance and fatigue do not occur.

(b) Where applicable, the flanges of the motors and equipment shall be identical.

(c) The precision tolerance class shall apply to all flange-mounted motors with regard to concentricity, perpendicularity and shaft run-out.

DA 05.16 SUBMERSIBLE MOTORS

The following additional requirements apply specifically to all submersible motors:

(a) All submersible motors shall be suited for submersion up to a depth of 1,5 times the depth of submersion shown on the drawings for each application, or as specified in the project specifications.

(b) All submersible motors shall have dynamically balanced rotors supported by maintenance-free, sealed-for-life ball bearings.

(c) All motors shall be suitably coated to ensure the satisfactory operation of the motor under the specified class of service.

(d) All terminal boxes shall be waterproof and suited for submersion up to the depth as specified for the motors.

(e) An adequate length of waterproof cable, purpose-made for submerging, shall be supplied with each submersible motor. The coupling of this cable to the normal power-distribution cable, which usually is of the PVC type with steel-wire armour, shall be placed at least 1,0 m above the maximum water level by means of a purpose-made, weatherproof, outdoor junction box. The submerged cable shall be supported to minimize any movement of the cable which results from turbulence caused by the operation of the equipment or the flow of the water.

(f) Thermistor protection shall be provided for submersible motors.

DA 05.17 ADDITIONAL REQUIREMENTS

(a) The rotation speed of motors shall not exceed 1 500 r/m unless approved otherwise by the Engineer.

(b) Thermistor protection shall be provided for each winding of each motor.

(c) The preferred class of insulation is Class F, derated in accordance with DA 05.16(d) above.

DA 05.18 TECHNICAL DATA SHEETS

Details of all individual electric machines and equipment requiring electrical energy shall be indicated on the 380 V motor and equipment schedule included in the technical data sheets.

DA 06 TESTING AND COMMISSIONING

DA 06.01 TESTS TO BE PERFORMED

(a) All pumping equipment shall be subject to the commissioning tests as described in Additional Specification SC: General Decommissioning, Testing and Commissioning.

(b) At least one of each type or size of pump supplied shall be subject to a delivery flow rate test. Flow rate or volumetric flow testing facilities will be supplied by others, unless otherwise specified in the detail specification.

(c) The operating point of each pump shall be determined.

(d) Efficiency tests will only be performed when specified in the detail specification.

(e) NPSH tests will only be performed when specified in the detail specification.

DA 06.02 PUMP OPERATING POINT

During the day 1 commissioning tests the pump operating point shall be determined by observing the following:

(a) Pump delivery and suction pressures, and

(b) Electric motor power consumption.

If no efficiency tests are required in the detail specification then the motor power consumption shall be calculated from the voltage and current measurements obtained during the commissioning test.
The Contractor shall supply the necessary adaptors, fittings and pressure gauges to measure the suction and delivery pressures. If no gauge fittings exist on the suction side, then the suction pressure conditions will be calculated from the system properties.

DA 06.03 FLOW RATE (DELIVERY), EFFICIENCY AND NPSH TESTS

(a) Testing will be done in accordance with BS 5316 Part 1, class C tests.

(b) Power consumption of electric motors shall be as determined by the three-wattmeter method where efficiency tests are required in the detail specification.

DA 06.04 TEST CONDITIONS

(a) All tests will be performed in situ.

(b) The pumped medium or liquid specified as the process liquid in the detail specifications shall be utilised during the tests. The Contractor shall obtain from the pump manufacturer the test point for clean water corresponding to the specified duty point for the pumped liquid, in order to relate the measured performance to the pump supplier's curves which are based on water.

DA 06.05 ADDITIONAL TESTS
Additional tests may be specified in the detail specification.

DA 07 MAINTENANCE

All borehole pumping equipment and systems shall be serviced and repaired, following

practical completion of the installation of which it forms part, to maintain it in perfect functional condition.

Maintenance to be carried out shall include routine preventative maintenance in accordance with the manufacturer's specification to be set out in the operating and maintenance manual, as well as unforeseen repair work or replacement.

The remuneration for monthly maintenance of borehole pumping equipment and systems shall be deemed included in the tendered rate for ten points of the installation of which the system forms part. Installations are specified in Additional Specification SA: General Maintenance.

The routine maintenance of the installations, systems and equipment shall include, but not be limited to the items listed in table DA 07/1 below:

DA 07.01 TABLE DA 07/01 ROUTINE MAINTENANCE OF INSTALLATIONS, SYSTEMS AND EQUIPMENT

NO	ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Remove, inspect and service submersible pumps	Four-monthly
2	Clean filters/strainers	Monthly
2	Inspect and clean air release valves	Monthly
3	Check V-belts	Monthly
4	Measure rest water-level	Weekly
5	Check MCC panel	Monthly
6	Check electric motors	Monthly
7	Log and record water meter reading and water usage	Daily
8	Log and record amps, volts and hour meter readings	Daily

DA 08 MEASUREMENT AND PAYMENT

DA.01 PUMP TESTING OF BOREHOLES ..... Unit: number

The unit of measurement shall be the number of boreholes tested on the written instructions of the Engineer.

The tendered rate shall include full compensation for all labour, equipment and material required for the complete testing of the boreholes in accordance with the specification.

DA.01.01 Extra over DA.01 for:

(a) The removal of existing equipment ..... Unit: number

The unit of measurement shall be the number of boreholes from which all the equipment is removed. The tendered rate shall include full compensation for the removal of existing operational pumps and motors and all associated pipework.

(b) Recovery of lost equipment..... Unit: number

The unit of measurement shall be the number of boreholes from which all the lost equipment is retrieved. The tendered rate shall cover the recovery of lost pumps and pipework for boreholes.

(c) Installation of temporary pumps..... Unit: number

The unit of measurement shall be the number of temporary pumps installed and later retrieved. The tendered rate shall be fully inclusive of the pump and pipes required to effectively test the boreholes in accordance with the specifications.

(d) Ground-water sampling..... Unit: number

The unit of measurement shall be the number of boreholes of which the water is sampled. The tendered rate shall be fully inclusive of the requirements of the specification irrespective of the number of samples taken from a borehole.

(e) Compilation of borehole report ..... Unit: number

The unit of measurement shall be the number of boreholes regarding which approved reports is compiled. The tendered rate shall be fully inclusive of the work required to

compile and produce six copies of each borehole recommendation report.

(f) Standing time.....Unit: day

The unit of measurement shall be the number of days no work could be carried out. This will cover periods when the test pumping rig and crew or, if more than one rig and crew are fielded, when all rigs and crews are idle, waiting for decisions by the Engineer where those decisions or whose presence is required before the commencement or continuation of the work instructed. Under no circumstances will standing time be payable for any delays other than those incurred by the Engineer's decisions. Except only for abnormal weather conditions as provided for in PS14 of Portion 1 of the Project Specifications, no standing time will be payable due to inclement weather or prevention of access to a site by the Contractor due to inclement weather.

(g) Interhole moves..... Unit: number

The unit of measurement shall be the number of interhole moves made. The tendered rate shall include all labour and equipment costs incurred in moving plant, equipment and labour from one hole to another hole.

(h) Removal of existing pumping equipment .....Unit: number

The unit of measurement shall be the number of boreholes from which equipment is removed prior to testing the borehole. The tendered rate shall cover the removal of existing pumping equipment from a borehole to be tested. Payment for removal up to an installed depth of 50 m shall be made at the unit rate tendered for in the Schedule of Quantities. Installed depths in excess of 50 m shall be remunerated for the first 50 m at the tendered unit rate and, for each full metre thereafter, at the rate per metre tendered in the Schedule of Quantities.

(i) Reinstallation of existing pumping equipment .....Unit: number

The unit of measurement shall be the number of boreholes in which removed equipment is re-installed. The tendered rate shall cover the reinstallation of existing pumping equipment in a borehole following test pumping of the borehole. Payment for installation up to a depth of 50 m shall be made at the unit rate tendered for in the Schedule of Quantities. Reinstallation depths in excess of 50 m shall be remunerated for the first 50 m at the tendered unit rate and, for each full metre thereafter, at the rate per metre tendered in the Schedule of Quantities.

The existing pumping equipment shall be reinstalled and left in working condition as it was found before removal unless the Contractor is instructed otherwise by the Engineer.

DA.02 REPAIR OF EXISTING STRUCTURES

DA.02.01 Brickwork..... Unit: m^2

The unit of measurement shall be the area of brickwork repaired.

The tendered rate shall include full compensation for all labour, materials and equipment required for the complete repair of brickwork.

DA.02.02 Concrete base slabs..... Unit: m^3

The unit of measurement shall be the cubic metre of concrete used in the repair of base slab.

The tendered rate shall include full compensation for all labour, materials, and equipment required to carry out the work as well as fro all work carried out.

DA.02.03 Clean around borehole.....Unit: number

The unit of measurement shall be the number of boreholes around which the area is cleaned and levelled.

The tendered rate shall cover full compensation for the cleaning of an area 20 m x 20 m around each borehole.

DA.02.04 Removal of concrete base slab.....Unit: cubic metre (m^3)

The unit of measurement shall be the cubic metre volume of concrete broken out of the existing base slab.

The tendered rate shall include full compensation for the removal of the concrete inclusive of all tools, labour, removal of surplus material to a damp site and all other work required to satisfactorily complete the task.

DA.02.05 **Painting of exposed pipework**.....Unit: m

The unit of measurement shall be the metre of pipework painted inside the pump house. The approximate diameter of the pipework is 100 mm.

The tendered rate shall include full compensation for the tools, labour, material, supply and delivery. The paintwork shall be conducted in accordance with Technical Specification BJ.

DA.03 **REPAIR/REPLACEMENT OF ELECTRICAL EQUIPMENT**

DA.03.01 **Detailed inspection and testing of components**.....Unit:number

The unit of measurement shall be the number of boreholes for which a detailed inspection has been performed and all electrical and mechanical components tested.

The tendered rate shall include full compensation for testing all electrical and mechanical components for carrying out inspections and for all labour and equipment needed to carry out the work.

DA.03.02 **Commissioning**.....Unit: number

The unit of measurement shall be the number of borehole installations commissioned.

The tendered rate shall include full compensation for all labour and equipment supplied and for the commissioning of each borehole installation.

DA.03.03 **Reconditioning of pumping equipment**..... Unit: number

The unit of measurement shall be the number of pumps and motors reconditioned.

The tendered rates shall include full compensation for replacement of components and materials and for, tools, transport, site handling and labour necessary for the complete reconditioning of pumping equipment to conform to all the specifications in Subclause DA 04.06.14: Pump technical details and installation.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

DA.03.04 **Repair of pumping equipment**.....Unit: number

The unit of measurement shall be the number of submersible pumps and motors repaired.

The tendered rate shall include full compensation for supply of an identification label, resetting the spacer between impeller and back plate and ensuring that impeller rotates freely, as well as cleaning and corrosion protection and installing a new hoisting chain.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

DA.03.05 **De-commissioning and removal of submersible pumping equipment**..... Unit: number

The unit of measurement shall be the number of submersible pumps and motors de-commissioned and removed.

The tendered rates shall include full compensation for tools, transport, site handling and labour necessary for the complete de-commissioning and removal of pumping equipment.

DA.03.06 **Servicing of submersible borehole pumps**..... Unit: number

The unit of measurement shall be the number of pumps serviced. The tendered rate shall include full compensation for servicing (including all consumables), cleaning, corrosion protection (including pump and motor base), adjusting, aligning, including disassembling and re-assembling. The tendered rate shall include all labour, tools, equipment and spare parts that form part of servicing as set out in the operating and maintenance manuals or as specified by the supplier.

DA.04 **SUBMERSIBLE CENTRIFUGAL PUMPS**

DA.04.01 **Supply and delivery of submersible borehole pumps:**

(a) (Pump description)..... Unit: number

(b) Etc for other pumps

The unit of measurement shall be the number of units supplied and delivered where each unit shall include one pump, one motor, one base plate, drop cable set, earth wire, flow inducer if required and all other accessories asspecified.

The tendered rates shall include full compensation for the design, manufacture, corrosion protection, testing, delivery to site, storage, patent rights, etc, of all the equipment complete as specified in the Specifications.

DA.04.02 **Installation of submersible borehole pumps:**

(a) (Pump description)..... Unit: number

(b) Etc for other pumps

The unit of measurement shall be the number of units installed. Each unit shall include one pump with motor or engine, base plate and all other accessories as specified.

The tendered rates shall include full compensation for the installation of the units, the making good of all damaged corrosion protection areas, maintenance and for all other costs and actions that are necessary to provide a complete and efficiently working system.

Payment under this item may only be claimed after the relevant operating manuals have been handed over to the Engineer.

DA.04.03 **Supply, deliver and install rising pipe (diameter and pressure class indicated)** .....Unit: number

The unit of measurement shall be the metre of rising pipe installed.

The tendered rate shall include full compensation for all labour, plant, transport and materials required to manufacture, supply and install the rising pipe, corrosion protection, fixing to the pump and base plate, including couplings, gaskets, nuts and bolts.

DA.04.04 **Remove existing equipment from borehole and store on site as directed by the Engineer:**

(a) (Equipment description)..... Unit: number

(b) Etc for other descriptions

The unit of measurement shall be the number of installations from which the equipment is removed.

The tendered rate shall include full compensation for the removal of the existing borehole equipment, providing a suitable storage facility, transporting the equipment to the storage facility and store the equipment for the period required.

DA.05 **SUBMERSIBLE PROGRESSING CAVITY PUMPS**

DA.05.01 **Supply and delivery of submersible progressing cavity pumping equipment:**

(a) Pump unit..... Unit: number

(b) Pulley head and base frame ..... Unit: number (c) Rising pipe..... Unit: m
(d) Rising pump shaft..... Unit: m

The unit of measurement for subitem DA.05.01(a) shall be the number of submersible progressing cavity pump units supplied and delivered.

The unit of measurement for subitem DA.05.01(b) shall be the number of pulley heads including two complete sets of drive belts and their protective safety cages (sized to enclose the drive pulley heads of the motor or engine, suited to the particular installation) and a base frame for each pulley head supplied and delivered.

The unit of measurement for subitem DA 05.01(c) shall be the linear metre length of rising pipe supplied and delivered.

The unit of measurement for subitem DA.05.01(d) shall be the linear metre length of shaft supplied and delivered.

The tendered rates shall include full compensation for the manufacture, corrosion protection, predelivery testing, transport to site, off-loading and all handling of equipment which shall include the following:

- the pump unit
- pulley head and base frame
- rising pipework and centralisers
- rising shaft and locating bearings
- all accessories including valves, fittings, V-belts, fasteners and auxiliary materials to render a complete pump unit.

DA.05.02 **Installation of submersible progressing cavity pumping equipment:**

(a) Pump unit.....Unit : number

(b) Pulley head and base frame.....Unit : number (c) Rising pipe .....Unit : m
(d) Rising pump shaft .....Unit : m

The unit of measurement for subitem DA.05.02(a) shall be the number of submersible progressing cavity pump units installed.

The unit of measurement for subitem DA.05.02(b) shall be the number of pulley heads including two complete sets of drive belts and a base frame for each pulley head installed.

The unit of measurement for subitem DA.05.02(c) shall be the linear metre length of rising pipe installed.

The unit of measurement for subitem DA.05.02(d) shall be the linear metre length of shaft installed.

The tendered rate shall include full compensation for the site handling and positioning and installation of the equipment including all labour and consumables required for a fully installed submersible progressing cavity pump.

Payment under this item may only be claimed after the relevant operating manuals have been handed over to the Engineer.

DA.06 **BOREHOLE STRUCTURES**

DA.06.01 **Clear area around borehole** .....Unit: square metre (m^2)

The unit of measurement shall be the square meter of area cleaned and levelled around the borehole.

DA.06.02 **Removal of concrete base slab**..... Unit: cubic metre (m^3)

The unit of measurement shall be the cubic metre volume of concrete broken out of the existing base slab.

The tendered rate shall include full compensation for the removal of the concrete inclusive of all equipment, labour, removal of surplus material to a dump site and all other work required to satisfactorily complete the task.

DA.06.03 **Laying of Concrete base slabs** ..... Unit: m^3

The unit of measurement shall be the cubic metre of concrete used for a new base slab or for the repair of a base slab.

The tendered rate shall include full compensation for all labour, materials, and equipment required to carry out the work, as well as cleaning of the construction area.

DA.06.04 **Brickwork** .....Unit: m^2

The unit of measurement shall be the area of brickwork repaired.

The tendered rate shall include full compensation for all labour, materials and equipment required for the complete repair of brickwork. The tendered rate shall also include the cleaning of the construction area and the removal of surplus material from site.

DA.06.05 **Repair of existing steel cover**.....Unit: number

The unit of measurement shall be the number of steel covers repaired.

The tendered rate shall include full compensation for all labour, materials and equipment required for the complete repair required and repainting of the existing borehole steel cover. The tendered rate shall also include the cleaning of the construction area and the removal of surplus material from site.

DA.06.06 **Supply, Deliver and Install new borehole enclosure** ..... Unit: number

The unit of measurement shall be the number of borehole enclosures installed.

The tendered rate shall include full compensation for all labour, materials and equipment required for the supply, delivery and installation of the new borehole enclosure complete as per the tender drawings. The tendered rate shall also include the cleaning of the construction area and the removal of surplus material from site.

DA.06.07 **Painting of exposed pipe work** ..... Unit: m

The unit of measurement shall be the metre of pipe work painted. The approximate diameter of the pipe work is 100 mm.

The tendered rate shall include full compensation for the tools, labour, material, supply and delivery. The paintwork shall be conducted in accordance with Particular Specification PBJ.

TECHNICAL SPECIFICATION

DC BOREHOLE SITING & DRILLING

CONTENTS

DC 01 SCOPE
DC 02 STANDARD SPECIFICATIONS
DC 03 CONTRACTOR'S RESPONSIBILITY AND APPROACH
DC
DC 04 DRILLING PROCEDURE
DC 05 MEASUREMENT AND PAYMENT

DC 01 SCOPE

This specification covers borehole drilling procedures, casing, backfilling, stabilising, protection and recording and reporting of related activities with the drilling of a borehole. The function of drilling of a borehole shall be supply of raw water to the facility at hand.

DC 02 STANDARD SPECIFICATIONS

DC 02.01 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.

DC 02.02 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.

DC 02.03 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.

DC 02.03 DWAF GUIDELINES

Minimum Standards and Guidelines for Groundwater Resource Development for the Community Water Supply and Sanitation Programme issued by the Department of Water Affairs and Forestry shall be adhered to unless otherwise specified.

DC 03 CONTRACTOR'S RESPONSIBILITY AND APPROACH

It is required that the drilling of any borehole be approached with due diligence and care on the part of the appointed drilling contractor. Specifically, it is required that the drilling of each borehole be approached on the premise that it will be successful and, as such, will serve the function of a raw water supply to the facility at hand. Under normal circumstances, the pre-drilling of a small diameter pilot borehole will not be allowed. Such an approach may only be considered with the approval of the Hydrogeological Consultant who shall be required to fully motivate such an approach to the Implementing Authority.

The Drilling Contractor shall function under the direct supervision of the Hydrogeological Consultant. This by no means implies that the Drilling Contractor is absolved from any responsibility. All drilling activities shall, therefore, be approached through communication and discussion between the Hydrogeological Consultant and the contractor with a view to developing the most suitable and mutually acceptable finished product serving the best interests of the project.

Failure by the contractor to timeously render advice and input where required shall be regarded as a dereliction of duty. This responsibility extends to informing the Hydrogeological Consultant of serious reservations regarding any aspect of the work. The contractor shall also be required to maintain the aesthetic appearance of the site during drilling operations, including keeping the site neat, tidy and free of litter. The contractor shall ensure that safety standards are met and that the work site is kept free, as far as is possible, from vehicular and pedestrian traffic and from interested bystanders and onlookers not involved with the project.

The appointed Drilling Contractor shall carry the final responsibility for the finished water supply borehole and all actions and activities leading up thereto.

DC 04 DRILLING PROCEDURE

DC 04.01 **WORKMANSHIP & PERFORMANCE**

The standard of workmanship of the Drilling Contractor shall be subject to close scrutiny by the Hydrogeological Consultant. Although it cannot be expected of the contractor to complete a specified number of boreholes in a given time period, it is reasonable to expect that "favourable progress" be made under normal circumstances and drilling conditions. An indication of what might be regarded as "favourable progress" is considered to fall in the range of 50 to 100 m of drilling advancement per day taking into consideration interhole moves and setup time.

Although work-in-progress may be completed, the contractor shall under no circumstances vacate a site before the Hydrogeological Consultant has inspected the completed works and provided written approval that the work executed conforms to the requirements of this specification.

DC 04.02 **DRILLING TECHNIQUE**

The drilling technique to be employed for the project at hand is that of rotary air percussion drilling employing a down-the-hole (DTH) hammer.

Depending on site-specific circumstances other techniques might be employed including: (1) mud rotary drilling, (2) Odex drilling, (3) dual-tube reverse circulation and (4) cable tool percussion drilling. Instances where another drilling technique might be considered more appropriate and efficient shall be identified by the Hydrogeological Consultant during the project and the Contractor informed accordingly.

DC 04.03 **EQUIPMENT AND MATERIAL**

The equipment made available by the Drilling Contractor shall be in good working order. Equipment shall be maintained in good condition for the duration of the project. Routine servicing and preventative maintenance of all equipment required for the drilling procedure and other ancillary equipment shall form the responsibility of Contractor and shall be deemed as included in the tendered rates.

The drilling equipment shall include a full air/foam pumping system. At the start of the project, the gauge diameter of the button drill bits to be employed with the rotary air percussion drilling technique shall conform closely to their manufactured gauge and shall also possess all of their tungsten carbide buttons.

The Hydrogeological Consultant shall discuss with the Drilling Contractor the retirement of a bit due to excessive wear or damage incurred during the course of the project. Further, it is imperative that the equipment be of a suitable size and capacity to deal, on occasion, with: (1) deep boreholes (up to 200 m), (2) larger than average borehole diameters (up to 254 mm), (3) large quantities of groundwater and (4) potentially onerous drilling conditions. Since this capability is provided in large measure by the air compressor, it is considered that a compressor having a capacity of at least 2400 kPa (24 bar) and a volume of at least 750 cfm is appropriate for most water borehole drilling applications and conditions using the rotary air percussion technique. In order to maintain the straightness of a borehole, the Hydrogeological Consultant may insist that the drilling contractor employ at least an overshot sleeve (drill collar) fitted to the pneumatic DTH hammer. Further precautions to ensure this aspect might include the use of a stabiliser rod immediately behind the bit/hammer/overshot combination. All materials to be used on the project should be new and meet project specifications.

Steel casing shall be: (1) of the seam-welded type, (2) round, (3) straight, (4) of uniform wall thickness and (5) have bevelled edges. Second-hand material such as steel casing recovered from an earlier borehole can be used provided that it has been refurbished to an acceptable condition. The Hydrogeological Consultant shall have the right to reject, with motivation, any material (including casing) that is deemed inappropriate, substandard or otherwise unsuitable for the project.

DC 04.03 **BOREHOLE CONSTRUCTION**

This sections addressed certain basic borehole construction practices which will contribute to final acceptance of the successfully finished product.

DC 04.03.01 **DRILLING DIAMETER**

Drilling of the water supply borehole shall commence at a diameter, which shall allow for the trouble free insertion of casing. Under normal circumstances, this entails drilling a 203 mm (8") or 216 mm (8½") diameter bore through the weathered overburden and any other potentially unstable near surface material. The bore shall penetrate at least three meters into fresh, more competent material before this horizon can be secured from potential collapse or wash-out by casing it off with nominal 165 mm (6½") or 152

mm (6") diameter steel casing. Thereafter, the bore is continued at 165 mm (or 152 mm) drilling diameter to its completion depth.

The presence of unstable rock formations (which are often also associated with groundwater-bearing horizons) at greater depths in the bore generally account for complications, which shall impact, on the abovementioned approach. The Drilling Contractor shall firstly attempt to penetrate through such horizons in order establish their vertical thickness. Such horizons often possess only a temporary instability and become "cleaned out" as drilling advances. In instances where such horizons remain unstable and severely hamper drilling progress, it will become necessary for the contractor to remove the surface casing and ream (widen) the borehole to a diameter of at least 203 mm (or 216

mm) to the depth of such unstable horizon. It will then be required to re-insert 165 mm (or 152 mm) nominal diameter casing to this depth and attempt to advance this casing through the unstable horizon.

In exceptional circumstances it may even be necessary to re-drill or ream the borehole to a diameter of 254 mm through unstable overburden material, insert nominal 203 mm (or 216 mm) diameter casing through this horizon and widen the borehole to 203 mm (or 216 mm) diameter below this depth to the unstable zone. Extremely onerous drilling conditions at depth might even warrant the commencement of drilling at a diameter of 305 mm or greater. This approach is often taken when aiming to maximise the exploitation of groundwater from a productive karst aquifer.

Information regarding the dimensions of the more commonly used button drill bits for rotary air percussion drilling is given in Table DC.1 together with casing diameters generally associated with each bit gauge.

Table DC.1.Dimensions of commonly used button drillbit gauge diameters for use with the rotary air percussion drilling method

BIT GAUGE DIAMETER	CASING INSIDE DIAMETER FOR DRILL-THROUGH PURPOSES
127 mm (5 in.)	143 to 146 mm
152 mm (6 in.)	156 to 159 mm
165 mm (6½ in.)	168 to 171 mm
203 mm (8 in.)	207 to 212 mm
216 mm (8½ in.)	
254 mm (10 in.)	257 to 264 mm
305 mm (12 in.)	

NOTE:

1. The bit gauge diameter is also given in the Imperial unit of inches (in.) since this unit is still in common use when referring to this parameter.
2. Casing inside diameter varies according to wall thickness (refer Table DC.2).

The information provided in Table DC.1 shows that each bit gauge passes comfortably through casing with a similar nominal diameter. For example, a 203 mm gauge bit can be used to extend the depth of a borehole already equipped with 207 to 212 mm inside diameter casing without having to reduce to the next smallest drilling diameter. Note also that a borehole drilled to a given diameter is able to accept casing having the next smallest diameter. For example, a 203 mm diameter borehole can be fitted with either 152 mm nominal inside diameter or preferably 165 mm nominal inside diameter steel casing.

In view of the foregoing, it is clear that the minimum final cased diameter of a successful raw water supply (for the extent of the facility at hand) borehole shall seldom be less than 152 mm nominal.

DC 04.03.02 **STEEL CASING**

Steel casing may either be used in a temporary manner or form a permanent part of the borehole infrastructure. Its temporary use is indicated in instances where, for example, the borehole is unsuccessful or the need for it to remain in place becomes redundant. Under these circumstances it is also referred to as a pre-collar, surface casing, starter casing, outer casing or soil casing generally to be removed (recovered) on completion of drilling. It shall be left in place where the Hydrogeological Consultant is of the opinion that the unsuccessful borehole should be secured to serve a long-term groundwater

monitoring purpose. In such instances, additional provision shall be made to protect the borehole against actions, which may compromise this function.

Steel casing shall be: (1) of the seam-welded type, (2) round, (3) straight, (4) of uniform wall thickness and (5) have bevelled edges. Secondhand material such as steel casing recovered from an earlier borehole can be used provided that it has been refurbished to an acceptable condition. The Hydrogeological Consultant shall have the right to reject, with motivation, any material (including casing) that is deemed inappropriate, substandard or otherwise unsuitable for the project.

More commonly, however, this casing constitutes the final casing with which a successful borehole is equipped. Its proper installation, therefore, is mandatory. It is installed from surface through unstable, unconsolidated or fractured materials usually occurring in the near surface. Under these circumstances, the function of steel casing includes one or more of: (1) supporting unstable materials against collapse into the borehole during drilling, (2) facilitating the installation or removal of other casing, (3) minimising the erosion and widening of the unstable upper portions of the borehole sidewall caused by the return flow established during drilling and/or the passage of drilling equipment/tools and (4) facilitating the placement of a sanitary seal and/or gravel pack or formation stabiliser.

In order to ensure as far as is possible that the annular space between this casing and the borehole sidewall remains open for the later emplacement of a sanitary seal, the circumferential entrance to this space shall be temporarily plugged. Hessian sacking packed around and lightly tamped into the surface entrance to this annular space can be used for this purpose. In instances where steel casing needs to be driven through unstable horizons (generally at greater depths in a borehole), it will be also be required that such casing be fitted with a casing shoe to protect the "mouth" of the casing from damage. Irrespective of the casing used to facilitate the drilling of the borehole, the final cased diameter of the finished product shall be sufficient for the borehole to easily accept a borehole pump. Since the outside diameter of the latter are generally in the order of 100 mm, it is required that the final cased diameter of the borehole not be less than 152 mm (6 in.) nominal where steel casing is used. Information on the dimensions of the more commonly used steel casing available locally is given in Table DC.2.

Table DC.2.Dimensions of commonly used and locally available steel borehole casing

OUTSIDE DIAMETER	WALL THICKNESS	INSIDE DIAMETER
165 mm	3.0 mm	159 mm
	4.0 mm	157 mm
(6 in. nominal)	4.5 mm	156 mm
177 mm	3.0 mm	171 mm
	4.0 mm	169 mm
(6½ in. nominal)	4.5 mm	168 mm
219 mm	3.5 mm	212 mm
	4.5 mm	210 mm
(8 in. nominal)	6.0 mm	207 mm
273 mm	4.5 mm	264 mm
	6.0 mm	261 mm
(10 in. nominal)	8.0 mm	257 mm

NOTES:

1. The casing outside diameter dimensions are also given in the Imperial unit of inches (in.) since this unit is still in common use when referring to this parameter.
2. Use of the term "nominal" when referring to casing diameter provides a directassociation with the gauge of the bit (Table DC.1) which most closely passes through it.

DC 04.03.03 **CASING SHOE**

This item is fitted (welded) to the bottom end (foot) of a casing string in order to protect the "mouth" of the casing from damage due to forcing the casing through unstable horizons. Its use is therefore only warranted (indeed mandatory) in instances where such conditions reveal themselves to require securement through the emplacement of casing.

DC 04.03.04 **uPVC CASING**

Also referred to as thermoplastic casing, the material generally comprises PVC (polyvinyl chloride) which, when treated to withstand ultraviolet radiation, is known as uPVC casing. Its application in the construction of water supply boreholes is

specific, being used mainly in instances where security against the collapse of a borehole sidewall is required and where steel casing does not already offer such security. In such instances, the casing is inserted the entire length of the borehole and will certainly be perforated for some portion of its length.

The diameter of this casing will also necessarily be smaller than that of the steel casing used which, in most instances, will have a nominal diameter of 165 mm. In order not to compromise too severely on the minimum nominal diameter requirement of 152 mm for successfully completed water supply boreholes, the inside diameter of the uPVC casing shall not be less than 128 mm with a wall thickness of 6 mm. It is also common practice to leave the steel casing in place in order to provide protection for the uPVC casing. The decision to use uPVC casing in the final construction of a borehole shall be made by the Hydrogeological Consultant.

DC 04.03.05 **PERFORATED CASING**

For the purposes of this project, perforated casing used shall be of a prefabricated type. As a general guideline, slots should be: (1) 300 mm in length, (2) 3 to 4 mm wide, (3) positioned in bands around the circumference of the casing, (4) spaced equally in each band, (5) each circumferential band of slots separated by 100 mm of plain pipe, (6) every second band of slots aligned with one another and (7) a 300 mm section of plain pipe left at both ends of the casing.

Bearing in mind that the number of slots forming each circumferential band depends not only on the casing diameter but also impact on the strength of the casing, it is suggested that the guidelines presented in Table DC.3 be adhered to in this regard.

Table DC.3.Recommended number of slots per circumferential band for various steel casing diameters and associated percentage open area provided

NOMINAL CASING DIAMETER	NUMBER OF SLOTS PER CIRCUMFERENTIAL BAND	PERCENTAGE OPEN AREA
152 mm	6	3.0%
165 mm	8	3.7%
203 mm	10	3.7%

Also presented in this table (Table DC.3) is the approximate open area provided by the above slot pattern applied to each of the given casing diameters. In certain instances, however, it may be required to use more sophisticated and expensive slotted casing. Also known as screens, these include: (1) continuously wound wedge wire screens, (2) louvered screens or bridge-slotted screens and (3) screens pre-coated with gravel. The decision to use such screens shall again be made by the Hydrogeological Consultant after providing motivation to and gaining acceptance from the Implementing Authority.

DC 04.03.06 **RECOVERY OF STEEL CASING**

The contractor shall make every effort to recover, only on instruction from the Hydrogeological Consultant, steel casing from unsuccessful or abandoned boreholes. This casing can also be refurbished to an acceptable condition for re-use.

DC 04.03.07 **BOREHOLE STRAIGHTNESS**

The Drilling Contractor in the presence of the Hydrogeological Consultant shall perform the straightness test and its success (or failure) recorded by this party.

A borehole, which fails a straightness test, shall be deemed lost and it shall be required of the Drilling Contractor to drill a replacement borehole at own expense. In the event that a straightness test is made before completion of the borehole, then the contractor shall be required to cease operations and facilitate access to the borehole for the duration of such activity.

DC 04.03.08 **BOREHOLE VERTICALITY**

The Hydrogeological Consultant in the presence of the Drilling Contractor shall perform the verticality test. The consultant shall therefore be required to provide the necessary equipment for conducting a verticality test. A borehole, which fails a verticality test, shall be deemed lost and it shall be required of the contractor to drill a replacement borehole at own expense. In the event that a verticality test is made before completion of the

borehole, then the Drilling Contractor shall be required to cease operations and facilitate access to the borehole for the duration of such activity.

DC 04.03.09 **BACKFILLING**

This entails filling the annular space between the borehole sidewall and the outside of the casing with suitable material. The purpose of annular backfilling includes: (1) the provision of a base on which to found a sanitary seal and (2) the provision of support for the sidewalls of the borehole and the casing. In instances where casing has been seated at a comparatively shallow depth in fresh material below a weathered near-surface horizon, all of the drill cuttings removed from the borehole whilst drilling represents suitable material for this purpose. Annular backfilling with this material is not advisable in instances where this is not the case, such as for example where the casing extends to a substantial depth and comprises slotted/perforated sections or where the water-bearing horizon is shallow and open to the borehole via slotted/perforated casing. In these instances, it shall be required to insert a formation stabiliser into the annulus. The backfilling shall extend to within approximately 5 m of the ground surface.

The Contractor shall allow for the cost of backfilling in the tendered rates.

DC 04.03.10 **FORMATION STABILISER**

This comprises material, which is placed in the annulus between the borehole sidewall and perforated/slotted sections of casing to stabilise the formation against collapse and ingress into the borehole. The drill cuttings and spoils removed from the borehole is not suitable material for this purpose. The stabiliser shall comprise material which is: (1) well sorted, (2) well rounded, (3) low in calcareous content and (4) graded such that the smallest grain size is larger than the casing perforations/slots. The stabiliser material can either be placed by hand or through a tremie pipe. Excessive bridging of stabiliser material in the annulus can be prevented: (1) through the use of centralisers on the casing or (2) by washing it in with clean water. The formation stabiliser should extend some 10 m above the top of the uppermost perforated/slotted section of casing before the borehole is developed.

The Contractor shall allow for the cost of formation stabilising in the tendered rates.

DC 04.03.11 **CONCRETE COLLAR**

The Drilling Contractor shall construct a shallow circular concrete collar around each successfully completed borehole. This collar shall have dimensions and volume as specified by the Hydrogeological Consultant. The concrete mixture shall required strength of some 30 MPa after 28 days. A similar collar may need to be constructed, on request of the Hydrogeological Consultant, over unsuccessful or abandoned boreholes.

The Contractor shall allow for the cost of the concrete collar in the tendered rates.

DC 04.03.12 **UNSUCCESSFUL AND ABANDONED BOREHOLES**

A borehole shall be declared unsuccessful at the discretion of the Hydrogeological Consultant. The latter may also, at any time during the course of the work, order the abandonment of a borehole in progress.

In such instances, the Hydrogeological Consultant shall instruct the Drilling Contractor on further actions to be taken. These may include either: (1) the salvage of any casing from the borehole and (2) the plugging of the borehole or
(3) the securement of the borehole for long term monitoring purposes, in which it case it shall be provided with a sanitary seal concrete collar protection and marking.

Plugging (or finishing) of an unsuccessful or abandoned borehole is aimed at removing any danger or hazard such boreholes may present to the environment, eg. as a conduit for the inflow of surface water into the groundwater regime or as a danger to traffic (whether human, stock or vehicular) in the immediate vicinity thereof. It shall also be required to cast a concrete collar over the infilled borehole.

The Drilling Contractor shall be remunerated for an unsuccessful or abandoned borehole on the basis of tendered rates in the Schedule of Rates for such of the following items as are relevant: (1) drilling per linear metre of depth for each relevant drilling diameter employed, (2) steel casing per linear metre thereof recovered, (3) backfilling,
(4) a sanitary seal, (5) borehole protection and (6) borehole marking. Payment for any casing left behind in an unsuccessful or abandoned borehole will only be made, on the same basis as described in (2) above, on written certification by the Hydrogeological Consultant that the contractor has made every reasonable attempt in this regard.

DC 04.03.13 **LOST BOREHOLES**

A borehole shall be declared lost by the Hydrogeological Consultant in the event that it can not be completed satisfactorily due to factors such as: (1) the irrecoverable loss of drilling equipment, materials or tools therein, (2) accident to plant or heavy machinery, (3) failure to pass a straightness test and (4) failure to pass a verticality test. A decision in this regard shall be made after

consultation with the Drilling Contractor, who shall have the considered option to either attempt remediation of the situation to the satisfaction of the Hydrogeological Consultant or, alternatively, declare the situation irretrievable. No payment shall be made for any work done, materials used or time spent by the Drilling Contractor on a lost borehole. The cost of any materials recovered in a damaged state from a lost borehole shall be borne by the contractor.

A borehole, which is declared lost, shall be replaced with a new borehole to be constructed by the Drilling Contractor in the vicinity of the lost borehole and at a position indicated by the Hydrogeological Consultant. Payment for a new borehole constructed under these circumstances shall be made on the same basis as for any other successfully completed borehole. Materials recovered in good condition may, however, be re-used by the contractor.

DC 04.03.14 **SANITARY SEAL**

Every successful water supply borehole shall be provided with a sanitary seal. The seal shall consist of portland cement mixed to slurry with bentonite and water, which is free of oil and other organic matter. The bentonite and water should be thoroughly mixed in the ratio of 2 kg bentonite to 25 l water prior to adding and mixing in 50 kg (one bag) cement. The final grout seal shall extend to a depth of at least 5 m below ground surface, ie. founded on the backfilling. In such shallow applications, the slurry can be gravity-fed into the annulus through a small diameter tube (tremie pipe) extending to the depth of emplacement. The tremie pipe should be withdrawn slowly as the slurry fills up the annulus. There shall be no voids in the sanitary seal.

The Contractor shall allow for the cost of the sanitary seal in the tendered rates.

DC 04.03.15 **BOREHOLE DEVELOPMENT**

The Geohraulogist shall submit proof of sufficient borehole development procedures. This activity shall be concluded with the collection of a 1liter representative water sample obtained from the return flow during development.

The Contractor shall allow for the cost of borehole development in the tendered rates.

DC 04.03.16 **BOREHOLE DISINFECTION**

The Geohraulogist shall submit proof of sufficient borehole disinfection procedures.

Guideline volumes/weights of common compounds to be used for disinfection purposes under most normal circumstances can be derived from the information provided in Table DC.4.

The Contractor shall allow for the cost of borehole disinfection in the tendered rates.

Table DC.4.Guideline volumes/weights of common sterilants to be used per unit volume of water for various borehole diameters

	VOLUME OF WATER PER METRE OF BOREHOLE	VOLUME/WEIGHT OF STERILANT TO BE USED FOR DISINFECTION PER UNIT VOLUME OF WATER BELOW GROUNDWATER REST LEVEL		
		Sodium hypochlorite	Calcium hypochlorite	Chlorinated lime
	18 l	500 ml (2 cups)	26 g (¼ cup)	90 g (1 cup)
	21 l	600 ml (2½ cups)	30 g (_ cup)	105 g (1 cup)
	33 l	940 ml (4 cups)	47 g (½ cup)	165 g (1½ cups)
	51 l	1500 ml (6 cups)	73 g (¾ cup)	255 g (2½ cups)

NOTES:

1. No distinction is drawn between open and cased portions of a borehole since these differences are considered to have a negligible impact on calculated unit volumes.
2. The trade percentage of chlorine in the listed sterilants is taken to be:
   - 3.5 percent by volume (35 ml/l) for sodium hypochlorite,
   - 70 percent by weight (700 g/kg) for calcium hypochlorite, and
   - 20 percent by weight (200 g/kg) for chlorinated lime.

EXAMPLE:
A 100-metre deep borehole with a nominal diameter of 165 mm and with a rest water level standing at a depth of 25 m below surface will require 75 x 30 g = 2,250 g (2.25 kg), alternatively 75 x _ cup = 25 cups, of calcium hypochlorite to achieve adequate disinfection. The same situation would require 75 x 600 ml = 45,000 ml (45 l) of sodium hypochlorite to achieve adequate disinfection.

DC 04.03.17 **BOREHOLE PROTECTION**

This entails sealing the borehole from the introduction of foreign material directly through the casing.

In order to provide the Hydrogeological Consultant with ready access to the borehole for water level measuring purposes, it is required that a small hole be drilled in the lid. This hole shall be furnished with a tamper-proof plug such as a "dead-end" threaded into a water pipe connector welded on the hole. The final diameter of the hole providing access to the borehole shall be sufficient to allow a "normal" dipmeter probe to pass through it. It is considered that a diameter of at least 10 mm and not more than 20 mm is suitable for this purpose.

The Contractor shall allow for the cost of borehole protection in the tendered rates.

DC 04.03.18 **BOREHOLE MARKING (IN THE FIELD)**

The activity itself represents marking the borehole by: (1) script-welding its assigned and unique identifying number onto the lid of the borehole and (2) planting a concrete block with dimensions of 200 mm x 200 mm x 200 mm (also bearing the number of the borehole) in the ground a distance of five metres to the north of the borehole.

It is the responsibility of the Hydrogeological Consultant to ensure that a borehole number is provided to the contractor for this purpose.

The Contractor shall allow for the cost of borehole marking in the tendered rates.

DC 04.03.19 **SITE FINISHING**

The activities associated with this task shall include the repair of construction scars on the work site resulting from drilling activities as well as the general cleanup of the site of waste materials, debris and oil spills. The latter shall be shoveled over and worked into the ground wherever possible.

Site finishing shall be deemed as included in the tendered rates.

DC 04.04 **DATA RECORDING AND REPORTING**

A detailed and accurate record of all information arising from the borehole drilling activity shall be recorded with care and diligence. The Drilling Contractor can collect much of this information. The Hydrogeological Consultant shall keep this current and available for inspection on request.

The contractor shall include the cost of data recording and reporting in the tendered rates.

It shall be the responsibility of the Hydrogeological Consultant to verify receipt of this information prior to certifying a claim by the Drilling Contractor in this regard. The following items of information represent the minimum number of parameters, which shall be monitored and recorded by the contractor:

- Penetration Rate
- Formation Sampling and Description
- Water Strike Depth
- Blow Yield
- Groundwater Rest Level

DC 04.05 **DOWN-THE-HOLE LOSS OF EQUIPMENT**

The Hydrogeological Consultant shall afford the contractor every opportunity and reasonable time to fish for lost equipment. The Drilling Contractor shall, in turn, keep the Hydrogeological Consultant informed of progress and the likelihood of success in this regard. The contractor shall have no claim against any other party for any losses incurred in this regard. The Hydrogeological Consultant shall finally decide on the fate of the borehole. It may either be declared successful or lost.

DC 04.05.01 **BOREHOLE DECLARED SUCCESSFUL**

Circumstances under which a borehole may be declared successful include: (1) the borehole has encountered significant water, (2) pumping equipment can be installed to an acceptable depth in the borehole and (3) the lost equipment does not pose a threat to the present and future quality of the groundwater. In the event that a borehole is declared successful despite the irrecoverable loss of drilling equipment, materials or tools therein, then the exact nature and position of the equipment lost in the borehole shall be recorded and appear in relevant project documentation. The Drilling Contractor shall be remunerated for a borehole declared successful under these circumstances on the same basis as for any other successfully completed borehole.

DC 04.05.02 **BOREHOLE DECLARED LOST**

Refer to paragraph DC 04.03.13.

DC 04.06 **BOREHOLE INFORMATION REQUIRED**

A detailed and accurate record of all information arising from the following activities shall be submitted by the Hydrogeological Consultant.

- Down-the-hole borehole measurement
- Borehole Construction Information
- Geological Information
- Hydrogeological Information
- Hydrochemical Information

The Contractor shall allow for the cost of the information in the tendered rates.

DC 04.07 **REHABILITATION OF EXISTING BOREHOLES**

The scope of this work may vary from the basic cleaning out and re- development of an existing borehole to the recovery of casing, the reaming and subsequent re-installation of casing. The nature of the rehabilitation required in each individual instance shall be identified prior to undertaking this activity since this shall indicate which equipment will most suitably complete the task.

The rehabilitation of an existing borehole shall be carried out under the supervision of the Hydrogeological Consultant. In any event, the execution of such work shall be subject to the same degree of data collection and record keeping as is required of a new borehole.

The Drilling Contractor shall be remunerated for this service on the basis of the rates tendered as per section DC 05. It shall be expected of the contractor to have assessed the potential technical risks involved with such work and, as a consequence, the contractor shall have no claim against any other party for the loss of equipment, materials or tools incurred in the course of such work.

DC 04.08 **FINAL ACCEPTANCE**

The Hydrogeological Consultant shall accept a successfully finished water supply borehole by issuing of a certificate of completion. At this stage, the Hydrogeological Consultant shall have established that all aspects pertaining to the work and the final product meet, at least, those of the various criteria and requirements set out above which have been imposed.

DC 04.09 **APPOINTMENT OF HYDROGEOLOGICAL CONSULTANT**

The Contractor shall be responsible for appointing a Hydrogeological Consultant for the purposes of this contract. The Hydrogeological Consultant shall be registered with the Department of Water Affairs and Forestry and shall be approved by the Engineer.

The Hydrogeological Consultant shall be responsible for the hydrogeological survey to site the borehole, oversee the drilling of the borehole and pump testing the borehole as

well classification of the drinking water for domestic purposes.

DC 05 MEASUREMENT AND PAYMENT

DC.01 DRILLING OF BOREHOLE ..... Unit: m

The contractor shall be remunerated for drilling per linear metre of depth at the rate tendered for each relevant drilling diameter employed.

The tendered rate shall include full compensation for all labour, equipment and material required, recording and reporting for the complete drilling of the boreholes in accordance with the specification.

DC.02 BOREHOLE CASING

DC.02.01 SteelCasing ..... Unit:m

The unit of measurement for steel casing per linear metre thereof supplied, delivered and installed.

The tendered rate shall include full compensation for all labour, materials, transport, recording and reporting and equipment required for the complete installation of the casing.

DC.02.02 Casing Shoe ..... Unit: item

Remuneration shall be for each casing shoe supplied and installed.

The tendered rate shall include full compensation for all labour, materials, transport, recording and reporting and equipment required for the complete installation of the casing shoe.

DC.02.03 uPVC Casing ..... Unit: m

The unit of measurement for uPVC casing per linear metre thereof supplied, delivered and installed.

The tendered rate shall include full compensation for all labour, materials, transport, recording and reporting and equipment required for the complete installation of the casing.

DC.02.04 Perforated Casing ..... Unit: m

The unit of measurement for perforated casing per linear metre thereof supplied, delivered and installed.

The tendered rate shall include full compensation for all labour, materials, transport, recording and reporting and equipment required for the complete installation of the casing.

DC.03 RECOVERY OF STEEL CASING ..... Unit: m

Remuneration for the recovery of steel casing shall be per linear metre thereof salvaged from a borehole.

The tendered rate shall include full compensation for all labour, materials, transport, recording and reporting and equipment required for the recovery of steel casing.

DC.04 APPOINTMENT OF HYDROGEOLOGICAL CONSULTANT

(a) Appointment of Hydrogeological Consultant..... Unit: PCSum

(b) Charge required by Contractor on subitem (a) above ..... Unit: %

Remuneration for the appointment of a Hydrogeological Consultant shall be based on a Prime Cost Sum. The Prime Cost Sum provided under subitem (a) in the Schedule of Quantities will be expended in accordance with Subclause 48(2) of the General Conditions of Contract.

The tendered percentage under subitem (b) will be paid to the Contractor on the value of each payment made to the Hydrogeological Consultant.

DC.05 REHABILITATION OF EXISTING BOREHOLES ..... Unit: m

The contractor shall be remunerated for rehabilitation of an existing borehole by by means of drilling per linear metre of depth at the rate tendered for each relevant drilling diameter

employed.

The contractor shall also be remunerated for the basic cleaning out and re- development of an existing borehole to the recovery of casing, the reaming and subsequent re-installation of casing. The nature of the rehabilitation required in each individual instance shall be identified prior to undertaking this activity since this shall indicate which equipment will most suitably complete the task.

The tendered rate shall include full compensation for all labour, equipment and material required recording and reporting for the complete drilling of the boreholes in order to rehabilitate an existing borehole in accordance with the specification.

The rehabilitation of an existing borehole shall be carried out under the supervision of the Hydrogeological Consultant. In any event, the execution of such work shall be subject to the same degree of data collection and record keeping as is required of a new borehole.

It shall be expected of the contractor to have assessed the potential technical risks involved with such work and, as a consequence, the contractor shall have no claim against any other party for the loss of equipment, materials or tools incurred in the course of such work.

TECHNICAL SPECIFICATION

DH OPERATION OF POTABLE WATER WORKS

CONTENTS

DH 01 SCOPE
DH 02 STANDARD SPECIFICATION AND REGULATIONS
DH 03 LEGAL AND GENERAL REQUIREMENTS
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DH 01 SCOPE

Potable water works shall mean all units, components, equipment and materials, and their relation to each other, employed to enable reliable and effective water treatment.

This specification covers the operation of a bulk water supply system with borehole pump systems and equipment related to effective water treatment.

The Contractor shall manage and operate the water supply system in accordance with the prescriptions in this specification, the relevant operation and maintenance manuals and **Additional Specification SF**. Operation duties shall generally refer to all tasks and actions required for operating the process units and components of the water works typically found at remote DPW sites such as police stations, border posts, etc. These works shall include (among others):

1. **Local authority connection with on-site storage:**
   - Water meter and isolating valves at connection
   - Feed to ground level and/or elevated tank(s)
   - Ground level tank/reservoir
   - Pump and rising main from ground level tank to elevated tank
   - Chlorination unit
   - Elevated tank(s): Plastic to 5kL capacity; pressed steel >5 kL
   - Feed from elevated tank to first user connection.

2. **Borehole(s):**
   - Four fully equipped production borehole(s): Duty (at least) and stand-by (where available)
   - Monitoring borehole (where applicable)
   - Water meter and isolating valves at each production borehole
   - Feed to ground level and/or elevated tank(s)
   - Ground level tank/reservoir
   - Pump and rising main from boreholes to ground level tank/reservoir
   - Chlorination unit
   - Elevated tank(s): Plastic to 5kL capacity; pressed steel >5 kL
   - Feed from elevated tank to first user connection.

3. **Desalination of brackish groundwater**
   - Reverse osmosis (RO) unit in full- or side-stream configuration, including high-pressure pumps, pressure vessel array and cleaning (CIP) system
   - Water meter in RO system pipework
   - Pre-treatment for RO process (where applicable), including anti-scalant addition and cartridge filtration
   - Post treatment (stabilisation) where applicable
   - On-site brine disposal.

This specification covers requirements for potable water quality, as well as testing procedures and equipment to verify these requirements.

This specification shall form an integral part of the repair and maintenance contract document and shall be read in conjunction with Portion 3: Additional Specifications included in this document.

DH 02 STANDARD SPECIFICATIONS AND REGULATIONS

DH 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.

SANS 1200	- Standardised specification for civil engineering construction
SANS 5667-2	- Water quality sampling, part 2: Guidance on sampling techniques
SANS 241	- South African Standard Specification for drinking water

DH 02.02 OTHER SPECIFICATIONS

The following Technical Specifications for repair and maintenance of water process units shall be read in conjunction with this specification and shall be deemed to form part thereof:

CI Pressed steel tanks
CE Water Distribution Networks
DA Borehole pump systems
DB Potable Water Filtration Systems
DF Potable Water Disinfection and Filtration Units SF General Operation

DH 02.03 ACTS, REGULATIONS AND STATUTORY REQUIREMENTS

All relevant regulations and statutory requirements as laid down in the latest edition of the following acts shall be adhered to:

- Occupational Health and Safety Act, 1993 (No. 85 of 1993)
- National Water Act (No. 36 of 1998)
- Water Services Act (No. 108 of 1997)
- Environment Conservation Act (No. 73 of 1989)
- National Environmental Management Act (No. 107 of 1998)

DH 02.04 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.

DH 02.05 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.

DH 03 LEGAL AND GENERAL REQUIREMENTS

DH 03.01 DEFINITION OF WATER USE

This specification covers the legal requirements for water use as regulated by the National Water Act (No. 36 of 1998). A large fraction of the activities performed by the Department of Public Works is covered by the general authorisations in terms of Section 39 of the Water Act. The following categories of water use are scheduled:

- Taking of water and storage of water (Section 2 (a) and (b)) of the Water Act.
- Engaging in a controlled activity, identified as such in Section 37 (1) of the Water Act. Irrigation of any land with waste or water containing waste generated through any industrial activity or by a water works (Section 21 (e) of the Water Act).
- Discharging of waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit, and disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generating process.
- Disposing of waste in a manner which may detrimentally impact a water resource (Section 28 of the Water Act).

DH 03.02 REGISTRATION OF WATER USE

According to the Water Act a water use must be registered with the Department of Water

Affairs and Forestry (DWAF). The prescribed forms are available on DWAF's internet web site:

http://www.dwaf.gov.za

The application forms for registration or licensing of a water use are available on the above website. Forms DW 771 / DW 758 R1c.doc (updated version) – Licensing Part 1: Company, Business or Partnership, National or Provincial Government are applicable.

Parts 1, 3, 4 and 8 of these forms will be completed by the Department of Public Works. All other forms shall be completed and submitted by the Contractor.

These registration forms shall be completed by the Contractor and must be submitted to:

The Director-General
Department of Public Works
Private Bag X65
PRETORIA
2001

For attention of: **Deputy Director, Water Management**

Based on the information so provided, the Department of Water Affairs and Forestry may require the applicant to apply for a license for the relevant water or wastewater use.

DH 03.03 LICENSING OF A WATER USE

In general a water use must be licensed unless it is:

- Listed in Schedule 1 (See page 152 of Government Gazette No. 19182 dated 26 August 1998)
- An existing lawful use.
- Permissible under a general authorisation (See Government Gazette No. 20526 dated 8 October 1999)

The responsible authority can waive the need for a license.

If licensing is required, the Department of Public Works will appoint an independent consultant for the duty.

DH 03.04 OPERATOR REGISTRATION AND CLASSIFICATION OF WATER CARE WORKS

In the terms of Section 26 (f) of the Water Act (No. 36 of 1988) operators shall be registered with the Department of Water Affairs and Forestry. The Contractor shall be responsible for the registration of workers/operators in terms of this requirement (See Regulation R2834 dated 27 December 1985). The Engineer will classify the water care works for tendering purposes.

DH 03.05 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

In terms of Government Notices R1182 and R1183 of 5 September 1997, new water care works as well as upgrading of water care works are generally subject to Environmental Impact Assessment. The relevant procedures are described in a guideline document: EIA Regulations, Implementation of Sections 21, 22 and 26 of the Environment Conservation Act (No. 73 of 1989).

An independent consultant will generally be appointed to conduct such assessment. An EIA must be submitted to the Department of Environmental Affairs and Tourism for approval by means of a Record of Decision.

Under normal conditions, an EIA will not be required for repair of water care works.

DH 03.06 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

An Environmental Management Plan (EMP) is required for all repair work that may generate waste (such as water treatment sludge) or that may detrimentally impact the environment during repair and operation of the water care works.

The Contractor shall prepare and submit an EMP to the Department of Public Works' project manager. His approval is not required, but the EMP should guide repair work so as to safeguard the environment from detrimental impact. The Contractor shall make provision in his tendered rates for all costs implied by the EMP.

DH 04 **GENERAL DESCRIPTION OF THE WATER SUPPLY SYSTEM**

DH 04.01 **PORT OF ENTRY: BULK WATER SUPPLY SYSTEM**

Water is pumped through a three boreholes with the delivery indicated in table DH.05.01 to the elevated concrete ground reservoir.

One additional borehole will also be connected to the elevated concrete ground reservoir indicated in table DH.05.01.

Potable water is pumped to an elevated concrete reservoir.

The complete bulk water system requires daily monitoring and operation in order to ensure effective reporting and supply of water to the operational area.

DH 05 **TECHNICAL DETAILS OF THE INSTALLATION**

DH 05.01 **LEBOMBO PORT OF ENTRY: BOREHOLE PUMP AND WATER PURIFICATION WORKS: REVERSE OSMOSIS**

The system comprises a self-contained reverse osmosis plant, with integral CIP system and anti-scalant dosing system.

The reverse osmosis plant must always be maintained and operated according to the manufacturer's specification. Improper maintenance and operation will result in membrane failure.

QTY	Position	Pump Description	Pump and Motor Description	Pumping Medium
1	Borehole submersible pump	Submersible Pump	2 ℓ/s with 80 m head	Clear borehole water
1	Filter feed and lifting pumps	Ebara Pump, model CMA 100T and CMB 150T	CMA 100T 0.75 kW and CMB 150T 1.1 kW	Clear water
1	RO Plant high pressure pump	Grundfos High Pressure Pump model CR10-12	Model CR10-12 4.0kW	Clear water

DH 06 **DETAILS OF THE REPAIR WORK**

Additional boreholes will be connected to the bulk water supply and a new chlorination system will be installed.

DH 07 **OPERATION**

DH 07.01 **GENERAL**

Operation shall include all activities and all other actions or rectifying measures necessary for optimal operation of water care works.

Remuneration for operation of the complete water works shall be deemed included in at the tendered rate for monthly payment of operation of the works.

DH 07.02 **PREPARATORY OPERATIONAL TASKS**

The preparatory tasks to be executed shall include, but shall not be limited to the items listed in the table below:

DH 04.02	PREPARATORY OPERATIONAL TASKS
01	Satisfy legal and general requirements**.**
02	Draft inventories of process units, components, materials, etc.
03	Draft process flow diagrams.
04	Derive from available information the design capacity and current load of the works.
05	Assess compliance with relevant design parameters to enable optimal operation of the plant according to its original functionality.
06	Draft plant-specific Operation and Maintenance manuals.
07	Institute required safety measures.
08	Draft template logbook.
09	Draft water balance of water and wastewater system.

DH 07.03 **GENERAL OPERATION WORK**

General operation of the water care works shall be done in accordance with this specification, with Additional Specification SF: General Operations, and with the Particular Specification related to this work.

The general operation work to be performed and executed shall include, but shall not be limited to the items listed in the table below.

DH 04.03	GENERAL OPERATION WORK	FREQUENCY
01	General housekeeping: Keep site and treatment facilities in neat and acceptable condition.	Daily
02	Control access to the site.	Daily
03	Maintain safety conditions on site.	Daily
04	Log and report pollution events, power failures, extraordinary process phenomena, etc. Check auto-reset of power to mechanical equipment.	Event
05	Calibrate water meters to ensure accurate flow data.	Six-Monthly
06	Record operating hours (and kW-hours where applicable) of all mechanical equipment.	Daily
07	Check operation of all valves and sluices.	Monthly

DH 07.04 **OPERATION OF SPECIFIC PROCESSES AND UNITS**

Operation of specific processes, units and components of the water care works shall be done in accordance with this specification, with Additional Specification SF: General Operations, and with the Particular Specification related to this work.

The specific operation work to be performed and executed shall include, but shall not be limited to the items listed in the table below.

DH 07.04.		OPERATION OF SPECIFIC PROCESSES AND UNITS	FREQUENCY
01		**Boreholes and equipment**	
	01	Check whether pump is operating.	Daily
	02	Record operating hours.	Daily
	03	Record pressure at borehole collar during operation.	Daily
	04	Record borehole water levels at start and stop of pump.	Daily
	05	Check operation of emergency stop switch.	Monthly
	06	Record meter reading.	Daily
	07	Record rainfall: Date, precipitation and duration per event.	Event
	08	Monitor pollution risk (e.g. septic tank or fuel depot close to borehole).	3 Months
02		**Treated water tanks and reservoirs**	
	01	Record water level in tank/reservoir.	Daily
	02	Empty and clean tank/reservoir.	6 Months
03		**Chlorination**	
	01	Check operation of chlorination facility.	Daily
	02	Ensure chlorine-dosing proportional to flow rate.	Weekly
	03	Measure residual chlorine concentration at outlet of contact tanks (generally the elevated storage tank).	Weekly
	04	Ensure dosage concentration and dosing rates compatible with specification requirements.	Weekly
04		**On-site pipework**	
	01	Flush pipework, tanks and geysers.	6 Months
	02	Measure residual pressure in pipelines.	3 Months
05		**Submersible pumps**	
	01	Check operation and correct switching of pumps.	Daily
	02	Clean pump suction sumps/chambers.	Weekly
	03	Check integrity of power supply and MCC	Monthly
06		**Power supply**	
	01	Check operation of stand-by generator where applicable	Daily

DH 08 **MONITORING AND REPORTING**

The contractor shall keep a written record of all measurements taken and analyses done for process control and for reporting to relevant authorities in terms of legal or project management requirements.

A logbook shall be kept for daily recording of failures, malfunctions, spills, pollution events, power failures and detail of corrective measures implemented.

The monitoring programme for the above measurements and analyses shall include, but shall not be limited to the items listed in the attached table.

DH 09 MEASUREMENT AND PAYMENT

DH 09.01 REGISTRATION OF A WATER USE.....Unit : Number

The unit of measurement shall be the number of potable water and sewage treatment plants to be registered. Boreholes are registered as single units. Separate forms are necessary for individual properties, as it is registered at the Surveyor General under its own title dead number. Multiple boreholes on the same property can be registered on the same form by using a summery of the location of each borehole.

The tendered rates shall include full compensation to obtain all relevant information from different authorities (Surveyor General, for instance) to complete the forms. It shall also include full compensation to complete and dispatch the application form

DH 09.02 ENVIRONMENTAL IMPACT ASSESSMENT (EIA): PRE-APPLICATION CONSULTATION, SUBMIT APPLICATION AND PLAN OF STUDY FOR SCOPING AND THE SCOPING REPORT..... Unit : Number

The unit of measurement shall be to perform the necessary tasks required by the relevant authorities to obtain authorisation for the proposed activity (or activities which may form any entity) up to the acceptance of and the issuing of Records of Decision. This can be performed by the contractor or if required, by the relevant authority, an independent consultant shall be appointed.

The unit of measurement shall be the number of scoping reports compiled by the contractor. The tendered rate shall include full compensation for performing the necessary tasks required by the relevant authorities to obtain authorisation for the proposed activity (or activities which may form an entity) up to the issuing of Record of Decision. Should it be required by the relevant authority that an independent consultant perform this duty such a consultant will be appointed for that purpose by the Department of Public Works.

DH 09.03 ENVIRONMENTAL IMPACT ASSESSMENT: PLAN OF STUDY FOR ENVIRONMENTAL IMPACT REPORT.....Unit : Number

The unite of measurement shall be to do a full Environmental Assessment if it is required by the relevant authority for the proposed activity (or activities which may form an activity), after the scooping report has been reviewed and accepted. The Environmental Impact Assessment shall be conducted by an independent consultant.

The tendered rates shall include full compensation for all the necessary tasks required by the relevant authority to authorise the activity (activities).

DH 09.04 ENVIRONMENTAL MANAGEMENT PLAN (EMP) DURING REPAIR AND OPERATION.....Unit : Number

The unit of measurement shall be number of EMP's compiled by the contractor. One EMP per site will be acceptable.

The tendered rates shall include full compensation for the compilation of an Environmental Management Plan, which will be executed during the repair,

maintenance, and operation of a potable water installation and sewerage purification works.

DH 09.05 REMUNERATION FOR OPERATIONAL RESPONSIBILITIES

Remuneration for the monthly operation of an installation is determined by a ten point per month scoring system (refer to score card in Technical Specification SF: General Operation of an Installation). The scoring system includes but is not limited to the following operational parameters:

- Potable water quality control analysis by an approved authority
- quality monitoring programme
- operation of a site laboratory
- tests performed on site to evaluate component performance
- record keeping and reporting system
- supply of chemicals necessary for the operation of the plant
- operators and supervisors
- tools and equipment for operational needs
- compliance with the required standard (SANS 241 Class 0 or Class 1) .

- daily operation of the entire plant to its optimum capacity
- Keep site clean, cut/mow weeds and natural grass to a length not longer than 50mm, remove shrubs and small trees from pond walls.

DH 09.06 **SUPPLY AND DELIVERY OF REVERSE OSMOSIS MEMBRANE ELEMENTS AND PRESSURE VESSELS**..... Unit : Number

The unit of measurement shall be number of elements and pressure vessels supplied and delivered.

The tendered rates shall include full compensation for the design, manufacture, corrosion protection, patent rights, pre-delivery testing and test certificates, transport for delivery to site and off-loading including all handling of the equipment. The equipment shall include the following:

End caps, o-rings, connectors and all pipe work for the stages and arrays.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

DH 09.07 **INSTALLATION, TESTING AND COMMISSIONING OF REVERSE OSMOSIS ELEMENT AND PRESSURE VESSELS** ..... Unit : Number

The unit of measurement shall be number of elements and pressure vessels, tested and commissioned.

The tendered rates shall include full compensation for the site handling and positioning of the equipment, including the fastening of the equipment in its designated position. The following shall also be included in the tendered rates:

(a) Coupling of all required pipes flanges, including all required gaskets, nuts, bolts, o-rings, connectors and washers;
(b) All required installation materials, labour and consumables to render a complete and working installation.

The tendered rates shall also include full compensation for all preliminary tests, delivery and efficiency tests if required and commissioning tests. Commissioning tests shall comply with the section dealing with testing and commissioning.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

DH 09.08 **SUPPLY OF CHEMICALS**..... Unit : Litre

The unit of measurement shall be the volume of Chemicals supplied in litres.

The tendered rates shall include full compensation for all labour, transport and site handling for the chemicals delivery and storage of the chemicals.

Separate items for chemical reagents and solutions which are required will be listed in Schedule of Quantities.

DEPARTMENT OF PUBLIC WORKS

BORDER CONTROL – PORTS OF

REPAIR, MAINTENANCE AND UPGRADING OF BUILDINGS, CIVIL INFRASTRUCTURE, ELECTRICAL INSTALLATIONS AND MECHANICAL EQUIPMENT

MONTHLY ANALYSIS REPORT- WATER PURIFICATION WORKS

																			YEAR		
MONTH	Conductivity (25^{O})	Dissolved Solids	pH (25	Turbidity NT	Calcium (Ca)	Chloride (Cl^{-})	Fluoride (F^{-})	Magnesium (Mg)	Potassium (K)	Sodium (Na	Sulfate (SO	Nitrate (NO_3	Zinc (Z	*Aluminium (Al)	Copper (Cu)	Iron (F	Manganese (Mn)	*Heterotrophic Plate	*Faecal Coliform	*Total Coliform	Total Hardness (CaC
JANUARY																					
FEBRUAR																					
MARCH																					
APRIL																					
MAY																					
JUNE																					
JULY																					
AUGUST																					
SEPTEMB																					
OCTOBER																					
NOVEMB																					
DECEMBE																					

* Tests to be submitted on a Monthly Basis

BORDER CONTROL – PORTS OF ENTRY

REPAIR, MAINTENANCE AND UPGRADING OF BUILDINGS, CIVIL INFRASTRUCTURE, ELECTRICAL INSTALLATIONS AND MECHANICAL EQUIPMENT

DAILY WATER CONSUMPTION REPORT IN k/ℓ

YEAR: MONTH:

DAY	A RAW WATER METER READING	B PRODUCT WATER METER READING	C WASTE	D BORE HOLE METER READING	E ELVATED TANK METER READING	D- DIFFIRENCE OF D AND E
1						
2						
3						
4						
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DEPARTMENT OF PUBLIC WORKS

BORDER CONTROL – PORTS OF ENTRY

36 MONTHS MAINTENANCE AND SERVICING OF BUILDINGS, CIVIL, MECHANICAL AND ELECTRICAL INFRASTRUCTURE AND INSTALLATIONS

BORE HOLE PUMP READINGS

YEAR:

MONTH:

Day	BOREHOLE 1: DELIVERY OF 1.2 ℓ/s for 12 HOURS						Comments
	Hour Reading	Hours worked	Amps	Water Meter Reading	m³ Pumped	m³/h	
1							
2							
3							
4							
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	DEPARTMENT OF PUBLIC WORKS	
	BORDER CONTROL – PORTS OF ENTRY	

36 MONTHS MAINTENANCE AND SERVICING OF BUILDINGS, CIVIL, MECHANICAL AND ELECTRICAL INFRASTRUCTURE AND INSTALLATIONS

BORE HOLE PUMP READINGS

YEAR:

MONTH:

Day	BOREHOLE 1: DELIVERY OF 1.2 ℓ/s for 12 HOURS						Comments
	our Reading	Hours worked	Amps	Water Meter Reading	m³ Pumped	m³/h	
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TECHNICAL SPECIFICATION

DL CHLORINATION SYSTEMS FOR THE DISINFECTION OF DRINKING WATER AT REMOTE BOREHOLE INSTALLATIONS

CONTENTS

DL 01 SCOPE
DL 02 STANDARD SPECIFICATIONS
DL 03 OPERATING AND MAINTENANCE MANUALS
DL 04 PROCUREMENT AND INSTALLATION OF CHLORINATION SYSTEMS
DL 05 TESTING AND COMMISSIONING
DL 06 OPERATION AND MAINTENANCE
DL 07 MEASUREMENT AND PAYMENT

DL 01 SCOPE

This specification states the requirements for all work related to the procurement, installation, testing, commissioning, operation and maintenance of chlorination equipment for the disinfection of drinking water at remote borehole installations. Chlorination equipment shall be provided as one of the following three technological systems, according to site-conditions and the relevant stipulations in this document:

1) Calcium hypochlorite dosing systems.
2) Sodium hypochlorite dosing systems.
3) Vacuum systems for gas chlorination.

Any on-site sodium hypochlorite generators, chlorine dioxide preparation systems or pressure systems for gas chlorination (direct chlorination) shall be deemed UNACCEPTABLE and are all excluded from the scope of this work.

DL 02 STANDARD SPECIFICATIONS

DL 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:

SANS 10298	- Indirect small to medium-sized gas chlorination systems for the disinfection of water
SANS 241	- Drinking water
SANS 10306	- The management of potable water in distribution systems
SANS 6052	- Residual chlorine content of water

DL 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

DL 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.

DL 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.

DL 03 OPERATING AND MAINTENANCE MANUALS

The Contractor shall be responsible for the compilation and production of operating and maintenance manuals including an inventory of all chlorination equipment.

This shall be done in accordance with Additional Specification SB: Operating and Maintenance Manuals. The completion of operating and maintenance manuals shall be a requirement for practical completion.

DL 04 PROCUREMENT AND INSTALLATION OF CHLORINATION SYSTEMS

DL 04.01 GENERAL

Chlorine and hypochlorite are strong bleaching and oxidizing agents and pose a SUBSTANTIAL SAFETY RISK.

The Contractor shall submit proof to the Engineer to demonstrate his (or his subcontractor's) understanding, skill and experience in the assembly of chlorination systems

All chlorine dosing equipment shall be manually adjustable to set accurate dosing rates within the range of average daily flow rates specified. The concentration of chlorine at the point of dosing shall be between 1 – 5 mg/l, so that the free residual chlorine concentration shall be between 0.2 – 1.0 mg/l at the furthest point of use in the water distribution system.

The chlorination system shall be installed in such a way as to dose upstream of overhead tanks/ reservoirs to provide for contact time. Where more than one borehole is used for water supply, the dosing point shall be installed in a common rising main, upstream of the overhead tanks/ reservoirs.

DL 04.02 CALCIUM HYPOCHLORITE DOSING SYSTEM

Calcium hypochlorite dosing shall be the system of choice for disinfection at small remote bore-hole water supply installations.

Calcium hypochlorite can be supplied as briquettes, chips or pellets. Chlorinators shall be designed to provide a consistently accurate dose of available chlorine to small water systems. Corrosion resistant plastics (polyethylene) shall be used in the product's construction.

All $Ca(ClO)_2$ supplied shall have a chlorine content of between 65 and 70% and an average moisture content of less than 4%. Calcium hypochlorite shall be properly packaged prevent contact with moisture and to ensure safety of handling. A shelf life of at least 3 months shall be maintained for supplied calcium hypochlorite.

The dosing plant uses a dry chemical product that is dissolved in water to make-up the required chlorine containing solution. When the chemical make-up tank is empty a specified mass of the chemical is added to the tank as it is filled with water to make up the required concentrate of chemicals in the solution.
The chemical solution used on this systems is 1,7% of Calcium Hypochlorite (*1,13% Cl)

Note*: Calcium Hypochlorite contains 68% chlorine

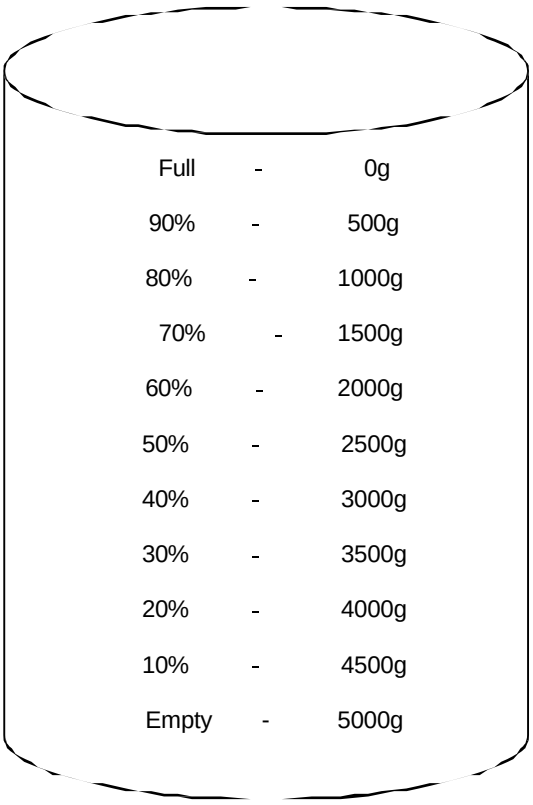
The principal of making up the chemical is to top up the tank once per week so that the tank is operating of the top half of the tank. This is done at the time of performing the weekly operational tasks. The level of the solution in the tank is used, as the indicator of how much chemical has to be added when performing the topping up task. If this is done, the concentrate of the chemical solution will stay constant.

The calcium component of the Calcium Hypochlorite will precipitate and cause a white settlement in the dosing tank. This settled white substance that accumulates at the bottom of the tank is not chlorine and needs to be cleaned out on a regular cycle as described in the three monthly procedures. The tank is used to its lowest operating level (15%) before executing the three monthly cleaning procedures.

The make-up tanks are marked in 10% increments. The mass of chemical that has to be added at each increment is indicated in gram at each increment as in the following illustration as example using the main plaza markings.

Illustration of the markings on the tank

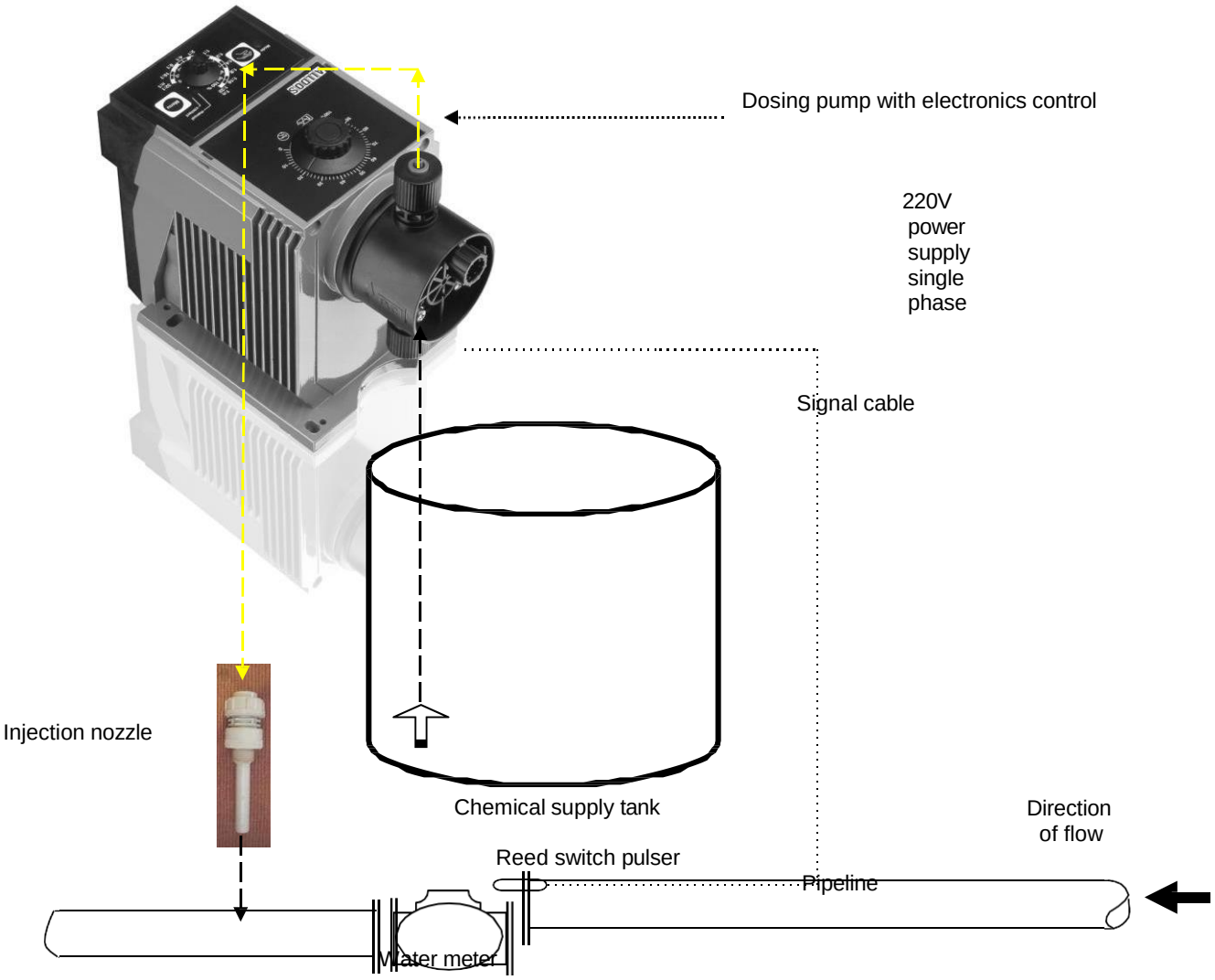
DL3



Tank level markings

Mass of Calcium Hypochlorite to be added when filling with water

Dosing proportionate to flow shall be done with displacement pulse dosing pump with electronic control, interlinked with flow meter, read switch pulses.



DL 04.03 **SODIUM HYPOCHLORITE DOSING SYSTEM**

Sodium hypochlorite is a colourless, transparent liquid, which shall be dissolved in cold water to a concentration of between 8 – 10% for liquid dosing. Sodium hypochlorite shall be safely stored, located it in a cool, dark place, maintaining pH 11 or more and avoiding contact with copper or nickel.

The size of dosing tank shall be dimensioned such and kept at a maximum level to ensure that sodium hypochlorite (NaOCl) does not break down to NaCl and NaOH.

A UV-stabilized polyethylene (PE) off-white or semitransparent dose tank is required, with a sintered drain-off connection and 4 lateral mounting places at the bottom on the tank shell. The dose tanks shall be optimized for stability and functionality.

The dosing apparatus shall be robust and shall not cause blockages. The dosing apparatus shall ensure absolutely precise dosing through a dosing process that is always strictly proportional to the quantity of water flowing through the main delivery pipe. This could be achieved through a flow meter in the dosing apparatus. The following special features shall be required:

(i) adjustable dosing capacity that avoids over- or under-dosing

(ii) automatic stop of an overload-proof synchronous motor under conditions of short-term pressure shocks, with automatic re-start when pressure drops to normal again

(iii) a control LED that indicates pump stokes, with a second LED that flashes if the liquid level becomes too low causing the dose pump to switch off automatically: the empty indication is directly combined with the suction line for this purpose.

DL 04.04 VACUUM GAS CHLORINATION SYSTEM

Vacuum gas chlorination systems shall only be considered where average daily flow rates are more than 8 l/s (i.e. around 700 m^3/d). The mean residence time of gas cylinders shall never be more than two months. Gas cylinders shall be mounted on mechanical balances.

Pressure systems feeding pressurized gaseous chlorine directly into the water supply system shall not be acceptable.

A dual system with two cylinders is required, including an automatic change- over device to switch between cylinders that shall be installed with a wall mounted manifold.

All chlorination equipment and ancillaries, the layout and installation, materials, operational safety measures and maintenance shall be strictly in accordance with SANS 10298.

DL 04.05 SAFETY SIGNS AT CHLORINATION INSTALLATION

Regardless of the type of chlorination system installed, warning signs shall be installed at the chlorination systems to be clearly visible. Warning signs shall also include all safety precautions for the operation and maintenance of chlorination systems, in accordance with the manufacturer's specifications and other relevant safety specifications and acts. A warning sign with first aid instructions shall also be installed at the chlorination system, specifying instructions for instances of skin exposure, eye exposure, inhalation exposure and swallowing, according to the manufacturer's specifications and SANS 10298.

DL 05 TESTING AND COMMISSIONING

After installation, the contractor shall evaluate the functioning of chlorination systems to ensure that there are no leaks and that the rate of dosing is set correctly.

DL 06 DESCRIPTION OF INSTALLATION

DL 06.01 BULK WATER

Water is pumped from multiple boreholes with borehole pumps and delivered into the elevated bulk storage tanks.

The boreholes are switched on and off to maintain a "full tank status". This manual does not cover details regarding the control of the boreholes.

An analysis of the borehole water indicated that the physical properties of the water were suitable for human consumption. The only treatment that the water requires is to dose it with a small quantity of chlorine so that any harmful bacteria and microorganisms that may enter the water can be destroyed.

A system was designed to dose chlorine at a rate of 0,5 to 2-mg/l. The object is to have a residual of chlorine left in the water so that by the time it reaches the user. The traceable presence of free chlorine should be between 0,2 to 0,5 mg/l. the dosing pump can be adjusted up or down to achieve the required residual.

The flow rate from the boreholes could vary depending on which of the boreholes are active and in which combination the boreholes are used. To maintain a constant dosing ratio (mg/l) the dosing facility has to be able to keep pace with possible fluctuations of flow from the boreholes.

"Proportionate to flow" takes place as follows:

- A water meter is used to measure the volume of water that is delivered from the boreholes to the storage tanks. This water meter is equipped with a sensor that gives one pulse for every 100L of water that has passed through the meter to the storage facility.
- A chemical dosing pump is used to dose a chlorine containing solution from the chemical make-up tank into the pipeline, before the water enters the storage tanks.
- The pulses from the water meter is received by an Alldos dosing pump with Etron electronics.
- Each pulse, as received from the water meter, is used to start the dosing pump and introduce a set volume of the chlorine containing solution into the pipeline to maintain

the required chlorine-dosing ratio

The dosing pump can be set to manual mode in case of failure of the signal from the water meter.

DL 06.01 WASTEWATER TREATMENT WORKS

The wastewater treatment works consists of a 180kg Chip Dozer with a capacity capable of holding 180kg Calcium Hypochlorite chips Scientific Chips.

The maximum feed rate is 50kg chips per hour and the system is capable of handling a flow rate 40-4000 litre water per hour. Is also consists of a double rotameter system with a 2000 litre maximum flow per rotameter.

The system must be regularly cleaned to prevent build-up and blockages. The cleaning procedure will form part of the maintenance and operation requirements.

DL 07 OPERATION AND MAINTENANCE

DL 07.01 GENERAL

Maintenance shall be carried out according to an approved maintenance plan and operation and maintenance manual, which shall specify actions including routine preventative maintenance according to the manufacturer's specifications, as well as unforeseen repair work, corrective maintenance and/or replacement of parts of the system.

DL 07.02 OPERATION AND ROUTINE PREVENTATIVE MAINTENANCE

The tasks related to the operation and routine preventative maintenance work shall include but not be limited to the GENERAL actions listed in table DL 06.02/1 below. SANS 241 shall be adhered to in the routine preventative maintenance of vacuum systems for gas chlorination.

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

TABLE DL 07.02/1

NO	ROUTINE PREVENTATIVE MAINTENANCE OF CHLORINATION SYSTEMS AND ANCILLARIES	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete system.	Daily
2	Clean complete installation thoroughly so that leaks would be obvious and clear when they occur.	Weekly
3	Check, service, repair and clean dosing apparatus from blockages.	Monthly
4	Corrosion protect all equipment and ancillaries.	Whenever necessary
5	Check for and repair all leaks. Report leaks.	Monthly
6	Check dosing rate and reset regulators if necessary.	Monthly
7	Measure residual chlorine in the drinking water system (DPD 4 or similar).	Weekly

DL 07.03 OPERATION

Operation of all chlorination systems shall include the supply of chemicals, including chlorine gas or sodium hypochlorite or calcium hypochlorite. The contractor shall supply chemicals to ensure that there is always enough supplied for a full month's requirement.

DL 07.04 SAFETY PROCEDURES AND PRE-CAUTIONS

SANS 10298 specifies operational safety in terms of general safety requirements, emergency action plans, personal protective equipment and handling of containers, which shall at all times be adhered to. Only personnel who are adequately trained shall be allowed to operate and maintain the chlorination systems.

DL 07.05 REMUNERATION

Remuneration for the monthly operation of chlorination systems, the supply of chlorine or

hypochlorite as well as ALL maintenance activities related to chlorination systems shall be deemed included in the tendered rate for ten points of the installation of which the system forms part. Installations are specified in Additional Specification SA: General Maintenance.

DL 08 MEASUREMENT AND PAYMENT

DL.01 **SUPPLY AND DELIVERY OF CHLORINATION SYSTEMS**..... Unit: number

The unit of measurement shall be the number of chlorination systems supplied and delivered, including all equipment and ancillaries deemed part of a functional system.

The tendered rates shall include full compensation for the design, manufacture, corrosion protection, patent rights, pre-delivery testing and test certificates. Different systems as specified in this document shall be listed in the Schedule of Quantities, according to:

i) Calcium hypochlorite dosing systems.
ii) Sodium hypochlorite dosing systems.
iii) Vacuum systems for gas chlorination.

Tendered rates shall include full compensation for all transport cost, including all handling of the equipment, loading and off-loading of chlorination systems.

Different systems shall be based on the daily average flow rate of the main water supply.

DL.02 **INSTALLATION, TESTING AND COMMISSIONING OF CHLORINATION SYSTEMS**.....Unit: number

The unit of measurement shall be the number of chlorination systems installed, tested and commissioned.

The tendered rates shall include full compensation for the site handling and positioning of the chlorination equipment, including the fastening of the equipment in its designated position. The following shall also be included in the tendered rates:

(a) Installation of all equipment, ancillaries and all other necessary appurtenances required to render a fully functional chlorination system;
(b) Coupling of all required pipes flanges, including all required gaskets, nuts, bolts and washers;
(c) Routing and fastening of all power cables, connecting of all electrical material and switchgear;
(d) All required installation materials, labour and consumables to render a complete and working installation.

The tendered rates shall also include full compensation for all preliminary tests, delivery and efficiency tests if required and commissioning tests to ensure a leak- free system and the correct settings of regulators to ensure accurate dosing.

Separate items will be listed in the Schedule of Quantities for different types and sizes of systems, as specified under payment item DL.01.

PARTICULAR SPECIFICATION

DW SUPPLY OF WATER

CONTENTS

DW 01	SCOPE
DW 02	STANDARD SPECIFICATIONS, REGULATIONS AND CODES OF PRACTICE
DW 03	DETAIL OF WORK
DW 04	PLANT: TRANSPORT
DW 05	TESTING
DW 06	PAYMENT ITEMS

DW 01 SCOPE

Procure, deliver and discharge, into the storage container(s) at each facility, potable water complying with the specified quality standards.

DW 02 STANDARD SPECIFICATIONS, REGULATIONS AND CODES OF PRACTICE

The supply of water is to be undertaken in compliance with the relevant specifications, regulations and/or codes of practice included in the following publications.

- SANS 241 of 2006 - South African Standard Specification for Drinking Water*
- SANS 10252-2: 1993 – Code of Practice "Water Supply and Drainage for Buildings, Part 2: Drainage Installations for Buildings" – Annexure B – Septic Tank Systems*
- National Water Act, Act No 36 of 1998**
- Occupational Health and Safety Act, No 85 of 1993*

DW 03 DETAIL OF WORK

DW 03.01 PROCUREMENT OF WATER

DW 03.01.01 Procurement of potable water

Water of quality in compliance with the South African Standard Specification for Drinking Water, SANS 241: 2006 and volume to meet the facility requirements is to be procured on a legal basis from a source(s) identified by the Contractor. Written proof of purchase, quantity, quality and date(s) is to be provided with the Contractors application for payment for services provided under the Contract.

DW 03.01.02 Procurement of raw water

Raw water is to be procured on a legal basis from a source(s) identified by the Contractor. Written proof of purchase, quantity, quality and date(s) is to be provided with the Contractors application for payment for services provided under the Contract.

DW 03.02 DELIVERY OF WATER TO FACILITIES

DW 03.02.01 General

The Contractor shall deliver the water to facilities on instruction from the Engineer within 24 hours.

DW 03.02.02 Delivery of potable water

The Contractor shall ensure that the water is not contaminated during delivery and upon discharge into the facility storage container(s) and must comply with the following macro- and micro-determinants and bacteriological limits:

MACRO- AND MICRO-DETERMINANTS	
1	**2**
Determined Mg/□	**Class 1**

Turbidity Magnesium	1
(as Mg) Sodium (as	70 max.
Na) Chloride (as Cl)	200 max.
Sulphate (as So4)	200 max.
Nitrate + nitrite (as N) Fluoride	400 max.
(as F)	10 max.
Zinc (as Zn)	1.0 max.
Aluminium (as Al) pH	1.0 max.
Conductivity Iron	0.3 max
Manganese	6.0 - 9.0
	150 mS/m
	0.2
	0.1

MICROBIOLOGICAL REQUIREMENTS				
1	**2**	**3**	**4**	**5**
Determinants	**Units**	**Allowable compliance contribution**		
		95% of samples, min	**4% of samples max**	**1% of samples max**
		Upper limits		
Heterotrophic plate count	Count/ml	100	1000	10000
Total coliform bacteria Feacal	Count/100 ml	Not detected	10	100
coliform bacteria	Count/100 ml	Not detected	1	10

DW 04 PLANT: TRANSPORT

The Contractor shall ensure that the type, condition and capacity of the vehicle(s), including standby vehicles, to be used is sufficient to fulfil the obligations of the Contract. The transport operation shall be undertaken in compliance with relevant transport ordinaries.

DW 05 TESTING

The Contractor is responsible to ensure that tests required ensuring compliancy with the specifications and ordinaries relating to the quality of water, are undertaken at the frequency and in terms of procedures prescribed.

DW 06 PAYMENT ITEMS

DW 06.01 **Supply units of 1000 litres (m^3) of potable water from commercial sources on the instruction of the Engineer/Department's representatives** .....Unit: m^3

The unit of measurement shall be the number of cubic metres of potable water delivered to site within 24 hours from the time that the Engineer has logged an emergency breakdown call with the Call Centre.

The tendered rate shall include full compensation for the labour, materials and equipment needed to supply potable water into the elevated storage tank as directed by the engineer.

The tendered rate shall include, initial testing of water quality, value related as well as all time related preliminary and general charges, the operation and maintenance cost of the vehicle and the remuneration costs of the driver and workers. Separate items will be listed in the schedule of quantities for different rates of delivery.

DW 06.02 Supply and delivery units of 1000 litres (m^3) of potable water from existing sources within a 3km radius on the instruction of the Engineer/Department's representatives

. .....Unit: m^3

The unit of measurement shall be the number of cubic metres of potable water delivered to site within 24 hours from the time that the Engineer has logged an emergency breakdown call with the Call Centre.

The tendered rate shall include full compensation for the labour, materials and equipment needed to supply and deliver potable water into the elevated storage tank as directed by the engineer.

The tendered rate shall include, initial testing of water quality, value related as well as all time related preliminary and general charges, the operation and maintenance cost of the vehicle and the remuneration costs of the driver and workers.

DW 06.03 **Supply units of 1000 litres (m^3) of raw water on the instruction of the Engineer/Department's representatives** ..... Unit: m^3

The unit of measurement shall be the number of cubic metres of raw water delivered to site.

The tendered rate shall include full compensation for the labour, materials and equipment needed to supply and deliver raw water into the raw storage tank or raw storage dams as directed by the engineer. It shall be possible to treat the raw water with the existing water treatment works on site to a standard that is in compliance with the South African Standard Specification for Drinking Water, SANS 241: 2006.

The tendered rate shall include, initial testing of water quality, value related as well as all time related preliminary and general charges, the operation and maintenance cost of the vehicle and the remuneration costs of the driver and workers. Separate items will be listed in the schedule of quantities for different rates of delivery.

DW 06.04 **Delivery of potable water from commercial sources on the instruction of the Engineer/Department's representatives** ..... Unit: km

The unit of measurement shall be the number of kilometres travelled from the commercial source approved by the Engineer delivered to the storage tank.

The tendered rate shall include full compensation for the labour, materials and equipment needed to transport potable water into the elevated storage tank as directed by the engineer.

The tendered rate shall include, value related as well as all time related preliminary and general charges, the operation and maintenance cost of the vehicle and the remuneration costs of the driver and workers.

PARTICULAR SPECIFICATION

EJ WATER QUALITY TESTING

CONTENTS

EJ 01 SCOPE
EJ 02 STANDARD SPECIFICATIONS
EJ 03 FLOW MEASUREMENT
EJ 04 DETAIL OF WORK
EJ 05 MEASUREMENT AND PAYMENT

EJ 01 SCOPE

This particular specification is applicable to the water quality testing by chemical analysis for both the sewage treatment works and the potable water purification works at LEBOMBO , Land Ports of Entry.

The specification covers requirements for sewage effluent standards as well as potable water standards. Testing procedures and equipment to verify these standards are also covered.

EJ 02 STANDARD SPECIFICATIONS

EJ 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:

SANS 5667-2	-	Water quality sampling, part 2: Guidance on sampling techniques
SANS 5667-2	-	Water quality sampling, part 10: Guidance on sampling of wastewater.
SANS 5011	-	Water - pH value
SANS 5217	-	Water - free and saline ammonia content
SANS 6048	-	Water - chemical oxygen demand
SANS 6049	-	Water - suspended solids content
SANS 6057	-	Electrical conductivity of water
SANS 4831	-	Microbiology: General guidance for the enumeration of coliforms: Most probable number technique
SANS 4833	-	Microbiology: General guidance for the enumeration of coliforms: Colony count technique at 30 °C
SANS 241:2006	-	Drinking water

EJ 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

EJ 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.

EJ 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.

EJ 03 FLOW MEASUREMENT

Flow rate shall be measured and recorded daily to populate a database of the following parameters:Total flow

(a) Maximum flow (peak flow)
(b) Minimum flow (night flow).

EJ 04 DETAIL OF WORK

EJ 04.01 **GENERAL**

As part of the operational responsibilities on this project the Contractor shall regularly test wastewater and effluent quality as specified in the following clauses.

Operation shall include maintaining all testing equipment, including equipment not supplied as part of the Contract, in a clean and perfect functional condition.

EJ 04.02 **TEST LABORATORY**

The existing buildings shall be utilised as a site laboratory. Should the Contractor require more space, it shall be provided at his cost.

EJ 04.03 **TEST EQUIPMENT**

The contractor shall provide for the following analytical glassware and testing apparatus as part of this Contract:

(a) Bench top pH, accurate and precise to at least 0,1 pH unit, including reference electrode and glass sensor or combination electrode;
(b) Turbidity meter.
(c) Electrical conductivity meter, with error not exceeding 1 % or 0,1 m S/m;
(d) Magnetic stirrer with PTFE (Teflon) stirring bars;
(e) 3 x 1 000 millilitre Imhoff cones with wooden rack;
(f) 2 x 500 millilitre volumetric flasks;
(g) 3 x pipettes (glass);
(h) 5 x 500ml glass beakers
(i) 2 x 1000ml plastic beakers
(j) 3 X 1000 ml graduated measuring cylinders

EJ 04.04 **WASTE WATER AND POTABLE WATER QUALITY TESTING**

Waste water and potable water quality shall be tested within the first month after completion and commissioning of the sewage treatment plant and the water purification plant respectively.

See Operation Schedules for respective waste water treatment works.

EJ 04.05 **SEWAGE EFFLUENT QUALITY TESTS**

The final effluent of the sewage treatment plant shall comply with the general limit of the General Authorizations in terms of Section 39 of the Water Act,1998 (Act No. 36 of 1998): DISCHARGE OF WASTE OR WATER CONTAINING WASTE INTO A WATER RESOURCE THROUGH A PIPE, CANAL, SEWER OR OTHER CONDUIT; AND DISPOSING IN ANY MANNER OF WATER WHICH CONTAINS WASTE FROM, OR WHICH HAS BEEN HEATED IN, ANY INDUSTRIAL OR POWER GENERATION PROCESS

The following analysis shall be performed by an approved authority on a monthly basis on the final effluent of the sewage works.

Faecal coliforms.(per 100ml)
Chemical Oxygen demand (mg/l) pH
Ammonia as Nitrogen (mg/l)
Nitrate as nitrogen (mg/l) Chlorine
as free chlorine (mg/l) Suspended
solids (mg/l) Electrical conductivity
(mS/m)
Ortho-phosphate as phosphorus (mg/l)

Provision shall be made for the full analysis as published in table 3.1 of the GENERAL AUTHORIZATIONS once during the term of the contract.

The sample shall be taken at the outflow of the last maturation pond.

J 04.06 **MONITORING PROGRAMME FOR SEWAGE TREATMENT WORKS**

Regular measurement of the quantity and quality of wastewater final effluent shall be recorded according to the requirements of Government Notice no 1191: General Authorisations in terms of section 39 of the National Water Act, 1998 (Act no 36 of 1998), 8 October 1999. Licensed works shall be monitored in accordance with the license requirements.

The Contractor shall keep a written record and report electronically on a prescribed report form of all values for the duration of the Contract, of the following wastewater discharge and relative activities:

(a) Quantity of wastewater final effluent discharged;
(b) Quality of the wastewater final effluent discharged;
(c) Detail of the monitoring programme;
(d) Detail of failures and malfunctions in the discharge system and detail of measures taken

EJ 04.07 **POTABLE WATER QUALITY TESTS**

An approved testing authority shall analyse the potable water on a monthly basis as per analysis schedule in particular specification PDH. Provision shall be made for a full Physical, organoleptic, and chemical requirements analysis once during the contract period. The sample shall be submitted to the testing authority according to prescription. The water distributed to consumers shall comply with the SANS 241:2006 Specification for the standards of drinking water. Only Class 1(recommended operational limit) water shall be distributed for human consumption.
The following analysis shall be performed by an approved authority on a monthly basis on the water delivered to the consumers.

MICROBIOLOGICAL ANALYSIS OF THE WATER IN ACCORDANCE WITH THE MICROBIOLOGICAL SAFETY REQUIREMENTS ACCORDING TO THE SANS 241:2006

The following analysis shall be performed by an approved authority on a monthly basis on the water delivered to the consumers.

Turbidity (NTU**)**
Calcium as Ca (mg/l)
Chloride as Cl^- (mg/l)
pH value
Electrical conductivity
Dissolved solids (mg/l)
Sodium as Na (mg/l) Nitrate as N (mg/l) Magnesium as Mg (mg/l) Sulfate as $SO4^=$ (mg/l) Aluminium as Al (µg/l) Iron as Fe (µg/l) Manganese as Mn (µg/l) Dissolved organic Carbon

EJ 05 **MEASUREMENT AND PAYMENT**

Remuneration for the monthly maintenance of the wastewater quality monitoring programme, maintenance of a site laboratory if necessary, laboratory equipment, testing to be performed on site during the maintenance phase as specified and record keeping system shall be deemed included in ten points for the maintenance of the installation of which wastewater quality control, measurement and testing form part.

Remuneration for all work and expenses related to water and wastewater quality tests by approved testing authorities in terms of SANS 10259 shall be paid to the Contractor as tendered for the number of tests including all water quality parameters as specified in EJ.

The Contractor shall be responsible for payment of testing authorities for any tests performed by them.

EJ4

Monthly Water Report

DWAF Water Use Registration Classification

Farm Name	Title Deed	Water Use	eg No	Expiry Date

DWAF Operator Registration &

Name & ID Number	Classification & Date of Issue

Class -

Date	Sample Point	Flow	Microbiological		Nitrate as N	Sulfate as SO4	Chloride as Cl^-	Sodium as Na	Magnesium as Mg	Calcium as Ca	Cl2	Al	Fe	Mn	pH		Turbidity		Cond.	DOC	Comments
			E. coli	Thermotol.coli							Free				Raw	Final	Raw	Final			
	Units	m3/day	col/100 ml		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	pH Units		NTU		mS/m	mg/l	Matters that require attention for the proper performance of the Water Works
	Spec.		nil	nil	<10	<400	<200	<200	<70	<150		<0.3	<0.2	<0.1		5.0-9.5		0.1 - 1	<150	<10	

Compiled:

Date:

Checked:

Date:

Sewage Analysis Report

DWAF Water Use Registration

Farm Name	*Title Deed*	*Water Use*	*Reg No.*	*Expiry Date*

DWAF Operator Registration

Name	*Reg No. & Date*

Class Works

Spec	Sample Point	Date	Flow	NH_3-N	NO_3-N	PO_4-P	COD	SupSol	pH	Cond	Res Cl_2	SAR	F-Coli	Comments
	Units		*m^3/day*	*mg/l*						*mS/m*	*mg/l*		*col/100 ml*	
	Water Act: Spec A: General Limits			*6*	*15*	*10*	*75*	*25*	*>5.5 <9.5*	*DW+70*	*0.25*		*1000*	
	Water Act: Spec B: Special Limits			*2*	*1.5*	*2.5*	*30*	*10*	*>5.5 <7.5*	*DW+50 <100*	*0*		*0*	
	Water Act: Spec C: Irrigation Limits(up to 500m^3/day						*400*		*>6.0 <9.0*	*<200*		*<5*	*100 000*	**Matters that require attention for the proper performance of**

Compiled: **Checked:**

Date: **Date:**

TECHNICAL SPECIFICATION

EA WASTEWATER INLETWORKS

CONTENTS

EA 01 SCOPE
EA 02 STANDARD SPECIFICATIONS
EA 03 ADDITIONAL REQUIREMENTS FOR REPAIR AND INSTALLATION OF WASTEWATER INLET WORKS EQUIPMENT
EA 04 OPERATION AND MAINTENANCE MANUALS
EA 05 DETAIL OF REPAIR WORK
EA 06 MAINTENANCE
EA 07 MEASUREMENT AND PAYMENT

EA 01 SCOPE

Wastewater inlet works shall mean all materials, units, components and equipment, and their relation to each other, employed to enable reliable screening, grit deposition and flow measurement of water at a variety of flow rates.

This specification covers the supply, delivery, repair, installation, testing and commissioning, as well as the maintenance of wastewater inlet works and equipment such as hand raked screens, hand stops and open channel sluices, grit channels, as well as flow measurement sensors and converter devices.

This specification shall form an integral part of the repair and maintenance 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 also be responsible to manage and maintain the wastewater inlet works in accordance with the prescriptions in this specification. The repair work and maintenance of the particular wastewater inlet works are specified in the relevant clauses on detail of repair work and maintenance in this specification.

EA 02 STANDARD SPECIFICATIONS

EA 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:

SANS 1200 - Standardized specification for civil engineering construction

EA 02.02 OTHER SPECIFICATIONS

NA

EA 02.03 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.

EA 02.04 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.

EA 02.05 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.

EA 03 ADDITIONAL REQUIREMENTS FOR REPAIR AND INSTALLATION OF WASTEWATER INLET WORKS EQUIPMENT

The specifications in EA 03 are of a general nature and if not referred to in Clause EA 05:

Detail of Repair Work, are not considered part of this Contract.

EA 03.01 FLOW MEASUREMENT REQUIREMENTS

In an open channel the flow rate shall be measured via the head caused by an obstruction such as a Parshall or long-throated flume, for which the relevant standardised head/flow rate conversion formulae shall be applied.

In a closed pipe system the flow shall be measured by the Doppler effect on the ultrasonic pulses passing through the liquid in the pipe.

Ultrasonic sensors shall be used to measure the Doppler effect, and an electronic converter device shall be employed to calculate the flow rate.

Apart from electronic flow measurement, a metal level indicator shall be installed in the channel at the correct position for measuring the depth (head). The level indicator shall be a ruler that shows both depth and flow rate on separate scales. The ruler shall have a black background and figures shall be yellow and clearly visible for people with normal eyesight from a standing position. The units of the ruler shall be millimetre for depth and m^3/h for flow rate. The scales shall be such that at least ten figures for each scale can be shown on the ruler.

EA 03.02 ULTRASONIC FLOW METERS AND LEVEL METERS

EA 03.02.01 General

All ultrasonic flow meters shall be microprocessor-based, non-contact meters and be able to be programmed to read flow accurately passing through any pipe or type of flume or over any type of weir, or to read level/volume accurately in an irregularly shaped container.

EA 03.02.02 Operating principle in Open Channels and Closed Pipes

In open channels a burst of ultrasonic pulses is transmitted from a transducer, which is not in contact with the medium. These pulses are reflected off the top surface of the medium and received by the same transducer. The time delay between the transmitted and received signal is proportional to the level between the transmitter/receiver, which is fixed, and the medium, which is variable. To compensate for the temperature dependence of the ultrasonic signal, the ambient temperature shall be measured at the transducer and shall be taken into consideration when the level difference is calculated between transmitter and medium.

In a closed pipe pulses pass through the wall of the pipe and through the liquid. The movement of liquid changes the characteristics of the pulses which are detected and calibrated to indicate a flow rate.

EA 03.02.03 Constructional requirements

The ultrasonic transducer shall include a built-in temperature sensor and shall have a minimum enclosure rating of IP 65. The transducer shall be corrosion protected, as well as immune to ultra-violet radiation.

The flow calculation shall be temperature compensated.

For flow application, the instrument shall provide for the following standard primary flow elements:

(a) Venturi flumes
(b) V-notched weirs
(c) Parshall flumes
(d) Broad crested weirs, or
(e) Any special obstruction with a known relationship between height of medium and flow rate.
(f) Closed, full flow pipes.

For this open channel applications a ten point look-up table with linear interpolation is deemed satisfactory.

For flow applications the instrument shall be equipped with a local flow rate indicator and an 8-digit totaliser. If the totaliser is fed from the microprocessor, it shall be supplied with a minimum of 24-hour battery backup to prevent data loss in the event of power failure.

In addition to the above, for flow meter applications a galvanically isolated pulsed output shall be provided for remote totalising.

A galvanically isolated 4-20 mA output, linear to flow or level shall be provided for remote indication and processing.

In open channel conditions where no stilling well is provided as part of the measuring structure, a suitably dimensioned stilling well shall be supplied as part of the instrument.

The control unit shall be supplied complete with battery backup to prevent loss of set- up data in the event of a power failure.

The control unit and associated power supplies and surge protection shall be housed in the previously detailed instrument enclosure.

For level measurement and/or multiple pump sump level control, the instrument shall be equipped and configured as follows:

(a) Control relays

A minimum of three single pole changeover (SPCO) relays shall be provided for pump control or level alarms. The on and off points for each relay shall be separately programmable.

Each relay shall have a battery backed four-digit (min) hours run time counter.

Time delay between individual relay on signals shall be possible to prevent electric or hydraulic shock loads.

The above relays shall be programmable as rate of rise or fall alarms.

(b) Alarm relay

A single-pole change-over relay shall be provided to signal mains failure, echo loss or any other instrument fault or high or low alarm as required.

(c) Current output

A galvanically isolated 4-20 mA signal linear to the tank/sump level shall be provided. The apron shall be selectable to be rising or falling with level and shall be selectable as part of or the full range of the instrument.

(d) Pumped volume indicator

By means of a minimum 8-digit totaliser, the instrument shall record the approximate pumped volume through a sump. An isolated pulsed output shall be provided for remote indication of this information.

(e) Auto test routine

An auto test routine shall be provided for level instruments used for pump sump control whereby a rising from zero level to transducer face and back again, can be simulated to check the operation of the level control system.

EA 03.02.04 Installation requirements

The ultrasonic transducer shall be supplied complete with mounting bracket and frame. The mounting frame shall be rigid and made from stainless steel. The transducer shall be mounted in such a way that it is free from all handrails, walkways, etc. Passing traffic and the operation of other machines in the vicinity of the transducer shall have no influence on the transducer.

The installation shall include all required interconnections and sundries between the sensor and control unit.

All equipment shall be installed according to the manufacturer's requirements.

EA 03.02.05 Accuracy

The accuracy of the measurement shall be better than 0.25 % of full scale.

EA 03.03 REQUIREMENTS FOR HAND RAKED SCREENS

Hand raked screens to be supplied under this Contract shall be manufactured from stainless steel. Screens shall be installed with stainless steel Rawl bolts in the channel floor and against the wall.

The screen shall be installed at an inclination of 70^{o} with the horizontal. The screen shall be manufactured and installed as illustrated on the drawings.

EA 03.04 REQUIREMENTS FOR GRIT CHANNELS

Grit channels shall be repaired where the concrete surfaces of the channel floor and walls have corroded. All corroded surfaces shall be repaired by applying a layer of quick setting epoxy grouting to the surfaces.

Grit channel sluice gates to be supplied under this Contract shall be manufactured from stainless steel to fit the channel dimensions. Sluices shall have a stainless steel cable, which connects them to the channel.

EA 04 OPERATING AND MAINTENANCE MANUALS

The Contractor shall at the start of the Contract be given all available 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.

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

EA 05 DETAIL OF REPAIR WORK

EA 05.01 GENERAL

The Engineer will demarcate any areas to be repaired and shall instruct the Contractor with regard to the repair work to be done.

EA 05.02 INLET WORKS

Repair work to the inlet sump, screen chambers and grit channels shall include the following:

LEBOMBO Port of Entry:

Replace corroded hand rake screen cover stands.

EA 06 MAINTENANCE

EA 06.01 GENERAL

Maintenance shall include all repair work, replacing of components, routine setting, fixing of leaks, general corrosion protection or any other actions or rectifying measures necessary for complete operation of wastewater works. Routine preventative maintenance according to the manufacturer's specification as set out in the operating and maintenance manual, as well as unforeseen repair work or replacement, shall be carried out.

Remuneration for maintenance of the complete wastewater inlet works shall be deemed included in ten points for the tendered rate for monthly payment of maintenance of the installation of which it forms part.

EA 06.02 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 table EA 06.02/1 below.

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

TABLE EA 06.02/1

NO	ROUTINE PREVENTATIVE MAINTENANCE OF INLET WORKS	MAINTENANCE FREQUENCY
1	Check and lubricate sluice guide rails.	Monthly
2	Clean and calibrate flow rate measurement device	Monthly

EA 06.03 FLOW RATE MEASUREMENT

The Contractor shall be responsible for the proper performance of flow measurement devices. To

ensure a perfect functional condition, the flow measuring devices shall be cleaned and calibrated monthly. The measuring devices shall be calibrated regularly by a manufacturer's representative according to his specification. Apart from regular calibration, the Contractor shall keep records of flow measurements to establish base line data that will be used for future monitoring and periodic maintenance calibration.

EA 07 MEASUREMENT AND PAYMENT

EA.01 SUPPLY AND DELIVERY OF SCREENING EQUIPMENT ..... Unit: number

The unit of measurement shall be the number of specified units of screening equipment supplied and delivered.

The tendered rates shall include full compensation for the design, manufacture, corrosion protection, patent rights, pre-delivery testing and test certificates, transport for delivery to site and off-loading, including all handling of the equipment. The equipment shall include the following:

(a) The wastewater screen
(b) Two hand rakes
(c) Stainless steel cable to lock hand rake to screen.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EA.02 SUPPLY AND DELIVERY OF FLOW MEASURING EQUIPMENT..... Unit: number

The unit of measurement shall be the number of specified units of flow measuring equipment supplied and delivered.

The tendered rates shall include full compensation for the design, manufacture, corrosion protection, patent rights, pre-delivery testing and test certificates, transport for delivery to site and off-loading, including all handling of the equipment. The equipment shall include the following:

(a) The flow sensor
(b) The converter device and transducer.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment, flow measuring devices installed, tested and commissioned.

EA.03 INSTALLATION, TESTING AND COMMISSIONING OF FLOW MEASURING EQUIPMENT ..... Unit: number

The tendered rates shall include full compensation for the site handling and positioning of the equipment, including the fastening of the equipment in its designated position. The following shall also be included in the tendered rates:

(a) Installation of the flow measuring sensor;
(b) Installation of the converter device;
(c) All required installation materials, labour and consumables to render a complete and working installation.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EA.04 INSTALLATION, TESTING AND COMMISSIONING OF SCREENING EQUIPMENT .....Unit : number

The unit of measurement shall be the number of screens tested and commissioned.

The tendered rates shall include full compensation for the site handling and positioning of the equipment, including the fastening of the equipment in its designated position. The following shall also be included in the tendered rates:

(a) Installation of the screen;
(b) All required installation materials, labour and consumables to render a complete and working installation.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EA.05 DECOMMISSIONING AND REMOVAL OF WASTEWATER INLET WORK EQUIPMENT ..... Unit : number

The unit of measurement shall be the number of specified units of wastewater inlet works

equipment decommissioned and removed.

The tendered rates shall include full compensation for all labour, machinery, tools, transport and site handling necessary for the decommissioning and removal equipment.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EA.06 **RECONDITIONING/SERVICING OF WASTEWATER INLET WORKS UNITS AND STRUCTURES**

(a) Clean screen chambers, grit channels and inlet work structure and treat corroded surfaces with quick-setting epoxy grouting .....Unit : square metre (m^2)

(b) Clean and remove silt and grit from raw water inlet structures .....Unit: number

(c) Remove, corrosion protect, paint and replace 25 mm diameter rod screen ..... Unit : number

(d) Decommissioning, servicing, testing, re-commissioning and calibration of flow measuring equipment:

(i) Ultrasonic open channel flow meter with transducer and totaliser, including all cables, fixtures and appurtenances..... Unit : number

(ii) Etc. for other types of flow meters

(e) Decommissioning, servicing, testing, re-commissioning and calibration of Huber mechanical screens….....Unit: number

The unit of measurement shall be the number of specified waste water inlet units and equipment decommissioned and reconditioned/serviced, or the square metre of screen chambers, grit channels and inlet work structures cleaned or treated.

The tendered rates shall include full compensation for all components, materials, tools, transport, site handling and labour necessary for the complete reconditioning of wastewater inlet works units and equipment in conformance with the specifications in Clause EA 05, Detail of repair work.

EB PUMP SYSTEMS

CONTENTS

EB 01 SCOPE
EB 02 STANDARDS
EB 03 PUMP DESIGN AND REQUIREMENTS
EB 04 MOTOR DESIGN AND REQUIREMENTS
EB 05 WORKING VOLTAGE AND SUPPLY SYSTEMS
EB 06 PROTECTION AND CONTROL DEVICES
EB 07 DETAIL OF WORK
EB 08 TESTING AND COMMISSIONING
EB 09 MAINTENANCE
EB 10 MEASUREMENT AND PAYMENT

EB 01 SCOPE

This section covers the decommissioning, removal, repair and reconditioning, installation, testing, commissioning and maintenance of pumping equipment, aerators, motor control devices and low voltage cables.

EB 02 STANDARDS

This specification shall be read in conjunction with the following specifications:

BS 5316, Part 1:	Acceptance tests for centrifugal, mixed flow and axial pumps.
SABS 948	Three-Phase Induction Motors
SABS 1222	Enclosures for electrical equipment (classified according to the degree of protection that the enclosure provides)
BS 4999	General requirements for rotating electrical machines
BS 1486: Part 2	Heavy duty lubrication nipples
ISO 281/1	Rolling bearings – dynamic load ratings and rating life

EB 03 PUMP DESIGN AND REQUIREMENTS

(a) Submersible pumps shall be designed to be suitable for submersion in sewage up to a depth of 5.0 m.

(b) The pump shaft shall be manufactured from stainless steel and shall be sealed where it enters the casing with double mechanical face seals.

(c) The impeller shall be suitable for pumping a type of wastewater as specified in EB 07: Detail of work. All impellers shall be of the non-clogging type. The spacer between the impeller and backplate shall be reset every six months to the minimum distance to prevent clogging of rags between impeller and backplate.

(d) The impeller shall be manufactured from stainless steel or, in the case of other materials, it shall be coated with an approved material resistant to abrasion and corrosion due to the environment specified. For pumps rated below 2 kW, non-metallic impellers may be utilised.

(e) The impeller shall be statically, dynamically and hydraulically balanced. No holes may be drilled in the impeller to balance it with regard to mass distribution.

(f) Only permanently sealed ball or roller bearings shall be installed.

(g) Bearings shall have a B-10 life rating of 100 000 hours.

(h) The pump shall be a currently catalogued product.

(i) Performance curves shall be based on a reproducible and certified test carried out in an approved testing facility, such as the SABS.

(j) The flow rate at break-off point of the curve for the impeller selected shall be at least 1.5 times that of the maximum flow rate specified.

(k) The head at zero delivery of the curve from the impeller selected shall be at least 1.2 times the maximum head in the pump's operational range.

(l) Each submersible pump shall be clearly labelled. The label shall be a 0,5 mm thick stainless steel plate of dimensions 100 mm x 50 mm. The label shall be fixed to the pump exterior with an approved adhesive or other method over its full back surface after the completion of corrosion protection on the pump. It may follow the shape of the pump exterior over areas suited for the bending of flat surfaces excluding sharp folds. Under no circumstances shall the label plate influence, damage or otherwise have other detrimental effects on the corrosion protection system. Information included on the label shall be: pump rates, pump head, power required, NPSH (r) rotational speed and impeller detail.

(m) All new submersible pumps shall be supplied with a length of power cable to suit the installation shown on the drawings.

(n) All new pumps utilised for the pumping of biological sludges shall be fitted with double flushed mechanical seals, which shall be included in the cost of the pumps. The pump shafts shall be hardened and accurately ground where the seal bears on the shaft. The rotating seal face shall be mounted on a flexible member sealing on the shaft as well. The flexible member shall be manufactured from rubber, PTFE or equivalent material suitable for the operating environment.

EB 04 MOTOR DESIGN AND REQUIREMENTS

(a) Electric motors shall comply with the requirements of SABS 948

(b) Imported motors forming an integral part of the pump shall be submitted to the South African Bureau of Standards to be tested in accordance with the requirements of SABS 948.

(c) All motors shall be standard catalogue models and shall be readily available.

(d) All motors shall, where possible, be from the same manufacturer and shall have the same interchangeable frames. Variations in type and size shall, where possible, be limited to prevent stocking a variety of special spares.

(e) All motors shall have dynamically balanced rotors supported by maintenance-free, sealed-for-life ball bearings.

(f) All motors shall be suitably coated to ensure the satisfactory operation of the motor under the specified class of service.

(g) All terminal boxes shall be waterproof and suited for submersion up to the depth as specified for the pumps.

(h) An adequate length of waterproof cable, purpose-made for submerging, shall be supplied with each submersible motor. The coupling of this cable to the normal power-distribution cable, which usually is of the PVC type with steel-wire armour, shall be placed at least 1,0 m above the maximum water level by means of a purpose-made, weatherproof, outdoor junction box. The submerged cable shall be supported to minimise any movement of the cable, which result from turbulence caused by the operation of the equipment or the flow of the water.

(i) Thermistor protection or Klixon type temperature switches shall be provided for submersible motors.

(j) Seal monitors shall be provided for submersible motors, together with the required seal monitor relays. The cost for the seal monitor relays shall be deemed to be included in the rated tendered for the equipment.

EB 05 WORKING VOLTAGE AND SUPPLY SYSTEMS

The motors shall be capable of operating within ±10% of the nominal supply voltage without risk of damage. All motors shall be suitable for operating continuously at the specified 3-phase voltage system under actual service conditions, including the ±10% voltage tolerance, without exceeding the specified temperature rise determined by the resistance on a basic full load heat run.

All motors shall be capable of operating continuously under actual service conditions at any supply frequency between 48 and 51 Hz together with any voltage between ± 5% of the nominal supply voltage.
The slip-in speed of any motor at 80% of the nominal voltage at 50 Hz shall not exceed a percentage agreed on by the Engineer, and the motors shall be capable of operating at this voltage for a period of five minutes without deleterious heating.

EB 06 PROTECTION AND CONTROL DEVICES

Submersible pumping equipment shall have float switches to switch the pump motor on and off, according to the level of the liquid. Switches shall operate freely and switch, not be hindered by cables or other switches and shall switch off at a level where no damage to the pump or motor will occur.

Three level switches shall operate a pump control system:

(a) Level switch one shall switch off pumps at low level.

(b) Level switch two shall switch on one pump at an intermediate level, to draw the liquid down to level 1. When the level again rises to where level switch two is switched on, the pump duty shall rotate to start the motor parallel to the one running the first time.

(c) Level switch three shall switch on both pumps to run in parallel at a high level.

(d) In the event of a pump failing to start, the other pump must automatically be restarted.

(e) Pumps shall be operated in both manual and automatic modes.

EB 07 DETAIL OF WORK

EB 07.01 DESCIPTION OF EXISTING INSTALLATION

EB 07.01.01 RAW SEWER PUMP STATION

LEBOMBO Land Port of Entry

The raw sewer sump of 64 m³ will be pumped out by means of the existing raw sewer pumps. The inlet works will be locked at the first inlet manhole. The sumps will be cleaned by means of high pressure washing and all items and sludge will be removed, dried out and disposed of at an approved and authorised dumping site.

EB 07.01.02 CLEAN PIPEWORK

As part of maintenance and operation all pipework inside the raw sewer pump station shall be washed with water and soap to remove all dirt. Cleaning will include cleaning of valves and fittings.

EB 07.01.03 FLOAT LEVEL SWITCH

Replace, test and commission float switches or other level probes if so instructed by the Engineer.

EB 07.01.04 MOTOR CONTROL CENTRE

The Motor Control Centre controlling the sewer pumps is still in a good condition. The Motor Control Centre comprises the following components:

- 4 x indicator lamps
- 2 x ammeters
- 1 x voltmeter
- 1 x voltmeter selector switch
- 2 x hour meters
- 1 x main switch
- 4 x selctor switches
- 2 x timers
- 2 x stop/start switches.

Check and tighten all terminations of all equipment.

Properly clean out all switchgear and equipment from dust and spider webs.

Dismantle and clean all moving parts and contacts of magnetic contactors and starters, re-assemble, check overload trip units and adjust correctly. Test for correct functioning on completion of electrical repqir work

Replacement of all defective lamps, control gear, etc.

EB 08 TESTING AND COMMISSIONING

EB 08.01 TEST TO BE PERFORMED

(a) All pumping equipment shall be subject to the commissioning tests as described in the standard specification on testing and commissioning

(b) At least one of each type or size of pump supplied, repaired or reconditioned, shall be subject to a delivery flow rate test. The Contractor will supply flow rate or volumetric flow testing facilities.

(c) The operating point of each pump shall be determined.

(d) Efficiency tests will be performed.

(e) NPSH tests will be performed.

EB 08.02 PUMP OPERATING POINT

During the day-01 commissioning tests the pump operating point shall be determined by observing the following:

(a) pump delivery and suction pressures, and
(b) electric motor power consumption.

If no efficiency tests are required, then the motor power consumption shall be calculated from the voltage and current measurements obtained during the commissioning test.

The Contractor shall supply the necessary adaptors, fittings and pressures gauges to measure the suction and delivery pressures. If no gauge fittings exist on the suction side, then the suction pressure conditions will be calculated from the system properties.

EB 08.03 FLOW RATE (DELIVERY), EFFICIENCY AND NPSH TESTS

(a) Testing will be done in accordance with BS 5316 Part 1, Class C tests.

(b) Power consumption of electric motors shall be as determined by the three Wattmeter method where efficiency tests are required in the detail specification.

EB 08.04 TEST CONDITIONS

(a) All tests will be performed in situ.

(b) The pumped medium or liquid specified as the process liquid in the detail specifications shall be utilised during the tests. The Contractor shall obtain from the pump manufacturer, the test point for clean water corresponding to the specified duty point for the pumped liquid, in order to relate the measured performance to the pump supplier's curves which are based on water.

EB 08.05 ADDITIONAL TESTS

Additional tests may be specified in the detail of work.

EB 09 OPERATING AND MAINTENANCE MANUALS

The contractor shall compile an operating and maintenance manual in accordance with Additional Specification SB: Operating and Maintenance Manuals.

The Operating and Maintenance Manuals shall provide for:

(a) A diagrammatic layout plan of the wastewater treatment works

(b) An inventory of all equipment and infrastructure

(c) Comprehensive explanations of and procedures of the operating and maintenance of:
- RAW sewer pump station with MCC
- Inlet works
- Septic tank
- Reed Beds

- All pump systems and motor control centres
- All valves/sluices.
- Chlorinating system

EB 10 TRAINING OF OPERATING PERSONNEL

The contractor shall be responsible for training of operating personnel who are employed by the Department of Public Works in accordance with additional specification SC: Training. The training course will be based on the Operating and Maintenance Manuals. A programme shall be submitted to the Engineer, and training shall be scheduled upon approval of the Operating and Maintenance Manuals and Training Programme.

The training shall be presented during a minimum of two sessions with a minimum duration of three hours each.

EB 12 MAINTENANCE

EB 12.01 GENERAL

All pumping equipment and systems shall be serviced and repaired, following practical completion of the installation of which it forms part, to maintain it in perfect functional condition.

The Port of Entry as listed below has been previously repaired under Repair and Maintenance Contracts for the Department of Public Works and Infrastructure, and the Contractor shall proceed with his Maintenance Responsibilities as listed below at the date of Site Handover.

Maintenance, including routine preventative maintenance according to the manufacturer's specification to be set out in the operating and maintenance manual, as well as unforeseen repair work or replacement, shall be carried out on:

Port of Entry:

(a) Two raw sewer pumps
(b) One mixer
(c) Level controller
(d) Two air lift pumps for sludge return
(e) Two aerators complete with motors
(f) Diffusers
(g) One filtrate pump
(h) Motor control centre (MCC) for all the pumps and equipment
(i) Chlorinating system (Grundofs Alldos dosing pump with tank).

The remuneration for monthly preventative and breakdown maintenance of pumping equipment, aerators and systems shall be deemed included in the tendered rate for ten points of the installation of which the system forms part. Installations are specified in Additional specification SA: General Maintenance.

EB 12.02 ROUTINE PREVENTATIVE MAINTENANCE

The routine preventative maintenance work to be carried out shall include but not be limited to the items listed in table EB 10.2/1 below.

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

TABLE EB 10.02/1

NO	ROUTINE PREVENTATIVE MAINTENANCE OF WASTEWATER PUMP SYSTEMS	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete system	Monthly
2	Check, service, repair and clean all pumps	Six-monthly

3	Corrosion protect pumps, motors and surface piping	Six-monthly
4	Check, inspect, report and repair all leaks	Monthly
5	Check and lubricate moving parts	Four-monthly

EB 13 MEASUREMENT AND PAYMENT

EB.01 **SUPPLY AND DELIVERY OF PUMPING EQUIPMENT** ..... **Unit**: number

The unit of measurement shall be the number of pumping equipment/aerators supplied and delivered.

The tendered rates shall include full compensation for the design, manufacture, corrosion protection, patent rights, pre-delivery testing and test certificates, transport for delivery to site and off-loading including all handling of the equipment. The equipment shall include the following:

(a) The pump/aerator and motor as integrated unit
(b) Electrical power cable

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EB.02 **INSTALLATION, TESTING AND COMMISSIONING OF PUMPING EQUIPMENT**..... Unit: number

The unit of measurement shall be the number of pumping equipment/aerators tested and commissioned.

The tendered rates shall include full compensation for the site handling and positioning of the pumping equipment/aerators including the fastening of the equipment in its designated position. The following shall also be included in the tendered rates:

(a) Installation of the guide rails and sealing frame.
(b) Coupling of all required pipes flanges, including all required gaskets, nuts, bolts and washers.
(c) Routing and fastening of the power cable up to the isolator box.
(d) All required installation materials, labour and consumables to render a complete and working installation.

The tendered rates shall also include full compensation for all preliminary tests, delivery and efficiency tests if required and commissioning tests. Commissioning tests shall comply with the section dealing with testing and commissioning.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EB.03 **DECOMMISSIONING AND REMOVAL OF PUMPING EQUIPMENT**..... Unit: number

The unit of measurement shall be the number of pumping equipment/aerators removed and decommissioned.
The tendered rates shall include full compensation for all labour, machinery, tools, transport and site handling necessary for the decommissioning and removal of submersible pumping equipment.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EB.04 **RECONDITIONING OF PUMPING EQUIPMENT** Unit: number

The unit of measurement shall be the number of pumps and motors/aerators including motors reconditioned.

The tendered rates shall include full compensation for replacement of components and materials and for, tools, transport, site handling and labour necessary for the complete reconditioning of pumping equipment/aerators to conform to all the specifications in EB 03: Pump design and requirements and EB 04: Motor design and requirements.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EB.05 **REPAIR OF PUMPING EQUIPMENT**.....Unit: number

The unit of measurement shall be the number of pumps and motors/aerators including motors repaired.
The tendered rate shall include full compensation for supply of an identification label, resetting the spacer between impeller and backplate and ensuring that impeller rotates freely as well as cleaning and corrosion protection and installing a new hoisting chain.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EB.06 **SERVICING OF PUMPING EQUIPMENT**.....Unit: number

The unit of measurement shall be the number of pumps or aerators serviced. The tendered rate shall include full compensation for servicing (including all consumables), cleaning, corrosion protection (including pump and motor base), adjusting, aligning, including disassembling and re-assembling. The tendered rate shall include all labour, tools, equipment and spare parts that form part of servicing as set out in the operating and maintenance manuals or as specified by the supplier.

EB.07 **SERVICING OF THE CHLORINATOR BRINE AND SALT TANKS**.....Unit: sum

The unit of measurement shall be a sum.

The tendered rate shall include full compensation for servicing (including all consumables), cleaning, corrosion protection, adjusting, including disassembling and re-assembling and commissioning. The tendered rate shall include all labour, tools, equipment and spare parts that form part of servicing as set out in the by the manufacturer.

EB.08 **SERVICING OF THE CHLORINATOR ELECTROLYSER**.....Unit: sum

The unit of measurement shall be a sum.

The tendered rate shall include full compensation for servicing (including all consumables), cleaning, corrosion protection, adjusting, including disassembling and re-assembling and commissioning. The tendered rate shall include all labour, tools, equipment and spare parts that form part of servicing as set out in the by the manufacturer.

EB.09 **SERVICING OF THE CHLORINATOR RECTIFIER**.....Unit: sum

The unit of measurement shall be a sum.

The tendered rate shall include full compensation for servicing (including all consumables), cleaning, corrosion protection, adjusting, including disassembling and re-assembling and commissioning. The tendered rate shall include all labour, tools, equipment and spare parts that form part of servicing as set out in the by the manufacturer.

EB.10 **SUPPLY OF THE CHLORINATOR ELECTROLYSER**.....Unit: sum

The unit of measurement shall be the number of electrolysers supplied, tested and commissioned.

The tendered rate shall include full compensation for the supply, delivery, installation, testing and commissioning of an electrolyser system similar to the existing. The tendered rates shall include full compensation for the site handling and positioning of the electrolyser including the fastening of the equipment in its designated position. The following shall also be included in the tendered rates:

(a) Connection to the existing system.
(b) Routing and fastening of the power cables and feed pipes.
(c) All required installation materials, labour and consumables to render a complete and working installation.

The tendered rates shall also include full compensation for all preliminary tests, delivery and efficiency tests if required and commissioning tests. Commissioning tests shall comply with the section dealing with testing and commissioning.

EB.11 **SUPPLY OF THE CHLORINATOR RECTIFIER**.....Unit: sum

The unit of measurement shall be the number of rectifiers supplied, tested and commissioned.

The tendered rate shall include full compensation for the supply, delivery, installation, testing and commissioning of a rectifier system similar to the existing. The tendered rates shall include full compensation for the site handling and positioning of the rectifier including the

fastening of the equipment in its designated position. The following shall also be included in the tendered rates:

(d) Connection to the existing system.
(e) Routing and fastening of the power cables.
(f) All required installation materials, labour and consumables to render a complete and working installation.

The tendered rates shall also include full compensation for all preliminary tests, delivery and efficiency tests if required and commissioning tests. Commissioning tests shall comply with the section dealing with testing and commissioning.

EB.12 **RECONDITIONING OF THE CHLORINATOR BRINE AND SALT TANKS** Unit: sum

The unit of measurement shall be a sum for the reconditioning of the brine and salt tanks.

The tendered rates shall include full compensation for replacement of components and materials and for, tools, transport, site handling and labour necessary for the complete reconditioning of brine and salt tanks.

EB.13 **REPLACE, TEST AND COMMISSIONING OF FLOAT LEVEL SWITCHES OR OTHER LEVEL PROBES** Unit: number

The unit of measurement shall be the number of level switches or probes replaced.

The tendered rates shall include full compensation for replacement of components and materials and for tools, transport, site handling and labour necessary for the complete reconditioning of all components of the level control devices

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EB.14 **PUMPING OUT, CLEANING AND RECONDITIONING OF WASTE WATER PUMP SUMPS AND RELATED INFRASTRUCTURE** .....Unit: number

The unit of measurement shall be the number of waste water pump sumps and related infra structure cleaned and reconditioned as described in.

The tendered rates shall include full compensation for all components, materials, tools, transport, site handling and labour necessary for the complete cleaning and reconditioning of wastewater pump sumps and related infrastructure.

EB.15 **RECONDITIONING OF MCC BOARDS OR OTHER ELECTRICITY BOARDS**.....Unit: number

The unit of measurement shall be the number of MCC boards or other electricity boards reconditioned/serviced.

The tendered rates shall include full compensation for replacement of components and materials and for tools, transport, site handling and labour necessary for the complete reconditioning of all components of the board.

The tendered rate shall further include full compensation for the cleaning and opening of MCC or kiosk, vermin protection, checking of MCB's, checking and tightening of wire terminations, fitting of labels and blank covers.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EB.16 **REPLACE MCC ENCLOSURE**.....Unit: number

The unit of measurement shall be the number of MCC boards enclosures replaced

The tendered rates shall include full compensation for the manufacturing, delivery and installation of the new 316 stainless steel enclosure including testing and commissioning of the MCC panel.

The tendered rate shall further include for the disconnecting, removal of all the electrical equipment and cabling from the old enclosure and the installation of all the equipment removed in to the new enclosure including all associated wiring, cable terminations and testing and commissioning of the MCC panel

EB.17 **SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF MCC BOARDS OR OTHER ELECTRICITY BOARDS** ..... Unit: number

The unit of measurement shall be the number of MCC boards or other electricity boards supplied of existing boards reconditioned.

The tendered rates shall include full compensation for supply of components and materials and for tools, transport, site handling and labour necessary for the complete installation of the board or supply of all components to provide a fully functional MCC board.

The tendered rates shall also include full compensation for all preliminary tests, delivery and efficiency tests if required and commissioning tests. Commissioning tests shall comply with the section dealing with testing and commissioning.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EB.18 **SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF MECHANICAL EQUIPMENT** ..... Unit:number

The unit of measurement shall be the number of the specified type of mechanical equipment supplied, installed, tested and commissioned.

The tendered rates shall include full compensation for supply of components and materials and for tools, transport, site handling and labour necessary for the complete installation of the board or supply of all components to provide a fully functional MCC board.

The tendered rates shall also include full compensation for all preliminary tests, delivery and efficiency tests if required and commissioning tests. Commissioning tests shall comply with the section dealing with testing and commissioning.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

TECHNICAL SPECIFICATION

EG SEPTIC TANK FACILITIES

CONTENTS

EG 01 SCOPE
EG 02 STANDARD SPECIFICATIONS
EG 03 INFORMATION REQUIREMENTS FOR SEPTIC TANK SYSTEMS
EG 04 DETAIL OF REPAIR AND MAINTENANCE
EG 05 RESOURCERS REQUIRED
EG 06 MEASUREMENT AND PAYMENT

EG 01 SCOPE

Septic tanks (STs) are generally used as the most appropriate method of sewage Disposal in rural/remote locations such as police stations. Typical problems experienced with ST facilities include:

- Inadequate capacity for the loads generated by their serviced populations, thus requiring too frequent emptying and consequent operation as conservancy tanks.
- Counter-sloping of feed sewers, causing blockages in these pipes.
- Inappropriate of broken inlet and/or outlet pipe-work (tee pieces).
- Top level of separation baffles too low, causing spillover of accumulated scum from primary to secondary compartment.
- Blocked connection between ST and disposal unit (mostly French drains-FDs).
- Blocked and/or overflowing FD, due to under-sized drain or retarded percolation.
- Uneven distribution of septic tank effluent into FD drain, caused by inappropriate slope and perforation of spreader pipe.
- Blockage of pipes and/or FDs by tree and grass roots.

EG 02 STANDARD SPECIFICATIONS

EG 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 conjuction with this specification and shall be deemed to form part thereof:

SABS 1200 - Standardized specification for civil engineering construction

EG 02.02 OTHER SPECIFICATTIONS

LB - General corrosion protection

EG 02.03 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.

EG 02.04 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.

EG 02.05 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.

EG 03 INFORMATION REQUIREMENTS FOR SEPTIC TANK SYSTEMS

The specifications in EG 03 are of a general nature and if not referred to in Clause EG 04: Detail of Repair and Maintenance, are not considered part of this Contract.

EG 03.01 SPECIFIC INFORMATION REQUIREMENTS

Specific information requirements re each ST facility include:

- Current and projected design population, incorporating appropriate design factors for domestic, public and institutional sanitation facilities (with/without detention cells)
- Dimensions and capacities of existing STs and FDs.
- ST emptying frequency and period since previous emptying event.
- Required ST and FD capacities.
- Integrity and serviceability of existing ST and FD structures and accessories (in/outlet fittings, baffle walls, rodding eyes on connecting pipes, etc.).
- Type and frequency of operational problems experienced, including resultant nuisance conditions
- Contravention of applicable legal requirements.
- Availability and utilization of groundwater (GW), its risk of pollution by the sanitation facility and precautions practiced, such as chlorination of water supplied to users.

- Depth of GW table.
- Distance of separation between ST/FD and GW source.
- Other modes of water supply (with/without special treatment), such as Local Authority (LA) connection, surface source and carting from a remote source.
- Feasibility of connecting the water supply and/or sanitation facility to a LA-system.

EG 04 DETAIL OF REPAIR AND MAINTENANCE EG 04.01 ALL INSTALLATIONS

The following general/repair and maintenance tasks shall be performed on all installations, whether specific problems are experienced, or not:

- Assess category in which the installation falls: Maintenance (no specific problems – largely applicable to FDs), Emergency repair and Repair (problematic cases – largely applicable to FDs), and/or Upgrading (applicable to STs or FDs, depending on design population). Measure internal length and width of tank, as well as depth from top of roof slab to top levels (TLs) of scum layer, supermarket layer and sludge layer, and to floor level (FL).
- Prepare temporary sludge disposal facility – the more appropriate of the following:
  - Drying bed/pond.
  - Direct on-site burial.
  - Carting to nearby sewage treatment works or domestic sanitary landfill site.
- Install permanent sewage by-pass facility consisting of a pre-fabricated tank
- of appropriate volume (c. 1m^3 for single dwelling, larger for communal facilities) parallel to the ST, with up- and downstream connecting pipes and plugs.
- Install rodding eyes for regular cleaning of connecting pipes, particularly those between the ST and FD
- Using a stirrer, pump and/or bacterial aids, break up scum and sludge layers and suspend tank content to enable its pumping.
- Empty tank by means of pumping – retain seed sample for re-commissioning of tanks. Remove large settled objects, such as bricks, etc. Operate by-pass tank during emptying and re- commissioning of main tank.
- Clean connecting pipes and accessories, e.g. in/outlet tees. Remove tree and grass roots from pipes.
- Maintain acceptable aesthetic conditions re smells and spillages during the cleaning cycle.

EG 04.02 INSTALLATIONS REQUIRING EMERGENCY REPAIR, REPAIR AND/OR UPGRADING

Facilities in these categories shall, in most cases, be designed as if for new installations. Appropriate design guidelines are given in:

Water Institute of Southern Africa (1998). Manual on the Design of Small Sewage Works.

Summaries of preliminary designs shall be submitted to the Project Manager for conceptual approval. The services of a hydro-geologist may have to be employed, particularly where the accompanying water supply is fed from GW sources.

In cases where the capacities of the ST and/or FD are inadequate for the flow to be treated, or where evidence of malfunctioning of the FD/disposal field is observed, the following tasks shall be carried out:

- Determine the design population/flow.
- In case of a single existing FD, install a duplicate FD and use it while the original FD is being refurbished. Thereafter, operate them alternately.
- In case of a disposal field (e.g. multiple FDs):
  - Dig an inspection hole close to the existing disposal field and characterize the soil profile to a depth of 1,2 to 1,5m below ground level
  - Select the most feasible percolation layer and perform the prescribed percolation test in that layer.
  - Assess the percolation capacity of the existing FD/disposal field and, if necessary, the additional capacity required.
  - Increase the installed capacity of the FD/disposal field to at least 120% of its design capacity and operate the two halves of the system alternately

- If the percolation zone of the FD/disposal filed is perceived to be blocked, as evidenced by effluent seeping to the surface:
  - Remove the stone media from the drain, wash off accumulated biomass and allow the media to dry
  - Strip a 100mm mantle of blocked soil from the sides and bottom of the drain and dispose of the spoil by on-site burial
  - Return the stone media to the drain and replenish shortages.

- Pipework In either case (new or refurbished FD), install flow distribution pipe horizontally at correct level and with percolation holes located such that flow will be spread evenly over the length and width of the drain.
  - Install vertical inspection pipe (from floor level to 1m above ground level) to enable assessment of water level in drain.
- The ST site must at all times be maintained in a neat and acceptable condition.

EG 04.03 Six monthly maintenance shall include the measurement and recording of sludge levels in the septic tank. Sludge removal shall be at frequencies as follows:

Population Served:

10 -	30 persons	-	2 years		
50 -	200 persons	-	1 year		
200 -	500 persons	-	6 months Single Household	-	3 years

EG 04.04 **OTHER MEANS OF DISPOSAL OF ST EFFLUENT**

Where geological conditions are such that ST effluent disposal by means of subsurface percolation is not feasible, the following alternative disposal methods may be considered:

- Evapo-transpiration beds, either as a stand-alone facility, or supplementary to a FD system.
- Reedbeds.
- Hydroponic systems

EG 05 **RESOURCES REQUIRED**

- Apparatus for measuring sludge and scum layers in STs.
- Apparatus for performing percolation tests.
- Excavator.
- Sludge pump.
- Stirrer/bacterial aids for breaking up of sludge and scum layers.
- Geo-hydrologist

EG 06 **MEASUREMENT AND PAYMENT**

EG 06.01 **MEASUREMENT AND PAYMENT FOR DESLUDGE AND GENERAL REPAIR OF SEPTIC TANKS**..... Unit: Number

The unit of measurement shall be for the procedure described in EG 04.01 as well as for site specific requirements to achieve a clean and operational septic tank.

The tendered rate shall include full compensation for cleaning, excavation, installation, removing of obsolete material and rubble, dealing with water logged conditions, execution of the Environmental Measurement Plan during repair, provision of backfill and by-pass tanks and pipes and the disposal of sludge and surplus material. All labour shall also be included in the tendered rate.

EG 06.02 **MEASUREMENT AND PAYMENT FOR REHABILITATION OF FRENCH DRAIN SYSYTEM**..... Unit: Number

The unit of measurement shall be for the procedure described in EG 04.02 as well as for site specific requirements to achieve a clean and operational French Drain System.

The tendered rate shall include full compensation for the percolation test, the increased disposal field capacity, removal of stone media (if required), pipe work, rehabilitation of existing FD and installation of inspection pipes.

PARTICULAR SPECIFICATION

EJ WATER QUALITY TESTING

CONTENTS

EJ 01 SCOPE
EJ 02 STANDARD SPECIFICATIONS
EJ 03 FLOW MEASUREMENT
EJ 04 DETAIL OF WORK
EJ 05 MEASUREMENT AND PAYMENT

EJ 01 SCOPE

This particular specification is applicable to the water quality testing by chemical analysis for both the sewage treatment works and the potable water purification works at LEBOMBO , Port of Entry.

The specification covers requirements for sewage effluent standards as well as potable water standards. Testing procedures and equipment to verify these standards are also covered.

EJ 02 STANDARD SPECIFICATIONS

EJ 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:

SANS 5667-2	-	Water quality sampling, part 2: Guidance on sampling techniques
SANS 5667-2	-	Water quality sampling, part 10: Guidance on sampling of wastewater.
SANS 5011	-	Water - pH value
SANS 5217	-	Water - free and saline ammonia content
SANS 6048	-	Water - chemical oxygen demand
SANS 6049	-	Water - suspended solids content
SANS 6057	-	Electrical conductivity of water
SANS 4831	-	Microbiology: General guidance for the enumeration of coliforms: Most probable number technique
SANS 4833	-	Microbiology: General guidance for the enumeration of coliforms: Colony count technique at 30 °C
SANS 241:2006	-	Drinking water

EJ 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

EJ 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.

EJ 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.

EJ 03 FLOW MEASUREMENT

Flow rate shall be measured and recorded daily to populate a database of the following parameters:

(a) Total flow
(b) Maximum flow (peak flow)
(c) Minimum flow (night flow).

EJ 04 DETAIL OF WORK

EJ 04.01 **GENERAL**

As part of the operational responsibilities on this project the Contractor shall regularly test wastewater and effluent quality as specified in the following clauses.

Operation shall include maintaining all testing equipment, including equipment not supplied as part of the Contract, in a clean and perfect functional condition.

EJ 04.02 **TEST LABORATORY**

The existing buildings shall be utilised as a site laboratory. Should the Contractor require more space, it shall be provided at his cost.

EJ 04.03 **TEST EQUIPMENT**

The contractor shall provide for the following analytical glassware and testing apparatus as part of this Contract:

(a) Bench top pH, accurate and precise to at least 0,1 pH unit, including reference electrode and glass sensor or combination electrode;
(b) Turbidity meter.
(c) Electrical conductivity meter, with error not exceeding 1 % or 0,1 m S/m;
(d) Magnetic stirrer with PTFE (Teflon) stirring bars;
(e) 3 x 1 000 millilitre Imhoff cones with wooden rack;
(f) 2 x 500 millilitre volumetric flasks;
(g) 3 x pipettes (glass);
(h) 5 x 500ml glass beakers
(i) 2 x 1000ml plastic beakers
(j) 3 X 1000 ml graduated measuring cylinders

EJ 04.04 **WASTE WATER AND POTABLE WATER QUALITY TESTING**

Waste water and potable water quality shall be tested within the first month after completion and commissioning of the sewage treatment plant and the water purification plant respectively.

See Operation Schedules for respective waste water treatment works.

EJ 04.05 **SEWAGE EFFLUENT QUALITY TESTS**

The final effluent of the sewage treatment plant shall comply with the general limit of the General Authorizations in terms of Section 39 of the Water Act,1998 (Act No. 36 of 1998): DISCHARGE OF WASTE OR WATER CONTAINING WASTE INTO A WATER RESOURCE THROUGH A PIPE, CANAL, SEWER OR OTHER CONDUIT; AND DISPOSING IN ANY MANNER OF WATER WHICH CONTAINS WASTE FROM, OR WHICH HAS BEEN HEATED IN, ANY INDUSTRIAL OR POWER GENERATION PROCESS

The following analysis shall be performed by an approved authority on a monthly basis on the final effluent of the sewage works.

Faecal coliforms.(per 100ml)
Chemical Oxygen demand (mg/l) pH
Ammonia as Nitrogen (mg/l)
Nitrate as nitrogen (mg/l) Chlorine
as free chlorine (mg/l) Suspended
solids (mg/l) Electrical conductivity
(mS/m)
Ortho-phosphate as phosphorus (mg/l)

Provision shall be made for the full analysis as published in table 3.1 of the GENERAL AUTHORIZATIONS once during the term of the contract.

The sample shall be taken at the outflow of the last maturation pond.

J 04.06 **MONITORING PROGRAMME FOR SEWAGE TREATMENT WORKS**

Regular measurement of the quantity and quality of wastewater final effluent shall be recorded according to the requirements of Government Notice no 1191: General Authorisations in terms of section 39 of the National Water Act, 1998 (Act no 36 of 1998), 8 October 1999. Licensed works shall be monitored in accordance with the license requirements.

The Contractor shall keep a written record and report electronically on a prescribed report form of all values for the duration of the Contract, of the following wastewater discharge and relative activities:

(a) Quantity of wastewater final effluent discharged;
(b) Quality of the wastewater final effluent discharged;
(c) Detail of the monitoring programme;
(d) Detail of failures and malfunctions in the discharge system and detail of measures taken.

EJ 04.07 **POTABLE WATER QUALITY TESTS**

An approved testing authority shall analyse the potable water on a monthly basis as per analysis schedule in particular specification PDH. Provision shall be made for a full Physical, organoleptic, and chemical requirements analysis once during the contract period. The sample shall be submitted to the testing authority according to prescription. The water distributed to consumers shall comply with the SANS 241:2006 Specification for the standards of drinking water. Only Class 1(recommended operational limit) water shall be distributed for human consumption.
The following analysis shall be performed by an approved authority on a monthly basis on the water delivered to the consumers.

MICROBIOLOGICAL ANALYSIS OF THE WATER IN ACCORDANCE WITH THE MICROBIOLOGICAL SAFETY REQUIREMENTS ACCORDING TO THE SANS 241:2006

The following analysis shall be performed by an approved authority on a monthly basis on the water delivered to the consumers.

Turbidity (NTU**)**
Calcium as Ca (mg/l)
Chloride as Cl^- (mg/l)
pH value
Electrical conductivity
Dissolved solids (mg/l)
Sodium as Na (mg/l) Nitrate as N (mg/l) Magnesium as Mg (mg/l) Sulfate as $SO_4^{=}$ (mg/l) Aluminium as Al (µg/l) Iron as Fe (µg/l) Manganese as Mn (µg/l) Dissolved organic Carbon

EJ 05 **MEASUREMENT AND PAYMENT**

Remuneration for the monthly maintenance of the wastewater quality monitoring programme, maintenance of a site laboratory if necessary, laboratory equipment, testing to be performed on site during the maintenance phase as specified and record keeping system shall be deemed included in ten points for the maintenance of the installation of which wastewater quality control, measurement and testing form part.

Remuneration for all work and expenses related to water and wastewater quality tests by approved testing authorities in terms of SANS 10259 shall be paid to the Contractor as tendered for the number of tests including all water quality parameters as specified in EJ.

The Contractor shall be responsible for payment of testing authorities for any tests performed by them.

Monthly Water Report

DWAF Water Use Registration Classification

Farm Name	Title Deed	Water Use	eg No	Expiry Date

DWAF Operator Registration &

Name & ID Number	Classification & Date of Issue

Class -

Date	Sample Point	Flow	Microbiological		Nitrate as N	Sulfate as SO4	Chloride as Cl⁻	Sodium as Na	Magnesium as Mg	Calcium as Ca	Cl2	Al	Fe	Mn	pH		Turbidity		Cond.	DOC	Comments
			E. coli												Raw	Final	Raw	Final			
	Uni	m^3/day	col/100 ml		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	pH Units		NTU		mS/m	mg/l	Matters that require attention for the proper performance of the Water Works
	Spe		nil	nil	<10	<400	<200	<200	<70	<150		<0.3	<0.2	<0.1		5.0-9.5		0.1 - 1	<150	<10	

Compiled:

Date:

Checked:

Date:

Sewage Analysis Report

DWAF Water Use Registration

Farm Name	*Title Deed*	*Water Use*	*Reg No.*	*Expiry Date*

DWAF Operator Registration

Name	*Reg No. & Date*

Class Works

Spec	Sample Point	Date	Flow	NH3-	NO3-	PO4	CO	SupS	pH	Con	Res	SA	F-Coli	Comments
	Units		*m 3*	*mg*						*mS/*	*mg/l*		*col/100*	
	Water Act: Spec A:			*6*	*15*	*10*	*75*	*25*	*>5.*	*DW+*	*0.25*		*1000*	
	Water Act: Spec B: Special Limits			*2*	*1.5*	*2.5*	*30*	*10*	*>5.5*	*DW+50*	*0*		*0*	
	Water Act: Spec C: Irrigation Limits(up to						*400*		*>6.0*	*<200*		*<5*	*100 000*	Matters that require attention for the proper performance of the Water Works

Compiled: **Checked:**

Date: **Date:**

TECHNICAL SPECIFICATION

EK VALVES AND SLUICE GATES FOR WATER TREATMENT PLANTS

CONTENTS

EK 01 SCOPE
EK 02 STANDARD SPECIFICATIONS
EK 03 ADDITIONAL REQUIREMENTS
EK 04 OPERATING AND MAINTENANCE MANUALS
EK 05 DETAIL OF WORK
EK 06 MAINTENANCE
EK 07 MEASUREMENT AND PAYMENT

EK 01 SCOPE

This specification covers the maintenance, as well as the supply, delivery, installation, testing and commissioning of manual valves and sluice gates.

This specification shall form an integral part of the maintenance 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.

EK 02 STANDARD SPECIFICATIONS

EK 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:

SANS 1123 - Steel pipe flanges
SANS 664 - Cast-iron gate valves for water works.

EK 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, 1993 (Act no 85 of 1993) shall be adhered to.

EK 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.

EK 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.

EK 03 ADDITIONAL REQUIREMENTS

EK 03.01 INSTALLATION AND HAND WHEELS

Valves shall be installed in positions as shown on the relevant drawings, process flow diagrams and as specified in Clause EK 05 (Detail of work) of this specification.

Where applicable, the spindles or wheels of valves shall clearly indicate the direction of closure, which shall be clockwise when viewing the valve from and along the valve spindle axis.

EK 03.02 GATE VALVES

Gate valves shall have non-rising spindles, or rising spindles, as specified in Clause EK 05 (Detail of work).

Each gate valve shall comply with the following specifications:

(a) Each valve shall be a resilient seal gate valve in accordance with SANS 664.

(b) Each valve shall be designed to facilitate maintenance without the body of the valve having to be removed from the line.

(c) Each valve shall be double flanged, with the flange drilling being in accordance with SANS 1123.

(d) Each valve shall be resistant to the corrosive environment in which it has to operate.

The materials to be used in the manufacture of each valve in pipelines (with diameters exceeding 100 mm) for the conveyance of water and sewage are the following:

Component	Material
Body	Cast iron
Bonnet	Cast iron
Gate	Cast iron
Bridge	Carbon steel
Gland	Carbon steel
Spindle	Stainless steel 304
Gate seals	Neoprene
Gate studs	Stainless steel 304
Gate nuts	Stainless steel 304
Gland packing	Graphite asbestos
Gaskets	Rubber

EK 03.03 **SLUICE GATES**

The frames, spindles, spindle braces and gates of all sluice gates shall be manufactured from stainless steel 304, unless otherwise specified.

All gates shall be guided by rigid guide rails. The gates shall be held uniformly against the side facings of the frames by the action of adjustable wedges and shall provide drop-tight closure under the specified conditions.

All channel sluice gates shall be of the level invert type fitted with renewable seals of a non-biodegradable material on the invert.

All sluice gates to be supplied shall be hand-operated and shall be supplied with clockwise closing hand wheels. If rising spindles are to be used, the rising spindles shall be protected by suitable sleeves which provide convenient visual inspection and greasing facilities.

Hand wheels shall be of cast iron with diameters to suit operating either directly on the head frame or on a stainless steel (grade 304) tubular pedestal to suit the installation depth. Where necessitated by the mass of the gate and/or the pressure against the gate, suitable gearing shall be provided so as to facilitate the operation.

All parts shall be designed with a minimum factor of safety against structural failure of not less than 3,0 based on the working stresses of the material. In the design due consideration shall be given to the thickness of materials with regard to corrosion and operating conditions.

The sluice gates shall be designed with suitable stiffeners to prevent the gates from deforming or buckling on account of unbalanced pressures acting on the sluice gates.

All channel sluice gates shall be designed for an unbalanced water pressure caused by a water column of twice the height of the gate.

The maximum force required at a hand wheel or crank to raise a gate or open a valve shall not exceed 100 N.

The Contractor shall supply the Engineer with all information regarding cavities to be left in the channel floors and walls and all the details concerning holding-down bolts or any other information relating to details of installation in civil structures to be constructed.

The Contractor shall be responsible for all handling, installation and grouting of the sluice gates and shall carry out all necessary adjustments to ensure proper and smooth operation.

EK 03.04 **NON-RETURN VALVES**

(a) Non-return valves shall be full bore valves with swing gates.

(b) Non-return valves shall be flanged into a pipeline.

(c) Non-return valves shall be manufactured from materials suitable for use in corrosive environments. Bodies shall be manufactured from cast iron. Swing gates shall be manufactured from stainless steel.

(d) Swing gates shall rotate freely, but shall close drip-tight under return pressure.

EK 03.05 CORROSION PROTECTION

Corrosion protection shall be in accordance with Technical Specification BJ: Paintwork and the Contractor shall ensure that all new, serviced or reconditioned units are fit for operation in the relevant environment.

EK 04 OPERATING AND MAINTENANCE MANUALS

The Contractor shall at the start of the Contract be given all available 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.

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

EK 05 DETAIL OF WORK

The Engineer will demarcate any areas to be repaired and shall instruct the Contractor with regard to the repair work to be done.

The work to be done regarding valves and sluice gates is shown
below. Decommission and remove valves and sluice gates
Recondition/servicing gate valves or sluice gates. Paint valves with high gloss enamel paint. For preparation work see BJ 03.01.03, prepare according to condition of the metal.

Installation, testing and commissioning of valves or sluice gates

EK 06 MAINTENANCE

All valves and sluice gates forming part of wastewater treatment installations shall be maintained from the date of practical completion of the installation of which they form part, until the end of the Contract.

Maintenance shall include all repair work, replacing of components, fixing leaks, routine settings (of flow rates, etc), corrosion protection and all other actions necessary to maintain valves and sluice gates in a perfect functional condition.

Remuneration for maintenance of valves and sluice gates shall be deemed included in the tendered rate for ten points for the monthly maintenance of the installation of which valves and sluice gates form part.

EK 07 MEASUREMENT AND PAYMENT

EK07.01 SUPPLY AND DELIVERY OF GATE VALVES, AIR RELEASE VALVES, NON-RETURN VALVES AND SLUICE GATES.....Unit: number

The unit of measurement shall be the number of manually or electrically actuated valves, air release valves or sluice gates supplied.

The tendered rates shall include full compensation for the design, manufacture, corrosion protection, testing, delivery into storage or on the site, etc, as well as all royalties, patent rights, etc, for the valves or sluice gates complete with headstock, seals, guide rails, frame, etc, as specified.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EK07.02 INSTALLATION, TESTING AND COMMISSIONING OF GATE VALVES, AIR RELEASE VALVES, NON-RETURN VALVES AND SLUICE GATES .. Unit: number

The unit of measurement shall be the number of valves or sluice gates installed.

The tendered rates shall include full compensation for the installation, making good all the damaged corrosion-protected areas, testing, calibration, commissioning and maintenance of the valves or sluice gates and for all other costs and actions necessitated to obtain a complete and efficiently working system.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EK07.03 **SERVICE GATE VALVES, AIR RELEASE VALVES, NON-RETURN VALVES AND SLUICE GATES**.....Unit: number

The unit of measurement shall be the number of gate valves, non-return valves or sluice gates serviced.

The tendered rate shall include full compensation for cleaning, removing rust, removing dried sludge or other solids from surfaces and moving parts, proper greasing of all moving parts, preparation for corrosion protection coating and painting of gate valves or sluice gates.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EK07.04 **RECONDITION GATE VALVES, AIR RELEASE VALVES, NON-RETURN VALVES AND SLUICE GATES**

..... Unit: number

The unit of measurement shall be the number of gate valves or sluice gates reconditioned.

The tendered rate shall include full compensation for cleaning, removing rust, removing dried sludge or other solids from surfaces and moving parts, replacing components such as spindles, hand wheels or gates, replacing or repair of seals, proper greasing of all moving parts, preparation for corrosion protection, painting or any other action or cost necessitated to recondition a gate valve or sluice gate to a perfect functional condition.

Items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EK07.05 **DECOMMISSION AND REMOVE GATE VALVES, AIR RELEASE VALVES, NON-RETURN VALVES AND SLUICE GATES**.....Unit: number

The unit of measurement shall be the number of valves or sluice gates decommissioned and removed.

The tendered rate shall include full compensation for all labour and equipment required to decommission and remove values or sluice gates, such as installation of temporary spades or blank flanges, maintaining existing liquid volumes, loosening and removal of bolts and nuts, or any other action required.

Separate items will be scheduled in the Schedule of Quantities for different types and sizes of valves or sluice gates.

TECHNICAL SPECIFICATION

EM OPERATION OF WASTEWATER WORKS

CONTENTS

EM 01 SCOPE
EM 02 STANDARD SPECIFICATION AND REGULATIONS
EM 03 LEGAL AND GENERAL REQUIREMENTS
EM 04 OPERATION
EM 05 MONITORING AND REPORTING
EM 06 MEASUREMENT AND PAYMENT

EM 01 SCOPE

Wastewater works shall mean all units, components, equipment and materials, and their relation to each other, employed to enable reliable and effective wastewater treatment.

This specification covers the operation of a wastewater works and equipment related to effective wastewater treatment.

The Contractor shall manage and operate the wastewater works in accordance with the prescriptions in this specification, the relevant operation and maintenance manuals and **Additional Specification SF**. Operation duties shall generally refer to all tasks and actions required to operate the process units and components of the following wastewater works and shall include (among others):

TABLE 1 : PROCESS UNITS FOR TYPICAL DPW SYSTEM TYPES

Septic	Oxidation	Rotating	Biological	Activated Sludge
Septic tank(s)	Inlet works: Screening & degritting	Inlet works: Screening & degritting	Inlet works: Screening, degritting, flow measuring	Inlet works: Screening, degritting, flow measuring
French drain (s)	Floating solids trap	Septic tank(s)	Peak flow cut-off & storage/ balancing tank	Peak flow cut-off & storage/balancing tank
	Oxidation ponds: primary & secondary	Biological reactor(s): rotating discs	Pump station(s)	Biological reactor(s): completely mixed, oxidation ditch, sequencing batch, multiple tanks.
	Surface aerator(s)	Humus tank(s)	Flow regulating facilities	Aerator(s): Vertical axis surface, horizontal axis surface, course/fine bubble
	Re-circulation facilities	Flow regulating facilities	Primary settling tank(s)	Waste activated sludge (RAS) facilities
	Flow measuring facilities	Flow measuring facilities	Bio filter(s)	Flow regulating facilities
	On site burial facility: grit & screenings	Maturation pond(s)	Humus tank(s0 (Secondary settling tank SST)	Return activated sludge (RAS) facilities
		Reed bed(s)	Chemical phosphate removal facilities	Clarifier(s) (Secondary settling tank – SST)
		Sludge drying beds	Chlorine dosing & contact facilities	Chemicalphosphate removal facilities
		On site burial facility: Grit & screenings	Flow measuring facilities	Biological nutrient removal facilities

		Sludge disposal facilities: Burial, lagoon storage, composting, co-disposal export	Maturation pond(s)	Chlorine dosing & contact facilities
			Anaerobic digester(s)	Flow measuring facilities
			Sludge drying beds	Maturation pond(s)
			On site burial facility: Grit & screenings	Sludge drying beds
			Sludge disposal facilities: Burial, lagoon storage, composting, co-disposal, export	On site burial facility: Grit & screenings
				Sludge disposal facilities: Burial, lagoon storage, composting, co-disposal, export

This specification covers requirements for effluent standards, as well as testing procedures and equipment to verify these standards.

This specification shall form an integral part of the repair and maintenance contract document and shall be read in conjunction with Portion 3: Additional Specifications included in this document.

Assessment of the following design parameters is a prerequisite for proper operation of the wastewater works:

TABLE 2 : KEY DESIGN PARAMETERS FOR PROCESSES AND UNITS

NOTE: Acknowledged guidelines must be used for design & construction, e.g. WISA, 1988: Manual on the Design of Small Sewage Works

Septic	**Oxidation**	**Rotating**	**Biological**	**Activated Sludge**
Population served	Population served & per capita organic loads	Population served & per capita organic loads	Population served & per capita organic loads	Population served & per capita organic loads
Hydraulic retention time (combined building drainage	Average & peek dry & wet weather flow rates	Average & peak dry & wet weather flow rates	Average & peak dry & wet weather flow rates	Average & peak dry & wet weather flow rates
Sludge retention time	Hydraulic & organic loading rates	Hydraulic & organic loading rates	Hydraulic, organic & nutrient loading rates per surface area & bed volume	Hydraulic, organic & nutrient loading rates
Desludging frequency	Hydraulic retention time	Septic tank capacity & desludging frequency	Type, size, volume, void ratio & depth of filter media	Sludge age (20 – 30 days) & solids loading rate
Type & permeability of subsoil	Availability of land for ponds & for effluent disposal by irrigation	Wetted surface area: Number, size, spacing & submersion depth of discs	Aeration rate of filter media	Active sludge mass & density
	Suitability of climatic conditions	Hydraulic retention time	Dosing rate of flow distribution assembly	Hydraulic control of sludge mass (by wasting of sludge from reactor): WAS rate – volume of reactor/sludge age
	Proximity to residential areas (Odours)	Rotational speed of discs	Rotational speed of flow distribution assembly	Sludge age required for nitrification

		Geometry & surface loading rates of humus tanks & appurtenances	Geometry & surface loading rates of TSTs, humus tanks & appurtenances	Return flow rate of activated sludge (1.5 – 2.5 x influent flow rate)
		Sludge & effluent return flow rates	Effluent return flow rates	Oxygen requirements, type & capacity if aeration equipment, control of aeration rate
			Geometry & hydraulic retention	Surface and solids flux loading rates of clarifier
				Additional reactor volume & anaerobic/anoxic zones required for biological nutrient removal

EM 02 **STANDARD SPECIFICATIONS AND REGULATIONS**

EM 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.

SANS 1200 - Standardised specification for civil engineering construction

SANS 5667-2 - Water quality sampling, part 2: Guidance on sampling techniques

SANS 5667-2 - Water quality sampling, part 10: Guidance on sampling of wastewater (when available)

SANS 5011 - Water – PH value

SANS 5217 - Water – free and saline ammonia
content SANS 6048 - Water – chemical oxygen demand

SANS 6049 - Water – suspended solids content

SANS 6057 - Electrical conductivity of water

SANS 4831 - Microbiology: General guidance for the enumeration of coliforms: Most probable number technique

SANS 4833 - Microbiology: General guidance for the enumeration of coliforms: Colony count technique at 30°C

EM 02.02 **OTHER SPECIFICATIONS**

The following Technical Specifications for repair and maintenance of wastewater process units shall be read in conjunction with this specification and shall be deemed to form part thereof:

EA Wastewater inlet works
EB Wastewater pump systems EC Sedimentation tanks
ED Biological trickling filters EE Activated sludge works
EF Sludge treatment and disposal
EG Septic tank and conservancy tanks and disposal fields
EH Oxidation and maturation ponds
EI Disinfection of wastewater
EJ Wastewater quality measurement and testing
EK Valves and sluice gates for wastewater
EL Rotating biological contactors

EM 02.03 **ACTS, REGULATIONS AND STATUTORY REQUIREMENTS**

All relevant regulations and statutory requirements as laid down in the latest edition of the following acts shall be adhered to:

- Occupational Health and Safety Act, 1993 (No. 85 of 1993)
- National Water Act (No. 36 of 1998)
- Water Services Act (No. 108 of 1997)
- Environment Conservation Act (No. 73 of 1989)
- National Environmental Management Act (No. 107 of 1998)

EM 02.04 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.

EM 02.05 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.

EM 03 LEGAL AND GENERAL REQUIREMENTS

EM 03.01 DEFINITION OF WATER USE

A water use must be licensed unless it is:

Listed in Schedule 1 (See page 152 of Government Gazette No. 19182 dated 26 August 1998)

An existing lawful use.

Permissible under a general authorisation (See Government Gazette No. 20526 dated 8 October 1999)

The responsible authority can waive the need for a license.

This specification covers the legal requirements for water use as regulated by the National Water Act (No. 36 of 1998). The following categories of water use are scheduled:

- Taking of water and storage of water (Section 2 (a) and (b)) of the Water Act.
- Engaging in a controlled activity, identified as such in Section 37 (1) of the Water Act. Irrigation of any land with waste or water containing waste generated through any industrial activity or by a water works (Section 21 (e) of the Water Act).
- Discharging of waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit, and disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generating process.
- Disposing of waste in a manner which may detrimentally impact a water resource (Section 28 of the Water Act).

EM 03.02 OPERATOR REGISTRATION AND CLASSIFICATION OF WATER CARE WORKS

In the terms of Section 26 (f) of the Water Act (No. 36 of 1988) operators shall be registered with the Department of Water Affairs. The Contractor shall be responsible for the registration of workers/operators in terms of this requirement (See Regulation R2834 dated 27 December 1985). The water care works will be classified by the Engineer for tendering purposes.

Draft regulations regarding the registration of waterworks and process controllers in terms of section 116 of the National Water Act, 1998 was published in Regulation Gazette No. 8411 dated 24 February 2006 and tenderers shall familiarize themselves with the progress regarding the promulgation of the new regulations.

The preliminary classification of the Wastewater Treatment Works is Class D.

EM 03.03 COMPILATION OF A BASIC ASSESSMENT REPORT

In terms of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) a Basic Assessment process must be conducted as part of a waste management license application for the treatment of effluent, wastewater or sewage with an annual through

put capacity of more than 2 000 m³ but less than 15 000 m³. The expansion of such facilities which requires an amendment of the existing license will also require that a Basic Assessment must be conducted.

The activities involved are published in Government Notice No 718 dated 3 July 2009 under Category A of the Notice.

EM 03.04 ENVIRONMENTAL IMPACT ASSESSESSMENT REPORT (EIAR)

In terms of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) an Environmental Impact Assessment process must be conducted as part of a waste management license application for the treatment of sewage, effluent or wastewater with an annual throughput capacity of 15 000 m³ or more.

The construction and expansion of these facilities will also require that an Environmental Impact Assessment must be conducted. The activities involved are published under Category B of Government Notice No 718 dated 3 July 2009.

EM 03.05 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

An Environmental Management Plan (EMP) is required for all repair work that may generate waste (such as sewage sludge) or that may detrimentally impact the environment during repair and operation of the water care works.

The Contractor shall prepare and submit an EMP to the Department of Public Works' project manager. His approval is not required, but the EMP should guide repair work so as to safeguard the environment from detrimental impact. The Contractor shall make provision in his tendered rates for all costs implied by the EMP.

EM 04 OPERATION

EM 04.01 GENERAL

Operation shall include all activities and all other actions or rectifying measures necessary for optimal operation of water care works.

Remuneration for operation of the complete water works shall be deemed included in ten points for the tendered rate of monthly payment of operation of the works.

EM 04.02 PREPARATORY OPERATIONAL TASKS

The preparatory tasks to be executed shall include, but shall not be limited to the items listed in the table below:

No.	OPERATIONAL TASKS
01	Satisfy legal and general requirements.
02	Draft inventories of process units, components, materials, etc.
03	Derive from available information the design capacity and current load of the works.
04	Assess compliance with relevant design parameters to enable optimal operation of the plant according to its original functionality.
05	Apply required safety measures.
06	Draft template logbook

EM 04.03 **PREPARATORY OPERATIONAL TASKS**

The preparatory tasks to be executed shall include, but shall not be limited to the items listed in the table below:

EM 04.02	PREPARATORY OPERATIONAL TASKS
01	Satisfy legal and general requirements**.**
02	Draft inventories of process units, components, materials, etc.
03	Draft process flow diagrams.
04	Derive from available information the design capacity and current load of the works.
05	Assess compliance with relevant design parameters to enable optimal operation of the plant according to its original functionality.
06	Draft plant-specific Operation and Maintenance manuals.
07	Institute required safety measures.
08	Draft template logbook.
09	Draft water balance of water and wastewater system.

EM 04.04 **GENERAL OPERATION WORK**

General operation of the water care works shall be done in accordance with this specification, with Additional Specification SF: General Operations and with the Particular Specification related to this work.

Remuneration for the monthly operation of an installation is determined by a ten point per month scoring system (refer to score card in Technical Specification SF: General Operation of an Installation).

The Contractor shall ensure that the plant is operational for 24 hours a day for 7 day a week and shall ensure at least one night watchman that has been trained and is knowledgeable of the plant's operational procedures as well as the setting of mechanical equipment.

The scoring system includes but is not limited to the following operational parameters:

EM 04.03	GENERAL OPERATION WORK	FREQUENCY
01	General housekeeping: Keep site in neat and acceptable condition.	Daily
02	Control access to the site.	Daily
03	Maintain safety conditions on site.	Daily
04	Log and report spills, pollution events, power failures, extraordinary process phenomena, etc. Check auto-reset of power to mechanical equipment.	Event
05	Calibrate and set flow measuring to ensure equalised hydraulic loading rates on downstream process units.	Yearly
06	Calibrate and set flow measuring equipment to ensure accurate flow data.	6 Months
07	Calibrate and set peak wet weather flow cut-off weirs at inlet works.	Yearly
08	Synchronise, by means of mathematical modelling and measurement, process units in integrated systems with recycling (such as activated sludge systems) and make adjustments where necessary.	6 Months

09	Develop a feel for effective treatment by means of visual indicators of good/bad plant performance: Colour, odour, foam, algae growth, aerator spray patterns, effluent clarity, bubbles, floating material, solids accumulation, flow patterns, turbulence, touch.	Daily
10	Record operating hours and kW-hours of all mechanical equipment.	Daily
11	Check operation of all valves and sluices.	Monthly
12	Wastewater quality control analysis by an approved authority.	Daily
13	Quality monitoring programme and record keeping and reporting system.	Daily
14	Operation of a site laboratory.	Daily
15	Tests performed on site to evaluate component performance.	Daily
16	Supply of all chemicals necessary for the operation of the plant.	Daily
17	Workers, operators and supervisors.	Daily
18	Tools and equipment and laboratory equipment for operational needs	Daily
19	Compliance with the required effluent standard subject to the Engineer's discretion.	Daily
20	Operation of the entire plant to its optimum capacity.	24 hours per day

EM 04.05 **OPERATION OF SPECIFIC PROCESSES AND UNITS**

Operation of specific processes, units and components of the water care works shall be done in accordance with this specification, with Additional Specification SF: General Operations and with the Particular Specification related to this work.

The specific operation work to be performed and executed shall include, but shall not be limited to the items listed in the table below.

		OPERATION OF SPECIFIC PROCESSES AND UNITS	**FREQUENCY**
01		**Inlet works**	
	01	Hand-raked screens: Remove screenings (rags, plastics, etc), ensuring that only degradable material is passed on to subsequent process units. (Last removal after evening peak flow)	2 hours during day
	02	Mechanical screens: Inspect for proper operation and ensure automatic functioning overnight.	2 hours during day
	03	Alternate flow through degritting channels and remove grit from isolated channel.	Daily
	04	Wash screenings and grit, and return degradable material to treatment train.	Hourly
	05	Dispose of screenings and grit by on-site burial.	Daily
	06	Measure and log PH	Daily
02		**Re-circulation facilities**	
	01	Check whether pumps are operating.	Daily
	02	Check return flow rates.	Monthly
03		**Flow measuring facilities**	
	01	Check whether measuring facilities are operating: Level sensor, integrating flow meter, data logger.	Daily
	02	Keep flume/weir and stilling chamber free of floating/settling material.	Daily

	03	At flumes/weirs where continuous recording equipment is not available, measure and record flow depth and time daily at visually observed peak flows, and at least once per month at minimum night flow.	Daily
04		**On-site burial of solids**	
	01	Ensure daily covering with soil of disposed material.	Daily
	02	Attend to nuisance conditions at disposal site.	Event
05		**Rotating bio-contactors (RBC)**	
	01	Check whether RBC rotors are operating	Daily

	02	Check whether return flow pumps are operating.	Daily
	03	Measure and record return flow rate.	Monthly
	04	Scour humus tank and check for clumps of floating sludge.	Twice Daily
	05	Remove scum and clean overflow weir.	Daily
	06	Check and log scum, water and sludge depths in septic tank. If sludge depth exceeds 50% of tank depth, desludge the tank. Desludge tank at least once per year.	Monthly
06		**Primary and secondary settling tanks.**	
	01	Scour settling tank and check for clumps of floating sludge.	Daily
	02	Remove scum and clean overflow weirs.	Daily
	03	Clean submerged portion of settling tank walls by pushing settled sludge on inclined surfaces down to the apex of the cone.	Monthly
07		**Flow regulating facilities**	
	01	Keep flow-routing chambers free of accumulating solids.	Daily
	02	Calibrate and set flow-splitting facilities to ensure equalised hydraulic loading rates on downstream process units.	Yearly
	03	Check operation of flow dosing siphons and keep snifter pipes free of blockages.	Daily
08		**Pump stations**	
	01	Check operation and correct switching of pumps.	Daily
	02	Clean pump sumps.	Weekly
09		**Disinfection**	
	01	Check operation of chlorination facilities.	Daily
	02	Clean chlorine contact tank.	Monthly
	03	Ensure chlorine-dosing proportional to flow rate.	Weekly
	04	Measure and Log Total Chlorine	Daily
10		**Effluent disposal facilities**	
	01	Oxidation ponds: Manage irrigation of effluent as means of disposal.	Daily
	02	Ensure erosion free discharge to receiving water body.	Monthly
	03	Measure and log PH	Day
11		**Power supply**	
	01	Check operation of stand-by generator where applicable.	Monthly

EM 04.06 **<u>CHEMICALS</u>**

The Contractor shall be required to supply all chemicals used in treatment of wastewater as instructed by the Engineer. The Contractor shall include the cost for chemicals in the ten points per month for the operation of an installation.

A chemicals logbook shall be supplied by the Contractor to record the use of chemicals. The logbook shall be completed with every test and shall include the following information:

(a) Date
(b) Name of testing official
(c) Test performed
(d) Chemical used
(e) Amount used (weight).

The Contractor shall be liable to replace any unaccounted for chemicals at his

own cost.

EM 04.07 **MONITORING AND REPORTING**

The contractor shall keep a written record of all measurements taken and analyses done for process control and for reporting to relevant authorities in terms of legal or project management requirements.

A logbook shall be kept for daily recording of failures, malfunctions, spills, pollution events, power failures and detail of measures taken.

The monitoring programme for the above measurements and analyses shall include, but shall not be limited to the items listed in the table below.

EM 05 PAYMENT ITEMS

EM.05.01 **Pump out of sludge into a suitable waste containment vehicle for transportation** ..... Unit: cubic metre . (m^3)

The unit of measurement shall be the cubic metre of sludge pumped, multiplied by the distance (one-way) in kilometre.

The tendered rates shall include full compensation for all components, materials, tools, transport, site handling and labour necessary for the complete pumping, removal and disposal of the sludge.

The Contractor shall be required to provide a certificate of the disposed sludge as proof from the registered treatment plant indicated by the Engineer.

The waste containment vehicle shall be a commercially registered waste containment vehicle capable of handling no less than $10m^3$ at a time.

EM.05.02 **Disposing of sludge at a registered commercial source on the instruction of the Engineer/Department's representatives** .....Unit: m^3-km

The unit of measurement shall be the cubic meter load of sludge multiplied with the number of kilometres travelled (one way trip) to the commercial source approved by the Engineer.

The tendered rate shall include full compensation for the labour, materials and equipment needed to transport sludge to a registered wastewater treatment works indicated by the Engineer.

The tendered rate shall include, value related as well as all time related preliminary and general charges, the operation and maintenance cost of the suitable commercial waste containment vehicle and the remuneration costs of the driver and workers.

The Contractor shall be required to provide a certificate of the disposed sludge as proof from the registered treatment plant indicated by the Engineer.

TABLE 3: MONITORING PROGRAMME: FREQUENCY OF MEASUREMENTS AND

System	Sampling point	On-site measurements						Chemical analyses (grab sampling)											Chemical analyses (composite			
		Temp	pH	Flow rate	SVI	DO	Sludge	COD	SS	VSS	NH_3	NO_3	TKN	PO_4	DO	Alkal-	EC	F.coli	COD	SS	NH_3	PO_4
Septic tanks	Septic tank	-	-	-	-	-	month	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxidation ponds	OPX Inlet	-	day	daily peaks	-	-	month	month	-	month	-	-	-	month	-	-	-	-	-	-	-	-
	OXP Outlet	-	day	-	-	-	-	month	month	-	month	month	-	-	-	-	-	-	-	-	-	-
Rotating biocontactor (RBC)	ST Inlet	-	day	daily peaks	-	-	month	month	month	month	-	-	month	month	month	month	-	-	-	-	-	-
	Septic tank	-	-	-	-	-	month	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Reactor outlet	-	day	-	day	-	-	month	month	-	-	-	-	-	month	-	-	-	-	-	-	-
	Humus tank overflow	-	-	-	-	-	-	month	month	-	month	month	-	-	-	-	-	-	-	-	-	-
	Humus tank underflow	-	-	monthly at daily peak	-	-	-	-	month	-	-	-	-	-	-	-	-	-	-	-	-	-
	Maturation pond outlet	-	day	-	-	-	-	month	month	-	month	month	-	month	-	month	month	month	-	-	-	-
Biofilters	PST inlet	-	day	daily continuous	-	-	-	month	month	month	month	-	-	month	month	month	month	-	year	year	year	year
	Humus tank overflow	-	-	-	-	-	-	month	month	-	month	month	-	-	month	-	-	-	-	-	-	-
	Maturation pond outlet	-	day	-	-	-	-	month	month	-	month	month	-	month	-	month	month	month	year	year	year	year
Activated sludge system	Reactor inlet	-	day	daily continuous	-	day	-	month	month	month	month	-	6 months	month	-	month	month	-	year	year	year	year
	Reactor	-	day	-	day	day	-	month	month	month	month	-	-	-	-	month	-	-	-	-	-	-
	Clarifier overflow	-	-	-	-	day	-	month	month	-	month	month	-	-	-	month	-	-	-	-	-	-
	Clarifier underflow	-	-	monthly at daily peak	-	-	-	-	month	-	-	-	-	-	-	-	-	-	-	-	-	-
	Maturation pond outlet	-	day	-	-	-	-	month	month	-	month	month	-	month	-	-	month	month	year	year	year	year

TECHNICAL SPECIFICATIONS

FD HEATING VENTILATION AND AIRCONDITIONING SYSTEMS

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FD 01 SCOPE

This specification covers the general maintenance and servicing of heating, ventilation and air-conditioning systems, which include the following:

a) Room air-conditioning units with air cooled condensers
(b) Refrigeration pipework
(c) Electric motors
(d) Air filters
(e) Noise and vibration
(f) Labelling and identification.

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.

The Contractor shall at all times adhere to this specification, unless otherwise specified in the Particular Specification.

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 SANS and other specifications and codes

SANS 046	-	Copper tube manufacturing code of practice
SANS 10400	-	The applications of building regulations
SANS 10103	-	The measurement and rating of environmental noise with respect to annoyance and speech communication
SANS 10139	-	The prevention, automatic detection and extinguishing of fire in buildings
SANS 10140	-	Identification colour marketing
SANS 10142	-	Code of practice for the wiring of premises
SANS 10147	-	Refrigerating systems, including plants associated with air- conditioning systems
SANS 10173	-	Installation, testing and balancing of duct work
SANS 630	-	Decorative high-gloss enamel paint for interior and exterior
SANS 763	-	General coating thickness
SANS 1238	-	HVAC duct construction standards
Act 103	-	National Building Regulations and Building Standard Act, 1977 (Act No 103 of 1977) as amended

FD 02.01.02 Department of Public Works Specifications

PW 371 - Specification of materials and methods to be used STS 1
- Standard specification for air conditioning services STS 5
- Standard Specification for electrical installations and equipment pertaining to mechanical installations

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 of 1993: Construction Regulations, 2014 as promulgated in Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) 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 of new high quality, design 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 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, 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 **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 03.04 **AIR FILTERS**

FD 03.04.01 **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 03.04.02 **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 03.5 **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 03.6 **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 03.7 **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 dispatched.

(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 SANS.

FD 03.8 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 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.

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 06 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 occupies 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 Departmental approved inspection authorities for all inspections and tests to be conducted. This will be done and approved in writing among the relevant parties.

FD 07 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 08 COMMISSIONING AND RECOMMISSIONING OF PLANT AND INSTALLATION

FD 08.01 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 08.02 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 hotconnections.
(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 08.03 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 08.03.01 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 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 10 REPAIR WORK TO INSTALLATION SYSTEMS AND EQUIPMENT

FD 10.01 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) Self-contained air-conditioning units.

FD 10.02 **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 11 MAINTENANCE TO INSTALATION AND EQUIPMENT

FD 11.01 **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;
(d) Cleaning of filters,

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 categorized by the Contractor for each maintenance activity under the following headings:

(a) 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 11.02 DEFINITION AND QUALIFICATION OF ACTIONS

FD 11.02.01 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) 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 11.02.02 Monthly maintenance actions

TABLE FD 11.02.02/1: SELF-CONTAINED AIR-CONDITIONING UNIT

REFERENCE NUMBER	ACTION
S-1	Clean filters, replace if required
S-2	Inspect air intake and discharge for blockages
S-3	Check all refrigerant, drainage pipes for damaged and leaks
S-4	Check sightglass: clear or flash gas
S-5	Carry out visual inspection of condenser coil for blockages and correct operation of fans
S-6	Carry out visual inspection of evaporator coil for blockages and correct operation of supply fan
S-7	Check enclosure for damages
S-8	Check electric motor running temperatures
S-9	Check electric connections for tightness
S-10	Test thermostat and control operation
S-11	Clean condensate tray and test drainage for proper operation
S-12	Check cooling and heating cycle

Note: The monthly actions shall include the activities of the daily maintenance actions.

FD 11.02.03 Biannual maintenance actions

TABLE FD 11.02.03/1: SELF-CONTAINED AIR-CONDITIONING UNITS

REFERENCE NUMBER	ACTION

S-1	Clean filters, replace if required
S-2	Inspect air intake and discharge for blockages
S-3	Check all refrigerant, drainage pipes for damages and leaks
S-4	Check sight-glass: clear or flash gas
S-5	Carry out visual inspection of condenser coil for blockages and correct operation of fans
S-6	Carry out visual inspection of evaporator coil for blockages and correct operation of supply fan
S-7	Check enclosure for damages
S-8	Check electric motor running temperatures
S-9	Check electric connections for tightness
S-10	Test thermostat and control operation
S-11	Clean condensate tray and test drainage for proper operation
S-12	Check filter/dryer
S-13	Check superheat and functioning of expansion valve
S-14	Check operation of HP and LP switch
S-15	Check operation of controllers
S-16	De-rust, neutralize and touch up paint work
S-17	Check cooling and heating cycle
S-18	Clean evaporator and condenser coil chemically
S-19	Clean all filter frames and seals
S-20	Check fan motor and compressor current
S-21	Check and test overload settings
S-22	Lubricate all bearings

Note: The above biannual actions include the activities of the monthly maintenance actions.

TECHNICAL SPECIFICATION

FN CLEAR-WATER PUMP SYSTEMS

CONTENTS

FN 01	SCOPE
FN 02	STANDARD SPECIFICATIONS
FN 03	AS-BUILT INFORMATION AND OPERATING AND MAINTENANCE MANUALS
FN 04	PUMP DESIGN AND REQUIREMENTS
FN 05	MOTOR DESIGN AND REQUIREMENTS
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FN 01 SCOPE

This specification covers the decommissioning, removal, repair and reconditioning, installation, testing, commissioning and maintenance of pumping equipment, motor control devices and low-voltage cables. The function of clear-water pump systems shall be the delivery of water at a specified flow rate and head to the required location.

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.

FN 02 STANDARD SPECIFICATIONS

FN 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:

BS 5316, Part 1	-	Acceptance tests for centrifugal, mixed flow and axial pumps
SABS 948	-	Three-phase induction motors
SANS 1222	-	Enclosures for electrical equipment (classified according to the degree of protection that the enclosure provides)
BS 4999	-	General requirements for rotating electrical machines
BS 1486, Part 2	-	Heavy duty lubrication nipples
ISO 281/1	-	Rolling bearings – dynamic load ratings and rating life

FN 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

FN 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.

FN 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.

FN 03 AS-BUILT INFORMATION AND OPERATING AND MAINTENANCE MANUALS

The Contractor shall at the start of the Contract be given all available 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.

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

FN 04 PUMP DESIGN AND REQUIREMENTS

(a) The pump shaft shall be manufactured from stainless steel and shall be sealed where it enters the casing with double mechanical face seals.

(b) The impeller shall be suitable for pumping the type of clear water as specified in Clause FN 08 (Detail of work) of this specification.

(c) The impeller shall be manufactured from stainless steel or, in the case of other materials, it shall be coated with an approved material resistant to abrasion and corrosion prevalent to the conditions under which the impeller shall operate. For pumps rated below 2 kW non-metallic impellers may be utilised.

(d) The impeller shall be statically, dynamically and hydraulically balanced. No holes may be drilled in the impeller to balance it with regard to mass distribution.

(e) Only permanently sealed ball or roller bearings shall be installed.

(f) Bearings shall have a B-10 life rating of 100 000 hours.

(g) The pump shall be a currently catalogued product.

(h) Performance curves shall be based on a reproducible and certified test carried out in an approved testing facility, such as the SABS.

(i) The flow rate at break-off point of the curve for the impeller selected shall be at least 1,5 times that of the maximum flow rate specified.

(j) The head at zero delivery of the curve of the impeller selected shall be at least 1,2 times the maximum head in the pump's operational range.

(k) Each pump shall be clearly labelled. The label shall be a 0,5 mm thick stainless steel plate of dimensions 100 mm x 50 mm. The label shall be fixed to the pump exterior with an approved adhesive or other method after the completion of corrosion protection on the pump. It may be bent to follow the shape of the pump exterior but shall not be bent to accommodate sharp folds. Under no circumstances shall the stainless steel plate of the label influence, damage or otherwise have a detrimental effect on the corrosion protection system. The label shall include the following information:

- pump rates
- pump head
- power required
- NPSH (r) rotational speed
- impeller detail.

(l) All new submersible pumps shall be supplied with a length of power cable to suit the installation shown on the drawings.

(m) All new pumps shall be fitted with double flush mechanical seals, which shall be included in the cost of the pumps. The pump shafts shall be hardened and accurately ground where the seal bears on the shaft. The rotating seal face shall be mounted on a flexible member, sealing on the shaft as well. The flexible member shall be manufactured from rubber, PTFE or equivalent material suitable for the operating environment.

(n) Centrifugal pumps shall comply with relevant and applicable items under the clause on technical requirements regarding all pump types, as well as the following:

(i) Preference shall be given to pumps of the self-regulating type and where the power consumption characteristic is such that the power consumption decreases with an increase in delivery to beyond a certain limit, thus ensuring that the motor is not overloaded in the event of a large reduction in pumping head.

(ii) The casing for centrifugal pumps shall be horizontally or vertically split to allow removal of parts.

(iii) The efficiency of the pump shall not be less than 95 % of its maximum efficiency at the selected operating point, where the latter shall not be less than 80 %.

FN 05 MOTOR DESIGN AND REQUIREMENTS

(a) Electric motors shall comply with the requirements of SABS 948

(b) Imported motors forming an integral part of the pump shall be submitted to the South African Bureau of Standards to be tested in accordance with the requirements of SABS 948.

(c) All motors shall be standard catalogue models and shall be readily available.

(d) All motors shall, where possible, be from the same manufacturer and shall have the same interchangeable frames. Variations in type and size shall, where possible, be limited to make stocking a variety of special spares unnecessary.

(e) All motors shall have dynamically balanced rotors supported by maintenance- free, sealed-for-life ball bearings.

(f) All motors shall be suitably coated to ensure the satisfactory operation of the motor under the specified class of service.

(g) All terminal boxes shall be waterproof and suited for submersion up to the depth as specified for the pumps.

(h) An adequate length of waterproof cable, purpose-made for submerging, shall be supplied with each submersible motor. The coupling of this cable to the normal power-distribution cable, which usually is of the PVC type with steel-wire armour, shall be placed at least 1,0 m above the maximum water level by means of a purpose-made, weatherproof, outdoor junction box. The submerged cable shall be supported to minimise any movement of the cable, which result from turbulence caused by the operation of the equipment or the flow of the water.

(i) Thermistor protection or Klixon type temperature switches shall be provided for submersible motors.

(j) Seal monitors shall be provided for submersible motors, together with the required seal monitor relays. The cost for the seal monitor relays shall be deemed to be included in the rates tendered for the equipment.

FN 06 WORKING VOLTAGE AND SUPPLY SYSTEMS

The motors shall be capable of operating within ± 10 % of the nominal supply voltage without risk of damage. All motors shall be suitable for operating continuously at the specified three-phase voltage system under actual service conditions, including the
± 10 % voltage tolerance, without exceeding the specified temperature rise determined by the resistance on a basic full load heat run.

All motors shall be capable of operating continuously under actual service conditions at any supply frequency between 48 and 51 Hz together with any voltage between ± 5 % of the nominal supply voltage.

The slip-in speed of any motor at 80 % of the nominal voltage at 50 Hz shall not exceed a percentage agreed on by the Engineer, and the motors shall be capable of operating at this voltage for a period of five minutes without deleterious heating.

FN 07 PROTECTION AND CONTROL DEVICES

Submersible pumping equipment shall have float switches to switch the pump motor on and off, according to the level of the liquid. Switches shall operate freely and not be hindered by cables or other switches and shall switch off at a level where no damage to the pump or motor will occur.

Three level switches shall operate a pump control system:

(a) Level switch one shall switch off pumps at low level;

(b) Level switch two shall switch on one pump at an intermediate level, to draw the liquid down to level 1. When the level again rises to where level switch two was switched on, the pump duty shall rotate and start the motor parallel to the one which ran the first time;

(c) Level switch three shall switch on both pumps to run in parallel at a high level.

In the event of a pump failing to start, the other pump must automatically be restarted. Pumps shall be operated in both manual and automatic modes.

FN 08 DETAIL OF WORK

FN 08.01 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 demarcate any areas to be repaired and shall instruct the Contractor with regard to the repair work to be done.

FN 08.02 **TESTING EQUIPMENT**

All electrical and mechanical equipment shall be checked at the start of the Contract to establish which items need to be repaired, reconditioned or replaced.

FN 08.03 BULK WATER PUMP SYSTEM

The electric motors and pumps were in perfect working order at the time of the tender. Only the maintenance specification will be applicable to the pump including its motor.

The following submersible raw water pumps shall be serviced and maintained under this contract

- Two submersible raw water pumps at the existing Port of Entry river sump area. One duty pump and one stand-by pump, which will alternate as specified in FN 08.07.

Specific details regarding the pump station and pump duty points are specified below:

(a) Two submersible raw water pumps shall be installed at the existing river pump

(b) The pump curve for the pump shall pass through the average duty point of **6 l/s @ 90m**

(c) The pump shall pump raw water from the Komati River up to the existing raw water balancing reservoir at the water treatment works.

FN 08.03.01 WATER TREATMENT WORKS PUMPS

The water treatment works pump system consists of two pumps with electric motors.

The details are as follows:

(a)

1 x Pump:	PENTAX (SRENDOLA-VI-ITALY)
Type:	CM 40/750 No A
L/min:	100/600
Hm:	50/35
kW:	5.5
Hp:	7.5
R.P.M.:	2840
Hz:	50
IP:	44

(b)

1 X Pump:	NOCCI
Type:	NRM2 65-40-200B
No:	A707052
L/min:	250/60
Hm:	38/27
kW:	6.3
R.P.M.:	2900

Hz:	50
IP:	44

Both pumps with electric motors were in perfect working order at the time of the tender.

The pumps shall be serviced as measured in the Schedule of Quantities. The pumps with its motors shall be included in maintenance, as specified in the maintenance specification.

FN 08.03.02 CUSTOMS **COMMERCIAL AREA HIGH LIFT PUMP**

The water treatment works pump system consists of two pumps with

electric motors. The details are as follows:

(a)

1 x Pump:	PENTAX (SRENDOLA-VI-ITALY)
Type:	CM 75/100
L/min:	20-90
Hm:	17.5-26
kW:	0.59
R.P.M.:	2800
Hz:	50
IP:	44
A:	4.5

The pump with electric motors were in perfect working order at the time of the tender.

The pumps with its motors shall be included in maintenance, as specified in the maintenance specification.

FN 08.04 **MOTOR CONTROL CENTRE**

(a) The inside and outside of all surfaces of the motor control centre must be thoroughly cleaned and metal surfaces treated for rust and corrosion and repainted to specification.

(b) Float switches for level sensing shall be checked. Missing, damaged or faulty switches shall be replaced with new switches of similar and equal type. The switches must be installed and supported on suitable brackets to prevent the cables and switches from tangling, due to the inflow of the sewage water.

(c) Check and tighten all terminations of all equipment.

(d) Clean out all switchgear and equipment properly to remove dust and spider webs.

(e) Dismantle and clean all moving parts and contacts of magnetic contactors and starters, reassemble, check overload trip units and adjust correctly. Test for correct functioning on completion of repair work.

(f) Replace any damaged ammeters, switches and lamps on the control with parts similar and equal to the existing types on the panel.

(g) Wiring diagrams of all electrical panels and MCC panels shall be compiled.

FN 08.05 **STANDARD MOTOR CONTROL CENTRE REQUIREMENTS**

(a) The new replacement motor control centre for the water pumps shall be wired to comply with the requirements as set out in this clause.

(b) The motor control centre shall be of the free standing, weatherproof, corrosion resistant

(c) Motor Control Centre panel material must be of 2.0mm thick IP65, 3CR12, coated steel.

(d) The face plate of the motor control centre must be inside the complete panel and the complete

panel must have a lockable door, capable of locking with a padlock.

(e) The faceplate of the motor control centre must have a lockable isolator to ensure that the panel if off when the face plate cover is opened.

(f) The power supply cable from the MCC to the pump shall be tested for conformity to be re-used. In the event that the cable might not pass such testing by the Contractor, the Contractor shall inform the Engineer in writing. The Engineer will instruct the Contractor with regard to a new cable to be installed. *Remuneration, in the event of a new power supply cable being required from the MCC to the pump, will be measured under the re- measurable electrical repair quantities and must* ***not*** *be included in the payment item for the replacement and equipping of the Motor Control Centre!*

(g) Provide an engraved label on the door of the MCC with the relevant MCC number on. The label shall be secured with screws and nuts.

(h) The existing level float switches will be tested and replaced if defective.

(i) Switchgear and equipment shall be installed in the MCC to indicate and ensure:

- Automatically regulate the start and stop of the pumps
- Indicate the time that the pumps has been operating since commissioning (hour meters)
- Start/ stop the pumps manually
- Indicate that the pumps is running
- Indicate that the pumps has tripped
- Indicate Amps for each pump
- Indicate Main Supply Voltage (L1, L2 & L3) & ((L1/L2, L2/L3 & L3/L1)
- Ensure Phase failure protection
- Insulation resistance before start-up
- Temperature (Tempcon, Pt sensor and PTC/thermal switch)
- Overload/under load
- Overvoltage/under voltage
- Phase sequence
- Power factor
- Power consumption
- Harmonic distortion
- Run and start capacitor (single-phase)
- Operating hours and number of starts
- Lightning and surge protection

(j) Test for correct functioning on completion of electrical repair work.

(k) Emergency stop buttons shall be installed at the pump in weather boxes for emergency stop functions.

FN 08.05.01 SPECIFIC REQUIREMENTS FOR BORE HOLE PUMPS

(a) The bore hole pump motor control centres for Skilpadshek shall operate automatically by means of switching off when there is no flow in the pipe line or when the pressure exceeds the maximum working pressure.

(b) The motor control centre will then restart the pump after a set time duration and follow (a) again.

(c) The motor control centre must be able to operate the pump in accordance with the set working time per day. (7day/24hour timer).

FN 09 TESTING AND COMMISSIONING

FN 09.01 TEST TO BE PERFORMED

(a) All pumping equipment shall be subject to the commissioning tests as described in the applicable specification.

(b) At least one of each type or size of pump supplied, repaired or reconditioned, shall be subject to a delivery flow rate test. The Contractor shall supply flow rate or volumetric flow testing facilities.

(c) The operating point of each pump shall be determined.

(d) Efficiency tests shall be performed.

(e) NPSH tests shall be performed.

FN 09.02 PUMP OPERATING POINT

During the day 1 commissioning tests the pump operating point shall be determined by observing the following:

(a) pump delivery and suction pressures, and
(b) electric motor power consumption.

If no efficiency tests are required, then the motor power consumption shall be calculated from the voltage and current measurements obtained during the commissioning test.

The Contractor shall supply the necessary adaptors, fittings and pressures gauges to measure the suction and delivery pressures. If no gauge fittings exist on the suction side, then the suction pressure conditions will be calculated from the system properties.

FN 09.03 FLOW RATE (DELIVERY), EFFICIENCY AND NPSH TESTS

(a) Testing shall be done in accordance with BS 5316 Part 1, class C tests.

(b) Power consumption of electric motors shall be as determined by the three-wattmeter method where efficiency tests are required in the detail specification.

FN 09.04 TEST CONDITIONS

(a) All tests shall be performed in situ.

(b) The pumped medium or liquid shall be water.

FN 09.05 ADDITIONAL TESTS

Additional tests may be specified in the detail of work.

FN 10 MAINTENANCE

FN 10.01 GENERAL

All pumping equipment and systems shall be serviced and repaired, following practical completion of the installation of which it forms part, to maintain it in perfect functional condition.

Maintenance of the swimming pool with its associated equipment, as well as frequent cleaning of the strainer, sand-filter and mechanical cleaning of the pool shall form part of the maintenance responsibility of the Contractor, as defined in this specification. The maintenance responsibility shall include supply and addition of any chemicals that might be necessary for the maintenance of the water quality of the swimming pool.

Maintenance shall be carried out and shall include routine preventative maintenance according to the manufacturer's specification to be set out in the operating and maintenance manual, as well as unforeseen repairwork or replacement.

The remuneration for monthly maintenance of pumping equipment and systems shall be deemed included in the tendered rate for 10 points of the installation of which the system forms part. Installations are specified in Additional Specification SA: General Maintenance, and illustrated in detail on the mechanical flow diagram.

FN 10.02 ROUTINE PREVENTATIVE MAINTENANCE

The routine preventative maintenance work to be carried out shall include but not be limited to the items listed in table FN 10.2/1 below.

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

TABLE FN 10.02/1

NO	ROUTINE PREVENTATIVE MAINTENANCE OF CLEAR-WATER PUMP SYSTEMS	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete systems	Monthly
2	Check, service, repair and clean all pumps	Six-monthly
3	Check, service, repair and clean all motor control	Six-monthly
	centres and level censing devices.	

4	Corrosion protect pumps, motors and surface piping	As required
5	Check, inspect, report and repair all leaks	Monthly

6	Check and lubricate moving parts	Six-monthly

FN 11 MEASUREMENT AND PAYMENT

FN11.01 SUPPLY AND DELIVERY OF PUMPING EQUIPMENT ..... Unit: number

The unit of measurement shall be the number of pumping equipment units supplied and delivered.

The tendered rates shall include full compensation for the design, manufacture, corrosion protection, patent rights, pre-delivery testing and test certificates, transport for delivery to site and off-loading, including all handling of the equipment. The equipment shall include the following:

(a) The pump and motor as an integrated unit
(b) Electrical power cable.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

FN11.02 INSTALLATION, TESTING AND COMMISSIONING OF PUMPING EQUIPMENT ..... Unit: number

The unit of measurement shall be the number of pumping equipment units tested and commissioned.

The tendered rates shall include full compensation for the site handling and positioning of the pumping equipment, including the fastening of the equipment in its designated position. The following shall also be included in the tendered rates:

(a) Installation of the guide rails and sealing frame;
(b) Coupling of all required pipes flanges, including all required gaskets, nuts, bolts and washers;
(c) Routing and fastening of the power cable up to the isolator box;
(d) All required installation materials, labour and consumables to render a complete and working installation.

The tendered rates shall also include full compensation for all preliminary tests, delivery and efficiency tests if required and commissioning tests. Commissioning tests shall comply with the section dealing with testing and commissioning.
Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

FN11.03 DECOMMISSIONING AND REMOVAL OF PUMPING EQUIPMENT ..... Unit: number

The unit of measurement shall be the number of pumping equipment units decommissioned and removed.

The tendered rates shall include full compensation for all labour, machinery, tools, transport and site handling necessary for the decommissioning and removal of pumping equipment.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

FN11.04 RECONDITIONING OF PUMPING EQUIPMENT ..... Unit: number

The unit of measurement shall be the number of pumps and motors reconditioned.

The tendered rates shall include full compensation for replacement of components and materials, and for tools, transport, site handling and labour necessary for the complete reconditioning of pumping equipment to conform to all the specifications in Clauses FN 04: Pump design and requirements, and FN 05: Motor design and requirements.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

FN11.05 REPAIR OF PUMPING EQUIPMENT ..... Unit: number

The unit of measurement shall be the number of pumps and motors repaired.

The tendered rate shall include full compensation for supply of an identification label, resetting the spacer between impeller and back plate and ensuring that impeller rotates freely, as well as cleaning and corrosion protection and installing a new hoisting chain.
Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

FN11.06 **SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF MCC BOARDS OR OTHER ELECTRICITY BOARDS**..... Unit: number

The unit of measurement shall be the number of MCC boards or other electricity boards supplied.

The tendered rates shall include full compensation for supply of the complete motor control centre as per the requirement in the specification and components and materials and for tools, transport, site handling and labour necessary for supply of a fully functional MCC board.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

FN11.07 **DECOMMISSION, RECONDITION, TEST AND COMMISSION MCC BOARDS OR OTHER ELECTRICITY BOARDS**.....Unit: number

The unit of measurement shall be the number of MCC boards or other electricity boards reconditioned.

The tendered rates shall include full compensation for replacement of existing components and materials and for tools, transport, site handling and labour necessary for the complete reconditioning of all components of the board or replacement of all components to provide a fully functional MCC board in accordance with the specification.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

FN11.08 **COMPILATION OF WIRING DIAGRAMS**.....Unit: number

The unit of measurement shall be the number of wiring diagrams compiled.

The tendered rates shall include full compensation for drawing, printing, computer time and any other associated costs necessary for the compilation of a wiring diagram.

FN11.09 **RECONDITIONING OF TELEMETRIC SYSTEMS**.....Unit: number

The unit of measurement shall be the number of telemetric systems repaired/ reconditioned.

The tendered rates shall include full compensation for replacement of components and materials and for tools, transport, site handling and labour necessary for the complete reconditioning/repair of all components of the telemetric system.

TECHNICAL SPECIFICATION

HA MV SWITCHGEAR SYSTEMS

CONTENTS

HA 01	SCOPE
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HA 11	MEDIUM VOLTAGE SWITCHGEAR: TECHNICAL DETAILS
HA 12	SUBSTATION BUILDING AND YARD: TECHNICAL DETAILS

HA 01 SCOPE

HA 01.01 This specification comprises all aspects regarding the maintenance and servicing of Medium voltage switchgear, Substation building and yard.

HA 01.02 This specification shall form an integral part of the maintenance and servicing contract document and shall be read in conjunction with Part C, 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 the specification and shall deemed to form part thereof.

HA 02.02 **SANS Specifications**

- SANS 1195
- SANS 172
- SANS 763
- SANS 555
- SANS 1091

HA 02.03 **BSI Specifications**

- BSI 5463
- BSI 159
- BSI 223
- BSI 2562
- BSI 2692
- BSI 88
- BSI 5227
- BSI 729
- BSI 148
- BSI 5253
- BSI 5463
- BSI 142

HA 02.04 **Occupational Health and Safety Act of 1993 (OHS-Act)**

HA 02.05 **Manufacturer's specifications and maintenance instructions**

HA 02.06 **Additional requirements**

Equipment and material installed shall be new and unused.
Air and Oil switches, MV and LV switches and Protective relays shall bear the SANS stamp. The Contractor shall ensure that all safety regulations and measures are applied and enforced during repair and maintenance work.

HA 03 AS-BUILT INFORMATION AND OPERATING AND MAINTENANCE MANUALS

HA 03.01 Procurement of available as-built information. At the commencement of the contract, the Contractor shall obtain all available as-built documentation.

The Contractor shall be responsible for the verification of the correctness of all such information. The Contractor shall, in the probable case of non-availability and correctness of such information be responsible for the compilation of a complete set of as-built drawings, inventory list and Operating and Instruction Manuals.

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.

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 be structured and shall at least include the following:

- ♦ <u>System Description</u>
  - ➢ Complete system description of the distribution system. This shall be done for each substation individually. The system description shall contain detailed information regarding the supply configuration (substation, cabling, distribution kiosks, pole mounted switchgear), the system configuration (switchgear, cabling, metering, batteries) and the switchgear detail as well as the earthing and lightning protection arrangement.
- ♦ <u>Commissioning Data</u>
  - ➢ Complete commissioning, test and inspection data of the MV switchgear. This shall be done for each substation installation individually.
- ♦ <u>Operating data</u>
  - ➢ Safety precautions to be implemented.
  - ➢ Operating of MV system: Switchgear, relays, battery and charger sets.
- ♦ <u>Maintenance instructions</u>
  - ➢ Projected frequency of fuse replacement per substation.
  - ➢ Procedure to verify operation of circuit breaker - controlled circuits.
  - ➢ Trouble shooting diagram.
  - ➢ Equipment details, including manufacturer's brochures / pamphlets, order numbers and list of components.
  - ➢ Schedule of serviceable components of medium voltageswitchgear.
  - ➢ Hoisting equipment specification, if applicable.

HA 04 TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK

HA 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
- ➢ current per phase
- ➢ earthing resistance testing
- ➢ contact resistance per phase

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.

HA 05 LOGGING AND RECORDING PROCEDURES

HA 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.

HA 05.02 The logbook shall be stored in a safe place inside the main substation and shall only be utilised 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 medium voltage Switchgear inspection and maintenance actions
- ➢ Bi-annual inspection and testing of medium voltage switchgear
- ➢ Annual earthing test report
- ➢ Breakdown / call out reports.

HA 06 MAINTENANCE TOOLS AND SPARES

HA 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 Engi- neer. Any deficiencies or short fall or damaged Tools and Spares shall be replaced with new equipment / material, as part of the contract.

HA 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 thiscontract.

HA 06.03 The Tools and Spares shall at least include the following: Medium voltage switchgear operating tools.

MV fuses rated 25A 22kV 40kA. Cut out fuse element 10A & 20A

HA 07 QUALITY ASSURANCE SYSTEM

HA 07.01 Following formal approval of his Quality Assurance system by the Engineer, the Contractor shall implement the approved QA system.

HA 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.

HA 08 RE-COMMISSIONING OF INSTALLATION

HA 08.01 On completion of the repair work, the MV installations shall be put into operation.

HA 09 MAINTENANCE AND SERVICING WORK TO MV INSTALLATIONS

HA 09.01 The various MV systems shall be maintained and serviced as measured in the bills of quantities, Installation A10, during the first period of the repair and maintenance contract.

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

HA 09.03 The Contractor shall record the repair actions in tabular format before the mainte- nance 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 (e.g. batteries, relays, contacts, etc). 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 Engineer.

HA 09.06 The maintenance phase of this contract shall commence once the repair works on the installation have been commissioned and handed over to the satisfaction of the Engineer.

HA 10 MV INSTALLATION MAINTENANCE

HA 10.01 The various MV systems shall be maintained following the initial repair work. The maintenance contract shall run for the balance of the 36-month contract period.

HA 10.02 The following maintenance actions will be required under this period of the contract:

- ♦ routine preventative maintenance
- ♦ corrective maintenance
- ♦ breakdown maintenance

These actions are defined in the Additional Specification SA - General Mainte- nance.

HA 10.03 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.

HA 11 MEDIUM VOLTAGE SWITCHGEAR: TECHNICAL DETAILS

HA 11.01 Installation description

This section describes the electrical distribution network that will be repaired and maintained in terms of this contract. The network is operated at 22kV.

a) Distribution Substations

The electrical distribution network includes 4 miniature substations. The Miniature Substations contains a Schneider circuit breaker (Ring Main Unit) and is connected to an incoming, outgoing and (500kVA & 315kVA) transformer feeder MV cables.

HA 11.02 Scope of repair work

Clean, check and service 22kV circuit breaker.

HA 11.03 Repair work: Measurement and payment

Item	Unit

a) Service ring main unit

The unit of measure shall be the total for the work. The tendered rate shall include full compensation for:
The unit measurement shall be the number of ring main units serviced. The tendered rate shall include full compensation for the following.
Wipe down and clean framework. Clean tank.
Check, clean and lubricate mechanism. Check interlocks.
Clean fuse contacts.
Remove rust and repaint where necessary. Use rust remover sand thoroughly and apply neutralizer. Apply primer and 2 coats of enamel paint. Check and repair vermin proofing.
Test oil dielectrical strength, moisture, moisture content, acidity and undertake gas analysis per random sample.

Item	Unit
(b) Service battery and charger set.	No

The unit of measurement shall be the number of battery and charger sets serviced. The tendered rate shall include full compensation for the following:
Battery and charger sets

Replacement of batteries.
Cleaning of connections and terminals.
Measure and record SG where applicable. Top up each cell. Check battery capacity, with an external load.
Apply insulating grease to contacts. Check and test battery charger operation.

Battery trip unit service and test.

Item	Unit
(c) Check protection relay	No

The unit of measure shall be the number of panels with relays tested. The tendered rate shall include full compensation for the following: 22kV panels with 3 x OC (IDMT) 1 x EF
Current transformers; (3 x per panel)
Primary injection
Secondary injection and all other tests Protection relays per panel:
Testing and commissioning Indication and metering Interlocking and scheme
Control functions Supervisory functions
General: Cleaning panels, fuse holders, relays, enclosures, instrumentation; check fuses, vermin-proofing, lubrication.

Item	Unit

(d) Add additional cable box oil — Litre

The unit of measure shall be the number of litres of oil added.

The tendered rate shall include full compensation for ordering, supplying and adding additional oil. The oil must be as semi fluid grade of compound 'Pentrol' or equipment.

Item	Unit

(e) Replace neon lamps and capacitor diverters — No

The unit or measure shall be the number of neon lamps and capacitor diverters replaced.

The tendered rate shall include full compensation for the replacement of faulty neon lamps and capacitor diverters.

Item	Unit

(f) Re-tape MV busbars. — No.

The unit of measure shall be a lump sum.

The tendered rate shall include full compensation to re-tape the MV busbars to the bushings inside the MV panel using PVC insulation tape.

Item	Unit

(g) Repair oil leak on cable box. — No

The unit of measure shall be the number of cable boxes repaired.

The tendered rate shall include full compensation for the repairing of oil leaks.

Item	Unit

(h) Provide MV ring schematic. — Item

The unit of measure shall be the number of MV ring schematic installed.

The tendered rate shall include full compensation for compiling, supply and installation of a A3 laminated framed schematic in the substation.

HA 11.04 **Maintenance work**

HA 11.04.01 **Monthly**

Visual inspection of switchgear. Check
for oil leaks.
Check oil levels.
Recording of current and voltage readings in and signing of record book.

HA 11.04.02 **Annual**

Service all medium voltage Switchgear. Record
all test results in record book.

HA 11.05 **Maintenance Work: Measurement and Payment**

Refer to clause SA 06 of the Additional Specification - SA General Maintenance.

Remuneration for the Maintenance work shall form of the overall Medium and Low Voltage Installation (Installation A10).

HA 12 **SUBSTATION BUILDING AND YARD**

HA 12.01 **Installation description**

This section describes the electrical distribution network that will be repaired and maintained in terms of this contract.

a) Miniature Substations

Four conventional plinth mounted miniature substations form part of the distribution

network.

HA 12.02 **SCOPE OF REPAIR WORK**

Open substation, clean substation. Provide framed schematic.
Provide labels and markings on substations. Check and report on condition of substation.

HA 12.03 **REPAIR WORK: MEASUREMENT AND PAYMENT**

	Item	Unit
a)	Provide labels, notices and schematics.	No.

The unit of measure shall be the number of substations ladled. The tendered rate shall include full compensation for the following: Provide substation number.
Mark doors HV/TRF/LV/ESC, etc.
Provide OHS Act notice at each substation. Provide a A3 laminated framed schematic.

	Item	Unit
b)	Service miniature substation.	No.

The unit of measurement shall be the number of miniature substations serviced.

The tendered rate shall include full compensation for the following:

Removal of flaking paint, sanding and repainting of miniature substation shell with 1 x coat primer and 2 x coats enamel paint (Avocado green), clean and remove all vegetation around the miniature substation and apply weed killer over the area.

Sanding and repair of the foundation and repaint of the foundation with 1 coat primer and 2 coats epoxy.
General cleaning of miniature substation interior.

	Item	Unit
c)	Check mini-substation earthing.	No

The unit of measure shall be the number of mini-substation earths checked. The tendered rate shall include full compensation for the following:
Measuring of earthing system earth resistance. Checking of earthing of all equipment.
Secure earth termination. Retentioning of all earth connections.

	Item	Unit
d)	Provide MV ring schematic.	Item

The unit of measure shall be the number of MV ring schematic installed.

The tendered rate shall include full compensation for the ordering, supply and installation of a A3 laminated framed schematic on the miniature substation.

	Item	Unit
e)	Supply MV operating handles.	No.

The unit of measure shall be the number of operating handles supplied.

The tendered rate shall include full compensation for the supply of operating handles if and when instructed by the engineer.

HA 12.04 **MAINTENANCE WORK**

HA 12.04.01 **Monthly**

Clean inside and around minisubs (weed control with Round up). Complete log books and report

HA 12.04.02 **Annual**

Service minisubs

HA 12.05 **MAINTENANCE WORK: MEASUREMENT AND PAYMENT**

Refer to clause SA 06 of the Additional Specification - SA General Maintenance.

Remuneration for the Maintenance work shall form of the overall Medium and Low Voltage Installation (Installation A10).

TECHNICAL SPECIFICATION

HB STANDBY POWER SYSTEMS

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HB 11 MAINTENANCE OF STANDBY POWER INSTALLATIONS

HB 01 SCOPE

HB 01.01 This specification comprises all aspects regarding the maintenance and servicing of standby power systems. The standby power sources consist of:

i) One 80 kVA diesel generator at Customs Commercial Area
ii) One 250 kVA diesel generator at Top Control Area
iii) One 15kVA UPS unit at Port of Entry
iv) One 10kVA UPS unit at Port of Entry
v) Two 5kVA UPS units at Customs Commercial Area.

HB 01.02 This specification shall form an integral part of the maintenance and servicing contract document and shall be read in conjunction with Portion 3, the Additional Specifications included with this document.

HB 02 STANDARD SPECIFICATIONS, REGULATIONS AND CODES

HB 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.

HB 02.02 SANS Specifications

2.2.1 SANS 10400: NATIONAL BUILDING REGULATIONS
2.2.2 SANS 10142: WIRING CODE

HB 02.03 Department of Public Works Specification PW 774

HB 02.04 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

HB 02.05 Manufacturer's specifications and maintenance instructions

HB 02.06 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.

HB 03 OPERATING AND MAINTENANCE MANUALS

HB 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 seven sets of hard copies.

HB 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:

3.2.1 Description of installation

a) 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.
b) Service records

3.2.2 Commissioning Data

a) Complete commissioning, test and inspection data of standby power system.

3.2.3 Operating Data

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.

a) Safety precautions to be implemented.
b) Operation of systems; automatic, manual and bypass switching.
c) Emergency starting and forced change-over procedure.

3.2.4 Maintenance Documentation

a) Recommended service intervals with service descriptions.
b) Projected service life of:
   - diesel engine to next overhaul
   - diesel engine starter batteries
   - electronics on UPS units
   - battery pack
c) Trouble shooting diagrams.
d) Schedule of consumable spares.
e) Schedule of batteries comprising the battery bank.

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:

4.1.1 output phase voltages
4.1.2 output current per phase
4.1.3 insulation testing at 500V
4.1.4 system earthing resistance testing by means of wheatstone bridge instrument
4.1.5 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:

5.2.1 Monthly inspection and maintenance actions.
5.2.2 Scheduled services.
5.2.3 Breakdown / call out reports.
5.2.4 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 (1 off)
Distribution Board face plate square key (1 off)
20L HD diesel oil as per engine manufacturer's specification
220V diesel jockey pump
5m 20mm ∅ diesel hose
10mm² battery jumper cables: 1 pair
First Aid Kit
Industrial type wall mounted (aluminium) paper towel dispenser with paper cartridge per generator room similar or equal to "Kimberley Clark MP Wall Stand"

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

The stand-by generator at the Lebombo Port of Entry (POE) have 2 Power Generators, in the Commercial and Top Control Area (Main Port) with the following technical descriptions:

1. Lebombo Port of Entry Site

- Three-phase synchronous A.C. Generator,
- 250kVA, 400V, 50HZ Standy Generator, and.
- A diesel Engine manufactured by VOLVO.

The surroundings at which this generator is installed has the following attributes:

- The general condition of the generator room and a generator itself is in a satisfactory state.
- The High Voltage and Cardio Pulmonary Resuscitation (CPR) warning signage are visible affixed on the door and also on the inside wall, The entrance into the generator room is secured.
- A spare 250KVA, 400V, 50HZ spare emergency standby generator shall also be provided under this contract for emergency power supply to operational POE facility.

2. Commercial Area

- Three-phase synchronous A.C. Generator,
- 80kVA, 400V, 50HZ Standy Generator, and.
- A diesel Engine manufactured by VOLVO.

The surroundings at which this generator is installed has the following attributes:

- The general condition of the generator room and a generator itself is in a satisfactory state.
- The High Voltage and Cardio Pulmonary Resuscitation (CPR) warning signage are visible

affixed on the door and also on the inside wall, The entrance into the generator room is secured.

- A spare 80KVA, 400V, 50HZ spare emergency standby generator shall also be provided under this contract for emergency power supply to operational Commercial Area of the POE facility.

HB 10.02 **Scope of repair work: Generators**

HB 10.02.01 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 and control panel and clean internally and externally. Simulate and verify all alarm and shut down conditions. Replace all inoperative lamps, sirens and meters. Check and complete all labelling and notices.

Repair lagging on exhaust system.

Reinstate fuel shut off system with fusible link.
Fit new padlocks on enclosure.
Supply and install a fuel/water separator with automatic water dump feature in the fuel line from the tank to the generator. The separator shall be manufactured from robust corrosion resistant material and shall be similar or equal to Duvalco MK3 series.

Supply and install a fuel modular filtration with automatic water dump feature at the bulk fuel tank. The fuel modular filtration shall be manufactured from robust corrosion resistant material and shall be similar or equal to Duvalco FMS series.

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 10.02.04 Add an 12/24 V DC fluorescent emergency light, with switch above the control
Control panel door of each generator installation.
The light shall be energised via a push button switch with adjustable run-down timer (0 – 120 minutes)

HB 10.03 **Generator repair work: measurement and payment**

HB 10.03.01 **Repair plant room**

The unit of measurement shall be the number of plant room cleaned and painted.

The tendered rate shall include full compensation for the repair of Floors that shall be washed (Steam cleaned) and painted with grey 2-part industrial self levelling 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 the number of services performed on alternators in the 20kW to 150kW range

The tendered rate shall include full compensation for the complete mechanical/electrical service of the generator installation according to the manufacturer's instructions, replacement of wiring, opening and cleaning of alternator and alarm panel as well as the steam cleaning of the assembly as described in Clause HB 10.02.

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HB 10.03.03 **Diesel engine service**

The unit of measurement shall be the number of mechanical services performed on diesel engines in the 20kW to 1000kW 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, replacement of wiring, V-belts and hoses as needed and other consumable items as described in Clause HB 10.02 and the steam cleaning of the assembly.

The tendered rate shall further include for the supply and installation of a fuel shut off system with fusible link including all consumables such as pipes, cables, fittings and taps.

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.

Service alarm and control panel and clean internally and externally. Simulate and verify all alarm and shut down conditions. Replace all inoperative lamps, sirens and meters. Check and complete all labelling and notices.

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 upon instruction from the Engineer.

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 10.03.10 **Repair alarm sounder**

The unit of measurement shall be the number of alarm / flasher units installed. The tender rate shall include full compensation for the repair of the panel mounted alarm and circuit and the supply and installation of the specified external alarm/flasher unit, in full working order including all cabling to and from the Control panel.

HB 10.03.11 **Add 12/24V DC emergency light.**

The unit of measurement shall be the number of lights installed. The tender rate shall include full compensation for the supply and installation of all materials, brackets and fixings for the specified emergency light in full working order above the Control panel.

HB 10.03.12 **Supply and install fuel water separator**

The unit of measurement shall be the number of fuel/water separator units with automatic water dump installed.

The tendered rate shall include full compensation for the ordering, supply, installation and commissioning of the fuel/water separator unit similar or equal to Duvalco MK 3 series or Duvalco Modular Filtration System.

HB 10.03.13 **Supply and install a fuel drip tray**

The unit of measurement shall be the number of fuel drip trays supplied and installed.

The tendered rate shall include full compensation for the manufacturing, supply and installation of a fuel drip tray as described in Clause HB 10.03

HB 10.03.14 **Supply and Install water jacket heater**

The unit of measurement shall be the number of water jacket heaters supplied and installed.

The tendered rate shall include full compensation for the installation of a water heater complete with a thermostat, element connection of all water hoses including all couplings and taps, cabling to and from the control panel and testing and commissioning of the unit

HB 10.03.15 **Repair Exhaust**

The unit of measurement shall be a sum for the removal of the existing exhaust and the supply and installation of the new exhaust similar to the existing.

The tendered rate shall include full compensation for the supply and installation of the new exhaust including, lagging, flexible connections and sealing of the room exit port.

HB 10.03.16 **Re-condition Diesel Engine**

The unit of measurement shall be the number of diesel engines re-conditioned according to the manufacturer's specifications.

The tendered rate shall include full compensation for the disconnection, removal and complete overhaul of the diesel engine at an approved mechanical engineering works.

The tender rate shall further include for the replacement of all the internal components, seals, pipes, fittings etc of the diesel engine.

HB 11 **MAINTENANCE OF THE INSTALLATION**

HB 11.01 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.

HB 11.02 The following maintenance actions will be required under the contract:

11.2.1 Routine Preventative Maintenance
11.2.2 Corrective Maintenance
11.2.3 Breakdown Maintenance

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

HB 11.03 The maintenance schedules and frequency of services and maintenance activities hall 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 11.04 **Generator maintenance: scope of work.**

HB 11.04.01 **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 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.

(g) Complete Standby Generator monthly log sheets

(h) Record running hours, diesel consumption etc.

HB 11.04.02 **Annual or 150-hour service 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.

(d) Replace oil and fuel filters.

HB 11.04.03 **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 11.05 **Generator maintenance: measurement and payment**

Refer to Clause SA 06 of the ADDITIONAL SPECIFICATION: SA GENERAL MAINTENANCE.

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
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HC 06	MAINTENANCE TOOLS AND SPARES
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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 maintenance of low voltage systems. Low voltage comprises:

- low voltage distribution boards
- low voltage kiosks

HC 01.02 This specification shall form an integral part of the 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 **SANS Specifications**

- SANS 10142-1
- SANS 10142-2
- SANS 141
- SANS 1091
- SANS 763
- SANS 1195
- SANS 784

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 SANS 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.

HC 06 **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 his responsibility under this contract.

HC 06.03 **The Tools and Spares shall at least include the following:**

DB Key
DB face plate square key.

HC 07 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.

HC 08 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 compartment in the miniature substation.

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.

HC 11.03 **Repair work: measurement and payment**

	Item	Unit
(a)	Service low voltage distribution boards	No

The unit of measure shall be the number of low voltage boards serviced.

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.

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 kiosks. The kiosks contain circuit 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) Replace door hinges and latches

6) Replace panel catches

HC 12.03 **Repair work: measurement and payments.**

Item

Unit

(a) Service distribution kiosk
No

The unit of measurement shall be the number of distribution kiosks serviced.

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.)

Item Unit

(b) Remove rust and paint kiosks
No

The unit of measurement shall be the total number of kiosks painted.

The tendered rate shall include full compensation for the removal of rust with a anti corrosion agent and the repainting of the whole kiosk.

Item Unit

(c) Label kiosks
No.

The unit of measure shall be the total number of kiosks labelled.

The tendered rate shall include full compensation for the labelling of kiosks circuit breakers, cable and the warning notification to be installed.

Item Unit

(d) Supply and install padlocks No.

The unit of measurement shall be the number of padlocks installed.

The tendered rate shall include full compensation for the ordering, supply, engraving and installation of the padlocks, locking devices and seals.

Lock shall be “keyed alike”.

Item Unit

(e) Replace distribution meter and stubby kiosks. No.

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.

Item Unit

(f) Replace door hinges on meter and distribution kiosks. No.

The tendered rate shall include full compensation for the removal of damaged hinges, the supply, delivery and installation of new hinges.

Item Unit

(g) Supply and install handles. No.
(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.

Item Unit

(h) Supply and install low voltage PVC/SWA/PVC Cu cable and bare copper earth wire. No.

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.)

Item Unit

(i) Termination of low voltage PVC/SWA/PVC Cu cables. No.

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.

	Item	Unit
(j)	Jointing of low voltage PVC/SWA/PVC Cu cable.	No.

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.

	Item	Unit
(k)	Excavations for cable trenches and meter boxes.	m^3

The unit of measurement shall be the total volume excavated and backfilled in dimensions as specified by the engineer.

	Item	Unit
(l)	Supply and installation bare copper earth conductor.	meter

The unit of measure 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).

	Item	Unit
(m)	Termination of bare copper earth conductor.	No.

The unit of measure 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.

	Item	Unit
(n)	Re-wiring of kiosk.	No

The unit of measure shall be number of kiosks re-wired.

The tendered rate shall include full compensation for removal of the existing wiring, re-wiring, labelling and commissioning of the kiosk.

	Item	Unit
(o)	Reposition contactors on kiosk.	No

The unit of measure shall be number of contactors repositioned.

The tendered rate shall include full compensation for removal of the existing wiring, removal of contactors, mounting in new positions re-wiring, labelling and commissioning of the kiosk.

	Item	Unit
(p)	Supply and install front covers.	No

The unit of measure shall be number of covers supplied and installed.

The tendered rate shall include full compensation for measuring, manufacturing painting and installation of front covers.

Item	Unit
(q) Replace distribution meter kiosks.	No.

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 6/4-way meter boxes complete with watt hour meters, circuit breakers, gland plate, labelling and concrete foot strip as specified. The distribution kiosks shall be similar or equal to Eprotech or Aluex.

Consumer distribution kiosks

(a) General

The kiosks shall be of adequate size to accommodate the number of outgoing consumer circuits specified.

The kiosks shall have two sections, namely:

(i) one section containing all incoming and outgoing switchgear and cables, and

(ii) one section containing the consumer meters and circuit breakers.

(b) Fabrication

The kiosks shall be fabricated from 3CR12 stainless steel of minimum thickness 2,5 mm and shall be mounted on a channel iron steel base.

A metal frame work, manufactured from solid angle iron, channel iron, or 2,5 mm 3CR12 folded sheet steel shall be mounted on the base of the kiosk. The kiosk shell shall be completely independent from the frame and equipment so that the kiosk shell can be removed and replaced without disconnecting any equipment. The kiosk shall be bolted down onto the base by means of four M16 high tensile bolts which shall be accessible from the inside of the kiosk only.

The kiosks shall be weatherproof, vermin and insect-proof and proved against tampering. To prevent the ingress of water onto live equipment, the door entry surrounds shall have a channel shape, at least 12 mm deep, to accommodate the door edge. A rubber or neoprene closer strip shall be so fitted to the edges of each door as to provide a seal to keep rain water and dust out of the kiosk.

The kiosk shall have a pitched roof that slopes downwards at the front and at the back with an overhang of at least 75 mm all round.

The kiosks shall be fitted with a door in the front and at the back of the kiosk. The maximum width per door shall be 600 mm. The doors shall provide free access to the equipment and shall provide a full view of all meters. The doors shall have well returning edges to fit into the channel of the door entry surrounds. Each door shall have three robust solid brass hinges each of length at least 100 mm. The hinges shall be completely concealed. Doors shall be fitted with lever locks equal or similar to the "Barker & Nelson" type. The locking mechanism shall facilitate three-point latching at the top, side and bottom of the doors. In the case of double doors, the first door shall be locked with two slides on the inside onto the kiosk shell. The second door shall close over a lip on the first one. Nylon door restraints shall be provided. The fixing points of the restraints at the door and the canopy shall be reinforced. The doors shall be earthed bonded to the frame by means of a copper braided strap, tooth washers, bolts and nuts.

Ventilation louvres with approximate size 225 x 150 mm shall be provided on both sides of the kiosk. Each ventilation louvre shall be covered on the inside with perforated plates with 2,5 mm holes so that

- it is not possible to push a steel wire through it into the interior of the kiosk, and
- it prevents vermin from entering into the kiosk.

A mounting panel shall be positioned in the centre of each kiosk, fixed to the frame work, for the mounting of the specified equipment.

(c) Mounting panel

The mounting panel shall consist of a minimum 3 mm thick mild steel plate.

The one section of the panel shall be equipped with copper busbars mounted on porcelain or similar insulators and of sufficient length to accommodate three 12 mm brass bolts for the connection of distribution cables and six consumer meter connections per phase. The busbars shall be tinned after the drilling of holes. The busbars shall be able to carry 250 Ampere at a current density of not more then 1,5 A/mm . Each busbar shall be marked red, yellow and blue with black for the neutral bar. The busbars shall be able to withstand the thermal and dynamic forces resulting from shortcircuits without deformation taking place or parts breaking.

The specified consumer equipment shall be installed in the second section. The mounting panel and equipment shall be enclosed by a machine punched removable front panel through which the operating handles of the equipment and the face plates of the meters protrude.

(d) Equipment installed in kiosks

The equipment to be installed in the kiosks shall be as specified in the detail specification.

(e) Wiring of kiosks

The internal wiring in the kiosks shall be done with PVC insulated copper conductors. The wiring shall be done in neat horizontal and vertical columns. Each consumer circuit shall be wired from the phase busbars to the circuit breaker and from the circuit breaker to the meter.

Connections to busbars and terminals shall be done by means of cable lugs crimped in an approved manner to the conductor ends. Connections to the busbars shall be made by means of cadmium plated high tensile steel bolts and nuts with locking washers.

(f) Earthing

A 25 mm x 6 mm long tinned copper earth bar shall be installed at the bottom of the kiosk.

10 mm diameter holes shall be drilled through the earth bar to provide for the distribution cable and service cable earth conductors. All bolts used for the fixing of the earth conductors shall be cadmium plated and only one earth conductor shall be connected per bolt.

The metal work of the kiosk shall be earthed to the earth bar by means of a 70 mm stranded copper conductor. An earth stud shall be provided on the kiosk housing for this purpose.

(g) Cable gland plate

The cables shall be terminated on a removable galvanised gland plate of suitable dimension and strength. The gland plate shall cover the full length of the kiosk.

The gland plate shall be at least 300 mm below the nearest terminal of switchgear allowing sufficient space for bending the cable ends. Sufficient space shall be provided underneath the gland plate to allow for the installation of the cables without removing the gland plate. The gland plate shall be earthed to the earth bar by means of a 70 mm stranded copper earth conductor.

(h) Terminal blocks

A terminal block of the "Klippon SAK" or equivalent type suitable for the termination of 16 mm stranded copper conductors shall be provided. Terminals shall be of the screw type and a terminal shall be provided for each service connection cable.

(i) Labels

The kiosks shall be supplied with the following labels:

(i) An aluminium label with 40 mm high letters and numeral indicating the kiosk number.

(ii) Engraved traffolite labels with 6 mm high numerals under each circuit breaker, meter, and terminal on the terminal block indicating the consumer stand number.

The labels shall have a white background and black letters. The 40 mm labels shall be fixed by means of rivets and the 6 mm high labels shall be inserted in 25 mm wide aluminium label holder mounted at the bottom of the relevant equipment.

(j) Danger signs

The requirements of Regulation C-52 of the Machinery and Occupational Safety Act No 6 of 1983 shall be complied with. All doors shall be fitted with a 150 x 100 mm Danger/Gevaar/Ingozi signs.

(k) Painting and finishing

(i) Post-weld cleaning and passivation of 3CR12

Post-weld cleaning shall be undertaken on all welded areas. One of the following cleaning methods may be used to remove all surface discolouration and scale from welded areas.

(1) Wire brushing : Where it is possible to remove the discolouration and detritus from weld areas by brushing, stainless steel wire brushes, that have not been used on other material other than 3CR12, may be used.

(2) Grinding: Dedicated grinding wheels and discs based on alumina shall be used for the dressing of welds. The use of silicon carbide wheels and discs shall not be used.

(3) Abrasive blast cleaning: The abrasive used shall be washed silica sand or alumina totally free of metallic iron, iron oxides or chlorides.

(ii) Chemical cleaning (pickling)

The pickling of 3CR12 shall be carried out using formulations based on nitric (HNO3) and hydrofluoric (HF) acid. Formulations based on hydrochloric acids shall not be used. Acids used shall conform to commercial purity standards. Where proprietary pickling formulations are used, the manufacturer's directions concerning the application procedures shall be strictly adhered to.

(iii) Passivation

The passivation of the 3CR12 shall be carried out as soon as possible after the post-weld cleaning has taken place. A solution made up of nitric acid shall be used for the passivation of the 3CR12. The solution shall be generously applied to the steel by brush, cloth, spray or dipping. Care shall be taken that the solution does not dry on the steel surface. The steel shall be thoroughly washed with clean cold water to remove all traces of the acid use.

(iv) General

The entire process of cleaning, pickling, passivation and neutralization shall be completed in one working day.
Tenderers shall submit full details of the post weld process their suppliers intend to use.

(v) Painting

All interior metal work shall be thoroughly derusted and degreased and shall be prepared for painting in accordance with SANS 066.

Immediately after cleaning a zinc chromate red oxide primer with a dry film thickness of 25 micrometre shall be applied in accordance with SANS 679. An intermediate enamel coat shall be applied to the primed surface and thereafter the finishing coat of white enamel paint shall be applied to the interior and "light stone", colour C37 SANS 1091 to the exterior.

The bases and under sides must be treated in an approved manner and finished with two coats epoxy-tar paint.

(l) Drawings and information

Tenderers shall submit full details of the cubicles offered with the following drawings with the tender

- a drawing indicating all dimensions of the kiosks
- a drawing indicating the dimensions of the plinth with fixing arrangements
- a drawing indicating the general internal equipment layout of the kiosks.

The successful tenderer shall, before the manufacturing of the kioskscommences, submit the final drawings to the Engineer for approval.

A schematic wiring diagram of the kiosk, as wired and colour coded, shall be submitted at the completion of the contract.

(m) Inspection

The successful tenderer shall allow the representative of the Engineer access to the manufacturer's works at all reasonable times to inspect the progress of the work and to witness all test

HC 12.04 Maintenance Work

HC 12.04.01 Monthly

a) Inspect and secure access doors and covers.

b) Inspect distribution 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.

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

TECHNICAL SPECIFICATION

HD SUBSTATION TRANSFORMERS

CONTENTS

HD 01	SCOPE
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HD 04	TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK
HD 05	LOGGING AND RECORDING PROCEDURES
HD 06	MAINTENANCE TOOLS AND SPARES
HD 07	QUALITY ASSURANCE SYSTEM
HD 08	RE-COMMISSIONING OF INSTALLATION
HD 09	REPAIR WORK TO INSTALLATIONS
HD 10	INSTALLATION MAINTENANCE
HD 11	SUBSTATION TRANSFORMERS: TECHNICAL DETAILS

HD 01 SCOPE

HD 01.01 This specification comprises all aspects regarding the maintenance and servicing of transformer systems. Transformers comprise:

- substation transformers
- pole mounted transformers.

HD 01.02 This specification shall form an integral part of the maintenance and servicing contract document and shall be read in conjunction with Part C, the Additional Specification included with this document.

HD 02 STANDARD SPECIFICATIONS, REGULATIONS AND CODES

HD 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.

HD 02.02 **SANS Specifications**

- SANS 0780
- SANS 10400
- SANS 10142
- SANS 10225
- SANS 01277
- SANS 1088
- SANS 1749
- SANS 1250
- SANS 1279
- SANS 1777
- SANS 1763
- SANS 1266
- ARP 035

HD 02.03 **Department of Public Works Specifications**

- PW 774

HD 02.04 **Occupational Health and Safety Act of 1993 (OHS-Act)**

HD 02.05 **Manufacturer's specifications and maintenance instructions**

HD 02.06 **Additional requirements**

Equipment and material installed shall be new and unused.
Air driers shall bear the SANS stamp. The Contractor shall ensure that all safety regulations and measures are applied and enforced during servicing and maintenance work on transformers.

HD 03 AS-BUILT INFORMATION AND OPERATING AND MAINTENANCE MANUALS

HD 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 Instruction 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.

HD 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 transformer system. This shall be done for each installation individually. The system description shall contain detailed information regarding the rating and diagram plates (SANS 780), connection and arrangements (MV and LV) as well as earthing and lightning protection arrangements.
- Commissioning Data
  - Complete commissioning, test and inspection data of the transformer system.

    This shall be done for each transformer installation individually. The commissioning data will comprise oil tests, megger tests and earth resistance tests.
- Operating data
  - Safety precautions to be implemented.
- Maintenance instructions
  - Projected frequency of replacement of drying agent.
  - Procedure to filter and purify oil.

HD 04 **TEST AND INSPECTION FOLLOWING COMPLETION OF SERVICING WORK**

HD 04.01 It is the responsibility of the Contractor to provide all labour, accessories and property calibrated and certified measuring instruments necessary to record the following parameters:

- no-load phase voltages
- earth resistance testing
- insulation 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.

HD 05 **LOGGING AND RECORDING PROCEDURES**

HD 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.

HD 05.02 The logbook shall be stored in a safe place inside the substation and shall only be utilised by the Contractor. 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 drier inspection and maintenance actions
- ➢ Bi-annual inspection of oil levels
- ➢ Annual earthing and insulation test report
- ➢ Breakdown / call out reports.

HD 06 MAINTENANCE TOOLS AND SPARES

HD 06.01 On commencement of the Maintenance Contract, the Contractor shall compile an inventory of the existing Tools and Spares in the presence of the Engineer. Any deficiencies or short fall or damaged Tools and Spares shall be replaced with new equipment / material, as part of the contract.

HD 06.02 The Tools and Spares shall be kept safe in a lockable store room on site. The Con- tractor 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.

HD 06.03 The Tools and Spares shall at least include the following:
Impact wrench

HD 07 QUALITY ASSURANCE SYSTEM

HD 07.01 Following formal approval of his Quality Assurance system by the Engineer, the Contractor shall implement the approved QA system.

HD 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.

HD 08 RE-COMMISSIONING OF INSTALLATION

HD 08.01 On completion of the repair work the transformer installations shall be put into operation.

HD 09 SERVICE WORK TO TRANSFORMER INSTALLATIONS

HD 09.01 The various transformer systems shall be serviced as measured in the bills of quantities, Installation A10, during the first period of the servicing and maintenance contract.

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

HD 09.03 The Contractor shall record the repair actions in tabular format before the mainte- nance phase commences.

HD 09.04 Servicing work shall be executed within the approved period. This period shall be agreed at the start of the contract period.

HD 09.05 New equipment and material (e.g. air driers etc.) 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.

HD 09.06 The maintenance phase of this contract shall commence once the work on the installation have been commissioned and handed over to the satisfaction of the Engineer.

HD 10 INSTALLATION MAINTENANCE

HD 10.01 The various transformer systems shall be maintained for the duration of the 36- month contract period.

HD 10.02 The following maintenance actions will be required under this period of the contract:

- ♦ routine preventative maintenance
- ♦ corrective maintenance

- ♦ breakdown maintenance

These actions are defined in the Additional Specification SA - General Mainte- nance.

HD 10.03 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.

HD 11 TRANSFORMERS: TECHNICAL DETAILS

HD 11.01 Installation description

This section describes the transformers that will be repaired and maintained in terms of this contract.

- Two 315kVA Miniature Substations
- Two 500kVA Miniature Substations

AREA	TYPE	MANUFACTURER	POWER RATING	SERIAL NO
Substation 1	Miniature Substation	Free State Transformers	315 kVA	TB090653
Substation 2	Miniature Substation	Free State Transformers	315 kVA	TB090654
Substation 3	Miniature Substation	Free State Transformers	500 kVA	TB090652
Substation 4	Miniature Substation	Free State Transformers	500 kVA	TB090651

HD 11.02 Scope of servicing work

Oil test: Specific tests to be carried out includes di-electric test, moisture content test, acidity test and gas analysis, per random sample.
Purification of transformer oil: oil to be drained purified and replaced.
Service transformer: Power wash at high pressure and high temperature. Check working of oil level gauge.
Clean and re-torque transformer bushings. Re-torque all loose bolts with impact wrench. Measure earth resistance.
Insulation resistance test: Perform at windings MV to LV, MV to earth and LV to earth.
Fit drier: Fit silica gel air drier.
Check drier: Check condition of drying agent and replace, if necessary.

HD 11.03 Service work

Item	Unit
Service transformer	No

The unit of measure shall be the number of transformers serviced.

The tendered rate shall include full compensation for cleaning of the transformer, re-torque of bushings and bolts, check oil level gauge, tightening of terminations, replace gaskets, seals, record tap changer settings, etc.

Item	Unit
Oil test	No

The unit of measure shall be the number of transformers that is tested.

The tenderer shall include full compensation for the complete test to be performed, which include the following tests:

- ➢ di-electric tests
- ➢ moisture content tests
- ➢ acidity tests and
- ➢ gas analysis tests.

Item	Unit
Oil purification	Item

The unit of measure shall be number of transformers which oil has been purified.

The tendered rate shall include full compensation for all labour, transport, draining, on site purification of transformer oil as per the oil test results or replacement of oil.

The tendered rate shall further include full compensation for the testing of the oil as per clause HD10.03 (b) and submitting the test results to the Representative.

	Item	Unit
(b)	Fit silica gel air drier	No

The unit of measure shall be the number of air driers installed.

The tendered rate shall include full compensation for the ordering, supply and installation of complete air driers to the supplier's specifica- tions.

	Item	Unit
(c)	Replace drier gel	No

The unit of measure shall be the number of driers where the drying agent is replaced.

The tendered rate shall include full compensation for the ordering, supply and installation of drier gel.

	Item	Unit
(d)	Add additional transformer oil	litres

The unit of measure shall be the number of litres of oil added to the transformer.

The tendered rate shall include full compensation for ordering, supply and adding additional oil (oil to SANS 0555 specification) to be supplied in 25 litre containers.

	Item	Unit
(e)	Repair oil leak	No.

The tendered rate shall include full compensation for the replacement of the transformer gasket if and when instructed by the engineer.

	Item	Unit
(i)	Re-tape LV and MV bushings and MV busbars.	item.

The unit of measure shall be a lump sum.

The tendered rate shall include full compensation to re-tape the LV and MV bushing and MV busbars to the bushings of the MV panel using PVC insulation tape.

HD 11.04 **Maintenance work**

HD 11.04.01 **General**

Refer to HD 10

HD 11.04.02 **Monthly**

Check oil levels
Check silica gel
Check for oil leaks
Visually inspect transformers and terminations.

HD 11.04.03 **Annual**

Service transformers Record
values in logbook Test Oil
Purification if required

HD 11.05 **Maintenance work: measurement and payment**

Refer to clause SA 06 of the Additional Specification - SA General Maintenance.

Remuneration for the maintenance work shall form part of the overall Medium and Low Voltage Installation (Installation A10).

TECHNICAL SPECIFICATION

HE EXTERIOR LIGHTING SYSTEMS

CONTENTS

HE 01	SCOPE
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HE 09	AREA LIGHTING: TECHNICAL DETAILS
HE 10	SECURITY FENCE LIGHTING: TECHNICAL DETAILS
HE 11	STREET LIGHTING: TECHNICAL DETAILS
HE 12	MAINTENANCE OF EXTERIOR LIGHTING SYSTEMS AND DISTRIBUTION KIOSKS

HE 01 SCOPE

HE 01.01 This specification comprises all aspects regarding the maintenance of external lighting systems. External lighting comprises:

i) Area lighting
ii) Security lighting along perimeter fences
iii) Street lighting

HE 01.02 This specification shall form an integral part of the maintenance and servicing contract document and shall be read in conjunction with Part C, 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 **SANS Specifications**

2.2.1	SANS 10400	National Building Regulation
2.2.2	SANS 10142	Wiring code
2.2.3	SANS 10225	Lighting masts
2.2.4	SANS 1277	Read lighting luminaires
2.2.5	SANS 1088	Spigot entries
2.2.6	SANS 1749	Glass polyester poles
2.2.7	SANS 1250	Capacitors, ballasts & lamps
2.2.8	SANS 1279	Floodlight luminaires
2.2.9	SANS 1777	Daylight switches
2.2.10	SANS 763	Galvanised coatings
2.2.11	SANS 1266	Discharge lamps
2.2.12	ARP 035	Streetlighting maintenance

HE 02.03 **Department of Public Works Specification PW 774**

HE 02.04 **Occupational Health and Safety Act of 1993: Construction Regulations, 2014**

HE 02.05 **Manufacturer's specifications and installation instructions**

HE 02.06 **Additional requirements**

Equipment and material supplied and installed shall be new and unused.
Luminaires and control gear shall bear the SANS 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 seven 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:

3.2.1 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.

3.2.2 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.

3.2.3 Operating data

a) Safety precautions to be implemented.
b) Operation of lighting systems; automatic, manual and bypass switching.

3.2.4 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:

4.1.1 Phase voltages
4.1.2 Current per phase
4.1.3 Illumination levels in lux
4.1.4 Insulation testing at 500V
4.1.5 Earthing resistance testing by means of wheatstone 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 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:

5.2.1 Monthly lamp inspection and maintenance actions.
5.2.2 Bi-annual inspection and testing of lighting systems.
5.2.3 Annual earthing test report.
5.2.4 Breakdown / call out reports.

HE 06 QUALITY ASSURANCE SYSTEM

HE 06.01 Following formal approval of his Quality Assurance system by the Engineer, the Contractor shall implement the approved QA system.

HE 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 by the Department.

HE 07 RE-COMMISSIONING OF INSTALLATION

HE 07.01 On practical completion of the repair work and lamp replacement, the lighting installations shall be put into operation.

HE 07.02 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 08 REPAIR WORK TO EXTERIOR LIGHTING INSTALLATIONS

HE 08.01 The various lighting systems shall be repaired as part of installation H during the first phase of the repair and maintenance contract

HE 08.02 The scope of the repair work shall include, but shall not be limited to the activities listed below.

HE 08.03 The Contractor shall record the repair actions in tabular format before the Contractor's responsibility for maintenance commences.

HE 08.04 Repair work shall be executed within the approved period for repairs.

HE 08.05 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 08.06 The following measurement and payment items shall apply for repair work

Item		Unit
HE 08.06(a)	**Excavate in all materials for trenches, backfill, compact and dispose of surplus material**	m^3

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 150mm sand bed and 200mm sand cover, backfilling, compacting and disposing of the surplus material.

Item		Unit
HE 08.06(b)	**Extra over item HE 08.06(a) for excavating in hard material**	**m^3**

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 HD 08.06(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 overbreak as well as the additional backfilling required, reinstating the trench bottom, and for any other incidentals resulting from overbreak.

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.

	Item	Unit
HE 08.06(c)	**Extra over item 3.10.1.1 for excavating by hand in all materials**	m^3

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).1in full compensation for the additional expense of excavating by means of hand labour instead of conventional trenching equipment.

	Item	Unit
HE 08.06(d)	**Extra over item HD09.06(a) for using backfill material obtained from sources provided by the Contractor**	m^3

The unit of measurement shall be the cubic metre of imported backfill material.

Item HD09.06(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 for material from designated borrow pits 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, all within 0,5 km.

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.

	Item	Unit
HE 08.06(e)	**Supply and Install Cable Sleeves**	m

The unit of measurement shall be the linear length in meter 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.

	Item	Unit
HE 08.06(f)	**Supply and Install Plastic Warning Tape**	m

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.

	Item	Unit
HE 08.06(g)	**Supply and delivery of low-voltage cable**	m

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.

	Item	Unit
HE 08.06(h)	**Lay LV-cable**	m

The unit of measurement shall be the linear length in meter of LV-cable installed.

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.

	Item	Unit
HE 08.06 (i)	**Termination of LV-cables**	No

The unit of measurement shall be the number of LV-cable terminations.

The tendered rate shall include full compensation for providing the cable glands, shrouds and lugs, the cost of handling, fitting and cutting the cable. Separate items shall be scheduled for each size and type of cable.

	Item	Unit
HE 08.06(j)	**Supply bare copper earth conductor**	m

The unit of measurement shall be the length in meter of bare copper earth conductor supplied.

The tendered rate shall include full compensation for procuring, furnishing and laying the specified earth continuity conductor.

	Item	Unit
HE 08.06(k)	**Installation of bare copper earth conductor**	m

The unit of measurement shall be the length in meter of bare copper earth conductor installed.
The tendered rate shall include full compensation for procuring, furnishing and laying the specified earth continuity conductor.

	Item	Unit
HE 08.06(l)	**Terminate and connect bare copper earth conductor**	No

The unit of measurement shall be the number of bare copper earth conductors terminated and connected.

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.

	Item	Unit
HE 08.06(m)	**Jointing of low-voltage cable**	No

The unit of measurement shall be the number of LV-cables joints.

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.

	Item	Unit
HE 08.06(n)	**Re-lamp luminaire**	No

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

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.

	Item	Unit
HE 08.06(o)	**Supply and installation of internal luminaire components**	No

The unit of measurement shall be the number of internal luminaire components replaced.

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.

	Item	Unit
HE 08.06(p)	**Internal wiring of luminaire**	No

The unit of measurement shall be the number of luminaires rewired with silicone insulated wiring.

The tendered rate shall include full compensation for the supply and wiring of a luminaire with silicone insulated wiring where the wiring is specified separately.

	Item	Unit
HE 08.06(q)	**Supply and install circuit breakers**	No

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

The tendered rate shall include full compensation for the supply and installation of the circuit breakers where the circuit breakers are specified separately.

	Item	Unit
HE 08.06(r)	**Supply and install isolators**	No

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

The tendered rate shall include full compensation for the supply and installation of the isolators where the isolators are specified separately.

	Item	Unit
HE 08.06(s)	**Supply and install contactors**	No

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

The tendered rate shall include full compensation for the supply and installation of the contactors where the contactors are specified separately.

	Item	Unit
HE 08.06(t)	**Supply and install of low-tension fuses**	No

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.

	Item	Unit

HE 08.06(u) **Supply and install photocell (plug-in type)** No

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.

Item Unit

HE 08.06(v) **Supply and install QAT-R type electronic timer** No

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.

Item Unit

HE 08.06(w) **Supply and install 0-30A HRC fuses** No

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.

Item Unit

HE 08.06(x) **Supply and install end connectors and insulating sleeves** No

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.

Item Unit

HE 08.06 (y) **Replace pole**

The unit of measure shall be the number of poles replaced.

The tendered rate shall include full compensation for the removal of all equipment from the existing pole, removal of the existing pole from site, ordering, supply and installation of the pole in the position specified.

The contractor shall install all existing equipment onto the new pole

Item Unit

HE 08.06 (z) **Replace Luminaire diffuser**

The unit of measure shall be the number of luminaire diffusers replaced.

The tendered rate shall include full compensation for the removal of the diffuser from the existing luminaire, ordering, supply and installation of the new diffuser as specified according to manufactures instructions.

Item Unit

HE 08.06 (aa) **Replace pole mounted brackets**

The unit of measure shall be the number of pole brackets replaced.

The tendered rate shall include full compensation for the ordering, supply and installation of the pole bracket including all fixing accessories as specified according to manufactures instructions.

The tendered rate shall further include for the removal of all old equipment from the pole and the supply and installation of the new equipment onto the pole bracket including the connection of the equipment.

Item Unit

HE 08.06 (ab) Replace pole cover

The unit of measure shall be the number of pole covers replaced.

The tendered rate shall include full compensation for the removal of the pole cover from the existing pole, ordering, supply and installation of the new pole cover as specified according to manufactures instructions.

Item	Unit
HE 08.06(ac) Junction boxes including pole mount brackets.	No.

The unit of measure shall be the number of junction boxes supplied and installed.

The tendered rate shall include full compensation for the supply and installation of junction boxes brackets and strapping. The junction box must be fitted with a neutral bar earth bar, din terminal rails and CBI circuit breaker clips to accommodate the maximum number of terminals and circuit breakers.

Item	Unit
HE 08.06(ad) Remove **rust and paint kiosks**	

The unit of measurement shall be the total number of kiosks painted.
The tendered rate shall include full compensation for the removal of rust with a anti corrosion agent and the repainting of the whole kiosk.

Item	Unit
HE 08.06(ae) Label kiosks	No.

The unit of measure shall be the total number of kiosks labelled.

The tendered rate shall include full compensation for the labelling of kiosks circuit breakers, cable and the warning notification to be installed.

Item	Unit
HE 08.06(af) Supply and install padlocks	No.

The unit of measurement shall be the number of padlocks installed.

The tendered rate shall include full compensation for the ordering, supply, engraving and installation of the padlocks, locking devices and seals.

Lock shall be “keyed alike”.

Item	Unit
HE 08.06(ag) Replace distribution meter kiosks.	No.

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 6/4-way meter boxes complete with watt hour meters, circuit breakers, gland plate, labelling and concrete foot strip as specified.

Consumer distribution kiosks

(a) General

The kiosks shall be of adequate size to accommodate the number of outgoing consumer circuits specified.

The kiosks shall have two sections, namely:

(i) one section containing all incoming and outgoing switchgear and cables, and

(ii) one section containing the consumer meters and circuit breakers.

(b) Fabrication

The kiosks shall be fabricated from 3CR12 stainless steel of minimum thickness 2,5 mm and shall be mounted on a channel iron steel base.

A metal frame work, manufactured from solid angle iron, channel iron, or 2,5 mm 3CR12 folded sheet steel shall be mounted on the base of the kiosk. The kiosk shell shall be completely independent from the frame and equipment so that the kiosk shell can be removed and replaced without disconnecting any equipment. The kiosk shall be bolted down onto the base by means of four M16 high tensile bolts which shall be accessible from the inside of the kiosk only.

The kiosks shall be weatherproof, vermin and insect-proof and proved against tampering. To prevent the ingress of water onto live equipment, the door entry surrounds shall have a channel shape, at least 12 mm deep, to accommodate the door edge. A rubber or neoprene closer strip shall be so fitted to the edges of each door as to provide a seal to keep rain water and dust out of the kiosk.

The kiosk shall have a pitched roof that slopes downwards at the front and at the back with an overhang of at least 75 mm all round.

The kiosks shall be fitted with a door in the front and at the back of the kiosk. The maximum width per door shall be 600 mm. The doors shall provide free access to the equipment and shall provide a full view of all meters. The doors shall have well returning edges to fit into the channel of the door entry surrounds. Each door shall have three robust solid brass hinges each of length at least 100 mm. The hinges shall be completely concealed. Doors shall be fitted with lever locks. The locking mechanism shall facilitate three-point latching at the top, side and bottom of the doors. In the case of double doors, the first door shall be locked with two slides on the inside onto the kiosk shell. The second door shall close over a lip on the first one. Nylon door restraints shall be provided. The fixing points of the restraints at the door and the canopy shall be reinforced. The doors shall be earthed bonded to the frame by means of a copper braided strap, tooth washers, bolts and nuts.

Ventilation louvres with approximate size 225 x 150 mm shall be provided on both sides of the kiosk. Each ventilation louvre shall be covered on the inside with perforated plates with 2,5 mm holes so that

- it is not possible to push a steel wire through it into the interior of the kiosk, and
- it prevents vermin from entering into the kiosk.

A mounting panel shall be positioned in the centre of each kiosk, fixed to the frame work, for the mounting of the specified equipment.

(c) Mounting panel

The mounting panel shall consist of a minimum 3 mm thick mild steel plate.

The one section of the panel shall be equipped with copper busbars mounted on porcelain or similar insulators and of sufficient length to accommodate three 12 mm brass bolts for the connection of distribution cables and six consumer meter connections per phase. The busbars shall be tinned after the drilling of holes. The busbars shall be able to carry 250 Ampere at a current density of not more then 1,5 A/mm^2. Each busbar shall be marked red, yellow and blue with black for the neutral bar. The busbars shall be able to withstand the thermal and dynamic forces resulting from short circuits without deformation taking place or parts breaking.

The specified consumer equipment shall be installed in the second section. The mounting panel and equipment shall be enclosed by a machine punched removable front panel through which the operating handles of the equipment and the face plates of the meters protrude.

(d) Equipment installed in kiosks

The equipment to be installed in the kiosks shall be as specified in the detail specification.

(e) Wiring of kiosks

The internal wiring in the kiosks shall be done with PVC insulated copper conductors. The wiring shall be done in neat horizontal and vertical columns. Each consumer circuit shall be wired from the phase busbars to the circuit breaker and from the circuit breaker to the meter.

Connections to busbars and terminals shall be done by means of cable lugs crimped in an approved manner to the conductor ends. Connections to the busbars shall be made by means of cadmium plated high tensile steel bolts and nuts with locking washers.

(f) Earthing

A 25 mm x 6 mm long tinned copper earth bar shall be installed at the bottom of the kiosk.

10 mm diameter holes shall be drilled through the earth bar to provide for the distribution cable and service cable earth conductors. All bolts used for the fixing of the earth conductors shall be cadmium plated and only one earth conductor shall be connected per bolt.

The metal work of the kiosk shall be earthed to the earth bar by means of a 70 mm^2 stranded copper conductor. An earth stud shall be provided on the kiosk housing for this purpose.

(g) Cable gland plate

The cables shall be terminated on a removable galvanised gland plate of suitable dimension and strength. The gland plate shall cover the full length of the kiosk.

The gland plate shall be at least 300 mm below the nearest terminal of switchgear allowing sufficient space for bending the cable ends. Sufficient space shall be provided underneath the gland plate to allow for the installation of the cables without removing the gland plate. The gland plate shall be earthed to the earth bar by means of a 70 mm^2 stranded copper earthconductor.

(h) Terminal blocks

A terminal block type suitable for the termination of 16 mm^2 stranded copper conductors shall be provided. Terminals shall be of the screw type and a terminal shall be provided for each service connection cable.

(i) Labels

The kiosks shall be supplied with the following labels:

(i) An aluminium label with 40 mm high letters and numeral indicating the kiosk number.

(ii) Engraved traffolite labels with 6 mm high numerals under each circuit breaker, meter, and terminal on the terminal block indicating the consumer stand number.

The labels shall have a white background and black letters. The 40 mm labels shall be fixed by means of rivets and the 6 mm high labels shall be inserted in 25 mm wide aluminium label holder mounted at the bottom of the relevant equipment.

(j) Danger signs

The requirements of Regulation C-52 of the Machinery and Occupational Safety Act No 6 of 1983 shall be complied with. All doors shall be fitted with a 150 x 100 mm Danger/Gevaar/Ingozi signs.

(k) Painting and finishing

(i) Post-weld cleaning and passivation of 3CR12

Post-weld cleaning shall be undertaken on all welded areas. One of the following cleaning methods may be used to remove all surface discolouration and scale from welded areas.

(1) Wire brushing : Where it is possible to remove the discolouration and detritus from weld areas by brushing, stainless steel wire brushes, that have not been used on other material other than 3CR12, may be used.

(2) Grinding: Dedicated grinding wheels and discs based on alumina shall be used for the dressing of welds. The use of silicon carbide wheels and discs shall not be used.

(3) Abrasive blast cleaning: The abrasive used shall be washed silica sand or alumina totally free of metallic iron, iron oxides or chlorides.

(ii) Chemical cleaning (pickling)

The pickling of 3CR12 shall be carried out using formulations based on nitric (HNO3) and hydrofluoric (HF) acid. Formulations based on hydrochloric acids shall not be used. Acids used shall conform to commercial purity standards. Where proprietary pickling formulations are used, the manufacturer's directions concerning the application procedures shall be strictly adhered to.

(iii) Passivation

The passivation of the 3CR12 shall be carried out as soon as possible after the post-weld cleaning has taken place. A solution made up of nitric acid shall be used for the passivation of the 3CR12. The solution shall be generously applied to the steel by brush, cloth, spray or dipping. Care shall be taken that the solution does not dry on the steel surface. The steel shall be thoroughly washed with clean cold water to remove all traces of the acid use.

(iv) General

The entire process of cleaning, pickling, passivation and neutralization shall be completed in one working day.
Tenderers shall submit full details of the post weld process their suppliers intend to use.

(v) Painting

All interior metal work shall be thoroughly derusted and degreased and shall be prepared for painting in accordance with SANS 066.

Immediately after cleaning a zinc chromate red oxide primer with a dry film thickness of 25 micrometre shall be applied in accordance with SANS 679. An intermediate enamel coat

shall be applied to the primed surface and thereafter the finishing coat of white enamel paint shall be applied to the interior and "light stone", colour C37 SANS 1091 to the exterior.

The bases and under sides must be treated in an approved manner and finished with two coats epoxy-tar paint.

(l) Drawings and information

Tenderers shall submit full details of the cubicles offered with the following drawings with the tender

- a drawing indicating all dimensions of the kiosks
- a drawing indicating the dimensions of the plinth with fixing arrangements
- a drawing indicating the general internal equipment layout of the kiosks.

The successful tenderer shall, before the manufacturing of the kiosks commences, submit the final drawings to the Engineer for approval.

A schematic wiring diagram of the kiosk, as wired and colour coded, shall be submitted at the completion of the contract.

(m) Inspection

The successful tenderer shall allow the representative of the Engineer access to the manufacturer's works at all reasonable times to inspect the progress of the work and to witness all tests

	Item	Unit
HE 08.06(ah)	**Replace door hinges on meter and distribution kiosks.**	No.

The tendered rate shall include full compensation for the removal of damaged hinges, the supply, delivery and installation of new hinges.

	Item	Unit
HE 08.06(ai)	**Supply and install handles.** (Perano type lockable turn catch door handle (heavy duty)	No.

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.

HE 09 AREA LIGHTING: TECHNICAL DETAILS

HE 09.01 Installation description

This section describes the electrical distribution network that will be repaired and maintained in terms of this contract.

Luminaries are suspended on fibreglass poles of various lengths. Area lights are controlled by means of photocells and manual on/off switches.

Description	Floodlights (no.)	Streetlights (no.)	Post Tops (no.)	High Mast (no.)	Area Lighting (no.)	Perimeter Lighting (no.)
Lebombo	56	32	51	8	16	117
Commercial	8	17		2		
Komati Lodge			23			
Residential			7			
Total	**64**	**49**	**81**	**10**	**16**	**117**

HE 09.02 Scope of repair work

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.

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.

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.

Service luminaries by washing with detergent and re-lamping where necessary. Clean lenses. Check condition of seals and glands and test for earth continuity.

Check consistency of aiming angles and tighten mounting bracket bolts

HE 09.03 **Repair work: Measurement and payment**

Item		Unit
(a)	**Relamp luminaire**	No

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 lamp according to the manufacturer's instructions.

Item		Unit
(b)	**Service luminaire**	No

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, corrosion protection, checking of seals and glands, cleaning of the lenses, tightening of stirrup bracket bolts and the checking of earthing continuity, connections and aiming angle.

Item		Unit
(c)	**Service light distribution kiosk or DB**	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. The contractor is to submit a report on the general condition of the kiosk or distribution boards (damaged, rust marks, etc.)

Item		Unit
(d)	**Supply and install padlocks**	No

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 padlocks, locking devices and seals. Locks shall be "key alike".

Item		Unit
(e)	**Service area light pole**	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, tightening all connections and straightening of pole

Item		Unit
(f)	**Replace luminaire**	No

The unit of measurement shall be number of luminaires replaced.

The tendered rate shall include full compensation for the supply and installation of LED Luminaires of similar light output and physical attributes as the original luminaire complete with lamp and control gear according to manufacturer's instructions.

Item		Unit
(g)	**Replace pole**	No

The unit of measure shall be the number of poles replaced.
The tendered rate shall include full compensation for the removal of all equipment from the existing pole, removal of the existing pole from site, ordering, supply and installation of the pole in the position specified.

The contractor shall install all existing equipment onto the new pole

Item		Unit
(h)	**Supply and install 25m High Scissor Light Mast**	No

The unit of measurement shall be the number of 25m high scissor light mast hot dip galvanised to SANS 121 ISO 1461 specification supplied and installed.

The tendered rate shall include full compensation for the manufacturing, delivery, assemble and erection of the 25m high scissor light mast complete with brackets to carry 9 x 400W HPS Floodlight luminaries, cabling, ring, wiring of luminaries, electrical distribution board and splitter box.

The tendered rate shall further include full compensation for grouting the gap between the mast base plate and the foundation with a Prostruct 531 mixture.

The earthing, excavations and casting of foundation of the mast will be measured elsewhere.

HIGH MAST SPECIFICATION

1. Construction
The masts shall be constructed from conical sections which, when assembled, will form a tapered column of circular cross section. There shall be no fillet welds of the overlaps. The sections shall be joined by friction fit only.
The masts shall be of lightweight construction and a base plate shall be welded to the bottom end of the lowest section suitably drilled for foundation bolts.
All welding to be subject to S.A.B.S. Spec 044 Part 3 Grade B and shall be carried out by S.A.B.S. coded welders only. Proof that all welders have been tested by the S.A.B.S. must be submitted on request. Inspection and acceptance certificates shall be furnished on request.

The steel used in the manufacture of the mast shall have an ultimate tensile strength of between 450 and 620 MPa and identical to SABS 1431 grade 300WA steel.
Proof must be supplied that the manufacturer is ISO 9001 accredited.

2 Dimensions
The masts offered shall give an overall floodlight mounting height of 25 m. The cross-section and wall thickness of the mast is determined on the basis of the working loads.

3. Working Loads
The masts shall be designed in accordance with the S.A.B.S. 0225 Code of Practice for the design and construction of lighting masts. The following site factors shall be considered:

Design wind speed	=	4Om/s
Class of structure	=	B
Category of terrain = 2		
Altitude of site	=	1200 m

The mast shall carry at its top 9 x 400W HPS Floodlights evenly around its circumference. Data on wind induced oscillations and the dynamic behaviour of the mast shall be submitted.

4. Access Opening
An access door adequately protected against the weather shall be provided in the mast, with the bottom lintel 600mm above the base plate. The door shall be adequately protected against vandalism and secured by three screws requiring a special opening tool.
A doorframe shall reinforce the opening in the mast.
The mounting strips welded opposite the door opening shall be drilled for the mounting of a control board. Earth terminals, as well as a support bar for the incoming supply cables, shall be provided below the door opening.

5. Corrosion Protection

All parts of the mast and raising and lowering device, not specified as manufactured from stainless steel, shall be hot dip galvanised to SAB Specification No. 763/1977 and inspection certificates provided if required.
No welding, drilling, punching, bending or removal of burrs shall be carried out after galvanising.

6. Electrical Connection to the Luminaires

A fully enclosed distribution board shall be provided for each mast, containing: 1 x 3
pole isolator (main switch)
3 x single pole MCB's (lights)
1 x single phase switched socket outlet for the use of a power tool 1 x
two pole earth leakage unit protecting the single-phase outlet 1 x
7pinCEEsocket
1 x adequately rated contactor
1 x single pole MCB acting as by-pass switch 1 x
single pole MCB protecting the contactor
All circuit breakers and isolators shall have a rupturing capacity of 5 kA and shall bear the mark of the S.A.B.S. and shall be accessible through cut-outs in the cover without having to remove the cover.

All equipment shall be clearly marked with engraved labels. No stick-on embossed tape shall be used. The distribution board shall be fully wired and ready for connection to the incoming supply cables.

7. FOUNDATIONS

Each mast shall be supplied with foundation bolts and templates. The bolts shall be hot dip galvanised over their entire length to S.A.B.S. Specification No. 763/1977. Two galvanised nuts, two washers and one spring washer shall be supplied for each bolt. The number of foundation bolts shall be determined according to the design of I .3 above. Calculations shall be submitted upon request.
A foundation plan, adequately designed for the conditions as per I .3 of this specification, and based on a soil bearing capacity of 150 kPa, giving details of the reinforcing required shall be submitted. Soil pressure and overturning safety factor shall be stated.
All reinforcing and foundation bolts shall have a minimum of 100mm concrete cover. The 28 days cube strength of the concrete shall be 25 MPa.
All foundations shall have a circular flat base from which a square plinth shall rise to above the surrounding ground level.
One or two PVC, Class B cable sleeves shall be provided from the centre of the top of the foundation plinth, through the concrete to a point below ground level on the side of the plinth.
After casting of the foundation, the slab shall be covered by earth, properly compacted. The area around the plinth shall be brought to the original level and shall be left neat and tidy.

8. LUMINAIRES

- The floodlight luminaire shall be beam type 400W HPS.
- The floodlight shall be suitable for HST 1000W lamp.
- The body of the luminaire shall be of die-cast aluminium with polyurethane finish.
- The reflector shall be high purity bright anodised aluminium and shall provide a narrow asymmetrical beam.
- The peak intensity shall not be less than 48000 lumens.
- The front glass shall be heat resistant armoured glass.
- The gaskets shall be silicone rubber.
- The fasteners shall be stainless steel.
- The luminaire control gear shall be housed in an integral weatherproof container.

HE 10 SECURITY FENCE LIGHTING: TECHNICAL DETAILS

HE 10.01 **Installation description**

This section describes the electrical distribution network that will be repaired and maintained in terms of this contract.

Luminaires are suspended on fibreglass poles. Lights are controlled by means of photocells and manual on/off switches.

HE 10.02 **Scope of repair work**

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.

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 distribution Kiosk, clean inside provide termile and rodent poison. 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 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.

HE 10.03 **Repair work: Measurement and payment**

Item		Unit
(a)	**Service security light pole**	No

The unit of measurement shall be the number of security light poles opened and serviced.

The tendered rate shall include full compensation for the opening of pole box, visual inspections, corrosion protection, straightening of poles if necessary, treating of wooden poles with creosote and securing circuit breakers and terminations.

The contractor shall give a general report on the condition of the pole and equipment. The report should indicate if poles are rotten (wood poles), bent (steel poles), broken (wood, steel, concrete or fiberglass poles) or if the pole should be painted (steel). Strap all cable to pole.

Item		Unit
(b)	**Re-lamp luminaire**	No

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

The tendered rate shall include full compensation for the supply and installation of the lamp according to the manufacturer's instructions.

Item		Unit
(c)	**Service distribution kiosk**	No

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 or distribution board, vermin protection, cleaning of circuit breakers, earth testing, secure circuit breakers and terminations and fitting of blank covers. The contractor is to submit a report on the general condition of the kiosk or distribution board (damaged, rust marks, etc.)

Item		Unit
(d)	**Replace luminaires**	No

The unit of measurement shall be the number of security floodlight luminaires replaced.

The tendered rate shall include full compensation for the supply and installation of LED Luminaires of similar light output and physical attributes as the original luminaire complete with lamp and control gear according to manufacturer's instructions.

Item		Unit
(e)	**Service luminaire**	No

The unit of measure shall be the number of luminaires serviced.

The tendered rate shall include full compensation for the service of the luminaire, including washing, corrosion protection, checking of seals and glands, cleaning of lenses, tightening of brackets bolts, checking of earthing continuity, checking of aiming angle and adjust if necessary

HE 11 STREETLIGHTING: TECHNICAL DETAILS

HE 11.01 **Installation description**

This section describes the electrical distribution network that will be repaired and maintained in terms of this contract.

Luminaires are suspended on steel, wood, concrete and fibreglass poles of various lengths. Street lights are controlled by means of photocells and manual on/off switches.

HE 11.02 **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 11.03 **Repair work: Measurement and payment**

Item		Unit
(a)	**Service streetlight pole**	No

The unit of measurement shall be the number of security light poles opened and serviced.

The tendered rate shall include full compensation for the opening of pole cover, visual inspections, straightening of poles if necessary and securing circuit breakers and terminations.

The contractor shall give a general report on the condition of the pole and equipment. The report should indicate if poles are rotten (wood poles), bent (steel poles), broken (wood, steel, concrete or fiberglass poles) or if the pole should be painted (steel). Strap all cable to pole.

Item		Unit
(b)	**Re-lamp luminaire**	No

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.

Item		Unit
(c)	**Service street Luminaire**	No

The unit of measure shall be the number of luminaires serviced.

The tendered rate shall include full compensation for the service of the luminaire, including washing, corrosion protection, checking of seals and glands, cleaning of lenses, tightening of brackets bolts, checking of earthing continuity, checking of aiming angle and adjust if necessary

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 LED Luminaires of similar light output and physical attributes as the original luminaire complete with lamp and control gear according to manufacturer's instructions.

Item		Unit
(e)	**Supply and install photocell bypass**	No

The unit of measure shall be the number of photocell bypasses installed.

The tendered rate shall include full compensation for the design supply and installation of the photocell bypass.

Item		Unit
(f)	**Replace 125MV choke in control gear.**	No

The unit of measure shall be the number of chokes installed.

The tendered rate shall make full compensation for ordering, supply and installation of chokes.

Item		Unit
(g)	**Replace connection to streetlight luminaire.**	No

The unit of measure shall be the number of connections replaced from the streetlight luminaire to the overhead line.

The tendered rate shall make full compensation for ordering, supply and connection of the luminaire to the overhead line with silicon cable or airduct and cable clamps on to the overhead line.

HE 12 MAINTENANCE OF THE INSTALLATION

HE 12.01 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 12.02 The following maintenance actions will be required under this phase of the contract:

12.2.1 Routine preventative maintenance
12.2.2 Corrective maintenance
12.2.3 Breakdown maintenance

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

HE 12.03 The maintenance schedules and frequency of maintenance activities shall be developed under the maintenance control plan which will be instituted by the Contractor. The Contractors responsibility in this regard is specified in the Additional Specification SA – General Maintenance.

HE 12.04 **The following shall be used as guidelines to ensure effective maintenance:**

12.4.1 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
v) Record values in record book

12.4.2 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.

12.4.3 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 luminaries and distribution kiosks.

HE.12.05 Maintenance shall include all repairs, replacing of components or materials, routine setting or any other actions necessary to ensure a perfect functional condition.

HE.12.06 **Maintenance work measurement and payment.**

Refer to clause SA06 of the ADDITIONAL SPECIFICATION: SA GENERAL MAINTENANCE

TECHNICAL SPECIFICATION

JC CONVENTIONAL FIRE FIGHTING EQUIPMENT

CONTENTS

JC 01 SCOPE
JC 02 STANDARD SPECIFICATIONS
JC 03 OPERATING AND MAINTENANCE MANUALS
JC 04 TRAINING OF OPERATORS FOR THE OPERATION OF THE INSTALLATION AND EQUIPMENT
JC 05 LOGGING AND RECORDING PROCEDURES
JC 06 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT
JC 07 MAINTENANCE TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

JC 01 SCOPE

This specification covers the general maintenance of the conventional fire fighting equipment installations, which include the following:

(a) Fire hydrants
(b) Fire hoses
(c) Fire extinguishers.

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. In the event of any discrepancies between the Technical Specification and the Particular Specification, the latter shall take precedence.

JC 02 STANDARD SPECIFICATIONS

JC 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.

JC 02.01.01 SANS and other specifications and codes

SANS 6172; 13.220.10 - Fire extinguishers, classification system, fire ratings ICS
CKS 532; ICS 13.220.10 - Fire extinguishers, foams
SANS 10105-1; 13.220.10 - Fire extinguishers, portable, classification system, ICS control systems
SANS 1322; 13.220.10 - Fire extinguishers, portable, non-refillable ICS

SANS 1567; 13.220.10 - Fire extinguishers, portable, rechargeable, carbon ICS dioxide
SANS 1475-1; 13.220.10 - Fire extinguishers, portable, reconditioning ICS
SANS 810; 13.220.10 - Fire extinguishers, powder, portable, rechargeable ICS
SANS 1522; - Fire extinguishers, powders ICS 13.220.10
SANS 1571; 13.220.10 - Fire extinguishers, transportable, rechargeable ICS
SANS 10105-1; 13.220.10 - Fire fighting equipment, fire extinguishers, portable ICS
SANS 1322; 13.220.10, 23.020.30 - Fire fighting equipment, fire extinguishers, portable, ICS non-refillable
SANS 543; - Fire fighting equipment, fire hose reels ICS 13.220.10
SANS 10105-2; - Fire fighting equipment, fire hose reels ICS 13.220.10
SANS 1128-2; ICS 13.220.10, 23.040.60 - Fire fighting equipment, fire hose, pipe couplings, pipe connections
SANS 1128-1; 23.060.99 - Fire fighting equipment, fire hydrants ICS 13.220.10,

SANS 810; 13.220.10	-	Fire fighting equipment, powder fire extinguishers, ICS portable, rechargeable
SANS 1475-1; 13.220.10	-	Fire fighting equipment, reconditioning, fire ICS extinguishers, portable
SANS 543;	-	Fire hose reels ICS 13.220.10
SANS 10105-2; ICS 13.220.10	-	Fire hose reels, classification systems, control systems
SANS 1475-2;	-	Fire hose reels, reconditioning ICS 13.220.10
SANS 1456-5; ICS 13.220.10	-	Fire hoses, collapsible, delivery pipes (fire fighting), oil resistance tests, chemical resistance tests
SANS 1456-2; 13.220.10	-	Fire hoses, collapsible, delivery pipes (fire fighting), ICS percolating hoses
SANS 1456-1; 13.220.10	-	Fire hose, collapsible, delivery pipes (fire fighting), ICS testing
SANS 1456-4; materials, ICS 13.220.10	-	Fire hoses, collapsible, delivery pipes, coated non-percolating hoses
SANS 1456-3; 13.220.10	-	Fire hoses, collapsible, delivery pipes, uncoated ICS materials, non-percolating hoses
SANS 1128-2; 13.220.10, 23.040.60	-	Fire hoses, pipe couplings, pipe connections ICS
SANS 1128-1; 13.220.10, 23.060.99	-	Fire hydrants, fire-fighting equipment ICS
SANS 1056-1; ICS 23.060.20	-	Fire safety, ball valves
SANS 10400	-	Application of the NBR
FPO/82/6E(STS 10)	-	Standard technical specification for a pump installation for automatic sprinkler fire extinguishing systems.

JC 02.01.02 **Department of Public Works Specifications:**

F.P.O/G.61/3E	-	Fire Security: A guide to Architects
PW 371	-	Specification of Materials and Methods to be used

JC 02.01.03 **Occupational Health and Safety Act of 1993: Construction Regulations, 2014**

JC 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.

In the event of a discrepancy between the statutory codes and the manufacturer's codes, the discrepancy shall be brought to the attention of the Engineer, who, in collaboration with the Employer and Local Authority, will prescribe the steps to be taken.

JC 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.

JC 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.

Over and above the afore-mentioned, the Contractor shall also be responsible for the compilation of the following:

(a) Cataloguing of the fire-fighting equipment

All the fire-fighting equipment must be catalogued under the following headings:

(i) Location and details of equipment
(ii) Service date
(iii) Service frequency

(iv) Condition of equipment
(v) History: Usage incidents, breaking, etc.

(b) Provision of a "Fire Plan"

The Contractor shall provide a Fire Plan indicating positions, and keeping up to date any changes of the equipment position, status and operation.

JC 04 TRAINING OF OPERATORS FOR THE OPERATION OF THE INSTALLATION AND EQUIPMENT

The end user shall be trained by the supplier of the fire fighting equipment to operate the individual fire fighting equipment.

Fire fighting training shall be done by a nationally accredited training institute (Fire Protection Association of South Africa).

JC 05 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 service records, system checks, breakdowns, maintenance visits, inspections, etc.

The logbook shall be stored in a safe place as agreed with the User Client and the Engineer and shall only be utilised by the Fire Protection Officer, the Contractor and the Engineer. The Contractor shall submit copies of the monthly entries and recordings into the logbook, together with his monthly report, to the Engineer.

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

(a) Service records
(b) Inspection and maintenance actions
(c) Breakdown reports
(d) Fire safety officer's comments
(e) 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 Engineer. This register shall be completed by all persons visiting the installation, including:

(a) Fire safety officer
(b) Contractor
(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.

JC 06 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

JC 06.01 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 applicable 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 fire fighting equipment shall be categorised under the following headings:

(a) Fire hydrants
(b) Fire hoses
(c) Fire extinguishers.

JC 06.02 **REPAIR WORK TO EXISTING EQUIPMENT**

The Contractor shall at the start of the repair and maintenance contract inspect, record and report on all the existing fire fighting equipment listed in this specification.

This inspection and report shall comprise the following:

(a) Establishing the condition of all equipment;

(b) Reporting all defects to equipment;

(c) Compliance of equipment in respect of the governing regulations at the start of the Contract;

(d) Recording all equipment with an identifying system;

(e) Details of all equipment;

(f) Suitability of equipment regarding the purpose it serves;

(g) Water supply pressure;

(h) Listing of latest service.

The Contractor shall report on the above in writing to the Engineer. No repair, service and/or replacement work shall commence prior to approval by or directives from the Engineer.

JC 06.03 **FIRE HYDRANTS**

Repair work to the fire hydrants system is detailed in the Particular Specification and shall include, but not be limited to the following:

(a) Replacement of damaged, broken, leaking, corroded pipe work and fittings;
(b) Replacement of main hydrant seal;
(c) Repair/replacement of quick coupling catches;
(d) Replacement of damaged shaft ends (right angle wheel type);
(e) Replacement of damaged and expired or missing 65 mm diameter hose streamers;
(f) Replacement of damaged or missing 65 mm diameter hose nozzle;
(g) Replacement of damaged valve stem seal;
(h) Replacement, repair and repainting of concrete pedestals;
(i) Replacement of fire damaged, missing or shortfall fire signage to equipment;
(j) Hydrants shall be labelled with identifying tags and details recorded.

JC 06.04 **FIRE HOSE**

Repair work to the fire hose is detailed in the Particular Specification and shall include but no be limited to the following:

(a) Replacement of the fire hose cabinet when severely damaged;
(b) Replacement of the 30 m hose where perished, damaged or missing;
(c) Replace gland packing and gaskets to hose reel shut-off valve;
(d) Replace missing hose reel shut-off valve wheel handles;
(e) Number and catalogue hose;
(f) Where hose shut-off valves are damaged beyond repair, these shall be replaced with new;
(g) Where paintwork of equipment has deteriorated, such equipment items shall be replaced and repainted in accordance with the manufacturer's specification;
(h) Fire hoses shall be labelled with identifying tags and details recorded, including service record.

JC 06.05 **FIRE EXTINGUISHERS**

Repair work to the fire extinguishers is detailed in the Particular Specification and shall include, but not be limited to the following:

(a) Replace wall mounting boards and brackets where damaged or missing.

(b) Dry chemical powder extinguishers shall be repaired and serviced and shall include at least the following:

(i) Replace discharge hose and nozzle where damaged or missing;
(ii) Replace gauge on bottle where reading is incorrect, damaged or missing;
(iii) Check, service and repair activation mechanism;
(iv) Replace DCP powder;
(v) Recharge discharge cylinder to the required capacity;
(vi) Reseal discharge mechanism;
(vii) Replace instructions on extinguishers where necessary;
(viii) Extinguishers shall be labelled with identifying tags and details recorded, including service record.

(c) CO_2 extinguishers shall be repaired and serviced and shall include at least the following:

(i) Replace discharge nozzle and pipe where damaged or missing;
(ii) Replace gauge on bottle where reading is incorrect, damaged or missing;
(iii) Repair activation mechanism;
(iv) Recharge with CO_2 to required capacity;
(v) Reseal discharge mechanism;
(vi) Replace instructions on extinguishers where necessary;
(vii) Extinguishers shall be labelled with identifying tags and details recorded, including service record.

JC 07 MAINTENANCE TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

JC 07.01 GENERAL

Annual 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 prior to and after practical completion of the work.

Maintenance 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 JC 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 PJC 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) Fire hydrants
(b) Fire hoses
(c) Fire extinguishers.

The Contractor shall be remunerated monthly, based on his performance, for maintaining the complete installation in a perfect functional condition.

JC 07.02 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 below under the respective headings.
These actions and findings shall be logged and reported on the relevant approved schedules and

reports.

JC 07.02.01 **Fire hydrants**

Maintenance work shall include at least the following actions and shall be scheduled in accordance with the relevant regulations and requirements and include monthly and six-monthly inspections and services.

(a) Check hydrant valve seal.
(b) Check right angle wheel for tightness.
(c) Check valve stem and or top for damage.
(d) Check valve stem seal and readjust.
(e) Check operation of quick couplers.
(f) Check operation (opening and closing movement of valve).
(g) Check water pressure and flow.
(h) Check stand pipe for rigidness and leaks.
(i) Log maintenance schedule.
(j) Report defects for processing and repair.
(k) For fire water pipe systems see Technical Specification AA.
(l) For fire pump see Technical Specifications FN and JA.

JC 07.02.02 **Fire hoses**

Maintenance work shall include at least the following actions and shall be scheduled in accordance with the relevant regulations and requirements and include monthly and six-monthly inspections and services.

(a) Check drain seal.
(b) Roll down hose and check for cracks or perishing.
(c) Check operation of PWD type nozzle.
(d) Check operation of drain.
(e) Check operation of fire hose valve.
(f) Check piping for leaks and damages.
(g) Log maintenance schedules.
(h) Report defects for processing and repair.
(i) For fire water pipe systems see Technical Specification AA.
(j) For fire pumps see Technical Specifications FN and JA.

JC 07.02.03 **Fire extinguishers**

Maintenance work shall include at least the following actions and shall be scheduled in accordance with the relevant regulations and requirements and include monthly and six-monthly inspections and services.

(a) General

(i) Check mounting of backboard and bracket.
(ii) Check charge of the extinguisher.
(iii) Check the condition of the discharge.
(iv) Check the mechanism condition of the discharge hose.
(v) Update the log entry on the extinguisher.
(vi) Log maintenance schedule.
(vii) Report defects for processing and repair.

(b) Individual types of extinguishers

Over and above the preceding requirements, the following shall apply to individual types of extinguishers.

(i) DCP extinguishers:
Check charge and replace powder at prescribed intervals.

(ii) CO_2 extinguisher:
Check charge.

JC 07.03 **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 installations for any

pending breakdowns, maladjustments or anomalies of equipment.

The Contractor shall report and take actions to correct such shortfall.

JC 07.04 **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.

PARTICULAR SPECIFICATION

PJC CONVENTIONAL FIRE FIGHTING EQUIPMENT

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PJC 07 DETAILS OF MAINTENANCE WORK

PJC 01 SCOPE

(a) This specification covers the particulars of the maintenance work to the conventional fire fighting equipment installation at the various sites. This Particular Specification shall be read in conjunction with Technical Specification JC: Conventional Fire Fighting 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

The intended 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. The Contractor shall be responsible to take over the completed installation which shall be maintained and serviced by the Contractor for the remainder of the 36-month Contract period. Additional repair work will also form part of the Maintenance work in the Contract.

(b) The fire fighting equipment to the ports of entries, its associated residential areas shall form part of this maintenance and servicing contract and is referred to as Installation A12. The piped fire water reticulation network to the equipment, such as hydrants and hose reels are also included in the maintenance.

PJC 02 GENERAL DESCRIPTION OF INSTALLATION

(a) LEBOMBO . LAND PORT OF ENTRIES

The Port of Entries consists of fire hydrants, hose reels and fire extinguishers. The residential and operational area is in a fully functional state.

PJC 03 TECHNICAL DETAILS OF EXISTING INSTALLATION

The equipment that is listed in the table below will be maintained as part of the Repair and Maintenance Contract. Newly installed firefighting equipment shall also form part of the Contractors maintenance responsibilities.

PJC 03.01 LEBOMBO EXISTING FIRE FIGHTING EQUIPMENT

No.	Installation	Number off	Description
1	Heating, ventilation, and air- conditioning systems – Splits Units	360	Air-conditioning units at various buildings
2	Heating, ventilation, and air- conditioning systems – VRF Indoor Units	16	Air-conditioning units at various buildings
3	Heating, ventilation, and air- conditioning systems – VRF Outdoor Units	4	Air-conditioning units at various buildings
4	Heating, ventilation, and air- conditioning systems – Air Handling Unit	2	Air-conditioning units at Port of Entry

5	Firefighting equipment	235	Firefighting extinguishers
		22	Fire Hydrant
		20	Fire hose reels
		3	Fire detection system
		3	Fire water booster pump
		12	Sand buckets

PJC 04 STATUS OF EXISTING INSTALLATION

At the time of compilation of this document the status of the equipment and installation was briefly as described below.

The existing firefighting equipment at the residential area is currently being maintained by a Contractor.

The existing firefighting equipment at the operational area is new.

PJC 05 DETAILS OF REPAIR AND SERVICE WORK

The following work shall form part of the intended repair work to the firefighting equipment. This work shall be done in accordance with the relevant regulations, codes, specifications and Technical Specification JC: Conventional Fire Fighting Equipment.

The description of the repair work as set out below shall be read in conjunction with the Schedule of Quantities and Technical Specifications

PJC 05.01 GENERAL DESCRIPTION OF REPAIR WORK

PJC 05.01.01 The Contractor shall, at the start of the Repair and Maintenance Contract, have the items, systems, equipment and installations listed below inspected by qualified personnel. This inspection shall include the establishing of any defects, leaks, conditions, damages, shortfalls, 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) Correlation of all firefighting equipment;
(b) Last service record;
(c) Inventory list of all equipment;
(d) Compliance with present governing regulations;
(e) Accessibility to equipment;
(f) Dynamic water pressure under flow conditions of equipment;
(g) As-built information.

PJC 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 firefighting equipment;
(b) Servicing and overhauling of all fire hose reels and fire hydrants;
(c) Servicing and recharging of all fire extinguishers;
(d) Replacing of missing and damaged fire extinguisher brackets;
(e) Replacing damaged fire hose reel cabinets;
(f) Supply and installation of additional fire hose reels, hydrants and extinguishers where necessary, in accordance with the requirements of SABS 0400;
(g) Servicing and overhauling of fire booster and pump connections;
(h) Compilation of fire plan for each of the service buildings;
(i) Compilation of inventory list with all relevant details and an identification system to all equipment.

PJC 05.02 REPAIR WORK TO FIRE FIGHTING EQUIPMENT

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

PJC 05.02.01 LEBOMBO , as listed in PJC 02

(a) Repair work is required.
(b) Allowance has been made for operational damages.

PJC 06 MEASUREMENT AND PAYMENT

All new building work and repair work to existing structures and buildings resulting from repairs to the conventional firefighting equipment as scheduled, shall be done in accordance with the Specifications for the structural and building section included elsewhere in this Tender Document. The costs of such building and repair works shall be deemed to be included in the tendered rates for the applicable items scheduled in this section.

PJC.01 **INSPECTION AND REPORT ON EXISTING INSTALLATIONS** .....Unit: item

The tendered sum shall include full compensation for the inspection and written report on all items, systems, components, equipment and installations, including the establishment of any defects, leaks conditions, damages, shortfalls, structural

soundness, repairs required, details of existing equipment and suitability of the equipment for the purpose it serves.

PJC.02 **AS-BUILT INFORMATION AND OPERATING AND MAINTENANCE MANUALS**.....Unit: sum

The tendered sum shall include full compensation for the compilation and submission of seven complete sets of inventory lists and operating and maintenance manuals in accordance with Additional Specification SB: Operating and Maintenance Manuals.The tendered sum shall also include full compensation for all equipment necessary to establish the exact position and level of underground services, as well as the recording of all information on electronic drawing format.

PJC.03 **ISOLATION, STRIPPING, DISMANTLING AND REMOVAL OF EXISTING FIRE FIGHTING EQUIPMENT** .....Unit: number

The tendered rates shall include full compensation for the isolation, stripping, dismantling and removal of irreparable damaged, broken or unsuitable fire hydrants, fire hose reels and fire extinguishers, including all valves, cabinets, mounting brackets, streamers, etc, as well as removal off site and/or storage of all removed items mentioned above.

PJC.04 **SUPPLY AND INSTALLATION OF FIRE HYDRANTS EQUIPMENT**. Unit: number

The tendered rate shall include full compensation for the supply, delivery, positioning, installation, testing, commissioning and hand-over of fire hydrants, including all necessary pipe work, fittings, bends and the reinstating of existing surfaces such as walls, floors, ceilings, etc.

The tendered rate shall also include full compensation for the supply, delivery, positioning, installation of cabinets, cupboards, valves, brackets,

The tendered rate shall also include full compensation for the supply, delivery and positioning and fixing of all fire signage as required by regulation.

The tendered rate shall also include full compensation for the labelling with identifying tags and recording of details of all equipment.

PJC.05 **SUPPLY AND INSTALLATION OF FIRE HOSE REELS**.....Unit: number

The tendered rate shall include full compensation for the supply, delivery, positioning, installation, testing, commissioning and hand-over of fire hose reels, including all necessary pipe work, cabinets, cupboards, valves, brackets, fittings, bends and the reinstating of existing surfaces such as walls, floors, ceilings, etc.

The tendered rate shall also include full compensation for the supply, delivery and positioning and fixing of all fire signage as required by regulation.

The tendered rate shall also include full compensation for the labelling with identifying tags and recording of details of all equipment.

PJC.06 **SUPPLY AND INSTALLATION OF FIRE EXTINGUISHERS**.....Unit: number

The tendered rate shall include full compensation for the supply, delivery, positioning, installation and hand-over of the fire extinguishers, including all necessary brackets, backboards, etc.

The tendered rates shall also include full compensation for the supply, delivery, positioning and fixing of all fire signage as required by regulation.

The tendered rate shall also include full compensation for the labelling with identifying tags and recording of details of all equipment.

PJC.07 **SERVICING, CLEANING AND REPAIR OF FIRE HYDRANTS** ..... Unit: number

The tendered rate shall include full compensation for the repair or replacement of damaged, broken, leaking or corroded pipe work and fittings, main hydrant seals, quick coupling catches, shaft ends for right-angle hand wheel type hydrants, streamers, hose nozzles, valve steam seals, fire cupboard doors and locks, damaged, missing or shortfall fire signage, etc.

The tendered rate shall also include full compensation for the labelling with identifying tags and recording of details of all equipment.

PJC.08 **SERVICING, CLEANING AND REPAIR OF FIRE HOSE REELS** ..... Unit: number

The tendered rate shall include full compensation for the repair or replacement of damaged hose drums, mountings and shut-off valves, replacement of damaged or missing 30 m hoses, hose nozzles, shut-off valve wheel handles, hose drum seals where leaks occur, gland packing and gaskets of shut-off values, repainting of deteriorated paintwork, replacement of fire cupboard doors and locks, damaged, missing or shortfall fire signage, etc.

The tendered rate shall also include full compensation for the labelling with identifying tags and recording of details of all equipment.

PJC.09 **SERVICING, CLEANING, RECHARGING AND REPAIR OF FIRE EXTINGUISHERS** ..... Unit: number

The tendered rate shall include full compensation for the repair or replacement of all damaged, faulty or missing discharge hoses and nozzles, pressure gauges, operating instructions, the recharging of discharge cylinder to required capacity for DCP, water and foam extinguishers, and the recharging of CO_2 extinguisher to capacity, repair, resealing of CO_2 discharge mechanism, checking, servicing and repairing of activation mechanisms, replacement of water and foam extinguishers that have corroded cylinders, replacement of DCP, water or foam content of extinguishers, the replacement of fire cupboard and cabinet doors and locks, damaged, missing or shortfall fire signage, brackets and backboards, etc.

The tendered rate shall also include full compensation for the labelling with identifying tags and recording of details of all equipment.

PJC.10 **SUPPLY AND INSTALLATION OF FIRE EQUIPMENT SIGNAGE** ..... Unit: number

The tendered rate shall include full compensation for the supply, delivery, positioning, installation and hand-over of the fire signage as required by regulation, including all necessary brackets, frames, etc. as described in the schedule of quantities.

PJC.11 **SERVICING, CLEANING AND REPAIR OF FIRE PUMP ROOM** ..... Unit: number

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, replacement of wiring, V-belts and hoses as needed and other consumables required including the steam cleaning of the assembly.

The tendered rate shall also include full service of all the listed equipment in PJC.02(a) that includes the pumping equipment and motor control centre and replacing the batteries in the motor control centre.

PJC.12 **FIRE FIGHTING TRAINING** ..... Unit: number

The tendered rate shall include the number of training sessions conducted for a maximum of 20 attendees including all training material, transport and training aids required.

The end user shall be trained, by the supplier of the firefighting equipment, to operate the individual firefighting equipment. Fire Fighting training shall be done by a national accredited training institute (Fire Protection Assotiation of South Africa).

PJC.13 **LABELLING OF ALL CONVENTIONAL FIRE FIGHTING EQUIPMENT WITH IDENTIFYING TAGS AND RECORDING OF DETAILS**.....Unit: number

The tendered rate shall include full compensation for the supply, delivery, positioning, and installation of identifying tags which must be in a printed or engraved format on each type of fire fighting equipment and bracket or holder.

The tendered rate shall also include full compensation for the supply, delivery, positioning, installation of labels on existing cabinets, cupboards, valves, brackets,

PJC 07 DETAILS OF MAINTENANCE WORK

PJC 07.01 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 A12. The Contractor shall adhere strictly to Additional Specification SA: General Maintenance, and Technical Specification JC: Conventional Fire Fighting 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 Technical Specification JC. 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 a failure of equipment, components and systems of this particular installation.

TECHNICAL SPECIFICATION

KA WATER

AUDIT CONTENTS

KA 01 SCOPE
KA 02 STANDARD SPECIFICATIONS
KA 03 EXECUTION OF REPAIR WORK
KA 04 MAINTENANCE
KA 05 MEASUREMENT AND PAYMENT

KA 01 SCOPE

This specification covers the material, equipment, testing and work required for the implementation of a water audit. It covers only the external water services comprising the water supply from the point of delivery and the associated distribution system.

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.

KA 02 STANDARD SPECIFICATIONS

KA 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

SANS 1200 DB - Earth works (pipe trenches) SANS 1200 LB - Bedding and pipes
SANS 10306 - Management of potable water in distribution systems
BS 1780 - Specification for Bourdon tube pressure and vacuum gauges

KA 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 Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) shall be adhered to.

KA 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.

KA 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.

KA 02.05 MECHANICAL PRESSURE GAUGES

(a) Analogue mechanical or Bourdon tube pressure gauges shall be of the bottom entry type and shall have faces at least 60 mm in diameter with clear, readable markings and indicators. The screw-in fitting shall be compatible with the pipe fitting, which shall be the metric equivalent of a ½ inch BSP internal thread unless otherwise specified. Threads shall be in accordance with BS 21 for jointing threads or BS 1387 for long screw threads. The Contractor shall provide the relevant details in the operation and maintenance manuals.

(b) The indicated range on the gauge shall span 120 % of the operational pressure range specified for the relevant equipment. Accuracy shall be within 3 % of the full-scale deflection value. An adjustable indicator shall be set to indicate the maximum operational system pressure clearly.

(c) It shall be possible to isolate the pressure gauge from the pressure pipe by means of a valve or a gauge cock, which shall be supplied and installed by the Contractor and shall be included in the tendered rate for the equipment.

(d) A gauge protector shall be fitted where a gauge has to indicate pressures in corrosive media or liquids that could easily clog the pressure ports. It is a requirement that gauge protectors be fitted where sludge is the workingmedium.

(e) Pressure gauges fitted to hydraulic pipelines shall be glycerine-filled for damping purposes, and gauges fitted to pneumatic or gas pipelines shall be vacuum- damped.

(f) The circumferential positioning of pressure gauges on water and sewerage pipes shall be in accordance with BS 5316: Part 1 class C, and the static head tapping shall also comply with these standards.

(g) Bourdon type pressure gauges shall comply with BS 1780.

KA 02.06 DATA LOGGER SPECIFICATION

KA 02.06.01 Special features required

The following special features are required of the data logger:

- Recording of analogue values (pressure) and flow simultaneously;
- Inputs may be used for either digital or analogue sensing devices;
- Three independent memories (day, hour and events);
- Positive and negative data logging;
- LC-display;
- Alarm contact;
- Battery-powered (independent of the mains power supply);
- Appropriate software included.

KA 02.06.02 Technical data

Protection Casing Operating temperature Storage temperature System clock Output

Alarm contact

IP68
Cast aluminium 0
to 50 °C
-10 to + 70 °C
Read time
V.24/RS 232-compatible data interface to connect to the PC. All socket connectors are waterproof.
FET open drain - 1 max 100 mA; U max 50 V

KA 02.06.03 Pressure sensor

The sensor may be either:
- direct-connected to a 3/8" NPT thread nipple, or
- connected by an adapter to a 3/8" Whitworth female connection. Material:
All parts which are in contact with the media and the housing must be manufactured from stainless steel.

Storage temperature	-55 to +100 °C
Operating temperature	-40 to +100 °C
Operating temperature interface	0 to +70 °C
Compensated range	0 to +70 °C
Media temperature	-40 to +125 °C
Humidity	0 to 100 % (RH)
Shock	50 g
Accuracy	± 1,0 % FS at constant temperature
Non-linearity	± 0,2 % FS
Repeatability	± 0,5 % FS
Thermal effects	0 °C to 70 °C
Response time	1,0 ms

Pressure ratings (bar):	Operating pressure	Proof pressure[2]	Burst[3]
	0 - 20,70	31,0	345

(a) Sensor including interface;
(b) Maximum pressure without causing damage to the sensing elements;
(c) The media will be contained until this extreme pressure limit is

exceeded. Measuring range: 0,0 to 20,7 bar

KA 03.01 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 demarcate any areas to be repaired and shall instruct the Contractor with regard to the repair work to be done.

KA 03.02 INSTALLATION OF WATER METERS

This section covers the installation and repair of all water meters that will be used as part of the water audit process.

KA 03.02.01 Bulk water meters

Bulk water meters at reservoirs shall be repaired or replaced depending on the condition of the meter. Meters not installed in accordance with the manufacturer's instructions shall also be rectified.

All reservoir outlets shall be metered. All boreholes will be metered.

KA 03.02.02 Zone meters

Zone meters shall be installed within the network where significant benefit can be obtained from dividing the area into zones so that the consumption pattern can be monitored and discrepancies between the supply and consumption within the area compared.

Zone meters will also be used for the measurement of night flows where required.

KA 03.02.03 Individual connections

All individual connections within the reticulation shall be metered. Such connections shall include meters for individual buildings.

KA 03.02.04 Domestic water meters

Meters for domestic water consumption shall be provided in above ground installations, but underground in secure areas.

KA 03.02.05 Combination water meters

The installation of combination water meters shall be considered for all installations where connections larger than 80 mm are used for institutions that have peak flows exceeding 400 times the minimum anticipated flow.

KA 03.02.06 Fire flow connections

Where fire flow connections are provided, measures shall be taken to ensure that the fire flow and domestic water consumption are metered separately. The Engineer will indicate where the meters are to be installed.

KA 03.03 ROUTINE INSPECTIONS OF PIPELINE ROUTES

KA 03.03.01 Water pipelines

The routes of all water supply pipelines shall be inspected for visible leaks. All leaks shall be properly logged and reported for repair.

KA 03.03.02 Sewer manholes

Sewer manholes shall be inspected for excessive night flows. The households in areas with high night flow rates shall be inspected for leakages resulting from leaking cisterns, etc, which occur on the consumers' side of the meters.

KA 03.04 COMPILATION OF DATABASE

The Contractor shall compile a database to assist in effective management of the system. The database shall contain the following information:

(a) Meter serial number
(b) Meter size
(c) Meter make
(d) Installation position
(e) Meter reading on installation
(f) Date of installation
(g) Date last calibrated
(h) Consumer name
(i) Postal and residential address

(j) Length and diameter of pipeline.

The above-mentioned data may also be provided as part of the User Client's billing system.

In the compilation of the database the Contractor shall ensure that the information required for the "water audit" software is also collected.

KA 03.05 LEAK DETECTION AND REPAIR

This clause covers the providing of additional equipment for implementing a water loss management programme in identified areas. Areas with significantly high unaccounted for water flows will be identified for measuring night flows.

KA 03.05.01 Provision of data loggers

Data loggers shall be provided in accordance with Particular Specification PA: Measuring instruments. The data loggers will enable the monitoring of flow patterns and detailed inspection of the minimum night flow in a particular area.

KA 03.05.02 Measurement of night flows

Measurement of the night flow shall be done as instructed by the Engineer.

KA 03.05.03 Meter management

All metered consumers must be incorporated into a billing system for the accurate compilation of monthly accounts for water consumed.

The billing system shall be user-friendly and cover at least the following aspects:

(a) Meter serial number;
(b) Consumer name;
(c) Postal and residential address;
(d) Meter reading at start and end of period;
(e) Dates of meter reading;
(f) Volume of water consumed;
(g) Tariff applicable for payment;
(h) Estimated interim accounts;
(i) Accounts in arrears;
(j) Unreadable accounts with associated reasons;
(k) Incorporation of prepayment meters and associated consumption.

KA 03.05.04 Provision of software

Software packages shall be provided to enable the following:

(a) Establishment of a meter database;
(b) Establishment of a user-friendly database;
(c) Water audit;
(d) Night-flow evaluation.

KA 03.05.05 Training and capacity building

This clause covers the training of representative staff of the User Client to acquire a level of competency so that they will be able to manage the water control plan.

The training programme shall include the following aspects:

(a) Software application for water balance, water audit and billing system;
(b) Meter reading;
(c) Use of data loggers.

SANS 10306 will be used as a basis for the training.

KA 04 MAINTENANCE

This specification must be read in conjunction with Additional Specification SA: General Maintenance.

All components of the water control plan including the associated water meters, as well as software and hardware for the computers, shall be maintained during the maintenance phase of the Contract. Maintenance of the system shall ensure reliable

functioning and optimum service life thereof. Commencement of maintenance of the system shall mean that the system has been repaired to its original level of serviceability and shall leave the Contractor with an as-new system to maintain for the remaining period of the 36 month contract.

Remuneration for maintaining the system, services and parts of the infrastructure in perfect functional condition is provided for in the Schedule of Quantities by means of monthly

payment items.

Maintenance implies and shall include monthly routine preventative maintenance and corrective maintenance, as well as breakdown maintenance on all components of the specified installation. Maintenance shall include all repair work, replacing of components, fixing defects or any other actions or rectifying measures necessary for complete operation of the water control plan.

KA 04.01 SCOPE OF MAINTENANCE

Maintenance work for the water control plan shall comprise the following:

KA 04.01.01 Monthly maintenance

(a) Check operation of water meters;
(b) Read all water meters;
(c) Verify sample meter readings;
(d) Update database;
(e) Issue consumer accounts;
(f) Repair visible leaks;
(g) Compile monthly water balance on volume and costs.

KA 04.01.02 Four-monthly maintenance

(a) Check sewer night flows three-monthly;

(b) Install data loggers to measure night flows at bulk and zone meters three- monthly;

(c) Analyse data from data loggers;

(d) Implement leak detection in areas indicated as problematic through data logger analysis.

KA 04.01.03 Six-monthly maintenance

(a) Clean strainer units at water meters;

(b) Confirm settings and operation of pressure-reducing valves.

KA 05 MEASUREMENT AND PAYMENT

KA.05.01 COMPILATION OF DATABASE ..... Unit: sum

The tendered sum shall include for the provision of the software and the input of all the initial data.

KA.05.02 MEASUREMENT OF NIGHT FLOWS ..... Unit: number

The unit of measurement shall be the number of periods during which a night flow is measured per water meter installation, irrespective of the duration of the measuring period.

The tendered rate shall include for the installation of data loggers, downloading of data, presentation and analysis of results and all associated incidental charges.

KA.05.03 METER MANAGEMENT SYSTEM ..... Unit: sum

The unit of measurement shall be a sum for the complete compilation of a meter management system sufficient for management of the installation.

The tendered rate shall include for the input of all related data.

KA.05.04 PROVISION OF SOFTWARE ..... Unit: number

The unit of measurement shall be the number of software packages provided.

The tendered rate shall include for the supply, delivery and installation of the relevant software. All associated labour costs shall be included but, the associated computer hardware costs are to be excluded.

Separate pay items will be listed in the Schedule of Quantities for different software packages.

KA.05.05 TRAINING AND CAPACITY BUILDING ..... Unit: sum

The unit of measurement shall be a sum to cover the respective training and capacity building offered.

The tendered rate shall include for the labour, transport, materials and all other related

costs. Separate items will be listed in the Schedule of Quantities for different courses

required.

KA.05.06 **SUPPLY AND INSTALLATION OF PRESSURE GAUGES**.....Unit: number

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

The tendered rate shall include full compensation for the supply and installation of the pressure gauges, including site handling, correct positioning, testing and all material and labour required to obtain a fully functional pressure gauge.

KA.05.07 **SUPPLY AND DELIVERY OF DATA LOGGERS**.....Unit: number

The unit of measurement shall be the number of data loggers supplied and delivered. There will be different items for different data loggers.

The tendered rate shall include full compensation for the corrosion protection, patent rights, royalties, transport and all other costs and actions required for the supply and delivery of data loggers as specified.

KA.05.08 **INSTALLATION, TESTING AND COMMISSIONING OF DATA LOGGERS AS SPECIFIED**.....Unit: number

The unit of measurement shall be the number of data loggers installed, tested and commissioned as specified.

The tendered rates shall include full compensation for the site handling, positioning, installation, testing and commissioning of the data loggers as specified, including all other costs and actions required to obtain a fully functional system for flow measurement.

All actions required as part of the software installation shall be included.

Additional Specifications

SA GENERAL MAINTENANCE

SB OPERATING AND MAINTENANCE MANUALS

SC GENERAL DECOMISSIONING,TESTING AND COMMISSIONING PROCEDURES

SD GENERAL TRAINING

SF GENERAL OPERATION

SH HIV / AIDS REQUIREMENTS

SI OCCUPATIONAL HEALTH AND SAFETY

SN IMPLEMENTATION OF LABOUR INTENSIVE INFRASTRUCTURE

PROJECTS UNDER THE EXPANDED PUBLIC WORKS PROGRAMME (EPWP)

SL EMPLOYMENT AND TRAINING OF YOUTH WORKER ON THE EXPANDED PUBLIC WORKS PROGRAMME (EPWP) INFRASTRUCTURE PROJECTS: NATIONAL YOUTH SERVICE (NYS).

ADDITIONAL SPECIFICATION

SA GENERAL MAINTENANCE

CONTENTS

SA 01	SCOPE
SA 02	MAINTENANCE REQUIREMENTS
SA 03	MAINTENANCE CONTROL
SA 04	COMMUNICATION
SA 05	PERFORMANCE MEASUREMENT
SA 06	MEASUREMENT AND PAYMENT

SA 01 SCOPE

Maintenance of the specified systems, services and/or parts of buildings and infrastructure shall all be referred to as "Maintenance of an Installation". Maintenance of all completed installations shall ensure reliable functioning and optimum service life thereof. Monthly maintenance responsibilities for each installation including all units and components as specified shall commence with access to the Site.

Maintenance of an installation shall be performed in accordance with the Technical and Particular Specifications, the Operating and Maintenance Manuals (where applicable) and the Maintenance Control Plan.

Remuneration for maintaining "installations" (systems, services and/or buildings and parts of the infrastructure) in good functional condition is provided for in the Schedules of Quantities by means of monthly payment items.

This Additional Specification covers maintenance requirements, development of a maintenance control plan, identification of equipment, site maintenance administration, maintenance performance measurement, as well as the items for measurement of the Contractor’s service level and resulting payment.

The contractor will have the opportunity at the start of the contract to point out items which are not in perfect working order which in turn will be services/repaired as per the relevant tendered repair rates.

The various installations are in good working order. This places the emphasis of this Contract on repair and maintenance.

No distinction will be made between prior to practical completion and completed installations for the purpose of maintenance.

The Contractor will have the opportunity at the start of the contract to point out items which are not in perfect working order which in turn will be serviced/repaired as per the relevant tendered rates. The Contractor must submit a written report of these items within 28 days of site hand over. Failing to submit the report within the allowed time will render any and all defective items part of the Contractor maintenance responsibly as set out in the relevant Technical and Particular Specifications.

The Contractor will further more at the start of the contract perform annual maintenance on all the installations as per the items listed in the different Technical and Particular Specifications as part of the Contractors maintenance obligation.

Maintenance of each of these installations will be the responsibility of the Contractor and will be evaluated on a monthly basis by the Engineer. The remuneration for maintenance work and responsibilities will be certified accordingly.

SA 02 MAINTENANCE REQUIREMENTS

SA 02.01 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall maintain the complete installations for the 36-month Contract period.

Maintenance implies and shall include monthly preventative maintenance, corrective maintenance, as well as breakdown maintenance on all components of the specified installations.

The maintenance control plan (specified in Clause SA 03) will be developed by the Contractor, to schedule the frequency of routine inspections and format of reports. The Contractor shall carry out inspections on the equipment as detailed in the Technical and Particular Specifications and the maintenance control plan. Each inspection, test or breakdown shall be recorded in an approved format and listed in a quarterly report (part of the maintenance control plan).

As part of repair of each installation, the Contractor shall submit a set of Operating and Maintenance Manuals where applicable. The Contractor shall ensure through training that the operating and maintenance personnel are conversant with the instructions as presented in the Operating and Maintenance Manuals. Continued training shall be included in the scope of maintenance work for the duration of the 36- month Contract, in accordance with Additional Specification SD: General Training.

The Operating and Maintenance Manuals, as approved by the Engineer, shall be used as a basis of preventative maintenance. The Contractor shall perform all preventative and corrective maintenance as described in the Operating and Maintenance Manuals. This shall be in accordance with the Technical and Particular Specifications.

The Contractor shall, as part of his maintenance responsibilities repair or replace faulty equipment upon logging of a breakdown, within the down-time as defined in Clause SA 05.02 at the Contractor’s cost, except in the event of replacement being labelled as exceeding liability as specified in Clause 63 of the Project Specific Conditions of Contract, in which case the Department of Public Works will bear part of the costs.

The Contractor shall rectify any faulty condition of which he becomes aware, even if it has not been logged. Such rectification shall also be logged and listed in the quarterly report.

SA 02.02 CONDITIONS FOR EXCEEDING THE CONTRACTOR’S LIABILITY DUE TO OPERATIONAL DAMAGE BREAKDOWNS

Irrespective the definition of operational damage given in the Oxford dictionary, it shall be defined for the purpose of this clause as being any damage caused on purpose or through negligence by the User Client’s employees, suppliers, subcontractors, etc. for any reason whatsoever. For the purpose of this clause, operational damage and vandalism shall have the same meaning. Where repair work is necessitated as a result of operational damage caused by User Clients or their associates, the Contractor will be requested to:

(a) perform work, using tendered rates for the supply, delivery and installation of material forming part of the repair work schedule, within the maximum down- time

allowed for operational damage, where the Engineer rules that the damage has been caused by incorrect operation;

(b) submit one (1) quotation for repair and/or replacement of the damaged unit, where tendered rates are not available and where the Engineer rules that the damage has been caused by incorrect operation;

(c) perform the work on receipt of an order from the Engineer, within the time offered as part of the quotation, and

(d) notify the Engineer well in advance of completion of the repair work in order to enable inspection.

The responsibility of determining whether damage to the installation was caused by people other than employees or associates of the Contractor shall rest with the Engineer.

Damage caused by the employees, suppliers, subcontractors, etc. of the Contractor, shall be repaired by the Contractor at his own cost.

SA 02.03 CONDITIONS FOR EXCEEDING THE CONTRACTOR'S LIABILITY ABOVE MARGINAL BREAKDOWN COST

In the event where the cost for the repair or replacement of any single component/subassembly where a breakdown has occurred due to a single failure, or where the cost for replacing a single item of equipment completely, exceeds the value of R15 000, 00 (transport, accommodation and travelling cost excluded), the liability of the Contractor is limited to the value of R15 000, 00. The additional cost above the value of R15 000,00 will be paid for by the Employer provided that conditions 1, 2 and 3 below have been met.

1. The defective part/component/subassembly or machine must be identifiable as a single subassembly or component and not the total of a number of small defects or breakdowns on subassemblies/components on any one or more machines.

   Examples of subassemblies/components are the following:

   (a) Should the wiring or bearings on an electric motor fail, the complete motor must be removed for repairs and the cost for the repairs on the complete motor will be regarded as repairs on a single subassembly/component.

   (b) A starter motor, for example, is a subassembly, which can be removed from the machine for repairs. The repairs on the starter motor together with the repairs on the main bearings will not be regarded as a repair on a single subassembly/component. If the complete diesel engine is replaced with its associated subassemblies the replacement of the complete unit will be regarded as a single component.

   (c) A pump as a whole is regarded as a single component. The pump and driving machine on long coupled pumps are regarded as separate subassemblies. Pumps and motors on close-coupled equipment are regarded as a single component. The pump and motor of a sump pump are therefore regarded as a single component.

(d) Control equipment for the control of a single item, with the sensing device, the controller itself and the final controlled variable are regarded as a single component of the system. The repairs on any one item on a controller have an influence on the rest of the control equipment and must after the replacement be commissioned again as a unit.

2. The Contractor shall submit a written report to the Engineer for approval. This report shall contain the following information:

(a) The make and model number of the machine serviced/inspected/ repaired/replaced;

(b) The identification number of the machine;

(c) A description or name and part number of the defective part/component or subassembly;

(d) A statement on whether the component could be repaired, together with a cost estimate;

(e) A quotation valid for a minimum period of 60 days if the component/part/subassembly has to be replaced or repaired by an outside firm. If the subassembly/machine is to be repaired or replaced by an outside company, the Contractor shall supply one (1) quotation for such parts/repairs or a quotation from any sole supplier. Only an original quotation will be accepted. The mark-up on such work shall be a percentage as tendered and shall be applicable to the total cost (VAT excluded) of repair work by outside companies;

(f) The expected urgency for the replacement or repairs, and

(g) The delivery time of a new component/subassembly/machine or delivery times on spares required to repair the defective component/ subassembly.

3. A written approval to proceed with the work must be issued by the Department. Copies of the original VAT invoices from outside companies for all repairs or spare parts supplied must be attached to the Contractor's invoice.

SA 02.04 EMERGENCY BREAKDOWN REPAIR VISIT

Whenever an emergency breakdown is logged at a site where no access has been given the Contractor, an “emergency breakdown repair visit” shall be carried out by the Contractor to attend to the repair of the emergency breakdown within 24 hours after it was logged with the Contractor.

Remuneration for the material and labour required to attend to repair of the emergency breakdown shall be deemed included in the payment item for maintenance of an installation based on a point system and measured monthly. Payment for the “emergency breakdown repair visit” will be measured separately in the schedule of quantities to cover the cost of the call-out, in terms of travel and accommodation cost, including travel time and any other cost associated with the call-out.

The Contractor will not be remunerated for emergency breakdown repair visits once the specific installation or site has been completed (Completion Certified). The contractor will be remunerated for maintenance and attending to emergency

breakdowns as per his payment item for maintenance of a completed installation based on a point system as measured monthly.

Typical examples of “emergency repair breakdown visits” would be:

- A Breakdown of any standby power generator that prevents the standby power generator from operating at its capacity and meeting the demand.
- A Breakdown of any water supply pump or any other component of the water supply or bulk water installation that affects the water supply to such an extent that it cannot meet the demand
- A Breakdown of the water reticulation network or sewer reticulation network that affects water supply or sewer removal to such an extent that the service is disrupted to any building.
- A Breakdown of site electrical or building electrical that disrupts power supply to a building (including residential unit)
- A Breakdown of a geyser that prevents it from supplying hot water as per specification
- Any other Breakdown that can be regarded as life threatening or having the potential to cause damage to equipment or property and is included in the scope of work to be maintained by the Contractor, as per the technical and particular specifications. The Engineer will be responsible for categorising a breakdown as an emergency.

SA 02.04 COMPONENTS INCLUDED IN MAINTENANCE SCOPE

The main sections of a facility with their subsections are as set out in the Technical Specifications and Particular Specifications where applicable and in the Schedule of Quantities and will each be deemed "an installation". Maintenance, as specified, will be applicable to all of these installations.

SA 02.04.01 LEBOMBO PORT OF ENTRY

Installation: Structural and Building Related Work
Installation: Plumbing and Drainage
Installation: Building Electrical
Installation: Fencing, Cleaning Of Buildings and Site Keeping
Installation: Bulk Water Supply Systems and External Water Networks
Installation: Wastewater Treatment Works and Sewer Networks
Installation: Roads and Storm Water Drainage
Installation: Standby Power Installations
Installation: External Lighting
Installation: Medium and Low Voltage
Installation: Heating, Ventilation and Air Conditioning Systems
Installation: Conventional Fire Fighting Equipment

SA 02.04.02 SITE AND BUILDING INFORMATION

SA 02.05 COMMENCEMENT OF MAINTENANCE PERIOD

Maintenance responsibilities for an installation prior to practical completion of repair work shall include maintenance of all individual units, equipment or components thereof, for which no repair work is required (as per the contract document) or for which the repair work has not yet started, and shall commence with access to the installation.

Where access to an installation with a view to commence repair work is delayed, then the maintenance responsibilities which in such cases will consist of keeping the installation in the condition it is in, shall commence immediately at the start of the Contract.

Such maintenance before access is obtained, shall consist for example of fixing leaks without replacing pipework or opening a blocked pipeline without further altering or inspecting such pipes.

The Contractor shall accept full maintenance responsibilities for each completed installation upon issue of a Certificate of Practical Completion for repair work of that installation.

The preliminary construction programme differentiates between commencements of maintenance on various installations.

SA 02.06 PREVENTATIVE MAINTENANCE: DEFINITION

This entails the rendering of services and servicing of equipment according to a predetermined maintenance control plan to:

(a) replace and service components of equipment, units or parts thereof for each installation at prescheduled moments regardless of condition;

(b) readjust, reset, clean, corrosion protect all components of equipment, units or parts thereof for each installation, and
(c) carry out all implied actions to maintain installations in their present functional condition.

Preventative maintenance shall be aimed at minimisation of breakdowns.

SA 02.07 CORRECTIVE MAINTENANCE: DEFINITION

This entails regular observation of the equipment, identifying pending breakdowns, maladjustment or anomalies of equipment, units or parts of installations and subsequent action to restore installations to the functional condition as before the breakdown.

SA 02.08 BREAKDOWN MAINTENANCE: DEFINITION

This entails repair and/or replacement of defective equipment, units or parts of installations following a breakdown that leaves the installation inoperable or unsafe, and subsequent action to restore installations to their normal functional condition, within the maximum down-time allowed.

SA 02.08 OPERATIONAL DAMAGE BREAKDOWN MAINTENANCE: DEFINITION

This entails repair and/or replacement of defective or damaged equipment, units or parts of installations following a breakdown that leaves the installation inoperable or unsafe, and subsequent action to restore installations to their normal functional condition, within the maximum down-time allowed.

Typical examples of “operational damage breakdown visits” would be:

- A Breakdown of any structural items such as locks, window handles and stays, windows, doors and any other structural related items.
- A Breakdown of any plumbing, drainage or sanitary ware related items.
- A Breakdown of any electrical related items.
- Any other damaged items not caused by normal wear and tear.

SA 02.09 SITE MAINTENANCE RECORD KEEPING

The Contractor shall provide and maintain hard-cover A4 maintenance files for each installation for the duration of the Contract. All schedules, checklists, breakdown reports,

preventative maintenance records, component replacement records and quarterly reports shall be filed, together with information regarding repairs exceeding the Contractor's liability, as set out in SA 02.02 and SA 02.03.

Site maintenance records shall be submitted at each monthly meeting.

SA 02.10 SUPPLY OF LABOUR, EQUIPMENT AND MATERIAL

SA 02.10.01 Labour

Competent personnel that have been trained by the Contractor, in accordance with Additional Specification SD: General Training shall execute all maintenance work.

SA 02.10.02 Equipment

All tools and equipment required for maintenance work shall be supplied by the Contractor at his cost (except where otherwise provided).

SA 02.10.03 Material

All material, spare parts, components, equipment and appurtenances necessary for the complete maintenance of each installation shall be supplied and installed by the Contractor at his cost, to a maximum value per part/subassembly as specified in the Special Conditions of Contract for exceeding Contractor's Liability.

Materials as provided for in the Schedule of Quantities, shall be supplied and delivered by the Contractor at the tendered rates upon order of the Engineer only, and shall be free-issued to the User Client for own use. The Contractor shall inform the Engineer of all scheduled deliveries to arrange official hand-over with the User Client.

SA 02.11 IDENTIFICATION OF EQUIPMENT

A unique identification number will be allocated only to each mechanical equipment item forming part of the installation. This identification number will be allocated and administered in collaboration with the User Client and must be described in the maintenance control plan.

Reference shall be made to identification numbers in the maintenance control plan, operating and maintenance manuals and during all maintenance activities, including the logging of breakdowns and other correspondence. Identification numbers shall also be indicated on as-built drawings.

SA 03 MAINTENANCE CONTROL

SA 03.01 SCOPE

Maintenance quality control shall be the responsibility of the Contractor. The Contractor shall introduce a maintenance control plan to assist him in ensuring that preventative, corrective and breakdown maintenance are performed as described in the operating and maintenance manuals and Technical and Particular Specifications.

SA 03.02 PRELIMINARY MAINTENANCE CONTROL PLAN

A preliminary version of the maintenance control plan shall be submitted with the programme and the framework of the preliminary version shall be as close as possible to that of the final maintenance control plan as specified in SA 03.03 below. Detail contained in this preliminary maintenance control plan shall include:

(a) Actual time that a representative of the Contractor will be present on Site for the

duration of the maintenance period;

(b) the scope and frequency of routine inspections

(c) repair methodology

(d) details of training plan to be implemented in accordance with Additional Specification SD

SA 03.03 MAINTENANCE CONTROL PLAN

(a) The maintenance control plan shall be based on the Contractor's preliminary maintenance control plan, and shall be bound in a neat, A4-sized, ring-bound document with a cover page and back cover. The contents of the document shall be indexed.
In drawing up the document, the Contractor may reproduce relevant paragraphs and clauses from any of the specifications forming past of the Contract documents, but should there be any discrepancies between such clauses and paragraphs in the maintenance control plan and those in the Contract documents, those in the Contract documents shall be regarded as being correct and shall apply.

(b) To ensure that the Engineer is satisfied that the Contractor understands the purpose and advantage of carrying out maintenance work according to a maintenance control plan he shall, as an introduction to the control plan document, set out his views as to what he believes the implementation of a maintenance control plan will achieve.

(c) The maintenance control plan shall also contain the following:

(i) A summary of the repair and maintenance work to be carried out under the Contract giving details of the conditions of the various installations at the facility(ies) affected by the activities under the Contract. The Contractor shall bear in mind that maintenance work may have to be carried out before the repair phase of the installation has been entirely completed and the summary mentioned above shall therefore differentiate between maintenance work before and after the repair phase has been completed.

(ii) Details of how the Contractor intends to carry out the various types of maintenance work especially breakdown maintenance should breakdowns occur.

(iii) Details of how the call centre works, as specified in clause SA 04 as well as all statistics of breakdowns, leakages, blockages, etc. available from the call centre for the installation and the age of the installation that has been taken into account in compiling the contents of the maintenance control plan.

(iv) A list of organisations and persons directly involved with the Contract or whose requirements have to be taken into account during the entire Contract Period such as the Department of Public Works, the User Client, the Consulting Engineer, the Contractor, the Local Authority, etc. Each person's position within his organisation as well as the applicable phone numbers shall be given.

(v) Details of monthly meetings to be hold with the Department of Public Works, the User Client, Contractor and Engineer;

(vi) Reports to be submitted after every routine inspection (all reports, checklists, breakdown records, score card results, etc. for each system of an installation shall be kept on the site in a hard cover file);

(vii) Procedures to address complaints and logged breakdowns;

(viii) Details of quarterly reports, summarising all inspections, together with inspection data such as nature of test, names of persons carrying out tests and inspection results. Detail of repairs and replacements, together with testing of repaired equipment shall also be reflected in this report, and

(ix) Assistance to be given by the Engineer with decisions regarding material, equipment and other recommendations.

(d) The codes of practice as set out in ISO 10006 and ISO 9004 for quality systems and management shall be used as a guideline for compiling a maintenance control plan. ISO accreditation is not a requirement in terms of this Contract.

(e) The maintenance control plan shall be upgraded when its contents are no longer representative of actual conditions.

(f) The Contractor shall check the contents of existing Operating and Maintenance Manuals (if available) and shall update or modify and then incorporate applicable data into his own manuals. Where no manuals exist, the Contractor shall draw up his own Operating and Maintenance Manuals.

Pertinent data contained in the Operating and Maintenance Manual may be transferred to the Maintenance control plan to make it a document which can be used as an independent handbook for maintenance work.

The Contractor is referred to the contents of paragraph (a) above regarding the reproduction of data, as this shall also be applicable to data reproduced from Operating and Maintenance Manuals.

SA 04 COMMUNICATION

The maintenance control plan (Clause SA 03) will provide, after agreement between the Contractor and the Engineer, for the following communication and complaint logging procedure:

(a) The Contractor shall establish a telephone and fax line and a cellular telephone connection to ensure that he can be reached at any time.

(b) The Contractor shall primarily be responsible for determining the items requiring preventative, corrective and breakdown maintenance, and shall communicate this information directly to his maintenance workforce.

(c) Should the Engineer or operating personnel of the User Client determine or suspect that preventative, corrective or breakdown maintenance is required, a call shall be logged through the call centre to reach the Contractor as soon as possible.

(d) Reaction times will be as described in Clause SA 05.02.

(e) All complaints of the User Client shall be reported to the Engineer via the call centre, as set out in the maintenance control plan, and the Engineer shall issue instructions to the Contractor. After the Contractor has attended to the complaint, the Engineer will provide feedback to the call centre both telephonically and via fax.

The call centre logs the details of the Engineer’s call and provides feedback to the complainant.

SA 05 PERFORMANCE MEASUREMENT

The Contractor's performance shall be measured against the following parameters:

SA 05.01 SPECIAL TESTING OF AN INSTALLATION

The Engineer may at any time inspect any part of the entire installation. During Maintenance work, the Engineer shall at his discretion order special tests to be carried out on complete installations at intervals of not less than four months, to verify the satisfactory functional condition of the installation.

The Engineer reserves the right to select at random component equipment and trade practices to be tested by independent authorities for compliance with specifications as specified in this Contract document.

The Contractor shall provide all equipment, tools and instruments required for testing.

SA 05.02 MAXIMUM MAINTENANCE DOWN-TIME

After a complaint has been logged and forwarded to the Contractor, the Contractor shall be expected to minimise the maintenance down-time until the system component is fully operational to the satisfaction of the Engineer. Should the Contractor not respond within the maximum down-time, the Engineer may arrange, at the cost of the Contractor, for the necessary repair work to be done by others.

Should the actual down-time exceed the maximum down-time the Contractor shall be liable to a payment reduction for the difference between actual down-time and maximum down-time. This is reflected in the table below:

REQUIRED MAINTENANCE	MAXIMUM DOWN- TIME ALLOWED	PAYMENT REDUCTION IF EXCEEDED
Fatal Breakdown	1 Hour	R 1 000/hour
Emergency Breakdown	12 Hours	R 2 000/day
Ordinary Breakdown	7 days	R 500/day
Operational damage repair	7 days	R 500/day

"Maximum down-time" shall mean the period of time allowed to repair a breakdown, and "actual down-time" shall mean the measured period from the instant when the breakdown was logged with the Contractor until the installation has been repaired to its functional specification.

"Immediate response repairs" shall imply breakdown maintenance repair work where no breakdowns are allowed at any time in terms of the Technical Specification.

"Emergency maintenance repairs" shall imply any breakdown maintenance repair work required to rectify a component or unit of the installation that disables the installation from functioning at its designed maximum requirement in terms of the Technical Specification.

"Ordinary maintenance repairs" shall imply all breakdown maintenance repair work required other than immediate response or emergency maintenance repairs.

"Operational damage repairs" shall imply all operational damage breakdown repair work required on any other damaged items not caused by normal wear and tear and shall also include and structural related breakdowns.

SA 05.03 PERFORMANCE-BASED PAYMENT

Remuneration for all value-related as well as all time-related preliminary and general charges shall be deemed included in the monthly maintenance payments for the various installations.

SA 05.03.01 Score-card

The Engineer shall inspect each installation monthly after Practical Completion of the repair phase of the installation. The Engineer shall use a score-card to measure the quality of preventative and corrective maintenance rendered by the Contractor during the preceding month, on all components that form part of the installation, in accordance with the maintenance specifications. The Engineer will record his inspection directly onto the score-card. The score-card shall serve to evaluate ten performance indicators each month.

SA 05.03.02 Performance indicators

Performance indicators shall be selected to measure the Contractor’s service level of preventative and corrective maintenance.

The Engineer shall have the opportunity to select ten (10) performance indicators each month, which shall focus on the measurement of maintenance quality against the relevant specifications for the ensuing month. 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 preventative and corrective maintenance work and shall be based on the maintenance control plan and operating and maintenance manuals. The work shall either be satisfactory, or unsatisfactory, and the Contractor shall score one (1) or zero (0) respectively per indicator.

Performance indicators shall be used to focus on certain key aspects of the work and shall in no way limit the Contractor's responsibility to do all the required work.

SA 05.03.03 Satisfactory performance

The Engineer shall inspect the site on an arbitrary day to measure the quality of maintenance against the ten selected performance indicators. Should the Contractor score the maximum points (10) he shall receive his full maintenance payment for the installation. Should the quality of preventative maintenance, or components requiring persistent corrective maintenance be unsatisfactory according to the score-card, the Contractor may fail to achieve full payment due to a reduced service level. Each monthly payment for maintenance shall be subject to evaluation based on the score- card.

A copy of the score-card including a guideline for the use thereof is included in this Specification.

SA 06 MEASUREMENT AND PAYMENT

SA.01 MAINTENANCE OF A COMPLETE INSTALLATION ..... Unit: point

The unit of measurement shall be a point. Each month shall represent a maximum of ten points and a minimum of zero points, depending on the performance and quality of maintenance. Ten points per month, determined by using the tendered rate per point, shall include full compensation for all liabilities and obligations described or implied in the Contract document and deemed by the Contractor to be applicable to the maintenance phase of the Contract, for the complete monthly maintenance of an entire installation, and all appurtenant works deemed to form part thereof, as defined in the relevant Technical or Particular Specifications.

The combined tendered rate for ten points (which shall not be less than 10% of the total tendered Contract Price) shall also include full compensation for complete preventative, corrective and breakdown maintenance (as defined in this General Maintenance Specification), including full compensation for all costs related to resetting, repair, procurement, supply, delivery, replacement, protecting, furnishing, installing, testing and commissioning of all items and material required to maintain the complete installation in a perfect functional condition. The only items not to be included in the rate for monthly maintenance points are:

1. Supply, delivery, installation and testing of special equipment/materials that will be measured elsewhere, and

2. Special testing of an installation.

Different installations shall be listed in the Schedule of Quantities, in accordance with the definition of each installation.

Although ten points per month shall include full compensation for preventative, corrective and breakdown maintenance, the Contractor might fail to achieve all points applicable in the event of unsatisfactory performance, in which case he shall still perform all maintenance requirements according to specification, but at his own cost where a reduction in points awarded is insufficient to cover his cost.

SA.02 **ADDITIONAL TESTS:**

SA.02.01 **Where ordered by the Engineer** ..... Unit: rand (R)

SA.02.02 **Charge required by the Contractor on sub item SA.03.01 above** .....Unit: %

An amount has been allowed in the Schedule of Quantities to cover the cost of additional tests required by the Engineer. The Engineer will have the sole authority to spend the amount or part thereof under subitem SA.03.01.

The tendered percentage under subitem SA.03.02 will be paid to the Contractor on the value of each payment made to the approved testing authority.

SA.03 **PAYMENT REDUCTION DUE TO EXCEEDING OF MAXIMUM ALLOWABLE DOWN-TIME DURING EMERGENCY BREAKDOWN** Unit: days

The unit of measurement shall be the number of days, in excess of 36 hours, during which a component of an installation was in a dysfunctional condition that required emergency repairs.

The negative fixed rate shall include full compensation for the User Client's loss in productivity and, multiplied by the number of days measured, shall be deducted from the certified amount due to the Contractor.

SA.04 **PAYMENT REDUCTION DUE TO EXCEEDING OF MAXIMUM ALLOWABLE DOWN-TIME DURING ORDINARY BREAKDOWN** Unit: days

The unit of measurement shall be the number of days, in excess of 7 days, during which a component of an installation was in a dysfunctional condition that required ordinary repairs.

The negative fixed rate shall include full compensation for the User Client's loss in productivity and, multiplied by the number of days measured, shall be deducted from the certified amount due to the Contractor.

SA.05 **PAYMENT REDUCTION DUE TO EXCEEDING OF MAXIMUM ALLOWABLE DOWN-TIME DURING OPERATIONAL DAMAGE BREAKDOWN**
. .....Unit: days

The unit of measurement shall be the number of days, in excess of 7 days, during which a component of an installation was in a dysfunctional condition that required ordinary repairs.

The negative fixed rate shall include full compensation for the Client's loss in productivity and, multiplied by the number of days measured, shall be deducted from the certified amount due to the Contractor.

SA.06 **CALL-OUT FOR REPAIR OF EMERGENCY BREAKDOWN (24 Hours)**..... Unit: No

The Unit of measurement shall be number. The Contractor will be remunerated for the number of call-out trips to the site, in order attend to the repair of an emergency breakdown logged (Before Access to a Site) with him by the Engineer. The tendered rate shall provide full compensation for all travel, accommodation and travel-time cost to and from the site. Remuneration for material and labour cost is deemed to be included under the "maintenance of a completed installation" payment item in the schedule of quantities, based on the points system and measured monthly.

DEPARTMENT OF PUBLIC WORKS
MAINTENACE SCORE-CARD

CONTRACT NUMBER: WCS .....

CONTRACT:

CONTRACTOR:

ENGINEER:

INSTALLATION: | | **MONTH**: | | | OF **36**

The following components of the installation were selected by the contractor at the Monthly Operation Meeting nr. | | | as performance indicators to be tested according to specification:

1. ENGINEER'S SELECTION	**0**	**1**
1.1		
1.2		
1.3		
1.4		
1.5		
1.6		
1.7		
1.8		
1.9		
1.10		

TOTAL SCORE: | |

D D / M M / Y Y

Engineer's Representative **Signature** **Date**

GUIDELINE FOR THE USE OF THE MAINTENANCE SCORE-CARD

The score-card and performance indicators must be used as a maintenance management tool. The aim with each score-card is to ensure that:

(a) the project focuses on key aspects of maintenance per month;
(b) the Contractor receives payment for his work, and
(c) the Employer receives value for money and a sustained high level of service.

Performance indicators must be selected to measure the Contractor's service level of preventative and corrective maintenance that will be based on the Maintenance Control Plan and the Operating and Maintenance Manuals (containing information specified in the Contract documentation).

For each specific installation, different performance indicators must be defined each month based on the content of the maintenance in relation to the scope of maintenance work per installation and must be based on the Contractor's service level record on preventative and corrective maintenance.

Breakdowns must be dealt with if and when necessary by logging of the breakdown and monitoring the downtime.

The Contractor and the Engineer must agree on all performance indicators at an occasion prior to the month during which the Contractor's performance (service level of maintenance) will be measured.

ADDITIONAL SPECIFICATION

SB OPERATING AND MAINTENANCE MANUALS

CONTENTS

SB 01 SCOPE
SB 02 PROCEDURE FOR SUBMISSION OF MANUALS
SB 03 FORMAT OF OPERATING AND MAINTENANCE MANUALS
SB 04 CONTENTS
SB 05 MEASUREMENT AND PAYMENT

SB 01 SCOPE

The Contractor shall be responsible for the compilation of complete sets of Operating and Maintenance Manuals. A separate Operating and Maintenance Manual shall be supplied for each installation where required and as defined in the Additional Specification SA: General Maintenance.

SB 02 PROCEDURE FOR SUBMISSION OF MANUALS

SB 02.01 SUBMISSION OF DRAFT MANUALS

A draft copy of each Operating and Maintenance Manual shall be submitted to the Engineer prior to safety inspection of the installation. Approval of the draft Operating and Maintenance Manuals shall be a prerequisite for commencement of the safety inspection in terms of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)

The manuals will be reviewed and checked by the Engineer and returned to the Contractor with comments, where necessary. The Contractor shall make the necessary changes and amendments to the manuals to incorporate the Engineer's comments.

SB 02.02 DEVELOPMENT OF FINAL MANUALS

A final draft copy of each Operating and Maintenance Manual shall be submitted to the Engineer at least one week prior to commencement of Day 1 tests on commissioning. This set of manuals will not be accepted without the Contractor's verification of the information contained in the manuals and the professional language editing thereof. The Engineer shall return the manuals to the Contractor, who shall make the final corrections. The Engineer will, however, not be responsible for the quality control on manuals. Approval of final Operating and Maintenance Manuals shall be a prerequisite for issuing of a Certificate of Practical Completion for repair of the installation.

After the Engineer has approved the final Operating and Maintenance Manuals, the Contractor shall provide the Engineer with seven (7) sets of the manuals. Approval of the final Operating and Maintenance Manuals shall be a prerequisite for issuing of a Certificate of Completion.

SB 03 FORMAT OF OPERATING AND MAINTENANCE MANUALS

(a) Manuals shall be bound in hardcover lever-arch files with plastic coatings. The files shall be clearly labelled on the front cover, as well as on the back band, with the following information:

(i) The title "Operating and Maintenance Manuals"

(ii) Name of the installation (as defined in Additional Specification SA: General Maintenance)

(iii) Name of the contract and contract number

(iv) The Contractor's name, address and contact telephone number and fax (logo optional)

(v) Month and year in which the manuals are finally handed over to the Employer

(vi) Name of the User Client.

(b) Pamphlets and bound leaflets/booklets from suppliers or manufacturers shall be placed in plastic pockets.

(c) Drawings and diagrams larger than A3 shall be folded and placed in plastic pockets to be easily removed or stored.

(d) The sections of the manuals specified below shall be clearly partitioned.

(e) Cross-referencing between drawings/diagrams and text shall be in a clear and consequent format.

(f) The Operating and Maintenance Manuals shall be supplied in English.

SB 04 CONTENTS

SB 04.01 TABLE OF CONTENTS

The table of contents shall appear on the second page and shall consist of the headings of the various sections in the manual and the relevant page numbers.

The table of contents shall essentially contain at least the following:

1. Introduction
   - 1.1 Scope of the manual
   - 1.2 General arrangement of the manual
   - 1.3 Description of installation
   - 1.4 Specifications

2. List of drawings and diagrams

3. Parts and components

4. Operating procedures

5. Maintenance

   5.1 Purpose of maintenance
   5.2 Preventative maintenance
   5.3 Trouble-shooting

6. Breakdown maintenance and repair

7. List of Appendices.

SB 04.02 INTRODUCTION

The introduction shall contain at least the following:

SB 04.02.01 Scope of the manual

A summary shall explain the scope of the contents.

SB 04.02.02 General arrangement of the manual

A brief description shall explain the way in which the manual is arranged.

SB 04.02.03 Description of installation

This section shall give a functional description of the complete installation covered by the manual, including all systems and/or functional units deemed to form part thereof, as defined in Additional Specification SA: General Maintenance.

SB 04.02.04 Specifications

A summary shall be given of the specifications applicable to the particular part of the Contract.

SB 04.03 DRAWINGS AND DIAGRAMS

SB 04.03.01 Mechanical flow diagrams (MFDs) and single line diagrams

Mechanical flow diagrams (for mechanical systems) or single line diagrams (for electrical systems) of the system and/or functional unit shall be included in the Operating and Maintenance Manuals for easy reference by the operators of the installation. Diagrams shall be drawn not only for parts of an installation that have been repaired, but also for the complete installation, including all the components.

SB 04.04 PARTS AND COMPONENTS

SB 04.04.01 Equipment data sheets

A data sheet shall be drawn up for each piece of equipment and/or machine forming part of the installation and shall contain the following information:

(a) Equipment tag number
(b) Equipment description
(c) Model/make/manufacturer
(d) Supplier/Reconditioning details
(e) Ordering details
(f) Details of fixed components
(g) Details of lubrication
(h) Maintenance references (refer to supplier/reconditioning technical manual).

SB 04.04.02 Technical equipment manuals

For each piece of equipment and/or machine forming part of the installation the following information shall be included in this section of the Operating and Maintenance Manuals:

(a) the supplier or reconditioning manual and/or standards of operating and maintenance instructions;

(b) illustrated parts breakdown and/or group assembly drawings as agreed with the Engineer;

(c) parts lists and data sheets, including all characteristic curves for machines indicating operation point, efficiency, power consumption, etc.;

(d) calibration charts, and

(e) test certificates for hydraulic pressure tests, flame-proof grading, materials, non-destructive examinations, coating and lining details, etc.

Each detailed description shall be accompanied by a set of engineering drawings. From the drawings the functionality of each part or component used, as well as the special characteristics associated with the part or component shall be very clear.

SB 04.04.03 Parts and components list

A detailed description shall specify all the parts and components used for the duration of the Contract. This description shall include new parts and components, as well as existing parts and components that have either been reconditioned or used as specified in the Contract.

The description shall state at least the part or component number, part or component name, the size of the part or component, an explanatory description, the quantity used, the material of which the part or component is made, the coating (if any), date of purchase, as well as any relevant remarks as to the application thereof.

Details of the manufacturer of the part or component shall also be listed. This shall at least state the name, address, telephone number, fax number and name of a contact person.

The supplier of the part or component shall also be stated and shall include at least the name, address, telephone number, fax number, name of a contact person and an alternative supplier (if available).

SB 04.04.04 Drawings

Drawings shall contain a descriptive heading, an explanatory key and relevant comments. Drawings shall be done on a computer-aided design package approved by the Engineer.
A compound drawing for all subassemblies shall clearly indicate how and where the various parts fit in the subassembly. The compound drawing shall be linked to the equipment data sheets and parts and components list and shall clearly specify the parts or components used, their model numbers, their sizes and the quantities used. The compound drawings shall also be accompanied by a short description explaining the workings of the subassembly, as well as the assembly of the parts or components to complete the subassembly.

SB 04.05 OPERATING PROCEDURES

The operating instructions shall be a step by step description of the manual start-up and shut-down procedure for every piece of equipment and/or process reconditioned, repaired or supplied with references to the MFDs. For automatic operation the operators shall be referred to the automatic control manual (if applicable).

The functioning of the installation shall be clearly described, using a flow diagram depicting the interrelationships among the various subassemblies. The subassemblies shall be described by descriptive drawings.

Each mechanical or process flow diagram shall contain at least a heading, relevant comments and a key.

Every subassembly shall also have its own flow diagram explaining the operation of the subassembly, as well as the application of each part and component. The application of the subassembly shall also be very clear. The flow diagram shall consist of at least a heading, relevant comments and an explanatory key.

A detailed description shall be given of all operational systems forming part of the installation, explaining the operation and functioning of the system and the number of operations personnel required for performing the operation successfully.

The preparations, which are required before the system can be operational, shall be clearly stated and explained.

The operation tasks shall be clearly explained with reference to dangerous situations that might occur. Hazardous operations shall be explained in great detail and cover all the applicable safety precautions.

SB 04.06 MAINTENANCE

SB 04.06.01 Purpose of maintenance

The maintenance process shall be explained and the main responsibilities described.

SB 04.06.02 Preventative maintenance

A preventative maintenance and lubrication schedule shall be included in this section. This schedule shall be in table format and shall include a summary of all the maintenance actions required for each different system and/or functional unit covered by this manual, in order to give a single summary of all routine preventative maintenance actions required for the complete installation.
The schedule shall indicate daily, weekly, fortnightly, monthly and yearly maintenance actions. A lubrication schedule summary shall also be included under this section.

The frequency of routine preventative maintenance actions shall be indicated very clearly.

The Contractor shall provide the maintenance requirements as prescribed by the manufacturer. The type of maintenance shall be clearly indicated. The description of the maintenance to be performed shall include at least the part name, location of the part in either the assembly or subassembly, the model number, the quantity of the particular part or component to be maintained, the type of maintenance, and notes on the maintenance procedure.

A brief description shall accompany the maintenance schedule, indicating special tools to be used, maintenance and test equipment required for the test procedures. Any special tools necessary for maintenance shall be specified in terms of name, model, size, manufacturer, supplier (name, telephone number, fax number, contact person), coating (if any) and notes on the use of the equipment.

Remarks on the system readiness checks of each subassembly shall be explained in detail. Routine inspection and maintenance processes shall be described. It shall be very clear what needs to be done, how to perform the necessary task and any dangers that are present.

SB 04.06.03 Trouble-shooting

An explanation shall be given to assist the maintenance personnel in analyzing and resolving malfunctions that might occur. Various scenarios with possible causes and rectification procedures shall be explained.

The scenarios shall be accompanied by drawings indicating the position of the part that is faulty. Each of these drawings shall have a heading, comments and an explanatory key.

SB 04.07 BREAKDOWN MAINTENANCE AND REPAIR

The Contractor shall describe the complete procedure to be followed in the event of a breakdown. It shall be very clear what the operating personnel should look for, how to eliminate any dangers due to the breakdown (eg electricity must be shut off in the event of problems with the wiring) and who should be contacted. The Contractor shall supply the names and telephone numbers of at least two contact persons who may be contacted in the event of a breakdown.

The Contractor shall refer to Additional Specification SA: General Maintenance, to determine the reaction time for the repair to the breakdown.

Repair instructions shall provide the maintenance personnel with detailed instructions for the removal and/or replacement of any item requiring replacement due to malfunctioning. Contact numbers shall also be given to assist maintenance personnel, should a breakdown occur.

The Contractor shall specify the actions expected of maintenance personnel in the event of a breakdown.

The Contractor shall also specify the testing procedures to be followed before the system can be put into operation again. Every procedure shall be described clearly and all the potential dangers pointed out, as well as the precautions that have to be taken.

The testing procedures shall be accompanied by drawings illustrating the process to be performed. Every drawing shall have a heading, comments and an explanatory key.

SB 05 MEASUREMENT AND PAYMENT

SB.01 **Compile and supply a complete set of Operating and Maintenance Manuals** .....Unit : sum

The unit of measurement shall be a sum for each complete set (seven copies) of Operating and Maintenance Manuals. Operating and Maintenance Manuals for different installations shall be measured separately in the Schedule of Quantities.

The tendered sum shall include full compensation for all technical research, gathering of information, compilation of manufacturer's instructions, compilation of drawings and diagrams, and for writing of all the descriptions, instructions and functional procedures, as well as language editing, in order to provide a clear and correct set of Operating and Maintenance Manuals.

The tendered sum shall also include full compensation for all expenses such as paper, copy work, binding and printing necessary for the completion of the manuals.

The tendered sum shall also include full compensation for the compilation of draft sets of operating and maintenance manuals in accordance with the specification, and for incorporation of all comments and corrective requirements.

SB.02 **Compile and supply a complete site plan** .....Unit : sum

The unit of measurement shall be a sum for the complete set (three A1-size copies for each plan) and electronic format of the site plan(s).

The tendered sum shall include full compensation for all expenses such as paper, copy work and printing required for the completion of the site plan.

The site plan shall include and comply with the following:

SB.02. 01 SCOPE

This specification provides minimum requirements for the preparation of a Site Layout Plan and is based on the specifications of the Department of Public Works.

SB.02. 02 SPECIFICATIONS

The Specification is based on the following specifications:

1. Civil Engineering Manual PW347/2012, Annexure A1
2. Specification of Materials and Methods to be Used PW371
3. Additional Specification SB: Operating and Maintenance Manuals.

   Compile and supply a complete Site Layout Plan:

   (a) Detail Ground Survey

   All services must be shown on a complete Site Layout Plan as required by the Engineer, including roads, fences, paving, transmission and telephone lines, etc. For sewerage reticulation and storm water drainage systems the pipe sizes, as well as invert heights must be provided. An effort must be made to trace the routes of these services.

   (b) Survey of Buildings

   The "footprint" of all the buildings and structures must be surveyed.

(c) General

All survey data shall be captured in electronic format.

SB.02. 03 TITLE BLOCK

The standard drawing sheet layout and title block of the Department of Public Works must be used.

Complete all the relevant fields in the title block with reference to the name of the Port of Entry in the appropriate block. The words SITE LAYOUT PLAN should form part of the drawing title.

SB.01 Drawing Number

The drawing number should consist of a four-part identifier:

- Port of entry designator: WCS: 056399
- Group: 1
- Drawing number: Numbering will start at 1
- Revision number: Will start at 01

Typical example: WCS: 056399 /1/1 Rev 01

SB.02 Overlay Sheets/Layering Scheme (if required)

The overlay sheet designator identifies the type of drawing (example: overlay for water reticulation) and can be added to the drawing number:

- C: Existing structures, facilities, roads, paving, fencing, etc.
- CR: Storm water drainage system
- CE: Electrical power and equipment
- CF: Fire fighting equipment
- CS: Sewer network
- CT: Telephone lines
- CW: Water reticulation system

Typical example for the numbering of an overlay sheet:
WCS: 056399 /1/**CW**/1 Rev 01

SB.02. 04 DRAFTING CONVENTIONS

The Site Layout Plan should be created following engineering conventions and standards in order to represent a clear drawing simplifying the huge amount of visual information.

SB.01 Paper Prints

Preference is given to size A1 plans, but for reporting size A3 will be used and the information should still be legible in this format.

SB.02 Scale

The Site Layout Plan must be drawn according to scale and the following scales can be used:

- 1:200 or
- 1:500 or
- 1:1000

SB.03 Plan Orientation

The Port of Entry should be rotated on the plan so that the north point arrow

are pointing in the direction of either the upper left or upper right quadrants of the plan. The north point arrow to be placed in the top right hand corner of the drawing space.

SB.04 **Contours**

Contours do not form part of the Site Layout Plan.

SB.05 **Line Weight**

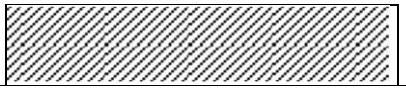
Line weight/width is extremely important and features such as the services should be drawn with lines that are more prominent. The following line weights (mm) can be used:

1.	0.10	5.	0.35
2.	0.15	6.	0.50
3.	0.25	7.	0.70
4.	0.30	8.	1.00

SB.06 **Line Type/Style**

The following typical standard line types that can be used:

TYPICAL LINE TYPES

LINE DESCRIPTION	LINE APPEARANCE
1. Centre Line	
2. Solid/Continuous line	
3. Short broken line	
4. Long broken line	
5. Break line	
6. Hatch lines 45°	

SB.07 **Hatching**

Hatching are angled line patterns to indicate the position of permanent structures. The spacing between lines should be consistent at 45º to the structure. Park Homes must be shown on the plan, but without hatching.

SB.08 **Surfaced Areas**

Surfaced roads should be indicated by two solid lines as well as paved areas.

Two long broken lines should be used to indicate gravel roads.

SB.09 **Non Standard Line Types**

The following lines could be used for the various services, but must be identified in the Legend as a non standard line type:

LEGEND

		Colour Code	Line Weight (mm)
W	Water pipe line	Cyan	0.50
S	Sewer pipe line	Black	0.50
EL	Electrical overhead line	Magenta	0.50
EC	Electrical cable	Magenta	0.50
T	Telephone line	Green	0.50
G	Gas pipe line	Brown	0.50
x	Fence line	Black	0.30
	Surfaced Road	Black	0.30
	Gravel Road	Black	0.30
	Railway Line	Black	0.25

SB.10 **Lettering and Font Styles**

Use the standard font style and font size for engineering drawings and do not use stylized fonts.

Create all text in upper case letters, except for certain unit designations such as km, m, mm, kVA, etc.

SB.11 **Site Layout Plan**

When the Port of Entry is too large for one sheet, divide the plan into logical sections. Add a key layout in the title block showing how the various sheets should be joined together to obtain a layout of the entire site. This key layout should form part of each sheet.

SB.12 **Facilities**

The name of the facility should be written adjacent to the facility. If the space is limited, a reference number of the facility, which refers to a description of the facility, is inserted in a table format in or close to the title block as a legend.

SB.13 **Fences and gates**

Show the position of the security fence and all other fences as well as gates. Include the height of all fences.

SB.14 **Destinations**

The destination to the nearest town with a pointing arrow should appear on all incoming and outgoing roads.

SB.02. 05 SERVICES

The position of the services is extremely important and should be indicated by lines that are more prominent/thicker. The description of the line types for the various services must be given in the Legend. See DIR04.09.

The following services, where applicable, must be shown on the Site Layout Pan for future reference:

SB.01 **Water Reticulation System**

Show the position of the water reticulation system and include the following:

- Pipe lines, pipe sizes, type of pipes, valves, meters, boreholes and tanks (include capacities). Show the direction of flow.

SB...02 **Sewerage Network**

Show the layout of the sewerage network and include the following:

- Pipe lines, pipe sizes, type of pipes, manholes, rodding eyes, septic tanks (include capacities), french drains (include volumes). Show the invert levels of all manholes as well as the position and level of the bench mark.

SB.03 **Electrical Power**

Indicate the position of electrical power lines, cables, substations, kiosks, flood lights along the perimeter as well as street lights and area lighting.

Air-conditioning units should be numbered and listed in table format including the type and size.

Give the source(s) of electrical power.

SB.04 **Telephone Lines**

Show the position of overhead telephone lines.

SB.05 **Storm water System**

Show the layout of the storm water system, culverts and sizes as well as inlet and outlet structures. Give the invert levels of all structures as well as the position and level of the bench mark.

SB.06 **Fire Fighting Equipment**

Include the pump installation, tank and capacity, fire hydrants, valves, meters, fire extinguishers and fire hose reels.

Fire extinguishers should be numbered and listed in table format including the type and size.

SB.02. 06 ELECTRONIC FORMAT

A complete set of electronic files shall be placed on CD(s) in a Data Exchange Format (DXF) or DWG format.

Affix a stick-on label to the CD with the following information:

- Department of Public Works and logo
- Name of Port of Entry
- WCS number
- Description: SITE LAYOUT PLAN
- Drawing number(s)
- Date issued
- Electronic format: DXF or DWG

SB.02. 07 SUBMISSION

The Consultant must submit A1 and A3 paper prints as well as a CD(s) of the Site Layout Plan(s) to the Project Manager before the Final Approval Certificate is signed.

The CD(s) must include the entire overlays/layering scheme and a compound drawing which includes all the services and information on one Site Layout Plan in DXF/DWG format.

During the Repair and Maintenance phase, the Project Manager will forward a request from time-to-time to the Consultants to prepare an A3 print(s) of the Site Layout Plan, which will be submitted as part of a report to Department of Public Works.

ADDITIONAL SPECIFICATION

SC GENERAL DECOMMISSIONING, TESTING AND COMMISSIONING PROCEDURES

CONTENTS

SC 01	SCOPE
SC 02	PHASED REPAIRS AND UPGRADING OF THE INSTALLATION
SC 03	DETAILED COMMISSIONING PROGRAMME
SC 04	COMMISSIONING COMMUNICATION CHANNELS
SC 05	COMMISSIONING RISK CONTROL AND PENALTIES
SC 06	DELAYS TO SCHEDULED SHUTDOWNS
SC 07	MATERIAL AND EQUIPMENT PROCUREMENT AND PROTECTION
SC 08	TESTING OF EQUIPMENT PRIOR TO RECOMMISSIONING
SC 09	TESTING OF MATERIAL AND EQUIPMENT SPECIFICATIONS AND WORKMANSHIP
SC 10	DECOMMISSIONING
SC 11	RECOMMISSIONING, COMMISSIONING AND COMPLETION OF INSTALLATIONS
SC 12	MEASUREMENT AND PAYMENT

SC 01 SCOPE

This specification encompasses all aspects of the repairs of systems and services that form part of an installation, including the factory and on-site testing, decommissioning, installation and commissioning of all equipment, instrumentation and materials reconditioned, supplied and installed as part of an installation as defined in Additional Specification SA: General Maintenance.

The specified procedures are the minimum requirements to be supplemented by various technical and particular specifications in this document. These requirements shall apply to all commissioning work scheduled as part of the initial repair work on installations, as well as commissioning work that is part of the routine preventive and corrective maintenance.

SC 02 PHASED REPAIRS AND UPGRADING OF THE INSTALLATION

When an installation consists of parallel systems or components, the complete installation and all its components shall be repaired without taking the complete installation out of commission at any time, unless otherwise specified in the Technical Specifications.

In order to schedule the repairs of an installation, all work shall be done in phases as specified in the Technical Specifications and illustrated in detail on

the drawings. Repairs of each part shall terminate with the successful reconditioning of that part.
Each part of the system shall be decommissioned and recommissioned in the sequence specified in the Technical Specifications and on the drawings.

The Contractor shall install all the necessary temporary specials, spool pieces, supporting frames and brackets to provide a functional link between each repaired and upgraded part of the system and the part of the installation that has not yet been repaired and upgraded during recommissioning. Electrical and instrumentation Contractors and subcontractors shall ensure that the system remains operational as specified, using either existing or newly installed instruments, cables or controls.

Payment is based on the successful recommissioning of a specific part of the installation.

SC 03 DETAILED COMMISSIONING PROGRAMME

No work of any kind on any part of the existing installation shall take place prior to the Engineer's approval of a detailed commissioning programme. This programme shall be submitted in addition to the general programme for planning and monitoring contract progress, at least two weeks prior to any programmed shutdown. The programme shall be the coordinated product of the Engineer and the User Client. Commissioning programmes shall take all process requirements into account. The detailed commissioning programme shall indicate all actions necessary for:

(a) Decommissioning

(b) Recommissioning of parts of the installation

(c) Commissioning of the installation as a whole.

All work deemed necessary for practical completion of the installation shall be indicated on the commissioning programme.

The programme shall indicate the milestones to be achieved before shutdown and decommissioning as activities of zero duration, all of which shall be prerequisites linked to the "start" of decommissioning.

The following specific actions shall be included in the programme, clearly indicating the time allowed for:

(a) Communication, including the time for confirmation of the official shutdown;

(b) Draining parts of the installation to sumps, where available, or to other storage facilities provided by the Contractor;

(c) Installation of temporary blanked flanges or other means of isolation where necessary;

(d) Partial decommissioning and removal of existing material and equipment to perform work, including protection of pipework against hot work, cutting into pipework, loosening bolts, flanges and all other work necessary for recommissioning;

(e) Installation of temporary functional links (pipe specials) between any two parts of the installation;

(f) Each individual field weld, subject to the Engineer's approval;

(g) Non-destructive testing of materials, for manufacturing/construction quality and for producing test results;

(h) Installation of all instruments and their connection to SCADA systems;

(i) Installation and connection of all power cables;

(j) De-aeration of all pipe sections;

(k) Communication between the Contractor, the Engineer, the Employer and the User Client;

(l) Start-up of the complete system, indicating start-up procedures.

Inspection of the prefabricated installation, testing of all equipment prior to final commissioning, pressure testing and non-destructive testing shall be clearly scheduled in the project progress programme.

Day 30 tests and instruction/training sessions with the User Client shall be scheduled in the project progress programme.

SC 04 COMMISSIONING COMMUNICATION CHANNELS

The Contractor shall communicate with the User Client's operating and maintenance managers via the Engineer to finalise start-up after decommissioning in accordance with the specified procedures.

The following key parties shall be involved before and during shutdown and decommissioning of any part of the system:

Contractor:	Site Agent
Engineer:	Resident Engineer
Employer:	Representative of Area Manager
User Client:	Operating and Maintenance Manager.

SC 05 COMMISSIONING RISK CONTROL AND PENALTIES

(a) All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act, 1993: Construction Regulations, 2014 as promulgated in Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) (as amended)

(b) The Contractor shall not be allowed to work on any part of the installation without obtaining a commissioning check permit on the day of shutdown. A typical example of a commissioning check permit is included in this document, referring to the minimum required milestones to be achieved prior to decommissioning.

(c) Payment reductions for exceeding the maximum permissible down-time during maintenance shall apply as stipulated in the General and special Conditions of Contract. This stipulation does not include shutdowns during programmed routine preventive maintenance work.

SC 06 DELAYS OF SCHEDULED SHUTDOWNS

Specific dates on which an installation shall be shut down for decommissioning shall be finalised during coordination meetings of all the parties involved, including the Engineer, the Employer, the User Client and the Contractor.

Although a date for each shutdown will be scheduled at the coordination meetings, the actual date of the shutdown shall be determined by the process requirements and user demands, allowing for a window of seven (7) calendar days from the date of the planned shutdown.

Prospective tenderers shall make allowances in their tendered rates for the shutdown to occur at any time during this seven-day period. No additional payment shall be due if the shutdown occurs within this seven-day period.

If the Contractor fails to commence with the shutdown and decommissioning of the installation within the scheduled period, all additional costs arising from the shutdown at a later stage shall be for the Contractor's account.

SC 07 MATERIAL AND EQUIPMENT PROCUREMENT AND PROTECTION

It is the responsibility of the Contractor to ensure the functionality of all units of new equipment prior to decommissioning, before installation of any specific part of the system. If the equipment, whether free-issued or not, does not conform to the functionality specifications during pre-installation testing, the Contractor shall notify the Engineer in writing without delay.

SC 08 TESTING OF EQUIPMENT PRIOR TO RECOMMISSIONING

The equipment shall be tested for functionality after pre-installation of equipment in parts of the installation.

(a) The Contractor shall inform the Engineer well in advance of his intention to perform the first tests and start-up of equipment in order to allow a representative of the Engineer to witness the tests. The extent of all precommissioning tests and checks shall be agreed with the Engineer prior to commencement.

(b) The Contractor shall first conduct his own tests of the equipment. When he is satisfied that the equipment complies with the specifications, he shall notify the Engineer that he is ready for the official tests on completion. The Contractor shall not conduct an official test without the Engineer's presence or approval. All equipment shall conform to the specified requirements.

(c) Before starting up any part of the installation or filling the tanks and sumps with liquid, the Contractor shall clean out the tanks, pipes, fittings, equipment or structures and, if necessary, make arrangements with other Contractors to remove their building rubble form the structures, check that all safety devices and alarms have been set and activated, all nuts have been tightened correctly, that all the equipment is complete and ready for start-up, that the plant has been installed correctly, and that copies of the operating manuals have been handed to the Engineer.

(d) The Contractor shall start up each section of equipment after ensuring that oil fillings, lubrication, vibration monitoring, cable termination and so

on have been correctly completed. He is also responsible for the first

refilling of all lubricating oils and for adjusting the plant to operate according to the specifications. Before any equipment is started or energised, the Contractor shall ensure that it is safe in terms of the personnel and equipment on the site to do so. The Contractor's tendered rates and sums shall allow for these costs.

All equipment shall be tested according to the relevant specifications that form part of this document.

No shutdown or decommissioning of any part of the system shall take place unless all the equipment to be installed have been tested by the Contractor and approved by the Engineer.

SC 09 TESTING OF MATERIAL AND EQUIPMENT SPECIFICATIONS AND WORKMANSHIP

All results of the required non-destructive, precommissioning and manufacturing testing shall be submitted to the Engineer well in advance of testing the equipment on recommissioning. All such test results shall be submitted before Day 1 commissioning tests and no certificate of practical completion shall be issued prior to receipt of the required test results.

SC 10 DECOMMISSIONING

The decommissioning period shall commence on the instant of the entire system shutdown. The recommissioning period shall start in parallel with decommissioning.

Shutdown and decommissioning shall not proceed without compliance with all the milestones in the detailed commissioning programme. The list of milestones in this document is not complete but indicates the minimum requirements. Milestones to be achieved prior to shutdown and decommissioning may be added to the programme at the Engineer's discretion.

The Contractor is responsible for the safe decommissioning of all material, equipment, components and instrumentation to avoid damage to parts or components of the installation.

SC 11 RECOMMISSIONING, COMMISSIONING AND COMPLETION OF INSTALLATIONS

SC 11.01 RE-COMMISSIONING

Re-commissioning means the commissioning of all sections or systems that form part of the installation to meet the required functional specifications for the individual section or system prior to commissioning of the repaired and upgraded installation.

The Contractor is responsible for the recommissioning of all parts of the system and he shall perform the tasks listed below.

(a) Prior notice shall be given to and proper arrangements shall be made for recommissioning with the Employer, the Engineer, the User Client and the suppliers of equipment that is affected by recommissioning and testing.

(b) If plant and equipment supplied by others are to be commissioned, the supplier's specific permission together with all requirements related to commissioning shall be obtained prior to recommissioning without in any

way altering the Special Conditions of Contract with reference to the Contractor's liability in terms of defects.

(c) The new and reconditioned parts of the installation shall be thoroughly inspected by a responsible representative of the Contractor to ensure that manufacture/construction and installation work have been completed according to the specifications.

SC 11.02 **COMMISSIONING AND COMPLETION OF REPAIRS AND UPGRADING WORK**

Commissioning means commissioning of the repaired and upgraded installation as a whole to perform in perfect working order.

(a) The commissioning period for each installation as a whole:

(i) Commences with the Day 1 tests of the complete repaired and upgraded installation;

(ii) Includes commissioning of all sections and systems that have been recommissioned prior to the Day 1 tests;

(iii) Includes training of the User Client's operating personnel and the maintenance teams;

(iv) Terminates with a Day 30 test in compliance with the commissioning report.

(b) The purpose of the Day 1 tests is to ensure that:

(i) The electronic, electrical and mechanical equipment and materials are functional and in perfect working order with respect to each other and the installation as a whole;

(ii) The commissioning period, including training, commences on successful completion of the Day 1 tests;

(iii) The Contractor is entitled to a certificate of practical completion for the repairs and upgrading of the installation on successful completion of the Day 1 tests;

(iv) The Contractor becomes responsible for maintenance of the installation and is entitled to performance-based payments in compliance with the Special Conditions of Contract and Additional Specification SA: General Maintenance.

(c) Commissioning shall be undertaken over a trouble-free period up to Day 30. During this period the Contractor shall train the User Client's operators and his maintenance team for operating and maintaining the installation. This training shall allow for all possible operational conditions, including emergency conditions, the correct servicing of every part, the type of oil or grease to be used, and similar tasks. The training shall take place by means of demonstrations, and the operating and maintenance manuals shall be referred to for this purpose.

(d) Day 30 commissioning tests shall be performed thirty calendar days after the successful completion of the Day 1 tests. The commissioning period of the installation terminates upon the successful completion of the Day 30 tests.

(e) The Contractor shall conduct all the tests required to satisfy the Engineer that the installation is performing according to specification, and shall make allowance for these tests in his tendered rates and prices. These tests shall be conducted to certify that the installation, as repaired, upgraded and installed, is in perfect working order in terms of the specified functional requirements. The Contractor shall note that all equipment is to be tested as part of an installation, where appropriate, and will not be passed if all protection devices, interlocking with other equipment, etc., are not fully functional.

(f) The Engineer shall provide commissioning sheets to the Contractor at least three weeks before the commissioning period commences, for all the equipment supplied, reconditioned and installed by the Contractor. The Contractor shall complete the commissioning sheets during the commissioning period and all items listed shall be entered. No completion certificate will be issued for an installation of which the equipment has incomplete commissioning reports. Information that is not available or applicable, or instances where certain tests have not been carried out, are subject to the Engineer's decision.

(g) Commissioning of the plant (which includes the thirty days between the Day 1 and Day 30 tests) includes operating under conditions that adequately prove that all the specifications have been met. All safety devices, standby plant, automatic controls and protection devices shall be adequately tested for reliability and correct functioning. The Contractor may be called upon to repeat testing during the maintenance period if the performance of the equipment is suspected to be substandard. Costs related to such tests shall be for the Contractor's account and shall comply with the specified requirements. Copies of updated commissioning reports shall be provided to the Engineer within two days after a test has been performed.

(h) The Contractor is responsible for providing all labour and materials (including testing equipment) during the commissioning period and shall carry out all the servicing and adjustments to ensure that the installation operates as specified. Valid calibration certificates shall be available for all testing equipment on the site during the commissioning period.

(i) Programmes for the Day 1 tests, Day 30 tests and instruction/training sessions with the User Client's operators and maintenance team shall be prepared by the Contractor and submitted to the Engineer at least two weeks before the commissioning period commences. The Contractor shall provide weekly updates of these schedules for the duration of the commissioning period.

(j) The Contractor shall note that if any equipment fails during the commissioning period, the equipment shall be repaired or replaced by the Contractor, and testing and commissioning shall commence from scratch.

(k) Successful commissioning of an installation entitles the Contractor to a certificate of completion for the installation.

SC 12 MEASUREMENT AND PAYMENT

SC.01 **Decommissioning and removing parts of the installation** .....Unit: sum

The unit of measurement shall be a sum.

The tendered sum shall include full compensation for all actions and labour required for shutdown and decommissioning of the entire installation as specified to enable decommissioning and removal of parts of the installation as listed in the Schedule of Quantities.

The tendered sum shall include full compensation for the decommissioning and removal of the parts and components of an installation as listed individually in the Schedule of Quantities, including actions and/or costs resulting from such work, to enable the recommissioning of parts of the repaired and/or upgraded installation.

The tendered sum shall include full compensation for final dismantling of decommissioned materials and equipment and the removal of all such items to stores on site, as directed by the Engineer.

SC.02 **Commissioning and testing of parts of the installation** .....Unit: sum

The unit of measurement shall be a sum.

The tendered sum shall include full compensation for commissioning and testing parts of the installation to be operational while still incomplete in relation to the entire repaired and/or upgraded system or installation.

Separate payment items shall be scheduled for separate parts of the system.

SC.03 **Commissioning and testing of the installation** .....Unit: sum

The unit of measurement shall be a sum.

The tendered sum shall include full compensation for commissioning the upgraded installation as a whole and for all costs and expenses related to labour, removal, repair, reinstallation and testing of material and equipment during the commissioning period for each part of the installation. The tendered sum shall include full compensation for the final commissioning and testing, including Day 1 and Day 30 tests, of all parts and components of the installation to the specified functional condition.

Payment shall be based on successful completion of the Day 30 tests.

SC.04 **Provision for safety and hot work requirements during shutdown** .....Unit: number

The unit of measurement shall be the number of shutdowns during which all the required safety and hot work requirements are provided.

The tendered rates shall include full compensation for all the required safety and hot work requirements and arrangements in accordance with the specifications during a shutdown period, including all labour, personnel, equipment, materials and consumables required.

ADDITIONAL SPECIFICATION
SD GENERAL TRAINING

CONTENTS

SD 01 SCOPE
SD 02 BASIC BETHOD REQUIREMENT
SD 03 TRAINING OF USER DEPARTMENT PERSONNEL
SD 04 TRAINING OF MAINTENANCE PERSONNEL

SD 01 SCOPE

The Contractor shall be responsible for providing diverse training to various groups, including operating and maintenance personnel. The Contractor shall develop and facilitate initial training sessions for all parties, as well as training sessions at specified intervals to revive and supplement the initial training. An accredited trainer shall present all training sessions.

This specification includes all requirements for methods to be employed, the syllabus required by the User Department, the syllabus required for maintenance managers and workers and the method of measurement and payment.

SD 02 BASIC METHOD REQUIREMENT

The Contractor shall be responsible for conducting a complete investigation of the groups that have to be trained in order to compile a proper training plan.

The investigation shall cover at least the following aspects:

(a) Assess likelihood of conformance to task-specific requirements (status quo) of capabilities.
(b) Identify minimum pre-qualification criteria in terms of existing knowledge and skill levels in relation to reaching target requirements.
(c) Evaluate personnel in terms of pre-qualification criteria and tasks to be performed (skills profile).
(d) Identify training needs
(e) Develop appropriate and accredited training course and material in terms of task- specific activities and identified training needs, and compile the training syllabus per installation.

The Contractor shall identify an accredited trainer to assist in the above investigation and finalise the compilation of a training plan and syllabus. Approval of the syllabus shall be a condition for issue of a Certificate of Practical Completion for repair of an installation. Once the training plan and syllabus have been approved the Contractor shall liase with the Engineer to establish a date and appropriate training venue that would be conducive to learning to perform training.

The training shall be revived within one month after initial training to determine its effectiveness. Further regular sessions shall be scheduled according to the effectiveness of initial training.

The Engineer will be responsible for recording all training sessions and shall keep an attendance register. The Engineer will also examine the trainees officially with each training session and issue certificates of trainees' acquired skills on satisfactory completion of the training.

SD 03 TRAINING OF USER DEPARTMENT PERSONNEL

The Contractor's training shall include training of the User Department's operators on biannual basis to acquaint them with operating of installations (especially electrical and mechanical systems). The training sessions shall comprise lectures and on-site (hands-on) demonstrations, and shall be conducted over two-day periods. The Contractor shall liaise with the Engineer to prepare for the correct number of trainee operators.

The content of training courses for operators shall include the essential features of operating the installation, as also described in the Operating and Maintenance Manuals

Completion of an installation shall, in terms of the Special Conditions of Contract, be subject to successful competition of training. The training course shall also be based on the Operating

and Maintenance Manuals. No training shall commence without the Engineer's approval of the final draft Operating and Maintenance Manual for the particular installation.

SD 04 TRAINING OF MAINTENANCE PERSONNEL

The Contractor shall train either his own employees, or local labourers, with regard to maintenance of the installation.

The training of maintenance managers shall include the following aspects:

(a) Awareness of safety, health and personal hygiene in terms of the requirements of the Occupational Health and Safety Act, 1993 (Act 85 of 1993);
(b) Functioning of the installation, including all its systems, services, parts of buildings and infrastructure;
(c) All septic tasks related to routine preventative maintenance;
(d) Interpretation and understanding of Operating and Maintenance Manuals with specific reference to requirements in cases of corrective and breakdown maintenance, and
(e) repair/reconditioning and installation/construction of equipment and materials forming part of an installation.

SD 05 MEASUREMENT AND PAYEMENT

SD.01 **Development of a syllabus for training of operators**.....Unit: sum

The unit of measurement shall be the lump sum for the compilation of a training syllabus for each installation that shall be measured separately in the Schedule of Quantities.

The tendered sum shall include full compensation for identification of pre-qualification criteria and training needs, staff assessment and evaluation prior to training, all technical research, development and compilation of an accredited training course and course material, and all other actions necessary for commencement of official training in accordance with the specification.

The tendered sum shall also include full compensation for the compilation of a draft syllabus and for incorporation of all the Engineer's comments and corrective requirements.

SD.02 **Presenting a training course for operators**.....Unit: number

The unit of measurement shall be the number of training courses presented based on the approved syllabus.

The tendered rate shall include full compensation for presenting a two-day training course, including lectures, demonstrations, on-site training and hands-on development and improvement of operators' skills to enable the operators to operate installations safely and efficiently.

The tendered rate shall include full compensation for the Contractor's time, appointment of the accredited trainer for the course, and for all material expenses such paper hand-outs and slides for the whole group of trainees, the number of which shall be determined during development of the training course.

SD.03 **Presenting a training course for maintenance personnel**.....Unit: number

The unit of measurement shall be the number of training courses presented.

The tendered rate shall include full compensation for presenting a two-day training course, including lectures, demonstrations, on-site training and hands-on development, and improvement of maintenance personnel's skills to enable them to maintain and repair installations safely and efficiently at the satisfactory functional condition specified.

The tendered rate shall include full compensation for the Contractor's time, appointment of the accredited trainer for the course, and for all material expenses such paper hand-outs and slides for the whole group of trainees, the number of which shall be determined during development of the training course

ADDITIONAL SPECIFICATION
SF GENERAL OPERATION

CONTENTS

SF 01 SCOPE
SF 02 OPERATION REQUIREMENTS
SF 03 OPERATION CONTROL
SF 04 COMMUNICATION
SF 05 PERFORMANCE MEASUREMENT
SF 06 MEASUREMENT AND PAYMENT

SF 01 SCOPE

Operation of the specified systems, services or equipment shall all be referred to as "Operation of an installation". Operation of an installation shall ensure effective functioning and optimum operational condition thereof. Monthly operation responsibilities for each installation including all units and components as specified shall commence with access to the installation.

Operation of an installation shall be performed in accordance with the Technical and Particular Specifications and the Operating and Maintenance Manuals.

Remuneration for operating "installations" (systems, services and equipment) is provided for in the Bills of Quantities by means of monthly payment items, depending on the score achieved by the operators.

This Additional Specification covers operation requirements, site operation administration, communication operation performance measurement, as well as the items for measurement of the Contractor's service level and resulting payment.

SF 02 OPERATION REQUIREMENTS

SF 02.01 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall operate the complete installation for 36-month Contract period.

Operation implies and shall include hourly operation, daily operation (night and day), weekly as well as monthly operation on all components of the specified installations, *including* public holidays and non-working days.

The Contractor shall operate the equipment as detailed in the Technical and Particular Specifications and the operation and maintenance manuals. Each operational function, task, test or action shall be recorded in an approved format and listed in a quarterly report by the Contractor.

As part of the repair of each installation, the Contractor shall submit a set of Operating and Maintenance Manuals where applicable. The Contractor shall ensure through training that the operating and maintenance personnel are conversant with the instructions as presented in the Operating and Maintenance Manuals. Continued training shall be included in the scope of operation work for the duration of the -month Contract, In accordance with Additional Specification SD: General Training.

The Operating and Maintenance Manuals, as approved by the Engineer, shall be used as a basis of hourly, daily, weekly and monthly operations. The Contractor shall perform all operational tasks as described in the Operating and Maintenance Manuals.

SF 02.04 COMPONENTS INCLUDED IN OPERATION SCOPE

The main sections of a facility with their subsections are set out in the Technical Specifications and Particular Specifications where applicable and in the Bill of Quantities and will each be deemed "an installation". Operation, as specified, will be applicable to all of the installations listed in the Bill of Quantities under the "OPERATION" section

SF 05.05 COMMENCEMENT OF OPERATION PERIOD

Operation responsibilities for an installation shall include operation of all individual units, equipment or components thereof, and shall commence with access to the installation.

SF 02.09 SITE OPERATION RECORD KEEPING

The Contractor shall provide and maintain hard-cover A4 Operation files for each installation that needs to be operated for the duration of the Contract. All schedules, checklists, actions, tasks, reports, hourly, daily and monthly operational records and quarterly reports shall be filed.

Sire operation records shall be submitted to the Engineer at each monthly meeting.

These files will become the property of the Department of Public Works after the completion of the 36 months contract.

SF 02.10 SUPPLY OF LABOUR, EQUIPMENT AND MATERIAL

SF 02.10.01 Labour (qualified where necessary)

Competent personnel (qualified where necessary) that have been trained by the Contractor or external training authority, in accordance with Additional Specification SD: General Training shall execute all operational work.

SF 02.10.02 Equipment

All tools and equipment required for operational work shall be supplied by the Contractor at his cost (except where otherwise provided).

SF 02.10.03 Material

All material, equipment, testing equipment, protective clothing and appurtenances necessary for the complete operation of each installation shall be supplied and installed by the Contractor at his own cost. Remuneration for *maintenance* actions and material shall be measured elsewhere in this document.

The technical specification of each specific installation to be operated, shall indicate whether the Contract should supply other consumables (such as chemicals or coal) as part of his operation requirements.

SF 03 OPERATION CONTROL

Operation quality control shall be the responsibility of the Contractor. The Contractor shall introduce his own quality assurance system to assist him in ensuring that hourly, daily and

monthly operational tasks are performed as described in the operating and maintenance manuals and Technical and Particular Specifications.

SF 04 COMMUNICATION

The Contractor shall communicate in writing to the Engineer the following operational results on a monthly basis:

(a) The quantity of ground water or surface water extracted and the total recorded as at the last day of each month.
(b) The quality of waste water irrigated or discharged into the environment and the total recorded weekly (compiled monthly)
(c) The quantity of the waste water by grab sampling, at the point at which the waste water enters the effluent disposal system.
(d) Record keeping of activities as specified shall be up to date on a daily basis and available to the Engineer on inspection.
(e) The quality of domestic waste water discharged into the environment.
(f) Details of failures and malfunctions and details of measures taken to avoid environmental pollution.

SF 05.03 PERFORMANCE-BASED PAYMENT

Remuneration for all value-related as well as all time-related preliminary and general charges shall be deemed included in the monthly operation payments for the various installations.

SF 05.03 Score-card

The Engineer shall inspect each installation monthly after access to the installation has been granted. The Engineer shall use a score-card to measure the quality of operational tasks rendered by the Contractor during the preceding month, on all components that form part of the installation, in accordance with the Operation specifications. The Engineer will record his inspection directly onto the score-card. The score-card shall serve to evaluate ten performance indicators each month in the manner set out below.

The Contractor shall always have the opportunity to score the maximum points, provided that his operation work complies with the Specifications. The Employer shall be protected against a reduced or unsatisfactory operational level and may refuse payment on such points.

SF 05.03.02 Performance indicators

Performance indicators shall be selected to measure the Contractor's service level of operation.

The Engineer shall select ten (10) performance indicators each month, which shall focus on the measurement of operation quality against the relevant specifications for the ensuing month. All ten (10) performance indicators are known to both the Engineer and the Contractor.

The Contractor shall aim to perform satisfactory on all ten performance indicators. All indicators shall be selected from the scope of his normal hourly, daily and monthly operation work and shall be based on the operation control plan and operating and maintenance manuals. The work shall either be satisfactory, or unsatisfactory, and the Contractor shall score one (1) or zero (0) respectively per indicator.

Performance indicators shall be used to focus on certain key aspects of the work and shall in no way limit the Contractor's responsibility to do all the required work.

SF 05.03.03 Satisfactory performance

The Engineer shall inspect the site on an arbitrary day to measure the quality of operation against the ten selected performance indicators. Should the Contractor score the maximum points (10) he shall receive his full operation payment for the installation. Should the quality of operation be unsatisfactory according to the score-card, the Contractor may fail to achieve full payment due to a reduced service level. Each monthly payment for operation shall be subject to evaluate based on the score-card.

A copy of the score-card including a guideline for the use thereof is included in this Specification.

SF 06 MEASUREMENT AND PAYMENT

SF.01 OPERATION OF AN INSTALLATION..... Unit: point

The unit of measurement shall be a point. Each month shall represent a maximum of ten points and a minimum of zero points, depending on the performance and quality of operation. Ten points per month, determined by using the tendered rate per point, shall include full compensation for all liabilities and obligations described or implied in the Contract documents and deemed by the Contractor to be applicable to the operation of an entire installation, and all appurtenant works deemed to form part thereof, as defined in the relevant Technical or Particular Specifications.

The combined bid rate for ten points shall also include full compensation for complete hourly, daily, weekly and monthly operation.

Although ten points per month shall include full compensation for hourly, daily and monthly operation, the Contractor might fail to achieve all points applicable in the event of unsatisfactory performance, in which case he shall still perform all operation requirements according to specification, but at his own cost where a reduction in points awarded is insufficient to cover his cost.

Remuneration for all value-related as well as all time-related preliminary and general charges shall be deemed included in the monthly operation payments for the various installations.

SF.02 **APPOINT MANDATORY CLASS I AND CLASS II PROCESS CONTROLLERS**.....Unit: point

The unit of measurement shall be each month the stipulated number of process controllers has performed the duties as prescribed in the Contract and Technical Specifications. Each month shall represent 16 hours per day for & days per week. The rate tendered for the process controllers shall include all duties as required by the process controllers in terms of the Contract and Technical Specifications.

The item shall not limit the Contractor to the amount of personnel required to operate the works but shall be deemed the minimum requirement for the operation of the works as required in the Contract and Technical Specifications.

Any additional labour or process controllers required to perform any preventative or breakdown operation work shall be included in the Contractor's rate tendered for the ten operation scoring points per month.

The item shall be deemed mandatory and the Contractor shall be liable in terms of the ten operation scoring points per month to ensure that the required process controllers are appointed.

Remuneration for all value-related as well as all time-related preliminary and general charges shall be deemed included in the monthly operation payments for the various installations.

SF.03 **APPOINT MANDATORY CLASS III AND CLASS IV PROCESS CONTROLLERS**.....Unit: point

The unit of measurement shall be each month the stipulated number of process controllers has performed the duties as prescribed in the Contract and Technical Specifications. Each month shall represent 8 hours per day for 5 days per week. The rate tendered for the process controllers shall include all duties as required by the process controllers in terms of the Contract and Technical Specifications.

The item shall not limit the Contractor to the amount of personnel required to operate the works but shall be deemed the minimum requirement for the operation of the works as required in the Contract and Technical Specifications.

Any additional labour or process controllers required to perform any preventative or breakdown operation work shall be included in the Contractor's rate tendered for the ten operation scoring points per month.

The item shall be deemed mandatory and the Contractor shall be liable in terms of the ten operation scoring points per month to ensure that the required process controllers are appointed.

Remuneration for all value-related as well as all time-related preliminary and general charges shall be deemed included in the monthly operation payments for the various installations.

GUIDELINE FOR THE USE OF THE OPERATION SCORE-CARD

The score-card and performance indicators must be used as an Operation management tool. The aim with each score-card is to ensure that:

(a) the project focuses on key aspects of Operation per month;
(b) the Contractor receives payment for his work, and
(c) the Employer receives value for money and a sustained high level of service.

Performance indicators must be selected to measure the Contractor's service level of operation that will be based on the Operating and Maintenance Manuals (containing information specified in the Contract documentation).

For each specific installation, different performance indicators must be defined each month

based on the content of the Operation in relation to the scope of Operation work per installation and must be based on the Contractor's service level record on operation.

The Contractor and the Engineer must agree on all performance indicators at an occasion prior to the month during which the Contractor's performance (service level of Operation) will be measured.

PW 1544

DEPARTMENT OF PUBLIC WORKS

HIV/AIDS

SPECIFICATION

OCTOBER 2004

SECTION

HIV/AIDS SPECIFICATION

HIV/AIDS REQUIREMENTS

1 SCOPE

This specification contains all requirements applicable to the Contractor for creating HIV/AIDS awareness amongst all of the Workers involved in this project for the duration of the construction period, through the following strategies:

- Raising awareness about HIV/AIDS through education and information on the nature of the disease, how it is transmitted, safe sexual behaviour, attitudes towards people affected and people living with HIV/AIDS, how to live a healthy lifestyle with HIV/AIDS, the importance of voluntary testing and counselling, the diagnosis and treatment of Sexually Transmitted Infections and the closest health Service Providers;

- Informing Workers of their rights with regard to HIV/AIDS in the workplace;

- Providing Workers with access to condoms and other awareness material that will enable them to make informed decisions about sexual practices.

2 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Service Provider: The natural or juristic person recognised and approved by the Department of Public Works as a specialist in conducting HIV/AIDS awareness programmes.

Service Provider Workshop Plan: A plan outlining the content, process and schedule of the training and education workshops, presented by a Service Provider which has been approved by the Representative/Agent.

Worker: Person in the employ of the Contractor or under the direction or supervision of the Contractor or any of his Sub-contractors, who is on site for a minimum period of 30 days in all.

2.2 Abbreviations

HIV : Human Immunodeficiency Virus.

AIDS : Acquired Immune Deficiency Syndrome.

STI : Sexually Transmitted Infection.

3 BASIC METHOD REQUIREMENT

3.1 The Contractor shall, through a Service Provider, conduct onsite workshops with the Workers.
The Service Provider shall develop and compile a Service Provider Workshop Plan to be presented at the workshops and which will be best suited for this project to achieve the specified objectives with regard to HIV/AIDS awareness.
The Service Provider Workshop Plan shall be based on the following information provided by the Contractor:

- Number of Workers and Sub-contractors on site;
- When new Workers or Sub-contractors will join the construction project;
- Duration of Workers and Sub-contractors on site;
- How the maximum number of Workers can be targeted with workshops;
- How the Contractor prefers workshops to be scheduled, e.g. three hourly sessions per Worker, or one 2.5 hour workshop per Worker;
- Profile of Workers, including educational level, age and gender (if available);
- Preferred time of day or month to conduct workshops;
- A Gantt chart reflecting the construction programme, for scheduling of workshops;
- Suitable venues for workshops.

The Contractor shall submit the Service Provider Workshop Plan for approval within 21 days after the tender acceptance date. After approval by the Representative/Agent, the Contractor shall make available a suitable venue that will be conducive to education and training.

3.2 The Service Provider Workshop Plan shall address, but will not be limited to the following:

3.2.1 The nature of the disease;
3.2.2 How it is transmitted;
3.2.3 Safe sexual behaviour;
3.2.4 Post exposure services such as voluntary counselling and testing (VCT) and nutritional plans for people living with HIV/AIDS;
3.2.5 Attitudes towards other people with HIV/AIDS;
3.2.6 Rights of the Worker in the workplace;
3.2.7 How the Awareness Champion will be equipped prior to commencement of the HIV/AIDS awareness programme with basic HIV/AIDS information and the necessary skills to handle questions regarding the HIV/AIDS awareness programme on site sensitively and confidentially;
3.2.8 How the Service Provider will support the Awareness Champion;
3.2.9 Location and contact numbers of the closest clinics, VCT facilities, counselling services and referral systems;
3.2.10 How the workshops will be presented, including frequency and duration;
3.2.11 How the workshops will fit in with the construction programme;
3.2.12 How the Service Provider will assess the knowledge and attitude levels of attendees to structure workshops accordingly;
3.2.13 How the video will be used;
3.2.14 How the Service Provider will elicit maximum participation from the Workers;
3.2.15 A questions and answers slot (interactive session).

The Service Provider Workshop Plan shall encompass the Specific Learning Outcomes (SLO) as stipulated.

4 HIV/ AIDS AWARENESS EDUCATION AND TRAINING

4.1 Workshops

The Contractor shall ensure that all Workers attend the workshops.

The workshops shall adequately deal with all the aspects contained in the Service Provider Workshop Plan. A video of HIV/AIDS in the construction industry, which can be obtained from all Regional Offices of the Department of Public Works, is to be screened to Workers at workshops. In order to enhance the learning experience, groups of not exceeding 25 people shall attend the interactive sessions of the workshops.

4.2 Recommended practice

4.2.1 Workshop Schedule

Presenting information contained in the Service Provider Workshop Plan can be divided in as many workshop sessions as deemed practicable by the Contractor, provided that all Workers are exposed to all aspects of the workshops as outlined in the Service Provider Workshop Plan.

Breaking down the content of information to be presented to Workers into more than one workshop session however, has the added advantage that messages are reinforced over time while providing opportunity between workshop sessions for Workers to reflect and test information. Workers will also have an opportunity to ask questions at a following session.

4.2.2 Service Providers

A database of recommended Service Providers is available from all Regional Offices of the Department of Public Works.

4.2.3 HIV/AIDS Specific Learning Outcomes and Assessment Criteria

Workers shall be exposed to workshops for a minimum duration of two-and-a-half hours. In order to set a minimum standard requirement, the following specific learning outcomes and assessment criteria shall be met.

4.2.3.1 UNIT 1: The nature of HIV/AIDS

After studying and understanding this unit, the Worker will be able to differentiate between HIV and AIDS and comprehend whether or not it is curable. The Worker will also be able to explain how the HI virus operates once a person is infected and identify the symptoms associated with the progression of HIV/AIDS.

Assessment Criteria:

1. Define and describe HIV and AIDS;
2. List and describe the progression of HIV/AIDS.

4.2.3.2 UNIT 2: Transmission of the HI virus

After studying and understanding this unit, the Worker will be able to identify bodily fluids that carry the HI virus. The Worker will be able to recognise how HIV/AIDS is transmitted and how it is not transmitted.

Assessment Criteria:

1. Record in what bodily fluids the HI virus can be found;
2. Describe how HIV/AIDS can be transmitted;
3. Demonstrate the ability to distinguish between how HIV/AIDS is transmitted and misconceptions around transmittance of HIV/AIDS.

4.2.3.3 UNIT 3: HIV/AIDS preventative measures

After studying and understanding this unit, the Worker will comprehend how to act in a way that would minimise the risk of HIV/AIDS infection and to use measures to prevent the HI virus from entering the bloodstream.

Assessment Criteria:

1. Report on how to minimise the risk of HIV/AIDS infection;
2. Report on precautions that can be taken to prevent HIV/AIDS infection;
3. Explain or demonstrate how to use a male and female condom;

4. List the factors that could jeopardize the safety of condoms provided against HIV/AIDS Transmission.

4.2.3.4 UNIT 4: Voluntary HIV/AIDS counselling and testing

After studying and understanding this unit, the Worker will be able to recognise methods of testing for HIV/AIDS infection. The Worker will be able to understand the purpose of voluntary HIV/AIDS testing and pre- and post-test counselling.

Assessment Criteria:
1. Describe methods of testing for HIV/AIDS infection;
2. Report on why voluntary testing is important;
3. Report on why pre- and post-test counselling is important.

4.2.3.5 UNIT 5: Living with HIV/AIDS

After studying and understanding this unit, the Worker will be able to recognise the importance of caring for people living with HIV/AIDS and be able to manage HIV/AIDS.

Assessment Criteria:
1. List and describe ways to manage HIV/AIDS;
2. Describe nutritional needs of people living with HIV/AIDS;
3. Describe ways to embrace a healthy lifestyle as a person living with HIV/AIDS; 4. Explain the need for counselling and support to people living with HIV/AIDS.

4.2.3.6 UNIT 6: Treatment options for people with HIV/AIDS

After studying and understanding this unit, the Worker will be familiar with the various treatments available to HIV/AIDS infected or potentially HIV/AIDS infected people.

Assessment Criteria:
1. Discuss anti-retroviral therapy;
2. List methods of treatment to prevent HIV/AIDS transmission from mother-to-child; 3. Describe the need for treatment of opportunistic diseases for people living with HIV/AIDS;
4. Describe post exposure prophylactics.

4.2.3.7 UNIT 7: The rights and responsibilities of Workers in the workplace with regard to HIV/AIDS

After studying and understanding this unit, the Worker will be able to identify the rights and responsibilities of the Worker living with HIV/AIDS in the workplace. The Worker will recognise the importance of accepting colleagues living with HIV/AIDS and treating them in a non-discriminative way.

Assessment Criteria:
1. Discuss the rights of a person living with HIV/AIDS in the workplace;
2. Discuss the responsibilities of a person living with HIV/AIDS in the workplace;
3. Report on why acceptance and non-discrimination of colleagues living with HIV/AIDS is important.

4.3 Displaying of plastic laminated posters and distribution of information booklets

The Contractor shall obtain a set of four laminated posters conveying different key messages and information booklets. The contractor should include the costs of posters and information booklets in his/her tender price.

The above-mentioned posters and information booklets have been prepared to raise awareness and to share information about HIV/AIDS and STI's.

Posters or display stands shall be displayed on site as soon as possible, but not later than 14 days after the date of site handover.

Posters shall be displayed in areas highly trafficked by Workers, including toilets, rest areas, the site office and compounds.

The posters on display must always be intact, clear and readable.

Information booklets must be distributed to all Workers as soon as possible, but not later than 14 days after site handover, or as soon as the Worker joins the site.

5 PROVIDING WORKERS WITH ACCESS TO CONDOMS

The Contractor shall provide and maintain condom dispensers and make both male and female condoms, complying with the requirements of SABS ISO 4074, available at all times to all Workers at readily accessible points on site, for the duration of the contract. The Contractor may obtain condom dispensers from the Department of Health and condoms may be obtained from the Local Clinic or the Department of Health.

At least one male and one female condom dispenser and a sufficient supply of condoms, all to the approval of the Representative/Agent, shall be made available on site within 14 days of site hand over. Contractors should note that arrangements to obtain condoms from the Department of Health Clinics prior to site hand over may be necessary, to ensure that condoms are available within 14 days of site handover.

Condoms shall be made available in areas highly trafficked by Workers, including toilets, the site office and compounds.

6 ENSURING ACCESS TO HIV/AIDS TESTING AND COUNSELLING FACILITIES AND TREATMENT OF SEXUALLY TRANSMITTED INFECTIONS (STI)

The Contractor shall provide Workers with the names of the closest Service Providers that provide HIV/AIDS testing and counselling and Clinics providing Sexually Transmitted Infection (STI) diagnosis and treatment. Information on these Service Providers and Clinics must be displayed on a poster of a size not smaller than A1 in an area highly trafficked by Workers.

7 APPOINTMENT OF AN HIV/AIDS AWARENESS CHAMPION

7.1 Within 14 days of site handover the Contractor shall appoint an Awareness Champion from amongst the Workers, who speaks, reads and writes English, who speaks and understands all the local languages spoken by the Workers and who shall be on site during all stages of the construction period. The Contractor shall ensure that the Awareness Champion has been trained by the Service Provider on basic HIV/AIDS information, the support services available and the necessary skills to handle questions regarding the HIV/AIDS programme in a sensitive and confidential manner.

7.2 The Awareness Champion shall be responsible for:

7.2.1 Liaising with the Service Provider on organising awareness workshops;

7.2.2 Filling condom dispensers and monitoring condom distribution; 7.2.3 Handing out information booklets; 7.2.4 Placing and maintaining posters.

8 MONITORING

The Contractor shall grant to the Representative/Agent reasonable access to the construction site, in order to establish that the Contractor complies with his obligations regarding HIV/AIDS awareness under this contract.

The Contractor must report problems experienced in implementing the HIV/AIDS requirements to the Representative/Agent.

The attached SITE CHECKLIST (SCHEDULE A) shall be completed and submitted at every construction progress inspection to the Representative/Agent.

The attached SERVICE PROVIDER REPORT (SCHEDULE B) shall be completed and submitted on a monthly basis to the Department's Project Manager, through the Representative/Agent.

The attached CONTRACTOR HIV/AIDS PROGRAMME REPORT (SCHEDULE C), a close out programme report, shall be completed by the Contractor at the end of the contract.

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SCHEDULE A

HIV/AIDS PROGRAMME: SITE CHECKLIST

When did construction commence: _____

Name of Departmental Project Manager: _____

Please refer to HIV/AIDS Programme activities during the reporting period

Tick the block if Contractor satisfactorily complied with specifications

DATE	**PI**				**PI**				**PI**				**PI**				**PI**				**PI**				**PI**			
	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M
Programme implemented within 14 days of site handover																												
Awareness champion on site																												
HIV/AIDS awareness service provider report																												
Male condom dispenser																												
Sufficient male condoms available																												
Male condom dispenser in a highly trafficked area																												
Female condom dispenser																												
Sufficient female condoms available																												
Female condom dispenser in a highly trafficked area																												
All four types of posters displayed																												
Posters in a good condition																												
Posters in a highly trafficked area																												

Posters displayed on local support services: clinic & VCT centre							
Support service poster/s in highly trafficked area							
Support service poster/s in a good condition							

Please indicate the applicable number for the reporting period							
Workers on payroll (at PI)							
Sub-Contractors who will be on site for longer than 30 days (at PI)							
Workshop attendees							
Number of workshops held							
Scheduled workshops according to approved workshop plan							
Booklets distributed							
Male condoms distributed							
Female condoms distributed							

Representative/Agent

Date

Contractor

Date

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Date of progress inspection: (ccyy/mm/dd)

Reporting period: (ccyy/mm/dd)_____to (ccyy/mm/dd) _____

Deviations from HIV/AIDS awareness programme plan:

Corrective actions:

_____ _____

Representative/Agent Departmental Project Manager

_____Date _____Date

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SCHEDULE B

HIV/AIDS AWARENESS PROGRAMME: SERVICE PROVIDER REPORT

Reporting period: (ccyy/mm/dd)_____to (ccyy/mm/dd) _____

Number of workshops conducted in reporting period: _____

Number of scheduled workshops according to approved workshop plan: _____

Deviations from workshop plan:

State reasons for deviating from workshop plan:

Corrective action:

_____ _____

Service Provider

_____ _____

Date Date

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HIV/AIDS AWARENESS PROGRAMME: WORKSHOP CONTENT ADDRESSED

Fill in the applicable information with regard to each workshop conducted																												
DATE	**W/S**				**W/S**				**W/S**				**W/S**				**W/S**				**W/S**				**W/S**			
	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M
Content of workshop: (Mark the content included)																												
SLO1																												
SLO2																												
SLO3																												
SLO4																												
SLO5																												
SLO6																												
SLO7																												
HIV/AIDS in construction video																												
Indicate the duration of the workshop in hours																												
Total number of Workers																												
Indicate workshop venue																												

HIV/AIDS AWARENESS PROGRAMME: ATTENDANCE REGISTER

Fill in your name and indicate attendance by ticking the appropriate date																									
DATE		**W/S**				**W/S**				**W/S**				**W/S**				**W/S**				**W/S**				**W/S**			
		D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M
No	**NAMES**																												

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SCHEDULE C

CONTRACTOR HIV/AIDS PROGRAMME REPORT

Project name: _____

Project Location: _____

Contract value of project: R_____

Department of Public Works Project Manager: _____

HIV/AIDS Programme duration: (ccyy/mm/dd)_____to (ccyy/mm/dd)

AWARENESS MATERIAL

Describe location of posters displayed during the programme:

_____

Comments on posters: _____

Indicate total number of booklets distributed: _____

Comments on booklets: _____

CONDOMS _____

Indicate total number of male condoms distributed: _____

Indicate total number of female condoms distributed: _____

Describe where male condom dispenser was placed: _Describe where female condom dispenser was placed: ___

HIV/AIDS WORKSHOPS

Indicate the total number of HIV/AIDS workshops conducted: _____

Indicate the duration of workshops: _____

Indicate the total number of Workers that participated in the HIV/AIDS workshops: _____

Indicate the total number of Workers that were exposed to the video on HIV/AIDS in the Construction Industry:

_____

Comments on HIV/AIDS workshops on site: _____

_____

GENERAL

Briefly describe programme activities and satisfaction with outcome: _____

_____

_____

Additional comments, suggestions or needs with regard to the HIV/AIDS awareness programmes on site:

_____

_____

_____

Please indicate if your company has a formal HIV/AIDS policy focussing on HIV/AIDS awareness raising and care and support of HIV/AIDS Workers:	Yes	No	Currently developing one

Please indicate if, to your knowledge, you have lost any workers during the duration of the project to HIV/AIDS related sicknesses. One or more of the following might indicate an HIV/AIDS related death:

Excessive weight loss	Coughing or chest pain	Vomiting
Reactive TB	Pain when swallowing	Meningitis
Hair loss	Persistent fever	Memory loss
Severe tiredness	Diarrhoea	Pneumonia

Number of HIV/AIDS-related deaths:

_____ _____

Contractor **Date**

_____ _____

Departmental Project Manager **Date**

SI.1

ADDITIONAL SPECIFICATION
SI OCCUPATIONAL HEALTH AND SAFETY

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SI 01 APPLICABLE LEGISLATION AND REGULATIONS

This document was prepared to guide the Agent in the compilation of a Health and Safety Specification in terms of Sub-regulation 4(1)a of Construction Regulations, 2014 as promulgated in Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) (as amended) . The content of this document or the fact it was made available for the use of the Agent will not relieve the Agent of any of his obligations in terms of the act.

The Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) together with its applicable Regulations ("the Act'') forms part of this Health and Safety Specification. Any word or expression to which a meaning has been assigned in the Act shall have the meaning so assigned to it unless the context otherwise indicates.

SI SCOPE OF WORK

All work forming part of this Contract is divided into installations. The maintenance and servicing work to be performed as part of the installations under this Contract mainly consists of the following: Buildings (Structural, Wet Services and Electrical) Roads, Stormwater, Water distribution, Sewer Networks, Standby Power generation, External
Lighting and Firefighting equipment at the various Ports of Entry as listed in the Scope of Works (PG-01.1)

SI 03 THE PRINCIPAL CONTRACTOR'S GENERAL DUTIES

The Principal Contractor's general duties in terms of this Health and Safety Specification are, but not limited to, the following:

1. Every Principal Contractor shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees and other contractors.
2. Without derogating from the generality of a Principal Contractor's duties under subsection (1), the matters to which those duties refer include in particular –
   a. the provision and maintenance of systems of work, plant and machinery that, as far as is reasonably practicable, are safe and without risks to health;
   b. taking such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees and other contractors, before resorting to personal protective equipment;
   c. making arrangements for ensuring, as far as is reasonably practicable, the and absence of risks to health in connection with the production, processing, handling, storage or transport of articles or substances;
   d. establishing, as far as is reasonably practicable, what hazards to the safety of persons are attached to any work which is performed substance which is produced, processed, used, handled, stored and any plant or machinery which is used in his business, and he shall, as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons, and he shall provide the necessary means to apply such precautionary measures;
   e. providing such information, instructions, training and supervision necessary to ensure, as far as is reasonably practicable, the work of his employees and other contractors;
   f. not permitting any employee or contractor to do any wo use, handle, store or transport any article or substance machinery, unless the precautionary measures contemplated in paragraphs (b) and (d), or any other precautionary measures which may be prescribed, have been taken;
   g. taking all necessary measures to ensure that the requirements of this Health and Safety Specification are complied with by every person in his employment or on premises under his control where plant or machinery is used;
   h. enforcing such measures as may be necessary in the interest of health and safety;
   i. ensuring that work is performed and that plant or machinery is used under the general supervision of a person trained to understand the hazards associated with it and who have the authority to ensure that precautionary measures taken by the employer are implemented; and
   j. causing all employees and other contractors to be informed regarding the scope of their authority as contemplated in section 37(1)(b) of the Act.
   k. Monthly OHS audit and reporting.

SI 04 THE PRINCIPAL CONTRACTOR'S SPECIFIC DUTIES

The Principal Contractor's specific duties in terms of this Health and Safety Specification are specified in Construction Regulations, 2014 as promulgated in Government Gazette No 37305 and Regulation Gazette No 10113, Government Notice R.84 of 7 February 2014 (as amended) (as amended) . (Hereinafter referred to as "Construction Regulation, 2014").

The Principal Contractor is specifically referred to the following sub-regulations of the Construction Regulation, 2003:

Subject	**Applicable sub-regulation of the Construction Regulation, 2014.**
Definitions	1
Scope of application	2
Notification of construction work	3
Principal Contractor and Contractor	5
Supervision of construction work	6
Risk assessment	7
Approved inspection authorities	29
Offences and penalties	30
Withdrawal of regulations	31
Short title	32

The Principal Contractor will acquaint himself with these duties and will make provision in his Contract price for the implementation and supervision these duties.

SI 05 THE PRINCIPAL CONTRACTOR'S SPECIFIC DUTIES WITH REGARD TO HAZARDOUS WORK OR ACTIVITIES

The following hazardous work or activities were identified in terms of the Construction Regulation, 2003, and it is the duty of the Principal Contractor to ensure that the said work and activities are performed or carried out in terms of the relevant sub-regulations of the Construction Regulation, 2003 and other applicable Regulations.

Hazardous work or activity	**Applicable sub-regulation of the Construction Regulation, 2003.**	**Other applicable Regulations**
Fall protection	8	
Structures	9	
Formwork and support work	10	
Excavation	11	Precautionary measure as stipulated for confined spaces under the General Safety Regulations published

		under Government Notice R.1031 of 30 May 1986, as amended
Demolition work	12	Asbestos related work will be conducted in accordance with the Asbestos Regulations published under Government Notice R.155 of 10 February 2002 as amended. Lead related work will be conducted in accordance with the Lead Regulations published under Government Notice R. 236 of 28 February 2002 as amended.
Scaffolding	14	Section 44 of the Act
Suspended scaffolds	15	Section 44 of the Act
Boatswains chairs	16	
Material hoists	17	
Explosive powered tools	19	
Cranes	20	Applicable provisions of the Driven Machinery Regulations as published under Government Notice R.533 of 16 March 1990, as amended
Construction vehicles	21	
Electrical installations and machinery on construction sites	22	Applicable provisions in the Electrical installation Regulations published under Government notice R.2920 of 23 October 1992 and the Electrical Machinery Regulations published under Government notice R.1953 of 12 August 1988 respectively as amended.
Use and temporary storage of flammable liquids on construction sites.	23	Applicable provisions as stipulated in the General Safety Regulations published under Government Notice R.1031 of 30 May 1986, as

		amended
Water environments	24	

Housekeeping on construction sites.	25	Applicable provisions as stipulated in the Environmental Regulations for Works places published under Government Notice R.2281 of 16 October 1987, as amended.
Stacking and storage on construction sites.	26	Applicable provisions as stipulated in the General Safety Regulations published under Government Notice R.1031of 30 May 1986, as amended.
Fire precautions on construction sites	27	Applicable provisions as stipulated in the Environmental Regulations for Works places published under Government Notice R.2281 of 16 October 1987, as amended.

SI 06 **MEASUREMENT AND PAYMENT**

SI.01 **OCCUPATIONAL HEALTH AND SAFETY** ..... Unit: month

The unit of measurement shall be a calendar month and shall include full compensation for all liabilities and obligations described or implied in the Contract document and deemed by the Contractor to be applicable for Compliance with OHS Act and Construction Regulations 2003, and all appurtenant works deemed to form part thereof, as defined in the relevant Specifications.

The contractor's Occupational Health and Safety shall be scored monthly as per the typical OHS-Audit Report contained in this specification. This item shall only be payable for the specific month in which the contractor exceeds an OHS-Audit-score of 95% or more. The contractor should note that all work on site may be stopped at any stage by the external OHS Auditor should the contractor not achieve the minimum score of 90% for the OHS Audit report.

Si 07 **RESPONSIBILITIES OF CONTRACTOR & SUB CONTRACTORS**

7.1 Principal Contractor and contractors appointed by the Principal Contractor

7.1.1 The Principal Contractor shall accept the appointment under the Terms and Conditions of Contract between the Department of Public Works and the Principal Contractor. The Contractor shall sign and agree to those terms and conditions and shall, before commencing work, notify the Department of Labour of the intended construction work in terms of Regulations 3 of the Construction Regulations. Annexure B of this Specification contains a "Notification of Construction Work" form. The Principal Contractor shall submit the notification in writing prior to commencement of work and inform Department of Public Works or his Agent accordingly. The above-mentioned notification of construction work must be kept available on site and be presented to any Inspector, Client Representative, Contractor or employee. **It is advised that the Labour Notification document be signed by both parties (Client and Principal Contractor) at site handover as no work, not even**

site establishment, will be allowed if this notification has not been sent to the department of Labour.

7.1.2 The Principal Contractor shall ensure that he/she is fully conversant with the requirements of this Specification and all relevant health and safety legislation. This Specification is not intended to supersede any Act, nor Regulations or any part of either. Those sections of the Act and the Construction Regulations, which apply to the scope of work to be performed by any Contractor in terms of this contract, (entirely or in part) will continue to be legally required of the Principal Contractor to comply with. No Contractor will in no manner or means be absolved from the responsibility to comply with all applicable sections of the Act, the Construction Regulations or any Regulations proclaimed under the Act, SABS Codes of Practice mentioned in any document pertaining to this project or which may perceivable be applicable to this contract.

7.1.3 The Principal Contractor shall provide and demonstrate to Department of Public Works a suitable and sufficiently documented health and safety plan based on this Specification, the Act and the Construction Regulations, which shall be applied from the date of commencement of and for the duration of execution of the works. This plan shall, as appendices, include the health and safety plans of all Sub-contractors for which he/she has to take responsibility in terms of this contract. **Note that no generic safety plan will be accepted. All safety plans shall be site specific.**

7.1.4 Any contractor involved in this project by means of construction work, supplying of any product, material or service, shall provide proof of his registration and good standing with the Compensation Commissioner or with a licensed compensation insurer prior to commencement with the works or service. Where the Department of Public Works have appointed any preselected or pre-approved contractor, such contractor will be seen as Principal Contractors and shall comply with all OHS requirements as set out in this document. **No contractor will be allowed on site without a letter of good standing from the Compensation Commissioner.**

7.1.5 The potential Principal Contractor shall, in submitting his/her tender, demonstrate that he/she has made provision for the cost of compliance with this Health and Safety Specifications and Requirement, the Act and any Regulations pertaining to the health and safety of employees at work. The Principal Contractor will furthermore ensure that any contractor appointed under him/her complies with this document ensuring that such a contractor:

7.1.5.1 Is in good standing with the Compensation Commissioner

7.1.5.2 Complies fully with the Basic Conditions of Employment Act of 1997.

7.1.5.3 Is fully conversant with the requirements set out in this document.

7.1.5.4 Have proof of qualification and certification of all appointed persons in terms of section 16.2 of the act, managers and supervisors in terms of the Act and any Regulations pertaining to the health and safety of employees at work. Should such certification not be valid or absent, such training shall be provided by the Client and costs incurred due to non- compliance shall be payable by the applicable contractor for the above-mentioned or any other training in terms of the Act or any Regulations pertaining to Health and Safety of employees.

7.1.5.5 Is a qualified contractor, specializing in the field for which he/she is appointed

7.1.5.6 Has the infrastructure and financial stability to adhere to all requirements within this document

7.1.5.7 Who is not represented on site by the Chief Executive Officer or Managing Director, a qualified person shall be appointed and available on site in terms of section of the Act.

N.B. Construction Regulation 5(3) (g) determines that potential contractors submitting tenders have made provision for the cost of health and safety measures during the construction process. The Contractor shall on tendering make provision for the cost of health and safety measures in terms of his/her documented Health and Safety Plan and measures based on these Health and Safety
Specifications during the period of the project. The cost shall be duly quantified and clearly identified for such identifiable purpose

7.1.6 The Principal Contractor shall consistently demonstrate his competence and the adequacy of his resources to perform the duties imposed on his/her in terms of this Specification, the Act and the Construction Regulations.

7.1.7 The Principal Contractor shall ensure that a copy of all contractors on site's health and safety plans are available on site and will be presented upon request to Department of Public Works, Safety Officer, Inspector, Sub-contractor or employee.

7.1.8 The Principal Contractor shall ensure that all health and safety files, including those of sub- contractors appointed by the Principal Contractor are available on site as required in terms of these Specifications, the Act or any Regulations pertaining to the health and safety of employees on site, and made available to Department of Public Works or Inspector upon request. Upon completion of the works, the Principal Contractor shall hand over a consolidated health and safety filing system to the Department of Public Works.

7.1.9 The Contractor shall, throughout execution of the project, ensure that all conditions imposed on his Sub-contractors in terms of the Act and the Construction Regulations are complied with as if they are the Principal Contractor.

7.1.10 The Contractor shall from time to time evaluate the relevance of the Health and Safety Plan/system and revise the same as required, following which revised plan/system shall be submitted to Department of Public Works and/or his/her Agent for approval.

7.1.11 All contractors shall from time to time and before any work is started, ensure that a qualified appointed Risk Assessor conducts a risk assessment regarding such work and communicate these risks with the health and safety committee in order to manage such risks and retain safety to all employees at work. Should such an appointed person not have the knowledge and certification to execute his/her responsibilities, The Client will train and certify such person/s and costs for such training will be paid by the applicable contractor.

7.1.12 The Principal Contractors shall keep on site a daily Hazard Identification and Risk Assessment (HIRA) document, ensuring that all supervisors and employees are familiar with the daily risks pertaining to the work at hand. Such documentation shall be kept on file for reference purposes at the site office. All supervisors shall be fully qualified to perform a risk assessment to uphold his/her responsibility in terms of the Construction Regulations 6(6).

7.1.13 The Principal Contractor shall ensure that no employee or visitor is allowed on site without a written approval permit from the Principal Contractor. Such permit will only be issued after site safety induction training has been conducted and the emergency procedures communicated with such employee/visitor. All safety induction records and acknowledgments of understanding employees/visitors shall be available on the safety file.

7.1.14 The Principal Contractor shall furthermore ensure that all contractors and employees entering the site are in possession of an identification card, containing a photo of the person carrying the identification, the employer detail and job description as well as any training detail.

7.2 Contractors appointed by the Principal Contractor

In addition, no contractor will be allowed to perform any work unless the following has been established and adhere to:

- Every contractor will enter into a mandatory agreement pertaining to the health and safety on site and to ensure the safety of his/her employees at work
- Every contractor will submit proof of good standing with the Compensation Commissioner. The contractor shall furthermore demonstrate an action plan of the renewal interval and process of the letter of good standing
- Before commencement of any work, the contractor will cause a risk assessment to be conduct by a certified Risk Assessor and take reasonable steps to ensure safety of his/her employees during such work
- . No contractor will *be* allowed on site without a written approval permit from the Principal Contractor. Site safety induction training must be conducted before any employee will be allowed to enter the site for the first time.

SI 08 HEALTH AND SAFETY FILE

Every contractor, which includes the Principal Contractor, shall in terms of Construction Regulation 5(7), keep a Health & Safety File on site at all times, which must include all documentation required in terms of the Act and Regulations. A full detailed index of the safety file required for this project is listed in section 24 of this document. The safety file of the Principal Contractor shall include a list of all Contractors on site who are appointed by the Principal Contractor and the agreements between the parties and details of work being done.

IMPORTANT

The Health and Safety File will remain the property of Department of Public Works and/or its Agent on its behalf throughout the period of the project and shall be consolidated and handed over to the Department of Public Works and/or its Agent on its behalf at the time of completion of the project. Under no circumstances may a safety file be removed form site or copied as all documentation in it is regarded as legal binding documents. Generic non site-specific documentation will not be accepted.

SI 09 OHS GOALS AND OBJECTIVES AND ARRANGEMENTS FOR MONITORING AND REVIEWING OHS PERFORMANCE

The Principal Contractor is required to maintain an acceptable disabling incident frequency rate (DIFR) and report on this to Department of Public Works and/or its Agent on its behalf on a monthly basis.

The Principal Contractor shall ensure injury and incident records (Near Hits, First Aid, Medical cases, Disabling Lost Time Incidents), training etc. referred to above are kept on site. All documents shall be made available to the client for inspection including the Department of Labour's Inspectors as required by the Occupational Health and Safety Act, 85 of 1993.

The statistics formula as listed below shall be adhered to.

$$\text{DIFR (Disabling Injury Frequency Rate)} \frac{\text{DI's x 1 000 000}}{\text{Man-hours}}$$

SI 10 IDENTIFICATION OF HAZARDS AND DEVELOPMENT OF RISK ASSESSMENTS, SAFE WORKING PROCEDURES (SWP) AND METHOD STATEMENTS

- The Contractor is required to develop Baseline Risk Assessments, which must be included in the tender document, identifying all the risks involved taken in consideration, the scope of work as seen from the current site situation. This risk assessment will assist the contractor in proactively plan for safety management, safety budgeting and execution of his/her safety plan.
- Once taken site, the contractor will perform an Issue Based Risk Assessment, addressing individual processes within the construction process
- Safe Working Procedures (SWP) and Method Statements for each activity executed in the contract or project must be drafted and implemented.
- Each contractor shall implement a daily Hazard Identification and Risk Assessment (HIRA) system where hazards and risk assessments are discussed with all employees involved with a specific task.
- Once risks have been identified, notice boards, symbolic safety signs and instructions must be placed or installed to prevent incidents and warn all parties involved of such hazards and risks

SI 11 ARRANGEMENT FOR MONITORING AND REVIEW

11.1 Monthly Audit by Client and/or its Agent on its behalf

Department of Public Works and/or its Agent on its behalf will be conducting Periodic Audits at times agreed with the Principal Contractor. Auditing will focus on the following:

- Legal compliance and documentation
- OHS Plan and implementation
- Appointment documentation
- Risk Assessments
- OHS Awareness
- Keeping of registers and checklists
- OHS Training
- OHS Committee
- Reporting, investigation and management of incidents
- Personal Protective Equipment
- Etc.

11.2 Other audits and inspections by client and/or its agent on its behalf

Department of Public Works and/or its Agent on its behalf reserves the right to conduct any other ad hoc audits and inspections as it and/or its Agent on its behalf deem necessary.

A representative of the Principal Contractor and the relevant Health and Safety Representative(s) must accompany the Department of Public Works and/or its Agent on its behalf on all Audits and Inspections and may conduct their own audit/inspection at the same time. Each party will, however, take responsibility for the results of his/her own audit/inspection results. The Department of Public Works and/or its Agent on its behalf may require to be handed a copy of the minutes of the previous Health and Safety Committee meeting reflecting possible recommendations made by that committee to the Employee for reference purposes.

11.3 Reports

11.3.1 The Contractor shall report all incidents where an employee is injured on duty to the extent that he/she:

- dies
- becomes unconscious
- loses a limb or part of a limb
- is injured or becomes ill to such a degree that he/she is likely either to die or to suffer a permanent physical defect or likely to be unable for a period of at least 14 days either to work or continue with the activity for which he/she was usually employed. **OR** where:
- a major incident occurred
- the health or safety of any person was endangered
- where a dangerous substance was pilled
- the uncontrolled release of any substance under pressure took place
- machinery or any part of machinery fractured or failed resulting in flying, falling or uncontrolled moving objects
- machinery ran out of control

to the Provincial Director of the Department of Labour within seven (7) days and at the same time to Department of Public Works and/or its Agent on its behalf.

Refer in this regard to Section 24 of the Act & General Administrative Regulation 8.

11.3.2 The Contractor is required to provide the Department of Public Works and/or its Agent on its behalf with copies of all statutory reports required in terms of the Act and the Regulations.

11.3.3 The Contractor is required to provide the Department of Public Works and/or its Agent on its behalf with a monthly "Health and Safety Risk Management Report".

11.3.4 The Contractor is required to provide a.s.a.p. Department of Public Works and/or its Agent on its behalf with copies of all internal and external accident/incident investigation reports including the reports contemplated below. As soon as the occurrence of any accident/incident of whatever nature comes to the notice of The Contractor; it shall be reported immediately to any of the following:

- Department of Public Works
- Client's Agent As per OHS Act

11.4 Review

The Principal Contractor is to review the Hazard Identification, Risk Assessments and Safe Work Processes monthly as the construction work develops and progresses and each time changes are made to the designs, plans and construction methods and processes.

The Principal Contractor must provide Department of Public Works and/or its Agent on its behalf, other Contractors and all other concerned parties with copies of any changes, alterations or amendments as contemplated in the above paragraph.

11.5 Site Rules and other Restrictions

11.5.1 Site Safety Rules

The Contractor must develop a set of ***site-specific*** OHS rules that will be applied to regulate the Health and Safety Plan and associated aspects of the construction. The site safety rules shall not be limited to, but include the following:

- No interaction shall take place between any employee and any visitor of the Port of Entry.
- No sleeping or any form of accommodation will be allowed on site
- No open fire will be allowed
- No alcohol or drug related substances will be allowed on site. The Principal Contractor shall either have breathalyser on site to prevent any person suspected of being intoxicated, from entering the site or appoint a sub-contractor to perform such a service.
- Smoking will not be allowed inside the Port of Entry buildings/structures.
- PPE issued shall include, but are not limited to:
    - SABS approved Safety boots. PVC Gumboots with steel toes and non-slip soles will be accepted
    - SASS approved overalls identifying the employer of such employee. No short pants will be allowed on site.
    - Employees working in areas where they are exposed to direct sunlight for long periods of time must be supplied with broad spectrum factor 30 sun block.
    - SABS approved hard hats
    - SABS approved hearing protection in noise demarcated areas
    - SABS approved safety harnesses with double lanyards
    - PPE issued shall not be off site
- No contractor, employee or visitor will be allowed on site without attending site safety induction training
- No employee or visitor will be allowed on site without the prescribed identification
- Emergency procedures shall be implemented
- First aid arrangements shall be implemented and communicated with all employees and visitors on site
- Reporting of incidents must be managed and a D1FR-rate be established

11.5.2 Security Arrangements

The Principal Contractor must establish site access rules and implement and maintain these throughout the construction period. Access control must include the rule that non-employees shall at all times be provided with fulltime supervision while on site.

All contractors and employees must be issued with proper identification as prescribed in section 7.2.14

After consultation with the user client, the principal Contractor must develop a set of Security rules and implement procedures and maintain these throughout the construction period.

After consultation with the BCOCC Port Coordinator, the Principal Contractor shall develop and implement an emergency plan to coincide with the BCOCC protocol regarding security arrangements in the case of emergencies.

No contractor, employee or visitor shall be allowed to interact with any Port of Entry visitors.

The Principal Contractor shall be responsible for his/her own security arrangements at store areas indicated by the BCOCC Port Coordinator.

11.6 Training

The contents and syllabi of all training required by the Act and Regulations pertaining to the Act, including any other or relevant training as required must be included in The Contractor's Health and Safety Plan and Health and Safety File.

11.6.1 General Induction Training

All employees and visitors must be in possession of proof of General Safety Induction training.

11.6.2 Other Training

All operators, drivers and users of construction vehicles, mobile plant equipment must be in possession of valid proof of training and certificate of competency. All operators of mobile machinery and construction vehicles as well as drivers shall be in possession of a medical certificate of fitness of which a copy shall be made available on the safety file.

All employees in jobs requiring training in terms of the Act and Regulations must be in possession of valid proof of training as follows:
Occupational Health and Safety Training Requirements: (as required by the Construction Regulations and as indicated by the Health and Safety Specification Document & the Risk Assessments and recommendations by the health and Safety Committee):

- General Induction (Section 8 of the Act)
- Site/Job Specific Induction (also visitors) (Sections 8 & 9 of the Act)
- Site/Project Manager
- Construction Supervisor (Construction Regulations 6.1)
- OHS Representatives (Section 18 (3) of the Act)
- Training of the Appointees indicated in 12.6.1 & 12.6.2 above
- Operation of Cranes (Driven Machinery Regulations 18 (11)
- Operators & Drivers of Construction Vehicles & Mobile Plant (Construction Regulation 21)
- Basic Fire Prevention & Protection (Environmental Regulations 9 and Construction Regulation 27)
- As a minimum basic First Aid to be upgraded when necessary (General Safety Regulations 3)
- Storekeeping Methods & Safe Stacking (Construction Regulation 26)
- Emergency, Security and Fire Co-coordinator All employees operating electrical power tools

11.7 Accident and Incident Investigation

The Principal Contractor is responsible to oversee the investigation process of all accidents/incidents where employees and non-employees were injured to the extent that he/she/they had to receive first aid or be referred for medical treatment by a doctor, hospital or clinic. (General Administrative Regulation 9)

The results of the investigation to be entered into the Accident/Incident Register listed above. (General Administrative Regulation 9)

The Contractor is responsible for the investigation of all non-injury incidents as described in Section 24 (1) (b) & (c) of the Act and keeping a record of the results of such investigations including the steps taken to prevent similar incidents in future.

The Contractor is responsible for the investigation of all road traffic accidents relating to the construction site and keeping a record of the results of such investigations including the steps taken to prevent similar accidents in future.

Notwithstanding the requirements of Section 24 of the Act, ALL incidents shall be investigated and reported on in writing, irrespective of whether such incident gave rise to injury or damage.

11.8 Health, Safety and Environmental Representatives (referred to as H&S Reps) and H&S Committees

11.8.1 Designation of H&S Representatives

Where a Contractor employs more than 20 persons (including the employees of other Contractors (sub-contractors) he/she has to appoint one H&S Representatives for every 50 employees or part thereof. (Section 17 of the Act and General Administrative Regulation 6 & 7).

H & S Representatives have to be designated in writing and the designation shall be in accordance with the collective Agreement as concluded between the parties as is required in terms of General Administration Regulation 6.

11.8.2 Duties and Functions of the H&S Representatives

The Contractor must ensure that the designated H&S Representatives conduct at least a weekly inspection of their respective areas of responsibility using a checklist and report thereon to the Principal Contractor, after which these reports shall be consolidated for submission to the Health and Safety Committee.

H&S Representatives must be included in and be part of accident/incident investigations.

H&S Representatives shall be members of at least one H&S Committee and must attend all meetings of that H&S committee.

***11.8.3* Establishment of Health and Safety Committee(s)**

The Contractor must establish a Health and Safety Committees consisting of designated H&s Representatives together with a number of Employers Representatives appointed as per Section 19(3) that are not allowed to exceed the number of H&S Representatives on the committee. The persons nominated by the employer on an H&S Committee must be designated in writing for such period as may be determined by him. The H&S Committee shall co-opt advisory (temporary) members and determine the procedures of the meetings including the chairmanship.

The H&S Committee must meet minimum monthly and consider at least the following Agenda for the first meeting. Thereafter the H&S Committee shall determine its own procedures as per the previous paragraph.

Agenda:

1) Opening and determining of chairmanship
2) Minutes of Previous Minutes and the process of compiling minutes
3) Observations
4) Program and Safety considerations
   - OHS Awareness campaign
   - Assessments and HIRA
   - Contractors OHS cooperation
5) Hygiene

- Drinkable water
- Toilets for each sex
- Toilet paper arrangements
- Hand wash facilities, including soap and handtowels/paper

6) Housekeeping
7) Incidents & Accidents / Injuries 8) Registers:
   a H&S Rep. Inspections b. Matters of First Aid
   c. Scaffolding
   d. Ladders
   e. Excavations
   f. Portable Electric Equipment
   g. Fire Equipment
   h. Power Hand tools
   i. Incident Report Investigation
   j. Pressure Vessels
   k. Personal Protective Equipment
9) Safety performance Evaluations
10) Education & Safety promotion program
11) First Aid Officials and training in First Aid
12) Demarcation of work- /hazardous-/safe areas / walkways
13) Posters and signage
14) Environmental preservation and conservation
15) Waste Management
16) Specific training programmes
17) General
18) Date of Next Meeting
19) Closing

SI 12 PROJECT/SITE SPECIFIC REQUIREMENTS

The following is a list of specific activities and considerations that have been identified for the project and site and for which Risk Assessments, Safe Working Procedures (SWP), management and control measures and Method Statements (where necessary) have to be developed by The Contractor:

- Site Establishment including:
  - Office/s
  - Secure/Safe Storage and storage areas for materials, plant & equipment o Ablution facilities o Sheltered dining area o Access and Egress control
  - Vehicle access to the site
- Dealing with existing Structures
- Location of existing Services
- Installation & Maintenance of Temporary Construction Electrical Supply, Lighting and Equipment
- Adjacent Land uses/Surrounding property exposures
- Boundary & Access control/Public Liability Exposures (Remember: the Employer is also responsible for the OHS of non-employees affected by his/her work activities.)
- Health risks arising from neighbouring as well as own activities and from the environment e.g. threats by dogs, bees, snakes, lightning, allergies etc.
- Exposures to Noise
- Exposure to Vibration

Exposure to dust

Protection against dehydration and heat exhaustion□

Protection from wet & cold conditions
Dealing with HIV/Aids and other diseases as per specific programme provided by Department of Public Works and/or its Agent on its behalf
Use of Portable Electrical Equipment including:

- Angle grinder
- Electrical Drilling machine
- Skill saw

Excavations including

- Ground/soil conditions
- Trenching
- Shoring

Drainage

- Barricading
- Flooding
- Daily inspections

Welding including:

- Arc Welding
- Gas welding
- Flame Cutting
- Use of LP Gas torches and appliances

Loading & Offloading of Trucks
Aggregate/Sand and other Materials Delivery
Manual and Mechanical Handling
Lifting and Lowering Operations
Driving & Operation of Construction Vehicles and Mobile Plant including

- Trenching machine o Excavator o Bomag Roller o Plate Compactor o Front End Loader o TLB
- Mobile Cranes and the ancillary lifting tackle
- Parking of Vehicles & Mobile Plant
- Towing of Vehicles & Mobile Plant

- Use and Storage of Flammable Liquids and other Hazardous Substances – Department of Public Works and/or its Agent on its behalf to be informed of this prior to commencing of the project

Layering and Bedding of trench floor
Installation of Pipes in trenches
Backfilling of Trenches
Protection against Flooding
Gabion work
Protection from Overhead Power Lines
Any hazards discovered by any contractor
As discovered from any inspections and audits conducted by Department of Public Works and/or its Agent on its behalf or by The Contractor or any other Contractor on site, As discovered from any accident/incident investigation

12.1 The following are in particular requirements depending on scope of works and will form a basis for compliance audits.

1. Administrative & Legal Requirements
2. Education, Training & Promotion
3. Public Safety & Emergency Preparedness
4. Personal Protective Equipment
5. Housekeeping
6. Scaffolding, Formwork & Support work
7. Ladders
8. Electrical Safeguarding
9. Emergency/Fire Prevention & Protection
10. Excavations & Demolition
11. Tools

12. Cranes
13. Personnel & Material Hoists
14. Transport & Materials Handling
15. Site Plant & Machinery
16. Plant & Storage Yard/Site Workshops Specifics
17. Health & Hygiene

SI 13 OUTLINED DATA, REFERENCES AND INFORMATION ON CERTAIN AND/OR SPECIFIC OBLIGATORY REQUIREMENTS TO ENSURE COMPLIANCE

13.1 Administrative & Legal Requirements

OHS Act Section/ Regulations	**Subject**	**Requirements**
Construction. Regulation 3	Notice of carrying out Construction work	Department of Labour notified Copy of Notice available on Site
General Admin.	*Copy of OHS Act (Act 85 of 1993)	Updated copy of Act & Regulations on site. Readily available for perusal by employees
COID Act Section 80	*Registration with Compensation. Insurer	Written proof of registration / Letter of good standing available on Site
Construction.	H&S Specification &	H&S Spec received from Client and/or its Agent

Regulation 4 & 5 (1)	Programme	on its behalf. OHS programme developed & Updated regularly

Section 8(2)(d) Construction. Regulation 7	*Hazard Identification & Risk Assessment	Hazard Identification carried out/Recorded Risk Assessment and – Plan drawn up/Updated RA Plan available on Site
Section 16(2)	*Assigned duties (Managers)	Employees/Sub-Contractors informed/trained Responsibility of complying with the OHS Act assigned
Construction. Regulation 6(1)	Designation of Person Responsible on Site	Competent person appointed in writing as Construction Supervisor with job description.
Construction. Regulation 6(2)	Designation of Assistant for above	Competent person appointed in writing as Assistant Construction Supervisor with job description
Section 17 & 18 General Administrative Regulations 6 & 7	*Designation of Health & Safety Representatives	More than 20 employees – one H&S Representative, one additional H&S Rep. for each 50 employees or part thereof. Designation in writing, period and area of responsibility specified in terms of GAR 6 & 7 Meaningful H&S Rep. reports. Reports actioned by Management.
Section 19 & 20General Administrative	*Health & Safety Committees	H&S Committee/s established. All H&S Reps shall be members of H&S Committees Additional members are appointed in writing. Meetings

Section 37(1) & (2)	*Agreement with Man dataries 1(Sub-) Contractors	Written agreement with (Sub-) Contractors List of (Sub-) Contractors displayed. Proof of Registration with Compensation Insurer/Letter of Good Standing Construction Supervisor designated Written arrangements re. H&S Reps & H&S Committee Written arrangements re. First Aid
Section 24 & General Admin. Regulation 8 COID Act Sect. 38, 39 & 41	*Reporting of Incidents (Dept. of Labour)	Incident Reporting Procedure displayed. All incidents in terms of Sect. 24 reported to the Provincial Director, Department of labour, within 3 days. (WCL I or 2) and to Department of Public Works and/or its Agent on its behalf. Cases of Occupational Disease Reported. Copies of Reports available on Site.
General Admin. Regulation 9	*Investigation and Recording of Incident	All injuries which resulted in the person receiving medical treatment other than first aid, recorded and investigated by investigator designated in writing. Copies of Reports (Annexure 1) available on Site. Tabled at H&S Committee meeting Action taken by Site Management
Construction. Regulation 8	Fall Prevention & Protection Site.	Competent person appointment to draw up and supervise the Fall Protection Plan. Proof of appointees' competence available on • Risk Assessment carried out for work at heights. Fall Protection Plan drawn up/updated. Available on Site.

SI 14 THE CONTRACTOR'S GENERAL DUTIES

The Contractor shall at all times ensure his status of an "employer" as referred to in the Act, and will abide by his/her responsibilities, duties and functions as per the requirements of the Act and Regulations with specific reference to Section 8 of the Act.

The Contractor shall keep, and on demand make available, a copy of the Act on site at all times and in addition to that he/she will introduce and maintain a file titled "Health and Safety File", or other record in permanent form, which shall contain all relevant aspects and information as contemplated in the Construction Regulations. He/she will make this file available to Department of Public Works or his representative whenever necessary or on request to an interested party.

SI 15 THE CONTRACTOR'S SPECIFIC DUTIES

The Contractor's specific duties in terms of these specifications are detailed in the Construction Regulations as published under government notice No. R1010 dated 18 July 2003.

The Contractor is specifically referred to the following elements of the Construction Regulations:

Regulation No. 1	Definitions
Regulation No. 2	Scope of application
Regulation No. 3	Notification of construction work
Regulation No. 5	Principal Contractor and Contractor
Regulation No. 6	Supervision of construction work
Regulation No. 7	Risk Assessment
Regulation No. 26	Stacking & Storage on construction sites
Regulation No. 28	Construction welfare facilities
Regulation No. 29	Approved Inspection authorities
Regulation No. 30	Offences and penalties

The list must not be taken to be exclusive or exhaustive!

The Contractor shall ensure compliance to the Act and its Regulations and specifically to the above regulations, and document each record in the Health and Safety File.

SI 16 THE CONTRACTOR'S SPECIFIC RESPONSIBILITIES WITH REGARD TO HAZARDOUS ACTIVITIES

The following activities are identifiable as hazardous in terms of the Construction Regulations.

The contractor shall execute the activities in accordance with the following Construction Regulations and other applicable regulations of the Act.

Regulation No. 8	Fall protection (Working on heights and in sub-ground level areas included)
Regulation No. 9	Structures
Regulation No. 10	Formwork and support work
Regulation No. 11	Excavation work
Regulation No. 12	Demolition work (Which is not foreseen for this project)
Regulation No. 13	Tunnelling
Regulation No. 14	Scaffolding
Regulation No. 15	Suspended platforms

Regulation No. 16	Boatswain's chairs
Regulation No. 17	Material hoists
Regulation No. 18	Batch plants
Regulation No. 19	Explosive powered tools
Regulation No. 20	Cranes
Regulation No. 21	Construction vehicles & mobile plant
Regulation No. 22	Electrical installations and machinery on construction sites
Regulation No. 23	Use and temporary storage of flammable liquids on construction sites
Regulation No. 24	Water environments
Regulation No. 25	Housekeeping on construction sites
Regulation No. 27	Fire precautions on construction sites

This limit must not be taken to be exclusive or exhaustive!

All of the above requirements will be read in conjunction with the relevant Regulations and Health and Safety standards as required by the Act. All documents and records required by the Construction Regulations will be kept in the Health and Safety File and will be made available at any time when required by Department of Public Works or his representative, or on request to an interested party.

SI 17 GENERAL NOTES TO THE CONTRACTOR

Legal Framework

Part of legal obligations

The more important Acts and relevant subordinate/secondary legislation as well as other (inter alia Local Government) legislation that also apply to the State as well as to State owned buildings and premises: -

(i) The latest issue of SABS 0142: "Code of practice for the Wiring of Premises"
(ii) The Local Government Ordinance or by-laws issued by the Local Authorities
(iii) The Fire Brigade Services Act 1987, Act 99 of 1987 as amended
(iv) The National Building Regulations and Building Standards Act 1977 (Act 103 of 1977) as amended and relevant proclaimed Regulations (SABS 0400)
(v) The Post Office Act 1958 (Act 44 of 1958) as amended
(vi) The Electricity Act 1984, Act 41 of 1984
(vii) The Regulations of Local Gas Board(s), including Publications of the SABS Standards and Codes of Practice, with specific reference to GNR 17468 dated 4th October 1997.
(viii) Legislation pertaining to water usage and the environment
(ix) Legislation governing the use of equipment, which may emit radiation (e.g. X-Rays etc.) (Hazardous Substances Act, 1973 (Act 15 of 1973))
(x) Common Law

Legal Liabilities

Common Law and Legislation

Based on two main criteria —

Would the reasonable person have foreseen the hazard?

That is a reasonable person in that specific position, taking experience, qualifications} authority, position in the organization etc. into consideration

- Would the reasonable person have taken precautionary measures (action) to prevent or limit the hazard?

Negligence can be proven on failure on any or both of the above criteria

SI 18 HOUSEKEEPING

Good housekeeping will be maintained at all times as per Construction Regulation No. 25. Poor housekeeping contributes to three major problems, namely:

- costly or increased incidents, □ fire or fire hazards and □ reduction in production.

Good housekeeping will enhance production time and the statement of "A clean site is a safe site" was never proven wrong.

Particular emphasis is to be placed on the following crucial elements of a construction site:

- Phase priorities and production/plant layout

Enclosures

- Pits, openings and shoring
- Storage facilities
- Effective, sufficient and maintained lighting or illumination
- Principal sources of injuries e.g. stairways, runways, ramps, loose building material
- Oil, grease, water, waste, rubble, glass, storm water
- Colour coding □ Demarcations
- Pollution
- Waste disposal
- Ablution and hygiene facilities
- First aid

The list must not be taken to be exclusive or exhaustive!

In promotion of environmental control all waste, rubble, scrap etc., will be disposed of at a registered dump site and records will be maintained. Where it is found to be impractical to use a registered dump site or it is not available, The Contractor will ensure that the matter is brought to record with Department of Public Works or his representative, after which suitable, acceptable alternatives will be sought and applied.

Dross and refuse from metals and waste matters or by-products which nature is such that they are poisonous or could pose a threat to living beings, shall be treated or disposed of by methods approved of by an inspector. Such matter shall be declared to the Department of Public Works and record of such removal of waste by an accredited waste removal contractor to a Government approved chemical waste site shall be documented and kept on file.

NOTE: No employer (Principal Contractor) shall require or permit any person to work at night or after hours unless there is adequate, suitable artificial lighting including support services in respect of Health and Safety.

SI 19 LOCKOUT SYSTEMS — ELECTRICAL

A system of control shall be established in order that no unauthorized person can energize a circuit, open a valve, or activate a machine on which people are working or doing maintenance, even if equipment, plant or machinery is out of commission for any period, thus eliminating injuries and damage to people and equipment as far as is reasonably practicable.

Physical/mechanical lock-out systems shall be part of the safety system and included in training. Lockouts shall be tagged and the system tested before commencing with any work or repairs.

A lockout system register shall be kept and all lockouts are logged and discussed during the OHS Committee meetings.

Any lockout which could affect the daily operation of the Port of Entry, shall be communicated with the BCOCC Port Coordinator and such discussions shall be documented and kept with all lockout documents.

SI 20 INCIDENT INVESTIGATION

Inspection, reporting, proactive auditing and control measures are the best way in which a responsible contractor can control his area of responsibility in terms of occupational health and safety. All incidents therefore, irrespective of whether it gave rise to loss, injury, damage or not, shall be reported and investigated and the results recorded in the Health and Safety File. (GAR 9)

SI 20 GENERAL

The project under control of The Contractor shall be subject to periodic health and safety audits that will be conducted by Department of Public Works at intervals agreed upon between The Contractor and Department of Public Works, provided such intervals will not exceed periods of one month. The Contractor is to ensure that he/she and all persons under his control on the construction site shall adhere to the above specifications, as non-conformance will lead to Department of Public Works taking action as directed by Construction Regulation 4.1(e). The Contractor should note that he/she shall be held liable for any anomalies including costs and resulting deficiencies due to delays caused by non- conformance and/or non-compliance to the above Health and Safety Specifications and the Health and Safety Plan based on these specifications.

SI 21 IMPORTANT LISTS AND RECORDS TO BE KEPT

The following are lists of several records that are to be kept in terms of the Construction Regulations. The lists are:

1 List of appointments

2 List of record keeping responsibilities

3 Inspection checklist

These lists and documents are to be used as a point of reference to determine which components of the Act would be applicable to a particular site or task or project, as was intended under paragraph 1 ("Preamble") above. **1. LIST OF APPOINTMENTS**

ITEM	REGULATION	APPOINTMENT	RESPONSIBLE PERSON
1	4(1)(c)	Principal contractor for each phase or project	Client Principal Contractor
2	5.(3)(B)	Contractor	Contractor
3	5(11)	Contractor	Contractor
4	6(1)	Construction supervisor	Contractor
5	6(2)	Construction supervisor sub-ordinates	Contractor
6	6(6)	Health and Safety Officer	Contractor
7	7(1)	Person to Carry Out Risk Assessment	Contractor
8	7(4)	Trainer/Instructor	Contractor
9	8(1)(a)	Fall Protection Planner	Contractor
10	10(a)	Formwork & Support Work Supervisor.	Contractor
11	10(e) + (f)	Formwork & Support Work Examiner	Contractor
12	11(1)	Excavation Supervisor	Contractor
13	11(3)(b)(ii)(b)	Professional Engineer or Technologist	Contractor

14	11(3)(k) & 12(11)	Explosives Expert (If needed)	Contractor
15	12(1)	Supervisor Demolition Work	Contractor
16	12(2) + (3)	Demolition Expert	Contractor
17	14(2)	Scaffold Supervisor	Contractor
18	15(1)	Suspended Platform Supervisor	Contractor
19	15(2)(c)	Compliance Plan Developer	Contractor
20	15(8)(c)	Suspended Platform Expert	Contractor
21	15(13)	Outrigger Expert	Contractor
22	17(8)(a)	Material Hoist Inspector	Contractor
23	18(1)	Batch Plant Supervisor	Contractor
24	18(7)	Batch Plant Operator	Contractor
25	19(2)(b)	Power Tool Expert	Contractor
26	19.2 (g)(i)	Power Tool Controller	Contractor
27	20(f)	Tower Crane Operator	Contractor
28	21(1)(d)(1)	Construction Vehicle and Mobile Plant Operator	Contractor
29	21(1)(j)	Construction Vehicle and Mobile Plant Inspector	Contractor
30	22(d)	Temporary Electrical Installations	Contractor
31	22(e)	Temporary Electrical Installations Controller	Contractor
32	26 a	Stacking and Storage Supervisor	Contractor
33	27(h)	Fire Equipment Inspector	Contractor

1. LIST OF RECORD KEEPING RESPONSIBILITIES

ITEM	CR	RECORD TO BE KEPT	RESPONSIBLE PERSON
1	3(3)	Notification to Provincial Director - Annexure A Available on site	Principal Contractor
2	4(3)	Copy of Principal Contractor's Health & Safety Plan Available on request	Client
3	5(6)	Copy of Principal Contractor's Health & Safety Plan As well as each Contractor's Health & Safety Plan Available on request	Principal Contractor
4	5 7	Health and Safety File opened and kept on site (including all documentation required in terms of the Act & Regulations) Available on request	Every Contractor
5	5(8)	Consolidated Health and Safety File handed to Client on completion on Construction work. To include all documentation required in terms of the Act & Regulations and records of all drawings, designs, materials used and similar information on the structure	Principal Contractor
6	5(9)	Comprehensive and Updated List of all Contractors on site, the agreements between the parties and the work being done Included in Health and Safety file and available on	Principal Contractor
7	6(7)	Keep record on the Health and Safety File of the input by Construction Safety Officer [CR 6 (7)] at design stage or on the Health and Safety Plan	Contractor
8	7(2)	Risk Assessment - Available on site for inspection	Contractor
9	7(9)	Proof of Health and Safety Induction Training	Every employer on site
10	8(3)	Construction Supervisor [CR 6(1)] has latest updated version of Fall Protection Plan [CR 8(1)]	Contractor
11	9(2)(b)	Inform contractor in writing of dangers and hazards relating to construction work	Designer of structure
12	9(3)	All drawings pertaining to the design of structure on site available for inspection	Contractor
13	9(4)	Record of inspections of the structure [First 2 years -once every 6 months, thereafter yearly] - Available on request	Owner of Structure
14	9(5)	Maintenance records - safety of structure - Available on request	Owner of Structure

15	10(d)	Drawings pertaining to the design of formwork/support work structure - Kept on site, available on request	Contractor
16	11(3)(h)	Record of excavation inspection - On site available on request	Contractor
17	15(11)	Suspend Platform inspection and performance test records Kept on site available, on request	Contractor
18	17(8)(c)	Material Hoist daily inspection entered and signed in record book kept on the premises	Contractor
19	17(8)(d)	Maintenance records for Material Hoist - Available on site	Contractor
20	18(9)	Records of Batch Plant maintenance and repairs on site available for inspection	Contractor
21	19(2)(g)(ii)	Issuing and collection of cartridges and nails or studs (Explosive Powered Tools) recorded in register - recipient signed for receipt as well as return	Contractor
22	21(1)(j)	Findings of daily inspections (prior to use) of Construction Vehicles and Mobile Plant	Contractor
23	22(d)	Record of temporary electrical installation inspections [once a week] and electrical machinery [daily before use] in a register and kept on site	Contractor
24	27(l)	Fire Evacuation Plan	Contractor

2. INSPECTION CHECKLISTS

Employer Particulars	
Employer:	
Registered Name of Enterprise:	
Trade Name of Enterprise:	_
Company Registration No.:	_
SARS Registration No.:	_
U1F Registration No.:	_
CO1DA Registration No.:	
Relevant SETA for EEA purposes:	
Industry Sector:	
Bargaining Council:	
Contact Person:	
Address of Premises:	
Postal Address:	
Telephone Number:	
Fax Number:	
E-mail Address:	
Chief Executive Officer:	
Chief Executive Officer Address:	

Competent Person:	
Maximum power demand: in KW	
Health and Safety Representatives:	
Activities, products manufactured and/ services rendered:	
Raw materials, materials and chemical/ biological substances:	
Total Number of Employees:	**Male:** **Female:**

Contractor Particulars	
CONTRACTOR NAME:	
WCA / FEMA NUMBER:	
H&S PLAN:	
RISK ASSESSMENTS:	
H&S FILE IS KEPT WHERE:	
CONTRACTS MANAGER:	
MANAGING DIRECTOR/CEO:	
COMPETENT PERSONS:	
OHSA 16.2 CEO DELEGATION	
C R 1 4 : SCAFFOLDING:	
C R 1 5 : SUSPENDED SCAFFOLDING:	
CR17 6: MATERIAL HOISTS:	
CR18(1): BATCH PLANT:	
CR8(1)(A): FALL PROTECTION:	
CR11(1)(1): EXCAVATION WORK:	
CR12: DEMOLITION WORK:	
CR19(2)(B): EXPLOSIVE POWER TOOLS	
CR27(A): STACKING	

INSPECTION				
SECTION	ITEM CHECKED	N/A	YES	NO
CR6(1)	APPOINTMENTS			
CR6(2)	Supervisor:			
S17(1)	Assistant Supervisor:			
S19(1)	Health & Safety Representative: (ratio)			
CR 12(1)	Health & Safety Committees			
	Demolition Director			
	DOCUMENTS			
	Records of Incidents			
	Copy of the Act			
	Safety Reps Report			
	Safety Committee Minutes			
	Lifting Machinery Log (Crane)			

	Notification of Construction Work			
	Risk Assessment			
	Proof of the Health & Safety Induction Training			
	Inspection of Excavation (Records)			
	Crane Operator Medical Certificate			
	Mobile Plant Operator Medical Certificate			
	Batch Plant Repairs & Maintenance Records			
	Temporary Electrical Installation Record			
	Health & Safety File			
	Suspended Platforms' Performance Records			
	Material Hoist Record Book			
	Scaffolding Log Book			
	Medical Certificate of Fitness			
	Construction Vehicle & Mobile Plant Register			
	Electrical Installation & Machinery Register			
	INCIDENTS			
	Reported			
	Recorded Investigated Action Taken			
	PUBLIC SITE			
	Sanitary Facilities			
	Changing facilities for each sex			
	Perimeter fence & no admittance			
	Overhead protection netting/falling objects			
	Pedestrian warning			
	PERSONAL SAFETY EQUIPMENT			
	Items Issued:			
	Items Required:			
	(What is the payment on each item?)			
	SAFETY PLANS			
	FIRST AID			
	Name(s) of First Aider(s)			
	Client's Health & Safety Specification			
	Principal's contractor H&S Plan			
	FIRE HAZARD & PRECAUTIONS			
	Flammables used, waste, hot work, diesel, fuel, gas			
	Portable Extinguishers			
	ELECTRICAL INSTALLATIONS & MACHINERY			
	Guarding & PPE to Electrical Installations			
	ILLUMINATION			
	Dangerous Places and signage as well			
	HOUSEKEEPING			

ADDITIONAL SPECIFICATION

SN **IMPLEMENTATION OF LABOUR-INTENSIVE INFRASTRUCTURE PROJECTS UNDER THE EXPANDED PUBLIC WORKS PROGRAMME (EPWP)**

CONTENTS

SN 01 SCOPE

SN 02 TERMINOLOGY AND DEFINITIONS

SN 03 APPLICABLE LABOUR LAWS

SN 04 EMPLOYMENT OF UNSKILLED AND SEMI-SKILLED WORKERS IN LABOUR INTENSIVE WORKS

SN 05 TRAINING OF EPWP WORKERS

SN 06 CONTRACTUAL OBLIGATIONS IN RELATION TO LABOUR

SN 07 SETTING OF RATE OF PAY

SN 08 GENERIC LABOUR INTENSIVE SPECIFICATION

SN 09 REPORTING

SN 10 MEASUREMENTS AND PAYMENT

SN 01 SCOPE

This project is part of the Expanded Public Works Programme and aims to alleviate and reduce unemployment. EPWP will achieve this aim through the provision of work opportunities as part of the project. EPWP workers will be recruited and trained in skills relevant to the work to be done on this project. These workers will be employed by the Contractor as part of this project so that they can gain work experience on these projects. The Contractor will be required to manage, supervise and report on the EPWP workers, monthly for a period of 36 months. Furthermore the Contractor will be required to supervise these EPW workers to ensure that the work they perform is of the required standard.

Labour-intensive infrastructure projects under the EPWP include:

- using labour intensive construction methods to provide employment opportunities to local unemployed people;
- providing training or skills development to those locally employed workers; □ building cost-effective and quality assets.

The employment of locally employed temporary workers on all EPWP labour intensive infrastructure projects must be in accordance With the Code of Good Practice for the Employment and Conditions for Expanded Public Works Programmes Issued in terms of the Basic Conditions of Employment Act, 1997 (Act N°75 of 1997).

SN 02 TERMINOLOGY AND DEFINITIONS

SN 02.01 TERMINOLOGY

(a) BY HAND	Refers to the use of tools which are manually operated and powered
(b) EPWP	Expanded Public Works Programme, a National Programme of the government of South Africa, approved by Cabinet
(c) DOL	Department of Labour, Labour-intensive refers to methods of construction involving a mix of machines and labour, where labour, utilising hand tools and light plant and equipment, is preferred to the use of heavy machines, where technically and economically feasible.(Note: The normal emphasis on the cost-effectiveness and r l quality of the asset must be retained).
(d) Public body	Refers to a department, trading entity, constitutional institution, municipality, public entity or municipal entity.
(e) Scope of work	Refers to a specification and description of the services or construction works which are to be provided and any other requirements and constraints relating to the manner in which the contract is to be performed

SN 02.02 DEFINITIONS

(a) "employer" means the contractor or any party employing the worker / beneficiary under the EPWP Programme.

(b) "client" means the Department of Public Works.

(c) " worker" means any person working or training in an elementary occupation on an EPWP.

SN 03 APPLICABLE LABOUR LAWS

In line with the Expanded Public Works Programme (EPWP) policies, the Code of Good Practice for Employment and Conditions of Work for Expanded Public Works Programmes read in conjunction with a Ministerial Determination for Expanded Works Programmes issued by the Minister of Labour in terms of Section 50(1) of the Basic Conditions of Employment Act of 1997 of which extracts have been reproduced below in clauses SN 04, shall apply to , works described in the scope of work and which are undertaken by unskilled or semi-skilled workers.

SN 04 EMPLOYMENT OF UNSKILLED AND SEMI-SKILLED WORKERS IN LABOUR INTENSIVE WORKS

SN 04.01 REQUIREMENTS FOR THE SOURCING AND ENGAGEMENT OF LABOUR

The beneficiaries of the programmes should be locally-based (as close to the project site as possible) individuals prepared to work on the specific EPWP.

In order to spread the benefits as broadly as possible in the community, a maximum of one person per household should be employed, taking local available labour into account.

Workers from other areas may be employed if they have skills that are required for a project and there are not enough persons in the local communities who have those skills or who could undergo appropriate skills training. However, workers from other communities should not exceed 20% of all persons working on a programme. A proper skills audit should be conducted, where possible, in an area where an EPWP is in operation.

Programmes should set participation targets for employment with respect to women, youth, and people with disabilities.

The proposed targets are:

- 55% women;
- 40% youth from 16 to 35 years of age; and
- 2% people with disabilities

EPWPs should seek to achieve these targets in all occupational categories. Persons under sixteen years of age may not be employed on EPWP.

SN 04.02 SPECIFIC PROVISIONS PERTAINING TO SANS 1914-5

Definitions

Targeted labour: Unemployed persons who are employed as local labour on the project.

Contract participation goals

- The specified contract participation goal for the contract is stated in the Scope of Works. The contract participation goal shall be measured in the performance of the contract to enable the employment provided to targeted labour to be quantified.
- The wages and allowances used to calculate the contract participation goal shall, with respect to both time—rated and task rated workers, comprise all wages paid and any training allowance paid in respect of agreed training programmes.
- Further to the provisions of clause 3.3.2 of SANS 1914.5, written contracts shall been entered into with targeted labour.

The definition for net amount shall be amended as follows:

- Financial value of the contract upon completion, exclusive of any value added tax or sales tax which the law requires the employer to pay the contractor.

SN 05 TRAINING OF EPWP WORKERS

The contractor shall provide all the necessary on-the—job training to targeted labour to enable such labour to master the basic work techniques required to undertake the work in accordance with the requirements of the contract in a manner that does not compromise worker health and safety.

Three types of training are applicable, namely

- Life skills;
- On the job training;
- First Aid training;
- Technical Skills training.

Training will be implemented by training instructors accredited by DOL and/or CETA:

- EPWP workers shall be employed on the projects for a minimum period of 12 months.
- EPWP workers shall be deployed on projects in the vicinity of their homes. The same arrangements as for other workers regarding accommodation, subsistence and travel shall be applicable to EPWP workers.

(a) The contractor shall provide all the necessary on-the-job training to targeted labour to enable such labour to master the basic work techniques required to undertake the work in accordance with the requirements of the contract in a manner that does not compromise worker health and safety.

(b) The cost of the formal training of targeted labour, will be funded by the provincial office of the Department of Labour. This training should take place as close to the project site as practically possible. The contractor, must access this training by informing the relevant provincial office of the Department of Labour in writing, within 14 days of being awarded the contract, of the likely number of persons that will undergo training and when such training is required. The employer must be furnished with a copy of this request.

(c) A copy of this training request made by the contractor to the DOL provincial office must also be faxed to the EPWP Training Director in the Department of Public Works — Cinderella Makunike, Fax Number 012 328 6820 or email cinderella.makunike@dpw.gov.za Tel: 083 677 4026

(d) The contractor shall be responsible for scheduling the training of workers and shall take all reasonable steps to ensure that each beneficiary is provided with a minimum of six (6) days of formal training if he/she is employed for 3 months or less and a minimum of ten (10) days if he/she is employed for 4 months or more.

(e) The contractor shall do nothing to dissuade targeted labour from participating in the above mentioned training programmes.

(f) An allowance equal to 100% of the task rate or daily rate shall be paid by the contractor to workers who attend formal training, in terms of (d) above.

(g) Proof of compliance with the requirements of (a) to (e) must be provided by the Contractor to the Employer prior to submission of the final payment certificate.

SN 06 CONTRACTUAL OBLIGATIONS IN RELATION TO LABOUR

The EPWP workers to be employed in the programme (EPWP) shall be directly contracted to the Contractor. Over and above the construction and project management responsibilities, the contractor will be expected to perform the tasks and responsibilities as set out in this specification. Implementation of labour intensive practices under the Expanded Public Works Programme (EPWP) is required to a value of not less than 10% of the tendered contract amount for wages paid to local labour.

SN 07 PAYMENT OF WORKERS

Employers must pay workers at least the minimum rate as stipulated in the Ministerial Determination: Expanded Public Works Programme.

Workers can be paid on the basis of the number of tasks completed. These workers are referred to as "task-rated workers". Alternatively, workers can be paid on a daily rate.

There are jobs where it is not possible to pay workers on the basis of tasks performed. These workers must be paid on the basis of the amount of time they worked. They are referred to as "time-rated workers".

On the task-based system, a worker is paid for each task completed or part thereof.
If workers are informed a day before that work will not take place the next day, they should not be entitled to any payment.

Workers will be paid a training allowance in case they are required to attend agreed training programmes. This should be equal to 100% of the daily task rate for task-rate workers or 100% of the daily rate of pay for time-rated workers. All the costs of training will be covered, for example, travel, trainers, material, tuition fees.

Where a worker participates in a learnership, the relevant learnership determination must be used to determine the training allowance whilst on training.

Each worker must be given written particulars of employment and verbal explanations in an appropriate language of their rate of pay and how this is to be calculated.
Where a project is completed earlier than anticipated the worker should receive the full agreed remuneration for the stipulated period of the contract if the pay for the task was to be calculated on the basis of time. Where such work was to be performed on a task-based system, the full agreed remuneration for the task should be paid for early completion.

SN 07.01 PENALTY FOR NON-ACHIEVEMENT OF LOCAL LABOUR TARGET (LLT)

The Contractor will be assessed on a quarterly basis in the event that the Contractor fails to substantiate that any failure to achieve the Local Labour Target (LLT) was due to quantitative underruns, the elimination of items, or any other reason beyond the Contractor's control which may be acceptable to the Employer, the Contractor shall pay to the Employer penalties (P) in an amount determined in accordance with the following formula:

$$\mathbf{P=}\ I \times \frac{(0 - Do)}{(100)} \times NA$$

Where D = tendered Local Labour Target (LLT) percentage.

Do = the Local Labour Target (LLT) which the Employer's Representative, based on the

credits passed, certifies as being achieved upon completion of the Contract.

NA = Net Amount, being Tender Sum excluding VAT and CPA

P = Rand value of penalty payable

SN 08 GENERIC LABOUR INTENSIVE SPECIFICATION

The Generic Labour-intensive specification below is the same as SANS 1921-5, Construction and management requirement for works contracts- Part 5: Earthworks activities which are to be performed by hand and should be included in the scope of works without amendment or modification as set out below.

SN 08.01 SCOPE

This specification establishes general requirements for activities which are to be executed by hand involving the following:

a) Trenches having a depth of less than 1.5 metres
b) Cleaning of storm water drainage
c) Cleaning of roads and sidewalks
d) Clearing of fence routes
e) Cleaning and site keeping
d) Cleaning of buildings

SN 08.02 PRECEDENCE

Where this specification is in conflict with any other standard or specification referred to in the Scope of Works to this Contract, the requirements of this specification shall prevail.

SN 08.03 HAND EXCAVATEABLE MATERIAL

Hand excavateable material is material:

a) granular materials:
   i. whose consistency when profiled may in terms of table 1 be classified as very loose, loose, medium dense, or dense; or
   i) where the material is a gravel having a maximum particle size of 10mm and contains no cobbles or isolated boulders, no more than 15 blows of a dynamic cone penetrometer is required to penetrate 100mm;
b) cohesive materials:
   i. whose consistency when profiled may in terms of table 1 be classified as very soft, soft, firm, stiff and stiff / very stiff; or
   ii. where the material is a gravel having a maximum particle size of 10 mm and contains no cobbles or isolated boulders, no more than 8 blows of a dynamic cone penetrometer is required to penetrate 100 mm; **Note:**
      i. A boulder, a cobble and gravel is material with a particle size greater than 200 mm, between 60 and 200 mm.
      ii. A dynamic cone penetrometer is an instrument used to measure the in-situ shear resistance of a soil comprising a drop weight of approximately 10 kg which falls through a height of 400 mm and drives a cone having a maximum diameter of 20 mm (cone angle of 60°with respect to the horizontal) into the material being used.

SN 08.04 TRENCH EXCAVATION

All hand excavateable material in trenches having a depth of less than 1,5 metres shall be excavated by hand.

SN 08.05 COMPACTION OF BACKFILLING TO TRENCHES (AREAS NOT SUBJECT TO TRAFFIC)

Backfilling to trenches shall be placed in layers of thickness (before compaction) not exceeding 100mm. Each layer shall be compacted using hand stampers

a) to 90% Proctor density;

b) such that in excess of 5 blows of a dynamic come penetrometer (DCP) is required to penetrate 100 mm of the backfill, provided that backfill does not comprise more than 10% gravel of size less than 10mm and contains no isolated boulders, or

c) such that the density of the compacted trench backfill is not less than that of the surrounding undisturbed soil when tested comparatively with a DCP.

08.06 EXCAVATION

All hand excavateable material including topsoil classified as hand excavateable shall be excavated by hand. Harder material may be loosened by mechanical means prior to excavation by hand.

The excavation of any material which presents the possibility of danger or injury to workers shall not be excavated by hand.

SN 08.07 CLEARING AND GRUBBING

Grass and small bushes shall be cleared by hand.

SN 08.8 SHAPING

All shaping shall be undertaken by hand.

SN 08.09 LOADING

All loading shall be done by hand, regardless of the method of haulage.

SN 08.10 HAUL

Excavation material shall be hauled to its point of placement by means of wheelbarrows where the haul distance is not greater than 150 m.

SN 08.11 OFFLOADING

All material, however transported, is to be off- loaded by hand, unless tipper-trucks are utilised for haulage

SN 08.12 SPREADING

All material shall be spread by hand.

SN 08.13 COMPACTION

Small areas may be compacted by hand provided that the specified compaction is achieved.

SN 08.14 GRASSING

All grassing shall be undertaking by sprigging, sodding, or seeding by hand.

SN 08.15 STONE PITCHING AND RUBBLE CONCRETE MASONRY

All stone required for stone pitching and rubble concrete masonry, whether grouted or dry, must to be collected, loaded, off loaded and placed by hand. Sand and stone shall be hauled to its point of placement by means of wheelbarrows where the haul distance is not greater than 150 m. Grout shall be mixed and placed by hand.

SN 08.16 MANUFACTURED ELEMENTS

Elements manufactured or designed by the Contractor, such as manhole rings and cover slabs, precast concrete planks and pipes, masonry units and edge beams shall not individually, have a mass of more than 320 kg. In addition the items shall be large enough so that four workers can conveniently and simultaneously acquire a proper hand hold on them.

SN 08.17 ROADS

The following operations may be carried out using labour intensive methods:

1. Site clearance
2. Layer work construction including loading, hauling and spreading material.

Note: All compaction should be done using conventional compaction equipment and where necessary the use of heavy machinery may be employed to loosen material for excavation by hand. Where significant use of blasting is indicated, then the Works are probably not suitable for labour intensive methods.

3. Where higher standards of roads are to be constructed then the following operations may be included:

- Macadam base course either dry, water bound or emulsion bound; foamed bitumen gravel; emulsion treated gravel; or slurry bound or composite macadams.
- Application of bitumen bound surface treatment (cold) including spreading and dragging of chips.
- Slurry treatments to existing or new road surfaces.
- In situ concrete roads
- Segmented block paved roads.
- Cast in-situ block pavements (hyson-cells);
- Road markings.

4. Fencing.
5. Erection of road signs.
6. Grass maintenance.
7. Road reserve maintenance.
8. Rubble masonry bridges, culverts and retaining walls

SN 08.18 STORM WATER

The following operations may be constructed using labour intensive construction methods:

1. Gabions and Reno mattresses.
2. Small diameter pre-cast concrete elements (pipes and arches).
3. Grassed or lined water channels

08.19 SEWERS

The following operations may be constructed using labour intensive construction methods:

1. Sewer manholes either in brickwork or using specially manufactured pre-cast manhole rings (individual mass less than 320 kg).
2. Sewer manhole covers and lids using specially designed pre-cast units.
3. Maturation or flocculation ponds with least dimension not exceeding 100m.

SN 08.20 WATER

The following operations may be constructed using labour intensive construction methods:

1. Laying of water pipelines, fittings and house connections in all materials (including steel) where the mass of individual pipe lengths does not exceed 320 kg.
2. Construction of ferro-cement reservoirs.
3. Excavation for membrane lined and floating roof reservoirs.
4. Construction of small masonry reservoirs.
5. Spring and well protection measures

SN 08.21 HAUL OF MATERIAL

Where the haul of any material exceeds 200 m, consideration should be given to the use of local resources for transporting material. This includes the use of animal drawn vehicles and small trailer combinations utilising locally sourced tractors. All loading and offloading can be done by hand.

SN 08.22 ELECTRICITY

The following operations may be constructed using labour intensive methods:
1. Excavation of trenches for reticulation of all voltages.
2. Excavation for and erection of poles for overhead lines.
3. Installation of all electricity cables (joints and terminations by qualified persons).

SN 08.23 BILL OF QUANTITIES

Labour-intensive works is highlighted in the bills of quantities for the payment items relating to labour-intensive works (LI).

SN 09 REPORTING

The Consultant shall, before certifying a contractor's payment certificate, ensure that the contractor has submitted labour information in a format and timeframe specified by the employer. If the information submitted by the contractor is inadequate the consultant shall not submit the payment certificate to the employer for payment.

The Contractor's payment invoices shall be accompanied by labour information for the corresponding period in a format specified by the employer. If the contractors chooses to delay submitting payment invoices, labour returns shall still be submitted as per frequency and timeframe stipulated by the Employer. The contractor's invoices shall not be paid until all pending labour information has been submitted

SN 10 MEASUREMENTS AND PAYMENT

The number of EPWP workers specified for this contract that will receive orientation and life skills development training is 15 and technical training is 15

SN 10.01 PAYMENT FOR EMPLOYMENT AND TRAINING OF EPWP WORKERS (TARGET: - 15 EPWP WORKERS)

Labour-intensive works is highlighted in the bills of quantities for the payment items relating to labour-intensive works (LI).

SN 10.01.01 Orientation and Life Skills development training for EPWP workers for an average of 10 days per EPWP worker Unit: PC Sum

SN 10.01.02 Technical skills training for EPWP workers for an average of 20 days per EPWP worker Unit: PC Sum

SN 10.01.03 First Aid Level 1 training for EPWP workers for an average of 5 days per EPWP worker Unit: PC Sum

SN 10.01.04 Profit and attendance for administration of items 1 and 2 above Unit: percentage (%)

SN 10.02 PAYMENT FOR TRAVELING OF EPWP WORKERS

SN 10.02.01 Travelling (based on return trip/EPWP worker) .....Unit: worker/ day

SN

The unit of measurement shall be the number of EPWP workers transported from the nearest local community to the work place and back on a daily basis. The tendered shall allow for the cost of each worker to be able to safely reach the work place and travel back each day and shall be measured as a number for each worker per day.

10.03 EMPLOYMENT OF EPWP WORKERS

SN 10.03.01 Employment of EPWP workers Unit: PC Sum

The unit of measurement shall be the number of EPWP workers at the labour rate of comparable unskilled work in the local area alternatively a minimum R 1 734 per month as the amount indicated in the Ministerial Determination 4: EPWP, dated 01 November 2015, Clause 14.2: Minimum of R78.86 per day multiplied by the period employed in months and the rate tendered shall include full compensation for all costs associated with the employment of EPWP workers and for complying with the conditions of contract. The cost for the training shall be excluded from this item. This item is based on a 24 months appointment for EPWP workers.

SN 10.03 PROVISION OF EPWP DESIGNED OVERALLS AND HARD HATS AND SAFETY BOOTS (PPE) TO EPWP WORKERS

SN 10.04.01 Supply 2 x EPWP branded overalls to each EPWP worker Unit: PC. Sum

SN 10.04.02 Supply 1 x EPWP branded hard hat to each EPWP worker Unit: PC.Sum

SN 10.04.03 Supply 1 x pair of safety boots to each EPWP worker Unit: PC.Sum

SN 10.04.04 Profit and attendance for administration of items 1, 2 and 3 above Unit: %

EPWP worker overalls should be orange (top and bottom) as per EPWP branding specification with the exception of Correctional Services contracts where the overalls should be blue (top and bottom). A minimum of two overalls per EPWP worker should be blue (top and bottom). A minimum of two overalls per EPWP worker should be supplied. Hard hats should be orange and branded as per the EPWP branding specification.

An amount has been provided in the Schedule of Quantities under sub item SM 11.04.01 and SM 11.04.02 for the supply of EPWP designed overalls and hard hat, as per the EPWP branding specification provided by the EPWP unit. The tendered percentage under sub items SM 10.05.02 will be paid to the contractor on the value of each payment pertaining to the supply of overalls and hard hats and safety boots to cover his expenses in this regard.

ADDITIONAL SPECIFICATION

SL EMPLOYMENT AND TRAINING OF YOUTH WORKERS ON THE EXPANDED PUBLIC WORKS PROGRAMME (EPWP) INFRASTRUCTURE PROJECTS: NATIONAL YOUTH SERVICE (NYS)

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SL 01

SCOPE

This project is part of the Expanded Public Works Programme and the National Youth Service Programme (NYS) and aims to train young people and provide them with practical work experience as part of this programme. Youth aged between 18 and 35 will be recruited and trained in skills relevant to the work to be done on this project. These youth will have to be employed by the contractor as part of this project so that they can gain their work experience on these projects. The training of the youth will be coordinated and implemented by a separate service provider. This service provider will provide the contractor with a list of all the youth and the training each of these youth have received. The Contractor will be required to employ all of these youth for a minimum period of 6 months. Furthermore the Contractor will be required to supervise these youth to ensure that the work they perform is of the required standard. The contractor's staff will be required to assist and mentor the youth to ensure that they are able to perform the type of work they need to do to the satisfactory standards required. The contractor will not be required to employ all youth in the programme at the same time, but may rotate the youth on the project, as long as all youth are employed for the minimum duration stated earlier

This specification contains the standard terms and conditions for workers employed in elementary occupations and trained on a Special Public Works Programme (SPWP) for the National Youth Services Programme. These terms and conditions do NOT apply to persons employed in the supervision and management of a SPWP.

SL 02 TERMINOLOGY AND DEFINITIONS

SL 02.01 TERMINOLOGY

(a)

(b)	EPWP	The Code of Good Practice for Expanded Public Works Programmes, which has been gazetted by the Department of Labour, and which provides for special conditions of employment for these EPWP projects. In terms of the Code of Good Practice, the workers on these projects are entitled to formal training, which will be provided by training providers appointed (and funded) by the Department of Labour. For projects of up to six months in duration, this training will cover life-skills and information about other education, training and employment opportunities.
(c)	EPWP	Expanded Public Works Programme, a National Programme of the government of South Africa, approved by Cabinet.
(d)	NYDA	National Youth Development Agency.
	DOL	Department of Labour.

SL 02.02 **DEFINITIONS**

(a)	"employer"	means the contractor or any party employing the worker / beneficiary under the EPWP – NYS Programme. means the Department of Public Works.
(b)	"client"	
(c)		" worker / trainee" means any person working or training in an elementary occupation on a EPWP.

SL 03 **APPLICABLE LABOUR LAWS**

In line with the Expanded Public Works Programme (EPWP) policies, the Ministerial Determination, Special Public Works Programmes, issued in terms of the Basic Conditions of Employment Act of 1997 by the Minister of labour in government Notice No. R63 of 25 January 2002, of which extracts have been reproduced below in

clauses SL 04, shall apply to works described in the scope of work and which are undertaken by unskilled or semi-skilled workers.
The Code of Good Practise for Employment and Conditions of Work for Special Public Works Programmes, issued in terms of the Basic Conditions of Employment Act of 1997 by the Minister of Labour in Government Notice No. R64 of 25 January 2002 shall apply to works described in the scope of work and which unskilled or semi-skilled workers undertake.

SL 04 EXTRACTS FROM MINISTERIAL DETERMINATION REGARDING SPWP

SL 04.01 DEFINITIONS

In this specification –

(a) "department" means any department of the State, implementing agent or contractor;

(b) "employer" means any department that hires workers to work in elementary occupations on a SPWP;

(c) "worker" means any person working in an elementary occupation on a SPWP;

(d) "elementary occupation" means any occupation involving unskilled or semi- skilled work;

(e) "management" means any person employed by a department or implementing agency to administer or execute a SPWP;

(f) "task" means a fixed quantity of work;

(g) "task-based work" means work in which a worker is paid a fixed rate for performing a task;

(h) "task-rated worker" means a worker paid on the basis of the number of tasks completed;

(i) "time-rated worker" means a worker paid on the basis of the length of time worked

(j) "Service Provider" means the consultant appointed by Department to coordinate and arrange the employment and training of labour on EPWP infrastructure projects.

SL 04.02 TERMS OF WORK

(a) Workers on a SPWP are employed on a temporary basis.

(b) A worker may NOT be employed for longer than 24 months in any five-year cycle on a SPWP.

(c) Employment on a SPWP does not qualify as employment and a worker so employed does not have to register as a contributor for the purposes of the Unemployment Insurance Act 30 of 1966.

SL 04.03 NORMAL HOURS OF WORK

(a) An employer may not set tasks or hours of work that require a worker to work–

(i) more than forty hours in any week (ii)

on more than five days in any week; and

(iii) for more than eight hours on any day.

(b) An employer and a worker may agree that the worker will work four days per week. The worker may then work up to ten hours per day.

(c) A task-rated worker may not work more than a total of 55 hours in any week to complete the tasks (based on a 40-hour week) allocated to him.

Every work is entitled to a daily rest period of at least eight consecutive hours. The daily rest period is measured from the time the worker ends work on one day until the time the worker starts work on the next day.

SL 04.04 MEAL BREAKS

(a) A worker may not work for more than five hours without taking a meal break of at least thirty minutes duration.

(b) An employer and worker may agree on longer meal breaks.

(c) A worker may not work during a meal break. However, an employer may require a worker to perform duties during a meal break if those duties cannot be left unattended and cannot be performed by another worker. An employer must take

reasonable steps to ensure that a worker is relieved of his or her duties during the meal break.

(d) A worker is not entitled to payment for the period of a meal break. However, a worker who is paid on the basis of time worked must be paid if the worker is required to work or to be available for work during the meal break.

SL 04.05 SPECIAL CONDITIONS FOR SECURITY GUARDS

(a) A security guard may work up to 55 hours per week and up to eleven hours per day.

(b) A security guard who works more than ten hours per day must have a meal break of at least one hour duration or two breaks of at least 30 minutes duration each.

SL 04.06 DAILY REST PERIOD

Every worker is entitled to a daily rest period of at least eight consecutive hours. The daily rest period is measured from the time the worker ends work on one day until the time the worker starts work on the next day.

SL 04.07 WEEKLY REST PERIOD

Every worker must have two days off every week. A worker may only work on their day off to perform work which must be done without delay and cannot be performed by workers during their ordinary hours of work ("emergency work").

SL 04.08 WORK ON SUNDAYS AND PUBLIC HOLIDAYS

(a) A worker may only work on a Sunday or public holiday to perform emergency or security work.

(b) Work on Sundays is paid at the ordinary rate of pay.

(c) A task-rated worker who works on a public holiday must be paid –

(i) the worker's daily task rate, if the worker works for less than four hours;

(ii) double the worker's daily task rate, if the worker works for more than four hours.

(d) A time-rated worker who works on a public holiday must be paid –

(i) the worker's daily rate of pay, if the worker works for less than four hours on the public holiday;

(ii) double the worker's daily rate of pay, if the worker works for more than four hours on the public holiday.

SL 04.09 <u>SICK LEAVE</u>

(a) Only workers who work four or more days per week have the right to claim sick- pay in terms of this clause.

(b) A worker who is unable to work on account of illness or injury is entitled to claim one day's paid sick leave for every full month that the worker has worked in terms of a contract.

(c) A worker may accumulate a maximum of twelve days' sick leave in a year.

(d) Accumulated sick-leave may not be transferred from one contract to another contract.

(e) An employer must pay a task-rated worker the worker's daily task rate for a day's sick leave.

(f) An employer must pay a time-rated worker the worker's daily rate of pay for a day's sick leave.

(g) An employer must pay a worker sick pay on the worker's usual payday.

(h) Before paying sick-pay, an employer may require a worker to produce a certificate stating that the worker was unable to work on account of sickness or injury if the worker is –

(i) absent from work for more than two consecutive days; or

(ii) absent from work on more than two occasions in any eight-week period.

(i) A medical certificate must be issued and signed by a medical practitioner, a qualified nurse or a clinic staff member authorised to issue medical certificates indicating the duration and reason for incapacity.

(j) A worker is not entitled to paid sick-leave for a work-related injury or occupational disease for which the worker can claim compensation under the Compensation for Occupational Injuries and Diseases Act.

SL 04.10 <u>MATERNITY LEAVE</u>

(a) A worker may take up to four consecutive months' unpaid maternity leave.

(b) A worker is not entitled to any payment or employment-related benefits during maternity leave.

(c) A worker must give her employer reasonable notice of when she will start maternity leave and when she will return to work.

(d) A worker is not required to take the full period of maternity leave. However, a worker may not work for four weeks before the expected date of birth of her child or for six weeks after the birth of her child, unless a medical practitioner, midwife or qualified nurse certifies that she is fit to do so.

(e) A worker may begin maternity leave –

(i) four weeks before the expected date of birth; or

(ii) on an earlier date –

(1) if a medical practitioner, midwife or certified nurse certifies that it is necessary for the health of the worker or that of her unborn child; or

(2) if agreed to between employer and worker; or

(iii) on a later date, if a medical practitioner, midwife or certified nurse has certified that the worker is able to continue to work without endangering her health.

(f) A worker who has a miscarriage during the third trimester of pregnancy or bears a stillborn child may take maternity leave for up to six weeks after the miscarriage or stillbirth.

(g) A worker who returns to work after maternity leave, has the right to start a new cycle of twenty-four months employment, unless the SPWP on which she was employed has ended.

SL 04.11 <u>FAMILY RESPONSIBILITY LEAVE</u>

(a) Workers, who work for at least four days per week, are entitled to three days paid family responsibility leave each year in the following circumstances -

(i) when the employee's child is born;

(ii) when the employee's child is sick;
(iii) in the event of the death of –

(1) the employee's spouse or life partner

(2) the employee's parent, adoptive parent, grandparent, child, adopted child, grandchild or sibling

SL 04.12 STATEMENT OF CONDITIONS

(a) An employer must give a worker a statement containing the following details at the start of employment –

(i) the employer's name and address and the name of the SPWP;

(ii) the tasks or job that the worker is to perform;

(iii) the period for which the worker is hired or, if this is not certain, the expected duration of the contract;

(iv) the worker's rate of pay and how this is to be calculated;

(v) the training that the worker may be entitled to receive during the SPWP.

(b) An employer must ensure that these terms are explained in a suitable language to any employee who is unable to read the statement.

(c) An employer must supply each worker with a copy of the relevant conditions of employment contained in this specification.

(d) An employer must enter into a formal contract of employment with each employee. A copy of a pro-forma is attached at the end of this specification.

SL 04.13 KEEPING RECORDS

(a) Every employer must keep a written record of at least the following –

(i) the worker's name and position;

(ii) in the case of a task-rated worker, the number of tasks completed by the worker;

(iii) in the case of a time-rated worker, the time worked by the worker;

(iv) payments made to each worker.

(b) The employer must keep this record for a period of at least three years after the completion of the SPWP.

SL 04.14 <u>PAYMENT</u>

(a) A task-rated worker will only be paid for tasks that have been completed.

(b) An employer must pay a task-rated worker within five weeks of the work being completed and the work having been approved by the manager or the contractor having submitted an invoice to the employer. Payment must be made in cash, by cheque or by direct deposit into a bank account designated by the worker.

(c) A time-rated worker will be paid at the end of each month and payment must be made in cash, by cheque or by direct deposit into a bank account designated by the worker.

(d) Payment in cash or by cheque must take place –

(i) at the workplace or at a place agreed to by at least 75% of the workers; and

(ii) during the worker's working hours or within fifteen minutes of the start or finish of work;

(e) All payments must be enclosed in a sealed envelope which becomes the property of the worker.

(f) An employer must give a worker the following information in writing –

(i) the period for which payment is made;

(ii) the number of tasks completed or hours worked;

(iii) the worker's earnings;

(iv) any money deducted from the payment;

(v) the actual amount paid to the worker.

(g) If the worker is paid in cash or by cheque, this information must be recorded on the envelope and the worker must acknowledge receipt of payment by signing for it.

(h) If a worker's employment is terminated, the employer must pay all monies owing to that worker within one month of the termination of employment.

SL 04.15 <u>DEDUCTIONS</u>

(a) An employer may not deduct money from a worker's payment unless the deduction is required in terms of a law.

(b) An employer must deduct and pay to the SA Revenue Services any income tax that the worker is required to pay.

(c) An employer who deducts money from a worker's pay for payment to another person must pay the money to that person within the time period and other requirements specified in the agreement law, court order or arbitration award concerned.

(d) An employer may not require or allow a worker to –

(i) repay any payment except an overpayment previously made by the employer by mistake;

(ii) state that the worker received a greater amount of money than the employer actually paid to the worker; or

(iii) pay the employer or any other person for having been employed.

SL 04.16 <u>HEALTH AND SAFETY</u>

(a) Employers must take all reasonable steps to ensure that the working environment is healthy and safe and that all legal requirements regarding health and safety are strictly adhered to.

(b) A worker must:

(i) work in a way that does not endanger his/her health and safety or that of any other person;

(ii) obey any health and safety instruction;

(iii) obey all health and safety rules of the SPWP;

(iv) use any personal protective equipment or clothing issued by the employer;

(v) report any accident, near-miss incident or dangerous behaviour by another person to their employer or manager.

SL 04.17 COMPENSATION FOR INJURIES AND DISEASES

(a) It is the responsibility of employers to arrange for all persons employed on a SPWP to be covered in terms of the Compensation for Occupational Injuries and Diseases Act, 130 of 1993.

(b) A worker must report any work-related injury or occupational disease to their employer or manager.

(c) The employer must report the accident or disease to the Compensation Commissioner.

(d) An employer must pay a worker who is unable to work because of an injury caused by an accident at work 75% of their earnings for up to three months. The employer will be refunded this amount by the Compensation Commissioner. This does NOT apply to injuries caused by accidents outside the workplace such as road accidents or accidents at home.

SL 04.18 TERMINATION

(a) The employer may terminate the employment of a worker provided he has a valid reason and after following existing termination procedures.

(b) A worker will not receive severance pay on termination.

(c) A worker is not required to give notice to terminate employment. However, a worker who wishes to resign should advise the employer in advance to allow the employer to find a replacement.

(d) A worker who is absent for more than three consecutive days without informing the employer of an intention to return to work will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.

(e) A worker who does not attend required training events, without good reason, will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.

SL 04.19 CERTIFICATE OF SERVICE

(a) On termination of employment, a worker is entitled to a certificate stating –

(i) the worker's full name;

(ii) the name and address of the employer;

(iii) the SPWP on which the worker worked;

(iv) the work performed by the worker;

(v) any training received by the worker as part of the SPWP;

(vi) the period for which the worker worked on the SPWP;

(vii) any other information agreed on by the employer and worker.

SL 05 EMPLOYER'S RESPONSIBILITIES

The employer shall adhere to the conditions of employment as stipulated in the *Code of Good Practice for Employment and Conditions of Work for Special Public Works Programmes*. Over and above the conditions stipulated above, he shall be responsible to:

(a) formulate and design a contract between himself/ herself and each of the recruited youth workers, ensuring that the contract does not contravene any of the Acts stipulated in South African Law, e.g. Basic Conditions of Employment Act, etc. (A copy of a pro-forma contract is attached at the end of this specification);

(b) screen and select suitable candidates for employment from the priority list of youth workers provided by the NYDA;

(c) ensure that the recruited youth workers are made available to receive basic life skills training which will be conducted and paid for by the NYDA;

(d) ensure that all youth workers receive instruction on safety on site prior to them commencing with work on site;

(e) ensure that all youth workers are covered under workmen's compensation for as long as they are contracted to the contractor. Payment to the Compensation Commissioner shall be the responsibility of the contractor;

(f) assist in the identification and assessment of potential youth workers to undergo advanced technical training in respective trades;

(g) test and implement strict quality control and to ensure that the health and safety regulations are adhered to;

(h) provide all youth workers with the necessary protective clothing as required by law for the specific trades that they are involved in.

(i) provide overall supervision and day-to-day management of youth workers and/or sub-contractors; and

(j) ensure that all youth workers are paid their wages on time through a pre-agreed payment method as stipulated in the contract with the youth worker.

SL 06 PLACEMENT OF RECRUITED YOUTH WORKERS

Employers will be contractually obliged to:

(a) employ youth workers from targeted social groups from the priority list provided by the Service Provider/ NYDA.

(b) facilitate on-the-job training and skills development programmes for the youth workers;

(c) achieve the following minimum employment targets:

(i) 100% people between the ages of 18 and 35

(ii) 60% women;

(iii) 2% people with disabilities.

(d) brief youth workers on the conditions of employment as specified in sub clause SL 04.09 above;

(e) enter into a contract with each youth worker, which contract will form part of the Employment Agreement;

(f) allow youth workers the opportunity to attend life skills training through DOL. This shall be arranged at the beginning of the contract;

(g) ensure that payments to youth workers are made as set out in sub clauses SL 04.14 and SL 04.15 above.

(h) set up of personal profile files as prescribed by Service Provider and as set out in sub clause SL 04.13 above.

(i) in addition to (h) - a copy of the I.D;
- qualifications;
- career progress; e.g.
  - Status of technical improvement,
  - Willingness to work,
  - Leadership capabilities,
  - Discipline; and

▪ Any other factors that can assist DPW-HR with the placement of the youth workers at the end of the programme

- EPWP Employment Agreement, and
- list of small trade tools;

must be included in the youth worker's personal profile file.

SL 07 TRAINING OF YOUTH WORKERS

Three types of training are applicable, namely

- Life skills;
- On the job training
- Technical Skills training.

Training will be implemented by training instructors accredited by DOL and/or CETA:

- Youth workers shall be employed on the projects for an average of 6 months.
- Youth workers shall be deployed on projects in the vicinity of their homes. The same arrangements as for other workers regarding accommodation, subsistence and travel shall be applicable to youth workers.

(a) Life skills training

All youth workers are entitled to undergo life skills training. Training of this module will be flexible enough to meet the needs of the employer. Training should take place immediately after site hand-over and during the period of site establishment and pre-planning before actual construction starts, alternatively this will be spread over the duration of the contract period. The contractor will be required to work closely with the person to schedule the training sessions so that the timing of the training is aligned with the contractors work schedule and his demand for workers.

(b) On-the job training

The Employer shall provide youth workers with on-the-job training to enable them to fulfil their employment requirements. The employer shall also be expected to closely monitor the job performance of youth workers and shall identify potential youth workers for skills development programmes.

(c) Technical skills training

The Employer shall assist in identifying youth workers for further training. These youth workers will undergo further technical training to prepare them for opportunities as semi-skilled labourers.

Such training will comprise of an off-site theoretical component and practical training on-site. The contractor will be responsible for on-site practical work under his supervision. Youth workers who graduate from the first phase of the training programme will be identified and given opportunities to register for skills development programmes. These can ultimately result in an accredited qualification. The programme will consist of theoretical instruction away from the construction site as well as on-site practical work under the supervision of the employer. Candidates will be entitled to employment to complete all training modules.

SL 08 BENEFICIARY (YOUTH WORKERS) SELECTION CRITERIA

PREAMBLE

SL 08.01

The *Code of Good Practise for Employment and Conditions of Work for Expanded Public Works Programmes* encourages:

- optimal use of locally-based labour in an Expanded Public Works Programme (EPWP);
- a focus on targeted groups which consist of namely youth, consisting of women, female-headed households, disabled and households coping with HIV/AIDS; and
- the empowerment of individuals and communities engaged in an EPWP through the provision of training.

SL 08.02 BENEFICIARY (YOUTH WORKERS) SELECTION CRITERIA

(a) The youth workers of the programmes should preferably be non-working individuals from the most vulnerable sections of disadvantaged communities who do not receive any social security pension income. The local community must, through all structures available, be informed of and consulted about the establishment of any EPWP – NYS

(b) In order to spread the benefit as broadly as possible in the community, a maximum of one person per household should be employed, taking local circumstances into account.

(c) Skilled artisans from other areas may be employed if they have skills that are required for a project and there are not enough persons in the local communities who have those skills or who could undergo appropriate skills training. However, this should not result in more than 20% of persons working on a programme not being from local communities.

(d) Programmes should set participation targets for employment with respect to youth, single male- and female-headed households, women, people with disabilities, households coping with HIV/AIDS, people who have never worked, and those in long-term unemployment.

(e) The proposed targets as set out in sub clause SL 06 (c)

- 100% youth from 18 to 35 years of age;
- 60% women;
- 2% disabled.

(e) Have Matric Certificate or a minimum Grade 10 with Maths and Science subjects.

SL 09 CONTRACTUAL OBLIGATIONS IN RELATION TO YOUTH LABOUR

The youth workers to be employed in the programme (EPWP-NYS) shall be directly contracted to the employer. Over and above the construction and project management responsibilities, the employer will be expected to perform the tasks and responsibilities as set out in clause SL 05 above.

SL 10 PROVINCIAL RATES OF PAY

It is stipulated that youth workers on the EPWP-NYS receive a minimum of R 1 735 per month whilst working and R 1 735 per month whilst on training in ALL provinces. Should youth workers be attending training whilst employed by the contractor, the contractor will still be responsible for payment to the youth worker whilst at training.

SL 11 MEASUREMENTS AND PAYMENT

The number of youth workers specified for this contract that will receive orientation, life skills development training and technical training is 15.

SL 11.01 <u>PAYMENT FOR TRAINING OF YOUTH WORKERS (TARGET: - 15 YOUTH WORKERS)</u>

SL 11.01.01 Orientation and Life Skills development training for youth workers for an average of **26** days per youth worker.....Unit: Prov.Sum

SL 11.01.02 Technical skills training for youth workers for an average of____ days per youth worker.....Unit: Prov.Sum

The above items are only applicable if DoL / NYDA do not fund the specific training.

SL 11.01.03 Payment reduction due to not meeting the target as in SL 11.01.01 and SL 11.01.02…..……..……..Unit: Youth worker **LESS R 2000 per youth worker**

SL 11.01.04 Profit and attendance (on items 1 and 2 above) unit: 10 %

SL 11.02 PAYMENT FOR TRAVELLING AND ACCOMMODATION DURING OFF-SITE TRAINING

SL 11.02.01 Orientation / Life skills development training for 10 days each:

1 Travelling (based on R30 per day return trip/trainer) .....Unit: PC.sum
2 Accommodation (based on 5 nights per week and R150/trainer per night) .....Unit: PC.Sum
3 Profit and attendance (on items 1 and 2 above).....Unit: %

SL 11.02.02 Skills development and technical training:

1 Travelling (based on R30 per day return trip/trainer).....Unit: PC.Sum
2 Accommodation (based on 5 nights per week and R150/trainer per night) .....Unit: PC.Sum
3 Profit and attendance (on items 1 and 2 above) Unit: %

The units of measurement for sub items SL 11.02.01 (01) and SL 11.02.02 (01) above shall be the cost for travel for the trainer off site that must be arranged by the contractor. Amounts quoted shall be corrected according to re-measurement based on actual invoices.

The unit of measurement for sub items SL 11.02.01 (02) and SL 11.02.02 (02) above shall be the amounts in Rand expended for accommodation for the trainer off site that must be arranged by the contractor. Amounts quoted shall be corrected according to re-measurement based on actual invoices.

The tendered percentages under sub items SL 11.02.01 (03) and SL 11.02.02 (03) will be paid to the contractor on the value of each payment pertaining to the travelling and accommodation to cover his expenses in this regard.

SL 11.03 ALTERNATIVE WORKERS FOR THE PERIOD OF OFF-SITE TRAINING

SL 11.03.01 Skills development and technical training for youth workers for a period of **10** days per youth worker Unit: worker-days

SL 11.03.02 Skills development and Technical training for youth workers for a period of 120 days per youth worker .....Unit Worker-days

The unit of measurement shall be the number of youth workers replaced while in training multiplied by the number of days.

The rates tendered shall include full compensation for additional replacement labour during periods of off-site training.

SL 11.04 EMPLOYMENT OF YOUTH WORKERS

SL 11.04.01 Employment of youth workers.....Unit: Prov.Sum

The unit of measurement shall be the number of youth workers at the labour rate of R 1 735.00 per month as the amount determined by the Ministerial Determination 4: Expanded Public Works Programs (Government Notice No. 9745: 4th May 2012) multiplied by the period employed in months and the rate tendered shall include full compensation for all costs associated with the employment of youth workers and for complying with the conditions of contract. The cost for the training shall be excluded from this item. This item is based on 6 months appointment for youth workers.

SL 11.05 PROVISION OF EPWP DESIGNED OVERALLS AND HARD HATS TO YOUTH WORKERS

SL 11.05.01 Supply 2 x EPWP branded overalls, 1 x EPWP branded hard hat, gloves and safety boots to each youth worker (allowed R 1 800.00 / youth worker) ….....Unit: PC.Sum

Youth worker overalls should be orange (top and bottom) as per EPWP branding specification with the exception of Correctional Services contracts where the overalls should be blue (top and bottom). **A minimum of two overalls per youth worker should be supplied**. Hard hats should be orange and branded as per the EPWP branding specification.

SL 11.05.02 Profit and attendance Unit: 10%

An amount has been provided in the Schedule of Quantities under sub item SL 10.05.01 for the supply of EPWP designed overalls and hard hat, as per the EPWP branding specification provided by the EPWP unit, and the Service Provider. The Service Provider will have sole authority to spend the amounts or part thereof. The tendered percentage under sub items SL 10.05.02 will be paid to the contractor on the value of each payment pertaining to the supply of overalls and hard hats to cover his expenses in this regard.

SL 11.06 PROVISION OF SMALL TOOLS FOR YOUTH WORKERS

SL 11.06.01 Provide all youth workers with prescribed tools for their respective trades. Specification for the mentioned tools to be provided by the Service Provider. These tools will become the property of the youth workers after the completion of the programme (**allowed R 1500-00 / youth worker**) ..... Unit: PC.Sum

SL 11.06.02 Profit and attendance ……..Unit: %

SL 11.07 APPOINTMENT OF YOUTH TEAM LEADER/S

SL 11.07.01 Appointment of Youth Team Leader/s for the duration of the contract (allowed R 3 000-00) .....Unit: Prov.Sum

The Youth Team Leader will act as CLO/PLO to facilitate the project work between the youth workers and the contractor. (Ratio 1:15)

SL 11.08 LIAISON WITH SERVICE PROVIDER..... Unit: hours tendered rate shall include full compensation for the cost of liaising with the Service Provider and Social Facilitators on all issues regarding the works.

SL.21

EPWP - NYS AGREEMENT LIMITED DURATION CONTRACT OF EMPLOYMENT

[Example] **FOR**

EXPANDED PUBLIC WORKS PROGRAMME

BETWEEN

Company Name: ……

(herein after referred to as the "**contractor**")

Company Address: ……

Contract Name: …….

AND

Surname and Name/s ……..

(hereinafter referred to as the "**Youth worker**")

Residential Address:.....ID number: ……..

1. The contractor hereby appoints the Youth worker in terms of a Limited Duration Contract, to work as a youth worker within a Special Public Works Programme (SPWP) Project.

2. This contract must be read in conjunction with the standard terms and conditions of employment applicable to a SPWP, a copy of which is attached.

3. The project where you will be employed is referred to as …….....
and is located at …….

4. The contract will start on ……and end on……..

5. You must be aware that **this contract is a Limited Duration Contract** and **not a permanent job.** Your minimum period of employment will be 6 months and the contract may be terminated for one of the

following reasons:

(a) Funding for the programme in your areas comes to an end.

(b) You repeatedly do not perform in terms of the tasks set out in your work programme.

(c) If you breach any of the terms and conditions of this contract.

6. You will be employed as a general worker within the contract, you may, depending on the contractor's operational needs, be required to perform other duties that can be reasonably expected of you.

7. You will adhere to the contractors' disciplinary code.

8. You will be required to work your daily hours from …….. to.....which included your meal break.

9. While you are working you will report to ……

10. You will be paid a time-rate amount of R .....per hour.

11. The contractor shall not be required to provide to local workers:

- holiday, leave, sick or severance pay;
- a pension or similar scheme;
- a medical aid or similar scheme.

12. Signed on this day …… of ..... 20……

Contractor: …….. Date: …….

Youth Worker: …….. Date: …….

Witness: …….. Date: ……..