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BOOK 2 OF 2

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Department
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA

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

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ISSUED BY:

THE DIRECTOR-GENERAL

Department of Public Works and Infrastructure

Central Government Offices

c/o Bosman & Madiba streets

Pretoria

0001

Name of tenderer: .....

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AA 01 SCOPE

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

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

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

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

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 OW 371

AA 02.01.02 Department of Public Works Specifications

OW 371 - Specification of materials and methods to be used. (Fourth revision, October 1993)
Guide for architects concerning drainage, water supply and stormwater drainage
PW 343 - Building specifications for regional offices
FPO/G61/3E - Guide to architects
Drainage details.

AA 02.01.03 Occupational Health and Safety Act of 1993

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act of 1993: Construction Regulations, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 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, holderbats, etc, and at appropriate intervals, to provide a rigid, proper suspended system and as required by the manufacturer.

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

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

AA 03.04 **PRESSURE TESTING OF PIPES**

(a) All new pipe installations under the 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 hanger rods.

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

(d) Prefabricated galvanized steel piping and fittings above ground

Prefabricated galvanized steel piping can be used for above ground rainwater drainage systems. The pipe to be used shall be plain ended medium gauge uncoated pipe to SANS 62 galvanized to SANS 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

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

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

(b) Replacement of damaged, broken and missing gully gratings, manhole covers and frames, cleaning eye covers, screws and bolts, inspection eye covers, end caps and vent cowls;

(c) Repair work to damaged manholes, gullies, cleaning eyes, floor drains, etc, including builder's work and benching;

(d) Initial unblocking and cleaning of all drainage pipework, traps, floor drains, gullies and sanitary ware equipment;

(e) Video surveying of all underground drainage pipework to establish root ingress, damaged pipework, fat build-up, blockages, incorrect falls, sagging and as-built information. This survey shall be utilised to establish the extent of repair and upgrade work to be executed;

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

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

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

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

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

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

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

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

AA 09.03.02 **Material and equipment specification for soil and wastewater drainage systems**

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

(a) Vitrified clay pipe and fittings

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

The jointing method to be used shall be polypropylene couplings with integral rubber seal similar or equal to Vitrosleeve according to SANS 974 allowing up to 2,5 ° angular movement per joint and 5 mm line displacement per joint. The joint shall retain an effective water seal with regard to the above conditions with a 6 meter water head.

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

The installation shall be tested according to the NBRI information sheet X/BOU 2-34.

(b) Supercast cast-iron pipe and fittings

Supercast cast-iron pipes can be used for underground and above ground installations. Plain-ended spun cast-iron pipes and fittings manufactured from 150 grade A grey iron in accordance with SANS 1034 shall be used. Fittings and pipes shall be free of pinholes, blowholes, blemishes, flash and foundry sand and to have a smooth bore. All pipes and fittings are to be sand-blasted

and coated on the inside and outside by submersion in corrosion inhibited oxide primer or bitumen paint.

The pipes and fittings shall be joined by means of stainless steel neoprene couplings as supplied by the manufacturer of the pipe system. The coupling shall be installed according to the manufacturer's specification and be tightened with a torque wrench to a torque of 6,8 Nm.

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

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

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

(c) uPVC soil and waste pipe and fittings

UPVC soil, vent and waste pipe systems can be used for underground and above ground drainage installations. This piping shall conform in all respects to SANS 971 for underground systems and to SANS 967 for above ground systems.

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

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

(d) Structural wall uPVC pipes and fittings

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

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

(e) Geberit HDPe pipes and fittings

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

The complete system shall be pressure tested in accordance with the NBRI information sheet X/BOU 2-34.

(f) Stainless steel floor traps and floor channels

Stainless steel floor traps and channels shall be manufactured from 304 stainless steel with a load capacity of 1 500 kg. The floor traps shall have a flow capacity of 3 litre/second.

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

(g) Cast-iron floor traps

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

AA 09.04 DOMESTIC WATER DISTRIBUTION AND RETICULATION NETWORKS

AA 09.04.01 General

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

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

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

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

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

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

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

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

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

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

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

(k) Repair, service and log readings of water meters including cleaning of integral strainers;

(l) Water storage tanks are to be emptied, cleaned out, repaired, sealed and put back into operation. Ball float and/or filling valves to these tanks are to be serviced and repaired where required;

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

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

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

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

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

AA 09.04.02 **Material and equipment specification for domestic water distribution and reticulation networks**

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

(a) Copper pipe installation

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

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

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

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

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

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

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

(viii) The heat source to be used shall be propane gas with induction air, at a temperature not higher than 240 °C. The pipe ends and fittings shall be cleaned and waxed with an approved solder flux, before soldering.

The pipe and fittings shall then be fitted together and heated to the correct temperature before the solder is applied. Care must be taken not to add too much or too little solder to the joint. Immediately after setting of the solder the joint shall be wiped clean with a wet cloth. Pipes shall be washed out as soon as possible after jointing and all traces of flux shall be removed.

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

(x) Copper pipes and fitting shall be installed strictly to the manufacturer's specification and include the following:

(1) No labour bends;

(2) Provision for thermal contraction and expansion of pipes;

(3) Pipe brackets shall be installed at appropriate positions where pipes are installed on surface level;

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

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

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

(xii) Pipe hangers and brackets shall be installed according to the manufacturer's specification on the following maximum spacings:

PIPE DIAMETER (mm)	HORIZONTAL (metre)	VERTICAL (metre)
15	1,3	1,9
22 and 28	1,9	2,5
35 and 42	2,5	2,8
54	2,5	3,9
67 – 108	2,8	3,9

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

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

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

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

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

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

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

(b) Galvanized steel pipe installations

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

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

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

(iv) In pipe ducts and elsewhere pipes shall be fixed onto walls, soffits, etc, with approved type of supports, 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:

PIPE DIAMETER (mm)	HORIZONTAL (metre)	VERTICAL (metre)
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 air locks. A minimum rise of 1:250 shall be maintained to high points, which shall be fitted with suitable air release valves.

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

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

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

(x) The type of pipe joint compound shall be approved by the Engineer and used sparingly with good quality hemp. For pipes larger than 80 mm diameter a jointing compound such as Epidermix 32 shall be used.

(xi) Any pipe buried shall have at least 900 mm cover and be coated and wrapped to SANS 1117 and tested in the presence of the Engineer.

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

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

(xiv) Valves shall be installed on all branch pipes and ball-o-stop valves on all connectors to basin pillar 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 strain on fittings and pipe joints.

(c) uPVC underground pipe installations

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

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

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

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

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

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

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

(viii) Pipe trenching and bedding:

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 a Densopol 80 HT Tape or similar approved.

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

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

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

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

(d) HDPe underground pipe installations

(i) HDPE piping shall be Type 4 HDPe pipe to SANS 533.

(ii) All fittings shall be of Plasson compression type and shall conform 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 in accordance with SANS 1200 DB and to the Engineer's and approval.

(v) Pipe trenching and bedding:

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 Densopol 80 HT tape or similar approved.

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

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

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

(e) Valves

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

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

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

The valves shall be fitted with a square key spindle top to close the valves in clockwise direction and socket ends to SANS 665 to fit into uPVC Class 12 pipe and installed to detail.

(ii) Gate valves underground in valve chamber to connect to 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 valves shall conform to SANS 776 Class 125. The valves shall be able to withstand a working pressure of 1 600 kPa. The valve shall be fitted with a hand wheel on an extended spindle shaft of 700 mm to close in a clockwise direction and installed to detail.

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

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

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

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

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

Gate valves shall be equipped with non-rising spindle, spherical graphite iron body to SANS 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 valves 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, table 16, 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.

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

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

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

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

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

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

The valves shall be able to withstand a working pressure of 1 600 kPa.

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

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

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

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

(viii) Angle regulating valves

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

(f) Strainers

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

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

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

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

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

These strainers shall be of the Y-type with bronze or dezincified brass body, stainless steel strainer element and must be equipped with BSP threaded socket ends. The hole sizes of the strainer element shall be maximum 0,8 mm diameter. The strainer shall be suitable for a temperature of up to 90 °C at a pressure rating of 1 000 kPa and installed with the element facing downwards or a maximum of 45° sideways.

(g) Non-return valves

(i) Non-return valves for cold water (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 NB) and cold water (up to 50 mm NB)

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

(h) Air release valves and vacuum breakers

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

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

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

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

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

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

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

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

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

(iv) Vacuum breaker up to 40 mm diameter

The vacuum breaker shall be fitted with neoprene seal, spring-loaded disc in a dezincified brass or bronze body. The valve shall seal watertight and shall be designed to withstand a working pressure of 1 000 kPa and a temperature of 90 °C.

(i) Pressure-reducing valves

(i) Combination pressure-reducing stations

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

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

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

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

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

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

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

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

(j) Water meters

(i) Combination water meters

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

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

These water meters shall be of the dry type with all gears and transmission and roller counters in a dry head, and shall be equipped with flanged ends to SANS 1123, cast-iron body with high quality corrosion-proof coating. The meter shall be protected from magnetic fields and sealed to prevent tampering with adjustments. The meter must be able to work up to a pressure of 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. Accuracy of meter shall be not less than 98 %.

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

(iii) Water meters (up to 50 mm 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.

(k) Adjustable balancing valves

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

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

The calibrated adjustable balancing valves shall be of the angle valve type equipped with bronze valve body, bronze disc, internal seals with BSP threaded ends. The valve shall be fitted with stop-cock connection ends on inlet and outlet onto which the differential pressure gauge can be coupled. The valve shall be equipped with an indicator on the valve handle to show the position of the valve opening. The valve shall be suitable for operating at a temperature of 90 °C against a pressure of 1 000 kPa.

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

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

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

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

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

(m) Expansion bellows

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

Expansion bellows shall be of the rubber-lined type fitted between flanges. These bellows shall be suitable for an operating temperature of -10 °C to 110 °C at an operating pressure of 1 500 kPa. The bellows shall be installed strictly in accordance with the manufacturer's specifications.

(ii) Expansion bellows for copper pipes (up to 40 mm NB)

These expansion bellows shall have a copper body with corrugated stainless steel lining and soldered capillary type couplings. The bellows shall be capable to withstand a working pressure of 600 kPa

at a temperature of 140 °C. Installation shall be strictly in accordance with the manufacturer's specifications.

(n) Lagging of hot-water pipes

(i) Preformed closed cell flame retarded flexible insulation sections

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

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

Thermaflex thickness for various pipe sizes shall be as follows:

PIPE SIZE (STEEL)	PIPE SIZE (COPPER)	THERMAFLEX THICKNESS
50 mm dia	54 mm dia	20 mm
40 mm dia	42 mm dia	20 mm dia
32 mm dia	35 mm dia	15 mm dia
25 mm dia	28 mm dia	15 mm dia
20 mm dia	22 mm dia	15 mm dia
15 mm dia	15 mm dia	15 mm dia

(ii) Preformed fibreglass sections with galvanized sheet metal muffs

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

Fibreglass section thickness for the various pipe sizes shall be as follows:

PIPE SIZE (STEEL)	PIPE SIZE (COPPER)	FIRBREGLASS THICKNESS
100 mm dia	108 mm dia	50 mm dia
80 mm dia	76 mm dia	40 mm dia
65 mm dia	67 mm dia	40 mm dia

PIPE SIZE (STEEL)	PIPE SIZE (COPPER)	FIRBREGLASS THICKNESS
40 mm dia	54 mm dia	25 mm dia
40 mm dia	42 mm dia	25 mm dia
32 mm dia	35 mm dia	25 mm dia
25 mm dia	28 mm dia	20 mm dia
20 mm dia	22 mm dia	20 mm dia
15 mm dia	15 mm dia	20 mm dia

AA 09.05 **SANITARY AND BRASSWARE EQUIPMENT**

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

(a) Damaged and/or broken irreparable sanitary and brassware equipment shall be replaced with equal specification equipment or approved alternative. These shall be installed strictly to the manufacturer's specifications.

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

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

(d) Loose sanitary ware shall be re-fixed and bracketed to structures in accordance with the manufacturer's specifications.

(e) Stained sanitary ware equipment shall be cleaned, where possible, with approved cleaning agent in accordance with the manufacturer's specification.

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

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

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

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

(j) Replace missing and/or damaged shower gratings with equal specification or approved alternatives.

(k) Service and repair water metering taps by utilising manufacturer's replacement kits where necessary. Where damaged beyond repair the complete item shall be replaced with equal specification or approved alternative.

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

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

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

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

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

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

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

AA 09.06 FIRE WATER PIPED RETICULATION NETWORKS

AA 09.06.01 General

Repair work to the fire water piped reticulation networks is detailed in the Particular Specification and shall include but no be limited to the work described below. This specification only covers the water piped reticulation for the fire water protection system, while the equipment to this installation, such as fire hydrants, hose reels and extinguishers, are covered and detailed in Technical Specification JC: Conventional Fire Fighting Equipment. This specification has to be read in conjunction with the afore-mentioned specification.

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

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

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

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

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

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

(g) Report all problems related to fire fighting equipment to the Engineer.

(h) Water storage tanks are to be emptied, cleaned out, repaired, sealed and put back into operation. Ball float and/or filling valves to these tanks are to be serviced and repaired where required.

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

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

(k) Record pressure readings on supply to installation.

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

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

(a) Galvanized steel pipe installation

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

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

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

(iv) In pipe ducts and elsewhere pipes shall be fixed onto walls, soffits, etc, with approved type of supports, 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 maintain equipment.

(v) Pipes shall be supported according to the manufacturer's specifications 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	2450
50 dia to 150 dia	2 450	3 050

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

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

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

(ix) The type of pipe joint compound shall be approved by the Engineer and used sparingly with good quality hemp. For pipes larger than 80 mm diameter a jointing compound such as Epidermix 32 shall be used.

(x) Any buried pipe shall have at least 900 mm cover and be coated and wrapped to SANS 1117 and tested in the presence of the Engineer.

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

(b) uPVC underground pipe installations

(i) uPVC piping shall conform to SANS 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) Pipe trenching and bedding:

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

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

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

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

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

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

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

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

(c) HDPe underground pipe installations

(i) All HDPe piping shall be Type 4 HDPe pipe to SANS 533.

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

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

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

(v) Pipe trenching and bedding:

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 Densopol 80 HT tape or similar approved.

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

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

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

(d) Valves

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

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

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

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

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

(ii) Gate valves underground in valve chambers to connect to uPVC piping

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

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

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

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

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

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

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

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

The valves shall be able to withstand a working pressure of 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

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
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	Four-monthly
12	Check, inspect, repair or replace all bracketing systems	Four-monthly
13	Check, inspect, service, repair/replace all air release valves and vacuum breakers	Four-monthly
14	Check, service, repair or replace all ball float valves	Four-monthly
15	Check, inspect, test, service, repair/replace all geyser installations	Four-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

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
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.

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, powerskirting, 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 10199	SANS 164	SANS 1065
SANS 10400	SANS 172	SANS 1411	SANS 1012		SANS 1084	SANS 1086
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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003.

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:

20 off PL 9W lamps
20 off 21W lamps
50 off 36W fluorescent lamps
20 off 58W fluorescent lamps
20 off 18W fluorescent lamps
10 off 250W HPS lamps
5 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:

Installation A3: Mahamba Port of Entry

Installation B3: Bothashoop Port of Entry

Installation C3: Emahlathini 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 covers.

(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.

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.

(ii) Damaged or incomplete luminaires

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

(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 lampholder.
- Seal conduit and wiring entry with silicone to eliminate water ingress.
- Fit new lamp.
- Check condition of earth stud and luminaire earth connection.
- Replace all missing screws, lens catches, bolts.
- Close cover securely, check stirrup bolts.

SCHEDULE OF LUMINAIRES

TYPE	DESCRIPTION
A	2 x 58W SABS OPEN CHANNEL FLUORESCENT LUNINAIRE – VOLTEX LIGHTING TYPE : R1/T-258 SS
B	2 x 36W SABS OPEN CHANNEL FLUORESCENT LUNINAIRE - VOLTEX LIGHTING TYPE : R1/T-236 SS
C	1 x 58W SABS OPEN CHANNEL FLUORESCENT LUMINAIRE - VOLTEX LIGHTING TYPE : R1/T-158 SS
D	1 x 36W SABS OPEN CHANNEL FLUORESCENT LUMINAIRE - VOLTEX LIGHTING TYPE : R1/T-136 SS
E	2 x 58W SABS IP 55 FLUORESCENT LUMINAIRE - VOLTEX LIGHTING TYPE : C2-258SS WITH WATERTIGHT DIFFUSER
F	3X 36W RECESSED MOUNTED FLUORESCENT LUMINAIRE WITH SINGLE PARABOLIC REFLECTOR
G	2X 36W RECESSED MOUNTED FLUORESCENT LUMINAIRE WITH SINGLE PARABOLIC REFLECTOR
H	2X 18W RECESSED MOUNTED FLUORESCENT LUMINAIRE WITH SINGLE PARABOLIC REFLECTOR
I	3X 18W RECESSED MOUNTED FLUORESCENT LUMINAIRE WITH SINGLE PARABOLIC REFLECTOR
J	2X 58W SURFACE MOUNTED FLUORESCENT LUMINAIRE WITH SINGLE PARABOLIC REFLECTOR
K	70W HPS B40 BRITELITE WALL MOUNTED BULKHEAD LUMINAIRE : VOLTEX LIGHTING TYPE B40-70W HPS
L	BULKHEAD LUMINAIRE - VOLTEX LIGHTING TYPE: B10 WITH 2XPL9 LAMPS
M	BULKHEAD LUMINAIRE - VOLTEX LIGHTING TYPE: B10 WITH 21 W DULUX EL ECO LAMP
N	DÉCORATIVE ROUND BULKHEAD – RADIANT TYPE: WT2A
O	DÉCORATIVE ROUND BULKHEAD WITH GRID – RADIANT TYPE: WT2G
P	250W HPS FLOODLIGHT LUMINAIRE : VOLTEX LIGHTING TYPE : L14ST-250 HPS
Q	250W MV LOWBAY DOWNLIGHTER BEKA TYPE: BEKATEC 250W HPS
R	400W MV SABS APPROVED HIGH BAY LUMINAIRE WITH AUTO LIGHT SIMILAR OR EQUALT TO BEKA BAY
S	BOWL TYPE IP55 BATHROOM FITTING WITH CERAMIC LAMP HOLDER WITH DULUX EL ECO 21W/E27 LAMP
T	DÉCOR ROUND CHEESE BULKHEAD 250 MM GLASS BOWL-ILM TYPE: DEC/RND/CHS/250 WITH 21 W DULUX EL ECO LAMP
U	WALL MOUNTED DÉCOR SPOT LIGHT ILM TYPE : ACC/SPT/100
V	CEILING MOUNTED 3 LIGHT DECORATIVE LUMINAIRE WITH GLASS CUPS AND DULUX EL ECO 21W/E27 LAMPS
W	CEILING MOUNTED 2 LIGHT DECORATIVE LUMINAIRE WITH GLASS CUPS AND DULUX EL ECO 21W/E27 LAMPS
X	CEILING MOUNTED SINGLE LIGHT DECORATIVE LUMINAIRE WITH GLASS CUPS AND DULUX EL ECO 21W/E27 LAMPS
Y	BULKHEAD LUMINAIRE - BEKA TYPE SERIES 30: WITH 2XPL9W CFL LAMPS
Z	CEILING FAN WITH 1 X GLASS CUPS AND 100W GLS LAMPS
AA	2XPL26W DOWN LIGHTER VOLTEX LIGHTING TYPE : CAS/S-2PL26
AB	21W DOWN LIGHTER VOLTEX LIGHTING TYPE : CAS/S-21W

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, powerskirting 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 — m^3

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 supply and installation of the specified lamp according to the manufacturer's instructions. Replacement date must be written on lamp.

	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 meter 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, lampholders, 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 15°. Concealed fixed type Galvanised baked enamel roof sheeting will in general be used to cover roofs with slopes not exceeding 15°. 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 baked enamel/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 @ 15°) 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 @ 15°) 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 @ 15°) 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 @ 15°) 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: (m²)	
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 <75mg 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: m^2**

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

(ii) Etc.

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: m²**

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 2,5m² 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: m²**

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: m²**

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

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

BB 01 SCOPE

Carpentry and joinery shall mean the 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 45° the purlins shall be erected on edge (narrow edge).
(ii) All purlins shall be secured to rafters at each intersection in addition to nails. In roof voids a single 3,2 mm diameter galvanised wire tie bound twice with twisted ends or a galvanised bent plate connector shall be used for securing purlins to rafters. On roof overhangs only galvanised bent plate connectors shall be used for securing purlins to rafters.
(iii) Splices shall be staggered. Splices that do not conform to the requirements of clause 8.8 of 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

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

CONTENTS

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 m^2 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. Detailed instructions will be issued during construction.

BC 05 MAINTENANCE

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: m²

(b) Etc. for other material and locations

The unit of measurement shall be square metre of material removed.

The tendered rate shall include full compensation for the removing of existing waterproofing, flashing strips, sundry items, etc.

BC.02.03 **Prepare existing surfaces:**

(a) Prepare existing concrete surface to receive new screed as specified ..... Unit: m²

(b) Prepare existing concrete or screeded surface to receive new waterproofing system ..... Unit: m²

The unit of measurement shall be the square metre of the exposed surface prepared to receive the new screed or waterproofing material.

The tendered rates shall cover the cost for preparing the existing surfaces as specified and scheduled in (a) and (b) to receive new screeds or waterproofing.

BC.02.04 **Roof screeds:** ..... Unit: m²

The unit of measurement shall be the square metre of exposed surfaces to be screeded.

The tendered rate shall include all costs for supplying, delivering, storing on site, handling, etc of the materials necessary for the screed, including mixing and laying of screeds to 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

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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 OW 371. All plastering shall be painted in accordance with Technical Specification BJ: Paintwork, or tiled according to this specification BD.

The Engineer shall inspect the plaster surfaces and establish which wall plastering must be repaired. Reasons for replacing existing plastering will include, but not limited to the following:

(a) Excessive plaster cracking
(b) Loose (delaminated) and spalling plaster
(c) Dusting
(d) Scaling and flaking
(e) Defective plaster mix.

All chases shall be marked out in straight lines and neatly cut on either side of the recess for the pipe/conduit with an angle grinder. The width of the removed plastering must extend at least 30 mm beyond the edge of the chasing. Pipes or conduits shall be fixed before commencing grouting and plastering.

After the pipe has been put in place, the void shall be filled with a non-shrink cement grout of 60 MPa compressive strength at 28 days. The chases shall then be covered by fixing with shot-fired nails a weld mesh strip (30 mm 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 m^2 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 OW 371. The code of practice for the fixing of glazed wall tiles, SANS 10107 and the recommendations of the South African Ceramic Tile Manufacturer's Association (SACTMA) must be adhered to.

All tiled areas must be checked for damaged surfaces or to determine where tile adhesion to subsurface proves to be of non-satisfactory standard. In cases where tiled surfaces need to be redone, proper care shall be taken in removing all damaged tiles, as well as any adhesive remains on the subsurface.

Matching of existing size and colour should be pursued wherever possible.

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 OW 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 OW 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 OW 371. All ironmongery shall be approved by the agent/representative before fixing. Articles shall be fixed with screws of similar metal and shall be eased, oiled, adjusted and left in perfect working order on completion.

All ironmongery shall be inspected to assess the level of workability, paying special attention to door handles, locks, door closers, door stops, door catches, fixing of these fittings, etc. Should any of these fittings be found unsuitable due to damage, corrosion, etc, they shall be replaced. Where existing holes in wood are worn out, these holes must be plugged with wood to receive the screws.

Toilet doors in ablutions must be fitted with approved D-type natural anodised aluminium pull handles and 150 x 150 mm plate. Install 15 mm diameter concealed steel roller ball catch with chromium-plated striker plate with circular hole for roller ball catch. Fix this plate to door frame with two aluminium pop rivets.

BD 03.09.02 Door locks

Each lock shall be provided with two keys and no key shall pass a second lock. All mortice locks, mortice latches and night latches, rim and cylinder rim night latches, and escutcheon for locks shall comply with the requirements of the SANS. The Contractor shall supply all screws, etc, required for completion of the work.

BD 03.09.03 Cupboard doors

Where required according to the Schedule of Quantities, built-in cupboard doors in sleeping quarters are to be provided with 2 x angle iron sections of 35 x 80 x 3 mm thick x 10 mm diameter hole for a padlock that must be fixed to the inside of the cupboard door.

Locker doors shall be provided with a 50 x 50 x 5 mm thick mild steel angle x 10 mm diameter hole for a padlock site welded to the locker.

BD 04 DETAIL OF REPAIR WORK

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

BD 05 MAINTENANCE

No maintenance will be required for walls under this contract.

BD 06 MEASUREMENT AND PAYMENT

BD 06.01 MEASUREMENT AND RATES

BD 06.01.01 General inclusion of costs and specific specifications

Notes:

Where applicable, standard SANS 1200 measurement and payment items shall be used for Earthworks (Small Works) (1200 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

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

BE 01 SCOPE

Floors shall mean the scope of work to 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.

TECHNICAL SPECIFICATION

BF STRUCTURAL CONCRETE (REPAIRS)

CONTENTS

BF 01 SCOPE
BF 02 STANDARD SPECIFICATIONS
BF 03 REQUIREMENTS OF REPAIR WORK
BF 04 MAINTENANCE
BF 05 MEASUREMENT AND PAYMENT

BF 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 buildings.

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

The complete scope of repair work shall be according to the section: Detail of repair work.

Maintenance of this part of the installation (the works) shall be performed according to the Additional Specification: General Maintenance and the specific requirements to be included in this Technical Specification.

BF 02 STANDARD SPECIFICATIONS

BF 02.01 GENERAL STANDARD SPECIFICATIONS

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

OW 371	-	Specification of Materials and Methods to be used Fourth Edition, Oct. 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

BF 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BC: Waterproofing
Technical Specification BD: Walls
Technical Specification BE: Floors
Technical Specification BG: Metalwork
Technical Specification BK: Water Retaining Structures
Joint materials manufacturer's specifications (they shall take precedence over others)
Concrete repair materials manufacturer's specification (they shall take precedence over others)

BF 02.03 REQUIREMENTS FOR REPAIR OF STRUCTURAL CONCRETE

BF 02.03.01 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:

- 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 can not be classified under severe concrete repair, will be treated on merit. Detailed instructions will be issued during repair/maintenance for the rehabilitation of such structural concrete elements.

BF 02.30.02 Surface Concrete repair procedure

The following procedure, or similar approved by the Engineer to be used:

- Remove all loose and defective material and clean around affected area to expose aggregate.

- Saw-cut 10mm vertically around edges of repair area and break out concrete within to avoid tapered feathering.

- Wet area well, approximately 30 minutes before commencement of repair.

- Apply an approved shrinkage compensated cementitious repair mortar in strict accordance with the manufacturer's specifications.

- The repaired surface to be cured by covering with plastic sheeting and keeping wet for 48 hours or as otherwise specified.

BF 02.03.03 Mild to Moderate Concrete repair procedure

The following procedure, or similar approved by the Engineer to be used:

- Remove all loose and defective material and break out to a minimum depth of 10mm.
- Saw-cut 10mm vertically around edges of repair area and break out concrete within, to avoid tapered feathering.
- Ensure that concrete is free from laitance, oil, grease etc and is sound, firm and clean.
- Exposed reinforcing to be wire brushed clean and free of all rust and then coated with an approved single component epoxy zinc primer.
- The concrete to be thoroughly wetted and kept wet for a minimum of 12 hours before applying remedial product, loose standing water to be removed prior to application of repair mortar.
- Apply an approved shrinkage compensated cementitious repair mortar in strict accordance with the manufacturer's specifications.
- The repaired surface to be cured by covering with plastic sheeting and keeping wet for 48 hours or as otherwise specified.

BF 02.03.04 Severe Concrete repair procedure

The following procedure or similar approved by the Engineer 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 10mm.
- Ensure that the cavity is clean, dry and free of any debris.
- Apply an approved epoxy resin repair compound strictly in accordance with the manufacturer's specifications.
- In certain cases, which will be treated on merit, cementitious repair mortars as specified in BF 02.3.3, will be permitted.

BF 02.03.05 **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 will determine the extent of repair work required, which will in most cases, require individual specifications to suit.

BF 02.03.06 Concrete crack repair procedure
(Generally used where cracking could adversely affect the structure)

The following procedure, or similar approved by the Engineer to be used:

- The surface over the entire length of the crack should be wire brushed to remove laitance or any other deleterious materials from the concrete.
- If the surface of the concrete is unsound, chase a vee cut into the crack.
- All debris to be removed.
- Drill holes into the crack. The size, depth and centres etc. as specified for the crack injection product to be used. 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.

BF 02.03.07 Cleaning of Concrete

Concrete surfaces which have been soiled, stained, marked etc., and are aesthetically displeasing to the eye, must be cleaned to as close as possible, to new condition. Approved water-soluble cleaners and/or acid etching cleaners must be used strictly in accordance with manufacturers specifications.

BF 02.03.08 Expansion joints

Existing horizontal and vertical expansion joints to be inspected to determine the extent of damage to the joints. The existing expansion joints and other building elements shall be protected from damage during the progress of any repair work of expansion joints and on completion shall be cleaned and handed over in a perfect condition. Only skilled workmen experienced in the preparation for and application of the remedial products shall carry out the work.

The extent of the expansion joint remedial work to be determined by the site Engineer.

BF 02.03.09 Expansion joint remedial procedure

The following procedure to be used for remedial work to expansion joints. The site Engineer to confirm the remedial procedure required for each application and all workmanship is subject to his approval.

- Remove all damaged sealant from expansion joint.
- Joint former/filler to be inspected and if in poor condition, must be removed.
- Remove all loose materials mechanically to ensure a sound, clean and dry concrete surface.
- Where required, the sides of the concrete joint to be cut smooth and straight with an angle grinder or diamond saw.
- Where required, the edges of the expansion joints to be provided with a fillet. Engineer 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 for approval prior to installation.

BF 03 DETAIL OF REPAIR WORK

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

BF 04 MAINTENANCE

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

All components forming part of the structural concrete shall be maintained as part of the maintenance of installations as defined in the Additional Specification: General Maintenance, during the maintenance phase of the contract.

Maintenance shall include all repair work, replacing of components, fixing of defects or any other actions or rectifying measures necessary to maintain perfect functional condition of structural concrete according to the Operation and Maintenance Manuals and as specified in this specification. All structural concrete shall be kept in a good condition.

Maintenance on the structural concrete shall also include all other actions related to (or springing forth from) maintenance, such as:

- Replacing of loose or spalled concrete.
- Premature deterioration of concrete.
- Cleaning of wall and floor joints.
- Maintenance of expansion joints in structural concrete.

Remuneration for maintenance of the complete structural concrete shall be deemed included in the tendered monthly payment for maintenance of the installation under which it falls.

BF 05 MEASUREMENT AND PAYMENT

Refer to Technical Specification BK Measurements and Payments: Building work.

TECHNICAL SPECIFICATION

BH FITTINGS

CONTENTS

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

BH 01 SCOPE

Fittings shall mean the scope of work to 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 composite board
SANS 1099 -	Hardwood furniture timber
SANS 1783-3 -	Softwood timber for industrial use
SANS 1385 -	Kitchen cupboards of steel, composite board and timber

BH 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BD: Walls
Technical Specification BG: Metalwork
Technical Specification BJ: Paintwork

BH 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

BH 03.01 ADDITIONAL REQUIREMENTS FOR REPAIR OF FITTINGS

BH 03.01.01 Built-in cupboards

The Engineer shall inspect all cupboards for defects and shall establish which components are to be replaced or repaired. Reasons for replacement will include, but not be limited to:

(a) Severely chipped or damaged block board;
(b) Severely chipped or damaged decorative laminates;
(c) Inadequacy of design, 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

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.

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:

- Severely chipped or damaged block board;
- Severely chipped or damaged decorative laminates;
- Inadequacy of design, eg strength of hinges, failure of door furniture, etc;
- Corroded steel elements.

All cupboards shall be properly screwed and fixed to walls and floors with suitable corrosion resistant screws and plastic plugs, washers, etc.

The Contractor & 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. Steel tops that have been damaged excessively shall be replaced.

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.

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.

TECHNICAL SPECIFICATION

BJ PAINTWORK

CONTENTS

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BJ 01 SCOPE

This specification covers the painting/repainting and maintenance of new and existing building components and maintenance thereafter for various types of buildings and structures.

Paintwork shall mean the scope of work related to the preparation, painting and maintenance of new and existing building components. This specification does not include work related to galvanising of steelwork, which is specified elsewhere.

The complete scope of paintwork shall be as described in BJ 04: Detail of repair work.

BJ 02 STANDARD SPECIFICATIONS

BJ 02.01 GENERAL STANDARD SPECIFICATIONS

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

SANS 515 - Decorative paint with a non-aqueous solvent base for interior use
SANS 630 - Decorative high gloss enamel for interior and exterior
SANS 631 - Decorative oil gloss paint for interior and exterior use
SANS 633 - Emulsion paints for interior decorative purposes
SANS 634 - Emulsion paints for exterior use
SANS 678 - Primers for wood for interior and exterior use
SANS 681 - Undercoats for paints
SANS 683 - Roof paints (relevant sections)
SANS 723 - Wash primer (metal etch primer)
SANS 801 - Epoxy-tar paints
SANS 887 - Varnish for interior use
SANS 926 - Two-pack zinc-rich epoxy primer
SANS 1227 - Textured wall coatings, emulsion base, for interior and exterior use
SANS 1319 - Zinc phosphate primers for steel
SANS 10064 - Preparation of steel surfaces for coating
OW 371 - Specification of Materials and Methods to be used (Fourth edition, October 1993): Section 18

BJ 02.02 ADDITIONAL SPECIFICATIONS

Technical Specification BG: Metalwork
Paint manufacturers' specifications. These specifications shall take precedence over all others.

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

All paintwork will be inspected to determine the extent of peeling or flaking and the Engineer will determine the extent of paintwork required.

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.

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

CA ROADS

CONTENTS

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CA01 SCOPE

This specification covers the materials, equipment, methods, testing and work required for the repair and maintenance of existing roadways, parking areas, miscellaneous areas subjected to vehicular traffic and other miscellaneous paved areas. It covers both surfaced and unsurfaced roadways and includes appurtenant works such as kerbing, road markings, road signs and traffic signals.

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

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

The Contractor shall at all times adhere to this specification, unless otherwise specified in the Particular Specification.

CA02 STANDARD SPECIFICATIONS

CA 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

OW371	Specification of Materials and Methods to be used, fourth edition, October 1993
SANS 1200 D	Earthworks
SANS 1200 OM	Earthworks (roads, subgrade)
SANS 1200 M	Roads (general)
SANS 1200 ME	Subbase
SANS 1200 MF	Base
SANS 1200 MG	Bituminous surface treatment
SANS 1200 MH	Asphalt base and surfacing
SANS 1200 MJ	Segmented paving
SANS 1200 MK	Kerbing and channelling
SANS 1200 MM	Ancillary roadworks
COLTO	Standard Specifications for Road and Bridge Works for State Road Authorities

SADC Road Traffic Signs Manual (latest edition)

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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 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.

CA03 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.

CA04 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) Repair of segmented paving
(f) Repair of kerbing
(g) Erection and repair of road traffic signs and traffic-control devices
(h) Erection and repair of traffic signals
(i) Road markings
U) 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 Oversize index (1_0)8 Shrinkage product (Sp)° Grading coefficient (Get CBR: 35 at 95 per cent modified AASHTO compaction and OMCct	37,5 mm :;; 5 per cent 100 - 365 (maximum of 240 preferable) 16-34

a) $_0$ = Oversize index (per cent retained on 37,5 mm sieve)
b) $_p$ = Linear shrinkage x per cent passing 0,425 mm sieve
c) $_c$ = (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.

(a) Patching of concrete

Patching of concrete shall be done where indicated by the Engineer.

Unless otherwise instructed by the Engineer, the patching shall have a neat rectangular shape with sides parallel to existing joints. The concrete within the area to be patched shall be broken up and removed to its full depth. The vertical face of the existing concrete adjacent to the patch shall be planed with an abrasive wheel or power-driven concrete saw, if necessary, to provide a smooth face.

Immediately prior to the placing of new concrete, the surface of the underlying pavement layer shall be compacted with either hand or mechanical equipment, depending on the space available, to ensure a firm foundation surface.

An isolation joint shall be constructed between all interfaces of existing and new concrete. The isolation joint shall consist of a joint filler, a bond breaking strip and a polysulphide sealant. The isolation joint shall only be sealed between 21 and 28 days after the casting of the concrete, at which time the uppermost portion of the joint filler shall be raked out, the bond breaking strip inserted and the polysulphide sealant applied.

As the patching of concrete will generally occur in trafficked areas, the Contractor shall allow fully in the relevant rates for accommodation of traffic to 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 of work

(a) Removal of distressed pavement layers

The Engineer will demarcate any failed areas to be repaired, and shall instruct the Contractor with regard to the repair work to be done. The Contractor shall provide assistance and temporary traffic control facilities for marking out failed sections of the road.

Unless otherwise instructed by the Engineer, the patching shall have a neat rectangular shape, at right angles to the direction of traffic. The existing material shall be excavated and removed to the specified depth. Asphalt layers and surfacing shall be cut with approved cutting equipment.

Excavation for patching shall be cut with side slopes of approximately 60° to the horizontal.

Excavated material from each pavement layer shall be placed in separate stockpiles adjacent to the patch. The stockpiled material shall be reused or removed from the site in accordance with the Engineer's instructions.
After completion of the excavation to the specified depth, the Engineer shall be afforded the opportunity to examine the excavation. Where required, the floor of the excavation shall be compacted to the specified density for the layer concerned. These densities as percentages of modified AASHTO density are as follows:

Subbase	(150 - 300 mm below final base course level)	95%
Selected	(300 - 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 instructed by the Engineer.

Excavated material shall be removed from the site, unless re-use of material is instructed by the Engineer. Under no circumstances shall excess material be dumped in side drains or side banks.

(b) Backfilling

Prior to backfilling, the base and sides of the excavation shall be cleaned of all loose material. The top 150 mm of all excavations shall be regarded as base and all other backfill up to 500 mm below the final road level shall be regarded as subbase. Deeper excavations shall be backfilled with approved gravel to a density of 90% modified AASHTO density.

Backfilling of the excavation shall be done as follows:

(i) The Engineer may instruct the Contractor to use excavated material from the existing pavement, stabilised with cement, as backfilling, either for subbase layers only or for both subbase and base course layers.

Material shall be broken down and 60 kg/m^3 of Portland composite cement (Cem 11:32,5) shall be added. Water shall be uniformly mixed into the material. The material shall then be returned to the road and compacted to at least 95% of modified AASHTO density for the subbase layers and to 97% of modified AASHTO density for the base layers.

(ii) Where required by the Engineer, backfilling for the base course layer shall be done with imported material of G3 or better quality, treated with bitumen emulsion. Portland composite cement (Cem 11:32,5) shall be added at a rate of 25 kg/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 MSHTO 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: 1 part

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

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

(iv) 60% stable mix-grade emulsion (prepared from 80/100 penetration grade: between 75 and 90 litre/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/m², which must be allowed to dry (or alternatively according to the supplier's prescriptions).

The surfacing material shall be handled and placed according to the supplier's prescriptions.

(e) Production limitations

As far as it is practically possible the size of the area to be repaired shall be limited to that which can be excavated, backfilled and opened to traffic within a single working day. Where this is impractical the Contractor shall consult with the Engineer regarding the signs requirements for controlling the traffic during night time. No area that is to be prepared, shall be left exposed if rain is imminent.

The asphalt base material shall be placed in layers not exceeding 80 mm and crushed stone material be placed in layers not exceeding 100 mm measured in the loose. The surfacing material shall be placed in one layer at a thickness of40 mm± 10 mm.

(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 and equipment

All equipment shall be suitable for the specified use and size of working areas and shall be capable of obtaining the specified results.

Only approved cutting or sawing equipment may be used for cutting or sawing asphalt layers. The equipment must be capable of cutting asphalt layers to depths of 200 mm in

one operation without fragmenting the material, and in straight lines within the required tolerances.

The following items of plant and equipment shall also be available and in good working order:

(a) A vibratory roller having a mass approximately equal to that of a Bomag 90 or similar vibratory roller, with an adjustable amplitude and frequency of vibration;

(b) A mobile compressor capable of producing at least 3 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 11:32,5) 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)	8 - 16
Marshall flow (mm)	2-4
Stability/Flow (kN/mm)	3 minimum
Static creep modulus (MPa)	60 minimum
Indirect tensile strength @ 25 °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)					
Aqqreqate	94,5%		93,5%	93,0%	93,0%
Bitumen	5%		5,5%	6,0%	6,0%
Active filler	0,5%		1,0%	1,0%	1,0%

(d) Tack coat

The tack coat shall be 60% cationic emulsion complying with SANS 548.

CA 04.04.06 Variation from specified nominal rates of applications or nominal mix proportions

The various sections of these specifications specify nominal rates of applications or nominal mix proportions for materials such as bituminous materials, aggregates, fillers,

stabilizing agents, paint and other relevant materials. Tenderers shall base their tenders on these nominal rates of applications and mix proportions.

Where such nominal rates of applications or mix proportions are specified, provision is made for deviations in the quantities of material in consequence of the rates of application or mix proportions prescribed by the Engineer in each particular case in consideration of the available materials and the site.

Where the actual rates of applications or mix proportions used in the works vary from the specified nominal rates and mix proportions, adjustment to compensation will be made as:

(a) payment to the Contractor in respect of any authorised increase in quantities which exceed those specified and where such increase has been ordered in writing by the Engineer;

or

(b) a refund to the Employer in respect of the decrease in quantities that are less than those specified, irrespective of whether such decrease results from an 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 by him.

The Employer shall be refunded for any decrease in the specified rates of application or mix proportions at the same rate per unit of measurement as that tendered by the Contractor for additional materials required by an increase in the rates of applications or mix proportions.

CA 04.05 SURFACE PATCHING OF SURFACED ROADS

CA 04.05.01 General

This section covers the repair of potholes and edge breaks that have developed in the surface of surfaced roads, where there is no evidence of base failure. Potholes are local failures covering an area of less than 1 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 of work

Pothole and edge break repairs shall consist of trimming away ravelled edges and loose material to the full depth of the pothole or edge break and the backfilling thereof with asphalt.

(a) Excavation

Potholes: The existing material shall be removed in a neat rectangle to sound base, with a minimum dimension of 200 mm x 200 mm. All sides shall be at right angles or parallel to the direction of traffic. The minimum depth of excavation (layer thickness) is 30 mm and the maximum thickness of each layer shall be 50 mm.

Edge breaks: Loose and cracked edges shall be trimmed back in a neat rectangular shape as demarcated by the Engineer, parallel and at right angles to the centre line of the road to sound surrounding surfacing or base and excavated down to sound base. All edges shall be saw cut to a minimum depth of 30 mm below the road surface and the maximum thickness of each layer shall be 50 mm.

(b) Backfilling

After completion of the excavation the Engineer shall be afforded the opportunity to inspect it. The exposed layer shall be trimmed of all undulations to ensure a firm flat base and sides and shall be tacked with 60% cationic stable-grade bitumen emulsion at a rate of 0,6 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 nominal sized aggregate:	1 part
(ii)	6,7 mm nominal sized aggregate:	1 part
(iii)	Crusher sand (fine grade):	1 part
(iv)	60% stable mix-grade emulsion (prepared from 80/100 penetration grade):	Between 75 and 90 litre/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 shall be allowed to dry. The mixture shall then be placed on the areas to be sealed and screeded off in a layer of uniform thickness. After the emulsion has

broken and the layer has attained sufficient stability, it shall be compacted with a steel wheeled roller. The thickness of the layer shall be the same as that of the adjacent seal.

CA 04.05.03 Quality standard

The repaired area shall be rectangular in shape.

The edges of the completed surfacing shall not be more than 3 mm higher than the existing surface. Nowhere shall the edges be below the surrounding road surface.

The thickness of the asphalt surfacing at any point shall be 40 mm± 10 mm.

The cross-fall of the completed area shall be equal to that of the adjacent surface to within a tolerance of± 0,5% cross-fall.

When tested with a 3 metre straight edge laid parallel to or at right angles to the road centre line the surface of the area shall not deviate from the bottom of the straight edge by more than 7 mm.

The reconstruction of the pavement layers shall require a standard of workmanship such that a patch will not deteriorate within the contract period.

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/m^2

(b) Surfacing material

The asphalt shall be a continuously graded medium asphalt either mixed on site or obtained from commercial sources. The asphalt mix to be used shall have the mix properties as specified in table CA 04.04.05/1.

A 60/70 penetration grade bitumen shall be used and the binder type shall comply with the requirements of SANS 307.

Grading limits and mix proportions for continuously graded asphalt applying to asphalt surfacing as stated in table CA 04.04.05/2 shall apply to asphalt used for surface patching.

CA 04.06 ASPHALT SURFACING

CA 04.06.01 General

This section covers the all work in connection with the construction of asphalt surfacing using paving equipment. It includes the procuring and furnishing of aggregate and bituminous binder, mixing at a central mixing plant, transporting, spreading and compaction of the mixture.

This section shall be read in conjunction with the relevant sections of the latest edition of the *Standard Specifications for Road and Bridge Works for State Road Authorities,* issued by COLTO.

The following sections are additions to or alterations of the COLTO specifications as applicable to this contract.

CA 04.06.02 Materials (section 4202)

(a) Bituminous binders

(i) Conventional binders

Add the following:

"The bitumen binder to be used for the continuously graded asphalt surfacing shall be 80/100 penetration road grade bitumen.

(b) Aggregates

(viii) Grading

Add the following:

"The aggregate for continuously graded asphalt surfacing shall be as specified for a medium grading as per Table 4202/7 in the standard specifications (COLTO).

(c) Fillers

Add the following:

"All asphalt mixes specified for use in the works, shall contain at least 1% by mass of hydrated lime filler."

CA 04.06.03 Composition of asphalt base and surfacing mixtures (section 4203)

Add the following:

"The nominal mix proportion (by mass) of the asphalt surfacing mixtures shall conform to the continuously graded medium mix as set out in Table B4202/7, except for the limits of the percentage passing through the 2,360 sieve which should be changed to "38 - 57".

The active mineral filler to be used in the asphalt mixes shall be hydrated lime."

Add the following after "TRH8" in the first sentence of the last paragraph:

", the new South African Hot Mix design guide,"

Add the following:

"The mix designs for continuously graded asphalt surfacing shall be executed to conform to the test requirements given in Table B4203/1 below, which replaces the requirements for these mixes given in Table 4203/1 of the standard specifications.

TABLE 84203/1

PROPERTY	CONTINUOUSLY GRADED ASPHALT SURFACING AND BASE	
	MINIMUM	**MAXIMUM**
Stability (kN)	8,0	15,0
Flow (mm)	2,0	4,0
Stability/flow (kN/mm)	2,5	-
Voids(%)	4,0	6,0
Air permeability (cm')	-	1 x 10-"
Film thickness (µm)	5,5	-
Immersion index(%)	75	-
VMA (%)	15	-
Dynamic Creep Modulus (MPa) at 40'C	25	-
Static Creep Modulus (MPa) at 40'C	100	-
Indirect tensile strength at 25'C (kPa)	1 000	1400
Filler/bitumen ratio	1,0	1,5
Additional testinq as per "South African Hot Mix Design Guide"		
Modified Lottman Test@ 7% voids	TSR 0,7	
Solllab wheel track test @>. 5 000 passes	< 1,25mm	
Gyratory test @ 300 gyrations	1,5%	
Other tests as instructed by the enQineer		

Number of Marshall compaction blows on each side of briquette = 75."

CA 04.06.04 General limitations and requirements and the stockpiling of mixed material (section 4205)

(c) Surface requirements

(iii) Tack coat

Replace the first paragraph with the following:

"A tack coat shall in all cases be applied to the surface to be paved."

Add the following:

"Hand spraying shall only be allowed on areas approved by the engineer. Efficient spray equipment, capable of spraying an even layer of binder covering the whole area to the specified rate, shall be used."

CA 04.06.05 B4214 Quality of materials and workmanship

(b) Coring of asphalt layers

Add the following:

"Cores may only be drilled when the road temperature is 20 °C or below. Each core hole must be filled with hot asphalt and compacted within 12 hours of having been drilled.

Asphalt must be cored within 2 days of having been paved and the density results delivered to the engineer within 2 days of coring.

The engineer reserves the right to withhold payment for asphalt work until all test results for the section of work concerned have been received and the work fully approved."

(c) Routine inspection and tests

Add the following:

"Test results and measurements will be assessed in accordance with the provisions of section 8300: Quality control (Scheme 2)."

CA 04.07 REPAIR OF SEGMENTED PAVING

This section covers the replacement of an existing area of segmented paving as well as the reprocessing and/or replacement of the underlying pavement layers.

CA 04.07.01 Construction

The Engineer will demarcate any areas to be repaired and shall instruct the Contractor with regard to the repair work to be done.

The demarcated area shall be repaired true to line, level and cross-section as shown on the drawings or as directed by the Engineer.

The demarcated area of damaged segmented paving shall be removed. Unless otherwise instructed by the Engineer the pavement layers shall be reinstated as follows:

(i) Selected layers shall be of at least a GS quality and shall be compacted to at least 93% of modified AASHTO density.

(ii) Material for the subbase layers shall be stabilized with 3% cement and compacted to 9S% of modified AASHTO density, and shall be of at least a GS quality.

(iii) The material for the base layer shall be stabilized with S% 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

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

(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-rivetted" 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 TRAFFIC SIGNALS

CA 04.10.01 General

This section covers the installation and maintenance of traffic signals by specialist contractors.

The requirements of the Southern Africa Development Community Road Traffic Signs Manual shall apply to traffic signals provided under this Contract.

CA 04.10.02 Plant and materials

(a) Quality

The Contractor shall provide full technical details and dimensions of the required items for approval by the Engineer before ordering, commencement, manufacture or construction, of the following items, which shall bear the SASS mark:

- the controller;
- vehicle detector units;
- CCIU or modem;
- traffic lights;

- electrical switchgear and terminal blocks, and
- supporting structures, poles, brackets and method of fixing for traffic lights.

Only new plant and materials of merchantable quality and meeting acceptable industry standards shall be used. Plant and materials used shall conform to samples provided by the Contractor, or cited as examples, and approved by the Engineer.

All plant and materials shall be inspected and tested by the manufacturer at the manufacturer's works before delivery.

(b) Environment and working conditions

Plant shall be manufactured, constructed and erected to withstand and operate within the full range of climatic and atmospheric conditions encountered in the relevant area. Electrical components, modules, wiring, printed circuit boards and terminals shall be protected against corrosion, the effects of extreme winds and the effects of extreme temperatures, all as applicable.

(c) Electricity supply

Nominal 230 V RMS 50 Hz electricity supplied by ESCOM is available on the site. The system shall also be connected to the emergency standby power generated on the site during interruptions in ESCOM supply. An electric power distribution board of at least 30 A capacity shall be supplied for each traffic signal.

(d) Electrical earthing

All traffic signal installations shall be earthed to an earth electrode or trench earth designed in accordance to SANS 0199. The earth electrode resistance shall not exceed 2 ohms.

The preferred method of earthing is to run a 16 mm^2 bare hard-drawn copper conductor with the supply cable. Where the supply cable is less than 30 m long, or where earth resistivity is high and the specific earth electrode resistance cannot be achieved by means of a trench earth only, two earth spikes shall be driven vertically into the ground in the trench bottom. One shall be as close as possible to the controller cabinet and the second shall be at least 6 m away. The two spikes shall be connected to each other by means of a trench earth conductor.

Earth conductors shall be copper-clad steel-cored or stainless steel of not less than 19 mm diameter and 2 000 mm length, complying with SANS 1063. The top of each spike and any bare earth condutor shall be at least 500 mm below ground level.

CA 04.10.02 Remedying defects

(a) Defects liability

The Contractor shall remedy any defect in the work, or malfunctioning of traffic signals, within the Defects Liability Period. This period shall be 12 months from the date of issue of the Certificate of Completion, always provided that the period of the Contractor's liability for latent defects shall be

unlimited.

In the event that a traffic signal or an item of plant is repaired or replaced during the Defects Liability Period, the Defects Liability Period for specific item shall be extended by an amount that, when added to the un-expired portion of the Defects Liability Period, totals 12 months from the date of such repair or replacement.

(b) Rectifying defects

The Contractor may, with the approval of the Engineer, effect temporary repairs, always provided such repair does not jeopardize safety and that a permanent repair is effected within 24 hours of the temporary repair having been completed.

(c) Replacement of defective plant and materials

Any defective controller, vehicle detector unit or traffic light shall be replaced in its entirety. Defective plant shall not be repaired. In the case of a defective controller, where the effect may be attributed to the malfunctioning of a replaceable plug-in module or PC board, the Contractor may, with the prior approval of the Engineer, replace the defective module or board.

(d) Recurring defects

In the event that a defective item or a module or PC board has been replaced and the replacement becomes defective or malfunctions any time afterwards, the Contractor shall make a thorough investigation into the cause of the defect or malfunction and report his finding to the Engineer, together with his recommendations for permanently rectifying the defect or malfunction and ensuring it will not re-occur in the item and any other items that are of a similar material or construction.

If the Contractor fails to make, what in the opinion of the Engineer is a conclusive recommendation or effect a permanent remedy, the Employer shall be entitled to take such steps as are necessary to replace the plant with plant from a different manufacturer. The reasonable costs of doing this shall be to the account of the Contractor.

CA 04.10 ROAD MARKING

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 °C, or when, in the opinion of the Engineer, the wind strength is such that it may adversely affect the painting operations.

No road-marking paint may be applied when visibility is dangerously impeded by mist, smoke or smog.

CA 04.10.04 Mechanical equipment for painting

The equipment shall consist of an apparatus for cleaning the surfaces, a mechanical road-painting machine and all additional hand-operated equipment necessary for completing the work. The mechanical road-marking machine shall be capable of painting at least two lines simultaneously and shall apply the paint to a uniform film thickness at the rates of application specified hereinafter. The machine shall be so designed that it will be capable of painting the road markings everywhere to a uniform width with sides within the tolerances specified hereinafter, without the paint running or splashing. The machine shall further be capable of painting lines of different widths by adjusting the spray jets on the machine or by means of additional equipment attached to the machine.

The machine shall be provided with clearly visible amber warning flashing lights which shall always be in operation when the machine is on the road.

CA 04.10.05 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 effect the durability of the paint, and he shall point out these conditions to the Engineer in writing. Disputes arising from such conditions shall be referred to the relevant Regional Engineer for arbitration before road marking commences.

The Contractor shall protect the retro-reflective surfaces of roadstuds when paint is applied and remove the protection immediately after the paint has been applied.

On concrete and bituminous surfaces where polished aggregate is exposed, a tack coat shall be used. On new concrete surfaces any laitance and/or curing compound shall be removed before the markings are applied.

The material shall not be laid over loose debris, mud or similar extraneous matter or over old flaking markings of paint or thermoplastic material. If the road surface is at a temperature of less than 5 °C, or if it is wet, it shall be warmed carefully by a road heater so that, when the material is laid, the surface temperature is above 5 °C and the surface dry.

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. Pre-marking of such a roadway shall entail the searching for and marking of such broken line segments. Painting shall thereafter be done to the same tolerances as prescribed in CA 04.1010.

After spotting, the positions of the proposed road markings such as broken lines and the starting and finishing points of barrier lines shall be indicated on the road. These pre-markings shall be approved by the Engineer prior to commencement of any painting operations.

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 04.10.01 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/m^2
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.

CA05 MAINTENANCE

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

All components of the roadway infrastructure, which includes the road surface, underlying layer works, kerbing, road markings, road signs, sidewalks and gravel shoulders, shall be maintained during the Contract.

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

Jeppes Reef Port of Entry:

(i) Maintenance of approximately 3,400 m² of concrete block paving at operational road

(ii) Maintenance of approximately 2,400 m² of concrete block paving at residential road

(iii) Maintenance of approximately 1500 m² of tar road

(iv) Maintenance of approximately 220 m² of concrete road

This description of the road and paved areas to be maintained is not necessarily complete and shall not limit the maintenance work to be carried out by the Contractor under this contract.

Maintenance shall include all repair work, replacing of components, fixing of defects, or any other actions or rectifying measures necessary for complete and safe functioning of the road infrastructure.

Maintenance of the road infrastructure shall also include all other actions related to maintenance, such as temporary accommodation of traffic through and around work areas, and provision of temporary accesses to properties.

Remuneration for maintenance of the complete roadway infrastructure shall be deemed included in the tendered monthly payment for maintenance thereof, and shall be paid as detailed in Additional Specification SA: General Maintenance.

CA 05.01 ROAD INFRASTRUCTURE

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

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete installation	Monthly
2	Check, inspect, repair all surface and kerb failures	Monthly
3	Check, inspect, repair all pavement failures	Six-monthly
4	Blade all gravel roads and parking areas	Annually
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

CA06 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.

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 overbridge and for all equipment, labour, supervision, nuts, bolts, transport, handling, etc, necessary for the installation of the road sign board.

CA.07.02 Road sign supports (overhead road sign structures excluded)

(a) Steel tubing of 76 mm diameter and 3 mm wall thickness ..... Unit: metre (m)

The unit of measurement shall be the metre of steel tubing used. Bolts and other accessories shall not be measured.

The tendered rates shall include full compensation for erecting the road sign supports, including all bolts, screws, rivets, welding and accessories, together with the painting and galvanizing required and the provision and treatment of breakaway holes in timber supports.
The tendered rates shall also include full compensation for tying up, 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.

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 authorisod dimensions will not be measured for payment.

The tendered rate shall include full compensation for procuring, furnishing and placing the gravel.

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.

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.

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.

High security vehicle barrier:

(a) 4 m road width..... Unit: number

(b) 5 m road width..... Unit: number

The unit of measurement shall be the number of systems installed as specified.

The tendered rates shall include full compensation for the supply, installation and commissioning of the system complete with all controls, vehicle detection loops, booms, STOP signs, traffic signals and accessories, including all preparatory work, excavations in existing road materials, all to the manufacturer's specifications.

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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 shall be adhered to.

CB 02.03 MANUFACTURERS' SPECIFICATIONS, CODES OF PRACTICE AND INSTALLATION INSTRUCTIONS

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

CB 02.04 MUNICIPAL REGULATIONS, LAWS AND BY-LAWS

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

CB 03 OPERATING AND MAINTENANCE MANUALS

No operating and maintenance manuals will be developed for this section.

The contractor shall use the Maintenance Control Plan (see SA Maintenance) to schedule routine preventative maintenance activities.

CB 04 EXECUTION OF REPAIR WORK

CB 04.01 GENERAL

The Contractor shall investigate and inspect all areas of the installation to confirm the extent of the repair work required and shall report to the Engineer. The Engineer will thereafter indicate any areas to be repaired and shall instruct the Contractor with regard to the repair work to be done.

At the start of the repair and maintenance contract all 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 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 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 disposed of where instructed by 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 material shall be well rammed at the optimum moisture content for the material used.

Where excavations are in hard material, overbreak shall be backfilled with concrete of the same class as specified for the lining.

In the case of kerbs and channels the trenches shall be excavated to the required depths and the bedding material shall be well rammed before placing the concrete.

Where wash-aways have occurred, any cavities or voids in the foundation material must be backfilled in layers not exceeding 150 mm in thickness and compacted to 90 % of modified AASHTO density.

(b) Concrete linings

Concrete lining of open drains shall be cast in situ only and the exposed surfaces shall be given a class U2 (wood-floated) surface finish.

Sealed joints in concrete shall be in accordance with the details indicated on the drawings and joints shall be painted with a coat of approved bituminous emulsion containing 60 % of pure bitumen by mass.

Expansion joints shall be made in accordance with the drawings.

(c) Half-round channels

Cast in situ half-round channels shall be constructed in accordance with the drawings, or to fit existing sections.

(d) Kerbing and channeling

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

Kerbing and channeling shall be laid on the approved bedding with close joints filled with 3:1 sand: cement mortar not exceeding 10 mm in thickness and neatly pointed with a pointing trowel. Kerbing shall be propped with class 15/19 in-situ concrete at each joint (size: 300 mm long x 200 mm wide x 80 % of kerb height).

(e) Concrete cast against existing surfaced edges

Where concrete lining or concrete channeling in kerb and channel combinations is to be cast against existing surfacing the edge shall first be cut, before excavation, with approved sawing equipment to provide a neat straight edge. Care shall be taken during the placing of the concrete not to spill concrete onto the adjacent surfacing. Any concrete stains shall be removed by the Contractor at his own expense.

(f) Reinstatement of damaged existing structures

Damaged existing structures shall be demolished to the extent directed by the Engineer on site and the resulting debris shall be spoiled.

The reinstatement of damaged sections shall be carried out to the same standards prescribed for new construction and shall be paid for under the relevant items scheduled for new structures.

Provision shall be made for the reinstatement of existing damaged prefabricated concrete half round channels.

(g) Inlet and outlet structures

The structures shall be constructed in accordance with the requirements specified in the relevant section in this specification.

CB 04.04.02 Quality standard

The drains shall be constructed neatly to the dimensions shown on the drawings and within the specified dimensional and alignment tolerances.

Repairs to drains shall be in uniformity with existing structures.

CB 04.04.03 Materials

(a) Concrete

Concrete for the various structural components shall comply with the class detailed on the drawings. Concrete in channel linings shall be class 20/19.

(b) Steel reinforcement

(i) Steel bars

Steel reinforcing bars shall comply with the requirements of SANS 920.

(ii) Welded steel mesh

Welded steel mesh shall comply with the requirements of SANS 1024.

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 approved cohesive 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.

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

(i) Maintenance of approximately 4500 m of concrete-lined channels of varying sizes.

(ii) Maintenance of approximately 900 m of concrete-lined channel 2m deep with a 2m base width and sloping sides outside the perimeter fence.

(iii) Maintenance of approximately 60 m of rectangular precast concrete culverts of varying sizes.

(iv) Maintenance of approximately 400 m of concrete storm water pipes 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 complete and safe functioning of the stormwater drainage infrastructure.

Maintenance on the stormwater drainage infrastructure shall also include all other actions related to maintenance, such as temporary drainage features and temporary accommodation of traffic.

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 storm water 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

CC 01	SCOPE
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CC01 SCOPE

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

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.

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.

CC02 STANDARD SPECIFICATIONS

CC 02.01 GENERAL STANDARD SPECIFICATIONS.J 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) (198'8)
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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 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.

CC03 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.

CC04 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 PO_STS 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 FE_NCES

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.

Boom gates shall be level to the ground when closed and dual boom gates shall be on the same height when closed. The opening between the ends of two boom gates shall not be more than 150 mm when closed. Boom gates shall be so erected that it is possible to remain in an open position without the hazard of falling when they are unattended.

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.

CCOS **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 81 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 152 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 typing 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 50 x 50 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 **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
3,15-4,0mm	0,10 mm

CC 06.06 GATES

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

CC 06.07 HIGH SECURITY FENCING

CC 06.07.01 POSTS

Posts for 3.0m high fence

100mm x 75mm x 6mm Angle Iron Posts, Predrilled holes for fixing panels & Hot dipped Galvanised in accordance with ISO 1461 (Min. 70 microns)

CC 06.07.01 MESH

Mesh for 3.0m high fence
Mesh type 1

3-5-8 S Welded Mesh Panels
Inner Apertures: 72.2mm x 8.7mm
Wire dia.: 4mm
Width of panel: 2.515m or 3.050m
Tensile strength of wire: 600 - 750N/mm²
Weld strength: 75 to 80%
Weight: 9.34kg/m²
Height of panel (Approximate): 2.985m
Coating Galfan Class A coated to SANS spec.10224-2:2003 (min. 240g/m2)

- **12 MONTH ANTI-VANDALISM GUARANTEE APPLICABLE ON THE 358 S Welded Mesh Panels**

Mesh type 2

3-5-10 S Welded Mesh Panels
Inner Apertures: 73.2mm x 9.7mm
Wire dia.: 3mm
Width of panel: 2.515m or 3.050m
Tensile strength of wire: 600 - 750N/mm²
Weld strength: 75 to 80%
Weight: 5.00kg/m²
Height of panel (Approximate): 2.985m
Coating: Galfan Class A Coated to EN 10224-2 specification (min. 240g/m^2)

CC 06.07.01 COVERING PLATE

Covering Plate for 3.0m high fence

70mm x 6mm Flatiron section, Predrilled countersunk holes for fixing mesh to posts. Hot dipped Galvanised in accordance with ISO 1461 (Min. 70 microns)

CC 06.07.01 TOP RAIL

Top Rail Plate for 3.0m high fence

40mm x 40mm x 3mm Angle Iron, including predrilled holes for fixing rails to posts and for fixing top section of mesh to rail. Top rail to be fitted with 32mm high x 2mm thick serrated comb. Razor combs to be fillet welded 10mm at every 100mm centres. Hot dipped Galvanised in accordance with ISO 1461

Minimum coating of toprail: 55 microns
Minimum coating of serrated comb: 55 microns

CC 06.07.01 BOTTOM RAIL

Bottom Rail for 3.0m high fence

40mm x 40mm x 3mm Angle Iron, predrilled holes for fixing rails to posts & for fixing bottom section of mesh to rail. Hot dipped Galvanised in accordance with ISO 1461. Minimum coating of bottom rail: 55 microns

CC 06.07.01 FIXING ACCESSORIES

Fixing Accessories for 3.0m high fence

MS x 40mm Stainless steel countersunk flush lock bolts, stainless steel fender washers M8 x 25mm x 2mm & MS stainless steel shear nuts to attach covering plate & mesh to posts.
MS x 30mm Stainless steel cup square bolts, stainless steel fender washers MS x 25mm x 2mm & MS stainless steel shear nuts to attach bottom & top section of mesh to rails.
MS x 40mm Stainless steel cup square bolts, stainless steel fender washers M8 x 25mm x 2mm & MS stainless steel shear nuts to attach ends of rails to posts

CC 06.07.01 SECURITY EXTENSIONS

- 450mm or 730mm single cranked overhang with 3 strands of Motto 1.6mm double stranded Aluzinc barbed wire & Barbed Tape Concertina Coil 700mm dia. manufactured from Galfan Class A Coated Wire to SANS 10224-2:2003 specification & 2200 2incalu 0.5mm strip.

- 500mm or 700mm straight extension with 3 strands of Motto 1.6mm double stranded Aluzinc Barbed Wire & Flatwrap Razor Wire 500mm or 700mm dia. manufactured from Galfan Class A Coated Wire to SANS 10224-2:2003 specification & 2200 2incalu 0.5mm strip.

CC07 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:

1) Mahamba Port of Entry:

   a) Maintenance of approximately 1050 m of perimeter fence and gates consisting of 1,8 m high diamond mesh with 600mm 45° angle barbed wire;

   b) Maintenance of approximately 620 m of perimeter fence and gates consisting of 1,8 m high diamond mesh with barbed wire and flat wrap;

   c) Maintenance of approximately 2410 m of 1,2 m high diamond mesh fence and gates around residences at Mahamba Port of Entry;

   d) Maintenance of approximately 570 m of 1,8 m high diamond mesh fence and gates inside the operational area at Mahamba Port of Entry;

   e) Maintenance of approximately 360 m of 1,8 m high pre-cast concrete perimeter wall at Mahamba Port of Entry.

2) Emahlathini Port of Entry

   a) Maintenance of approximately 1054 m of perimeter fence and gates consisting of 1,8 m high diamond mesh and a additional 600mm 45° overhang with strings of barbed wire;
   b) Maintenance of approximately 638 m of 1,2 m high diamond mesh fence and gates around residences.

3) Bothashoop Port of Entry

   a) Mainten nce of approximately 1863 m of perimeter fence and gates consisting of 1,8 m high diamond mesh and a additional 600mm 45° overhang with strings of barbed wire;

   b) Maintenance of approximately 297 m of 1,2 m high diamond mesh fence and gates around residences.

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 CC.7

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 fence route.

(b) Inspect and report on the installation.

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

(d) Corrosion protection on fencing, gates and tubular posts

CCOS MEASUREMENT AND PAYMENT

CC.01 CLEARING THE FENCE ROUTE:

CC.01.01 1 m wide striQ 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 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: metre (m)

d) Welded Mesh Panels ..... Unit: number

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

f) Posts ..... Unit: number

g) Top Rails ..... Unit: number

h) Bottom Rails ..... Unit: number

i) Gates ..... Unit: number

j) Y-standards ..... Unit: number

k) Over hang extensions ..... Unit: metre (m)

l) Concrete Footing ..... Unit: metre (m)

m) Concrete Palisade Fence ..... Unit: number

n) Pre-cast Concrete Wall ..... 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 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) Welded mesh for security fence

The unit of measurement shall be the number of welded mesh panels replaced and the quantity shall be calculated using the prescribed length between posts.

d) 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. Posts for security fencing shall be measured per number including covering plates for fixing mesh to posts and fixing accessories.

e) Top rails

The unit of measurement shall be the number of top rails replaced including all fixing accessories.

f) Bottom rails

The unit of measurement shall be the number of bottom rails replaced including all fixing accessories.

g) Security extensions

The unit of measurement shall be the metre of each type of security extension measured in place and between end posts including all fixing accessories.

h) Gates

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

i) Concrete footings

The unit of measurement shall be the metre of concrete put in place between end posts and comply with SASS 1200 G specifications.

j) Concrete Palisade Fence

The unit of measurement shall be the number of each type of palisade fence post, cross member or palisades replaced.

k) Pre-cast Concrete Wall

The unit of measurement shall be the number of each type of pre-cast wall posts or units replaced.

TECHNICAL SPECIFICATION

CE WATER DISTRIBUTION NETWORKS

CONTENTS

CE 01 SCOPE
CE 02 STANDARD SPECIFICATIONS
CE 03 OPERATING AND MAINTENANCE MANUALS
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CE 05 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK
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CE 08 MEASUREMENT AND PAYMENT

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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 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 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.

(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) HDPe underground pipe installations

(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 manufacturers 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 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.

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 Recondition valves ..... 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.

(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:

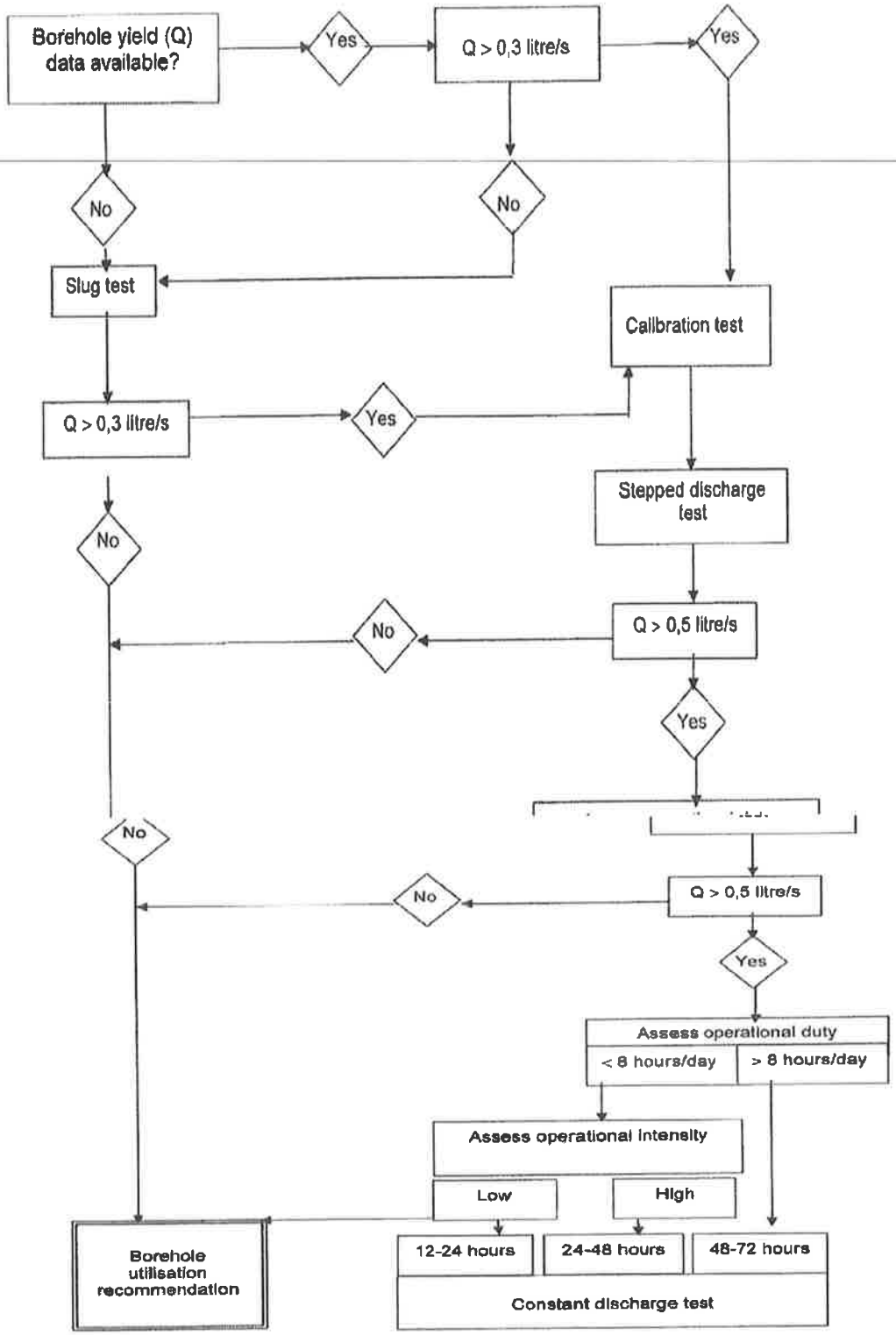
(1) The amount of water blown out of the borehole during drilling operations;

(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
Stepped discharge test
No
No
Q > 0,5 litre/s
Yes
No
Q > 0,5 litre/s
Yes
Assess operational duty
< 8 hours/day
> 8 hours/day
Assess operational intensity
Low
High
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/sand 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 utilization 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 equipmenUinstrumentation

This equipmenUinstrumentation 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 (1O 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 sam.Eill!:l,g

(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:	± 0,3 TU (0 - 3 TU); otherwise± 10 %
Radiocarbon:	± 2 pMC (> 40 pMC); ± 1 pMC (< 40 pMC)
Oxygen-18:	$\delta^{18}O$; + 0,15 ‰
Deuterium:	$\delta^{2}H$; ± 1,5 ‰

DA 04.02.04 Aborted tests and bre_akd_0wns

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.

(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.

DA 04.05 SUBMERSIBLE CENTRIF UGAL PUMPS

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 De,eth 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 Pl.1111.12 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...Im.E!ellers

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 Se ls 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..w,Qe**

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 Pum,t! 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 !;!late

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 Pum,t! 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 DeQth 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 PumR..,!Reed

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 st,all be removable and serviceable and shall under no circumstances be integrated into the body of the pumps.

DA 04.06.06 PumQ 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 PumQ 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 **Risin9..R!E!e**

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 vent

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 P ulley 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 d[ives

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 *mis* 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 **PumQ 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.

DA05 GENERAL SPECIFICATI ON fOR ELECT RIC 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 JER_MINAL 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.

DA06 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 commissionmg 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), EEFICJENCY 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.

DA07 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:

TABLE DA 07/1 ROUTINE MAINTENANCE OF INSTALLATIONS, SYSTEMS AND EQUIPMENT

NO	ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Service submersible pumps	Six-monthly
2	Clean filters/strainers	Two-monthly
3	Check V-belts	Monthly
4	Measure rest water-level	Monthly
5	Check MCC panel	Two-monthly
6	Check electric motors	Monthly

DA08 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: m²

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: m³

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 (m³)

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.03.04 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 as specified.

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 III!!!!.PS:

(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 SUBMER_SIBLE_P_RQG_RESSING 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.

TECHNICAL SPECIFICATION

DB PRESSURE FILTERS

CONTENTS

DB 01	SCOPE
0802	STANDARD SPECIFICATIONS
0803	OPERATING AND MAINTENANCE MANUALS
DB04	MOTOR DESIGN AND REQUIREMENTS
0805	WORKING VOLTAGE AND SUPPLY SYSTEMS
DB06	DETAIL OF WORK
0807	FILTER MEDIA
DB08	FILTER PROCESS REQUIREMENTS
DB 09	FLOW RATES
DB10	MAINTENANCE
DB 11	MEASUREMENT AND PAYMENT

DB 01 SCOPE

This specification covers the decommissioning, removal, replacement, repair and reconditioning, installation, testing, commissioning and maintenance of pressure filters and equipment such as backwash equipment, motor control centres, low voltage cables, filter media and filter under drain systems.

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. The repair work and maintenance of the particular filter systems are specified in the relevant clauses on detail of repair work and maintenance in this specification.

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.

DB02 STANDARD SPECIFICATIONS

DB 02.01 GENERAL STANDARD Sf>_ECIfICATIONS, 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 241		Drinking Water
SANS 1036	-	The management of potable water distribution systems

DB 02.02 **OCCUPA TIONAL 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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 shall be adhered to.

DB 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.

DB 02.04 MUNICIPAL REGULATIONSs LAWS AND BY-LAWS

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

DB03 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.

DB04 MOTOR DESIGN AND REQUIREMENTS

(a) Electric motors shall comply with the requirements of SANS 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 SANS 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 results 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.

U) 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.

0805 WORKING VOLTAGE AND_SUPPLY SYST_EMS

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.

0806 DETAIL OF WORK

The existing dual media filters at Emahlathini Port of Entry will only be maintained by the contractor under this contract.

DB 06.01 PRESSURE DUAL/MULJI_MEDJ_A_fILT_ER_SYSTEMS

Filter data:

Filter diameter	700mm
Filter effective area	0,385m²
Filter height	1380mm
Material of construction	Glass Reinforced fibre (GRP)
Under-drain	225 micron slotted ABS on segmented balanced grid
Project design pressure	100 kPa
Max operating pressure	240 kPa
Test pressure	360 Kpa

DB 06.03 **UNDER DRAIN SYSTEMS**

The under drain system shall be replaced whenever the filter media is replaced. Only authentic under drain systems obtainable from the supplier of the filter shall be installed.

DB07 **FIl TER MEDIA**

Silica sand and hydro anthracite media shall be used as filtration media. The composition of the filter media shall be as follows:

- 150 litre Silica Sand: grain size:0.4mm - 0.8mm
- 150 litre Hydro Anthracite grain size :0.8mm - 1.6mm

DB08 FIl TER PROCESS REQUIREMENTS

The Pressure Filters conform to the following process requirements:

- Only chemically treated (flocculated} and clarified water shall be treated in the filters.
- Filtered water is collected in the under drain system.
- The same under drain system is used for the backwash system of the filter.
- Operating pressure maximum 200kpa

DB09 FLOW RATES

- The filtration rate shall be not more than 4m/hour.

DB10 MAINTENANCE

DB 10.01 GENERAL

All wastewater 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 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 wastewater 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, and illustrated in detail on the mechanical flow diagram.

DB 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 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 PRESSURE FILTER SYSTEMS	MAINTENANCE FREQUENCY
1	Visually inspect and report on complete system	Monthly
2	Check back wash and filtration flow rates	Monthly
3	Check, inspect, report and repair leaks	Monthly
4	Check filter inlet and outlet pressure	Daily
5	Check valve settings for specific mode	Daily

DB 11 MEASUREMENT AND AYMENT

DB11.01 SUPPLY AND DELIV ER v Q F E ILTER EQUIPMENT ..... Unit: number

The unit of measurement shall be the number of filter 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 GRP filter vessel with lid, O-rings and holding down bolts, nuts and washers.
(b) Filter media
(c) Under drain pipe work

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

DB11.02 INSTALLATION, TESTING AND COMMISSIONING OF FILTER E QUIPMENT ..... Unit: number

The unit of measurement shall be the number of filter equipment units installed, 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) The pump(s) as an integrated unit of the filter system
(b) Electrical power cable.
(c) The GRP filter vessel and its associated parts.
(d) Filter media
(e) Under drain pipe work
(f) Routing and fastening of the power cable up to the isolator box;
(g) 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.

0811.03 DECOMMISSIONING AND REMOVAL OF FILTER EQUIPMENT..... Unit: number

The unit of measurement shall be the number of filter equipment units de-commissioned 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 filter equipment.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

0811.04 **SERVICE/RECONDITIONING_O_f_fJLTER _EQUIPMENT** Unit: number

The unit of measurement shall be the number of filter equipment units reconditioned/serviced.

The tendered rates shall include full compensation for the reconditioning/servicing of components and materials, and for tools, transport, site handling and labour necessary for the complete reconditioning of filter equipment to conform to all the specifications in Clause DB.OS: Motor design and requirements.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

0811.05 **REPAIR OF FILTER EQUIPMENT,** .....Unit: number

The unit of measurement shall be the number of filter equipment units 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.

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
DL04	PROCUREMENT AND INSTALLATION OF CHLORINATION SYSTEMS
DL 05	TESTING AND COMMISSIONING
DL06	OPERATION AND MAINTENANCE
DL 07	MEASUREMENT AND PAYMENT

DL01 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.

DL02 STANDARD SPECIFI CAIIONS

DL 02.01 GENERAL STANDARD SPECIFICATION_S, 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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 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.

DL03 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.

DL04 PROCUREMENT AND INSTALLATION OF CHLORINATION SYSTE MS

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.

Dosing is based on the principle of erosion of solid calcium hypochlorite (Ca(ClO)2), which dissolves in water and is introduced into the main water supply system through a venturi system. This means that the dosing only takes place while there is flow in the main pipe.

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.

The venturi shall be installed in a pipe section forming a U-loop that is connected to the main pipe with isolating ball valves. A ball valve shall also be installed in the main pipe that shall normally be closed to direct water through the venturi, as illustrated in figure DL1. Partial opening of the ball valves shall ensure the correct backpressure to set dose rate. Closing of the ball valves in the U-loop shall enable dismantling of the venturi without interrupting the main water flow. Easy access to clear blockages shall be provided in the design of the installation. A UV-stabilized polyethylene (PE) off-white or semitransparent dose tank is required.

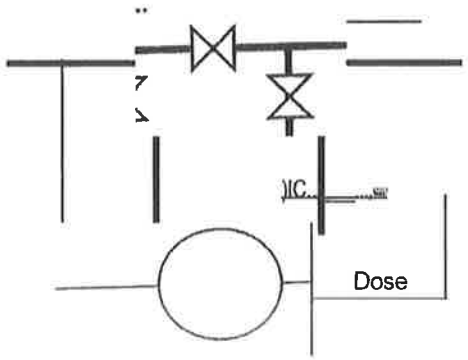


Figure DL 1: Schematic layout of venturi system for calcium hypochlorite dosing.

All Ca(CIO)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.

DL 04.03 **SODIUM HYPOCHLORITE DOSIN_G_ S'IS_T_EM**

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 (NaOCI) 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 YACUUM 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.

DL05 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.

DL06 OPERATION AND MAINTENANCE

DL 06.01 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 06.02 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 06.02/1

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 06.03 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 06.04 SAFETY PROCEDURES AND fR_E-CA_UTIQNS

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 06.05 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.

DL07 MEASUREMENT AND PAYMENT

DL.01 SUPPLY AND DELIVERY Of CH_LQRI_NATION 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.

JECHNICAL SPECIEICATION

DN D OSING SYSTEMS FOR THE FLOCCULATION OF DRINKING WATER

CONTENTS

DN 01	SCOPE
DN 02	STANDARD SPECIFICATIONS
DN 03	OPERATING AND MAINTENANCE MANUALS
DN 04	PROCUREMENT AND INSTALLATION OF DOSING SYSTEMS
DN 05	PROJECT SPECIFICATIONS
DN 06	TESTING AND COMMISIONING
DN 07	OPERATION AND MAINTENANCE
DN 08	MEASUREMENT AND PAYMENT

DN 01 SCOPE

This specification states the requirements for all work related to the procurement, installation, testing, commissioning, operation and maintenance of dosing equipment for the coagulation and flocculation of drinking water at the water works of the Lebombo Port of Entry Prison.

DN02 STANDARD SPECIFICATIONS

DN 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 SM 1052	- Residual chlorine content of water

DN 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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 shall be adhered to.

DN 02.03 **MANUFACTURERS' SPECIFICATIONS, CODES OF PRACTICE AND INSTALLATION JNSTRUCTIONS**

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

DN 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.

DN 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 chemical dosing 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.

DN 04 **PROCUREMENT ANO INS_JALL._ATIQN OF DOSING SYSTEMS**

DN 04.01 **GENERAL**

The Contractor shall submit proof to the Engineer to demonstrate his (or his subcontractor's) understanding, skill and experience in the assembly of chemical dosing systems for water purification

All dosing equipment shall be manually adjustable to set accurate dosing rates within the range of average daily flow rates specified. The dosing range shall be between 1 - 200 mg/l .

The dosing system shall be installed in such a way as to dose at the start of the coagulatiqn cascade to utilize the full potential of the mixing energy available..

DN 04.02 **COAGULATION LFLOCCULATION SYSTE M**

The dosing system required shall consist of the following components:

- 150 L dosing tank with electric stirrer, no 2.
- Extraction device and level indicator, no 2.
- Suction pulsation damper, no 2.
- Metering pumps, 20 l/ hour @ 10 bar working pressure, no 2.
- Overflow valve, no 2.
- Pressure retention valve, no 2.
- Pulsation damper, no 2.
- Metering tube, no 2.
- Injection unit, no 2.
- 63mm dia uPVC class 16 pipe including wall brackets at 0.5m c/c, 90°bends and couplings, 1Om.

DN05 PROJECT SPECIFICATION

The raw water to be purified and reticulated as potable water to consumers residing at the Emahlathini Port of Entry is pumped from the river. The raw water shall be treated to remove turbidity and colour and the final clarified and filtered drinking water shall be disinfected to achieve the statutory requirement for the physical, organoleptic, chemical and microbiological requirements in accordance with SANS 241-2006.

The purification process includes the following:

- Destabilisation of particles by introducing a coagulanUflocculent into a rapid mixing zone.
- Followed by flocculation in a slow mixing zone.
- Followed by clarification in sedimentation tank
- Followed by filtration in sand filter
- Followed by disinfection by chlorination at the clean water reservoir inlet.

DN 05.01 MATERIALS

All materials used to assemble the dosing equipment shall be in accordance with the manufacturer's specification and within the prescribed working range specified.

DN 05.02 SYSTEM COMPON_ENTS

Notwithstanding the system components described in this specification or in the data sheets, the supplied system must be a complete working system, including dosing pumps, chemical containers for working solutions and chemical supply lines. Dosing tanks shall be installed in such a manner that it can be removed and cleaned before the new batch of working solutions are prepared.

The components of a typical dosing system shall include the following:

- Dosing tanks with electrical agitator for the preparation and dispensing of working solutions.
- An extraction device and level indicator
- A suction pulsation damper.
- Dosing pumps(Duty and Standby)
- Overflow valve.
- Pressure retention valve.
- Pulsation damper (Delivery side)
- Measuring tube
- Injection unit

The final assembly of the dosing system shall be approved by the Engineer.
For a schematic layout please see Annexure 2

DN 05.03 ELECTRICAL_POW_ER SUPPLY

Electrical power supply at 220V, single phase, 50Hz will be made available in the dosing room as well as the chlorine store.

The Contractor shall co-ordinate the interfacing requirements of the Electrical Subcontractor and the relevant Mechanical Subcontractor.

ON 05.04 **CIVIL REQUIREMENTS**

The Contractor shall construct and install plinths, holding-down bolts, pipe ducts, excavate trenches and perform other civil construction work with due cognizance of the relevant Sub-contractor's requirements. Grouting of the bolts shall only be performed after setting up of the plant by the Contractor.

The Contractor shall be responsible for erecting, installing and fixing all pumps, pipe work and ancillary equipment.

DN06 TESTING AND COMMISSIONING

After installation, the contractor shall evaluate the functioning of the dosing systems to ensure that there are no leaks and that the rate of dosing is set correctly.

DN07 OPERATION AND MAINTENANCE

ON 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.

ON 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 07.02/1 below.
These actions and findings shall be logged and reported on the relevant approved schedules and reports.

TABLE PbL 07.02.1

NO	ROUTINE PREVENTATIVE MAINTENANCE OF CHEMICAL DOSING 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 room and apparatus.	Monthly
4	Corrosion protect all equipment and ancillaries.	Whenever necessary
5	Check for and repair all leaks.	Monthly
6	Check dosing rate and reset regulators if necessary.	Monthly

DN 07.03 OPERATION

Operation of all chemical dosing systems shall include:

- The supply of water purification chemicals. The contractor shall supply chemicals to ensure that there is always enough supplied for a full month's requirement.
- Record keeping of the turbidity readings of raw water as well as purified water.
- The concentration of chemical working solutions.
- The % settings on the dosing pumps.
- The capacity of the dosing pump in use.
- The actual volume of chemicals consumed.
- Monthly analysis of the product water in terms of SANS 241:2006
- Reporting in writing preferably electronically of the above.

DN 07.05 REMUNERATION

Remuneration for the monthly operation of chemical dosing systems, the supply of water purification chemicals as well as all maintenance and reporting activities related to chemical dosing 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.

DN 08 MEASUREMENT AND PAYMENT

DN.01 SUPPLY AND DELIVERY OF CHEMICAL DOSING SYSTEMS ..... unit: number

The unit of measurement shall be the number of chemical dosing 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.
- The tendered rate shall include all components as listed in PON 05.02 above

Tendered rates shall include full compensation for all transport cost, including all handling of the equipment, loading and off-loading of chemical dosing systems.

DN.02 INSTALLATION, TESTING AND COMMISSIONING OF CHEMICAL DOSING SYSTEMS ..... Unit: number

The unit of measurement shall be the number of chemical dosing systems installed, 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 all equipment, ancillaries and all other necessary appurtenances required to render a fully functional dosing 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.

DN.03 **SERVICING, TESTIN AND COMMISSIONING OF CHEMICAL DOSING SYSTEMS** ..... Unit: number

The unit of measurement shall be the number of dosing systems serviced, tested and commissioned.

The tendered rates shall include full compensation for the servicing, testing and commissioning, site handling and positioning of the dosing equipment, setting of the dosing rate including the fastening of the equipment in its designated position.

DN.04 DECOMMISSIONING AND REPAIR/RECONDITIONING OF VALVES AND SLUICE GATES..... Unit: number

The unit of measurement shall be the number of gate valves, flow control valves and sluice gates decommissioned and repaired or reconditioned.

The tendered rate shall include full compensation for replacement of components and materials for tools, transport, site handling and labour necessary for the complete decommissioning, dismantling, cleaning, repair or reconditioning of gate valves, flow control valves and sluice gates.

DN.05 INSTALLATION, TESTING AND COMMISSIONING OF VALVES AND SLUICE GATES ..... Unit: number

The unit of measurement shall be the number of gate valves, flow control valves and sluice gates installed, tested and commissioned.

The tendered rate shall include full compensation for the installation, testing, and commissioning making good all corrosion protected areas and for all other costs and actions necessary to obtain a complete working valve, control valve and sluice gate system as well as for materials, tools, transport, site handling and labour.

JfCI:U!JICAL SPECIFICATION

WASTEWATER PUMP SYSTEMS AND AERATORS

CONTENTS

EB 01	SCOPE
EB 02	STANDARD SPECIFICATIONS
EB 03	OPERATING AND MAINTENANCE MANUALS
EB 04	PUMP DESIGN AND REQUIREMENTS
EB 05	MOTOR DESIGN AND REQUIREMENTS
EB 06	WORKING VOLTAGE AND SUPPLY SYSTEMS
EB 07	PROTECTION AND CONTROL DEVICES
EB 08	DETAIL OF WORK
EB 09	TESTING AND COMMISSIONING
EB 10	MAINTENANCE
EB 11	MEASUREMENT AND PAYMENT

EB 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 wastewater pump systems shall be delivery of sewage or sludge at a specified flow rate and head to the required location.

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. The repair work and maintenance of the particular wastewater pump systems are specified in the relevant clauses on detail of repair work and maintenance in this specification.

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.

EB02 STANDARD SPECIFICATIOfiS

EB 02.01 GENERAL STANQARD 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
BS 1486, Part 2		Heavy-duty lubrication nipples
ISO 281/1		Rolling bearings - dynamic load ratings and rating life.

EB 02.02 OCCUPATIONAL HEALTH AND SAFETY ACT OF 1993

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

EB 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.

EB **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.

EB 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.

EB04 **PUMP DESIGN AND REQUIREMENTS**

(a) Submersible pumps shall be designed to be suitable for submersion in sewage up to a depth of 5 m.

(b) The pump shaft shall be manufactured from stainless steel and shall be sealed with double mechanical face seals where it enters the casing.

(c) The impeller shall be suitable for pumping a type of wastewater as specified in Clause EB 08: Detail of work. All impellers shall be of the non-clogging type. The spacer between the impeller and back plate shall be reset every six months to the minimum distance to prevent clogging of rags between impeller and back plate.

(d) The impeller shall be manufactured from stainless steel or, in the case of other materials, 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.

U) 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. The label shall include the following information:

pump rates
pump head
power required
NPSH(r) rotational speed
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.

(o) 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 %.

EB05 MOTOR DESIGN AND REQUJREMENTS

(a) Electric motors shall comply with the requirements of SANS 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 SANS 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 results 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.

U) 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.

EB 06 WORKING VOLTAGE AND SUPPLY S'IST_EM_S

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.

EB 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 is switched on, the pump duty shall rotate to 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 restart.

Pumps shall be operated in both manual and automatic modes.

EB 08 DETAIL OF WORK

The Engineer will demarcate any areas to be repaired and shall instruct the Contractor with regard to the maintenance and servicing work to be done.

EB 08.01 SLUDGE PUMP SYSTEJ\IIS

Electrically operated submersible vortex impeller pump with a working point of 10 l/s at a total head of 6 meter,3kW, 1450 rpm with 195mm dia impeller

EB 08.02 TESTLNG EQUIPMENT

N/A

EB 08.03 HUMUS PUMPING EQU Ie MENT

0.75kW 380V settler sludge return pump similar or equal to Best model No.3

EB 08.04 AERATORS

Double stage side channel bower 3.4kW 380V 7.2A @ 410 mbar static pressure at sea level @74db similar or equal to Sirocco

EB 08.05 MOTOR CONTROL CE NTRE

(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) Missing, damaged or faulty float 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 board 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

EB 09 TESTING AND COMMISSIONING

EB 09.01 TESTS TO BE PERFORMED

(a) All pumping equipment shall be subject to the commissioning tests as described in the standard 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.

EB 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 pressure gauges to measure the suction and delivery pressures. If no gauge fittings exist on the suction side of a submersible pump, then the suction pressure conditions shall be calculated from the system properties.

EB 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.

EB 09.04 TEST CONDITIONS

(a) All tests shall 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 09.05 ADDITIONAL TESTS

Additional tests may be specified in the detail of the work.

EB 10 MAINTENANCE

EB 10.01 GENERAL

All wastewater 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 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 wastewater 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, and illustrated in detail on the mechanical flow diagram.

EB **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 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	Once per contract
4	Check, inspect, report and repair all leaks	Monthly
5	Check and lubricate moving parts	Four-monthly

EB 11 ME_ASUREMENT AND PAYMENT

EB11.01 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.

EB11.02 INSTALLATION, TESTING AND COMMISSIONING OF **PUMPING** EQUIPMENT.....Unit: number

The unit of measurement shall be the number of pumping equipment units installed, 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.

EB11.03 DECOMMISSIONING AND REMOVAL OF PUMPING EQUIPMENT..... Unit: number

The unit of measurement shall be the number of pumping equipment units de-commissioned 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.

EB11.04 **SERVICE/RECONDITIONING OF PUMPING EQUIPMENT** , Unit: number

The unit of measurement shall be the number of pumps and motors reconditioned/serviced.

The tendered rates shall include full compensation for the reconditioning/servicing 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 EB.04: Pump design and requirements, and EB.05: Motor design and requirements.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EB11.05 **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.

EB 11.06 **RECONDITIONING OF FLOAT LEVEL SWITCHES OR OTHER LEVEL PROBES** Unit: number

The unit of measurement shall be the number of level switches or probes 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 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 11.07 **CLEANING AND REMOVAL OF REDUNDANT EQUIPMENT FROM WASTE WATER PUMP SUMPS, PUMP ROOMS AND RELATED INFRASTRUCTURE**.....Unit :sum

The unit of measurement shall be a sum to clean and remove redundant material from waste water pump sumps and related infra structure such as valve chambers and pump rooms.

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 in conformance with the specifications in Clause EA 08, Detail of Work.

r_e_CHNICAL SPECIFICATION

SEDIMENTATION TANKS

CONTENTS

EC 01	SCOPE
EC02	STANDARD SPECIFICATIONS AND ADDITIONAL SPECIFICATIONS
EC03	ADDITIONAL REQUIREMENTS FOR REPAIR OF SEDIMENTATION TANKS AND APPURTENANCES
EC04	OPERATING AND MAINTENANCE MANUALS
EC05	DETAIL OF REPAIR WORK
EC 06	MAINTENANCE OF SEDIMENTATION TANKS
EC 07	MEASUREMENT AND PAYMENT

EC 01 SCOPE

Sedimentation tanks for sewage treatment works include all circular primary settling tanks and circular secondary settling tanks (also referred to as final clarifiers in activated sludge works or humus tanks, where sedimentation tanks are downstream of biological trickling filters). In water purification works circular as well as rectangular clarifiers are used. The repair work and maintenance responsibilities of sedimentation tanks shall form part of the whole of a wastewater treatment works. The use of mechanical scrapers is excluded from the work and responsibilities described herein.

The function of the primary sedimentation tanks is the reduction in organic load entering the biological treatment facility. The reduction in organic load is achieved as a result of solid material (raw sludge) settling under the influence of gravity. Raw sludge shall be withdrawn to sludge treatment and disposal works.

The function of secondary sedimentation tanks/ clarifiers is to ensure sufficiently clarified water for filtration at water purification works, as well as thickened activated sludge as return activated sludge to a biological reactor, or withdrawal of humus where the sedimentation tank is downstream of a biological trickling filter. Water purification sludge withdrawal, activated sludge return and humus withdrawal systems are included in the work and responsibilities described in this specification.

The maintenance of sedimentation tanks shall include various responsibilities, as specified in the relevant clauses. Maintenance responsibilities shall include all work to ensure the functional performance of sedimentation tanks and to maintain the specified quality of effluent.

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. The repair work and maintenance of the particular wastewater sedimentation tanks are specified in the relevant clauses on detail of repair work and maintenance in this specification.

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.

EC 02 STANDARD SPECIFICATIONS ANO ADDITIONAL 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:

EC 02.01 GI:N ERAL STANDARD SPECIFICATIONS, REGULATIONS ANO CODES

SANS 1200 Standardized specification for civil engineering construction

SANS SM 1049 Water - suspended solids content, second edition, 1990

Operating manual for biological nutrient removal wastewater treatment works, WRC Report no TT83/97, 1997

Theory, design and operation of nutrient removal activated sludge processes; WRC Report no 15525, 1984

EC 02.02 OTHER SPECIFICATIONS

EB Wastewater pump systems
EF Sludge treatment and disposal

EC 02.03 OCCUPATIONAL HEALTH AND SAFETY ACT OF 1993

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

EC 02.04 MANUFACTURERS' SPECIFICATIONS, CODES OF PRACTICE ANO INSTALLATION INSTRUCJIQN_S

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

EC 02.05 MUNICIPAL REGULATIONS, LAWS ANO BY-LAWS

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

EC03 ADDITIONAL REQUIREMENTS FOR REPAIR ANO RECOMMISSIONING OF SEDIMENTATION TANKS ANO APPURTENANCES

EC 03.01 GENERAL

Sedimentation tanks shall be repaired to the level of designed functionality or to comply with requirements of laws and regulations. The repair work shall enable the Contractor to maintain the units as new units for the period as specified.

EC 03.02 FIXED BRIDGES

Fixed bridges shall be repaired allowing safe access to the centre of sedimentation tanks. Bridges shall be repaired to comply with the Occupational Health and Safety Act 85 of 1993.

Bridge repair shall imply removal thereof to complete repair work where specified. Repair work shall include sanding and painting of metal to yield a finish protected against corrosion. Hand railings and walkways shall be cleaned, corrosion protected, fixed and replaced in part where necessary.

Access for cleaning of stilling wells shall not be impaired as a consequence of repair work.

EC 03.03 INLET PIPEWORK AND VALVES

Repair of inlet pipework shall include all lengths of pipe between the previous process unit and the centre stilling well outlet. Pipework shall be repaired where sedimentation tanks are taken out of commission and flow bypassed through parallel units or bypassed to other process units.

Repair work shall include fixing and/or replacement of lengths of pipe, brackets and hangers and all appurtenances, as detailed on the drawings.

EC 03.04 STILLING WELLS

Stilling wells shall be removed together with the fixed bridge and repaired with a finish to protect the stilling well against corrosion. The diameter, material and method of fixing shall be as detailed on drawings.

EC 03.05 EFFLUENT WEIRS

Where specified, effluent weirs shall be removed and reinstalled horizontally, within tolerance, to ensure equal flow distribution through the sedimentation tank. The weirs shall be sanded and painted against corrosion before reinstallation.

EC 03.06 EFFLUENT LAUNDERS AND PERIMETER WALLS

All cracks in effluent launders shall be sealed and all algae removed from surface. The Contractor shall make temporary arrangements to accommodate the existing flow during repair work. The walls of the launder (on the perimeter of the tank) channel shall be repaired where necessary. All hand railings, cemented tiles or other barriers on the perimeter and on top of walls shall be cemented, repaired and painted.

EC 03.07 SCUM WITHDRAWAL SYSTEMS

Scum withdrawal systems at primary settling tanks shall be repaired together with the central stilling well. From the central stilling well an open chute (half pipe) shall run radially to the scum baffle. From the scum baffle the full pipe shall run to the outside of the tank to remove scum. A valve shall be connected to the far end of the pipe and will open into a scum/sludge manhole. A straining basket or screen at the open end of the valve (pipe end) shall intercept all artificial solids present in scum. A scum baffle (scum board) shall prevent scum from escaping the sedimentation tank. The circular scum baffle shall run around the sedimentation tank 300 - 400 mm from the inside of the effluent weir. The scum baffle shall be 450 - 500 mm high and submerged by at least 400 mm of its height.

Repair work shall include replacement, repair, cleaning and corrosion protection of the outlet chute; pipeline and scum baffle to form a perfect working system.

EC 03.08 PRIMARY SEIJLING TANKS

Where parallel tanks are used, both tanks shall be emptied and cleaned completely. The Contractor shall isolate one tank and divert all flow to other tank(s) to do repair work, which shall include cleaning of pipelines entering the sedimentation tank, desludging all components/parts of the sedimentation tank and repairing cracks and waterproofing.

Where single tanks are provided adequate provision shall be made for the decommissioning of the tank and the accommodation of the flow.

EC **03.09** **SLUDGE WITHDRAWAL SYSTEM (PRIMARY SETTLING TANKS)**

The sludge withdrawal system shall consist of a pipeline and a manually opened gate valve. The repair work shall include removing the valve, while isolating the outlet pipe by means of a flanged spade and blank flange. The gate valve shall be fully reconditioned.

EC 03.10 SECONDARY SETTLING TANKS

Where parallel tanks are used, both tanks shall be emptied and cleaned completely. The Contractor shall isolate one tank and divert all flow to other tank(s) to do repair work, which shall include cleaning of pipelines entering the sedimentation tank, de-sludging all components/parts of the sedimentation tank and repairing cracks and waterproofing.

Where single tanks are used the tank shall be decommissioned and adequate provision shall be made for temporary treatment and disposal.

EC 03.11 **ACTIVATED SLUDGE RETURN, WATER PURIFICATION SLUDGE AND HUMUS WITHDRAWAL SYSTEMS**

The activated sludge return, water purification sludge or humus withdrawal systems can consist of a pipeline and manually opened gate valve running into a sludge pump sump. The repair work shall include removing the valve, while isolating the outlet pipe by means of a flanged spade and blank flange. The gate valve shall be fully reconditioned.

Where submersible pumps are used for sludge return or humus/ water purification sludge withdrawal such pumps shall be reconditioned where specified in accordance with the requirements of Technical Specification EB: Wastewater pump systems. The electrical supply and motor control of submersible pumps shall be repaired with the pump where specified in accordance with the requirements of the relevant technical specifications.

Submersible pumps shall be switched on when a level float switch reaches a certain fixed level (medium height) in the sump. Pumps shall be stopped at a certain low level. When the same medium level is reached again, the next pump shall be switched on (duty rotation). When a still higher level is reached, a level float switch shall cause both pumps to run simultaneously in parallel (high flow conditions).

EC 03.12 RECOMMISSIONING OF SEDIMENTATION TANKS

Sedimentation tanks shall be re-commissioned on completion of repair work by allowing them to fill with natural flow. Initial sludge carry-over must be reduced by bringing the system into function, as described, as quickly as possible. Correct functioning must be achieved within 24 hours. A continuous low flow withdrawal of sludge (thin sludge) during commissioning that establishes down flow may aid in commissioning sedimentation tanks.

EC04 **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.

EC 05 DETAIL OF REPAIR WORK

EC 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.

EC06 MAINTENANCE OF SEDIMENTATION TANKS

EC 06.01 GENERAL

The maintenance requirements specified in the clauses below shall be the minimum requirements and shall not in any way indemnify the Contractor from maintaining the entire installation in a perfect functional condition.

Maintenance shall include any repair work, cleaning of all components, corrosion protection, replacing of non-functional components and materials, routine setting, fixing of leaks, or any other actions or rectifying measures necessary to ensure perfect operation of sedimentation tanks according to the functional specification thereof.

The Contractor shall be responsible to compile a database of information containing all test results, including his own tests to ensure correct functioning of the system, with operating conditions, to aid in improving future operation of the plant.

Remuneration for monthly maintenance of all sedimentation tanks shall be deemed included with the tendered rate for ten maintenance points of the installation of which sedimentation tanks form part.

EC 06.02 STATIC BRIDGES

Bridges of both primary and secondary settling tanks shall be maintained clean and protected against corrosion. The bridges shall be maintained safe to enable work and inspections.

EC 06.03 INLET PIPEWORK

Inlet pipework shall be kept open and functional at all times. Pipes shall be cleaned and unblocked when necessary. Pipework shall be maintained leak-free at all times.

Screens shall be cleaned regularly and the debris disposed of.

EC **06.04** **STILLING WELLS**

Stilling wells shall be kept clean on a daily basis as often as necessary to prevent the build-up of a scum layer of froth and floating debris. Scum shall be removed through the scum withdrawal chute, or manually when necessary.

EC 06.05 EFFLUENT WEIRS

The effluent weirs shall be kept clean and all algae or other growths shall be removed. Floating artificial solids shall be removed and prevented from escaping the sedimentation tank. Artificial solids shall be disposed of with screenings removed at the inlet works. The weirs shall be maintained in perfect functional condition.

EC 06.06 **EFFLUENT/OUTFLOW LAUNDERS**

The effluent launders shall be kept clean and all algae or other growths shall be removed. The launders shall be maintained in perfect functional condition.

EC 06.07 **SCUM WITHDRAWAL AND SCUM WITHDRAWAL SYSTEMS**

Scum shall be withdrawn every three to four hours or more often when necessary, on a daily basis. A water spray system assists in the settling of scum and floating sludge. Apart from scum withdrawal, the scum collecting in the central stilling well, as well as scum and debris stuck to the scum baffle along the inside perimeter of the sedimentation tank shall be removed spraying with water. The maintenance of sedimentation tanks shall prevent formation of scum layers.

The scum withdrawal system consisting of stilling wells, open chutes, scum baffles, pipelines, valves, screens and wash water spraying nozzles shall be maintained in a perfect functional condition.

EC 06.08 **PRIMARY SETTLING TANKS**

Settled wastewater samples shall be taken in the primary settling tank between the scum baffle and the outflow weir. The settle able solids in the water sample shall be measured by means of an Imhoff cone test, as specified in Technical Specification EJ: Wastewater quality, measurement and testing. Settled sewage shall not have a value exceeding 0.4 millilitre/litre settle able solids.

The perfect functional condition of primary settling tanks shall amongst other criteria be evaluated against this value.

EC 06.09 **SLUDGE WITHDRAWAL SYSTEM (PRIMARY SETTLING TANKS)**

EC 06.09.01 **Quantity of raw sludge withdrawal**

The sludge valve shall be opened slowly until fully open, to discharge sludge while the condition of the sludge is observed. When the sludge seems to clear, the valve shall be closed slowly. The operation shall be repeated after two to three minutes. Piping through settled sludge may cause water to appear clear before a sufficient volume of sludge has been withdrawn. The operation shall be repeated until the outflow remains clear after a few repetitions of the operation.

The sludge valve shall always be opened and closed very slowly to prevent the occurrence of pressure surges that disturb the settled sludge and cause rising thereof.

Sludge shall be withdrawn an hour prior to peak flow conditions in the morning (before 07:00), and again at midday and then before the maintenance personnel leave the site (around 17:00).

The frequency of sludge withdrawal shall be increased when necessitated by the high content of suspended solids in the effluent.

EC 06.09.02 Sludge withdrawal

Sludge shall be withdrawn 3X daily from the bottom of the primary settling tank. The sludge valve shall be opened slowly, and not completely, to discharge sludge.

The volume of sludge withdrawn from the primary settling tank shall be controlled in volumes of thickened sludge to prevent overfilling of the digesters with water.

EC 06.09.03 Sludge withdrawal system

The complete sludge withdrawal system comprising a sludge valve(s), gravity pipeline to a sludge sump, the sludge sump, pumping equipment and electrical cables, controls and equipment shall all be kept in a perfect functional condition to ensure that raw sludge can be withdrawn from primary settling tanks and discharged to the digesters.

EC 06.10 SECONDARY SEDIMENTATION TANKS

A difference shall be made between the maintenance of clarifiers (downstream of activated sludge reactors and water purification works) and humus tanks (downstream of biological trickling filters). Both types of sedimentation tanks shall be used to clarify treated wastewater and purified water.

In the case of clarifiers, the return activated sludge shall be reintroduced back into the reactor for controlling the sludge age.

In the case of humus tanks, the humus shall be withdrawn from the process and disposed of with raw sludge or directly to sludge digesters, as specified.

In the case of water purification sludge the shall be dried and disposed of with sewage sludge or at a registered landfill.

EC 06.10.01 Maintenance of secondary sedimentation tanks and appurtenances

The water-retaining tank structure shall be maintained together with appurtenances such as hand railings, pipework and channels.

EC 06.10.02 Sludge withdrawal systems

Sludge withdrawal systems for secondary sedimentation tanks include return activated sludge systems or humus withdrawal systems (humus tanks). Both systems shall be maintained to keep central sludge hoppers, pipework, valves, concrete sumps (water-retaining structures), submersible pumping equipment, electrical control equipment and cables, grating and hand railings in a perfect functional condition.

EC 06.10.03 Return activated sludge withdrawal rate

A sample of homogenous water between the scum baffle and the outflow weir of the secondary settling tank shall be taken to measure the content of settable solids. Return activated sludge (RAS) shall be withdrawn twenty four hours per day. Withdrawal rates are determined for the control of biological processes and shall be

set on site. RAS: Waste water inflow ratio shall be calculated on site and thickening must be controlled so that the ratio does not exceed 1.5

EC 06.10.04 Scum withdrawal

Secondary settling tank scum, if formation of scum occurs, shall be removed / withdrawn manually by means of a net or pressurised wash water spray.

EC **06.11** HUMUS WITHDRAWAL

EC 06.11.01 Humus withdrawal rate

A sample of homogenous water between the scum baffle and the outflow weir of the humus tank shall be taken to measure the content of suspended solids. Based on this value, the volume of humus withdrawn daily shall be adapted. The rate of humus withdrawal (quantity and frequency of withdrawal) shall be increased until the required suspended solids content is achieved.

The humus valve shall be opened slowly until fully open, to discharge humus while the condition of the humus is observed. When the humus stream seems to clear, the valve shall be closed slowly. The operation shall be repeated after two to three minutes. Piping through settled humus may cause water to appear clear before the full volume of humus has been withdrawn. The operation shall be repeated until the outflow remains clear after a few repetitions of the operation.

The humus valve shall always be opened and closed very slowly to prevent the occurrence of pressure surges that disturb the settled sludge and cause rising thereof.

Humus shall be withdrawn an hour prior to peak flow conditions in the morning (before 07:00), and again at midday and then before the maintenance personnel leave the site (around 17:00).

The frequency of humus withdrawal shall be increased when necessitated by the high content of suspended solids in the effluent.

EC 06.11.02 Slou9h!!!g

The increased loading of humus tanks due to sloughing (as described in Technical Specification ED: Biological trickling filters) shall be managed as part of maintenance responsibilities. The rate of humus withdrawal shall be increased steadily when sloughing is expected or experienced.

EC **06.11.03** Scum withdrawal

Humus tank scum, if formation of scum occurs, shall be removed / withdrawn manually by means of a net or pressurised wash water spray.

EC07 MEASUREMENT AND PAYMENT

EC 07.01 DECOMMISSIONING OF SETTLING TANKS (CLARIFIERS) A O EQUIPMENT

Unit: number

The unit of measurement shall be the number of specified units of wastewater settling tanks and equipment (effluent launders, overflow weirs, stilling wells, pipe work,

platforms, bridges, accommodation of existing flow etc.) 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 in compliance with Clause EC 03.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EC 07.02 RECONDITIONING/REPLACEMENT AND COMMISSIONING OF **SETTLING TANK UNITS** (CLARIFIERS) AND EQUIPMENT.....Unit: number

The unit of measurement shall be the number of specified units of equipment (effluent launders, overflow weirs stilling wells, pipe work, platforms, bridges, accommodation of existing flow etc.) reconditioned / replaced.

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 compliance with Clause EC 03.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EC 07.03 DECOMMISSIONING AND REMOVAL OF RETURN **ACTIVATED SLUDGE** UNIT ANJ:LEQUIPMENT 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.

EC 07.04 RECONDITIONING AND COMMISSIONING OF RETURN **ACTIVATED SLUDGE** UNITS AND EQUIPMENT , Unit: number

The unit of measurement shall be the number of specified units of equipment reconditioned.

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 compliance with Clause EA 03 (Detail of repair work) of Technical Specification EA: Wastewater inlet works.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EC 07.05 DECOMMISSIONING AND REPAIR/RECONDITIONING OF VALVES AND SLUICE **GATES**..... Unit: number

The unit of measurement shall be the number of valves and sluice gates decommissioned and repaired or reconditioned.

The tendered rate shall include full compensation for replacement of components and materials for tools, transport, site handling and labour necessary for the complete decommissioning, dismantling, cleaning, repair or reconditioning of valves and sluice gates to conform to all the specifications in EC 02 and EC 03.

EC 07.06 **INSTALLATION, TESTING AND COMMISSIONING OF VALVES AND SLUICE GATES** .....Unit: number

The unit of measurement shall be the number of valves and sluice gates installed, tested and commissioned.

The tendered rate shall include full compensation for the installation, testing, and commissioning making good all corrosion protected areas and for all other costs and actions necessary to obtain a complete working system as well as for materials, tools, transport, site handling and labour necessary to conform to all the specifications in EC 02 and EC 03.

EC **07.07** **REPAIR AND RECONDITIONING OF CLARIFIER CONCRETE STRUCTURES** .....Unit: m^2

The unit of measurement shall be the are of clarifier concrete structures to be reconditioned / repaired.

The tendered rates shall include full compensation for all components, materials, tools, transport, site handling and labour necessary for the complete reconditioning/repair of the concrete structure to be repaired.

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
EG02 STANDARD SPECIFICATIONS
EG 03 INFORMATION REQUIREMENTS FOR SEPTIC TANK SYSTEMS
EG 04 DETAIL OF REPAIR AND MAINTENANCE
EG 05 RESOURCES 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 or 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.

EG02 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 conjunction with this specification and shall be deemed to form part thereof:

SANS 1200 Standardized specification for civil engineering construction

EG 02.02 OTHER SPECIFICATIONS

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 of 1993: Construction Regulations, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 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.

EG03 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 utilisation of groundwater (GW), its risk of pollution by the sanitation facility and precautions practised, 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.

EG04 IIEIA_IL_OF REPAIRI\NO_M_AINtENANCE

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, supernatant 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 (1988). *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 characterise 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.

EGOS **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.

EG06 MEASUREMENT AND PAYMENT

EG 06.01 DESLUDGE AND GENERAL REPAIR
OF SEPTIC TANKS.....Unit: m^3

The unit of measurement shall be the cubic metre of the capacity of the septic tanks desludged and repaired as per the procedure described in the specifications 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 temporary 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 REHABILITATION
OF FRENCH DRAIN S_YST_EM.....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.

EG 06.03 ALLIENATIVE METHODS TO AUGMENT THE SEPTIC TANK/
FRENCH DRAIN TREAMENT.....Unit: Number

The unit of measurement shall be for the construction of the component to augment the ST/FD treatment system (see EG 04.04).

The tendered shall include the full compensation for the installation or construction of the system as approved by the Engineer.

The earth walls of the reed beds shall be cared for not to be overgrown by natural vegetation and all shrubs, bushes and trees shall be removed before they can cause any damage to the walls. Natural grass on the outer surface of the walls need not to be removed but shall be cut regularly and shall not be allowed to grow to a length that exceeds 100 mm. Natural grass and weeds shall not be allowed to grow onto the surface of the reed beds and it shall be removed regularly.

EQ 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.

EQ 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.

EQ 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.

EQ03 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.

EQ04 DETAIL OF WORK

EQ 04.01 No scheduled repair work **is indicated in the schedule of quantities.**

EQ05 MAINTENANCE

Maintenance of reed beds shall include all work necessary to maintain in a good condition with regard to the establishment of trees, weeds and natural grass amongst the reed growth. Invasive growths shall be removed manually and disposed of.

Reed bed outlet structures, inlet weirs and all pipe work and channels interconnecting the reed beds with other units (such as sedimentation tank outlet pipes or effluent recycle outlet channels) shall be maintained clean, neat and in a perfect functional condition.

The regular maintenance of reed bed walls with regard to erosion and the removal of bushes and trees from the walls shall form part of the maintenance work.

Remuneration for the maintenance of reed beds shall be included in the tendered rate for ten points for maintenance of the installation of which reed beds form part.

Installations shall be as defined in Additional Specification SA: General Maintenance, and on the mechanical flow diagram.

EQ06 **MEASUREMENTANDPAYMENT**

EQ.01 DIYE_RSIQN OE FLOW_B_EIWEEN COMPONENTS BYi

a) Pumping effluent. ..... Unit: m^3
b) Constructing temporary pipe lines and channels ..... Unit: m

The unit of measurement shall be the cubic metres of effluent pumped and the length of pipe lines and channels constructed.

The tendered rates shall include full compensation for all labour, machinery, tools, pumping equipment and transport necessary for the diversion of the effluent. The tendered rate shall include the provisioning and installation of a suitable water meter (accuracy $1m^3$) to determine the volume of effluent pumped.

EQ.02 REPAIR AND RECONDITIONING OF REED BED CONCRETE STRUCTURES
. ..... Unit: number

The unit of measurement shall be the number of specified units of reed bed concrete structures to be reconditioned/ repaired.

The tendered rates shall include full compensation for all components, materials, tools, transport, site handling and labour necessary for the complete reconditioning/repair of reed bed units in compliance with Clause EH 04.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

EQ.03 SUPPLY, INSTALLATION AND CONSTRUCTION OF REED BED OVERFLOW **AND BY-PASS STRUCTURES/P1PE SLUICES AND SLUICE FRAMES**

Sluice gates and frames, gate valves, weirs, T-pieces, Bell mouth inlets and couplings..... Unit: number
Over flow pipes and by-pass pipe lines..... Unit: metre

The unit of measurement shall be the number of overflow structures constructed, sluice gates and sluice frames supplied and installed. For pipe installations the unit of measurement shall be the meters of pipe installed.

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 sluice gates, pipes and frames;
(b) Overflow weirs constructed
(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.

EQ.04 REMOVE VEGETATION AND MOWING OF EARTH WALLS.

Unit: m²

The unit of measurement shall be the area cleared of vegetation.

The tendered rates shall include full compensation for all labour, machinery, tools, and transport necessary to remove the vegetation (shrubs, bushes and trees) from the pond walls and to cut the natural grass and to dispose of it at an authorised solid waste disposal site. Any damage to the structure of the earth walls shall be repaired and the cost shall be for the contractor.

EQ.05 REHABILITATION AND SHAPING OF EARTH WALLS.

Unit: m²

The unit of measurement shall be the area ripped, shaped and compacted.

The tendered rates shall include full compensation for all labour, machinery, tools, and transport necessary to import spoilt material stored on site within free haul distance rip, shape and compact the pond walls and floor..

EQ.06 SUPPLY AND INSTALLATION OF HDPE LINING IN REED BEDS

Unit: m²

The unit of measurement shall be for the supply and installation of HOPE lining to line the specified area to render the pond a water tight structure.

The tendered rates shall include full compensation for the site handling and labour for the positioning of the lining, including the joining and sealing of the lining in its position at the over flow weirs as well as to anchor the lining at the top of the embankment. . The joints shall be water tight.
All required installation materials, labour and consumables to render a complete and working installation shall be included in the tendered rate.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

TECHNICAL SPECIFICATIONS

FD HEATING VENTILATION AND AIRCONDITIONING SYSTEMS

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FD 01 SCOPE

This specification covers the general repair and maintenance of heating, ventilation and air-conditioning systems, which include the following:

(a) Room air-conditioning units with air cooled condensers
(b) Refrigeration pipework
(c) Fans and attenuators
(d) Electric motors
(e) Air filters
(f) Duct work
(g) Air terminals
(h) Noise and vibration
(i) Painting and cleaning
(k) Labelling and identification.

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

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

The Contractor shall at all times adhere to this specification, unless otherwise specified in the Particular Specification.

FD02 STANDARD SPECIFICATIONS

FD 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

FD 02.01.01 SABS and other s,eecifications and codes

SASS 046	Copper tube manufacturing code of practice
SASS 0400	The applications of building regulations
SASS 0103	The measurement and rating of environmental noise with respect to annoyance and speech communication
SASS 0139	The prevention, automatic detection and extinguishing of fire in buildings
SASS 0140	Identification colour marketing
SASS 0142-1	Code of practice for the wiring of premises
SASS 0147	Refrigerating systems, including plants associated with air-conditioning systems
SASS 0173	Installation, testing and balancing of duct work
SASS 630	Decorative high-gloss enamel paint for interior and exterior
SASS 763	General coating thickness
SASS 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

OWG 371	Specification of materials and methods to be used
STD.PWD.VIII -	Standard specification for refrigeration services

FD **02.01.03** Occupational Health and Safety **Act of 1993**

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act of 1993: Construction Regulations, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 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 GEN ERAL REeAIR AND _IN_STA_LLATION 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 SABS specifications and codes, except where otherwise specified or approved by the Engineer in writing.

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

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

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

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

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

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

FD 03.02 TESTING OF REFRIGERATION PIPING AND EQUIPMENT

(a} All new refrigerant pipe installations shall be thoroughly tested to be sure that they are absolutely tight. Nitrogen must be used to pressure test the system at 1,5 times the working pressure. A pressure-reducing valve must be used to set the test pressure. A leak test must be carried out on the entire system.

(b} All new refrigerant pipe installations shall be vacuum pumped by means of a suitable vacuum-pump. An absolute pressure of 2500 micron must be reached. Allow the system to stand under vacuum for a minimum of 12 hours. If no noticeable rise in pressure has taken place after 12 hours, the system may be charged.

(c} The dryness of the refrigeration system shall be indicated by an approved moisture indicator.

(d} Should moisture be present, the system shall be leak tested and the leak repaired. Should no leak be present, the system shall be flushed with dry nitrogen and vacuum pumped again as described above.

(e) If the completed system complies with all the Specifications and passes the test and inspection, it can be approved and the Contractor may be instructed to recharge the system with the correct refrigerant and refrigerant charge.

(f) Under no circumstances shall the refrigerant piping/installation be purged.

FD 03.03 REFRIGERANTS

(a) No CFC refrigerant shall be used in new installations.

(b) Equipment still running on CFC shall be maintained until such time that a leak occurs or the system has to be decanted. The system shall then be converted to a compatible HCFC or HFC as described in the Montreal Protocol and recommended by the compressor manufacturer.

(c) Any CFC refrigerant that has to be discharged, shall be decanted by means of an approved reclaiming system, and not discharged to the atmosphere. Should the Contractor not comply with this requirement, full action shall be taken contractually and statutory against him.

(d) Any refrigeration system not supplied with three-way service valves, shall be provided with Schreuder type service valves. These valves shall be installed on both suction and discharge lines of the compressors. Tap-o-line valves shall not be fitted or used on the systems.

(e) In the event of an electrical motor burn-out in a hermetic or semi-hermetic compressor, a burn-out drier shall be used. Purging only is prohibited. The burn-out drier shall be installed and removed as per the manufacturer's instructions.

(f) No synthetic components or solutions shall be used to repair leaks in refrigeration piping, on coils or evaporators. Only approved gas welding shall be used. Should the leak be of such nature that repair is not possible, the item should be replaced.

FD 03.04 FANS AND ATTENUATORS

FD 03.04.01 General

(a) Requirements under this heading apply to fans that are not integral parts of complete units supplied by recognised suppliers. Selected fans shall be such that the operating point is as close as possible to maximum efficiency.

(b) Fan motors selected must be capable of supplying not less that 10 % above the specified air quantity without overloading.

(c) The system resistance must be calculated and the fan selected to meet the required static pressure, taking into consideration the site altitude, system air temperature and air density at which the system duty shall be met. The selection must be submitted to the Engineer for approval before ordering the equipment.

(d) Belt drives shall be designed for a minimum overload of 25 % and not less than two matched belts may be used. Belts shall be selected and installed according to BS 790.

(e) Pulleys shall be of the adjustable speed taper-lock type and shall be accurately keyed to the shafts and aligned before the system is put into operation.

(f) Belt guards shall be supplied in accordance with Occupational Health and Safety Act, No 85 of 1993. The guards shall have an expanded metal front and shall allow oiling and the use of a tachometer without removal of the guard.

(g) Bearings shall be selected for a minimum life expectancy of 200 000 hours at the given duty.

(h) Lubrication points shall be readily accessible and shall be extended to the outside to permit lubrication without removal of the fan. Fan shafts shall be suitably protected from rust and corrosion.

FD 03.04.02 Axial flow fans

(a) Axial flow fans shall be in-line direct-driven type with the motor mounted inside the fan housing.

(b) Fans shall be of the multi-bladed aerofoil type of a non-ferrous construction. The number of blades vary according to the application. The fans shall be provided with adjustable blade pitch indexed to permit field adjustment.

(c) Fan casings shall be constructed of hot-dip galvanized mild steel with a minimum thickness of 3 mm and mild steel galvanized flanges on each side drilled for connections to matching flanges on ducting.

FD 03.04.03 Sound JlttenuatQJ'S

(a) Sound attenuators shall be installed in the positions indicated on the drawings and shall be selected to provide the noise criteria levels as specified. All sound attenuators shall be products of an accredited manufacturer who publishes selection data on these products. Data shall be submitted to the Engineer for approval before ordering.

(b) Metalwork shall be galvanized steel and acoustic insulation shall be non-combustible material, properly bonded and covered so as not to permit particles to be eroded by air moving over it.

(c) Sound absorbing lining material shall have a density not less than 48 kg/m^3 and thickness of not less than 50 mm.

FD 03.05 CANOPIES AND GREASE ELIMINATORS

(a) Kitchen canopies shall be connected to the extract fan by means of cuts of which the joints and seams are of the welded or soldered construction and shall be watertight. Cleaning openings shall be provided at such intervals on the ducting that the inside of the ducting can be reached for cleaning purposes. The fan shall be provided with a cleaning access door, as well as a drain point at the bottom.

(b) Fire dampers, operated with fusible links, shall be provided in each air outlet connection and shall form an integral part of the canopy construction.

(c) Lights shall be fitted into the canopy by the manufacturer. Access to the tube for tube replacement shall be through the face of the fittings without the use of tools.

(d) Grease filters shall contain a series of vertical baffles to change the direction of the air flow and efficiently divert grease particles out of the air stream by centrifugal action. Each filter bank shall contain a condensate trough and removable grease storage container.

FD 03.06 ELECTRIC MOTORS

(a) All electric motors shall be of one make, unless integral with the equipment, and shall not operate in excess of 1500 r/min unless previously approved by the Engineer for specific reasons. Motors, unless otherwise specified, shall be 380 volt, three-phase, 50 hertz for all sizes from and including 0,37 kW upwards. Smaller motors may be 220 volt, single-phase, 50 hertz.

(b) All motors shall be totally enclosed, fan-cooled and have metric frame dimensions. Motors shall be quiet in operation to the full acceptance of the Engineer.

(c) Three-phase motors shall all be squirrel cage induction type, special high torque motors being used on high inertia loads such as centrifugal fans, where otherwise excessively large motors, necessary to overcome driven equipment inertia, cause operation BHP to be less than 70 % of motor nameplate kW.

(d) Starting methods for three-phase motors shall be as follows:

Motors up to 5,5 kW	DOL
Above 5,5 kW	Star-delta started, provided that the starting current does not exceed three times the full load amps.

(e) Single-phase motors shall be capacitor started, induction run type with built-in manual reset overload protection.

(f) Nameplate rating of electric motors shall be at least 15 % larger than the required driven equipment brake drive losses duly accounted for, on motors below 15 kW. On larger motors a 10 % margin shall suffice.

(g) All switch panels shall have a phase failure and low voltage protection with automatic reset adjustable to a maximum period of 10 minutes.

FD 03.07 DUCTWORK

(a) This specification covers the air distribution system as shown on the drawings. Duct work shall be manufactured in accordance with the standard specification for air-conditioning duct work, SASS 1238. Duct work shall be erected in accordance with the code of practice for the installation, testing and balancing of duct work, SASS 0173.

(b) Fittings such as elbows, parallel flow branches, branch connections, off-sets and transitions shall be manufactured and installed in accordance with the SMACNA standards.

(c) All ducting shall be sufficiently airtight to ensure economical and quiet performance of the system, and joints shall be suitably sealed in accordance with the relevant SMACNA standard with suitable non-combustible filler compound.

(d) The Contractor shall provide all hangers and supports which are to be hot-dip galvanized after fabrication to SASS 193. No explosive fasteners to the building structure shall be allowed, only approved expanding bolts or clamps are permissible.

(e) The duct work shall be connected to the air terminals by means of flexible ducting. Flexible ducting shall be coated fibreglass fabric with a mineral base. Flexible ducting shall be installed with "easy" bends of not less than one duct diameter centre line and shall be supported to SMACNA specification to ensure

that the ducting does not kink. The length of the flexible duct shall be kept to a minimum and shall not exceed lengths of 1200 mm.

FD 03.08 AIR TERMINALS

(a) Air distribution shall be effected by means of the supply air grilles as indicated on the drawing. The finish of the grilles shall be epoxy powder-coated, the colour of which shall be advised and approved by the Engineer. Supply air grilles shall be of the double defection type, consisting of two rows of individually adjustable aerofoil section vanes, front vanes horizontal rear vanes vertical, all vanes housed in a surrounding fixing flange with neat mitred joints in the corner.

(b) Supply air grilles shall be of steel construction and shall be provided with burglar bars. The inoer section will be only accessible from above and the face plate of the grille is fixed from above. No screws or fixing devices are accessible from below.

(c) Supply grilles are supplied with a plenum box with spigot and connected to the spigot on the ducting by means of flexible ducting.

(d) Transfer grilles shall be of steel construction and be provided with burglar bars. Standard door grilles may be installed with a burglar bar assembly in between.

FD 03.09 AIR F_ILTER_S

FD 03.09.01 General

(a) Provide and install air filters in the positions as indicated on the drawings.

(b) Filters shall be standard products of a reputable manufacturer regularly engaged in the manufacture of the particular filter. The manufacturer shall submit evidence to the satisfaction of the Engineer that the filters have been tested by an independent authority and that they meet the minimum arrestance, efficiency and dust holding capacity.

(c) Filters shall be tested in accordance with ASHRAE test standard 52 - 76.

(d) A Megnahelic gauge calibrated from zero to 500 Pa shall be installed, connected with copper tubing to static pressure tips complete with isolating valves.

FD 03.09.02 Prjm_aJY filters

(a) Primary filters shall, unless otherwise stated, be washable on woven polyester material, pleated to provide an extended surface with a dust spot efficiency of minimum 40 % and an arrestance of 85 %.

(b) Media shall be firmly held in place by rustproof wire screens to maintain pleat strength and spacing.

(c) Media and support screens shall be continuously bonded into aluminium support.

(d) Frames shall be folded to form a robust media support frame. The bonding between media and frame shall be continuous to prevent leakage.

(e) Each filter shall be provided with a factory made holding frame, constructed of not less than 1,0 mm thick galvanized mild steel provided with suitable seals and quick release spring type clips to securely hold the filter cell in place without permitting leakage of air.

(f) The holding frames of multiple cell filter banks shall be suitably joined and sealed so as to prevent leakage of air between the frames.

FD 03.10 LABELLING AND IDENTIFICATION

All equipment shall be labelled and identified using black Traffolite labels with 10 mm high white lettering on the labels. Labels will be secured using epoxy base glue.

The identification number used on these labels shall correspond with the equipment number on the complete inventory list.

FD 03.11 NOISE AND VIBRATION

(a) Particular care shall be taken in the selection, application and installation of all equipment used to ensure that the equipment will operate below the required noise level for public areas of NC 35 and with the least vibration possible, all to the satisfaction of the Engineer.

(b) Equipment shall be mounted on vibration isolators of the correct type and selection depending on deflection requirement and vibrating frequency.

(c) Anti-vibration connections shall be used on duct work where it joins vibrating equipment such as fans and air-conditioning units.

(d) Suitable sound attenuating devices shall be incorporated within the duct work to reduce airborne noise to acceptable levels as specified.

(e) The subcontractor shall provide sound level data to the Engineer on the completion of the installation detailing the noise levels in NC level for each separate area. No measurement shall be taken closer than 1 metre from any outlet.

FD 03.12 PAINTING AND CLEANING

(a) No untreated metal surfaces shall be allowed on the project. Items which are not galvanized or similarly protected against rust and corrosion shall be painted as detailed below. No equipment, hangers, brackets, etc, shall be delivered to site in unprotected condition; they shall be factory coated with an approved zinc-rich prime coat before being despatched.

(b) Painting shall comprise the following consecutive processes. Thoroughly clean, descale and degrease all surfaces, apply one coat of approved zinc-rich primer and one coat of universal undercoat, and finish off with two coats of quality high-gloss enamel. Final finish shall be to the full approval of the Engineer.

(c) Items with galvanized finish, such as cable trays, need not be painted but shall be properly cleaned with suitable galvanized iron cleaning fluid. Where galvanized finish is painted, it shall be primed with a calcium plumbate primer.

(d) It is not a requirement to paint duct work, conduits or pipework installed in roof voids and shafts, where they are not visible, if they are galvanized. Items as mentioned above shall be properly cleaned and painted as specified above.

(e) Visible sections of the inside of ducting through grilles shall be painted matt black after degreasing and priming as specified above.

(f) Plant and equipment shall be painted with the relevant colour in accordance with SABS.

FD 03.13 SELF-CONTAINED AIR-CONDITIONING UNITS

(a) The self-contained packaged unit shall be a fully catalogued product and documentation shall include performance curves and selection tables.

(b) Self-contained room air-conditioning units consist of unit casing, compressor, evaporator and fan, condenser and fan, refrigerant pipework with expansion device and the relevant controls. The condenser unit shall form an integral part of the unit or be separate for split applications.

(c) Unit casings shall be of sheet metal construction with a baked enamel finish to give a corrosion resistance. Units shall be suitably insulated to ensure quiet operation.

(d) Evaporator fans shall be of the double inlet centrifugal type with integral motor or belt-driven. The fan assembly shall be isolated from the unit by means of rubber mounts and the unit shall operate without vibration.

(e) Condensate trays shall be manufactured of non-corrosive materials and shall be insulated and condensate shall be piped to the nearest drain point.

(f) Washable WP 77 filters shall be provided and installed behind the inlet grille and shall be easily removable.

(g) Compressors shall be of the hermetically sealed dome type with crankcase heaters and suitable vibration isolators.

(h) Condenser coils shall be copper tubes with aluminium fins for inland use. Condenser fans shall be propeller fans or of the centrifugal type.

(i). Refrigerant piping shall be installed and repaired as specified in FD 03.

FD04 AS-BUILT INFORMATION PtND OPEBATING 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 _e.ru!lQment

(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.

FOOS 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.

FOOS TESTS AND INSPECTIONS ON COM fLETION 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, adjustod 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.

FD0S 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 an control checks

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

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

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

(iv) Check and test all controls with main circuits isolated.

(v) Check all motor-driven equipment for correct rotational directions.

(vi) Check and test the operation of all indication and warning lights.

(vii) Check, set, record and readjust all equipment control and set points in accordance with manufacturer's specification.

(viii) Run all motor-driven equipment for a period to ensure free movement and correct operation, feed pumps only to be operated for a short interval to check rotation.

FD 08.03 COMMISSIONING AND_COMPLETION_Of_BEPAIRS

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** Air-coJJditioning **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 S YSTEMS 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 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.
U) 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 INSTAL ATION 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 categorised 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) 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: 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 Annual maintenance actions

TABLE FD 11.02.03/1: 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, neutralise 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 annual actions include the activities of the monthly maintenance actions.

PARTICULAR SPECIFICATIONS

PFD HEATING VENTILATION AND AIR CONDITIONING SYSTEM

CONTENTS

PFD 01 SCOPE
PFD02 GENERAL DESCRIPTION OF INSTALLATIONS
PFD03 TECHNICAL DETAILS OF INSTALLATION
PFD04 DETAILS OF REPAIR WORK
PFD05 DETAILS OF MAINTENANCE WORK

PFD 01 SCOPE

(a) This specification encompasses all aspects regarding the particulars of the repair and maintenance work to the Heating Ventilation and Air-conditioning systems at various Ports of Entry. This particular Specification shall be read in conjunction with the Technical Specification FD: Heating, Ventilation and air-conditioning systems and all additional and technical specifications compil d as part of this document, and in particular the following Additional specifications.

SA: General Maintenance

SB: Operating and Maintenance Manuals

SC: General Decommissioning, Testing and Commissioning Procedures

The intended service, reapir and maintenance work to this installation will restore the existing installation to a safe, efficiently functional system that complies with all statutory regulations and applicable standards, in the process repairing all defects and shortfalls. On completion of the repair work, the equipment shall be maintained and serviced by the Contractor for the remainder of the 36-month Contract period.

The installations which have to be repaired and maintained under this Contract includes the following equipment and is referred to as Installation B9, C7, 07 & E6:

(1) Ninety Seven (97) of existing split, wall and window unit air conditioning units in various buildings at Mahamba Port of Entry

(2) Twenty Eight (28) of existing split unit air conditioning units at Emahlathini Port of Entry

(3) Eighteen (18) of existing split unit air conditioning units in various buildings at Bothashoop Port of Entry

PFD 02 GENERAL DE SCRIPTION OF INSTALLATIONS

The split unit air conditioning units are inside the offices and at the residential area for a cooler working condition for workers, residents, public and the electronic equipment. (Heating detail not provided).

PFD03 TECHNICAL DET AILS OF INSTALLATION

At the time of this document the existing installation consisted of the equipment and plant as listed below with their relevant technical detail.

PFD 03.01 **AIR CONDITIONING UNITS:**

Installation ID:	**Type 1**	**Type2**	**Type3**	**Type4**
Equipment Details	44 of	2 of	66 of	1 of
Manufacturer	**LG**	**LG**	**LG**	Carrier
Type	**High Wall Split** Unit	**High Wall Split** Unit	**High Wall Split** Unit	**High Wall Split** Unit
Model	**LS-T266 CEL LS-NC2665DMO LSUC2665DMO**	**LST-186ABL HSUC1865DA4 LSNC1865DMO**	**LS-R126 CEL LS-R126AAL LSUH1264DM**	**38QCE012708**
Cooling (Btu/h)	**26000**	**18000**	**12000**	**12000**
Cooling power (Watt)	**2700W**	**1860W**	**1260W**	**1260W**
Cooling Amps	**12.8**	**9.2**	**5.8**	**6.0**
Installation ID:	Types	**Type6**	**Type7**	**Type8**
Equipment Details	2 of	4 of	2 of	2 of
Manufacturer	Totaline	Defy Silhouette	TCL	Dunham Bush
Type	High Wall Split Unit	Wall unit	High Wall Split Unit	High Wall Split Unit
Model	AS-09HR4FMC	**N/A**	TAC-09CHS/E	
Cooling (Btu/h)	9000	N/A	9000	12000
Cooling power (Watt)	900	**NIA**	N/A	1260W
Cooling Amps	4.2	**N/A**	4.2	5.8
Installation ID:	**Type9**	**Type 10**	**Type 11**	**Type 12**
Equipment Details	16 of	2 of	1 of	2 of
Manufacturer	National/ LG	Shining	LG	LG
Type	Wall unit	KFR-70W	Cassette Unit	Cassette Unit
Model	**N/A**	N/A		
Cooling (Btu/h)	**NIA**	NIA	18000	12000
Cooling power (Watt)	**N/A**	7000W	1860W	1260W
Cooling Amps	N/A	N/A	9.2	5.8

PFD 04 DETAILS OF REPAIR WORK

PFD 04.01 GENERAL D_ESCR_IPTION OF REPAIR WORK

PFD 04.01.01 The Contractor shall at the start of the Repair and Maintenance Contract inspect the items, systems, equipment, components and installations listed below. This inspection shall include the establishing of any defects, leaks, conditions, damages, shortfalls, structural soundness, repairs required, details of existing equipment, suitability of equipment for the purpose it serves, etc. The Contractor shall report back to the Engineer in writing on all the above and the following items. No repair work shall commence prior to approval by the Engineer:

(a) Air-conditioning units;

(b) Support and bracketing system;

(c) Drainage installations to equipment;

(d) Electrical supply, wiring to and control of equipment.

PFD 04.01.02 The general scope of repair work to this installation shall at least include, but not be limited to the following. Any items, components, installations and systems not detailed in the Particular Specification shall be repaired and/or replaced if found to be defective and/or inoperative.

(a) All statutory inspections required for steam-driven equipment shall be inspected, tested and certified by an approved third party inspection authority where required by the Occupational Health and Safety Act as amended;

(b) Dismantling, stripping, overhauling, repair, service, reassembling, testing and commissioning of all equipment that form part of this installation;

(c) Implementation of a maintenance control plan;

(d) Supplying as-built information and drawings, as well as operating and maintenance manuals for all equipment that form part of this installation.

PFD 04.02 DETAILS OF REPAIR WORK TO EQUIPME_N_J

The following work shall form part of the repair work the heating, Ventilation and Air Conditioning Systems. This work shall be done in accordance with the relevant regulations, codes of practice, specifications and Technical specification FD: Heating ventilation and air conditioning, as set out in this document. The following work shall be included.

PFD 04.02.01 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. Replace panel seals.

(f) Check setting and operation of all pressure switches, reset if required.

(g) Check setting and operation of all safety switches, i.a. LP&HP switches, oil pressure switch.

(h) Check setting and operation of thermostats.

(i) Check timers and reset if required.

u) 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 section FD 03.02

(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 fan blades and check unbalance.

(z) Replaced suction line insulation.

(aa) Check all service valves for full operation, replaced caps if missing.

PFD 04.02.02 Exract/Ventilation Fans:

(a) De-rust, neutralise and touch up paintwork.

(b) Check tightness of all securing bolts.

(c) Check bearings of fan motors and lubricate.

(d) Clean fan-blades and check for unbalance.

(e) Check fans, speed control and fan motor.

(f) Check running amps of fan.

(g) Reseal penetrations through the wall.

(h) Check controls and wiring of the fans.

(i) Replace filters.

PFD 05.01 HEATING VENTILATION AND AIRCONDITIONING SYSTEM REPAIR WORK: MEASUREMENT AND PAYMENT

Item			Unit
PFD	05.01.01	**Service AC units**	No

The unit of measurement shall be the number of AC units serviced.

The tendered rate shall include full compensation for the servicing of the units as per Manufacturer's instructions, cleaning of filters, evaporator coils, condenser coils, housing, checking of all switches, thermostat and compressors as described in clause PFD 04.02.01.

Item			Unit
PFD	05.01.02	Replace AC temp **controller**	No

The unit of measurement shall be the number of defective controllers replaced.

The tendered rate shall include full compensation for the removal of the defective controller, the supply and installation of the new controller as well as testing.

TECHNICAL SPECIFICATION

FN CLEAR-WATER PUMP SYSTEMS

CONTENTS

FN 01	SCOPE
FN 02	STANDARD SPECIFICATIONS
FN 03	AS-BUiIT INFORMATION AND OPERATING AND MAINTENANCE MANUALS
FN 04	PUMP DESIGN AND REQUIREMENTS
FN 05	MOTOR DESIGN AND REQUIREMENTS
FN 06	WORKING VOLTAGE AND SUPPLY SYSTEMS
FN 07	PROTECTION AND CONTROL DEVICES
FN 08	DETAIL OF WORK
FN 09	TESTING AND COMMISSIONING
FN 10	MAINTENANCE
FN 11	MEASUREMENT AND PAYMENT

FN 01 SCOPE

This specification covers maintenance and servicing 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 SPECIFJCATIONS

FN 02.01 GENERAL STANDARQSPECIFICATIONS, 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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 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.

FN04 fLI M P 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.

U) 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 AfiD REQUIREMENTS

(a) Electric motors shall comply with the requirements of SASS 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 SASS 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 servicing work required and shall report to the Engineer. The Engineer will thereafter demarcate any areas to be serviced 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 Emahlathini Border Control Port of Entry river sump area. One duty pump and one stand-by pump, which will alternate as specified in FN 08.06.

FN 08.04 WATER TREATMENT WORKS PUMPS

The water treatment works pump system consists of two Pentax pumps with electric motors.

The details are as follows:

(a)

1 x Pump:	PENTAX (SRENDOLA-VI-ITALY)
Type:	CM 40/750 No A
Umin:	100/600
Hm:	50/35
kW:	5.5
Hp:	7.5
R.P.M.:	2840
Hz:	50
IP:	44

(b)

1 x Pump:	PENTAX (VERONELLA (VR) - ITALY)
Type:	CM 40/160 A
Umin:	100/600
Hm:	38/27
kW:	4
Hp:	5.5
R.P.M.:	2840
Hz:	50
IP:	44

FN 08.05 **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 08.06 MOTOR CONTROL CENTRE (RAW WATER PUMPS)

(a) The existing motor control centre for the control of the raw water pumps is situated at the standby power generator/LV building near the police building. The existing motor control centre shall be replaced to comply with the following requirements:

(b) The new replacement motor control centre for the raw water pumps shall be wired to comply with the requirements as set out in this clause.

(c) The power supply cable from the MCC to the two pumps at the sump shall be tested for conformity to be re-used for the supply of the two new pumps. 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 Contract r 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 sump, 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.*

(d) 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.

(e) New float control switches (2 off) shall be supplied, delivered and installed in the raw water balancing tank (situated at the water treatment works - approximately 400 m away from the raw water MCC for the level censing functions, as follows (remuneration for the float control switches included in this payment item for the motor control centre):

- When the raw water balancing tank is 50% full, one pump shall start to fill the tank until it is full
- When the raw water balancing tank is full, the pump shall switch off

- A censing cable shall be installed between the level censing devices at the water treatment works and the MCC. *Remuneration for the censing cable required from the MCC to the water treatment works 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 Work will be directed on site by the Engineer, based on the availability of sleeves, need for excavation etc.*

(f) Switchgear and equipment shall be installed in the MCC to:

- Automatically regulate the start and stop of pumps as set out in (e)
- Indicate which pump is running
- Indicate a pump that has tripped
- Indicate the time each pump has been operating since new (hour meters)
- Alternate pumps after every start - stop pump cycle
- Manually override the alternating of pumps and select either pump manually
- Start/stop either pump manually.

(g) Test for correct functioning on completion of electrical repair work.

(h) Emergency stop buttons shall be installed at the pump sump in all weather box for emergency stop functions.

FN 08.07 MOTOR CONTROL CENTRE (WATER TREATMENT WORKS)

(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) The electrical connections inside the MCC need to be re-wired.

(c) Switchgear and equipment shall be installed in the MCC to:

- Automatically regulate the start and stop of pumps
- Start/stop either pump manually.
- Indicate which pump is running
- Indicate a pump that has tripped
- Hour meters to indicate the time each pump has been operating since new.

(d) The float control switches for the level sensing functions are working at the time of the tender and shall only be maintained by the Contractor.

(e) 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.

(f) Check and tighten all terminations of all equipment.

(g) Properly clean out all switchgear and equipment from dust and spider webs.

(h) 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 repair work.

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 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	Clean inlet sump	Six-monthly
2	Visually inspect and report on complete systems	Monthly
3	Check, service, repair and clean all pumps	Six-monthly
7	Check, service, repair and clean all motor control centres and level censing devices.	Six-monthly
4	Corrosion protect pumps, motors and surface piping	As required
5	Check, inspect, report and repair all leaks	Monthly
6	Check and lu.bricate moving parts	Six-monthly

FN 11 MEASUREMENTANDPAY MENT

FN.01 SUPPLY AND DE LIVERY 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.

FN.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.

FN.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.

FN.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.

FN.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.

FN.06 **SUPPLY OR 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 supplied of existing boards reconditioned.

The tendered rates shall include full compensation for supply and replacement of components and materials and for tools, transport, site handling and labour necessary for the complete reconditioning of all components of the board or supply of all components to provide a fully functional MCC board.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment.

FN.07 **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.

FN.08 **SUPPLY AND DELIVERY OF PIPEWORK, VALVES, FITTINGS, SPECIALS AND ANCHORING** .....Unit: sum

The unit of measurement shall be the sum for the pipework, valves, fittings, specials and anchoring complete as detailed in section FN0S.04.02 items (a) to (g) and on drawing 048175/4/B.

The tendered rate shall include full compensation for the design, manufacture, procurement, corrosion protection, storage, transport for delivery to site and off-loading including all handling of the complete section of pipework or pipework reticulation specified, which shall include the pipes, fittings, fixing equipment, drainage valves, manual isolation valves, reducers, flanges, welding, nozzles and appurtenances to ensure a complete operational system.

FN.09 **INSTALLATION, TESTING AND COMMISSIONING OF PIPEWORK, VALVES, FITTINGS AND S fECIALS** ..... Unit: sum

The unit of measurement shall be the sum for installation and testing of the pipework, valves, fittings, specials and anchoring detailed in section FN08.04.02 items (a) to (g) and on drawing 048175/4/B.

The tendered rate shall include full compensation for the installation and flushing of the pipework to provide a complete working system as detailed in the standard and detail specifications. The cost for handling of equipment, fixing ot pipework, coupling of flanges and all installation materials and labour shall be included in the tendered rates.

The tendered rate shall include full compensation for al field testing, including re-testing where required and the contractor shall provide all instrumentation, tools, equipment and labour at no extra cost to perform the following:

- Testing of welds
- Testing of linings and coatings
- Hydraulic or pneumatic field-testing.

The pipe work system shall be tested as a whole together with the appurtenant pumps, valves, etc.

TECHNICAL SPECIFICATION

HA MV SWITCHGEAR SYSTEMS

CONTENTS

HA01	SCOPE
HA02	STANDARD SPECIFICATIONS, REGULATIONS, CODES AND ADDITIONAL SPECIFICATIONS
HA03	AS-BUilT INFORMATION AND OPERATING AND MAINTENANCE MANUALS
HA04	TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK
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HA09	REPAIR WORK TO INSTALLATIONS
HA10	INSTALLATION MAINTENANCE
HA 11	MEDIUM VOLTAGE SWITCHGEAR: TECHNICAL DETAILS
HA12	SUBSTATION BUILDING AND YARD: TECHNICAL DETAILS

HA01 SCOPE

HA 01.01 This specification comprises all aspects regarding the repair and maintenance of Medium voltage switchgear, Substation building and yard.

HA 01.02 This specification shall form an integral part of the repair and maintenance contract document and shall be read in conjunction with Part C, the Additional Specification included with this document.

HA02 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.

HB 02.02 **SANS S,eecifications**

- SANS 1195
- SANS 172
- SANS 763
- SANS 555
- SANS 1091

HB 02.03 **BSI S,eecifications**

- BSI 5463
- BSI 159
- BSI223
- BSI2562
- BSI2692
- BSI88
- BSI5227
- 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 S(lecifications and maintenance instructions

HA 02.06 Additional regulrements

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.

HA03 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:

- System Description
  - Complete system description of the distribution system. This shall be done for each substation individually. The system descriptlon 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.
- Commissioning Data
  - Complete commissioning, test and inspection data of the MV switchgear.
    This shall be done for each substation installation individually.
- Operating data
  - Safety precautions to be implemented.
  - Operating of MV system : Switchgear, relays, battery and charger sets.

- Maintenance instructions

  - 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 voltage switchgear.
  - Hoisting equipment specification, if applicable.

HA04 TEST AND INSPECTI ON 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.

HA05 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.

HA06 MAINTENANCE TOO LS 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 Engineer. 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 this contract.

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

Medium voltage switchgear operating tools.

MV fuses rated 25A 12kV 40kA.
Cut out fuse element 10A & 20A

HA07 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.

HA08 RE-COMMISSIONING OF INSTALLATION

HA 08.01 On completion of the repair work, the MV installations shall be put into operation.

HA09 REPAIR WORK TO MV INSTALLATIONS

HA 09.01 The various MV systems shall be repaired as measured in the bills of quantities, Installation A3, 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 maintenance phase commences.

HA 09.04 Repair work shall be executed within the approved period for repairs. This period shall be agreed at the start of the contract period.

HA 09.05 New equipment and material (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 work 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 Maintenance.

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 descyi,lltion

This section describes the electrical distribution network that will be repaired and maintained in terms of this contract. The network is urgently operated at 11kV.

a) Distribution Substatio n s

The electrical distribution network includes 1 distribution substation. The substation are brick built containing 3 rooms. The MV room contains a SF6 Ring Main unit and is connected to an incoming and transformer feeder MV cable.

HA 11.02 Scope of repair work

Clean, check and service 11kV circuit breaker, replace tripping batteries, check charger and protection.

Check and repair oil leaks on cable boxes.

Recover redundant equipment not in use.

HA 11.03 Repair work : Measurement and payment

	Item	Unit
(a)	Service 11kV switchgear (bulk oil type)	No

The unit of measurement shall be the number of panels serviced.

The tendered rate shall include full compensation for the following :

Truck

Wipe down and clean carriage and circuit breaker framework.

Open circuit breaker and examine turbulators and contacts. Replace if necessary.

Clean insulation.
Clean and lubricate isolating contacts and check freedom of movement.
Remove insulating oil.
Clean tank and circuit breaker.
Replace insulating oil (Oil to SANS 1555 specification)
Replace tank gasket.
Check, clean an lubricate mechanism.
Check, clean and lubricate the lifting screw and guides of the carriage.
Check interlocks.
Check opening and closing speeds.
Record contact resistance per phase.
Lubricate carriage wheels, locating bolt and linkage.
Clean and lubricate secondary isolating contacts and check freedom of movement.
Remove rust and repaint where necessary. User rust remover, sand thoroughly and apply neutralizer. Apply primer before 2 coats of enamel paint.

Fixed Panel

Wipe down and clean externally.
Clean circuit breaker and panel compartment.

Remove all secondary fuses and clean contact surfaces.
Check auxiliary contacts and connections.
Check switches and connections in panel and CT Chamber.
Lubricate shutter mechanism.
Lubricate all hinges and handles.
Clean circuit and busbar orifice insulators.
Clean busbar chamber.
Clean isolating plugs and regrease.
Check operation of orifice shutters.
Check and lubricate selector gate mechanism.
Clean voltage transformer orifices.
Clean secondary and earth contacts of the voltage transformer.
Lubricate voltage transformer carriage.
Check and replace indication lamps.
Open, check and clean air insulated cable end boxes.
Remove rust and repaint where necessary. Use rust remover, sand thoroughly and apply neutrallzer. Apply primer before 2 coats of enamel paint.
Reassemble, test and commission.
Close and trip manually and electrically several times.
Carry out thermal scan of busbars.
Check and repair vermin proofing.

	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:

11kV 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.

HA 11.04 **Scoee of maintenance work**

HA 11.04.01 **Monthl**

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 Pa_y:ment**

Refer to clause SA 06 of the Additional Specification - SA General Maintenance.

HA 12 SUBSTATION BUILDING AND YARD

HA 12.01 Installation descriQtion

This section describes the electrical distribution network that will be repaired and maintained In terms of thls contract.

a) Distribution S1.1b_$iation

Distribution substation consists of a three room brick building, containing MV swltchgear, transformer and LV distribution boards all fenced in.

b) Pole Transfor mer

Two pole mounted Transformers forms part of the distribution network.

HA 12.02 Sco2e of Repair Work

Open substation, clean substation, cut and replace duct covers.
Provide framed schematic in HV switch room.
Provide labels and markings on substations.
Check and report on condition of building elements.

HA 12.03 Repair Work : Measurement and Payment

	Item	Unit
(a)	Substation earthing	No

The unit of measurement shall be the number of substation earths checked.

The tendered rate shall include full compensation for the following :

Measurement of earthing system earth resistance.
Checking of earthing of all equipment.
Secure earth termination.
Re-tensioning of all earth connections.

	Item	Unit
(b)	Substation yard and building service.	No

The unit of measurement shall be the number of substations serviced.

Check condition of substation, ventilation louvres, doors, hinges and locking mechanisms and report to site engineer for further action. Check substation for roof leaks and report to site engineer for further action.

Clean and remove all alien vegetation from the yard and apply weed killer over the entire substation area if substation yard is stoned.

General cleaning of substation interior.

	Item	Unit
(c)	Provide labels, notices and schematics.	No.

The unit of measure shall be the number of substations labeled.

The tendered rate shall include full compensation for the following :

Provide substation number.
Mark room doors HV/TRF/LV/ESC, etc.
Provide OHS Act notice at each substation.
Provide a A3 laminated framed schematic in the medium voltage room.

	Item	Unit
(d)	Supply duct covers.	Item

The unit of measure shall be the total sum for the replacement and cutting of covers.

The tendered rate shall include full compensation for the following :

a) The contractor shall manufacture and install sections of cable trench cover plates to fit the sections in substations where old cover plates have been removed. The contractor shall measure up the cable trenches and manufacture the plates to fit exactly in the required sections. The dimensions specified in this procedure shall only be used as a basis to determine the tendered rate.

b) The cover plates shall be manufactured from mild steel chequered plate with a base thickness of 4.5mm and a chequered stud thickness of 6.1mm. Each cover plate shall have two guiding lengths of angle iron welded to the bottom of the plate. The guiding angle irons shall be welded in positions parallel to the length of the cable trench. The guiding angle irons shall be positioned at the edges of the plate, and shall form a tight fitting stop against the edges of the cable trench. The angle irons shall be mild steel with dimensions 40mm x 40mm x 3mm.

c) Each cover plate shall be fitted with two steel lifting handles fitted at opposing ends of the plate (in line with the length of the cable trench). The handles shall be fitted through holes drilled in the plate, and shall be such that they form irremovable parts of the plate.

d) All metal edges shall be chamfered to remove all burrs so that the cover plates can be handled without injury.

e) Each cover plate and its handless shall be painted with a suitable anti-corrosive primer after all welding and chamfering has been completed. All metal surfaces shall be cleaned (prior to painting) and painted in accordance with the paint manufacturer's recommendations.

	Item	Unit
(e)	Vermin proof cable ducts.	Item

The tendered rate shall include full compensation for opening, cleaning vermin proofing and closing of duct covers.

	Item	Unit
(f)	Re-paint substation roof and gutters.	Item

Report to site engineer for further action by others.

	Item	Unit
(g)	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.

	Item	Unit
(h)	Repair roof leaks in transformer room.	Item

Report to site engineer for further action by others.

	Item	Unit
(i)	Re-label panels	No.

The unit of measure shall be the number of panels re-labeled.

The tendered rate shall include full compensation for the re-labeling of panels with engraved labels as specified in the bill of quantities.

	Item	Unit
0)	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.

	Item	Unit
(k)	Supply and install tool holder.	No.

The unit of measure shall be the number of tool holder installed.

The tendered rate shall include full compensation for the supply and installation of suitable tool holders that can accommodate all operating handles for the switchgear in the MV room of the substation. Tool holders must be installed inside the MV room of the substation.

	Item	Unit
(l)	Re-placement of 75W Rapid start fluorescent lights.	No.

The unit of measure shall be the number of light fittings re-placed.

The tendered rate shall include full compensation for removal of the existing 2 x 75W commercial type fluorescent light and supply and installation of a new 2 x 58W switch start commercial fluorescent light fitting.

	Item	Unit
(m)	Re-paint substation louvers and doors.	No

The unit of measure shall be the number of louvers or doors re-painted.

The tendered rate shall include full compensation for cleaning, de-rusting with a de-rusting agent, removal of loose paint, sand paper of surfaces, apply primer before two coats of enamel paint to the doors or louvers.

	Item	Unit
(n)	Re-paint substation rooms.	No

The unit of measure shall be the number of rooms re-painted.

The tendered rate shall include full compensation for cleaning of walls and ceilings and applying one coat primer and two coats of paint to match the existing colour of the walls.

HA 12.04 **Sco,ee of Mainten n e Work**

HA 12.04.01 **Monthll**

Clean substation yard and buildings.

HA 12.04.02 **Annual**

Service substation building.

HA 12.05 **Maintenance Wotk ; Measurement and Pa1ment**

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 B3).

TECHNICAL SPECIFICATION

HB STANDBY POWER SYSTEMS

CQN'TENTS

HB 01	SCOPE
HB02	STANDARD SPECIFICATIONS, REGULATIONS, CODES AND ADDITIONAL SPECIFICATIONS
HB 03	OPERATING AND MAINTENANCE MANUALS
HB04	TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK
HB 05	LOGGING AND RECORDING PROCEDURES
HB06	MAINTENANCE TOOLS AND SPARES
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HB 08	RE-COMMISSIONING OF INSTALLATION
HB09	REPAIR WORK TO INSTALLATIONS
HB10	DIESEL GENERATORS: TECHNICAL DETAILS
HB 11	UPS UNITS: TECHNICAL DETAILS
HB12	MAINTENANCE OF STANDBY POWER INSTALLATIONS

HB01 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 150 kVA diesel generator at Mahamba
ii) One 60 kVA diesel generator at Bothashoop
iii) One 60 kVA diesel generator at Emahlathini
iv) One 10kVA UPS unit at Mahamba Port of Entry
v) One 15kVA UPS unit at Bothashoop Port of Entry
vi) One 15kVA UPS unit at Emahlathini Port of Entry

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.

HB02 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 b read in conjunction with this specification and shall deemed to form part thereof.

HB 02.02 **SANS S_llecifications**

02.02.01 SANS 10400: NATIONAL BUILDING REGULATIONS
02.02.02 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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003 shall be adhered to.

HB 02.05 **Manufacturer's specifications and maintenance instructions**

HB 02.06 **Additional reguirements**

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.

HB03 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:

03.02.01 DescriQtion 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

03.02.02 Commissioning Data

a) Complete commissioning, test and inspection data of standby power system.

This shall be done for each installation individually. The commissioning data will comprise voltage and output current measurements, running hour meter readings, battery voltage during starting and engine compression tests.

03.02.03 Operating Data

a) Safety precautions to be implemented.
b) Operation of systems; automatic, manual and bypass switching.
c) Emergency starting and forced change-over procedure.

03.02.04 Maintenance 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 I SPECTIONS PRIOR TO PRACTICAL COMPL ETIO OF REPAIR WORK

HB 04.01 It is the responsibility of the Contractor to provide all labour, accessories and properly calibrated and certified measuring instruments necessary to record the following parameters:

04.01.01 output phase voltages
04.01.02 output current per phase
04.01.03 insulation testing at 500V
04.01.04 system earthing resistance testing by means of wheatstone bridge instrument
04.01.05 load testing, utilising dummy loads

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

HB05 LOGGING AND RECORDING PROCEDURES

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

HB 05.02 The logbook shall be stored in a safe place inside each generator room and shall only be utilised by the Contractor and Engineer. A copy of the monthly entries and recordings into this logbook shall be submitted by the Contractor together with his monthly report to the Engineer.

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

05.02.01 Monthly inspection and maintenance actions.
05.02.02 Scheduled services.
05.02.03 Breakdown / call out reports.
05.02.04 Major overhaul or battery replacements.

HB06 MAINTENANCE TOOLS AND SPARES

HB 06.01 On commencement of the Repair and Maintenance Contract, the Contractor shall supply and deliver certain tools and spares to the user client. These tools and spares will be the property of the Department of Public Works. Any deficiencies or short fall or damaged Tools and Spares during the contract shall be replaced with new equipment/ material.

HB 06.02 The Tools and Spares shall be kept safe in a lockable store room on site. The Contractor shall provide his own lock for the designated store room. The inventory of the Tools and Spares shall be verified on a monthly basis. Any short fall shall be replaced by the Contractor as part of his responsibility under this contract.

HB 06.03 The Tools and Spares shall at least include the following:
Distribution Board key (3 off)
Distribution Board face plate square key (3 off)
20L HD diesel oil as per engine manufacturer's specification
Oil funnel
25L distilled water
Battery hydrometer
12V diesel jockey pump

5m 20mm0 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"

HB07 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.

HB08 RE-COMMISSIONING OF INSTALLATION

On practical completion of the repair work, battery replacement and services, the installations shall be put into operation.

HB09 REPAIR WORK TO STANDBY POWER INSTALLATIONS

HB 09.01 The scope of the maintenance work shall include, but shall not be limited to the activities listed below.

HB 09.02 The Contractor shall record the repair actions in tabular format before the Contractor's responsibility for maintenance commences.

HB 09.03 New equipment and material (eg. batteries, fuel pumps, starter motor, etc shall be supplied with a written guarantee confirming a defects liability period of 12 months from date of practical completion. These guarantees shall be furnished in favour of the Department of Public Works.

HB 10 STANDBY GENERATORS: TECHNICAL DETAILS

HB 10.01 **Installation description**
Refer to the enclosed schedule:

ITEM No.	Locality	Engine Description	Alternator Description	Output kVA	Auto/ Manual/ Switching	Operational Yes/No	Approx year of installation	Critical load	Last service
	Mahamaba Port of Enrty	John Deere	Marathon	150	Auto	Yes	2010	Offices & Security lights	2011
2	Bothashoop Port of Enrty	John Deere	Leroy Somer	60	Auto	Yes	2007	Offices and Security lights	2011
3	Emahlathini Port of Enrty	John Deere	Marelli Motori	60	Auto	Yes	2007	Offices and Security lights	2011

HB 10.02 Scope of repair work : Generators

HB 10.02.01 Clean plant room, clean and re-lamp luminaires. Seal all sleeves with chicken wire and builders foam. Put rodent poison inside cable trenches (2 x 500g).
Paint floor with epoxy paint.

Service diesel engine and steam clean engine, alternator as well as day tank.

Inspect all rubber hoses and wiring; replace if required.
Service existing battery.

Do cold starting volt drop test on prime mover starter battery; replace starter battery if required.

Clean sliprings and inspect brushgear. Open alternator terminal box, clean and tighten terminations. Check and record earthing value as measured with resistance measuring instrument.

Service alarm and cotrol 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 and reseal room exit port.

Reinstate fuel shut off system with fusible link.

Fit new padlocks on plant room.

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.

A drip tray approximately 100mm deep shall be mounted below the fuel tank and must be large enough to collect any fuel that drips from the tank. The drip tray shall be manufactured from black mild steel. The thickness of the drip tray sheet steel shall not be less than 2mm.

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 Re lant 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 and upgrade of the plant room. Walls and ceilings shall be washed with sugar soap. Floors 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.

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 150kW 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 Dummi 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 cotrol 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 Su2Pb! 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 Reaair 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 and 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 Re air 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 8e-c_ondition 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 10.03.17 **Supply and install day fuel tank**

The unit of measurement shall be a lump sum for the supply and installation of a day fuel tank as specified below.

The tendered rate shall include full compensation for the installation of the new day fuel tank including, connection, piping, jockey pump, fusible link and all consumables as specified below.

A fuel tank shall be installed in the plant room. The tank shall have sufficient capacity for standby sets to run the engine on full load for a period of 12 hours (+/- 400L). The fuel tank shall be a free standing type. The fuel tank shall be positioned such that free access to the tank may be afforded.

A water trap be fitted in the fuel pipeline from the tank to the engine.

The tank shall be fitted with a suitable filter, a full height gauge glass, "low fuel level" alarm, giving an audible and visible signal on the switchboard as well as a low-low fuel level cut-out.

An electrically operated pump with sufficient length of oil resistant hose to reach 2m beyond the door, shall be supplied, for each set for filling the fuel tank/s from 200 litre drums.

The interconnection fuel piping shall consist of copper tubes and the connection to vibrating components shall be in flexible tubing with armoured covering.

- The fuel tank shall be fitted with an alarm to provide an audible alarm on the generator control panel when the fuel level in the tank drops below 75 litres.
- A fuel level indicator shall be mounted on the tank in a position which is visible when operating the fuel pump. The indicator shall be a full height transparent gauge tube. The tube shall not be manufactured from glass or plastic. The lower gauge tube connection shall be fitted with a shut-off valve.
- A stopcock shall be fitted on the lowest point of the day tank to withdraw fuel samples.
- A mechanical fusible link across the diesel engine will provide fuel shut-off in case of fire. The daytank outlet shall be fitted with a 16 mm brass ball valve and 8 kg gravity dead-weight to facilitate the shut-off.

- A drip tray approximately 100mm deep shall be mounted below the fuel tank and must be large enough to collect any fuel that drips from the tank accessories. The drip tray shall be manufactured from black mild steel. The thickness of the drip tray sheet steel shall not be less than 2mm.
- Gravity feed lines shall be 22 mm o copper tubing with galvanised support brackets and galvanised protective unistrut sections between the bulk and day tanks. Underground piping shall be steel to SANS 62 with allowance for expansion, wrapped with Denso tape, overlapping 15 mm.
- The day tank level switch shall switch the 24 VDC solenoid valve at the day tank inlet to initiate gravity feed.
- Level switches shall be REMEX or approved equivalent.
- Note that a total of three level switches are required:
  - empty tank engine cut-out signal.
  - low fuel alarm
  - switching the inlet solenoid valve

- The day tank will be fitted with a 32 mm overflow outlet piped to the bulk tank with similar size return line.
- An insulated 16 mm^2 earth wire shall be provided to bond the bulk tank to the generator day tank.
- The fuel line will be provided with a high capacity water separator and 5 micron fuel filter with replaceable filter cartridges.
- The bulk fuel tank shall be fitted with a 25 mm hose with a manual operated pump.

HB 11 UPS UNITS: TECHNICAL DETAILS

HB 11.01 Installation des rietion

Refer to the enclosed schedule:

Item No	Locality	Manufacturer	Model	Output		Operational Yes/No	Approx year of installation	Critical load supplied	Last service
				Single phase	kVA				
1	Mahamba ICTRoom	Tower	Tower 1100	220	10 kVA	Yes	Unknown	Computers	2010
2	Bothashoop ICT Room	Tower	Tower 1100	220	15kVA	Yes	Unknown	Computers	2010
3	Emahlathini ICTRoom	Tower	Tower 1100	220	15kVA	Yes	Unknown	Computers	2010

HB 11.02 Scope of repair work : UPS unit

HB 11.02.1 Remove cabinet cover / doors. Clean unit internally and externally. Check operation of ventilating fan and replace air intake filter, if fitted. Check and record earthing value with prescribed resistance measuring instrument.

HB 11.02.02 Record output voltage, frequency and current in Record book. Record battery voltage.

HB 11.02.03 Clean battery cabinet and tighten terminals. Do witnessed dummy load test and submit report on condition of batteries.

HB 11.02.04 Replace UPS batteries upon instruction from Engineer.

HB 11.03 UPS repair work : measurement and payment

HB 11.03.01 Service UPS electronic and batterv cabinet

The unit of measurement shall be the number of UPS systems opened and serviced in accordance with manufacturer's instructions and as set out in Clause HB 11.02.

The tendered rate shall include full compensation for the opening, cleaning , visual inspection of cable terminations, ventilating fans, battery links and the recording of earthing resistance.

The tendered rate shall further include full compensation for the testing of all control cards and replacement of any defective control cards.

HB 11.03.02 Dummi load test

The unit of measurement shall be the number of on-site UPS dummy load tests performed.

The tendered rate shall include full compensation for the connection of a UPS dummy load, 30 minute full load test recording of test results, including battery voltage and reconnection of site cabling as well as a written report on battery condition.

HB 11.03.03 Re_place UPS batteries

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

The tendered rate shall include full compensation for the disconnection and safe disposal of old batteries and supply, installation and connection of new sealed "Willard Vantage" UPS batteries.

HB 11.03.04 Re_place UPS Unit

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

The tender rate shall include full compensation for the delivery, installation including all cabling and commissioning of the UPS unit.

HB 11.03.05 Re_place UPS Inverter

The unit of measurement shall be the number of defective UPS inverters diagnosed and replaced.

The tender rate shall include full compensation for the removal of the defective boards as well as the supply, installation and testing of the new inverter board.

HB 11.03.06 Replace UPS Battery Charger Card

The unit of measurement shall be the number of defective UPS battery charger cards diagnosed and replaced.

The tender rate shall include full compensation for the removal of the defective boards as well as the supply, installation and testing of the new battery charger card.

HB 11.03.07 Rellace UPS Fuses

The unit of measurement shall be the number of defective fuses replaced.

The tender rate shall include full compensation for the removal of the defective fuses as well as the supply, installation and testing of the new fuse.

HB12 MAINTENANCE OF THE INSTALLATION

HB 12.01 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 12.02 The following maintenance actions will be required under the contract:

12.02.01 routine preventative maintenance
12.02.02 corrective maintenance
12.02.03 breakdown maintenance
These actions are defined in the Additional Specification SA - General Maintenance.

HB 12.03 The maintenance schedules and frequency of services and maintenance activities 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 12.04 Generator main nance : scope of work.

HB 12.04.01 Monthl ection

(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 12.04.02 Annual insaection

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 every 150 hours

(e) Flush engine and replace coolant

HB 12.04.03 Every two years : inspecti n and service

In addition to the annual service, the cooling system shall be drained, flushed and refilled with water and prescribed water conditioner.

HB 12.05 Generator maintenance : measurement and Rml.ment

Refer to Clause SA 06 of the ADDITIONAL SPECIFICATION SA GENERAL MAINTENANCE.

HB 12.06 UPS maintenance : sco2e of work

HB 12.06.01 Monthl ection

(a) The following activities shall be executed during a monthly inspection:

record mains input voltage.
record unregulated DC voltage.
record battery charger voltage.
visually check appearance of DC capacitors.
visually inspect soft-start relays and resistors.
record power supply output voltage on 5V and on 12V tops.
measure "free running" frequency.
check phase-lock loop.
measure inverter output voltage and verify wave shape.
check fan operation.
check and record phase error voltage.
Mains failure test

(b) The following must be measured and recorded:

output voltage.
load current.
verify correct fuse ratings.

(c) Clean cabinets externally and internally.

HB 12.07 UPS maintenanc : measurement and payment

Refer to Clause SA 06 of the ADDITIONAL SPECIFICATION SA GENERAL MAINTENANCE.

TECHNICAL SPECIFICATION

HD S UB STATION TRANSFORMERS

CONTENTS

HD 01	SCOPE
HD02	STANDARD SPECIFICATIONS, REGULATIONS, CODES AND ADDITIONAL SPECIFICATIONS
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HD04	TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK
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HD06	MAINTENANCE TOOLS AND SPARES
HD07	QUALITY ASSURANCE SYSTEM
HOOS	RE-COMMISSIONING OF INSTALLATION
HD09	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 repair and maintenance of transformer systems. Transformers comprise:

- substation transformers
- pole mounted transformers.

HD 01.02 This specification shall form an integral part of the repair and maintenance contract document and shall be read in conjunction with Part C, the Additional Specification included with this document.

HD02 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

HD08 RE-COMMISSIONING OF INSTALLATION

HD 08.01 On completion of the repair work the transformer installations shall be put into operation.

HD09 REPAIR WORK TO TRANSFORMER INSTALLATIONS

HD 09.01 The various transformer systems shall be repaired as measured in the bills of quantities, Installation A3, during the first period of the repair 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 maintenance phase commences.

HD 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.

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 repair 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 following the initial repair work. The maintenance contract shall run for the balance 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 Maintenance.

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.

The transformer in the transformer room of the substation is rated at 315kVA and is of the dehydrating type.

HD 11.02 Scope of repair 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 Reeairwork

Item		Unit
(a)	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
(b)	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
- accidity tests and
- gas analysis tests.

Item		Unit
(c)	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
(d)	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 specifications.

	Item	Unit
(e)	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
(f)	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
(g)	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
(h)	Re-tape LVand 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	ScoJ;le of maintenance work
HD 11.04.01	General
	Refer to HD 10
HD 11.04.02	**Monthl3£**
	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 ment**
	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 83).

TECHNICAL SPECIFICATION

HE EXTERIOR LIGHTING SYSTEMS

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HE01 SCOPE

HE 01.01 This specification comprises all aspects regarding the maintenance and servicing 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.

HE02 STANDARD SPECIFICATIONSi 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 Saecifications

02.02.01	**SANS** 10400	National Building Regulation
02.02.02	SANS 10142	Wiring code
02.02.03	SANS 10225	Lighting masts
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02.02.12	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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 Jul_y_ 2003.

HE 02.05 Manufacturer's specifications and installation instructions

HE 02.06 Additional reguirements

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.

HE03 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:

03.02.01 DescriQtion of Installation

Complete system description of the lighting system. This shall be done for each lighting installation individually. The system description shall contain detailed information regarding the supply configuration (Distribution board, cabling, distribution kiosks, pole mounted distribution board), the switching arrangement (timers, photocells, override facilities) and the lighting (luminaire detail, lamp detail) as well as the earthing and lightning protection arrangement.

03.02.02 Commissioning Data

Complete commissioning, test and inspection data of lighting system.

This shall be done for each lighting installation individually. The commissioning data will comprise start-up and running current measurements at each termination point e.g. distribution board, kiosk and mast. Full data on lamps fitted with installation dates.

03.02.03 Operating data

a) Safety precautions to be implemented.
b) Operation of lighting systems; automatic, manual and bypass switching.

03.02.04 Maintenance instructions

a) Projected frequency of lamp replacement per lighting system.
b) Procedure to verify operation of photocell - controlled circuits.
c) Procedure to verify operation of timer- controlled circuits.
d) Trouble shooting diagram.

e) Luminaire details, including manufacturers brochures / pamphlets, order number, list of components and lamp specification.
f) Schedule of serviceable components per lighting system. These schedules shall include lamps, starters, ignitors, ballasts, lenses, etc.

HE04 TESTS AND INSPECTIONS

HF 04 01 It is the responsibility of the Contractor to provide all labour, accessories and properly calibrated and certified measuring instruments necessary to record the following parameters:

04.01.01 Phase voltages
04.01.02 Current per phase
04.01.03 Illumination levels in lux
04.01.04 Insulation testing at 500V
04.01.05 Earthing resistance testing by means of 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.

HE05 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:

05.02.01 Monthly lamp inspection and maintenance actions.
05.02.02 Bi-annual inspection and testing of lighting systems.
05.02.03 Annual earthing test report.
05.02.04 Breakdown / call out reports.

HE06 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.

HE07 RE-COMMISSIONING OF It,JSTALLATION

HE 07.01 On completion of the servicing 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 inspection to verify lamp stability and reliability of power reticulation

HE08 EXTERIOR LIGHTING INSTALLATIONS

HE 08.01 The various lighting systems shall be serviced as part of installation H during the first phase of the maintenance contract

HE 08.02 The scope of the 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
1) **HE 08.06(a)**	Excavate in all materials for trenches, backfill, compact **and** dispose of surplus **material**	m3

This rate shall apply to all the excavations.

The unit of measurement shall be the cubic metre of material excavated in trenches, classified according to the depth and width specified listed. The width classification shall be in accordance with the authorised dimensions and the depth classification in accordance with the total depth of the trench and not with the depth range in which the material is situated before excavation. The depth of excavation shall be measured to the underside of the bedding.

The tendered rate shall include full compensation for clearing and grubbing the trench areas and the temporary removal of improvements from the line of the trench, for excavating the trench, preparing the bottom of the trench, separating material unsuitable for backfill, keeping the excavations safe, dealing with any surface or subsurface water, measuring, classification and keeping of all records and for separating topsoil and selected backfill material where necessary.

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

	Item	Unit
HE 08.06(b)	Extra over item HE 09.06(a) for excavating **in hard material**	m3

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 09.06(a) in full compensation for the additional cost of excavating in hard material instead of soft.

The tendered rate shall include full compensation for any 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 08.0S(c)	Extra over item 3.10.1.1 for excavating by **hand in all materials**	m3

The unit of measurement shall be the cubic metre of trench material excavated by means of hand tools as instructed or authorised in writing by the Engineer where the use of conventional excavating equipment is either impractical or likely to cause damage to services, trees or property or where the electrical Contractor has to excavate by hand where he cannot excavate by machine.

The volumes of the trench excavation will be computed from the length and the depth to the bottom of the specified bedding layer and the minimum base widths specified in the drawings. The rate shall cover the cost of complying with the safety and protection requirements specified except where particular items are scheduled to cover particular costs for the excavation.

The tendered rate shall be paid extra over the rates tendered for item HE09.06(a).1 in full compensation for the additional expense of excavating by means of hand labour instead of conventional trenching equipment.

	Item	Unit
HE 08.0S(d)	Extra over item HD09.06(a) for using backfill material **obtained from sources provided by the Contractor**	m3

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 i.nstalling 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 eaxth 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(1)	**Terminate and connect bare co.(;!l;!er 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 08.0S(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(0)	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 08.0S(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 are specified seperately.

	Item	Unit
HE 08.0S(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 08.0S(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)	**Su 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 National 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 Heinemann QAT-R-Clip **in 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 08.0S(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 08.0S(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.

The end connectors shall be similar or equal to Pratley No 2 end connectors and insulating sleeves.

	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.

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 cresote 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 wrotten (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-lam_p 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)	Re2lace 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 the luminaire complete with the lamp and control gear according to the manufacturer's instructions.

Similar or equal to Beka Flood 400W HPS Floodlight

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: TECHNICA L DETA ILS

HE 11.01 Installation descri2tion

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.

AREA/STREET	POLE/ MAST INFORMATION		LUMINAIRE INFORMATION		
	MOUNTING HEIGHT	DESCRIPTION / MATERIAL	DESCRIPTION	SWITCHING	NUMBER
Mahamba	3m	Fibreglass Pole	70W HPS Post top	Photocell	23
Mahamba	7m	Wooden pole	125W MV Streetlight	Auto	4
Emahlathini	7m	Wooden pole	125W MV Streetlight	Auto	9
Emahlathini	3m	Fibreglass Pole	125W MV Post top	Photocell	6
BothasHoop	7m	Wooden pole	125W MV Streetlight	Auto	14

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

12.04.02 Scope of maintenance work on security lighting

a) Monthly

i) Verify operation of switching element.
ii) Check lamps.
iii) Check that all pole covers are secure.
iv) Visually check distribution kiosk.

b) Annual

Measure phase voltages and line currents in distribution kiosk or local distribution board. Record values in record book. Do vermin protection. Service all luminaires.

12.04.03 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 wor k** measurement and payment.

Refer to clause SA06 of the ADDITIONAL SPECIFICATION : SA GENERAL MAINTENANCE

TECHNICAL SPECIFICATION

FC HOT-WATER GENERATING INSTALLATIONS

CONTENTS

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

FC 01 SCOPE

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

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

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

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

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

FC 02 STANDARD SPECIFICATIONS

FC 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

FC 02.01.01 SABS and other specifications and codes

SABS 0400 - The applications of the building regulations SABS
0142 - Code of practice for the wiring of premises SABS 0140
- Identification colour marking
SABS 044 - Parts I to IV: Welding
SABS 460 - Copper tubes for domestic plumbing
SABS 0252 - Parts I and II
SABS 0103 - The measurement and rating of environmental noise with respect to annoyance and speech communications
SABS Specifications listed on page 3 of the DPW specification OW 371
Atmospheric Pollution Prevention Act, No 45 of 1965
BS 2790
BS 1740
BS 21
BS 1640
BS 5500

FC 02.01.02 Department of Public Works specifications

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

FC 02.01.03 Occupational Health and Safety Act of 1993

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

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

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

FC 02.01.05 Municipal regulations, laws and by-laws

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

FC 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

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

FC 03.01 GENERAL REPAIR AND INSTALLATIONS REQUIREMENTS

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

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

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

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

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

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

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

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

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

FC 04 OPERATING AND MAINTENANCE MANUALS

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

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

All information shall be recorded and reproduced in electronic format, as well as three sets of hard copies to be supplied to the Department.

Over and above what is specified in Additional Specification SB: Operating and Maintenance Manuals, the operating and maintenance manual to be compiled shall be structured to include at least the following:

(a) System description

Complete system description and the working of the plant.

(b) Commissioning data

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

(c) Operating data

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

(d) Mechanical equipment

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

(e) Maintenance instructions

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

(f) Electrical equipment

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

(g) Instrumentation and control

(i) Description of each control system;
(ii) Schedule of control equipment, indicating manufacturer, type, model number, capacity and addresses and telephone numbers of suppliers;
(iii) Maintenance instructions;
(iv) Manufacturer's brochures and pamphlets.

(h) Drawings

(i) Paper prints of all as-built mechanical and electrical drawings;
(ii) Wiring diagrams framed behind glass shall be mounted adjacent to each relevant control panel.

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

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

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

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

(a) Equipment and component recognition.

(b) How to operate the equipment including the following:

(i) Starting the equipment;
(ii) Manual and automatic controlling;
(iii) Shut-down and isolating of equipment and systems;
(iv) Cleaning of equipment.

(c) Emergency procedures to be followed in the case of breakages, system faults, steam cuts, etc.

(d) Safety precautions to be followed and implemented.

(e) The identification, reporting and recording of faults and operation of equipment.

(f) The logging of equipment operation, readings and settings.

FC 06 LOGGING AND RECORDING PROCEDURES

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

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

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

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

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

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

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

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

FC 07 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK

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

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

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

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

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

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

FC 08 QUALITY ASSURANCE SYSTEM

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

FC 09 COMMISSIONING AND RECOMMISIONING OF PLANT AND INSTALLATION

FC 09.01 GENERAL

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

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

The Contractor shall submit a full commissioning report.

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

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

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

(a) All required pre-commissioning mechanical checks

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

(ii) Check all moving parts.

(iii) Check seals, gaskets and joints.

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

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

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

(vii) Check and ensure that all control equipment such as pressure-reducing valves, heat control equipment, etc, are set and adjusted to the correct controlling value in accordance with the system parameters and manufacturer's specification.

(viii) All steam and condensate pre-commissioning checks shall be done in accordance with Technical Specification FB (where applicable).

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

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

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

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

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

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

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

(b) All required pre-commissioning electrical checks

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

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

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

(iv) Check and test all controls without livening up electrical equipment.

(v) Check all motor-driven equipment for correct rotational directions.

(vi) Check and test the operation of all indication and warning lights.

(vii) Check, set, record and readjust all equipment control and set points in accordance with manufacturer's specifications.

(viii) Run all motor-driven equipment for a period to ensure free movement and correct operation.

(c) Commissioning of equipment

On completion of the pre-commissioning checks the Contractor shall proceed with the commissioning of the equipment. This shall be done strictly in accordance with the manufacturer's specification and system parameters and shall include but not be limited to the following:

(i) During the commissioning process all safety and warning system checks are to be performed on the thermostatic control system where applicable.

(ii) During load conditions the equipment shall be readjusted and finally switched to automatic operation on completion of all automatic control functions for correct operation where applicable.

(iii) Check that steam pressure valves are readjusted where necessary to the correct set point under load conditions where applicable. This shall be done in accordance with Technical Specification FB: Steam Generating Installations.

(iv) Check the operation of all steam trap arrangements where applicable. This shall be done in accordance with Technical Specification FB: Steam Generating Installations.

(v) Check that water pressure-reducing valves are adjusted and set to the correct operating value for the specific system.

(vi) Check the correct operation of all systems. Readjust primary and secondary pumping control equipment where applicable.

(vii) Test and check for any leaks to the system, equipment and installation.

(viii) Check for any unnecessary strain to system, equipment and installation due to expansion and contraction.

(ix) Check the correct functioning of all heating temperature control equipment to ensure the correct switching levels and that all safeties are operational.

(x) Record temperatures and flow conditions.

The Contractor shall visit, inspect, test and readjust the systems, equipment and installation during the week following the recommissioning to ensure the correct functioning of the equipment and its associated components.

FC 10 GUARANTEE OF INSTALLATION AND EQUIPMENT

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

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

FC 11 MAINTENANCE TOOLS AND SPARES

Each installation shall be equipped with the necessary maintenance tools and spares required by the specific type of equipment and installation for the daily operation and maintenance of the system. At the start of the repair and maintenance contract the Contractor shall in the presence of the User Client make an inventory of the existing tools and spares, and any shortfall or damaged tools and spares shall be replaced with new. All replacement tools and spares shall be as specified by the equipment manufacturers. These tools and spares shall be kept in a lockable room or cabinet of which the maintenance supervisor and the Contractor shall carry keys. The Contractor shall on a monthly basis take stock of these items in the presence of the User Client's maintenance supervisor and record and report to the Engineer. Any shortfall shall be replaced by the Contractor as part of his responsibility under this Contract.

The tools and spares to be carried shall include but not be limited to at least the following:

(a) Tools

(i) Grease and oil lubrication equipment;
(ii) Equipment operating keys and tools.

(b) Spares

(i) Spare sight glasses for sight glass indicators, seals and gaskets (where applicable);
(ii) Spare seats, gaskets and gland packings for valves, etc;
(iii) Spare steam traps, at least one of each type present on the installation (where applicable);
(iv) Spare pressure gauges, at least one of each range and type;
(v) Spare electrical elements (where applicable);
(vi) Spare thermostats, at least one of each type present on the installation (where applicable);
(vii) Spare pilot lights, contactors, circuit brackets, relays, thermal overloads, etc, for electrical control panels;
(viii) Spare temperature gauges, at least one of each range and type.

FC 12 REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

FC 12.01 GENERAL

During the repair and maintenance contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but no be limited to the specified Particular Specification details.

All repair work shall be executed using approved materials and equipment suitable to the systems and/or installations they serve. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer's specifications and codes of practice and all additional and particular specifications included in this document.

The repair work items are listed in the Particular Specification and Schedule of Quantities with all relevant details, such as capacity, size, manufacturer, model number, etc.

All repair work shall be executed within the specified durations listed in the Appendix to Tender. All new equipment, materials and systems shall be furnished with a written guarantee of a defects liability period of 12 months commencing on the date of issue of a certificate for completion of the repair work. These guarantees shall be furnished in favour of the Department of Public Works.

Repair work items for the steam generating installations shall be categorised under the following headings:

(a) General requirements for hot-water generating installations

(b) Steam and condensate pipework (where applicable)

Refer to Technical Specification FB: Steam Distribution Installations.

(c) Hot-water storage vessels

(i) Existing hot-water storage vessels
(ii) Electrically driven storage vessels, new hot-water storage vessels
(iii) Heating services for hot-water storage vessels.

(d) Lagging and cladding of vessels and piping

(i) Vessel lagging and cladding
(ii) Hot-water and hot-water return pipe lagging and cladding

(e) Pressure testing

(f) Corrosion protection linings

(g) Sterilisation of installation

(h) Heating control equipment

(i) Steam heating equipment
(ii) Electrical heating equipment

(i) Instruments and controls

(i) Type of instrumentation and controls
(ii) Instrumentation and controls, installation requests

(j) Primary and secondary pumping installations

(i) Primary pumping equipment
(ii) Secondary pumping equipment

(k) Domestic hot-water and cold-water pipe installations

(i) Strainers
(ii) Valves
(iii) Air vents
(iv) Thermostatic water flow control valve
(v) Expansion equipment
(vi) Flow meters
(vii) Check valves
(viii) Vacuum breakers
(ix) Expansion release valve
(x) Safety valves

(xi) Pressure gauges

(l) Electrical installations

(i) Electrical control panels
(ii) Wiring and cabling.

Any repair work, which may be required on the systems, equipment and installation, shall be executed using approved materials, equipment, methods and tooling suitable for the specific application. The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, statutory regulations, manufacturer's specifications and codes of practice and as specified in all additional and particular specifications included in this document.

At the start of the repair and maintenance contract, the repair work specified in the Particular Specification shall be done in accordance with the items listed. Any repair work during the maintenance period shall also adhere to this specification.

FC 12.02 GENERAL REQUIREMENTS FOR HOT-WATER GENERATING INSTALLATIONS

All repair work and new installation of hot-water generating installations shall adhere to the standard specifications of the Department of Public Works and all relevant specifications, norms, standards and regulations applicable to this type of installation, including the following general requirements:

(a) The hot-water generating installation shall be repaired, installed and maintained as a complete functional unit, with all the responsibilities, functions and operating parameters taken into account to ensure the continuous supply of hot water to the consumer points.

(b) The hot-water generating installation shall be capable of providing ample supply of hot water to the consumer points by means of ensuring the correct sizing of the hot-water storage and production.

FC 12.03 STEAM AND CONDENSATE PIPEWORK

All steam and condensate installations shall be done in accordance with Technical Specification FB: Steam Distribution Installations.

FC 12.04 HOT-WATER STORAGE VESSELS

FC 12.04.01 Existing hot-water storage vessels

At the start of the maintenance and repair contract the Contractor shall inspect, repair, service, clean out and test all hot-water storage vessels.

The inspection shall include the following:

(a) Isolate drain, open manholes and clean out hot-water vessels.
(b) Inspect vessel welds.
(c) Inspect internal corrosion lining and check for any pit holes and damages to the vessel material and connections.
(d) Inspect lagging and cladding.

(e) Inspect condition of all elements, steam heating coils, controls, safety valves, etc.

During this inspection the Contractor shall notify the Engineer in advance to allow the Engineer to witness the Contractor's findings. The Contractor shall submit a written report on the findings.

All manhole and pipe gaskets shall be replaced.
No repair work shall be proceeded with prior to approval from the Engineer.

Should any welding repair work be required it shall be performed by a coded welder in accordance with acceptable practices, codes and norms.

Should the corrosion lining be damaged or corroded, thus necessitating the relining of the vessel, this shall be done with an approved lining suitable for the water quality and operating temperature under which this system is functioning.

For further details on repair to resisting linings and installation of new linings refer to FC12.06.

All safety valves shall be serviced, overhauled and readjusted to the correct safety pressure blow-off part.

All lagging and cladding shall be inspected, repaired and where necessary replaced.

On completion of all repair and service work the Contractor shall reinstate all equipment, fill the hot-water vessel with water and pressure test it to 1,5 times the permissible operating pressure or allowable test pressure.

On passing of the pressure test the Contractor shall re-commission the hot-water vessels and put it back on line.

FC 12.04.02 New hot-water storage vessels

Where new hot-water storage vessels are to be installed it shall be done in accordance with the following specification and on approval of the necessary workshop drawings to be provided by the Contractor.

The storage vessels shall be of the vertical cylindrical type with dished ends on both sides, and shall be manufactured to BS 5500 Category II in mild steel for a working pressure as indicated for the three systems. A pressure test certificate for each vessel shall be supplied by the manufacturer.

The vessel shall be equipped with at least the following :

(a) Properly sized flanged manhole for easy access
(b) Flanged inlets and outlets to SABS 1123 Table 10
(c) Sparge pipe on the cold-water inlet
(d) Correctly sized thermometer
(e) Correctly sized temperature and pressure relief valve
(f) Air release valve
(g) Correctly sized pressure gauge
(h) BSP threaded sockets for thermostats
(i) 40 mm diameter BSP threaded socket at the lowest point of the storage tank for draining purposes
(j) 50 mm diameter boss element segments for auxiliary elements.

An expansion relief valve shall be installed on the inlet to the storage vessels for thermal expansion.

Where pipe connections to the storage vessel are done with dissimilar materials (such as copper), isolating flanges shall be used (dielectric coupling).

Before ordering and manufacturing of storage vessels a workshop drawing shall be submitted to the Engineer for approval.

The Contractor shall satisfy himself that access and plantroom sizes are to the dimensions on the drawings and that the equipment will fit into the space allowed.

FC 12.04.03 Heating sources for hot-water storage vessels

(a) Electrical elements

Where electrical immersion elements are used to heat the water inside the hot-water storage vessel, these elements shall be replaced at the start of the repair and maintenance contract.

All the thermostat controls and safety cut outs shall be cleared, inspected, tested, adjusted to the set point and where necessary replaced.

(b) Steam heating

Where steam heat exchangers are used to heat the water inside the storage vessel, these coils shall be removed together with the steam chest and associated equipment. The coils shall be descaled, cleaned, inspected and tested.

Where necessary the heat exchanger and/or coils shall be replaced.

FC 12.05 **LAGGING AND CLADDING**

All lagging and cladding to hot-water vessels, primary heaters, secondary heaters and hot and circulation water piping shall be inspected for defects, damages and shortages at the start of the repair and maintenance contract. The Contractor shall report his findings to the Engineer in writing.

All repairs to be done shall match the existing installation and the Contractor shall ensure that no sharp edges from the metal cladding pose a danger to anybody.

The following specification shall be adhered to:

(a) Vessel lagging and cladding

The storage vessels shall be insulated with a 80 mm thick layer of mineral glass wool with a density of 88 kg/m³ and finally covered with 0,6 mm thick galvanized sheet metal. The sheet-metal work has to be done by a specialist. (All edges are to be rolled and no sharp edges will be allowed.)

(b) Hot-water and return water pipe lagging and cladding

All hot water and hot-water return pipes shall be insulated with preformed fibreglass sections covered with galvanized sheet-metal muffs in a water tight manner. Sheet-metal muffs shall be installed with the joints overlapping at least 50 mm and the longitudinal overlap pointing downwards to prevent ingress of water. The sheet-metal muff shall be strapped with 10 mm galvanized straps by means of a strapping tool with a

minimum of 2 straps/section. All pipe bends, T-pieces, etc, shall be insulated with 25 mm diameter fibreglass rope covered with a 12 mm thick layer of self-setting fibre cement. A reinforcing gauze shall be wrapped over the fibre cement while wet and then painted with mastic paint when dry.

Table FC 12.05/1 below provides a guideline for the preformed fibreglass section thickness to be used.

The fibreglass sections shall have a density of at least 88 kg/m^3.

TABLE FC 12.05/1: FIBREGLASS SECTION THICKNESS

PIPE SIZE (STEEL)	PIPE SIZE (COPPER)	THERMAFLEX THICKNESS
100 mm dia	108 mm dia	50 mm
80 mm dia	76 mm dia	40 mm
65 mm dia	67 mm dia	40 mm
50 mm dia	54 mm dia	25 mm
40 mm dia	42 mm dia	25 mm
32 mm dia	35 mm dia	25 mm
25 mm dia	28 mm dia	20 mm
20 mm dia	22 mm dia	20 mm
15 mm dia	15 mm dia	15 mm

FC 12.06 PRESSURE TESTING

The Contractor shall at the completion of the repair contract arrange for a complete pressure test to be executed on the hot-water generating installation. This shall be done in collaboration with the User Client and Engineer to ensure the minimum down-time of the installation, as well as to establish a suitable period for this pressure test. All leaks shall be repaired and the system shall be tested at the cost of the Contractor. This test shall be witnessed by the Engineer.

The tests shall be performed on all hot-water storage vessels, primary heating vessels, secondary heater vessels and domestic water pipe systems.

All safety and expansion release valves shall be removed and plugged, and on completion these shall be reinstalled.

The systems shall be filled with water after all branches have been plugged, sealed or closed.

The systems shall be hydraulically pressure tested by means of a suitable manually operated or mechanically driven pressure pump.

A pressure of at least 1,5 times the working pressure of the class rating of pipes or fittings shall be applied for a period of time specified in the specifications or as recommended by the manufacturers. (Refer to SABS 1200 for minimum and maximum test pressures.)

Tests should not be performed against closed valves.

Leakage which occurs shall be measured, calculated and checked against the allowable losses, as specified in SABS 1200.

If the completed sections comply with all specifications and pass the tests and inspection, it can be approved and the Contractor may be instructed to re-commission the plant.

FC 12.07 CORROSION PROTECTION LININGS

All vessel corrosion protection linings shall be inspected and repaired and/or replaced where necessary.

Repairs shall only be done to linings where the supplier and installer of these linings approve of such repairs. These repairs shall then be done strictly in accordance with the manufacturer's specification and shall be certified by an approved inspection authority.

Where new linings are to be installed, the required preparation work including sand blasting and removal of old lining shall be done in accordance with the recommendation of the supplier of the new lining.

Where new linings are to be introduced they shall be similar or equal to the following:

(a) Internally coated with a durable, high operating temperature glass flake lining with DTF of one millimetre, similar or equal to a Polygrass VE lining as supplied by Corrocoate, suitable for an operating temperature of 95 °C at the indicated working pressures.

The applications of these linings shall be witnessed and certified as being to the manufacturer's application standards by an approved inspection authority.

(b) Externally the vessels shall be coated with two coats of red oxide paint.

FC 12.08 STERILISATION OF WATER SIDE OF INSTALLATION

The Contractor shall at the completion of the repair contract sterilise the complete water side of the hot-water system including vessels and pipes.

This shall be done as described in the following guidelines.

(a) The complete system shall be filled with potable water chlorinated to a concentration of 15 mg of chlorine per litre of water which shall remain in contact with the inner surface of the pipeline for a period of not less than 24 hours. The pipeline shall be filled for sterilising in such a manner that no chlorine shock is created or air is trapped in the pipeline.

(b) The Contractor shall submit full details of the proposed method for sterilising the pipeline to the Engineer for approval at least 14 days before commencing sterilising.

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

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

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

(i) Chloride of lime to SABS 295 yielding 33 % free chlorine by mass;

(ii) Calcium hypochlorite to SABS 295 yielding 70 % free chlorine by mass;

(iii) Chlorine gas applied by chlorinator.

(f) After sterilisation, an approved water quality test to a minimum number of 10 % of the total water points, randomly selected, evenly spread and marked on drawings, shall be carried out. This test shall include a full bacteriological test as per SABS 241 and the results shall be submitted to the Engineer for inclusion in the Contract documents. Each abortive test shall be for the Contractor's cost.

When tested the water shall comply with the limits given in column 2 or 3, as relevant, of table FC 12.08/1.

TABLE FC 12.08/1: BACTERIOLOGICAL REQUIREMENTS

1 PROPERTY	2 RECOMMENDED MAXIMUM LIMIT	3 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

Note:

* If any coliform bacteria are found in a sample, take a second sample immediately after the tests on the first sample have been completed; this sample shall be free from coliform bacteria.

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

FC 12.09 HEATING CONTROL EQUIPMENT

The Contractor shall at the start of the repair and maintenance contract inspect, test, repair, readjust, and if necessary replace heating controls for the hot-water system.

This shall include the following:

(a) Check for correct switching and/or control temperature operating points.

(b) Check, test and ensure that the safety cut-out mechanisms are in place and switch and/or control at the correct level.

(c) Ensure that equipment has been installed in accordance with the manufacturer's specification.

(d) Ensure that all pockets are descaled and free of any defects.

The following control equipment shall be serviced, repaired and where required replaced if damaged beyond repair.

FC 12.09.01 **Steam heating control equipment**

Where immersed type thermostatic steam control valves are utilised they shall be serviced and repaired as follows:

(a) Dismantle and strip down thermostatic control valve including removal of pocket.
(b) Descale and clean all equipment.
(c) Replace element subassembly if necessary.
(d) Replace cover joint, gland packing, heater joint, coupling joint and all gaskets where applicable.
(e) Check valve seat and if necessary reseat.
(f) Reassemble control valve and reinstall, test and adjust to correct level.

All other type of thermostatic heating control valves shall be serviced, repaired and overhauled in accordance with the manufacturer's specification.

FC 12.09.02 **Electrical heating control equipment**

All electrical thermostat control equipment shall be serviced and repaired in accordance with the manufacturer's specification.

This shall include the following:

(a) Dismantle, clean and descale thermostat pockets.
(b) Test switching actions for correct operation.
(c) Test safety cut-out switching points for correct operation.

Replace thermostat if the switching does not take place in accordance with the manufacturer's specification.

FC 12.10 **PRIMARY AND SECONDARY PUMP INSTALLATIONS**

The Contractor shall at the start of the repair and maintenance contract inspect, test, service and if required replace primary and secondary circulating pumps.

The pumps are to be inspected, tested, serviced and repaired together with their associated equipment and pipework. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the pumps and equipment shall include at least the following:

(a) Inspect and test the pumps for correct operation.

(b) Replace gland packings, seals and gaskets.

(c) Inspect and test for any bearing noise and replace if necessary.

(d) Clean out pump strainers, check non-return valves, valves, etc.

(e) Test pump motor windings for balance phases, insulation test and check wiring.

(f) Inspect pump mountings and repair if necessary.

Where in-line glandless canned pumps are used, these shall be inspected, tested, serviced where possible, impeller inspected and cleaned and if found beyond repair, replace with a suitable replacement in accordance with the operating parameters.

FC 12.11 DOMESTIC HOT AND COLD WATER INSTALLATIONS

The Contractor shall at the start of the repair and maintenance contract inspect, tests, service, repair and if required, replace damaged items on the complete hot and cold-water piping installation inside the hot-water generating plant rooms.

The repair work specification shall be read in conjunction with Technical Specification AA: Plumbing and Drainage Installations.

Repair work to the domestic hot and cold-water installation networks shall be as detailed in the Particular Specification and shall include, but not be limited to the following:

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

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

(c) Test the proper closing of all valves and where valves do not close properly, the valves shall be refurbished, descaled and if necessary replaced.

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

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

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

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

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

(i) Do repair work to bracketing systems including fixing and repair of existing brackets and the introduction of additional brackets where required.

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

(k) Repair, service and log readings of watermeters including cleaning of integral strainers.

(l) Water pipes are to be sampled for corrosion and scaling. The Engineer shall evaluate the actions to be carried out if the outcome of this sampling requires attention.

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

(n) Pressure test and sterilise repaired new installation and equipment.

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

FC 12.12 ELECTRICAL INSTALLATION, WIRING AND CONTROL PANELS

FC 12.12.01 Instrumentation and controls

All instrumentation and control equipment shall be inspected, tested, repaired, adjusted and where necessary replaced. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the instrumentation and control equipment shall include at least the following:

(a) Test all equipment for correct operation.

(b) Inspect, test, service, adjust setting and if necessary repair, and/or replace steam detector.

(c) Inspect, recalibrate and, if beyond repair, replace steam pressure gauge.

FC 12.12.02 Electrical control panels

All electrical control panels shall be inspected, tested, and repaired, including all equipment inside the control panel. All repair and service work shall be done strictly in accordance with the manufacturer's specification.

The repair work to the electrical control panels shall include at least the following:

(a) Test all control equipment for correct operation.

(b) Check and test all MCBs, isolators, contactors, overloads, other type of motor drives, pilot lights, control switches, etc, and readjust all set points; where equipment is found to be faulty these shall be replaced with new approved equipment.

(c) Check all wiring and connections for proper conducting and replace where hot connections are found.

(d) Clean out panel interior and exterior, inspect panel body, fascias, doors, paintwork, etc, and repair where necessary.

FC 13 MAINTENANCE TO INSTALLATIONS AND EQUIPMENT

[Note: There will be no maintenance work required for this installation and equipment in this contract.]

FC 13.01 GENERAL

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

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

(a) Routine preventative maintenance;
(b) Corrective maintenance, and
(c) Breakdown maintenance,

as defined in Additional Specification SA: General Maintenance, for the specified installations described under FC 01 of this specification.

The maintenance work to be performed and executed shall be done strictly in accordance with Additional Specification SA: General Maintenance, and as specified in Particular Specification PFC and this specification.

The said maintenance work shall be executed in accordance with the relevant codes of practice, statutory regulations, standards, regulations, municipal laws and by-laws and the manufacturers' specifications and codes of practice.

The maintenance schedules and frequency shall be developed under the maintenance control plan to be instituted by the Contractor, as specified in Additional Specification SA: General Maintenance.

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

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

(a) Steam and condensate pipework (where applicable)
(b) Hot-water storage vessels
(c) Heating equipment
(d) Lagging and cladding of vessels and piping
(e) Corrosion protection linings
(f) Circulating pumps
(g) Domestic hot and cold-water piping systems
(h) Electrical controls, panels and wiring.

The Contractor shall be remunerated monthly, based on his performance, for maintaining the complete installation in a perfect functional condition.

FC 13.02 ROUTINE PREVENTATIVE MAINTENANCE

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

The routine maintenance work to be performed and executed shall include but not be limited to the items listed in tables FC 13.02/1, FC 13.02/2, FC 13.02/3 and FC 13.02/4 below under the respective headings.
These actions and findings shall be logged and reported on the relevant approved schedules and reports.

TABLE FC 13.02/1: WEEKLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	Inspect equipment, components and installations for any visible defects, leaks, damages and/or pending faults.	Contractor	Check/Record
2	Check and record all pressure gauge temperature and flow meter readings, and readjust equipment if necessary.	Contractor	Adjust/Check/Record
3	Check operation of pumps, heating equipment and controls for correct functioning.	Contractor	Check/Record
4	Check electrical control panels for any faults.	Contractor	Check/Record
5	Report any faults, defects, leaks, damages, etc, to Engineer.	User Client	Check/Record/Report

TABLE FC 13.02/2: MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under table FC 13.02/1	Contractor/ User Client	Check/Record Adjust/Repair/Report
2	Blow down all dirt pockets and record.	Contractor	Service/Record
3	Clean out all stainers and record.	Contractor	Service/Record
4	Check all valve gland seals and packings for leaks and replace and repair if necessary.	Contractor	Check/Service/Repair /Record
5	Check, inspect and repair if necessary all expansion joints for leaks and damages.	Contractor	Check/Repair/Record
6	Check all safety devices for correct operation and repair and replace where necessary.	Contractor	Check/Service/Repair /Record

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
7	Check and test all electrical control functions and operations. Repair and report any faults and defects.	Contractor	Check/Service/Repair /Record
8	Complete logbook and report.	Contractor	Report

TABLE FC 13.02/3: FOUR-MONTHLY ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under tables FC 13.02/1 and FC 13.02/2.	User Client/ Contractor	Check/Record/Adjust/ Repair
2	Service, repair, clean, replace seals gaskets, reset and/or replace worn parts as directed by the manufacturer of all steam traps (where applicable).	Contractor	Check/Service/Repair /Report
3	Service, repair, replace glasses and gaskets where necessary and clean all sight glasses.	Contractor	Check/Service, Repair, Report
4	Repair lagging and cladding where necessary.	Contractor	Check/Repair/Report
5	Repair all steam leaks.	Contractor	Check/Repair/Report
6	Repair all water leaks.	Contractor	Check/Repair/Report
7	Inspect and test all heating equipment Repair where necessary.	Contractor	Check/Repair/Report
8	Inspect all hot -water storage vessels for any leaks and packing faults. Repair if necessary.	Contractor	Check/Repair/Report
9	Test, inspect and repair all pumps.	Contractor	Check/Service/ Repair/Report
10	Lubricate all lubrication points in accordance with the manufacturer's specification.	Contractor	Check/Service/ Report
11	Complete logbook and report.	Contractor	Report

TABLE FC 13.02/4: ANNUAL ACTIONS AND MAINTENANCE

ITEM	MAINTENANCE DESCRIPTION	ACTION RESPONSIBILITY	ACTION
1	All as listed under tables FC 13.02/1, FC 13.02/2 and FC 13.02/3.	User Client / Contractor	Check/Record/ Adjust/Repair
2	Drain, clean out, inspect and repair all defects and linings on hot-water storage vessels.	Contractor	Inspect / Test / Service / Repair
3	Inspect and repaint all equipment where required.	Contractor	Inspect / Test / Service / Repair
4	Remove, strip, service, repair, adjust and replace where necessary all pressure control and safety valve equipment.	Contractor	Service / Repair / Adjust / Report
5	Complete logbook and report.	Contractor	Report

FC 13.03 **CORRECTIVE MAINTENANCE**

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

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

The Contractor shall report and take actions to correct such defects.

FC 13.04 **BREAKDOWN MAINTENANCE**

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

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

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

The Contractor shall have access to the necessary spares, equipment and tools for any possible breakdowns.

TECHNICAL SPECIFICATION

HE EXTERIOR LIGHTING SYSTEMS

CONTENTS

HE 01	SCOPE
HE 02	STANDARD SPECIFICATIONS, REGULATIONS, CODES AND ADDITIONAL SPECIFICATIONS
HE 03	OPERATING AND MAINTENANCE MANUALS
HE 04	TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK
HE 05	LOGGING AND RECORDING PROCEDURES
HE 06	QUALITY ASSURANCE SYSTEM
HE 07	RE-COMMISSIONING OF INSTALLATION
HE 08	REPAIR WORK TO EXTERIOR LIGHTING INSTALLATIONS AND KIOSKS
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

02.02.01	SANS 10400	National Building Regulation
02.02.02	SANS 10142	Wiring code
02.02.03	SANS 10225	Lighting masts
02.02.04	SANS 1277	Read lighting luminaires
02.02.05	SANS 1088	Spigot entries
02.02.06	SANS 1749	Glass polyester poles
02.02.07	SANS 1250	Capacitors, ballasts & lamps
02.02.08	SANS 1279	Floodlight luminaires
02.02.09	SANS 1777	Daylight switches
02.02.10	SANS 763	Galvanised coatings
02.02.11	SANS 1266	Discharge lamps
02.02.12	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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003.

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:

03.02.01 Description of Installation

Complete system description of the lighting system. This shall be done for each lighting installation individually. The system description shall contain detailed information regarding the supply configuration (Distribution board, cabling, distribution kiosks, pole mounted distribution board), the switching arrangement (timers, photocells, override facilities) and the lighting (luminaire detail, lamp detail) as well as the earthing and lightning protection arrangement.

03.02.02 Commissioning Data

Complete commissioning, test and inspection data of lighting system.

This shall be done for each lighting installation individually. The commissioning data will comprise start-up and running current measurements at each termination point e.g. distribution board, kiosk and mast. Full data on lamps fitted with installation dates.

03.02.03 Operating data

a) Safety precautions to be implemented.
b) Operation of lighting systems; automatic, manual and bypass switching.

03.02.04 Maintenance instructions

a) Projected frequency of lamp replacement per lighting system.
b) Procedure to verify operation of photocell – controlled circuits.
c) Procedure to verify operation of timer – controlled circuits.
d) Trouble shooting diagram.
e) Luminaire details, including manufacturers brochures / pamphlets, order number, list of components and lamp specification.

f) Schedule of serviceable components per lighting system. These schedules shall include lamps, starters, ignitors, ballasts, lenses, etc.

HE 04 TESTS AND INSPECTIONS PRIOR TO PRACTICAL COMPLETION OF REPAIR WORK

HE 04.01 It is the responsibility of the Contractor to provide all labour, accessories and properly calibrated and certified measuring instruments necessary to record the following parameters:

04.01.01 Phase voltages
04.01.02 Current per phase
04.01.03 Illumination levels in lux
04.01.04 Insulation testing at 500V
04.01.05 Earthing resistance testing by means of 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:

05.02.01 Monthly lamp inspection and maintenance actions.
05.02.02 Bi-annual inspection and testing of lighting systems.
05.02.03 Annual earthing test report.
05.02.04 Breakdown / call out reports.

HE 06 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 are specified seperately.

	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 amount 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/mm². 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 mm² 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 earthbar by means of a 70 mm² stranded copper earth conductor.

(h) Terminal blocks

A terminal block type suitable for the termination of 16 mm² 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 trafolite 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.

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 the specified 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	=	40m/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 cresote 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 wrotten (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 the luminaire complete with the lamp and control gear according to the 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 wrotten (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 the luminaire complete with the lamp and control gear as per 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:

12.02.01 Routine preventative maintenance
12.02.02 Corrective maintenance
12.02.03 Breakdown maintenance

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

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:**

12.04.01 Scope of maintenance work on area lighting

a) Monthly

i) Verify operation of switching element
ii) Check lamps
iii) Check mast door for weatherproof seal
iv) Check earth connection at footing, record value

b) Annual

i) Service all luminaires
ii) Measure earth resistance of electrode
iii) Measure earth resistance of trench earth
v) Record values in record book

12.04.02 Scope of maintenance work on security lighting

a) Monthly

i) Verify operation of switching element.
ii) Check lamps.
iii) Check that all pole covers are secure.
iv) Visually check distribution kiosk.

b) Annual

Measure phase voltages and line currents in distribution kiosk or local distribution board. Record values in record book. Do vermin protection. Service all luminaires.

12.04.03 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
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JC 05	LOGGING AND RECORDING PROCEDURES
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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 hose reels
(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; ICS 13.220.10	- Fire extinguishers, classification system, fire ratings
CKS 532; ICS 13.220.10	- Fire extinguishers, foams
SANS 10105-1; ICS 13.220.10	- Fire extinguishers, portable, classification system, control systems
SANS 1322; ICS 13.220.10	- Fire extinguishers, portable, non-refillable
SANS 1567; ICS 13.220.10	- Fire extinguishers, portable, rechargeable, carbon dioxide

SANS 1573; ICS 13.220.10	-	Fire extinguishers, portable, rechargeable, foams
SANS 1475-1; ICS 13.220.10	-	Fire extinguishers, portable, reconditioning
SANS 810; ICS 13.220.10	-	Fire extinguishers, powder, portable, rechargeable
SANS 1522; ICS 13.220.10	-	Fire extinguishers, powders
SANS 1571; ICS 13.220.10	-	Fire extinguishers, transportable, rechargeable
SANS 889; ICS 13.220.10	-	Fire extinguishers, water fire extinguishers, portable, rechargeable
SANS 10105-1; ICS 13.220.10	-	Fire fighting equipment, fire extinguishers, portable
SANS 1322; ICS 13.220.10, 23.020.30	-	Fire fighting equipment, fire extinguishers, portable, non-refillable
SANS 543; ICS 13.220.10	-	Fire fighting equipment, fire hose reels
SANS 10105-2; ICS 13.220.10	-	Fire fighting equipment, fire hose reels
SANS 1128-2; ICS 13.220.10, 23.040.60	-	Fire fighting equipment, fire hose, pipe couplings, pipe connections
SANS 1128-1; ICS 13.220.10, 23.060.99	-	Fire fighting equipment, fire hydrants
SANS 810; ICS 13.220.10	-	Fire fighting equipment, powder fire extinguishers, portable, rechargeable
SANS 1475-1; ICS 13.220.10	-	Fire fighting equipment, reconditioning, fire extinguishers, portable
SANS 889; ICS 13.220.10	-	Fire fighting equipment, water fire extinguishers, portable, rechargeable
SANS 543; ICS 13.220.10	-	Fire hose reels
SANS 10105-2; ICS 13.220.10	-	Fire hose reels, classification systems, control systems
SANS 1475-2; ICS 13.220.10	-	Fire hose reels, reconditioning
SANS 1456-5; ICS 13.220.10	-	Fire hoses, collapsible, delivery pipes (fire fighting), oil resistance tests, chemical resistance tests
SANS 1456-2; ICS 13.220.10	-	Fire hoses, collapsible, delivery pipes (fire fighting), percolating hoses
SANS 1456-1; ICS 13.220.10	-	Fire hose, collapsible, delivery pipes (fire fighting), testing
SANS 1456-4;	-	Fire hoses, collapsible, delivery pipes, coated materials,

ICS 13.220.10		non-percolating hoses
SANS 1456-3; ICS 13.220.10	-	Fire hoses, collapsible, delivery pipes, uncoated materials, non-percolating hoses
SANS 1128-2; ICS 13.220.10, 23.040.60	-	Fire hoses, pipe couplings, pipe connections
SANS 1128-1; ICS 13 220 10, 23 060.99	-	Fire hydrants, fire-fighting equipment
SANS 1056-1; ICS 23.060.20	-	Fire safety, ball valves
SANS 10400	-	Application of the NBR
SANS 10287	-	Automatic sprinkler installations for fire fighting purposes.
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, 2003 as promulgated in Government Gazette No 25207 and Regulation Gazette No 7721 of 18 July 2003.

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 hose reels
(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 REELS

Repair work to the fire hose reel systems is detailed in the Particular Specification and shall include but no be limited to the following:

(a) Replacement of the hose drum seal where leaks occur;

(b) Replacement of the 30 m hose where perished, damaged or missing;

(c) Repair damaged hose drums and, where directed by the Engineer, replace with new;

(d) Replace gland packing and gaskets to hose reel shut-off valve;

(e) Replace missing hose reel shut-off valve wheel handles;

(f) Number and catalogue hose reel;

(g) Where hose reels shut-off valves are damaged beyond repair, these shall be replaced with new;

(h) All hose reel mountings shall be checked and where loose or damaged, replaced with new;

(i) Where paintwork of equipment has deteriorated, such equipment items shall be replaced and repainted in accordance with the manufacturer's specification;

(j) Hose reels 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.

(d) Water extinguishers shall be repaired and serviced and shall include at least the following:

(i) Check cylinder for corrosion and report to Engineer. Where directed, the complete unit shall be replaced;

(ii) Replace discharge hose and nozzle where damaged and missing;

(iii) Replace gauge on bottle where damaged, missing or where reading is incorrect;

(iv) Check service and repair activation mechanism;

(v) Replace water content;

(vi) Recharge discharge cylinder to the required capacity;

(vii) Reseal discharge mechanism;

(viii) Replace instructions on extinguisher where damaged or missing;

(ix) Extinguishers shall be labelled with identifying tags and details recorded, including service record.

(e) Foam type extinguisher shall be serviced and repaired and shall include at least the following:

(i) Check cylinder for corrosion and report to Engineer. Where directed, the complete unit shall be replaced;

(ii) Replace discharge hose and nozzle where damaged or missing;

(iii) Replace gauge on bottle where damaged, missing or incorrect;

(iv) Check, service and repair activation mechanism;

(v) Replace foam concentrate content;

(vi) Recharge discharge cylinder to required capacity;

(vii) Reseal discharge mechanism;

(viii) Replace instructions on extinguisher where damaged or missing;

(ix) 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 hose reels
(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 hose reels**

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 reel valve.

(f) Lubricate moving parts of drum.

(g) Check pressure and flow of fire hose reel.

(h) Check piping for leaks and damages.

(i) Log maintenance schedules.

(j) Report defects for processing and repair.

(k) For fire water pipe systems see Technical Specification AA.

(l) 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.

(iii) Water extinguisher:
Replace water at pre-described intervals.

(iv) Foam extinguisher:

Check foam mix and replace at predetermined intervals.

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.

MUNICIPAL REGULATIONS. LAWS AND BY-LAWS

KA 02.04 All municipal regulations laws, by-laws and special requirements of the Local Authority shall be adhered to unless otherwise specified.

MECHANICAL PRESSURE GAUGES

KA 02.05

(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 working medium.

(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

The data logger shall be a Meinecke Cosmos data logger or similar approved.

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	IP68
Casing	Cast aluminium
Operating temperature	0 to 50 °C
Storage temperature	-10 to+ 70 °C
System clock	Read time
Output	V.24/RS 232-compatible data interface to connect to the PC. All socket connectors are waterproof.
Alarm contact	FET open drain - 1 max 100 mA; U max 50 V

KA 02.06.03 Pressure sensors

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	Oto +70 °C
Compensated range	Oto +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 03.05.03 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;
U) 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 (WAR);
(d) Night-flow evaluation (SANFLOW).

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.

KA04 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 Regular 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 Annual maintenance

(a) Clean strainer units at water meters;

(b) Confirm settings and operation of pressure-reducing valves.

KA05 MEASUREMENT AND PAYMENT

KA.01 C_OMPILATION OF DATABASE .....Unit: sum

The tendered sum shall include for the provision of the software and the input of all the initial data.

KA.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.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.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 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.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.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.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.

BF PEST CONTROL

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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 buildinQs.
SANS 10133	Code of practice for the application of pesticides in food handling, food processing, and catering establishments.

CODE	DESCRIPTION
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

BE 08.03 RECORDS OF PEST CONTROL OPERATORS

All pest control operators shall be in possession of the National Certificate in pest control, as approved by the Department of National Education. The Pest Control Operator (PCO) shall be in possession of a Registration Certificate issued by the Department of Agriculture in accordance with Act 36 of 1947.

The Pest Control Operator's details and certifications shall be made available for inspection by the Engineer prior to the application of pesticides.

A copy of the Pest Control Operator's details and certifications shall be submitted together with the Pesticide Application Log Sheet (Form PC-1) completed for each pesticide application.

BF 09 NOTIFICATION OF INTENTION TO ADMINISTER PEST CONTROL

Before pest control procedures may commence a notification shall be submitted to the Employer's representative responsible for the facility. The Notification of Intent to Administer Pest Control (Form PC-2, that forms part of this specification) shall include the following details:

- The name and address of the person being notified
- The pest control procedure to be employed and the purpose of the pest control
- The pesticide to be employed
- The date and time of commencement

The pest control operator is to sign the notification to acknowledge responsibility for the precautions to be taken before, during and after operations.

The Employer's representative responsible for the facility is to sign the notification to acknowledge receipt of the notice.

Pest control procedures may only be implemented once the notification has been completed and signed by all relevant parties.

BF10 PREPARATION OF THE AREA AFFECTED BY PEST CONTROL

The PCO shall arrange, with the Engineer via the Contractor, a suitable time for the pest control area to be vacated and provide an approximate time for the completion of pest control.

The PCO shall provide the Employer's representative responsible for the facility with a written list of all materials and articles that must be removed from the facility before the administering of pesticides may commence.

After the PCO is satisfied that all materials, which might be damaged or contaminated during the application of pesticides, have been removed he will conduct a thorough inspection of the area before pest control application may commence.

BF 11 CLEARANCE AFTER PEST CONTROL

Upon completion of the application of pesticides the 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.

BF12 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 BE 09, BE 10 & BE 11 for the supply, preparation, delivery and the application of the pesticides, for the safe disposal of empty pesticide containers and for storage, transport and handling.

The tendered sum shall include full compensation for the cost of all materials required for the rodent proofing of the facility as well as for the supply, delivery, storage, handling, transport and installation of such materials.

The tendered sum shall also include full compensation for all testing, including re-testing where applicable for all instrumentation, tools, equipment and labour that may be required as well as for the logging and recording of all required data as described this specification.

BF .03 Monitoring And Reporting Of Pest Control Status — **Unit: Number**

The unit of measurement shall be the number of reports with recommendations compiled and submitted for each location in each facility.

The tendered rate shall include full compensation for monitoring the pest control status, for the supply of all equipment used during monitoring, for delivery of relevant equipment, and for the cost of compiling the reports with recommendations.

The tendered rate shall also include full compensation for all testing, including re-testing where applicable, for all instrumentation, tools, equipment and labour that may be required as well as for the logging and recording of all required data as described in this specification.

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.
SIGNED (Employer's Representative responsible for facility): _____

PC-2

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.

SIGNED (Employer's Representative responsible for facility):

DATE: _____

SIGNED (Pest Control Operator):

_____

_____

_____

The undersigned acknowledges receipt of this notice of clearance

DATE:

PARTICULAR SPECIFICATION

PAA PLUMBING AND DRAINAGE INSTALLATION

CONTENTS

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PAA 02 GENERAL DESCRIPTION OF INSTALLATION
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PAA 01 SCOPE

(a) This specification covers the particulars of the repair and maintenance work to the plumbing and drainage installations. 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
SE: Development of Affirmable Business Enterprise.

The intended repair and maintenance work to this installation will restore the existing installation to a safe, efficiently functional system that complies with all statutory regulations and applicable standards, in the process repairing all defects and shortfalls. On completion of the repair work, the completed installation shall be maintained and serviced by the Contractor for the remainder of the allocated Contract period.

(b) The complex consists of various areas as listed below, which form part of the repair and maintenance contract for plumbing and drainage installation, as well as the fire water piped reticulation installations.

(i) Kitchen,
(ii) Stores,
(iii) Single cells and
(iv) Communal cells.

PAA 02 GENERAL DESCRIPTION OF INSTALLATION

The existing plumbing and drainage installation provides potable hot and cold water to the various areas on this site.

The potable cold water installation is provided with supply points from the reticulation network inside the buildings at very kitchen area and chased into walls to outlet points.

The potable hot-water installation is provided with supplies from various hot- water geyser units where applicable.

Central hot-water systems are not dealt with under this contract but all domestic water geysers form part of this contract.

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 INSTALLATION

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

PAA 03.01 SANITARY AND BRASSWARE: GENERAL

	SANITARY WARE	BRASSWARE	TRAP
WCs (cistern)	Armitage Shanks/Suda/ Vaal, white, floor-mounted, vitreous china,	Brass shut-off valves	Not applicable
WCs (flush)	Armitage Shanks, white, floor-mounted, vitreous china. White, vitreous china, Vaal. Cape Stainless, stainless steel	Flush valve, concealed type wear and tear not to effect the body work	Not applicable
Cistern (WC)	Wall-mounted, white, CI. Wall-mounted, white, plastic	Brass shut-off valves	Not applicable
Urinals (cistern)	Elgin / City Metal, floor-mounted, stainless steel. Armitage Shanks, white, wall-mounted, vitreous china	Brass shut-off valves	Not applicable
Urinals (flush)	Elgin/City Metal, floor-mounted, stainless steel. Armitage Shanks, white, wall-mounted, vitreous china. Cape Stainless, stainless steel	Jnr flush valve, concealed and exposed type, shut-off valves	CP bottle trap. Flexi P-trap
WHBs	Armitage Shanks, white wall-mounted, white enamel CI, stainless steel	Pillar taps handles fixed to spindle by factory press fit pillar taps	Flexi P-trap CP bottle trap lead P-trap
Showers	Vandal proof shower heads. Channel drain type	15 mm CP undertile stop-cocks, water saver shower heads	Brass P-trap with CP grating
Wash troughs	Stainless steel, double bowl, wall-mounted	Wall type taps hndles fixed to spindle by factory press fit wall type taps	Flexi P-trap
Baths	Steel enamel, white, 2 m long	Cobra 20 mm, CP star handle wall type taps	Not applicable

	SANITARY WARE	BRASSWARE	TRAP
Sinks	Stainless steel, cabinet-mounted	20 mm CP handles fixed to spindle by factory press fit, 20 mm sink mixer with overarm swivel outlet	Flexi P-trap , lead P-trap
Wash tubs	Concrete double bowl	CP wall type taps	Lead P-trap
S Hopper	Wall-mounted white porcelain	15 mm CP star handle taps	Not applicable

PAA 03.02 **SANITARY DRAINAGE PIPING: GENERAL**

	PIPE	FITTINGS	EQUIPMENT
Gullies	VCP	CI grating	Not applicable
Waste pipes	GMS	Brass	Not applicable
Soil pipes	S&S CI	S&S CI	Not applicable
Cleaning eyes	CI (ABC)	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	GMS	See specifications

PAA 03.05 PLUMBING FIXTURE QUANTITIES

At the time of completion of this document the various facilities were equipped with the number of plumbing fixtures as tabled below.

PAA 03.06 FIRE WATER INSTALLATION QUANTITIES

The following quantities of fire fighting equipment currently installed, are tabled below. The piped reticulation networks to these equipment items shall form part of this contract.

PAA 04 STATUS OF EXISTING INSTALLATION

At the time of compilation of this document the status of the equipment and installation was briefly as follows:

PAA 04.01 FACILITIES

PAA 04.01.01 Sanitary and brassware

The sanitary and brassware can be grouped into three categories:

- installations that were installed a long time ago;
- installations that have been refurbished by the maintenance department in recent years, and
- The general condition of these installations varies accordingly, and the following are common occurrences for every category.

(a) Old installations:

(i) Recessed flush valve links and push buttons are missing.
(ii) Flush valves in ducts are leaking.
(iii) Cast-iron cisterns are corroded, broken and damaged.
(iv) Shower heads are missing or broken.
(v) Shower and tap handles are generally missing.
(vi) WCs and WHBs are damaged, ripped out of walls, etc.
(vii) Shower and urinal gratings are missing, resulting in excessive blockages.

(b) Refurbished installations:

(i) Recessed flush valve links and push buttons are missing.
(ii) Shower heads are missing or broken.
(iii) Shower and tap handles are generally missing.
(iv) Shower and urinal gratings are missing, resulting in excessive blockages.

PAA 04.01.02 Plumbing and drainage installation

The general condition of the plumbing and drainage installation can also be grouped into three categories:

(a) Old installations:

The installations are generally in poor condition and require extensive repairs and replacements. The following common problems were noticed:

(i) Regular blockages on drainage pipe installation;
(ii) Regular leaks developing on the water reticulation network above and underground;
(iii) Missing gully gratings, IE covers and CE covers on drainage system, and broken manhole covers;
(iv) Surface-mounted temporary hot-water pipes are prone to damage by inmates.

(b) Refurbished installations:

The installations are generally in good condition and require limited repairs:

(i) Water pipe bracketing and hot-water pipe insulation require attention;
(ii) Regular blockages on drainage pipe installation;
(iii) Missing gully gratings, IE covers and CE covers on drainage system, and broken manhole covers.

(c) Problems experienced with hot-water supply to certain areas are due to the following:

(i) Insufficient storage and heating capacity for the number of users
(ii) Overcrowding of facilities;
(iii) Leaks developing on piping and equipment;
(iv) Incorrect functioning and failure of hot-water generating plants at

(d) There are problems with the floor drainage installation in the old kitchen at, currently being used as a serving kitchen and scullery. This is due to constant blockages, caused by age, insufficient straining facilities, and the absence of a grease trap that can lead to fat build-up inside drainage lines.

PAA 04.02 RESIDENTIAL BUILDINGS

These facilities are in varying conditions, corresponding to the age of the installation. The following common problems have been observed:

(a) Old houses (previously accommodation for non-white members) and old single quarters:

(i) The sanitary and brassware, the plumbing and drainage installations, and geysers have been damaged by corrosion and vandalism to such an extent that extensive replacement is necessary.

(b) Old houses and flats:

(i) Extensive damage to sanitary ware such as baths, WHBs and WCs.
(ii) Old geyser installations result in frequent failures and low hot-water pressure;
(iii) Corrosion and damage to a large proportion of domestic water and drainage installations.

(c) New houses, flats and single quarters:

(i) Limited damage to sanitary and brassware, and plumbing and drainage installations;
(ii) A latent problem is experienced with geyser pressure-reducing valves.

PAA 04.03 **RECREATIONAL FACILITIES**

These facilities are generally in a fair and functional condition. The following problems have been observed:

(a) Sanitary and brassware are damaged in some ablutions, due to corrosion and vandalism in isolated cases.

(b) Blockages occur in drainage pipes at rugby stadium.

(c) There is insufficient hot water in staff kitchen due to inadequate geyser installation.

(d) Most areas have insufficient fire protection equipment.

(e) There are isolated leaks on underground water pipes due to corrosion.

PAA 04.04 **WORKSHOPS, STORAGE, MAINTENANCE AND TRANSPORT FACILITES**

(a) Facilities are generally in a fair condition and require limited repairs to sanitary and brassware, and plumbing and drainage pipes.

(b) Extensive repairs and replacements to inmates ablutions are necessary.

(c) Most areas have inadequate fire protection.

PAA 04.05 **OFFICE AND SUPPORT SERVICES FACILITIES**

(a) Facilities are generally in a fair condition and require limited repairs to sanitary and brassware, and plumbing and drainage pipes.

(b) Extensive repairs and replacements to inmates' ablutions are necessary.

(c) Most areas have inadequate fire protection.

PAA 04.06 **AGRICULTURAL FACILITIES**

The installations that form part of these facilities are in varying condition. The following problems were identified:

(a) Old GMS water pipe installations in some areas are badly corroded and frequent leaks occur.

(b) Equipment, plumbing and drainage in inmates' ablutions and some other ablutions are in a poor state and necessitate extensive replacements.

(c) Inadequate floor/drainage at dairy leads to unhygienic conditions.

(d) Unprotected underground GMS pipes at piggery are very corroded.

PAA 04.07 **TRAINING AND EDUCATIONAL FACILITIES**

These installations are generally in a fair condition and require limited repairs to and replacements of equipment and piped reticulation.

The services to primary school ablutions are in a poor condition and require complete replacement.

PAA 04.08 **MAIN KITCHEN AND BAKERY, ABATTOIR AND LAUNDRY**

There are various problems at these installations, in particular with regard to drainage systems. The following items were identified:

(a) Equipment in inmates' ablution areas and kitchen are damaged, and will require repairs and replacement.

(b) The lack of a floor drainage system and grease trap in the kitchen, a lint trap at the laundry, and blood accumulating pit and blood drying bank at the abattoir are against regulations and cause build-up in the sewer pipes and subsequently frequent leaks.

PAA 04.09 **MAIN GATE HOUSE**

These installations are generally in a fair condition with limited repairs and replacements required to equipment and piped reticulation.

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 Contract inspect the items, systems, equipment, components and installations listed below. This inspection shall include the establishing 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.

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 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-off enamel, replacing of damaged 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, replacing of washers, gland packings 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 Ablutions and communal ablutions

(a) ablutions and communal ablutions

(i) Replace aboveground GMS cold-water pipe installation complete with copper pipes with capillary soldered fittings.

(ii) Service and repair copper hot-water installation, including insulation and bracketing, and replace pipes and fittings that are beyond repair.

(iii) Service and repair sanitary drainage installation, and replace items that are missing or beyond repair, including traps and inspection eyes.

(iv) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(3) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(4) Rubber flexi-traps for WHBs, wash troughs and urinals;
(5) Vandal-proof shower gratings;
(6) Vandal-proof water saving shower heads;

(7) Brace wall-mounted taps in washing areas with approved brackets.

(v) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with vandal-proof alternatives, and replace missing or irreparably damaged equipment with the following approved items:

(1) Stainless steel braced WHBs and wash troughs;
(2) Stainless steel wall-mounted and urinals;
(3) Stainless steel WCs.

(vi) Equipment such as concealed flush valve mechanisms that are installed in areas accessible to inmates, such as courtyards, are to be enclosed in a lockable cabinet constructed from an angle iron frame and expanded metal panels, fixed to wall with expansion bolts.

(b) Visitors ablution

(i) Replace GMS water pipe installation with copper pipes with capillary soldered fittings.

(ii) Service and repair sanitary drainage installation and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(2) Cisterns and concealed senior flush valves to be replaced with concealed senior flush valves;
(3) Rubber flexi-traps for WHBs, wash troughs and urinals.

(iv) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with vandal-proof alternatives, and replace missing or irreparably damaged equipment with the following approved items:

(1) Stainless steel urinals;
(2) Vitreous china floor-mounted WC pans.

(c) Guard towers

(i) Replace GMS water pipes with copper pipe and soldered fittings, and service and repair copper pipe installation.

(ii) Service and repair sanitary drainage installation, and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Replace corroded cast-iron cistern with plastic cisterns;
(3) Rubber flexi-traps for WHBs, wash troughs and urinals.

(iv) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with vandal-proof alternatives, and replace missing or irreparably damaged equipment with the following approved items:

(1) Stainless steel braced WHBs and wash troughs;
(2) Vitreous china floor-mounted WC pans.

(d) Hospital

(i) Service and repair of copper domestic water installation, including insulation of hot-water pipes and replacement of unsuitable brackets, and irreparable sections of pipes and fittings.

(ii) Service and repair sanitary and brassware with repair kits, and replace missing or irreparably damaged equipment.

(e) Administration offices

(i) Replace GMS water pipe installation with copper pipes with capillary soldered fittings.

(ii) Service and repair sanitary drainage installation, and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(3) Rubber flexi-traps for WHBs, wash troughs and urinals;
(4) Vandal-proof shower gratings;
(5) Vandal-proof water saving shower heads.

(iv) Service and repair all sanitary ware, including destaining and chip repair of vitreous or enamelled surfaces, dent removal from stainless steel equipment, replacement of missing or damaged parts such as WC seats and lids, or replacement of irreparable equipment.

(f) Facility main reticulation installations

(i) Service and repair domestic water installations, including insulation and bracketing, pressure testing of installations, replacement of damaged, corroded or leaking sections of piping and fittings and unsuitable brackets.

(ii) Service and repair sewer pipes, including rodding of system and visual inspection by means of a video survey if required. Replace damaged and leaking sections of sewer and fittings, damaged or broken inspection eyes, cleaning eyes and manhole covers.

(iii) Install a dedicated fire water supply network to existing and new fire hose reels and hydrants, including a fire water booster.

(iv) Replace underground cold-water ring supplying garden taps in cell block courtyard.

(v) Install a strainer to domestic water supply.

PAA 05.02.02

(a) Old youth cell ablutions

(i) Replace aboveground GMS cold-water pipe installation complete with copper pipes with capillary soldered fittings.

(ii) Service and repair copper hot-water installation, including insulation and bracketing, and replace pipes and fittings that are beyond repair.

(iii) Service and repair sanitary drainage installation, and replace items that are missing or beyond repair, including traps and inspection eyes.

(iv) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valve;
(3) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(4) Rubber flexi-traps for WHBs, wash troughs and urinals;
(5) Vandal-proof shower gratings;
(6) Vandal-proof water saving shower heads;
(7) Brace wall-mounted taps in washing areas with approved brackets.

(v) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with vandal-proof alternatives, and replace missing or irreparably damaged equipment with the following approved items:

(1) Stainless steel braced WHBs and wash troughs;
(2) Stainless steel wall-mounted type urinals;

(3) Stainless steel WCs.

(vi) Equipment such as concealed flush valve mechanisms that are installed in areas accessible to inmates, such as courtyards, are to be enclosed in a lockable cabinet constructed using an angle iron frame and expanded metal panels, fixed to wall with expansion bolts.

(b) Refurbished cell ablutions and single cell ablutions

(i) Service and repair copper domestic water installation, including insulation of hot-water pipes and replacement of unsuitable brackets and irreparable sections of pipes and fittings.

(ii) Service and repair sanitary drainage installation and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(3) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(4) Rubber flexi-traps for WHBs, wash troughs and urinals;
(5) Vandal-proof shower gratings;
(6) Vandal-proof water-saving shower heads;
(7) Brace wall-mounted taps in washing areas with approved brackets.

(iv) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with vandal-proof alternatives, and replace missing or irreparably damaged equipment with the following approved items:

(1) Stainless steel braced WHBs and wash troughs;
(2) Stainless steel wall-mounted type urinals;
(3) Stainless steel WCs.

(v) Equipment such as concealed flush valve mechanisms that are installed in areas accessible to inmates, such as courtyards, are to be enclosed in a lockable cabinet constructed using an angle iron frame and expanded metal panels, fixed to wall with expansion bolts.

(vi) Disconnect and remove geysers in single cell ablutions and connect to nearby hot-water distribution lines from central hot-water plant.

(c) Non-refurbished cell ablutions

(i) Replace GMS water pipe installation with copper pipes with capillary soldered fittings.

(ii) Service and repair sanitary drainage installation, and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Replace all brassware with the following approved equipment:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(3) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(4) Rubber flexi-traps for WHBs, wash troughs and urinals;
(5) Vandal-proof shower gratings;
(6) Vandal-proof water-saving shower heads.
(7) Brace wall-mounted taps in washing areas with approved brackets.

(iv) Replace all sanitary ware with the following approved equipment:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(3) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(4) Rubber flexi-traps for WHBs, wash troughs and urinals;
(5) Vandal-proof shower gratings;
(6) Vandal-proof water-saving shower heads;
(7) Brace wall-mounted taps in washing areas with approved brackets.

(v) Replace all sanitary ware with the following approved equipment:

(1) Stainless steel braced WHBs and wash troughs;
(2) Stainless steel wall-mounted and recessed urinals;
(3) Stainless steel WCs.

(vi) Equipment such as concealed flush valve mechanisms that are installed in areas accessible to inmates, such as courtyards, are to be enclosed in a lockable cabinet constructed using an angle iron frame and expanded metal panels, fixed to wall with expansion bolts.

(d) School, education and training centre, clothing store, social workers' and parole offices

(i) Replace GMS water pipe installation with copper pipes with capillary soldered fittings.

(ii) Service and repair sanitary drainage installation, and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Connect washhand basin at training centre that currently drains into rainwater channel to sewer system.

(iv) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(3) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(4) Rubber flexi-traps for WHBs, wash troughs and urinals;
(5) Vandal-proof shower gratings;
(6) Vandal-proof water-saving shower heads;
(7) Brace wall-mounted taps in washing areas with approved brackets.

(v) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with vandal-proof alternatives, for inmates ablution, and replace missing or irreparably damaged equipment with the following approved items:

(1) Stainless steel WHBs and wash troughs;
(2) Stainless steel wall-mounted and recessed urinals;
(3) Stainless steel WCs.

(vi) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with vandal-proof alternatives, for members ablution, and replace missing or irreparably damaged equipment with the following approved items

(1) Stainless steel braced WHBs and wash troughs;
(2) Vitreous china floor-mounted WC pans;
(3) Stainless steel cabinet-mounted sink.

(vii) Equipment such as concealed flush valve mechanisms that are installed in areas accessible to inmates, such as courtyards, are to be enclosed in a lockable cabinet constructed using an angle iron frame and expanded metal panels, fixed to wall with expansion bolts.

(viii) Service and repair domestic geyser installation and replace geysers that are beyond repair.

(e) Hospital section

(i) Replace GMS water pipe installation with copper pipes with capillary soldered fittings.

(ii) Service and repair sanitary drainage installation and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(3) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(4) Rubber flexi-traps for WHBs, wash troughs and urinals;
(5) Vandal-proof shower gratings;
(6) Vandal-proof water-saving shower heads;
(7) Brace wall-mounted taps in washing areas with approved brackets.

(iv) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with vandal-proof alternatives, and replace missing or irreparably damaged equipment with the following approved items:

(1) Stainless steel WHBs and wash trough;
(2) Stainless steel wall-mounted and recessed urinals;
(3) Stainless steel WCs.

(v) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with vandal-proof alternatives, and replace missing or irreparably damaged equipment with the following approved items:

(1) Stainless steel braced WHBs and wash troughs;
(2) Vitreous china floor-mounted WC pans;
(3) Stainless steel cabinet-mounted sink.

(vi) Equipment such as concealed flush valve mechanisms that are installed in areas accessible to inmates, such as courtyards, are to be enclosed in a lockable cabinet constructed using an angle iron frame and expanded metal panels, fixed to wall with expansion bolts.

(vii) Disconnect and remove geysers and connect to nearby hot-water distribution lines from central hot-water plant.

(f) Kitchen and dining hall

(i) Replace GMS water pipe installation with copper pipes with capillary soldered fittings.

(ii) Service and repair sanitary drainage installation, and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Install stainless steel floor drains to kitchen and dining hall sculleries, and a 4 litre stainless steel grease trap, including drainage pipes and connection to sewer system, and disconnection of existing redundant kitchen floor drainage.

(iv) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(3) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(4) Rubber flexi-traps for WHBs, wash troughs and urinals;
(5) Vandal-proof shower gratings;
(6) Vandal-proof water-saving shower heads;
(7) Brace wall-mounted taps in washing areas with approved brackets.

(v) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with vandal-proof alternatives, and replace missing or irreparably damaged equipment with the following approved items:

(1) Stainless steel braced WHBs and wash troughs;
(2) Vitreous china floor-mounted WC pans;
(3) Stainless steel cabinet-mounted sink;
(4) Stainless steel pot sinks.

(vi) Equipment such as concealed flush valve mechanisms that are installed in areas accessible to inmates, such as courtyards, are to be enclosed in a lockable cabinet constructed using an angle iron frame and expanded metal panels, fixed to wall with expansion bolts.

(vii) Service and repair domestic geyser installation and replace geysers that are beyond repair.

(g) Administration building

(i) Replace GMS water pipe installation with copper pipes with capillary soldered fittings.

(ii) Service and repair sanitary drainage installation, and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(3) Rubber flexi-traps for WHBs, wash troughs and urinals;
(4) Vandal-proof shower gratings;
(5) Vandal-proof water-saving shower heads;

(iv) Service and repair all sanitary ware, including destaining and chip repair of vitreous or enamelled surfaces, dent removal from stainless steel equipment, replacement of missing or damaged parts such as WC seats and lids, or replacement of irreparable equipment.

(h) Facility main reticulation installations

(i) Service and repair domestic water installations, including insulation and bracketing, pressure testing of installations, replacement of damaged, corroded or leaking sections of piping and fittings and unsuitable brackets.

(ii) Service and repair sewer pipes, including rodding of system and visual inspection by means of a video survey if required. Replace damaged and leaking sections of sewer and fittings, damaged or broken inspection eyes, cleaning eyes and manhole covers.

(iii) Install fire water supply network to existing and new fire hose reels and hydrants from the existing water network.

(iv) Install a strainer to domestic water supply.

(v) Install proper supports and protection to elevated hot-water circulation pipes spanning between buildings.

PAA 05.02.03 Residential facilities

(a) Houses, flats and single quarters

(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 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, destaining and re-coating of baths, WC bowls and washhand basins, dent removal and destaining 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) Plastic cisterns
(2) Steel enamel bath tubs
(3) Stainless steel wash troughs.

(v) Service and repair domestic geysers, including descaling, testing for leaks, replacement of elements if required, servicing or replacement of valves, or replace geysers that are damaged beyond repair.

(vi) Replace interior safety valves on geysers at new houses with approved alternatives.

(vii) Geyser overflows to be piped down to ground level from penetrations through external walls at flats.

PAA 05.02.04 **Agricultural facilities**

(a) Tractor store and stables

(i) Replace GMS water pipe installation with copper pipes with capillary soldered fittings.

(ii) Service and repair sanitary drainage installation and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Replace all sanitary and brassware.

(iv) Install piped reticulation for a fire hose reel at tractor store.

(b) Dairy and surrounding buildings

(i) Replace aboveground GMS cold-water pipe installation complete with copper pipes with capillary soldered fittings.

(ii) Service and repair copper hot-water installation, including insulation and bracketing and replace pipes and fittings that are damaged beyond repair.

(iii) Service and repair sanitary drainage installation and replace items that are missing or beyond repair, including traps and inspection eyes.

(iv) Service and repair brassware with repair kits and replace with the following approved items, if missing or damaged beyond repair:

(1) WHB, wash trough, bath and shower taps with non-removable tap handles;
(2) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(3) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(4) Rubber flexi-traps for WHBs, wash troughs and urinals;
(5) Vandal-proof shower gratings;
(6) Vandal-proof water saving shower heads;
(7) Brace wall-mounted taps in washing areas with approved brackets.

(v) Service and repair sanitary ware, including destaining and chip repair of enamelled or vitreous china equipment, dent removal from stainless steel equipment, replacement of missing or damaged parts such as toilet seats with a vandal-proof alternatives for inmates' ablution, and replace missing or irreparably damaged equipment with the following approved items:

(1) Stainless steel washhand basins;
(2) Stainless steel wall-mounted and recessed urinals;
(3) Stainless steel WCs.

(vi) Service and repair underground domestic water installations, including insulation and bracketing, pressure testing of installations, replacement of damaged, corroded or leaking sections of piping and fittings and unsuitable brackets.

(vii) Replace wash troughs in milk room and connect waste to drainage system.

(viii) Install floor channels and sump to dairy and connect to drainage system.

(c) Piggery

(i) Service and repair domestic hot and cold water installation, including insulation and bracketing and replace leaking sections of pipes and fittings.

(ii) Service and repair sanitary drainage installation and replace items that are missing or beyond repair.

(iii) Replace underground water pipe installation and install a strainer on the main supply to this installation.

(iv) Replace damaged and missing drinking nozzles.

(d) Agriculture head office, implement store at dam, Eerstevallei store

(i) Replace existing GMS water pipes with capillary soldered copper pipe.

(ii) Repair and service copper water pipes, including bracketing, and replace leaking and damaged sections of pipes and fittings.

(iii) Repair and service sanitary and brassware, where necessary with repair kits, in members' ablutions, replace missing parts such as WC seats and lids, and replace damaged missing or excessively corroded equipment.

(iv) Replace sanitary and brassware in inmates' ablutions as per Prison's approved equipment.

(v) Service and repair domestic geysers, including descaling, testing for leaks, replacement of elements if required, servicing or replacement of valves, or replace geysers that are damaged beyond repair.

(vi) Replace majority of sanitary and brassware, as well as plumbing and drainage installations at implement store and Eerstevallei store, with the following:

(1) Approved sanitary and brassware;
(2) Copper water pipe and capillary soldered fittings;
(3) Plain ended cast-iron soil pipes and fittings and GMS waste pipes with brass fittings.

PAA 05.02.05 **Club, entertainment and sport facilities**

(a) Staff dining room, hall bar and a la carte

(i) Replace aboveground GMS cold-water pipes with copper pipes and service and repair copper pipes, replacing damaged or leaking sections of pipes.

(ii) Service and repair copper hot-water pipe installation and replace missing or leaking sections.

(iii) Inspect underground water piping, service and repair and replace leaking or damaged sections.

(iv) Service and repair sanitary drainage installations and replace items that are missing or beyond repair, including traps and inspection eyes.

(v) Service and repair sewer pipes, including rodding of system and visual inspection by means of video survey if required. Replace damaged and leaking sections of sewer and fittings, damaged or broken inspection eyes, cleaning eyes and manhole covers.

(vi) Install a fire water supply to new fire hose reels.

(vii) Install a strainer to domestic water supply.

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

(ix) Service and repair sanitary ware, including chip repair, destaining and re-coating of baths, WC bowls and washhand basins, dent removal from and destaining 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) Plastic cisterns
(2) Stainless steel wash troughs.

(x) Install a properly sized stainless steel grease trap and floor drainage system to kitchen and preparation area.

(xi) Service and repair domestic geysers including descaling, testing for leaks, replacement of elements if required, servicing or replacement of valves, or replace geysers that are damaged beyond repair.

(b) Swimming pool and ablutions, rugby stadium, gym, dam hall, bowls clubhouse

(i) Service and repair GMS domestic water installation, including pressure testing, and replace damaged or leaking sections of pipes and fittings.

(ii) Service and repair sanitary drainage installation and replace items that are missing or beyond repair, including traps and inspection eyes.

(iii) Service and repair sewer pipes, including rodding of system and visual inspection by means of video survey if required. Replace damaged and leaking sections of sewer and fittings, damaged or broken inspection eyes, cleaning eyes and manhole covers.

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

(v) Service and repair sanitary ware, including chip repair, destaining and re-coating of baths, WC bowls and washhand basins, dent removal and destaining of wash troughs and kitchen sinks and replace 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) Plastic cisterns
(2) Steel enamel bath tubs
(3) Stainless steel wash troughs.

(vi) Service and repair domestic geysers including descaling, testing for leaks, replacement of elements if required, servicing or replacement of valves, or replace geysers that are damaged beyond repair.

PAA 05.02.06 Workshops, storage, maintenance and transport facilities, boiler house

(a) Service and repair GMS domestic water installation, including pressure testing, and replace damaged or leaking sections of pipes and fittings.

(b) Replace GMS water pipes with copper at maintenance building where there is a mixture of GMS and copper.

(c) Service and repair sanitary drainage installation and replace items that are missing or beyond repair, including traps and inspection eyes.

(d) Service and repair sewer pipes, including rodding of system and visual inspection by means of video survey if required. Replace damaged and

leaking sections of sewer and fittings, damaged or broken inspection eyes, cleaning eyes and manhole covers.

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

(f) Service and repair sanitary ware, including chip repair, destaining and re-coating of baths, WC bowls and washhand basins, dent removal from and destaining 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:

(i) Plastic cisterns
(ii) Stainless steel wash troughs.

(g) Service and repair domestic geysers including descaling, testing for leaks, replacement of elements if required, servicing or replacement of valves, or replace geysers that are damaged beyond repair.

(h) Install fire water piped reticulation system to areas where fire hose reels are to be installed at workshops.

(i) Clean and service oil and sand traps at workshops and transport storage building.

PAA 05.02.07 **Office and support services facilities at inmates' ablutions, head office, doctor, instructors' offices, SAPS building, instructing office**

(a) Service and repair domestic water installation, including pressure testing, and replace damaged or leaking sections of pipes and fittings.

(b) Replace GMS water pipes with copper at SAPS building where there is a mixture of GMS and copper.

(c) Service and repair sanitary drainage installation and replace items that are missing or beyond repair, including traps and inspection eyes.

(d) Service and repair sewer pipes, including rodding of system and visual inspection by means of video survey if required. Replace damaged and leaking sections of sewer and fittings, damaged or broken inspection eyes, cleaning eyes and manhole covers.

(e) Replace all brassware with the following approved equipment at inmates' ablutions:

(i) WHB, wash trough, bath and shower taps with non-removable tap handles;
(ii) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(iii) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(iv) Rubber flexi-traps for WHBs, wash troughs and urinals;
(v) Vandal-proof shower gratings;
(vi) Vandal-proof water-saving shower heads;
(vii) Brace wall-mounted taps in washing areas with approved brackets.

(f) Replace all sanitary ware with the following approved equipment at inmates' ablutions:

(i) WHB, wash trough, bath and shower taps with non-removable tap handles;
(ii) Shut-off valves intended as flushing mechanisms for urinals, to be replaced with concealed junior flush valves where possible or exposed junior flush valves, regardless of condition of existing valves;
(iii) Cistern and concealed senior flush valves to be replaced with concealed senior flush valves;
(iv) Rubber flexi-traps for WHBs, wash troughs and urinals;
(v) Vandal-proof shower gratings;
(vi) Vandal-proof water-saving shower heads;
(vii) Brace wall-mounted taps in washing areas with approved brackets.

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

(h) Service and repair sanitary ware, including chip repair, destaining and re-coating of baths, WC bowls and washhand basins, dent removal from and destaining 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 at members' ablutions:

(i) Plastic cisterns
(ii) Stainless steel wash troughs.

(i) Service and repair domestic geysers, including descaling, testing for leaks, replacement of elements if required, servicing or replacement of valves, or replace geysers that are damaged beyond repair.

PAA 05.02.08 Training and education facilities (crèche, primary school, training centre, inmates training centre)

(a) Service and repair domestic water installation, including pressure testing, and replace damaged or leaking sections of pipes and fittings.

(b) Replace GMS water pipes with copper at primary school building where there is a mixture of GMS and copper.

(c) Service and repair sanitary drainage installation and replace items that are missing or beyond repair, including traps and inspection eyes.

(d) Service and repair sewer pipes, including rodding of system and visual inspection by means of video survey if required. Replace damaged and leaking sections of sewer and fittings, damaged or broken inspection eyes, cleaning eyes and manhole covers.

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

(f) Service and repair sanitary ware, including chip repair, destaining and re-coating of baths, WC bowls and washhand basins, dent removal and destaining 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:

(i) Plastic cisterns.
(ii) Steel enamel bath tubs.
(iii) Stainless steel wash troughs.

(g) Replace all sanitary and brassware at primary school ablutions.

(h) Service and repair domestic geysers, including descaling, testing for leaks, replacement of elements if required, servicing or replacement of valves, or replace geysers that are damaged beyond repair.

PAA 05.02.13 Main gate house

(a) Service and repair domestic water installation, including pressure testing, and replace damaged or leaking sections of pipe and fittings.

(b) Service and repair sanitary drainage installation and replace items that are missing or beyond repair, including traps and inspection eyes.

(c) Service and repair sewer pipes, including rodding of system and visual inspection by means of video survey if required. Replace damaged and leaking sections of sewer and fittings, damaged or broken inspection eyes, cleaning eyes and manhole covers.

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

(e) Service and repair sanitary ware, including chip repair, destaining and re-coating of baths, WC bowls and washhand basins, dent removal from and destaining 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.

(f) Install a strainer to domestic water supply.

PAA 06 DETAILS OF MAINTENANCE WORK

[Note: There will be no maintenance work required for this installation and equipment in this contract.]

PAA 06.01 GENERAL

The Contractor shall be responsible for the complete maintenance of all the equipment, components, installations and systems forming part of this repair and maintenance contract. 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) 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.

For this particular installation there shall be no fatal breakdown definition.

Emergency breakdown shall be defined as a failure of any equipment, components and systems which prevents the provision of water and the drainage of the equipment to the consumer points.

PAA 07 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: inumber

The unit of measurement shall be the number of times inspections of and reports on the installation are carried out on the instructions of the Engineer.

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

PAA.02 OPERATING AND MAINTENANCE MANUALS .....Unit: set

The unit of measurement shall be the set of operating and maintenance manuals provided.

The tendered rate for the set shall include full compensation for obtaining, verification, compilation and submission of a full set of as-built drawings, inventory lists and operating and maintenance manuals in accordance with Additional Specification SB: Operating and Maintenance Manuals.

The tendered rate shall also include full compensation for all equipment necessary to establish the exact position and depth of underground services as well as the recording of all information on electronic drawing format.

PAA.03 ISOLATION, STRIPPING, DISMANTLING AND REMOVAL OF EXISTING BRASSWARE, SANITARYWARE AND PIPING INSTALLATIONS.....Unit: number, metre

The unit of measurement shall be the number of each item of brassware and sanitaryware 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, undertile 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 pipework, 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 pipework installed on surface, underground, chased into walls, in ceiling voids and/or service ducts, as well as the plugging off of connections to this pipework as 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 pipework 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 thereof off site.

PAA.05 **SUPPLY AND INSTALLATION OF SANITARY- AND BRASSWARE** ..... Unit: number

The unit of measurement shall be the number of each item of sanitary and brassware supplied and installed, including all associated pipework 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 pipework, 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 and 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 and 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 pipework 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 unite of measurement still be the metre of each type of pipework supplied and installed in the fire water 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 pipework 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 pipework 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 pipework and fittings.

The tendered rate shall include full compensation for dismantling, cleaning and descaling, replacement of all gaskets, gland packings 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 **VIDEO SURVEYING OF UNDERGROUND DRAINAGE PIPEWORK** ..... Unit: metre

The unit of measurement shall be the metre of pipe surveyed irrespective the pipe material and diameter as authorised by the Engineer but not by the Engineer's Representative.

The tendered rate shall include full compensation for supplying and utilising the specialised equipment, for the operator's costs, for transport, for reporting on the fundings and for all else that may be required to carry out the survey successfully.

Reporting on the fundings of this video survey is over and above the reports carried out in terms of payment item PAA.01.

PAA.13 **SERVICING, CLEANING AND REPAIR OF DOMESTIC WATER AND DRAINAGE PIPE INSTALLATIONS** ..... Unit: metre

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) Initial unblocking only of all blocked drainage pipework, traps, floor drains and gullies;

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

(c) Repair work to damaged manholes, gullies, cleaning eyes, valve chambers, etc, including builders' work and benching;

(d) 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;

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

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

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

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

(i) Preparation, painting and repainting of pipework and equipment in accordance with Technical Specification BH: Fittings;

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

PAA.14 **SERVICING, CLEANING AND REPAIR OF DOMESTIC GEYSERS** ..... Unit: number

The unit of measurement shall be the number of domestic geyser 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 descaling, testing for leaks, replacing of elements if required, checking of safety valve operation and replacement if required, testing of thermostat operation and set point and replacement if required, and any other work or action to hand over an effective system that complies with local government regulations.

PAA.15 **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 fire water 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 pipework or fittings;

(c) Repair and service of all valves, including new gaskets, gland packings 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

PARTICULAR SPECIFICATION

PBF PEST CONTROL

CONTENTS

PBF 01 SCOPE
PBF 02 PESTS ATTACKING TIMBER
PBF 03 PESTS ATTACKING CARPETS & FABRICS
PBF04 ANTS
PBF05 RATS AND MICE

PBF 01 SCOPE

This specification covers the application of pesticides for the specific purpose of eliminating pest which may cause structural damage. This specification includes the breakdown of various buildings and installations included within the facility and the specific dimensions of each building.

PBF 02 PESTS ATTACKING TIMBER PBF

02.01 PESTS

Pests that caused damage to timber shall include but not be limited to the following:
mould, blue stain, powder post beetle, shot-hole borer, brown house borer, Cossonid woodborer, drywood termite, subterranean wood-destroying termites, false furniture beetle, furniture beetle, Italian beetle, decay and discolouring fungi.

PBF 02.02 LIST OF LOCATIONS

ITEM NO.	LOCATION	DESCRIPTION	DIMENSIONS m/m²/m³
02.02.01	Residential Buildings	Wooden beams and planks used in the roof. Ceiling boards. Wooden skirting and cornices. All insulations.	
02.02.02	Operational Buildings	Wooden beams and planks used in the roof. Ceiling boards. Wooden skirting and cornices. All insulations.	

PBF 02.03 PEST CONTROL PROGRAMME AND REPORTING

The pest control program submitted in terms of sub-clause BE 04.01 shall include but shall not be limited to:

(a) Initial inspection of all buildings and installations to ascertain the damage caused to timber by the activity of the various pests.
(b) If pests are found an initial "clean up" process is to be conducted.
(c) Continuous monitoring of the activity of pests.
(d) A comprehensive quarterly inspection of the buildings and installations.

(e) Reporting on the damage caused by and the activity of the pests together with recommendations (To follow quarterly inspection).
(f) Execution of the recommendations once approved by the Engineer.

PBF 03 PESTS ATTACKING CARPETS AND OTHER FABRICS

PBF 03.01 PESTS

Pests that cause damage to carpets and other fabrics shall include but not be limited to carpet beetles, clothes moths and fish moths.

PBF 03.02 LIST OF LOCATIONS

ITEM NO.	LOCATION	DESCRIPTION	mMENSIONS m/m²/m³
03.02.01	N/A	N/A	

PBF 03.03 PEST CONTROL PROGRAMME & REPORTING

A thorough inspection of the buildings and installations at each facility shall be conducted with specific attention to the relevance of preventative pest control. The Contractor shall compile a comprehensive pest control programme to be submitted to the Engineer for review and approval.

The preventative pest control programme may only commence upon instruction from the Engineer.

The pest control programme shall include but shall not be limited to:
(i) Initial inspection of all buildings and installations to ascertain the damage caused to carpets and other fabrics by the activity of the various pests.
(ii) If pests are found an initial "clean up" process is to be conducted.
(iii) A comprehensive inspection is to be conducted at the intervals specified below:
- Bi-annually in residential units.
- Bi-annually in office facilities.
- Two monthly in cell units.
- Monthly in all food preparation areas.

(iv) Reporting on the damage caused by the activity of the pests together with recommendations (To follow inspection as above).
(v) Execution of the recommendations once approved by the Engineer.

PBF 04 ANTS PBF 04.01 PESTS

Ants shall include all ants irrespective of size, colour or species.

PBF 04.02 LIST OF BUILDINGS AND INSTALLATIONS

ITEM NO.	LOCATION	DESCRIPTION	DIMENSIONS $m/m^2/m^3$
04.02.01	N/A	NIA	NIA

PBF04.03 PEST CONTROL PROGRAMME & REPORTING

A thorough inspection of the buildings and installations at each facility shall be conducted with specific attention to the relevance of preventative pest control. The Contractor shall compile a comprehensive pest control programme to be submitted to the Engineer for review and approval.

The preventative pest control programme may only commence upon instruction from the Engineer.

The pest control programme submitted in terms of sub-clause BE 04.01 shall include but not be limited to:

(a) Initial inspection of all the buildings and installations facilities to ascertain the damage caused by the activity of ants.
(b) If ants are found an initial "clean up" process is to be conducted.
(c) A comprehensive inspection is to be conducted at the intervals specified below:

- Bi-annually in residential units.
- Bi-annually in office facilities.
- Two monthly in cell units.
- Monthly in any food preparation area.

(d) Reporting on the damage caused by the activity of the ants together with recommendations (To follow inspection as above).
(e) Execution of the recommendations once approved by the Engineer.

PBF 05 RATS AND MICE

PBF 05.01 PESTS

Rats and mice shall include but shall not be limited to house mice, Norway rats and roof rats.

PBF 05.02 **LIST OF LOCATIONS**

ITEM NO.	LOCATION	DESCRIPTION	DIMENSIONS m/m²/m³
05.02.01	*N/A*	N/A	

PBF 05.03 PEST CONTROL PROGRAMME & REPORTING

The pest control programme submitted in terms of sub-clause BE 04.01 shall include but not be limited to:

(a) Initial inspection of all buildings and installations to ascertain the damage caused by the activity of rats and mice.
(b) Closing off of all potential entry points for rats and mice.
(c) If rats and/or mice are found an initial "clean up" process is to be conducted.
(d) Continuous baiting to assist in control and monitoring is to be conducted.
(e) A comprehensive inspection is to be conducted at the intervals specified below:

- Bi-annually in residential units.
- Bi-annually in office facilities.
- Two monthly in cell units.
- Monthly in any food preparation area.

(f) Reporting on the damage caused by the activity of mice and rats together with recommendations (To follow inspection as above).
(g) Execution of the recommendations once approved by the Engineer.

PBF 06 COCKROACHES PBF

06.01 **PESTS**

Cockroaches shall include all roaches irrespective of size, colour or species.

PBF 06.02 **LIST OF BUILDINGS AND INSTALLATIONS**

ITEM NO.	LOCATION	DESCRIPTION	DIMENSIONS m/m²/m³
06.02.01	Operational Buildings	Walls, storage areas, windows and all areas where entrance may be gained.	

PBF06.03 PEST CONTROL PROGRAMME & REPORTING

A thorough inspection of the buildings and installations at each facility shall be conducted with specific attention to the relevance of preventative pest control. The Contractor shall compile a comprehensive pest control programme to be submitted to the Engineer for review and approval.

The preventative pest control programme may only commence upon instruction from the Engineer.

The pest control programme submitted in terms of sub-clause BE 04.01 shall include but not be limited to:

(f) Initial inspection of all the buildings and installations facilities to ascertain the damage caused by the activity of cockroaches.

(g) If cockroaches are found an initial "clean up" process is to be conducted.

(h) A comprehensive inspection is to be conducted at the intervals specified below:

- Bi-annually in residential units.
- Bi-annually in office facilities.
- Two monthly in cell units.
- Monthly in any food preparation area.

(i) Reporting on the damage caused by the activity of the ants together with recommendations (To follow inspection as above).

U) Execution of the recommendations once approved by the Engineer.

PARTICULAR SPECIFICATION

PJC CONVENTIONAL FIRE FIGHTING EQUIPMENT

CONTENTS

PJC 01 SCOPE
PJC 02 GENERAL DESCRIPTION OF INSTALLATION
PJC 03 TECHNICAL DETAILS OF EXISTING INSTALLATION
PJC 04 STATUS OF EXISTING INSTALLATION
PJC 05 DETAILS OF REPAIR AND SERVICE WORK
PJC 06 MEASUREMENT AND PAYMENT
PJC 07 DETAILS OF MAINTENANCE WORK

PJC 01 SCOPE

(a) This specification covers the particulars of the repair and maintenance work to the conventional fire fighting equipment installation. 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
SD: General Training
SE: Development of Affirmable Business Enterprise.

The intended repair and maintenance work to this installation will restore the existing installation to a safe, efficiently functional system that complies with all statutory regulations and applicable standards, in the process repairing all defects and shortfalls. Monthly maintenance responsibilities for each installation shall commence with access to the site. A difference shall be made in payment for maintenance prior to and after practical completion of repair work. On completion of the repair work, the completed installation shall be maintained and serviced by the Contractor for the remainder of the 36-month Contract period.

(b) The fire fighting equipment to this complete complex shall form part of this repair and maintenance contract. The piped fire water reticulation network to the equipment, such as hydrants and hose reels, are dealt with under and form part of the plumbing and drainage repair and maintenance contract.

PJC 02 GENERAL DESCRIPTION OF INSTALLATION

The various buildings on the site are generally fed by means of a project reticulation network which feeds the fire fighting equipment such as hose reels and hydrants.

The buildings are also equipped with fire extinguishers.

PJC 03 TECHNICAL DETAILS OF EXISTING INSTALLATION

At the time of compilation of this document the existing installation consisted of the equipment listed below:

PJC 03.01 **FIRE FIGHTING EQUIPMENT**

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.

PJC 04.01 **LAST SERVICE**

The fire fighting equipment was last serviced between 2009 and 2011.

PJC 05 DETAILS OF REPAIR AND SERVICE WORK

The following work shall form part of the intended repair work to the fire fighting 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 included 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 inspect the items, systems, equipment and installations listed below. 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 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) Correlation of all fire fighting 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 irreparable damaged, missing and unsuitable fire fighting 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 connections;
(h) Supply and/or replace missing or damaged safety signs;
(i) Compilation of fire plan for each section of complex;
(j) 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 **Site reticulation network**

(a) Service and overhaul all fire fighting equipment with respect to service schedule dates, including replacement of seals, reseating and cleaning of valve seats, replacement of missing wheel handles, etc.
(b) Supply and install additional fire equipment, piping measured under the Repair Schedule of Quantities for plumbing and drainage.
(c) Test the flow conditions of all equipment.

PJC 06 MEASUREMENT AND PAYMENT

All new building work and repair work to existing structures and buildings resulting from repairs to the conventional fire fighting 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: set

The tendered sum shall include full compensation for the compilation and submission 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** .....Unit: set

The tendered rate shall include full compensation for the supply, delivery, positioning, installation, testing, commissioning and hand-over of fire hydrants, including all necessary pipework, 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.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 pipework, 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 pipework 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 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. The Contractor shall strictly adhere 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.

For this particular installation a fatal breakdown shall be defined as any equipment, systems and installations prohibiting fire fighting to any area of the complex as a whole.

Emergency breakdown shall be defined as a failure of equipment, components and systems of this particular installations.

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 prior to practical completion). Commencement of maintenance after practical completion of each installation shall mean that the installation has been repaired to an acceptable level of serviceability and shall leave the Contractor with a functional installation to maintain for the remaining period of the Contract.

A difference shall be made in payment for the maintenance prior to and after practical completion of repair work.

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 Bills 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.

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 SA 02.03, in which case the Department of Public Works will bear part of the costs.

The Contractor shall not claim additional establishment costs where repair work is to be carried out during the maintenance phase.

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**

Operational damage shall be defined for the purpose of this clause as being any damage caused on purpose, by accident or through negligence by the User Client's employees, inmates (where applicable), suppliers, subcontractors, etc for any reason whatsoever. Where repair work is necessitated during the contract as a result of operational damage caused by User Clients or their associates, the Contractor will be requested to:

(a) perform work, using rates bid 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 rates bid are not available and where the Engineer rules that the damage caused is operational;

(c) perform the work on receipt of an order from the Engineer, within the time offered as part of the quotation,

(d) notify the Engineer well in advance of completion of the repair work in order to enable inspection, and

(e) refrain from claiming additional establishment costs for such work.

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.

Operational 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 bid 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 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 Bill of Quantities and will each be deemed "an installation". Maintenance, as specified, will be applicable to all of these installations.

Maintenance in such is to cater for all work under installations till completion of the installation is approved by engineer.

Installation A: Medium A Kitchen Infrastructure
Installation B: Old Medium A Communal Cell Block
Installation C: Civil Infrastructure, External water reticulation related repair work
Installation D: Structural components

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 has been given but the commencement of repair work is delayed, then the maintenance responsibilities in such cases will consist of keeping the entire installation in the condition it is in by for example, 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.

A difference shall be made in payment for maintenance prior to and after practical completion of repair work.

The preliminary construction programme shall differentiate between commencements of maintenance on various installations.

SA 02.06 **DEFINITIONS**

(a) Routine preventative maintenance

This entails the rendering of services and servicing of equipment according to a predetermined maintenance control plan to:

(i) replace and service components of equipment, units or parts thereof for each installation at prescheduled moments regardless of condition;

(ii) readjust, reset, clean, corrosion protect all components of equipment, units or parts thereof for each installation, and

(iii) carry out all implied actions to maintain installations in their present functional condition.

Preventative maintenance shall be aimed at minimization of breakdowns.

(b) Corrective maintenance

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.

(c) Breakdown maintenance

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.

(d) Immediate response repairs

These repairs are defined as repair work required where no breakdowns are allowed at anytime in terms of the Technical Specifications.

(e) Emergency maintenance repairs

These repairs are defined as any work required to rectify an emergency breakdown that disables a complete installation and prevents it from functioning to its designed service level.

(f) Ordinary maintenance repairs

These repairs are defined as all maintenance work required other than emergency maintenance repairs.

(g) Fatal breakdown

Fatal breakdown is defined as an occurrence when an installation or a specified part thereof fails to operate for any period of time other than during the execution of routine preventative and corrective maintenance activities.

SA 02.07 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 02.08 SUPPLY OF LABOUR, EQUIPMENT AND MATERIAL

(a) Labour

Competent personnel that have been trained by the Contractor, in accordance with Additional Specification SD: General Training shall execute all maintenance work.

(b) Equipment

All tools and equipment and consumables required for maintenance work shall be supplied by the Contractor at his cost (except where otherwise provided).

(c) 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 Subclause SA 02.03 for exceeding Contractor's Liability.

Materials as provided for in the Bill of Quantities, shall be supplied and delivered by the Contractor at the rates bid 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.

The Contractor shall cede any supplier's or factory guarantee of repaired or replaced components to the Employer to ensure that such guarantees are not jeopardised in any way. All workmanship, materials and components used for breakdown repair shall be guaranteed for three (3) months.

SA 02.09 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 who 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 part 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 held 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 them 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. The breakdown registration form will be completed and faxed 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 breakdown close out form shall be completed by the Contractor and faxed to the Engineer as soon as the breakdown is repair by the Contractor.

The call centre logs the details of the Engineer's call and provides feedback to the complainant.

Reference shall also be made to Clause PS 7.12 of Portion 1 of the Project Specifications as well as to Additional Specifications SG regarding the Call Centre.

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.

The Contractor shall respond to a breakdown registration by travelling to Site to evaluate the breakdown (scope of repair work), estimate the realistic downtime and provide feedback to the Engineer.

Should the Contractor not be able to complete the required repair work within the maximum down-time period allowed, it shall be his responsibility to obtain extension of down-time from the Engineer. The written report shall clearly state the reasons for the extension, as well as the actual extension required.

Extension of down-time will only be granted by the Engineer if:

(a) the maximum down-time is unreasonable in relation to the scope of the repair work required;

(b) the delivery time of a new component/subassembly/machine or spares required for the repair of the defective component/subassembly does not enable the Contractor to successfully complete the repair work within the maximum breakdown down-time allowed.

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 (where specified)	Zero (immediate response)	R2 500/hour
Emergency Breakdown	24 hours	R2 500/day
Ordinary Breakdown	7 days	R500/day
Operational damage repair	7 days	R500/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.

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 will inspect each installation monthly after Practical Completion of the repair phase of the installation. The Engineer will 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 in the manner set out below.

The Contractor shall always have the opportunity to score the maximum points, provided that his preventative and corrective maintenance work comply with the Specifications. The Employer will therefore be protected against a reduced or unsatisfactory service level and may refuse payment on such points.

SA 05.03.02 **Performance indicators**

Performance indicators shall be selected to measure the Contractor's service level of preventative and corrective maintenance.

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 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 COMPLETED 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 rate bid 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 after practical completion of repair work, and all appurtenant works deemed to form part thereof, as defined in the relevant Technical or Particular Specifications.

The combined rate bid for ten points (which shall not be less than 10% of the total Bid Sum) 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 have been listed in the Bill 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.

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.02 MAINTENANCE OF AN INSTALLATION PRIOR TO PRACTICAL COMPLETION ..... 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 quality of maintenance. Ten points per month determined by using the rate bid per point, shall include full compensation for the monthly maintenance of an incomplete installation until practical completion of the repair work thereof.

The combined rate bid for ten points (which shall not be less than 10% of the total Bid Sum) shall include full compensation for preventative, corrective and breakdown maintenance (as defined in this General Maintenance Specification) of all units, equipment and/or components thereof that require no initial repair work in terms of the complete installation. As repair work progresses, maintenance responsibilities shall be extended to include those units, equipment or parts thereof that have been serviced, repaired or reconditioned.

Different installations have been listed in the Bill of Quantities, immediately below maintenance of a completed installation. The total number of points for maintenance of a completed installation plus maintenance of the same installation prior to practical

completion shall be 360.

Although ten points per month shall include full compensation for preventative corrective and breakdown maintenance, the Contractor might in the event of unsatisfactory performance fail to achieve all points applicable, 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.03 **ADDITIONAL TESTS:**

SA.03.01 **Where ordered by the Engineer** ..... Unit: rand (R)

SA.03.02 **Charge required by the Contractor on subitem SA.03.01 above** ..... Unit: %

An amount has been allowed in the Bills 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 percentage bid under subitem SA.03.02 will be paid to the Contractor on the value of each payment made to the approved testing authority.

SA.04 **PAYMENT REDUCTION DUE TO EXCEEDING OF MAXIMUM ALLOWABLE DOWN-TIME DURING FATAL BREAKDOWN** ..... Unit: hours

The unit of measurement shall be the number of hours during which a component of an installation was in a disfunctional condition and required immediate response repairs.

The negative fixed rate shall include full compensation for the User Client's loss in productivity and, multiplied by the number of hours 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 EMERGENCY BREAKDOWN** Unit: days

The unit of measurement shall be the number of days, in excess of 24 hours, during which a component of an installation was in a disfunctional 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.06 **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 disfunctional 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.07 **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 disfunctional 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.

A.08 **UPDATING EXISTING OPERATING AND MAINTENANCE MANUALS:**

SA.08.01 **Description of installation** ..... Unit: sum

SA.08.02 **etc. for other installations**

The unit of measurement shall be the sum of money needed to update the manuals for each installation. The rate bid shall include full compensation for checking the information in the manuals of each installation, for the necessary research, for drawings and diagrams, for all instructions or procedures that have to be drawn up and editing that has to be performed and for all else necessary to provide seven copies (one set) of the updated manuals all in accordance with additional specification SB.

DEPARTMENT OF PUBLIC WORKS
MAINTENANCE 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 Maintenance Meeting nr. ☐☐ as performance indicators to be tested according to specification:

1. CONTRACTOR'S SELECTION	**0**	**1**
1.1		
1.2		
1.3		
1.4		
1.5		
SUBTOTAL:		

The following components of the installation were selected by the Engineer as performance indicators to be tested According to specification:

2. ENGINEER'S SELECTION		
2.1		
2.2		
2.3		
2.4		
2.5		
SUBTOTAL:		

TOTAL SCORE: ☐☐

_____ _____ ☐☐/☐☐/☐☐☐☐

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)

Where and installation has an existing Operating and Maintenance Manual, the Contractor shall check whether its contents are still applicable and accurate. When drawing up his own Operating and Maintenance Manual for the installation, the Contractor shall incorporate there in all such existing applicable data. The existing Operating and Maintenance Manual shall then be disposed of provided written permission to do so has been obtained from the Engineer.

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.

(g) An electronic copy of the final manual shall be handed to the engineer upon approval of the operation and maintenance manual.

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 analysing 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 KEY PLAN** .....Unit : sum

The unit of measurement shall be a sum for each complete set (three A0-size copies) of the key 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 key plan.

The key plan shall include and comply with the following:

(a) Detail ground survey

All services must be shown on a complete key plan as required by the Engineer, including roads, fences, paving, transmission and telephone lines, etc. For sewerage reticulation and stormwater 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 (DXF).

SB.03 **UPDATE AND REVISE THE EXISTING 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 updated, revised and compiled. Operating and Maintenance Manuals for different installations shall be measured separately in the Schedule of Quantities.

The Contractor shall note that existing manuals may not be to an acceptable standard or may not be available. All manuals that exist will be available to view at the compulsory site inspection.

The Contractor shall also note that manuals may not necessarily be available in an electronic format.

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 manuals shall also include all new equipment installed under this contract.

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.

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 and 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) The safety instructions stipulated by the Occupational Health and Safety Act, 1993 (Act 85 of 1993) shall be adhered to at all times.

(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 Conditions of Contract and

the Contract Data. 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 bidders shall make allowances in their bid 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 RECOMMISSIONING

Recommissioning 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 General Conditions of Contract and the Contract Data 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 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 bid 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 sum bid 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 Bill of Quantities.

The sum bid shall include full compensation for the decommissioning and removal of the parts and components of an installation as listed individually in the Bill 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 sum bid 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 sum bid 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 billed 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 sum bid 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 sum bid 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 bid 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 METHOD REQUIREMENT
SD 03 TRAINING OF USER CLIENT PERSONNEL
SD 04 TRAINING OF MAINTENANCE PERSONNEL
SD 05 MEASUREMENT AND PAYMENT

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 Client, 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 courses 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 liaise with the Engineer to establish a date and appropriate training venue that would be conductive to learning to perform training.

The training shall be revived within one month after initial training to determine its effectiveness. Further regular training sessions shall be scheduled according to the effectiveness of initial maintenance and operating activities.

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 CLIENT PERSONNEL

The Contractor's training shall include training of the User Client'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 Contract Data, be subject to successful completion 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 specific 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 PAYMENT

SD.01 **DEVELOPMENT OF A SYLLABUS FOR TRAINING OF OPERATORS** ....Unit: sum

The unit of measurement shall be the sum for the compilation of a training syllabus for each installation that shall be measured separately in the Bill of Quantities.

The sum bid 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 sessions in accordance with the specification.

The sum bid 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 bid 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 bid rate shall include full compensation for the Contractor's time, appointment of the accredited trainer for the course, and for all material expenses such as 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 bid 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 bid rate shall include full compensation for the Contractor's time, appointment of the accredited trainer for the course, and for all material expenses such as 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

SH HIV/AIDS REQUIREMENTS

CONTENTS

SH 01 SCOPE
SH 02 MAINTENANCE REQUIREMENTS
SH 03 MAINTENANCE CONTROL
SH 04 COMMUNICATION
SH 05 PERFORMANCE MEASUREMENT
SH 06 MEASUREMENT AND PAYMENT

SH 01 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

SH 02 DEFINITIONS AND ABBREVIATIONS

SH 02.01 DEFINITIONS

Service Provider: The natural or juristic person recognised and approved by the National Department of Health 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 total.

SH 02.02 ABBREVIATIONS

HIV	:	Human Immunodeficiency Virus
AIDS	:	Acquired Immune Deficiency Syndrome
STI	:	Sexually Transmitted Infection

SH 03 BASIC METHOD REQUIREMENT

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.

The Service Provider Workshop Plan shall address, but will not be limited to the following:

- The nature of the disease;
- How it is transmitted;
- Safe sexual behaviour;
- Post exposure services such as voluntary counselling and testing (VCT) and nutritional plans for people living with HIV/AIDS;
- Attitudes towards other people with HIV/AIDS;
- Rights of the Worker in the workplace;
- 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;
- How the Service Provider will support the Awareness Champion;
- Location and contact numbers of the closest clinics, VCT facilities, counselling services and referral systems;
- How the workshops will be presented, including frequency and duration;
- How the workshops will fit in with the construction programme;
- How the Service Provider will assess the knowledge and attitude levels of attendees to structure workshops accordingly;
- How the video will be used;
- How the Service Provider will elicit maximum participation from the Workers;
- A questions and answers slot (interactive session)
- The Service Provider Workshop Plan shall encompass the Specific Learning Outcomes (SLO) as stipulated

SH 04 HIV/ AIDS AWARENESS EDUCATION AND TRAINING

SH 04.01 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 National Department of Health, 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.

SH 04.02 RECOMMENDED PRACTICE

SH 04.02.01 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.

SH 04.02.02 SERVICE PROVIDERS

A database of recommended Service Providers is available from all Regional Offices of the National Department of Health

SH 04.02.03 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.

04.02.03.01 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

04.02.03.02 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

04.02.03.03 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

04.02.03.04 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

04.02.03.05 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

04.02.03.06 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

04.02.03.07 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

SH 04.03 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, which are available from all Regional Offices of the National Department of Health.

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

SH 05 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.

SH 06 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

SH 07 APPOINTMENT OF AN HIV/AIDS AWARENESS CHAMPION

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

The Awareness Champion shall be responsible for:

7.1 Liasing with the Service Provider on organising awareness workshops;

7.2 Filling condom dispensers and monitoring condom distribution;

7.3 Handing out information booklets;

7.4 Placing and maintaining posters

SH 08 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

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
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							
_____ Contractor							

SCHEDULE A

Date of progress inspection (dd/mm/yy) _____

Reporting period: (dd/mm/yy)_____to (dd/mm/yy) _____

Deviations from HIV/AIDS awareness programme plan:

Corrective actions

_____ _____

Representative/Agent Departmental Project Manager

_____ _____

Date Date

SCHEDULE A

SCHEDULE B

HIV/AIDS AWARENESS PROGRAMME: SERVICE PROVIDER REPORT

Reporting period: (dd/mm/yy)_____to (dd/mm/yy) _____

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 actions:

_____ _____

Service Provider Contractor

_____ _____

Date Date

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
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							
ndicate workshop venue							

SCHEDULE B

PW1544

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**							

SCHEDULE B

SCHEDULE C

CONTRACTOR HIV/AIDS PROGRAMME REPORT

Project name _____

Project Location _____

Contract value of project (R) _____

National Department of Health Project Manager _____

HIV/AIDS Programme duration: (dd/mm/yy) _____ to (dd/mm/yy) _____

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**

ADDITIONAL SPECIFICATION

SI OCCUPATIONAL HEALTH AND SAFETY

CONTENTS

SI 01	APPLICABLE LEGISLATION AND REGULATIONS
SI 02	SCOPE OF WORK
SI 03	THE PRINCIPLE CONTRACTOR'S GENERAL DUTIES
SI 04	THE PRINCIPLE CONTRACTOR'S SPECIFIC DUTIES
SI 05	THE PRINCIPLE CONTRACTOR'S SPECIFIC DUTIES WITH REGARD TO HAZARDOUS WORK OR ACTIVITIES

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 the Construction Regulation as published under Government Notice R.2003 of 18 July 2003. 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 02 SCOPE OF WORK

All work forming part of this Contract is divided into installations.

Installation A: Medium A Prison : Kitchen Infrastructure

During the previous contract (Contract 2), the related repairs have been done and completed, but as a result of no maintenance done on the equipment and infrastructure of the kitchen facility, some repairs are urgently needed to kitchen equipment, electrical reticulation and overall plumbing network.

Installation B: Old Medium A Prison : Cell Block

The original scope for the cells block under previous contracts (Contract 1 and 2), was to repair/replace, roof sheets, plaster to walls, civil works in bathroom areas, replacement of all electrical infrastructure and replacement of structural concrete roof slabs. Around 90% of the work in total was completed, but not all were approved due to unaccepted quality of work and building methods.

Under this contract, the unapproved work needs to be checked, removed and redone. This entails removing of roof cladding and sheets, wall tiles, geysers, urinals and plaster etc to such extent till such level where the quality can be regained to the approval of the engineer.

The work shall also include some rebuild to walls, replacement of cladding, re-plastering, re-painting and general plumbing repairs to level and seal leaks to all piping done in wall sections and on external areas of complex.

Testing of underground sewer pipes previously installed, are to be done and re-opening might be needed to ensure proper flow rates.

Installation C: Civil Infrastructure, External water reticulation related repair work

A new piping network has added to the existing fire piping reticulation at the cell block, to better pressure and reticulation of the overall network. The piping will need to be removed to give access to unapproved plaster work, which needs to be redone as well as expansion joins along the roof slabs.

Water meters have been installed during the previous contracts (Contract 1 and 2). Three new meter inspection boxes have been installed at medium C houses, which need to be finalized, marked and tested. The meters installed at Maximum prison houses, needs minor repairs and testing to complete the work.

Pressure testing and drawings of all piping to reticulation network to be completed and submitted. Information of work done during previous Contract 2 contract shall be submitted to contractor by engineer.

Installation D: Medium A Prison : Kitchen and Cell Block : Structural Components

A new floor was installed during previous contract in the kitchen and approved by engineer.

Due to operational traffic over the past year 2013, some minor areas of the Pro Struct (Stoneclad UT) floor coating has been damaged and needs to be replaced. The areas shall be identified and opened as per engineer's instructions.

The roof slabs installed at the cells needs to be checked for cracks. Thus far, no faults or concerns have been recorded.

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 safety and absence of risks to health in connection with the production, processing, use, handling, storage or transport of articles or substances;

d. establishing, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported 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 as may be necessary to ensure, as far as is reasonably practicable, the health and safety at work of his employees and other contractors;

f. not permitting any employee or contractor to do any work or to produce, process, use, handle, store or transport any article or substance or to operate any plant or 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.

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 the Construction Regulation as published under Government Notice R. 2003 of 18 July 2003. (Hereinafter referred to as "Construction Regulation, 2003").

The Principal Contractor is specifically referred to the following sub-regulations of the Construction Regulation, 2003:

Subject	Applicable sub-regulation of the Construction Regulation, 2003.
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 of 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.

Hazardous work or activity	Applicable sub-regulation of the Construction Regulation, 2003.	Other applicable Regulations
		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

Hazardous work or activity	Applicable sub-regulation of the Construction Regulation, 2003.	Other applicable Regulations
		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.1031 of 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.
Construction Welfare facilities	28	Applicable provisions as stipulated in the Facilities Regulations under Government Notice R.1593 of 12 August 1988, as amended.

SI 06 PERFORMANCE MEASUREMENT

The Contractors compliance to the Occupational Health and Safety Act shall be measured against pre-set parameters relating to compliance to the Act.

SI 06.01 INSPECTIONS BY THE APPOINTED OHSA OFFICER

The OHSA Officer shall inspect the construction site at any time during the construction and repair work period. The Officer shall complete a score card consisting of the following parameters to ensure that the Principal Contractor provide and maintain as far as reasonable a working environment that is safe and without risk to the health of his employees and other persons:

1. Safety Management
2. Appointments
3. Registers
4. Facilities
5. Incident Management
6. Signs
7. Contractors (Sub-Contractors)
8. Activity / Conditions
9. Personal Protective Equipment
10. Electrical

11. Housekeeping
12. Site Establishment
13. Records

SI 06.02 EVALUATION SCORE CARD

The OHSA Officer shall inspect each of the above indicated compliance criteria relating to construction and repair work for each type of installation.

The Officer will use a score card to measure compliance under the 13 Sections culminating in a total of 82 possible inspection items, depending on construction activities being executed

The Officer will record his inspection findings directly onto the Score Card. Items that are not applicable to the site or construction work will not be relevant on the score card and each will have a maximum score of 100%. The Contractor shall always have to comply 100% to each section in order to receive payment for the point associated with that particular section.

SI 06.03 PERFORMANCE SCORE CARD

The thirteen performance indicators shall be recorded on the Performance Score Card and will be used to measure the Contractors remuneration for compliance to the Occupational Health and Safety Act.

The Contractor shall aim to perform satisfactory on all 13 indicators. Compliance shall either be satisfactory (full compliance) or unsatisfactory(less than 100% per indicator) and the Contractor shall score one (1) or zero (0) respectively per indicator.

A copy of the OHSA Evaluation Score Card and Performance Score Card is included in this specification.

SI 07 MEASUREMENT AND PAYMENT

SI. 01 COMPLAINCE TO OHSA REQUIREMENTS AND CONSTRUCTION REGULATIONS 2003 .....Points

The unit of measurement shall be a point. Each month shall represent a maximum of thirteen points and a minimum of zero points depending on the compliance to the OHSA.

Thirteen points per month shall mean full compensation for OHSA compliance for work.

DEPARTMENT OF PUBLIC WORKS
OHSA PERFORMANCE SCORE CARD

CONTRACT NUMBER: WCS _____

CONTRACT:
CONTRACTOR: _____
ENGINEER: _____

INSTALLATION: **MONTH:** 0 0 OF **36**

OHSA Performance Indicators

1. ITEMS	**0**	**1**
1.1 SAFETY MANAGEMENT		
1.2 APPOINTMENTS		
1.3 REGISTERS		
1.4 FACILITIES		
1.5 INCIDENT MANAGEMENT		
1.6 SIGNS		
1.7 CONTRACTORS (SUB CONTRACTORS)		
1.8 ACTIVITY / CONDITIONS		
1.9 PERSONAL PROTECTIVE EQUIPMENT		
1.10 ELECTRICAL		
1.11 HOUSEKEEPING		
1.12 SITE ESTABLISHMENT		
1.13 RECORDS		
TOTAL:		

Engineer's Representative **Signature** **Date**

Construction, Repair and Maintenance

ADDITIONAL SPECIFICATION. SI OCCUPATIONAL HEALTH SAFETY EVALUATION SCORE CARD

ITEM NO	DESCRIPTION ITEM	POSSIBLE POINTS	POINTS AWARDED
1	**SAFETY MANAGEMENT**		
1.1	Client SHE (SI) Specifications available on site?	1	
1.2	Principal Contractors SHE Plan available?	1	
1.3	Adequate Risk Assessments available?	1	
1.4	Safe Work Procedures available?	1	
1.5	Safe Work Procedures approved by Engineer?	1	
1.6	Fall Protection Plan available?	1	
1.7	Notification of Construction Work available?	1	
2	**APPOINTMENTS**		
2.1	Contractor to confirm if there are any new appointments to be minuted	1	
2.2	Are all the appointments recorded and available in the Health and Safety File ?	1	
3	**REGISTERS**		
3.1	Fire Extinguisher (stores, site office etc.)	1	
3.2	Ladders	1	
3.3	Scaffolding	1	
3.4	Excavations	1	
3.5	Form / Support Work	1	
3.6	Portable Electrical Tools	1	
3.7	Hand tool Inspection	1	
3.8	Personal Protective Equipment & Clothing (PPE & C)	1	
3.9	Explosive Powered Tools	1	
3.10	Crane	1	
3.11	Lifting Machines	1	
3.12	Lifting Tackle	1	
3.13	Construction Vehicles	1	
3.14	Material/ Man Hoist	1	
3.15	Hazardous Chemical Register	1	
4	**FACILITIES**		
4.1	Hygiene Inspection performed?	1	
4.2	Toilets adequate and clean for workers?	1	
4.3	Change Area available?	1	
4.4	Eating Area available for workers?	1	
4.5	Washing Area available for workers?	1	
5	**INCIDENT MANAGEMENT**		
5.1	First Aid Box adequate and available?	1	
5.2	First Aider on site & valid First Aid Certificate in place?	1	
5.3	Any incidents to report; (Annexure 1 report; recur/investigation; record to CEM)?	1	
6	**SIGNS**		
6.1	"No Unauthorized Entry" Signs?	1	
6.2	"Danger Construction Work" signs?	1	
6.3	"Danger Lifting Operations" sign?	1	
6.4	"Hard Hats" sign?	1	
6.5	"Dust Mask" sign?	1	
6.6	"Ear Protection" sign?	1	
6.7	"Eye Protection" sign?	1	
6.8	"Safety Harness" sign?	1	
6.9	"No Smoking" sign?	1	
6.10	Scaffold use: "Safe" or "Unsafe" signs?	1	
6.11	"Emergency Assembly Point" sign?	1	

ITEM NO	ACTION ITEM	POSSIBLE POINTS	POINTS AWARDED
7	**CONTRACTORS (SUB CONTRACTORS)**		
7.1	Updated list of Sub Contractors available?	1	
7.2	Mandatory Agreements with all Sub Contractors on file?	1	
7.3	Safety File complete (appointments, risk assessments, safe work procedures, registers)?	1	
7.4	Sub Contractor's First Aider on site or alternatively	1	
	First Aid Agreement in place with Contractor?		
8	**ACTIVITY / CONDITIONS**		
8.1	Correct use of Scaffolding?	1	
8.2	Correct use of Support Work?	1	
8.3	Workers working safely at Elevated Positions?	1	
8.4	Safe Operations?	1	
8.5	Barricading?	1	
8.6	Roof work: Harnesses & Lifelines?	1	
8.7	Excavation: Shoring & Batter?	1	
8.8	Manholes: Demarcated?	1	
8.9	Ladders Conditions?	1	
8.10	Construction Vehicle Condition?	1	
8.11	Haz. Chem. Substances Applications?	1	
8.12	Hand tools properly used and in good condition?	1	
9	**PERSONAL PROTECTIVE EQUIPMENT**		
9.1	Correctly issued (documented in file)?	1	
9.2	Used correctly?	1	
10	**ELECTRICAL**		
10.1	DB's & COC's?	1	
10.2	Good Plugs / Earth Wire?	1	
10.3	Electrical Leads / Condition?	1	
10.4	Portable Electrical Tools?	1	
11	**HOUSEKEEPING**		
11.1	Good Stacking & storage?	1	
11.2	Cement spillage control?	1	
11.3	Dust control?	1	
11.4	Placing of Sand / Stone / Bricks/ materials?	1	
12	**SITE ESTABLISHMENT**		
12.1	Office	1	
12.2	Stores	1	
12.3	Fencing / Hoarding	1	
12.4	Access Control	1	
13	**RECORDS**		
13.1	OHS Act; OHS spec; Construction Regulations	1	
13.2	SANS 10085 (Scaffolding)	1	
13.3	Safety Rep. Inspections	1	
13.4	Safety Meetings (Toolbox Talks and/ or Safety Committee)	1	
13.5	Employees Induction	1	
13.6	Visitors Inductions	1	
13.7	Job Assessments	1	
13.8	Medical Certificates	1	
13.9	Training Certificates (*Crane, Lifting Machines*, Vehicles, Scaffold, Safety Rep., TLB, Water Cart, Grader, Excavator, Roller, Front Loader, Mobile Crane, Bob-Cat, Bomag, Wacker and Tipper Trucks)	1	
	TOTAL POINTS TO BE AWARDED	**82**	
	TOTAL POINTS AWARDED	**0**	
	PERCENTAGE (%)	**0.00%**	

The Principal Contractor's Score Achieved is: **0.00%**

Compliance with Construction Regulations 2003 is SATISFACTORY / UNSATISFACTORY (delete which is N/A)

ADDITIONAL SPECIFICATION

SJ COVID-19 GUIDELINES FOR MANAGEMENT OF RISK ON CONSTRUCTION SITES

CONTENTS

SJ 01 SCOPE

SJ 02 SPECIFICATIONS, ACTS AND REGULATIONS

SJ 03 GENERAL REQUIREMENTS

SJ 04 DEGREE OF RISK PER SITE TYPE

SJ 05 RISK MITIGATION PLAN

SJ 06 MEASUREMENT AND PAYMENT

SJ 01 SCOPE

This specification covers guidelines and requirements to reduce the risk of a COVID-19 outbreak in the workplace and the possible impact on workers and the public.

SJ 02 SPECIFICATIONS, ACTS AND REGULATIONS

SJ 02.01 GENERAL STANDARD SPECIFICATIONS

The latest edition, including all amendments up to the 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
SH	HIV/AIDS Requirements
SI	OHS Act: Health and Safety
SANS 1200	Standard Specifications. A. General.

SJ 02.02 ACTS AND REGULATIONS

All regulations and statutory requirements as laid down in the latest edition of the following Acts and Regulations shall be adhered to:

ACT	DESCRIPTION
Act No. 85 of 1993	Occupational Health and Safety Act
	Construction Regulations, 2014
	Hazardous Biological Agents Regulation, 2000
Act No. 57 of 2002	Disaster Management Act
	COVID-19 Occupational Health and Safety Measures in Workplaces Covid-19 (C19 OHS), 2020
	Section 27(2) Regulations, 29 April 2020

SJ 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.

SJ 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.

SJ 03 GENERAL REQUIREMENTS

SJ 03.01 IMPLEMENTING WORKPLACE CONTROLS

The legislation governing workplaces in relation to COVID-19 is the Occupational Health and Safety Act (Act 85 of 1993) as amended, in conjunction with the Hazardous Biological Agents Regulation.

A COVID-19 specific risk assessment together with a written policy concerning the health and safety of all employees, clients, suppliers and sub-contractors who are associated with the Contractor, shall be drawn up and communicated to all the relevant parties, along with mitigation measures which need to be monitored and adjusted should the need arise.

SJ 03.01.01 WORKPLACE CONTROLS

- All offices (including site offices) will be sanitised before opening for business each day.
- Place posters that encourage staying home when sick, cough and sneeze- etiquette, and hand hygiene at the entrances of offices and sites.
- On-site induction with special emphasis on COVID-19 will be done with all employees upon return to work.
- Provide tissues and waste bins lined with a plastic bag so that they can be emptied without contact with the contents.
- Instruct employees to clean their hands frequently using soap and water, for at least 20 seconds or with an alcohol-based hand sanitiser that contains at least 70% alcohol.
- Continue routine environmental cleaning, which includes tools and equipment.
- Increase ventilation in offices by natural or mechanical means.
- Provide soap and water and/or alcohol-based hand sanitiser (at least 70%) in the workplace in multiple locations and in common areas to encourage hand hygiene.
- Practice social distancing (2m) as far as possible (no handshakes, hugs, kissing, horseplay or touching each other). Keep distance from each other while working on site. Supervisors will monitor this throughout the day.
- While queuing at the gate to enter the site, employees must stand in a line, with at least 2m between them.

- Desks for employees working in the office (site office) will be spaced at least 1.5m apart or where this is not possible, protective barriers will be erected between desks.
- It is compulsory to wear face masks at all times. Each employee will be issued with two cloth face masks to wear at work and while commuting, with appropriate training on the use of these masks. Arrangements will be made for the washing, drying and ironing of cloth masks.
- Temperature testing will be done on all employees every morning upon arrival to site, and also randomly during the day. All readings will be recorded, monitored and sent to the SHEQ department. The testing will be conducted by the site safety officer. On sites where a full-time safety officer is not available, the responsibility will fall onto the supervisor.
- During the temperature screening, employees will be screened for any additional symptoms such as body aches, loss of smell or taste, nausea, vomiting, diarrhoea, fatigue, weakness or tiredness. The results will be recorded in the Social Distancing Control Sheet and send to the SHEQ department. If an employee displays any of the symptoms, he will not be permitted to enter the site/offices.
- In addition to posters, brief employees and sub-contractors that anyone with a mild cough or low-grade fever (37.3 or more) needs to stay at home and take sick leave.
- Any employee who develops flu-like symptoms (i.e. cough, shortness of breath, fever) or any of the additional symptoms should inform his supervisor immediately.
- Where practical, the minimum number of employees will be allowed on site, and rotation, staggered working hours and shift work may be implemented. Promote working from home for employees who are able to do so.
- All visitors to site will undergo induction and temperature screening and must be in possession of the appropriate PPE (i.e. face mask) prior to being allowed access to site. No access will be granted to visitors not complying.
- All visitors will be required to sanitize their hands before entering the site as well as when they leave.
- Sub-contractors shall ensure that all of their employees are issued with face masks and any other necessary PPE, and that hand sanitiser and soap is available for their employees.
- Temperature testing will be done by the sub-contractor and records kept. Failure to do so will result in the sub-contractor's employee/s being put off-site until compliant.
- A copy of the Essential Service Permit must be available on site at all times. All sub-contractors to provide a copy of their Permit prior to being granted permission to work.
- All employees are obliged to comply with measures introduced in the workplace.

SJ 03.01.02 <u>WHAT TO DO WHEN AN EMPLOYEE ON SITE BECOMES ILL WITH COVID-19</u>

If someone becomes ill in the workplace and there is reason to suspect they may have contracted or come into contact with someone who has contracted the COVID-19 virus, the person must be isolated immediately, provided with a **FFP1 surgical mask**, and transport arranged for the employee to go home to be self-isolated or for medical examination. Ensure testing is done at an identified testing site.

The Department of Health and Department of Labour will be informed of any employees testing positive for COVID-19, whereafter an investigation will be conducted to establish the cause, Including any control failures. The risk assessment will be reviewed to ensure necessary controls and PPE is in place.The risk of transmission will be assessed, the employees working area disinfected.

If an employee is confirmed to have COVID-19, his/her fellow employees will be informed of their possible exposure to COVID-19 in the workplace and referred for screening, but confidentiality must be maintained at all times, and no discrimination must be shown toward an employee who tested positive for COVID-19.

If evidence exist that the employee contracted COVID-19 as a result of Occupation Exposure, a Claim for Compensation will be lodged in terms of the Compensation of Occupational Injuries and Diseases Act 1993 (Act No. 130 of 1993) in accordance with Notice 193 published on 3 March 2020.

Once an employee was positively diagnosed with COVID-19 and isolated in accordance with the Department of Health Guidelines, the employee may only return to work after he has undergone a medical evaluation confirming the employee has tested negative for COVID-19. The employee will be required to wear a face mask, maintain social distancing and adhere to cough and sneeze-etiquette. The employee will also be monitored for symptoms upon his/her return to work.

SJ 03.01.03 **TRANSPORT**

- Where transport is provided, occupancy of the vehicle should be reduced in line with social distancing practice.
- All passengers must wear face masks or respirators.
- All passengers to sanitise their hands before getting into the transport, as well as when disembarking.
- Transport vehicles should be sanitised before and after each trip.
- Employees making use of public transport to ensure they wear face masks and sanitise their hands regularly (before getting into the transport and when disembarking) and attempt not to touch any surfaces unless absolutely necessary.

SJ 03.01.04 **MEETINGS**

Wherever possible, meetings are to be held via tele or video conference in order to maintain social distancing and prevent the possible spread of COVID-19.

Toolbox talk meetings, inductions and briefing sessions should be done in open areas with social distancing in place.

Progress meetings and technical meetings will be held in the site meeting building specified as 14 meter x 5 meter = 70m² to accommodate 12 persons. The conference table will accommodate 12 attendees, 2 meters apart. The room shall be well ventilated at a maximum temperature of 22°C.

SJ 03.01.05 TRACKING RECORD LOG

Example:

Tracking Record log (Employees/Visitors)								
DATE	**NAME**	**ID NUMBER**	**AGE**	**TEMPERATURE IN**	**SIGNATURE**	**TEMPERATURE OUT**	**SIGNATURE**	**SECURITY CONTROL SIGNATURE**

SJ 03.01.05 TRAINING ATTENDANCE REGISTER

Example:

Training Attendance Register			
Training Description:			**Session No**
Date of training			
Time training started		**Time training ended**	
Duration of training			
Instructor name and signature			
Training provided (Tick applicable box)			
Read only	Class Room	Practical Demonstration	Communicated Changes

Employee number	**Employee name**	**Employee signature** *(Signature indicates acknowledgement that training was understood)*	**Type of training received**

SJ 04 DEGREE OF RISK PER SITE TYPE

BUILDING AND PROJECT TYPE	SITE SET-UP AND STAFF WELFARE	CONSTRUCTION STAGE
Lower Risk	For most, but not all project construction stage risk may be as follows:	For most but not all sites, set-up risk may be as follows:
Industrial, Logistical, Roads and Bridge Construction	**Lower Risk**	**Lower Risk**
Medium Risk	• Excavation and groundworks • Foundations and Piling	• Large Sites
Residential Accommodation	**Medium Risk**	**Medium Risk**
High Risk	• Basement and Substructure • Structural Frame • Roofing • Interior First Fix • Interior Second Fix	• Site and management offices
Healthcare facilities, Correctional Centers, Military Bases, Police Stations, Magistrates Offices		**High Risk**
	High Risk	• Scaffolding • Travel to and from site and access to site • Horizontal walkways and vertical access • Staff changing and locker rooms • Showers and toilets • Confined Spaces • Confined Sites
	• Cladding and Glazing • M+E and Lifts • Interior First Fix • Interior Second Fix	
	GUIDLINE **For each construction contract there will be different levels of risk and it will be critical to evaluate the specific risks of each individual project.**	**GUIDLINE** **For each construction site there will be different levels of risk and it will be critical to evaluate the specific risk of each individual project.**

SJ 05 RISK MITIGATION PLAN

RISK DESCRIPTION	MITIGATION PLAN/ACTION	RESPONSIBILITY
Demographics of Labour: • Inadequate procedures in place to identify potential infected employees and workers • Manage the exposure to COVID-19 on the project, including visitors and suppliers	Contractor is to maintain a register of all employees and workers on the project, including Sub-Contractors (inclusive of employees and workers) and Professional Team, keeping records of the following information as a minimum (Note: the NIOH document that is currently available): • Name • Age of employee/visitor • Contact Details • Health status • Socio-economic status/unskilled labour (work force) • Accommodation arrangements (work force)	**CONTRACTOR**

RISK DESCRIPTION	MITIGATION PLAN/ACTION	RESPONSIBILITY
Origin of labour and transportation Need to minimize the risk of exposure to virus whilst in transport	• On site transportation: Where on site transportation is done, a policy needs to be available for how such transportation will be made safe and limit any opportunity for cross infection. If possible, the Principal Contractor should provide their own transportation of work force. (Where not possible, use of public transport can be considered to comply to transport limitations) • Parking areas: Private and public vehicles are required to park outside of the construction site • Support staff for professional service providers are to work from office location or from home • Education and information: Information boards are required at entrance of sites and within Site Offices with information on the virus and precautions to be taken during working hours and traveling. • Social Distancing: o **On site**: As far as possible, work activities must be so arranged that social distance is kept to a minimum of 2 metre. o Site office: seating arrangements must be of such that social distancing for roll players is kept to a minimum of 1 metre, ie; '**ONE CHAIR, SKIP CHAIR, ONE CHAIR, SKIP CHAIR**'. o Roll players must be limited to Professional Team and principal contractor. o Facial Masks must be worn at all times by all roll players. o Contractor work force when on site and transportation to and from site, where hand gloves can be used, they should be worn at all times to minimize touching of possible contaminated surfaces and injury.	**CONTRACTOR AND PROFESSIONAL TEAM**

RISK DESCRIPTION	MITIGATION PLAN/ACTION	RESPONSIBILITY
Public transportation across boarders/towns/cities Where a return to work will necessitate travel between Provinces and cities for employees and workers to return to the project, The Principal Contractor and Sub-Contractors are to have in place procedures for or provision of transport for the return of workers to minimize the risk of exposure to the virus whilst in transit.	**The contractor to source/recommend a transport service provider that complies with all travel restrictions and requirements as gazetted by the government, inter alia:** • Maximum occupancy of vehicles to allow for social distancing • Vehicles sanitized before passengers board • Passengers provided with Face Masks and hand sanitizers provided within vehicles for passengers sanitization before boarding and after returning from vehicles for comfort breaks • Regular testing of body temperature • Adequate number of vehicles to be provided to comply with the maximum occupancy • Principal Contractor to put in place procedures for sanitization of personal belongings and luggage of work force on arrival at final destination • Permits to be provided per vehicle and per passenger from Authorising Authority	**CONTRACTOR**
Social Distancing: Construction site and facilities not set up in such a way that it will be possible as far as is practicable to maintain the required social distancing of 2 metres between persons when at work **Risk:** Manual labour for physical tasks and tasks that will not allow for social distancing;	<u>Tasks that require more than 1 person to complete</u>: • Providing adequate supplies of suitable PPE such as face masks, task specific gloves, safety glasses, disposable/additional coveralls; • PPE used during multi-person activities to be exchanged immediately after the task is completed; • Sealed bins to be provided for disposable PPE such as masks, disposable coveralls, disposable gloves, etc.; • Sealable bags provided to each person for keeping PPE requiring laundering, such as gloves and coveralls, and • Sanitizing/washing facilities provided for immediate sanitizing of hard hats, safety glasses, shoes, safety harnesses etc, on completion of multi-person tasks	**CONTRACTOR**

RISK DESCRIPTION	MITIGATION PLAN/ACTION	RESPONSIBILITY
Site access by non-employees/security access Inadequate access control measures in places	• Stop all non-essential visitors • All employees and non-employees to be screened with non-contact thermometers (Thermal Thermometers); • Body temperature checks with thermometer upon employee's arrival and departure; • Introduce staggered start and finish times to reduce congestion and contact at all times; • Take body temperatures of anybody stepping on or off site; • Monitor site access points to enable social distancing; • Number of access points to be reduced to enable controlled monitoring; • Ensure disinfectants are in place for disinfecting of shoes on entering/leaving the site; • Provide hand sanitizer for all entering the site to sanitize hands; • Allow social distancing of 2 metres in ques for all entering the site; • Regular cleaning of common contact surfaces areas, e.g.; desks, telephones handsets, site office door handles, chairs, etc.; • Drivers of suppliers of materials and goods and services must remain with their vehicles if load will allow it, if not, drivers are to wash hands before unloading goods and materials	**CONTRACTOR**
Alcohol and Drug Testing Lack of safe testing procedures in place for alcohol and drug testing	• Alcohol testing may only be done using single use test units, and must be disposed of in the appropriate contaminated waste bins provided on site; • Drug testing will only be done by an occupational health facility either using urine or blood sampling; • A protocol will be drawn up by the Principal Contractor to manage this with the occupational health service being used.	**CONTRACTOR**

RISK DESCRIPTION	MITIGATION PLAN/ACTION	RESPONSIBILITY
Medical Surveillance No methodology in place as part of the normal requirements for pre-placement, periodic and exit medicals that includes factors related to COVID-19	• The normal requirements of pre-placement, periodic and exit medicals will remain, with the Occupational health service providing a methodology of how they will be including factors relating to Covid-19. No lung functions or peak flows will be done until deemed safe to do so by the South African Thoracic Society. • It is preferable that occupational health service providers use a cloud-based record keeping service to ensure easy tracking and tracing. Free apps such as Square 1 is such an example. • Any person who contracts the virus may need to be reported to the Compensation Commissioner as an occupational disease where their work is to monitor and in contact with others. Such details are provided in the Compensation for Injuries and Diseases Act (COIDA). • Isolation of workers who have a temperature or any symptoms, and removal to the closest facility for testing and treatment, through the numbers provided. The PC is to ensure their policy on this includes such information. • Workers will be required to complete COVID-19 questionnaires prior to returning to site. Any worker with any symptoms is not to return to work, or notify the PC of same.	**CONTRACTOR**
Ablution Facilities on Site Unhygienic ablution facilities leading to poor hygiene	• Restrict the number of people using toilet facilities at any one time. e.g. use a welfare attendant; • Hand washing facilities (soap and water, paper towel) to be available where possible, and if not, to provide hand sanitizer. Wash hands before and after using the facilities • Induction training to educate to ensure all users are hand washing correctly; • Enhance the cleaning regimes for toilet facilities particularly door handles, locks and the toilet flush handle. Flush toilets preferably 1:15 ratio unless increased cleaning regime present; • Portable toilets should be avoided wherever possible, but where in use these should be cleaned and emptied more frequently. Portable toilets to be provided at a 1:10 ratio; • Provide suitable and enough rubbish bins for hand towels with regular removal and disposal be cleaned and emptied more frequently; • Introduce staggered start and finish times to reduce congestion and contact at all times; • Consider increasing the number or size of facilities available on site if possible.	**CONTRACTOR AND EMPLOYEES**

RISK DESCRIPTION	MITIGATION PLAN/ACTION	RESPONSIBILITY
Waste Management for Covid-19 Waste Outdated waste management arrangements in place that leads to an increased risk of the spread of Covid-19	Waste management arrangements to be updated to include provision for the disposal of additional waste generated due to preventative measures implemented. All waste to be managed as hazardous waste. **a. Disposal of any gloves, masks** The contractor shall dispose of all used gloves and masks as hazardous waste and provide sealable bags and containers for the safe disposal of this waste. **b. Paper towels** The contractor shall provide adequate supplies of paper towels on site. At points where these towels are provided lined waste bins to be placed in order to collect all used towels and then to be disposed of in hazardous waste. **c. Disinfectant solution** The contractor to provide adequate supplies of disinfectant on site where the use of water and soap for cleaning is not practical. If disinfectant dispensers are not refilled it should be disposed with other hazardous waste. **d. Wastewater** Wastewater at washing points, toilets, and bathrooms to be contained in a drainage system that prevent surface spills. If wastewater is contained in waste buckets it must be sealed when removed and disinfected after it is cleaned.	**CONTRACTOR**
Site Meetings Not limiting the number of employees at all activities to the minimum required to do the work in a safe manner.	Only necessary meeting participants should attend. • Attendees should be two metres apart from each other. • Rooms should be well ventilated / windows opened to allow fresh air circulation. • Consider holding meetings in open areas where possible. • Technological alternatives to be exploited for meeting • Attendance if possible (Zoom, Skype, MS Teams). • Training and awareness to address procedures and the importance of social distancing. • Toolbox talks to be conducted outdoors when possible in order for persons to maintain social distancing. Where inclement weather does not allow for this, toolbox talks to be conducted with smaller groupings of workers in a sheltered area large enough to maintain social distancing.	**CONTRACTOR**

RISK DESCRIPTION	MITIGATION PLAN/ACTION	RESPONSIBILITY
Signage Conflicting messages/notices displayed on the site in contravention with current requirements to respond to Covid-19	The Principal Contractor is to review all current signs and notices displayed on site. The PC is to avoid conflicting messages/notices that have been in place prior to lockdown and review accordingly. **a. Access rules** The contractor shall install additional signage with site rules specific to the prevention of spreading the COVID-19 virus at the access control points of the site. **b. Notices/Posters with protocols** Notices and posters shall be placed and installed to raise awareness and regarding protocols to be followed on site. These notices and posters shall be placed conspicuously at various points on the site including the following places: • Entrance • Site notice board • Site Office • Eating areas • Next to toilets and bathrooms • Hand washing stations • Storerooms	**CONTRACTOR**
Emergency Planning Emergency plan not completed and undated in line with current Regulations of the National Disaster Management Act	An updated emergency plan is to be completed that is in line with the current Regulations of the National Disaster Management Act. **a. First aid** Extra gloves, and disinfectants are to be available, first aiders are to be issued with at least FFP2 masks should they be required to respond **b. Evacuation plans** Evacuation plans should consider social distancing. **c. Isolation of potentially infected workers** The emergency plan is to consider how anyone who arrives on site and displays any of the symptoms, or has a raised temperature.	**CONTRACTOR**

RISK DESCRIPTION	MITIGATION PLAN/ACTION	RESPONSIBILITY
Welfare facilities Lack of procedures and arrangements for the provision of welfare facilities to prevent the spread of Covid-19 between employees on site	The Principal Contractor shall adapt arrangements regarding the provision of welfare facilities to be in line with Government guidelines and requirements. **a. Clean, storage for food and personal belongings** The Principal Contractor to provide lockable storage for all employees on site, which shall be disinfected daily. Training and awareness to address procedures and the importance of good hygiene practice. **b. No personal belongings to be kept on site** Apart from extra clean personal clothing no other personal belongings allowed on site accept if kept in locker provided by the Principal Contractor. **c. No communal drinking facilities (shared cups etc.)** The Principal Contractor to provide adequate supplies of bottled water to all employees on site. Empty bottles to be disposed of as normal waste. Training and awareness to address procedures and the importance of good hygiene practice. **d. Eating areas** The Principal Contractor is to limit the number of employees at all activities to the minimum. Stagger lunchbreaks and resting periods for work teams. Training and awareness to address procedures and the importance of good hygiene practice and social distancing. • Workers are required to stay on site once they have entered it and not use local shops. • Dedicated eating areas should be identified on site to reduce food waste and contamination. Where catering is provided on site, it should provide pre-prepared and wrapped food only; • Payments should be taken by contactless card wherever possible; • Crockery, eating utensils, cups etc. should be disposable if supplied; • Drinking water should be provided with enhanced cleaning measures of the tap mechanism introduced; • Tables should be cleaned and disinfected between each use; • All rubbish should be put straight in the bin and not left for someone else to clear up; • All areas used for eating must be thoroughly cleaned at the end of each break and shift, including chairs, door handles, vending machines and payment devices.	**CONTRACTOR AND EMPLOYEES**

RISK DESCRIPTION	MITIGATION PLAN/ACTION	RESPONSIBILITY
Consequence Management Inadequate processes and procedures in place for consequence management	• When non-compliance activities are noted, that activity will be stopped. Should the remedial actions not take place the site will be shut down till the corrective actions have been implemented. • Employees that do not work according to the SSHSS and SSHSP must be disciplined according to the company's disciplinary codes and practices. • Supervisory employees on site must ensure compliance, and when non conformances are noted disciplinary actions should also be followed. • Principal Contractor's should note that they could be fined and even according to the Disaster Management Act, arrested.	**CONTRACTOR**

SJ 06 MEASUREMENT AND PAYMENT

SJ 06.01 APPOINTMENT OF A COVID-19 AWARENESS CHAMPION.....Unit: Month

The unit of measurement shall be for the number of months the Awareness Champion is employed.

The tender rate shall include the training of the person on basic COVID-19 information and regulations and to ensure that the person has the necessary skills to handle questions and apply correct procedures regarding the COVID-19 regulations.

SJ 06.02 ARRANGING AWARENESS WORKSHOP ..... Unit: Number

The unit of measurement shall be for the number of events arranged.

The tender rate shall include the cost of the service provider, suitable venue and all tuition material and performing assessment procedures.

SJ 06.03 PROVIDING PERSONAL PROTECTIVE EQUIPMENT (PPE)..... Unit: Month

The unit of measurement shall be for the number of months the Contractor must provide PPE to all workers on site.

The tender rate shall include for face masks, gloves, tissues, towels etc. for all workers for the full construction period of 24 months.

SJ 06.04 PROVIDING SANITIZING/WASHING FACILITIES ..... Unit: Month

The unit of measurement shall be for the number of months the Contractor must provide sanitizing and washing facilities on site for the total 24 month contract period.

The tender rate shall include for providing sanitizing and washing facilities for all construction workers at all the different construction sites for all PPE equipment as specified.

SJ 06.05 ADDITIONAL ABLUTION FACILITIES ..... Unit: Number

The unit of measurement shall be for the number of facilities on the different construction sites.

The tender rate shall include for the construction of sanitizing and washing facilities consisting of a concrete floor area min 3 x 3 meter with 3 hand wash basins and IBR roof covering, including 5000ℓ water tank on stand, as well as soak away for grey water. The facilities to be maintained for the duration of construction at each site.

SJ 06.06 SITE MEETING VENUE ..... Unit: Sum

The unit of measurement shall be for the additional cost relating to the site meeting venue building as specified in SANS 1200 and PS 5.4.

The additional rate shall include for the additional m² size of the building and furniture which will consist of a separate chair and an 800mm x 600mm table desk for each of the 12 places.

SJ 06.07 PROVIDE NOTICES AND POSTERS ..... Unit: Month

The unit of measurement shall be for the posters and information notices and booklets to raise awareness and to share information about COVID-19.

The posters and notices must be maintained at places as indicated in Item 1.10.7 at all the different construction sites for the duration of construction.

SJ 06.08 PROVIDE SCREENING FACILITY ..... Unit: Month

The unit of measurement shall be for the provision of a screening facility to accommodate workers daily at the start of every working day, including provision of infrared forehead thermometers and the maintenance of the equipment for the duration of the 24 month contract period.

ADDITIONAL SPECIFICATION

SN IMPLEMENTATION OF LABOUR-INTENSIVE INFRASTRUCTURE PROJECTS UNDER THE EXPANDED PUBLIC WORKS PROGRAMME (EPWP)

CONTENTS

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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 EPWP 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 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 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 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 07.02 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:

$$P = 1 \times \frac{(0 - Do)}{(100)} \times NA$$

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) Ttrenches 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

   ii) 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 than10% 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.

SN 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 08.017 Clearing and grubbing

Grass and small bushes shall be cleared by hand.

SN 08.08 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

SN 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 off loading 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)

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

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.

SN 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 10.04 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**

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.