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

TENDER DOCUMENT

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ISSUED BY:

THE DIRECTOR GENERAL
DEPARTMENT OF PUBLIC WORKS
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MANANGA LAND PORT OF ENTRY: 36 MONTHS INFRASTRUCTURE MAINTENANCE AND REPAIRS OF BUILDING, CIVIL, MECHANICAL, ELECTRICAL AND INSTALLATIONS (APPOINTMENT OF A CONTRACTOR)

PART C3.2:
TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATION

A PLUMBING AND DRAINAGE INSTALLATIONS

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A 01 SCOPE

This specification covers the general repair and maintenance 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

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.

MANANGA LAND PORT OF ENTRY consists of various facilities, as listed in specification **SS: Site Specific Inventory**, which form part of the maintenance and repair contract for the plumbing and drainage installation.

A 02 STANDARD SPECIFICATIONS

A 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:

A 02.01.01 SANS Specifications and codes

SANS 10254	-	The installation, maintenance, replacement and repair of fixed electric storage water heating systems
SANS 10400	-	The application of the National Building Regulations
SANS 1200 DB	-	Earthworks (pipe trenches)
SANS 1200 LB	-	Bedding (pipes)
SANS 1200 L	-	Medium-pressure pipelines
SANS 10252. Part 1	-	Water supply installations for buildings
SANS 10252. Part 2	-	Drainage installations for buildings
SANS Specifications listed on page 3 of the DPW Specification PW 371		

A 02.01.02 Department of Public Works Specifications

PW 371	-	Construction Specifications Aug 2014 & Dec 2015

A 02.01.03 Occupational Health and Safety Act of 2014

The Contractor shall be required to comply with the Occupational Health and Safety Act 85 of 1993, Construction Regulations 2014 and related regulations.

A 02.01.04 Manufacturers' specifications, codes of practice and installation instructions

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

A 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.

A 03 GENERAL REPAIR AND MAINTENANCE

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.

A 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 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 so as not to 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 so 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 (Corrective maintenance) and preventative 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.

A 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 clean, free from burrs, and rough edges, and joined together tightly. Where applicable such as with galvanised piping, an approved pipe jointing 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. Pipes to be installed underground shall comply with the requirements of SANS 1200L and SANS 1200LB as far as bedding, excavation and backfilling are concerned.
- (c) All vertical pipes must be securely fixed with brackets and supports of approved type, 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 must be free to move in the brackets. 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 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 used to join 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 shall not be installed directly through the cornice. 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 near to 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 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.

A 03.03 GENERAL REQUIREMENTS FOR REPAIR AND INSTALLATION OF SOIL AND WASTEWATER INSTALLATIONS

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

A 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/or under surface beds shall be encased in concrete as detailed.
- (e) The sewer outside the boundary of a 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 affected existing services are to be located and exposed before commencing the proposed repair and maintenance 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) Any drainage pipe within the 45° range below building foundations shall be encased in concrete or soilcrete as specified.

A 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 reseat" (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, placed at appropriate intervals, to provide a rigid, proper suspended system 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.

A 03.04

PRESSURE TESTING OF WATER PIPES

- (a) All new pipe installations shall be pressure tested before being taken into use. The Engineer shall witness this pressure test. Tests shall be carried out both on surface-mounted and buried pipework. Buried pipes shall be backfilled except at fittings and joints before being tested.
- (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, to the approval of the Engineer, and the Contractor shall 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 shall close-off around pipes in walls, voids and ducts for above ground installations.

A 03.05

STERILISING OF WATER PIPES

- (a) Before any 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 water-hammer 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. All tests shall be for the Contractor's account.

A 03.06 AIR TEST FOR SEWER AND DRAINS

The following air test requirements are specified in the NBRI information sheet X/BOU 2-34 and are reproduced here. They shall be applicable to all air tests on new sewers and drains installed and shall be executed by the Contractor and witnessed by the Engineer.

A 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 must 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 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 pipeline.

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

A 04 DETAILS OF REPAIR WORK TO INSTALLATIONS, SYSTEMS AND EQUIPMENT

A 04.01 GENERAL

During the contract all the systems, installations and equipment shall be serviced as specified in the Specification and work instructions. This work shall include but not be limited to the specified Specification details.

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

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

The said work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer's specifications and codes of practice and all additional and particular specifications included in this document.

A 04.02 RAINWATER DISPOSAL SYSTEMS

A 04.02.01 General

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

- (a) Replacement of damaged, broken, leaking and 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) Work to damaged manholes, catch pits, curb 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 of drainage system where necessary;
- (f) Provision of additional rainwater drainage points where outlets are insufficient and ponding occurs;
- (g) Prevention of the ingress of any unauthorised effluent into this drainage system;
- (h) Realign and fix gutters to correct falls where necessary, including additional brackets where required.
- (i) Reinstatement and making good of walls, tiling, floors, concrete, road surfaces, etc, to approved acceptable levels where any service work has been executed;

A 04.02.02 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) uPVC pipe and fittings above ground

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

For pipe sizes larger than 160 mm diameter uPVC class 6 pressure pipe to SANS 966-1 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 jointing 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 shall with two hanger rods.

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

(b) 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.

A 04.03 SOIL AND WASTEWATER DRAINAGE SYSTEM

A 04.03.01 General

Corrective maintenance to the soil and wastewater drainage system 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 cowl;
- (c) Corrective maintenance to damaged manholes, gullies, cleaning eyes, floor drains, etc, including builder's work and benching;
- (d) Initial unblocking only of all blocked drainage pipework, traps, floor drains, gullies and the cleaning of sanitary ware equipment;
- (e) Repair of soil and wastewater drainage systems where necessary;
- (f) Work to bracketing systems including fixing and repair of existing brackets and the introduction of additional brackets where required;
- (g) Re-align, re-fix and bracket sanitary ware equipment to walls, floors, etc, where required;
- (h) Service and clean out sanitary ware and equipment traps;
- (i) Test pipe system, traps and equipment for leakage;

A 04.03.02 Material and equipment specification for soil and wastewater drainage systems

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

(a) 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.

A 04.04 DOMESTIC WATER DISTRIBUTION AND RETICULATION NETWORKS

A 04.04.01 General

Repair and Maintenance work to the domestic water distribution 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) 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 shall be refurbished, descaled or replaced where necessary;
- (d) Clean and service all strainers, including the replacement of strainer elements where corroded and installation of new gaskets;
- (e) 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) Service and check the proper functioning of all non-return valves;
- (g) Service, readjust and calibrate all safety and expansion relief valves;
- (h) Service and clean out all air release valves and vacuum breakers;
- (i) 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, serviced, sealed and replaced where required;

- (k) Service and log readings of water meters including cleaning of integral strainers;
- (l) Water supply has to be sampled monthly and chemically analysed for the suitability to the systems and materials it serves;
- (m) Domestic geysers are to be serviced in accordance with the manufacturer's specification and SANS 10254 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);

A 04.04.02 Material and equipment specification for domestic water distribution and reticulation networks

Materials and equipment to be used 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 instructions 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 or Class 2 (as described in the schedule of quantities) 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 dezincification resistant (DZR) type.
- (x) Copper pipes and fitting shall be installed strictly to the manufacturer's specification which shall 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 a 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 join these flanges.
- (xvi) All 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 pipes shall be marked in accordance with SANS 0140-1 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) PVC-U underground pipe installations

- (i) PVC-U piping shall conform to SANS 966 with rubber ring type joints.
- (ii) All bends shall be PVC-U 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) 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.
- (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.

(c) 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.

(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 Class 12 pipe and shall be installed to details provided.

- (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 shall be installed to details provided.

- (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 where 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.

(e) 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 (m³) and equipped with needle indicators reading in litres. Accuracy of meter shall be not less than 98 %.

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

(iii) Water meters (up to 50 mm 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.

(f) Lagging of water pipes

(i) Preformed closed cell flame retarded flexible insulation sections

Where pipes are installed in service ducts, ceiling voids, etc, 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 muffins.

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

A 04.05

SANITARY AND BRASSWARE EQUIPMENT

Repair work to the sanitary and brassware equipment 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 is unsuitable for the purpose and application they serve are to be replaced with suitable equipment.
- (c) The quantities of sanitary and brassware equipment needed 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 items of equipment facilities shall be increased 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 adjusted.
- (g) Unserviceable flush valves to be serviced utilizing the manufacturers repair kits only.
- (h) All pillar taps, mixers, sink taps and other taps are to be serviced, utilising repair kits. Where equipment connections are loose these shall be properly secured to sanitary ware and other equipment.
- (i) Replace missing and/or damaged shower gratings with gratings of equal specification or approved alternatives.
- (j) Service water metering taps by utilising manufacturer's replacement kits where necessary. Where damaged beyond repair the complete item shall be replaced with one of equal specification or approved alternative.
- (k) Readjust all timing mechanisms on flush valves and metering taps to the correct flushing and flow times.

- (l) Replace missing or damaged toilet seats and covers.
- (m) Service and clean out all bottle traps.
- (n) Service bath taps and mixers by utilising manufacturer's replacement kits.

A 04.06 FIRE WATER PIPED RETICULATION NETWORKS

Repair work to the fire water piped reticulation networks 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 related to this installation, such as fire hydrants, hose reels and extinguishers are covered and detailed in Technical Specification JC: Fire Fighting Equipment. This specification has to be read in conjunction with the afore-mentioned specification.

- (a) Service valves which shall include the installation of new gaskets, gland packings, seals, bolt and nuts, etc. If necessary the valves shall be replaced.
- (b) Where valves do not close properly, all these valves are to be refurbished, de-scaled and if necessary replaced.
- (c) Service and check the proper functioning of all non-return valves and backflow preventers.
- (d) Service, readjust and calibrate all pressure gauges.
- (e) Service bracketing systems including fixing of existing brackets and the provision of additional brackets where required.
- (f) Pressure test and sterilise new installations and equipment.

A 05 MEASUREMENT AND PAYMENT

A.01 SUPPLY AND INSTALLATION OF SANITARY WARE AND BRASSWARE..... Unit: metre, number

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

The tendered rate shall include full compensation for the removal of existing, supply, delivery, positioning, installation, testing, cleaning, commissioning and hand-over of sanitary and brassware including all necessary pipe work, traps, brackets, connectors, 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.

**A.02 SUPPLY AND INSTALLATION OF DOMESTIC
WATER PIPING INSTALLATION Unit: metre**

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

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

The tendered rates shall also include full compensation for the 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.

**A.03 REPLACE AND INSTALLATION OF DOMESTIC
GEYSER INSTALLATION Unit: number**

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

The tendered rates shall include full compensation for the removal of existing, replacement 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.

A.04 REPAIR, SERVICING AND CLEANING OF SANITARY WARE Unit: number

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

The tendered rate shall include full compensation for the repair 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 damaged or missing shower, urinal and channel outlet gratings.

**A.05 SERVICING, OVERHAULING AND CLEANING
OF BRASSWARE Unit: number**

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

The tendered rate shall include full compensation for dismantling, cleaning and de-scaling, replacement of all gaskets, gland packing and seals on all valves, replacement kits for worn or leaking flush valves, taps and mixers and metering taps and any other work or action required to hand over an effective system that complies with local government regulations.

A.06**REPAIR, SERVICING AND CLEANING OF DOMESTIC WATER
AND DRAINAGE PIPE INSTALLATIONS..... Unit: number, metre, item**

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

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

- (a) Unblocking and cleaning of all drainage pipe work, traps, floor drains and gullies;
- (b) 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;
- (c) Service and repair to all valves, strainers, pressure-reducing valves, water meters, non-return valves, air release valves and vacuum breakers, including new gaskets, gland packing and seals;
- (d) Repairing and/or replacement of damaged pipe lagging and cladding;

A.07**SERVICING, CLEANING AND REPAIR OF DOMESTIC GEYSERS Unit:
number**

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

The tendered rate shall include full compensation for the isolation, servicing, cleaning and testing of domestic geysers in accordance with the manufacturer's specifications, including de-scaling, 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.

TECHNICAL SPECIFICATION

AB BUILDING ELECTRICAL INSTALLATIONS

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AB 01 SCOPE

- AB 01.01** This specification comprises all aspects regarding the repair and maintenance of building electrical systems. Building electrical systems comprise:
- (i) Distribution boards and low voltage cable
 - (ii) Interior and exterior lighting of buildings
 - (iii) Small power and fixed appliances
 - (iv) Earthing and lightning protection system
- AB 01.02** This specification shall form an integral part of the repair and maintenance contract document and shall be read in conjunction with portion 3, the Additional Specifications included with this document. To be read in conjunction with Particular Specification ABP: Electrical Installations.

AB 02 STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

AB 02.02 SANS Specifications

General	Distribution and meter boards	LV cables and conductors	Lighting system	Earthing and lightning protection system	Small power installation	
					Power outlets	Conduits, power skirting, cable trays and ducting
SANS 10142-1	SANS 152		SANS 10114-1	SANS 03	SANS 152	SANS 950
SANS 10160	SANS 156	SANS 0198	SANS 163	SANS 0199	SANS 164	SANS 1065-1
SANS 10400	SANS 172	SANS 1411-1	SANS 1012		SANS 1084	SANS 1085
SANS 1222		SANS 1507	SANS 1084		SANS 1239	
			SANS 1250			
			SANS 1279			
			SANS 1777			
			SANS 10114-2			

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 storeroom on site. The Contractor shall provide his own lock for the designated storeroom. 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 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:

Port of Entry: Administration and Support Buildings

Port of Entry: Cell Block Buildings

Port of Entry: Living Quarters, Garages and Recreation Building

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

(ii) Damaged or incomplete luminaires

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

(iii) Fluorescent luminaires 2400mm long

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

(b) Light switches

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

- Remove switch cover.
- Check continuity of earth connection.
- Check operation of switch and replace if suspect.
- Replace switch cover, fit new csk stainless steel screws if required.

(c) Photocells

- Wash translucent body with detergent.
- Cover photocell and verify operation.
- Check bypass manual switching circuit.
- Enclose all exposed wiring in 16 mm ø Sprague.
- Install photocell in a dummy bulkhead.

(d) Floodlight and bulkhead luminaires

- Remove lens and lamp. Wash lens thoroughly.

- Wash luminaire body with detergent.
- Clean polished pure aluminium reflectors with benzene.
- Check condition of internal wiring, capacitor, ballasts and starters.
- Check condition of neoprene seal and replace if worn or damaged.
- Check condition of lamp holder.
- Seal conduit and wiring entry with silicone to eliminate water ingress.
- Fit new lamp.
- Check condition of earth stud and luminaire earth connection.
- Replace all missing screws, lens catches, bolts.
- Close cover securely, check stirrup bolts.

AB 10.02.03 Power outlets and fixed appliances

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

- (a) Inspect all power outlets and verify earthing.
- (b) Check contact points and tighten screws.
- (c) Replace missing screws and covers for outlet and draw boxes.
- (d) Replace missing, faulty or damaged socket outlets and plugs.
- (e) Check conditions and operation of local isolators and control switches for fixed equipment and replace if faulty, damaged or missing.
- (f) Check earthing of fixed appliances and test for earth continuity.
- (g) Inspect cable and wireways.
- (h) Check for rigidity and fastening of the cable ducts, ladders, ducting, power skirting and surface conduiting, fasten or replace if loose or damaged, check earthing and test for earth continuity.

AB 10.02.04 Earthing, bonding and lightning protection

- (a) Check earthing and bonding of outlet points, equipment, cable and wireways, fixed appliances, water and gas pipes, etc.
- (b) Check installation and termination of protective conductors and earth electrodes
- (c) Test for earth continuity.
- (d) Provide 6 mm² copper earth wire jumper between roof cladding and all gutter downpipes. Fasten with lugs and galvanized zinc bolts. Typically ten downpipes per housing unit. Earth at least two gutter downpipes by means of 50 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 50mm² 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

<u>Item</u>	<u>Unit</u>

AB.01.01 <u>Service distribution board</u>	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 Traffolite labels, neutral bars, earth bars etc. All downstream circuit breakers shall be rated at 6 kA fault level.

<u>Item</u>	<u>Unit</u>

AB.01.02 <u>Replace distribution board</u>	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.

<u>Item</u>	<u>Unit</u>

AB.01.03 <u>Replace cabling</u>	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.

<u>Item</u>	<u>Unit</u>

AB.01.04 <u>Replace wiring</u>	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.

<u>Item</u>	<u>Unit</u>
AB.01.05 <u>Jointing and termination of cables</u>	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

<u>Item</u>	<u>Unit</u>
AB.01.06 <u>Supply and install padlocks</u>	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 mm locally manufactured padlocks and locking devices as well as fitting each of the three keys with purpose-made pvc labels.

<u>Item</u>	<u>Unit</u>
AB.01.07 <u>Excavate in all materials for trenches, backfill, compact and dispose of surplus material</u>	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.

<u>Item</u>	<u>Unit</u>
AB.01.08 <u>Supply and install cable sleeves</u>	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.

<u>Item</u>	<u>Unit</u>
AB.01.09 <u>Supply and install plastic warning tape</u>	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.

<u>Item</u>	<u>Unit</u>
AB.01.10	
<u>Termination of the low voltage cable</u>	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.

<u>Item</u>	<u>Unit</u>
AB.01.11	
<u>Supply and install earth continuity conductor</u>	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.

<u>Item</u>	<u>Unit</u>
AB.01.12	
<u>Termination and connect earth continuity conductor</u>	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.	

<u>Item</u>	<u>Unit</u>
AB.01.13	
<u>Supply and installation of circuit breakers</u>	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.

<u>Item</u>	<u>Unit</u>
AB.01.14	
<u>Supply and installation of isolators</u>	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.

<u>Item</u>	<u>Unit</u>
AB.01.15	
<u>Supply and install contactors</u>	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.

<u>Item</u>	<u>Unit</u>

AB.01.16	<u>Supply and install switching timers</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.01.17	<u>Supply and install earth leakage units</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.01.18	<u>Supply and install fuses</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.01.19	<u>Supply and install surge arrestors</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.01.20	<u>Supply wire marker kit</u>	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	<u>Lighting system</u>	
	<u>Item</u>	<u>Unit</u>
AB.02.01	<u>Re-lamp luminaire</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.02.02	<u>Service luminaire</u>	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

<u>Item</u>	<u>Unit</u>
AB.02.03 <u>Replace luminaire</u>	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.

<u>Item</u>	<u>Unit</u>
AB.02.04 <u>Replace light switch</u>	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 Traffolite label as per Nosa-standard, cost of, which is included in rate.

	<u>Item</u>	<u>Unit</u>
AB.02.05	<u>Replace photo-electric switch</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.02.06	<u>Replace luminaire diffuser</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.02.07	<u>Service light switch</u>	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 Traffolite label as per Nosa-standard, cost of, which is included in rate.	
	<u>Item</u>	<u>Unit</u>
AB.02.08	<u>Remove, clean, store and reinstallation of luminaire</u>	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.	

	<u>Item</u>	<u>Unit</u>
AB.02.09	<u>Replace Lamp Holder</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.02.10	<u>Replace Luminaire internal components</u>	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	<u>Small power and fixed appliances</u>	
	<u>Item</u>	<u>Unit</u>
AB.03.01	<u>Replace socket outlet</u>	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, Traffolite label as per Nosa-standard, cost of, which is included in the rate.	
	<u>Item</u>	<u>Unit</u>
AB.03.02	<u>Replace isolator</u>	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 Traffolite label as per Nosa-standard, cost of, which is included in the rate.	
	<u>Item</u>	<u>Unit</u>
AB.03.03	<u>Replace plug tops</u>	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.	

	<u>Item</u>	<u>Unit</u>
AB.03.04	<u>Replace conduit</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.03.05	<u>Replace wiring channel</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.03.06	<u>Supply and install connections to fixed appliances</u>	No
	The unit of measurement shall be number of connections made. The tendered rate shall include full compensation for the supply and installing of the connections to the fixed appliances.	
	<u>Item</u>	<u>Unit</u>
AB.03.07	<u>Service socket outlet</u>	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, Traffolite 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.	
	<u>Item</u>	<u>Unit</u>
AB.03.08	<u>Service isolator</u>	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 Traffolite 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.	

	<u>Item</u>	<u>Unit</u>
AB.03.09	<u>Replace power skirting</u>	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 power skirting including all accessories.	
	<u>Item</u>	<u>Unit</u>
AB.03.10	<u>Supply and install Pratley boxes</u>	No
	The unit of measurement shall be the number of Pratley boxes supplied and installed.	
	The tendered rate shall include full compensation for the supply and installation of the specified type of Pratley box.	
	<u>Item</u>	<u>Unit</u>
AB.03.11	<u>Supply and install draw boxes</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.03.12	<u>Supply and install draw box cover plates</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.03.13	<u>Replace “stop-start” local control panel</u>	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 Traffolite label indicating load and supply DB.	
	<u>Item</u>	<u>Unit</u>
AB.03.14	<u>Test and service ceiling mounted fan</u>	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.	

	<u>Item</u>	<u>Unit</u>
AB.03.15	<u>Replace ceiling mounted fan</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.03.16	<u>Service ceiling mounted fan control switch</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.03.17	<u>Replace ceiling mounted fan control switch</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.03.18	<u>Replace domestic stove components</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.03.19	<u>Replace geyser components</u>	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.	

	<u>Item</u>	<u>Unit</u>
AB.03.20	<u>Supply and Install Stove</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.03.21	<u>Provide Certificate of Compliance</u>	No
	The unit of measurement shall be the number of Certificate of Compliance obtained from local authorities and issued to the Engineer.	
	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	<u>Earthing and bonding</u>	
	<u>Item</u>	<u>Unit</u>
AB.04.01	<u>Supply and install earthing and bonding for the installation</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.04.02	<u>Testing of the earth installation by a specialist contractor</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.04.03	<u>Supply and install earth electrodes</u>	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.	
	<u>Item</u>	<u>Unit</u>
AB.04.04	<u>Provide cadweld joint</u>	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.	
	<u>Item</u>	<u>Unit</u>

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.

PARTICULAR SPECIFICATION

ELECTRICAL INSTALLATIONS

ABP.1 SCOPE OF WORKS

This specification covers the contract engineering, manufacture, supply, delivery, erection, wiring, commissioning, testing and handing over in complete working order for immediate use. A guarantee for twelve months will be applicable on all equipment and workmanship, calculated from the final completion date, for the following:

- The supply and installation of all electrical or electrical related equipment as indicated in the Bill of Materials.
- The supply and installation of all electronic or electronic related equipment as indicated in the Bill of Materials.
- The supply and installation of all solar or solar related equipment as indicated in the Bill of Materials.
- The supplier/ installer may install any equipment from any manufacturer as long it is the same or better quality than the manufacturer mentioned either in the Bill of Materials or in this specification. It is the responsibility of the contractor to proof it is the same or better quality than specified.
- Emphasis will be on material and equipment manufactured in the Republic of South Africa.

ABP.2 GENERAL

The specifications must be read in conjunction with User Client's guidelines and standards latest revision. Tenderer to ensure that all equipment offered adheres to these standards.

The tendered is to familiarise themselves with this specification before pricing the tender, no claims shall be entertained in this regard.

Where no standard or specification is specifically mentioned, it shall be assumed that the applicable SABS, ISO, BSS, DIN, Department of Public works and Infrastructure (DPWI) Specification or applicable American Standard, listed in order of preference will apply.

The metric standard of SI units will apply to this specification.

Where conditions are at variance, this supplementary specification will have preference over both Standard Specification and drawings.

ABP.3 ENVIROMENTAL AND GEOGRAPHICAL

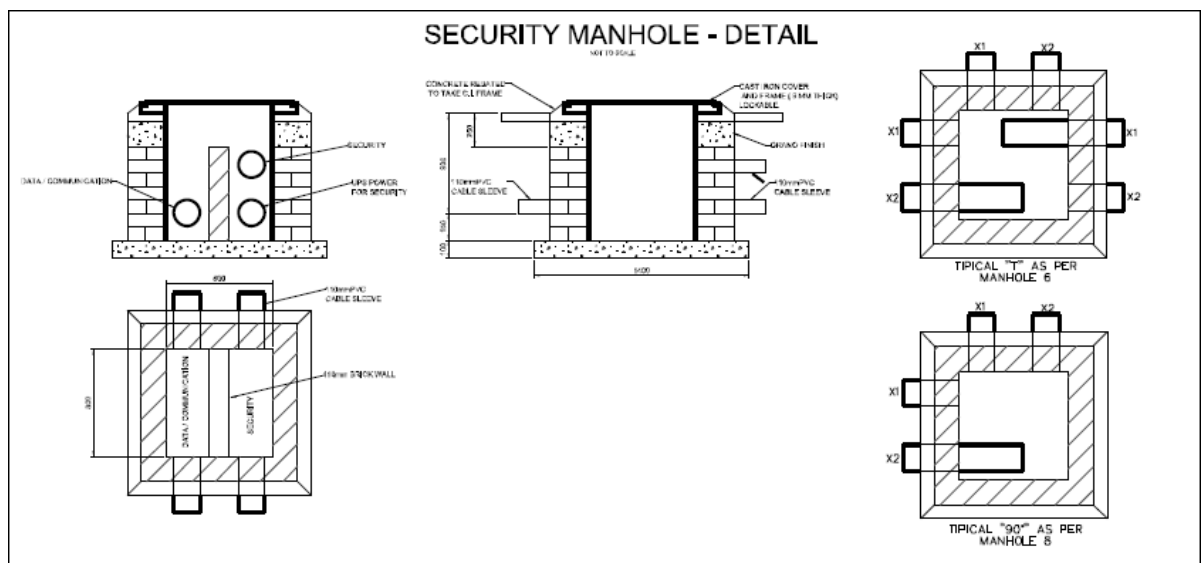
This project will take place at the port of entries. All installations should be done considering the climate and geographical attributes of the area.

ABP.4 TEMPORARY BUILDERS SUPPLY

The Contractor will allow for his own Builder's Supply and will connect from an existing power source on the campus. The contractor will ensure that the electrical works are properly earthed and safe. A Certificate of Compliance will be issue for the distribution board.

ABP.5 BULK SUPPLY

The bulk supply cable will be obtained from a mini substation in the vicinity of the building. The cable will be connected and routed underground and in cable trenches arrangement to the building.



ABP.6 EARTH MAT

Two new separate earth mats will be installed at the Mini-substation's edge one to be connected to the LV side and the other to be installed on the MV side. The earth mat to be below natural ground level (1.0m). The earth mat will consist of 16mm² round solid copper bars and will cover an area of at least 1.0m x 1.0m. The copper earth bars will form a grid of 500mm x 500mm. All connections will be cad-welded. Two round solid copper bars of 16mm² (the tails) from the mat will be connected to the Main DB earth bars. The tails will be connected at separate positions on the mat with a distance more than 1m apart. The tails will be connected into a separate York box at the mat and

connected to a 70mm² single core cable to the Mini-sub.

ABP.7 TRANSFORMERS

N/A for this project.

ABP.8 STANDBY GENERATOR AND CONTROL PANEL

ABP.8.1 GENERAL

This Specification covers the supply, delivery, factory testing and complete installation or servicing and re-testing on site and handover in full working order of the equipment and all associated equipment. The specification must be read in conjunction with the Departments Standby Diesel Alternator Sets GP/E4/1.

Full particulars, performance curves and illustrations of the equipment offered must be submitted with the tender. Contractors may quote for their standard equipment, complying as closely as possible with this Specification, but any deviations from the Specification must be fully detailed.

The questionnaire following this Specification must be completed by contractors in all respects.

The Employer reserves the right not to bind itself to accept the lowest or any tender.

Each diesel alternator set called for in this Specification will be used as a Standby Unit for the continuity of electrical power supply to emergency services.

The standby generator will be equal or better to CATTERPILLAR standard.

The following are a summary of the requirements

Standby capacity	200kVA
Generator type	Self excited, static regulated, brushless
IP rating	Drip proof IP 22
Over speed capacity	50%
Voltage regulation	½% Steady state 1% No load to full load
Time	Maximum time to full on load from mains failure = 12 seconds
Frequency	50Hz
Voltage LV	400V 3 Phase

Fuel tank	600 l fuel tank will be part of the generator construction. A containment tank will be installed below the fuel tank in case of spillages. The containment tank will be constructed from black 2mm mild steel and be able to accommodate 110% of the fuel tank capacity. Therefore, the fuel tank will be an incorporated part of the generator.
Additional equipment	Heavy duty air cleaner Air pre-cleaner Battery chargers with battery racks Charging alternators 1 Set of chop over contactors. Ducting to cowls for ventilation through the louvres
LV breakers	300A feeding Main Building.

ABP.8.2 REQUIREMENTS

The set shall be fully automatic, i.e. it shall start when any one phase of the main supply fails and shall shut down when the normal supply is re-established. The set shall be capable of delivering the specified output continuously under the site conditions mentioned below, without overheating. The engine shall be capable of delivering an output of 100% of the specified output for six hours in any period of 12 hours consecutive running.

ABP.8.3 BASE REQUIREMENTS

The engine and alternator of the set shall be built together on a common simplex-type frame, which will have anti-vibration mountings/pads between the engine – alternator, the frame and the concrete floor. The set shall be placed directly on a concrete floor.

ABP.8.4 OUTPUT VOLTAGE AND FREQUENCY

Output voltage : 400/231V
Frequency : 50 Hz

ABP.8.5 DERATING

The engine must be de-rated for the site conditions as set out.

The de-rating of the engine for site conditions shall be strictly in accordance with BSS 5514 of 1977 as amended to date. Any other methods of de-rating must have the approval of the Engineer and must be motivated in detail. Such de-rating must be guaranteed in writing and proved by the successful contractor at the site test.

ABP.8.6 DELIVERY

Equipment must be delivered to site, off-loaded and installed to prescribed location. Please note that the unit will be situated in the generator room and adequate planning must be done to place the generator.

ABP.8.7 ENGINE

The engine shall be a four stroke, full compression ignition, direct injection and of the readily available industrial rated type of diesel engine.

The engine shall comply with the requirements laid down in B.S.S. 5514 and must be of the direct injection, compression ignition type, running at a speed not exceeding 1 500 rpm.

The engine shall be amply rated for the required electrical output of the set when running under the above-mentioned site conditions. The starting period for either manual or automatic switching-on until the taking over by the generating set, in one step, on a load equal to the specified site electrical output, shall not exceed 12 seconds.

ABP.8.8 STARTING AND STOPPING

The engine shall be easily started from cold, without the use of any special ignition devices, under summer as well as winter conditions, against full load.

Contractors must state what arrangements are provided to ensure easy starting in cold weather. Full details of this equipment must be submitted. In the case of water-cooled engines, any electric heaters shall be thermostatically controlled. The electrical circuit for such heaters shall be taken from the control panel and must be protected by a suitable circuit breaker.

An electric starter motor must be fitted to the engine.

Besides the automatic starting and stopping, provision must be made on the control board for manual starting and stopping of the set.

The automatic control shall make provision for three consecutive starting attempts. Thereafter the set must be switched off, and the start failure relay on the switchboard must give a visible and audible indication of the fault.

ABP.8.9 STARTER BATTERY

The set must be supplied with a fully charged "Lead Acid" type battery, complete with the necessary electrolyte. The battery must have sufficient capacity to provide the starting torque stipulated by the engine makers, and for at least six consecutive starting attempts.

The batteries will form an integral part of the generator or will be in separate panels that are of same external appearance as the main panel.

ABP.8.10 COOLING

The engine must be water-cooled by a built-on heavy duty tropical type pressurized radiator.

All water-cooled engines shall be equipped with a centrifugal pump to circulate the water through the engine and radiators. The radiator and engine cooling system shall be filled with a rust inhibitor solution.

Protection must be provided against running at excessive temperatures. The operation of this protective device must give a visual and audible indication on the switchboard. All air ducts for the cooling of the engines are to be allowed for. An air duct shall be supplied from the radiator face to the air outlet louver.

The radiator will be installed flush to the wall. A grid of the same size as the radiator will be installed in the new opening. The existing opening will be closed and made neat. The grid will allow for sufficient air intake and manufactured from minimum 1.5 mm steel and powder coated. No pests, insects or birds will be able to enter the grid.

Where louvers are to be fitted to accommodate the cooling system, such louvers shall be sized according to the requirements of the manufacturer of the Standby Alternator set and where the need arises ducted to the unit.

Lubrication of the main bearing and other important moving parts shall be by forced feed system. An automatic low oil pressure cut-out must be fitted, operating the stop solenoid on the engine, and giving a visible and audible indication.

ABP.8.11 FUEL PUMP AND FUEL

Fuel injection equipment must be suitable for operation with the commercial brands of diesel fuel normally available locally. The equipment will be delivered with adequate fuel for testing purposes and for the re-filling of the tank afterwards.

ABP.8.12 FUEL TANK

The fuel tank will form an integrated part of the unit and will be installed at the bottom of the generator. Also see details described under 6.1 above. Additional to the above the following will apply:

Should the fuel tank require a fuel cooler this must be fitted.

The tank shall be fitted with a breather, a Rochester type fuel gauge, and a low-level alarm, giving an audible and visible signal on the switchboard.

An electric pump, fitted with a suitable length of oil-resistant hose, must be supplied, for filling the fuel tank from 200-liter drums placed at ground level or from a tanker at a minimum distance of 15m from the tank.

An electrical supply point must be installed at the electric pump of 16A and must consist of a watertight socket outlet unit. It will be supplied with a cable of 10mm² 2 Core Armoured dimensions. The supply point must be fed from the Standby Generator Panel via a 20A single phase Circuit Breaker. The cable will be installed via a brick wall (the hole will be properly sealed around the cable) and saddled against the wall at spacing not more than 300mm apart.

ABP.8.13 GOVERNOR

The speed of the engine shall be controlled by an ELECTRONIC governor in accordance with Class A0 of BSS.5514.

When full load is suddenly switched off or on, the temporary speed variation shall not exceed 2%. The permanent speed variation shall not exceed +/- 0.8% of the nominal engine speed. External facilities must be provided on the engine to adjust the nominal speed setting.

ABP.8.14 FLYWHEEL

A suitable flywheel must be fitted, so that lights fed from the set will be free from any visible flicker.

The cyclic irregularity of the set must be within the limit laid down in B.S.S.5514 of 1958.

ABP.8.15 EXHAUST SYSTEM

ABP.8.15.1 SILENCERS

It is essential to keep the noise level as low as possible. An effective exhaust silencing

system of the residential type is also to be provided, as specified in SANS 0103-1983, as amended.

The exhaust pipe shall be installed in such a way that the expelled exhaust fumes will not cause discomfort to the public. The exhaust pipe must be flexibly connected to the engine to take up vibrations transmitted from the engine, which may cause breakage.

Contractors shall quote for the supply & installation of silencers and baffles to ensure that the environment around the canopy is suitable for day-to-day work, without exceeding acceptable daily noise levels as applicable to a residential environment. The muffler and piping shall be manufactured from 3CR12.

ABP.8.15.2 ATTENUATION

Sound attenuation must be provided to ensure that the maximum sound level generated by the unit when measured at a height of 1.2 meters at a distance of 7 meters in any direction from the outside of the unit must not exceed 65 dB. When the plant is running at full load, all sound attenuation material must be of a non-flammable type.

ABP.8.16 ACCESSORIES

The engine must be supplied complete with all accessories, instruction manuals, spare part lists, etc. A spare set of fuel filters is to be supplied with the necessary tools for removal and refitting.

ABP.8.17 SAFETY NOTICES

All safety notices as specified in the OHS Act must be fitted to the container and a suitable 9kg dry powder fire extinguisher must be provided adjacent to the personnel access door.

A set of Laminated drawings of the switchboard/control panel must be affixed to the inside wall of the container adjacent to the switchboard.

ABP.8.18 ALTERNATOR

The alternator shall be of the self-excited brushless type, with enclosed ventilated drip-proof housing, and must be capable of supplying the specified output continuously with a temperature rise not exceeding the limits laid down in B.S.S. 2613 for rotor and starter windings with Class F or H insulation.

Both windings must be fully impregnated for tropical climate and must have an oil resisting varnish finish.

ABP.8.19 RATING

Unless stated to the contrary, the alternator shall generate the specified voltages on three-phase and at 50 Hz. The alternator shall be rated for the specified output and power factor as detailed.

The alternator may be of the two bearing or single bearing type equipped with ball or roller bearings. The bearings must be pre-lubricated to ensure long service periods without attention.

The alternator must be equipped with damper windings, enabling the unit to accommodate an unbalanced load of at least 25% of full load at any load and at the normal operating conditions without incurring any damage.

ABP.8.20 CONSTRUCTION

The rotor shall be dynamically balanced and all the windings and rotating components shall be suitable to withstand an over speed of 50%.

ABP.8.21 EXCITATION

The excitation system shall be designed to promote rapid voltage recovery, following the sudden application of the full load. The voltage shall recover to within 2,5% of the steady state voltage within 0,3 seconds following the application of full load and the transient voltage dip shall not exceed 10%.

ABP.8.22 WAVE FORM

The voltage wave form of the alternator shall be such that the total voltage of the harmonic frequencies shall not exceed 5% of the voltage of the fundamental frequency over the range from no load to full load.

ABP.8.23 RADIO INTERFERENCE

The alternator shall be suppressed to comply fully with the requirements of BS 800 as revised, as well as with all South African Department of Posts and Telegraph requirements.

ABP.8.24 REGULATION

The alternator must be self-regulated, the inherent voltage regulation not exceeding plus or minus 2.5% of the nominal voltage specified above, at all loads with the power factor between unity and 0,8 and within the driving speed variations of 4.5% between no-load and full load.

ABP.8.25 PERFORMANCE

The excitation system shall be designed to promote rapid voltage recovery following the sudden application of the full load. The voltage shall recover to within 2.½% of the steady state within 300 milliseconds following the application of full load and the transient voltage dip shall not exceed 10%.

ABP.8.26 COUPLING

The engine and alternator must be directly coupled by means of a first-class quality flexible coupling, or acceptable disc drive coupling.

ABP.8.27 AUTOMATIC CONTROL CUBICLE

A set mounted automatic control cubicle shall be supplied, the cubicle to incorporate all equipment necessary for the control and protection of the generating set, the automatic change-over, and the battery charging.

The cubicle shall be a totally enclosed free standing unit, and shall consist of steel panels, carried on a substantial angle iron framework or pressed steel panels welded.

The cubicle shall be flush fronted; all equipment shall be mounted on the back of the front plate on suitable supports.

All equipment, connections and terminals shall be easily accessible. The front panels shall be hinged, with square key locking. Self-tapping screws shall not be used in the construction of the cubicle. The ironwork of the cubicle shall be thoroughly de-rusted, primed with zinc-chromate, and finished with two coats of first-class red enamel, or powder coated in Signal Red.

Suitably rated terminals shall be provided for all main circuits and for the control and protection circuits. Where cable lugs are used, these shall be crimped on the cable. All terminals shall be clearly marked.

For the fine wiring, each wire shall be fitted with a cable or wire marker of approved type, and the numbering of these markers shall be shown on the wiring diagram of the switchboard.

All equipment on the cubicle, such as contactors, isolators, bus bars, etc., shall have ample current carrying capacity to handle the full load alternator current, as well as the rated fault current of the L V Panel.

ABP.8.28 SWITCHBOARD/CONTROL PANEL

A switchboard/control panel using a PLC type controller in preference to a Proprietary controller shall be used.

Note: Relay logic panels are not acceptable. The switchboard will be positioned in the plant room and switchgear rated for a 30kA fault level must be provided.

The following alarm circuits with the necessary sensors must be provided on the control panel:

- START FAILURE
- LOW OIL PRESSURE
- HIGH ENGINE TEMPERATURE
- OVER SPEED
- UNDER SPEED
- LOW RADIATOR WATER LEVEL
- ABNORMAL GENERATOR VOLTAGE ($\pm 10\%$ OF NORMAL)
- LOW DAY TANK FUEL LEVEL
- UNIT NOT ON AUTO
- BATTERY CHARGE FAILURE

In addition to the above supervisory indication lamps for MAINS-LOAD and GENERATOR-LOAD to indicate which system is supplying the load must be provided.

Controls must be provided in the control panel to control the fuel replenishment pump.

ABP.8.29 EARTHING

An earth bar shall be fitted in the control panel. The neutral point of the system must be solidly connected to the earth of the control panel. Suitable terminals must be provided on the earth bar for connection of the main earth conductors, which will be supplied and installed by others.

ABP.8.30 OPERATIONAL REQUIREMENTS

An automatic changeover with electrical and mechanical interlocking shall be provided installed in an approved position in the control cubicle. This changeover switches shall open when the normal "supply" voltage is interrupted and will automatically close when the terminal voltage of the alternator reaches its nominal voltage, thereby connecting the alternator on load.

Voltage and frequency monitor shall be installed to monitor the normal "supply".

The starting cycle shall consist of three-time relays, with two relays which will be adjustable between 0- 30 seconds. The two-time relays shall perform the starting cycle. The starting cycle shall actuate the first-time relay, which will energize the starter motor

of the engine for the preset time. The second time relay shall perform the "wait period" before the second and third starting attempt has been actuated.

After three unsuccessful starting cycles the third time relay shall be actuated to interrupt any further starting cycles and give an alarm "Start Failure". The third time relay shall have an adjustable time range of not less than 60 seconds.

When the alternator output voltage reaches the nominal value, the changeover contactor shall be activated to transfer load to the alternator.

A time delay shall be actuated when the supply network voltage is restored. This delay shall be adjustable between 0 - 10 minutes and shall actuate the changeover contactor to connect the load on back to the supply network.

After the load has been re-established to the supply network, the alternator set shall be switched off, by means of a run-down time, which will be adjustable between 0 - 10 minutes.

Should any of the above-mentioned control circuits or relays fail, the load shall be transferred automatically from the alternator to the supply network.

A siren must be of the continuous duty type or must be connected to an intermittent duty time relay.

A switch must be installed in the hooter circuit, to stop the audible signal. This switch shall be inside the cubicle with a suitable notice on the exterior.

The output terminals from the alarms in the AMF panel shall be wired to terminals in a flush mounted white 300mm x 300mm, flush mount enclosure in the manager's office indicating the following:

- Common Alarm.
- Low fuel alarm.
- Generator on load indicator lamp.
- Mains on load indicator lamp.
- Audible common alarm with cancel push button.

All indicator lamps shall be of the LED type.

Or suitable connections for connecting to a building management system

A stop delay with timer is required for the set, to keep the set running for an adjustable period of one to fifteen minutes after the return of the mains supply, before changing back to that supply and keep the set running for a further adjustable cooling period at no-load before stopping.

A four-position selector must be provided on the control panel, marked "Auto", "manual", "test" and "off".

With the selector on "auto", the set shall automatically start and stop, according to the mains supply being available or not.

With the selector on "test" it shall only be possible to start and stop the set with the push buttons, but the running set shall not be switched to the load.

With the selector on "manual", the set must take the load when started with the push button, but it must not be possible to switch the set on to the mains, or the mains on to the running set.

With the selector on "off", the set shall be completely disconnected from the automatic controls, for cleaning and maintenance of the engine.

ABP.8.31 BATTERY INSTALLATION

The starting batteries shall be adequately rated to suit the equipment provided. Battery terminals shall be coated with "Copra slip" or equivalent conductive grease. The battery shall preferably be mounted adjacent to the equipment.

Where electric starting is employed, the combination engine generator set shall be equipped with a fully charged lead-acid battery with the following requirements:

The battery shall have ample capacity for providing the starting torque stipulated by the engine manufacturer, and capacity for 3 such starts in a five-minute period.

The battery shall be supplied with a charger unit as described below.

ABP.8.32 BATTERY CHARGER

The switchboard detailed below shall contain facilities for charging the batteries from the mains.

The battery charger shall be of the fully automatic type and shall consist of an air-cooled transformer, silicon bridge rectifier, fuses and switching arrangement. All equipment shall be suitably rated and designed to automatically deliver a trickle or boost charge as determined by the battery voltage. The boost charge in amps shall not exceed 20% of the rated battery capacity.

A constant trickle charge facility is not acceptable. The charger shall switch off automatically when the battery is fully charged.

The charger must be provided with a Voltmeter and charge ammeter. These instruments must be mounted on the control panel door.

ABP.8.33 SWITCHBOARD/CONTROL PANEL

A switchboard / control panel must be provided for the control, metering and switching of the diesel alternator set.

Fault Level - The board and its equipment shall be rated at not less than the 380V asymmetrical prospective fault level specified in the detailed specification of the Electrical Installation, minimum 30 kA.

ABP.8.34 EQUIPMENT IN SWITCHBOARD

The following equipment is required on the board:

One flush 96 mm square dial voltmeter scaled 0 - 500V, reading the alternator voltage.

One flush voltmeter selector switch with three metering and one off position, connecting the voltmeter between phases and neutral.

One flush 96mm square dial indicating type frequency meter, indicating the alternator frequency.

One hour meter with cyclometer counter, reading the number of hours the plant has been operating. The smallest figure on this meter is to read 1/10th hours.

One set of fuses or MCB's for potential circuits of the meters.

Three flush 96mm square dial ammeters for measuring the alternator current, scaled to suit, complete with the necessary current transformer - combined instantaneous and maximum demand meters are required.

One triple pole circuit breaker for mains isolation.

One set of triple pole automatic change-over equipment with voltage and time delay relays, fitted with mechanical interlocks.

One triple pole circuit breaker for alternator protection against overload and short circuit conditions.

One four position operation selector switch, as specified.

Two push buttons or one switch marked "START" and "STOP" for manual starting and stopping the set.

One battery charger as specified, complete with flush ammeter and voltmeter.

One-stop delay as specified.

Relays with re-set push buttons as specified, for engine protection.

Two low fuel level alarm devices.

One warning hooter and one siren.

One low battery voltage alarm device.

Suitable terminals for incoming main and alternator cables, for the outgoing feeder, and for the earth connection.

Any other equipment necessary for the correct and safe operation of the installation.

A "General Alarm" output contact which will be in fail safe position and will initiate general alarm should any one of the above-mentioned alarms be initiated.

Panel lights to indicate:

- Mains - Load.
- Generator Load, to indicate which system is supplying the load.

The IP65 siren shall be wired to a point outside the plant room door.

ABP.8.35 MARKINGS

All labels, markings or instructions on the switchgear shall be as per the section on Coding, Labelling and Notices.

ABP.8.36 INSTALLATION

Except for the supply and connection of the incoming main and outgoing feeder cables, tenderers must include for the complete installation and wiring of the plant in running order.

The installation must comply with the regulations of the "Factories, Machinery and Building Works Act" of 1941, as amended to date, and with the "Standard Regulations for the Wiring of Premises" second edition as amended, as well as the General Specification for Electrical Installations appended hereto, or available on request.

For the alternator circuit PVC SWA PVC sheathed cable shall be used. For the control circuits either multi-core P V C cable OR PVC insulated wires in conduit may be used. The neutral of the system must be solidly earthed.

Additional to the above, "Moving Machinery", "Noise" and "Danger" signs must be installed.

ABP.8.37 OCCUPATIONAL HEALTH & SAFETY ACT (OHSACT)

This installation shall comply in its entirety with the Occupational Health & Safety Act, and its amendments to date, and with all other regulations and specifications governing the works.

ABP.8.37.1 WARNING NOTICES

In the plant room, a clearly legible and indelible warning notice shall be mounted in a conspicuous position. The notice shall be made of non-corrodible and non-deteriorating material, preferably plastic, and must read as follows:

“THIS MACHINE CAN START WITHOUT WARNING: KEEP CLEAR”

ABP.8.38 DRAWINGS

The successful tenderer will submit for approval within four weeks after adjudication of the Tender, three paper copies of the following drawings:

- Complete detailed general layout drawing.
- Working drawings of the cooling and exhaust systems.
- Complete detailed and dimensional drawings of the alternator set with all auxiliary equipment.
- Wiring diagrams of the control protection and alarm circuitries.
- Detailed layout of the equipment to be installed on the control panel.

All drawings shall be drawn on CAD (Caddie) and shall meet the requirements of SANS 0111-1980 as amended and SANS-1980 as amended, where applicable.

ABP.8.39 INFORMATION REQUIRED

Tenderers must furnish detailed descriptions and illustrations of the equipment offered and must complete the questionnaire following this specification. Failure to submit any of the information asked for may disqualify the tender.

ABP.8.40 GUARANTEE

The successful tenderer will be required to guarantee the complete plant for a period of 12 months from the date it has been taken over by the client, in running order.

If during this period the plant is not in working order, or not working satisfactorily owing to faulty material, design, or workmanship, the contractor shall be notified, and immediate steps shall be taken by him to rectify the defects and/or replace the affected parts on site, at his own expense.

ABP.8.41 INSTRUCTION OF OPERATOR

After completion of the installation, and when the plant is in running order, the successful tenderer will be required to instruct an attendant in the operation of the plant, until he is fully conversant with the equipment and the handling thereof.

Three copies of maintenance, fault-localizing and operating manual are to be handed over to the representative on site.

One set of manuals with all drawings shall be fixed in a plastic jacket inside the panel.

ABP.8.42 INTERNAL LABELLING

An "Ozakling" type label showing the part number, description and setting of all removal relays, monitors and timers shall be affixed to the inside of the panel. Typical timer settings shall be noted.

All removable items shall be labelled both on the item, and on or adjacent to the plug-in base on the panel.

A full set of drawings, including schematics and general arrangement drawings shall be framed and mounted on the plant room wall behind a Perspex cover.

ABP.8.43 TESTS

The following tests are to be carried out:

At the supplier's premises, before the generating set will be delivered to site:

The Engineers may be present during the test to satisfy them that the generating set complies with the specification and delivers the specified output.

The test must be carried out in accordance with B.S.S. 5514. The Engineer must be advised in time of the date of the test at least seven days prior to the test.

At the site after completion of the installation, all the instruments which may be required for the tests have to be provided by the successful tenderer.

Note that it will be necessary to conduct tests on load banks on site. On site tests shall be carried out for one hour on full load and one hour at 10% overload.

Test reports of both tests as specified under (a) and (b) are to be submitted to the Engineer.

ABP.8.44 LOCATION OF PLANT ROOM

The location of the plant room is as per the Architect's Drawings. The successful tenderer shall be responsible for lifting the set onto this plant room and positioning the set in the standby plant room.

The doors of the generator room will be new double doors of adequate size to allow easy generator access and enough air flow for the generator according to the supplier's specifications. The door will be lockable, manufactured from at least 1.5mm steel and powder coated.

ABP.8.45 MANUALS

Three copies of the complete set of manuals shall be provided to the full approval of the Engineer.

The contract shall be deemed as "Incomplete" until all manuals, drawings and descriptive literature are received and approved by the Engineer and will result in a minimum of 10% of the contract money being withheld.

ABP.8.46 COMPLIANCE WITH SPECIFICATION

Tenderers are to provide a clause by clause written confirmation that their offer complies with the clauses of this document. Where their offer does not comply, it is to be clearly indicated in the compliance schedule.

ABP.8.47 SIGNAGE

All signage as required to comply with local Fire Regulations, as well as SANS-0142 & SANS 0400 shall be supplied and fitted both inside and outside the plant room.

ABP.9 UNINTERRUPTED POWER SUPPLY

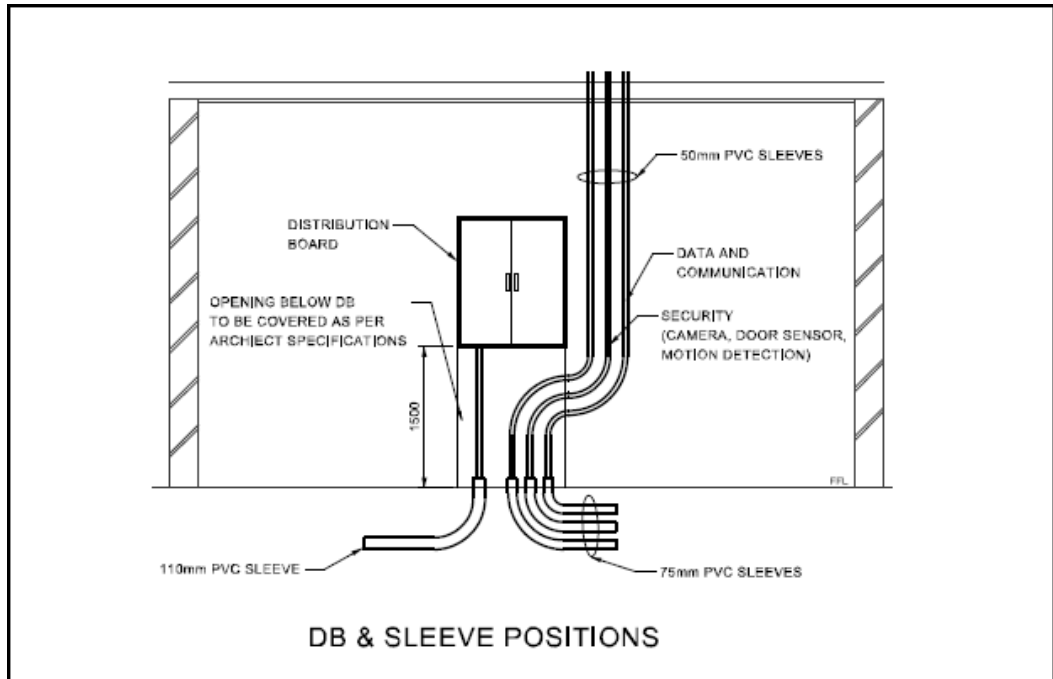
N/A for this project.

ABP.10 CABLE SLEEVE PIPES

All cable sleeves to be PVC.

The electrical contractor will be responsible for all excavations, installation of sleeves, backfill and making neat of all.

The ends of all sleeves shall be sealed with a non-hardening watertight compound after the installation of cables. All sleeves intended for future use shall likewise be sealed.



ABP.11NOTICES

The Contractor shall issue all notices and make the necessary arrangements with Supply Authorities, the Postmaster-General, S.A. Transport Services, Provincial of National Road authorities and other Authorities as may be required with respect to the installation. The Contractor will be held responsible for damage to any existing services brought to his attention by the relevant authorities and will be responsible for the cost of repairs.

ABP.12ELECTRICAL EQUIPMENT

All equipment and fittings supplied must be in accordance with the approved quality specification, suitable for the relevant supply voltage and frequency and must be approved by the Consultant's representative.

Specialised electrical equipment should be accompanied by technical specification submittals and will then need to be approved by the consultant before installation can take place. This will apply to equipment such as the insect catchers, hydro boils, geysers, etc.

ABP.13DRAWINGS

The drawings generally show the scope and extent of the proposed work and shall not be held as showing every minute detail of the work to be executed.

The position of power points, switches and light points that may be influenced by built-in furniture must be established on site, prior to these items being installed.

The contractor will supply a complete set of "As built" drawings at completion of the contract. This will be handed in with the Operational and Maintenance manuals.

ABP.14BALANCING OF LOAD

The Electrical Contractor is required to balance the load as equally as possible over the multiphase supply. When balancing of loads are not required, the specific phase to which a load must be connected will be indicated on the drawings.

ABP.15WORK SEQUENCE

The sequence, in which the work must be carried out, must be established in consultation with the Department's representative.

ABP.16SUPERVISION

The work shall always, for the duration of the contract be carried out under the supervision of a skilled and competent representative of the contractor, who will be able and authorised to receive and carry out instructions on behalf of the contractor. Enough workmen shall be always employed to ensure satisfactory progress of the work.

ABP.17SUPPLY OF MATERIAL

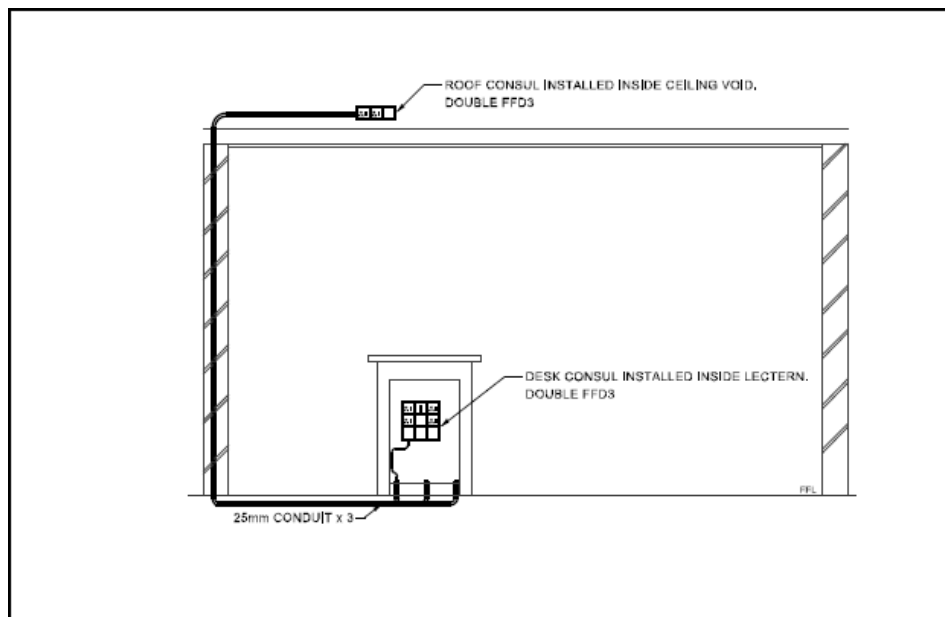
The contractor shall be responsible to supply all the required material for the complete installation.

ABP.18SERVICE CONDITIONS

All plant shall be designed for the climatic conditions appertaining to the service.

ABP.19SWITCHES AND SOCKET OUTLETS

All switches will be supplied with a metal cover plate with brush aluminium or stainless-steel finishing unless otherwise specified in the Bill of Materials.
Wiring will be done steel conduit. The detail for the installation of the roof and desk consuls is given in the picture below.



ABP.20LIGHT FITTINGS AND LAMPS

Light circuits will be wired in 20mm PVC conduit.

All Lux levels to be in accordance with the GDE Guidelines and will be adhered to.

All fittings to be supplied by the electrical contractor shall have the approval of the Department. Incandescent lamps shall bear the approved mark of the SABS and shall have the British light centre length.

The following fittings will be supplied and installed as per the Bills of Materials:

	20 Watt LED, 274mm x 274mm x 104mm square bulkhead with prismatic diffuser. IP65. Typical: Series 21
	1200 x 300 x 100mm, 2 x 20W LED, open channel surface mounted.
	1200 x 300 x 100mm, 2 x 20W LED, Acrylic diffuser, surface mounted.
	1200 x 300 x 100mm, 2 x 20W LED, Wire Guard surface mounted.
	20W 220V LED Downlighter, 140mm Diameter x

	102mm
	Emergency Lighting, Exit, single sided, wall mounted, with battery back-up. 330 x 145 x 46mm.

ABP.20.1 TUBULAR LED LAMP LUMINARIES

ABP.20.1.1 SCOPE

This specification covers the requirements for LED luminaries using tubular LED lamps for general indoor use. The type of luminaries covered is open-channel, industrial, decorative and recessed types and includes luminaries with one or more lamps with standard wattage ratings as specified in the Bills of Materials.

ABP.20.1.2 GENERAL

Luminaries, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective cover. Lamps shall be delivered separately.

ABP.20.1.3 STANDARDS

The following standard specifications of SABS shall apply to the luminaries' specifications:

SANS 1119	Interior Luminaries for LED lamps.
SANS 1250	Capacitors for use with LED and other discharge lamp ballasts.
SANS 890	Ballasts for LED lamps.
SANS 1464	Safety of Luminaries.
SANS 1479	Glow starters for LED lamps.
SANS IEC 400	Lamp holders for tubular LED lamps.
SANS 1041	Tubular LED lamps for general service.
SANS 1247	Coatings applied by the powder-coating process.
SANS 783	Baked enamels.
SANS 0142	Wiring of premises.
SANS 1464	Safety.
SANS 890	Noise levels.
SANS 1222	Protection.

ABP.20.1.4 FIXING

The luminaries shall be suitable for mounting in or against ceilings as described below:

All holdings will be galvanized, cadmium plated or stainless steel and completely corrosion proof.

The holding screws will not be longer than 30mm and not shorter than 20mm.

At least four fixing screws per luminaries will be supplied and installed.

The position of any other equipment or material that could be damaged when fixing luminaries must be established prior to fixing any luminaries.

Luminaries will be installed completely parallel, straight or/and horizontal.

ABP.20.1.5 ENVIRONMENTAL

The luminaries will be suitable to operate in ambient temperatures between -10°C and +40°C.

ABP.20.1.6 SAFETY

The luminaries will bear the SANS 1464 safety mark.

ABP.20.1.7 NOISE

Noisy ballasts will not be accepted and shall be replaced at no cost. All ballasts shall comply with the requirements of the latest edition of SANS 890, Part 1.

ABP.20.2 GENERAL TECHNICAL REQUIREMENTS

Tubular LED lamp luminaries shall comply fully with SANS 1119 and all amendments as well as the additional requirements of the specification. Luminaries shall bear the SABS mark.

The client reserves the right to have samples of luminaries offered tested by the SABS for compliance with SANS 1119. If sample luminaries are found not to comply with SANS 1119 the cost of such tests shall be borne by the tenderer.

ABP.20.3 CONSTRUCTION

Luminaries shall consist of a ventilated body manufactured of either cold rolled sheet steel not less than 0.8mm thick or injection moulded, flame retardant GRP, suitably

braced or stiffened to prevent distortion. The body shall be of sufficient strength for the mounting of the entire luminaries.

The luminaries shall be designed to accommodate the control gear, wiring, lamp holders and where applicable, the diffuser and reflectors. It shall be possible to reach the control gear without disconnecting wiring or removing the luminaries.

Except for mounting holes and/or slots and the required openings in air-return luminaries, the back of the body channel shall be closed over the full length of the luminaries.

Suitable knockouts shall be provided in the rear or both ends of the luminary's body for wire entry.

All components, including screws, bolts and nuts utilised in the construction of the luminaries or fixing of its components, shall be corrosion proof. Cadmium plated or stainless-steel materials are preferred.

The lamp compartment and body will have a degree of IP 65 protection as per SANS 1222.

ABP.20.4 INTERNAL WIRING

Luminaries shall be completely wired internally. Conductors shall be protected with grommets where they pass through holes in the body.

The wiring shall be totally enclosed to prevent any possible contact with live components while changing lamps.

The conductor insulation shall be rated to withstand the temperature inside the luminary's body without deterioration.

The wiring shall terminate on a suitable terminal block having screw down plates bearing on the wires.

Terminal where screws bear down directly on wires will not be acceptable.

An earth terminal, welded to the luminary's body, shall be provided where applicable. To ensure good earth continuity the earth terminal shall not be spray painted. The earth conductor shall be connected to this terminal by means of a crimped lug.

ABP.20.5 LAMP HOLDERS

Lamp holders shall preferably be of twist-lock type. The mounting of the holders shall be able to accommodate the tolerances experienced in the length of lamps and in the

manufacture of luminaries.

ABP.20.6 CONTROL GEAR

The control gear, ballasts, capacitors and starters shall be designed and manufactured to suit the control circuitry adopted. All luminaries shall operate on a switch-start basis.

Ballasts shall comply with SANS 890 and SANS 891, suitable for operation on 220V to 250V 50Hz supplies.

Ballasts shall further be suitable for the luminaries to ensure that the thermal limits specified in paragraph 3.5 of SANS 1119 are not exceeded.

Starters shall comply with SANS 1479 or with BS 3772 if it is not covered by SANS 1479. Starters with metal cans shall contain integral earthing facilities to earth the can upon insertion.

Starters shall be accessible from the outside of the luminaries, and the replacement of the starter shall not necessitate the removal of lamps.

Capacitors shall comply with SANS 1250. The power factor of each complete fitting shall be corrected to at least 0,85.

ABP.20.7 LAMPS

LED lamps shall be suitable for the control circuitry used. Lamps shall comply with SANS 1041.

Only Osram & Philips branded lamps will be accepted on this project.

If no colour is specified, the light colour shall correspond to colour 2 (4 300K) of SANS 1041.

Lamps of the same colour shall be provided for an entire installation unless specified to the contrary.

There shall be no visible flicker in the lamps and lamps shall readily strike when switched on. Faulty lamps or ballasts shall be replaced at no cost.

ABP.20.8 PHOTOMETRIC DATA

Photometric data sheets of the luminaries as prepared by a laboratory, that complies with SABS requirements, shall be submitted with the luminaries.

ABP.20.9 TECHNICAL INFORMATION

The tenderer shall include full technical particulars regarding the luminaries offered with the tender.

ABP.20.10 RECESSED LUMINARIES

Recessed luminaries shall be suitable for mounting in the ceiling structure specified in the project specification.

The diffuser or reflector shall fit flush with the ceiling and the only visible portion shall be the reflector or diffuser.

Should the luminaries be so designed that a surrounding frame is visible, then this frame shall be manufactured of anodized aluminium. The frame shall form a neat trim with the ceiling. The corners of the surrounding frame shall be mitred and reinforced.

ABH20.11 LOW- BRIGHTNESS LUMINARIES

The luminaries shall be provided with an aluminium louvre with V-shaped longitudinal vanes and extruded stepped cross-shielding plates.

Louvres shall be constructed from high purity aluminium (99.98%), chemically brightened and anodized.

The total Light Output Ratio (LOR) shall be 62% or better. In the plane between 60 and 90 from the vertical, the LOR shall be below 3%.

ABP.20.12 LOW GLARE LUMINARIES

The luminaries shall be provided with a die-formed, bright-anodized high-purity aluminium (99.98%) louver with parabolic reflecting surfaces in both directions.

The total LOR shall be 62% or better. In the plane between 60 and 90 from the vertical, the LOR shall be less than 1.3%.

ABP.20.13 LUMINARIES FOR USE IN AREAS WITH VISUAL DISPLAY TERMINALS

The luminaries shall have anodized specular louvers to provide the brightness control

required for this type of application.

At angles between 60 and 90 from the vertical the luminance shall not exceed 200cd/m².

At above angles the LOR shall be less than 0.6%. At angle between the vertical and 60 the LOR shall be 61% or better.

ABP.20.14 BULKHEAD LIGHT FITTINGS

ABP.20.14.1 SCOPE

The specification is for all bulkhead fittings to be used on this project.

ABP.20.14.2 GENERAL

Luminaries, associated equipment and control gear shall be new and unused and shall be supplied complete with lamps, control gear, diffusers, mounting brackets, etc. and shall be delivered to site in a protective cover. Lamps shall be delivered separately.

ABP.20.14.3 STANDARDS

The following standard specifications of the South-Africa Bureau of Standards shall apply to this luminary's specification:

SANS 1119	Interior Luminaries for LED lamps.
SANS 1250	Capacitors for use with LED and other discharge lamp ballast's
SANS 890	Ballasts for LED lamps
SANS 1464	Safety of Luminaries
SANS 1479	Glow starters for LED lamps
SANS IEC 400	Lamp holders for tubular LED lamps
SANS 1041	Tubular LED lamps for general service
SANS 1247	Coatings applied by the powder-coating process
SANS 783	Baked enamels
SANS 0142	Wiring of premises
SANS 1464	Safety
SANS 890	Noise levels
SANS 1222	Protection

ABP.20.14.4 PHYSICAL AND ENVIRONMENTAL REQUIREMENTS

N/A

ABP.20.14.5 AREAS OF APPLICATION

The luminaries are attended for outdoor as well as indoor use.

ABP.20.14.6 FIXING

The luminaries shall be suitable for mounting in or against ceilings as described below:

All holding screws will be galvanized, cadmium plated or stainless steel and completely corrosion proof.

The holding screws will not be longer than 30mm and not shorter than 20mm.

At least four fixing points per luminaries must be established.

The position of any other equipment or material that could be damaged when fixing luminaries must be established prior to fixing any luminary.

ABP.20.15 ENVIROMENTAL

The luminaries shall be suitable for operation in ambient temperatures between -10 C and +45 C.

ABP.20.16 SAFETY

The luminary shall bear the SANS 1464 safety mark.

ABP.20.17 NOISE

Noisy ballasts will not be accepted and shall be replaced at no cost. All ballasts shall comply with the requirements of the latest edition of SANS 890, Part 1.

ABP.20.18 GENERAL TECHNICAL REQUIREMENTS

ABP.20.18.1 GENERAL

The bulkhead luminaries shall be suitable for surface mounting on a ceiling or wall and shall allow for surface conduits to enter on all sides.

ABP.20.18.2 CONSTRUCTION

The luminaries shall consist of a high-pressure die cast aluminium base and a structured opaque high impact acrylic diffuser.

It shall be the shape specified in the Bill of materials and shall be designed to operate compact LED lamps up to 2 x 26W (staircases) or shaped as per the attached pamphlets for outside and bathroom lighting.

The diffuser shall be fixed to the body by four stainless steel Allen head screws. A silicon sponge gasket shall be fitted into a groove on the diffuser.

Four mounting holes shall be provided in the base for securing the diffuser onto the base.

All internal wiring shall be Teflon coated with protective sleeving to prevent damage by possible abrasion.

Main connections shall be by means of a suitable screw terminal block with a wire clamping contact.

All screws, bolts and metals shall be stainless steel or of non-corrosive material.

A luminary shall consist of a ventilated body manufactured of either cold rolled sheet steel not less than 0.8mm thick or injection moulded flame-retardant GRP, suitably braced or stiffened to prevent distortion. The body shall be of sufficient strength for the mounting of the entire luminary

ABP.20.19 LAMP HOLDERS

Lamp holders shall preferably be of twist-lock type. The mounting of the holders shall be able to accommodate the tolerances experienced in the length of lamps and in the manufacture of luminaries.

ABP.20.20 CONTROL GEAR

The control gear shall be incorporated inside the separate control gear compartment and be mounted on a removable gear tray.

It shall be suitable for operation with the specified rating of the lamp on a 230V + 3%-10% 50Hz single-phase system.

All control gear components shall be removable and bear the relevant SABS mark.

The luminaries shall be power factor corrected to a minimum of 0.85.

Ignitors, where applicable, shall be of the superposed pulse type.

The luminaries shall be able to withstand ambient temperatures of at least 45 C. without resulting in any electrical or mechanical component exceeding its maximum allowed

operating temperature.

The lamp compartment and body will have a degree of IP 65 protection as per SANS 1222.

ABP.20.21 LAMPS

Only Osram & Philips branded lamps will be accepted on this project.

If no colour is specified, the light colour shall correspond to colour 2 (4 300K) of SANS 1041.

Lamps of the same colour shall be provided for an entire installation unless specified to the contrary.

There shall be no visible flicker in the lamps and lamps shall readily strike when switched on. Faulty lamps or ballasts shall be replaced at no cost.

ABP.20.22 TECHNICAL INFORMATION

The Tenderer shall include full technical particulars regarding the luminaries offered with the tender.

ABP.20.23 EMERGENCY EXIT INDICATORS

Except for the following changes, all emergency exits will be indicated with the same Bulkhead fitting as specified above:

The high impact acrylic diffuser will be white.

The word "EXIT" will be indicated on the front of the diffuser and will be at least 60mm in height.

The colour of the script will be signal red.

The quality of the script will be such that it is engraved and will not be of the sticker type.

ABP.20.24 BATTERY BACK-UP UNITS

Where indicated on the attached drawings, bulkhead fittings will be fitted with battery back-up units with the following specifications:

The units must have self-testing facilities on a weekly basis and full functional test monthly.

It must have a one-hour standby facility with at least 18% of the normal light output.

It will have an external lamp, indicating the following:

- Mains on and system in working order.
- Battery voltage low.
- Battery voltage too high.
- Low-capacity battery.
- Bad lamps.
- No mains.

ABP.21 EARTHING AND BONDING

The Contractor will be responsible for all earthing and bonding of the building and installation; the earthing and bonding is to be carried out strictly to the specification and to the satisfaction of the Department's representative.

Connection from the main earth bar on the main board must be made to the cold water main, the incoming service earth conductor, if any and the earth mat or other local electrode by means of 12mm x 1,6mm solid copper strapping of 16mm² stranded (not solid) bare copper wire or such conductor as the Department's representative may direct. Main earth copper strapping where, installed below 3m from ground level, must be run in 20mm diameter conduit securely fixed to the walls.

All other hot and cold-water pipes shall be connected with 12mm x 0,8mm perforated for solid copper strapping (not conductors) to the nearest switchboard. The strapping shall be fixed to the pipe work with brass nuts and bolts and against walls with brass screws at 150mm centres. In all cases where metal water pipe, down pipes, flues, etc., is positioned within 1,6m of switchboards an earth connection consisting of copper strapping shall be installed between the pipe work and the board. In vertical building ducts accommodating both metal water pipes and electrical cables, all the pipes shall be earthed at each distribution board.

Where service connections consist of overhead conductors, all metal parts of roofs, gutters and down pipes shall be earthed. One bare 10 mm² copper conductor shall be installed over the full length of the ceiling void, fixed to the top purloin and connected to the main earth conductor and each switchboard. The roof and gutters shall be connected at 15 m intervals to this conductor by means of 12 mm x 0,8 mm copper strapping (not conductors) and galvanized bolts and nuts. Self-tapping screws are not acceptable. Where service connections consist of underground supplies, the above requirements are not applicable.

A separate earth connection shall be supplied between the earth bush-bar in each sub-distribution board and the earth bush-bar in the Main Switchboard. These connections shall consist of bare or insulated stranded copper conductors installed along the same routes as the supply cables or in the same conduit as the supply conductors.

Alternatively armoured cables with earth continuity conductors included in the armouring may be utilized where specified or approved.

An earth conductor shall be installed in all non-metal flexible conduit. This earth conductor shall not be installed externally to the flexible conduit but within the conduit with the other conductors. The earth conductor shall be connected to the earth terminals at both ends of the circuit.

Where non-metallic conduit is specified or allowed, the installation shall comply with the Department's standard quality specification for "conduit and conduit accessories."

Standard copper earth conductors shall be installed in the conduits and fixed securely to all metal appliances and equipment, including metal switch boxes, socket-outlet boxes, draw-boxes, switchboards, luminaries, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

ABP.22 INTERRUPTIONS OF ELECTRICAL SUPPLY

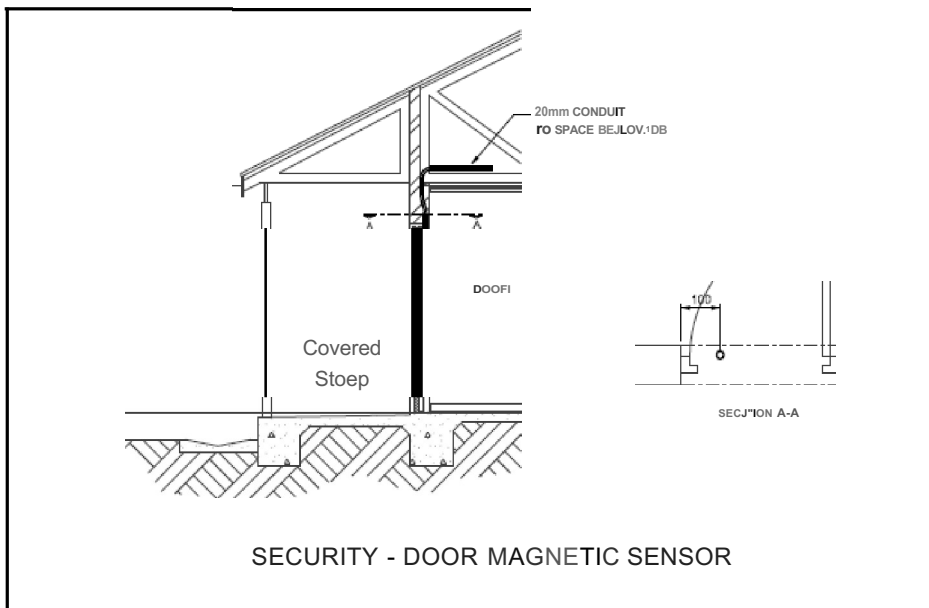
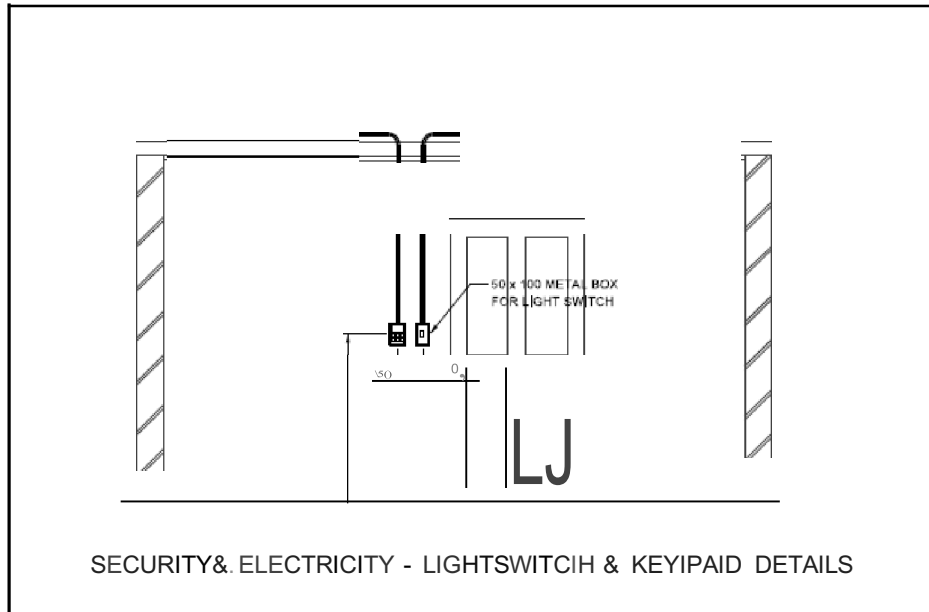
All interruptions of the electrical supply that may be necessary for the execution of the work will be subject to prior arrangement between the Contractor, the schools and the Municipality.

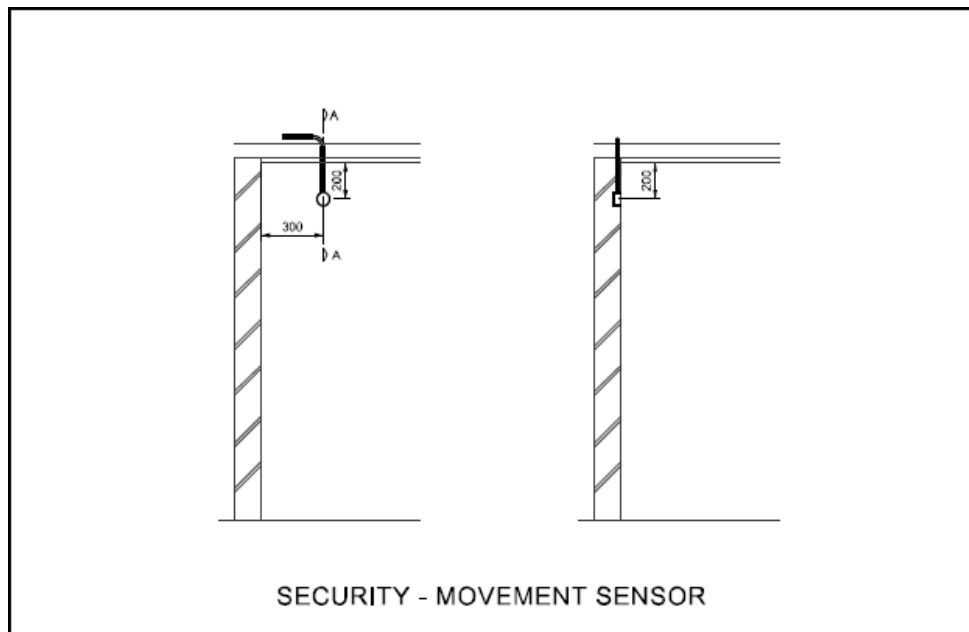
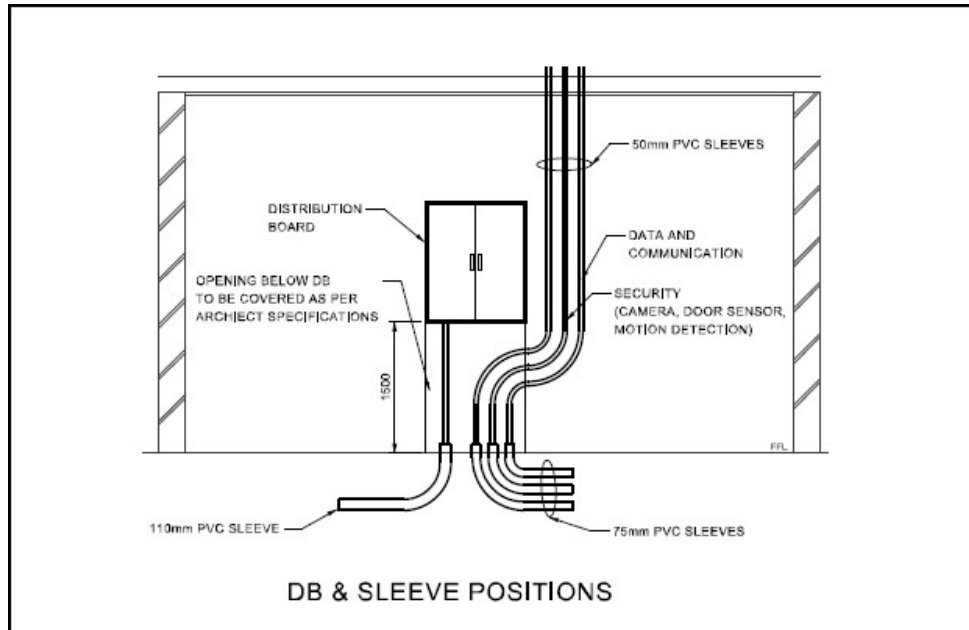
ABP.23 REGULATIONS AND CODES

The complete electrical installation shall be carried out in full compliance with the Wiring Code and with any Regulations or Codes of Practice in force or adopted in the area in which the contract is to be carried out. Tenderers shall familiarize themselves with all such Regulations or Codes before finalizing their prices; no price variations to the contract based on lack of knowledge or such Regulations or Codes will be allowed.

ABP.24 CONDUIT AND WIRING

Conduit will be PVC or steel 20mm or 25mm with SABS markings. Conduit will be fixed with raised saddles to ensure that the conduit is always horizontal at the roof and does not lift at entry level. Saddles will be installed at not more than 1000mm apart





ABP.25 CABLE TRAYS

Cable ladder” cable trays shall be used for all new cables in the ceiling void and service ducting. Typical OL9800 and OL9800 as per request

- Refer to Bill of quantities for detail on widths.

ABP.26 CABLES

Note: All LV regularly used cables will be XLPE Insulated PVC bedded SWA PVC sheathed 600/1000V manufactured to SANS 1507-4.

This contract will require the use of temporally cables from the main DB to the three level DB's that will be 4 Core Rubber insulated trailing cables.

The electrical contractor shall allow for the supply and complete installation of all distribution cables as indicated on the drawings and listed in the Schedule of Cables.

Tenderers must base their tender on the amounts of cable, including earth conductors, as indicated in the Bill of Quantities. During the work the actual lengths will be measured on site and adjustments will be made according to the price per meter length as inserted by the tenderer for the particular cable size concerned.

Tenderers must base their cost for trenching in earth; hard rock on the total quantities as indicated in the Bill of Quantities. The actual quantities, based on the dimensions as specified below for trenches for the applicable number of cables to be laid, will be measured on site during the service and adjustments made according to the price per cubic meter as inserted by the tenderer. Payment for cable trenching having a greater volume than that specified for the purpose will not be considered except where extra excavations are necessary to by-pass obstacles such as water pipes, drains, large boulders etc. In all such instances the amount of the extra excavations must be agreed upon on site between the Engineer and the contractor.

Cables in soil will be buried 1,5m underground. Cables that are attached to roofs or walls will be tied with aluminium strapping (25mm) every 400mm to 100mm cable racks.

The storage, transportation, handling and laying of the cables shall be according to first class practice, and the contractor shall have adequate and suitable equipment and labour to ensure that no damage is done to cables during such operations.

The cable-trenches shall be excavated to a depth of 0,6m deep below ground level and shall be 450mm wide for one to three cables, and the width shall be increased where more than three cables are laid together so that the cables may be placed at least two cable diameters apart throughout the run. The bottom of the trench shall be level and clear and the bottom and sides free from rocks or stones liable to cause damage to the cable.

The contractor must take all necessary precautions to prevent the trenching work being in any way a hazard to the personnel and public and to safeguard all structures, roads, sewage works or other property on the site from any risk of subsidence and damage.

In the trenches made in soft and hard rock the cables shall be laid on a 75mm thick bed of earth and be covered with a 150mm layer of earth before the trench is filled in.

No joints will be allowed in cables.

The laying of cables shall not be commenced until the trenches have been inspected and approved. The cable shall be removed from the drum in such a way that no twisting, tension or mechanical damage is caused and must be adequately supported at intervals during the whole operation. Care must be exercised where it is necessary to draw cables through pipes and ducts to avoid abrasion, elongation or distortion of any kind. The ends of such pipes and ducts shall be sealed to approval after drawing in of the cables.

Backfilling (after bedding) of the trenches is to be carried out with a proper grading of the material to ensure settling without voids, and the material is to be tamped down after the addition of every 150mm. The surface is to be made good as required.

On each completed section of the laid and jointed cable, the insulation resistance shall be tested to approval with an approved "Megger" type instrument of not less than 500V for low tension cables.

Earth continuity conductors are to be run with all underground cables constituting part of a low-tension distribution system. Such continuity conductors are to be stranded bare copper of a cross-sectional area equal to at least half that of one live conductor of the cable, but shall not be less than 4mm² or more than 70mm². A single earth wire may be used as earth continuity conductor for two or more cables run together, branch earth wires being brazed on where required.

ABP.27 LAYING, JOINTING AND MAKING OFF OF ELECTRICAL CABLES

NB: The requirements specified hereafter, are aimed essentially at high tension cable but are also valid for low tension cable, where applicable.

H	The use of the term "Inspector", includes the engineer or inspector of the Department or an empowered person of the concerned supervising consulting engineer's firm.
2	No cable is to be laid before the cable trench is approved and the soil qualification of the excavation is agreed upon by the contractor and inspector.
3	After the cable has been laid and before the cable trench is backfilled the inspector must ensure that the cable is properly bedded and that there is no undesirable material included in the bedding layer.
4	All cable jointing and the making-off of the cables must only be carried out by qualified experienced cable jointers. Helpers of the jointers may not saw, strip, cut, solder, etc. The cable and other work undertaken by them must be carried out under the strict and constant supervision of the jointer.

- 5 Before the contractor allows the jointer to commence with the jointing work or making-off of the cable (making-off is recognized as half a joint) he must take care and ensure:
- that he has adequate and suitable material available to complete the joint properly and efficiently. Special attention must be given to ensure the cable ferrules and cable lugs are of tinned copper and of sufficient size. The length of the jointing lugs must be at least six times the diameter of the conductor,
 - that the joint pit is dry and that all loose stones and material are removed,
 - that the walls and banks of the joint pit are reasonably firm and free from loose material which can fall into the pit,
 - that the necessary cofferdams or retaining walls are made to stop the flow of water into the joint pit,
 - that the joint pit is provided with suitable groundsheets so that the jointing work is carried out in clean conditions,
 - that the necessary tents or sails are installed over the joint pit to effectively avert unexpected rainfall and that sufficient light or lighting is provided,
 - that the necessary means are available to efficiently seal the jointing or cable end when an unexpected storm or cloudburst occurs, regardless of how far the work has progressed,
 - that the cables and other materials are dry, undamaged and in all respects are suitable for the joint work or making off,
 - that the heating of cable oil, cable compound, plumbers' metal and solder is arranged that they are at the correct temperature when required so that the cable is not unnecessarily exposed to the atmosphere and consequently the ingress of moisture (care must be taken of overheating)
- 6 Before the paper insulated cables are joined, they must be tested for the presence of moisture by the cable jointers test. This consists of the insertion of a piece of unhandled insulated impregnated paper tape in warm cable oil heated to a temperature of 130 ± 5 °C. Froth on the surface of the oil is an indication that moisture is present in the impregnated insulation and the amount of the froth gives an indication of the moisture present.
- 7 If the cable contains moisture or is found to be otherwise unsuitable for jointing or making off the inspector is to be notified

immediately and he will issue the necessary instruction to cope with the situation.

- 8 The joint or making-off of paper insulated cables must not be commenced during rainy weather.
- 9 Once a joint is in progress the jointer must proceed with the joint until it is complete and before he leaves the site.
- 10 After the individual cores have been insulated, they must be well basted with hot cable oil and again after the applicable separator and/or belt insulation tape is applied before the lead joint sleeve is placed in position.
- 11 The lead joint sleeve must be thoroughly cleaned and prepared before it is placed on the cable and must be kept clean during the whole jointing process. Seal the filling apertures of the sleeve with tape until the sleeve is ready for compound filling.
- 12 The plumbing joints employed to solder the joint sleeve to the cable sheath, must be cooled off with tallow and the joint sleeve is to be filled with compound while it is still warm. Top up continuously until the joint is filled to compensate for the compound shrinkage.
- 13 The outer joint box must be clean and free from corrosion. After it has been placed in position it must be slightly heated before being filled with compound. Top up until completely full.
- 14 As far as cable end boxes are concerned the requirements as set out above are valid where applicable.

ABP.28 DISTRIBUTION BOARDS AND CIRCUIT BREAKERS

The electrical contractor shall supply and install the distribution boards as indicated on the drawings. All distribution boards shall comply with the quality specification and be approved by the Engineer or by the Department's representative.

All DB's as well as both ends of cables will be marked with engraving on aluminium plate.

All distribution boards shall be manufactured according to the detail specifications and drawings and shall be **inspected** and **approved** by the Engineer before installation.

The Engineer shall first approve any other type of distribution board, which may be submitted as an alternative. All bus bars and lugs shall be insulated, and wiring shall

enter the switch gear from the back of the distribution board. All circuit breakers will be the quality of **CBI** or better.

Quality Specification and Manufacturers:

All switchgear and equipment shall comply with the specification in the document.

Wiring:

The manufacturers shall internally wire all distribution boards. Wiring between switchgear and busbars shall be done by means of PVC insulated stranded copper conductors, fixed to the busbars with copper lugs, and brass bolts.

Only color-coded wiring shall be accepted, e.g.: Red, yellow and blue for phases, and black for neutral.

Wiring coloured by means of PVC insulated tape shall not be accepted.

Wiring shall be neatly strapped in a vertical and horizontal manner. All instrument and control wiring shall be 2,5mm² PVC insulated copper conductors, and shall be numbered for ease of tracing circuits.

Colour:

The colour of all distribution boards shall be light stone, and all painting shall be done in accordance with the standard paint specifications in part 3 of this specification.

Doors:

Where specified, doors shall be of the removable type.

Separate Compartments:

Where distribution boards have separate compartments, they shall be separated by means of a metal dividing section and be equipped with individual removable circuit breaker covers.

Legend Cards:

The legend card will be replaced by the As-Built drawing if the DB layout of the building. Each breaker will be named according to its purpose.

The AS-Build diagrams will be updated and laminated. The laminated prints will be attached at each DB.

Typical wiring diagram of meter kiosk as requested in the bill of quantities

ABP.29**BILLS OF MATERIALS**

- 1 This Bill of Quantities forms part of and must be read in conjunction with the specification.
- .2 No alteration, erasure or addition is to be made in the text of the Bill of Quantities. Should any alteration, erasure or addition be made it will not be recognized but the original wording of the Bill of Quantities will be adhered to.
- 3 The Client will check the completed Bill of Quantities and reserves the right to adjust any individual price and to rectify any discrepancy whilst the total tender price as quoted remains unaltered.
- 4 The quantities given in the Bill for cable, cable markers, earth wire laid with cable, overhead conductors, overhead earth wire and excavations cannot be regarded as exact and are subject to measurement on site after completion of the service and adjustments will be made according to the unit rates given in the Bill.

All other quantities will not be measured on site.

In the event of discrepancies between the drawings, specifications and Bill of Quantities the Client shall decide whether the work as executed shall be re-measured on site or whether re-measurement shall be effected from the working drawings only.

NOTE:

Checking of Cable and Overhead Conductor Lengths

Notwithstanding the fact that the lengths of cables and overhead conductors as given in the Bills of Quantities have been measured from scaled drawings, the contractor shall check such lengths on site before ordering the cable as he will not be paid for excess cable after the completion of the service. Any allowance for off-cuts shall be made in the unit rates. The final measurements shall be based on the nett route length of the cables and overhead lines concerned.

- 5 Where alternative prices for gear of different manufacture are quoted the lowest alternative price for gear to specification must be quoted against the relevant item in the Bill of quantities. The remaining alternative prices must be furnished separately.
- 6 The unit prices quoted in the Bill of Quantities must include for such small Installation materials as are required for the complete installation in accordance with the specification.

ABP.30 FIRE & SMOKE DETECTION

ABP.30.1 Extent of Work

This specification includes the fire & smoke detection system for the complete building.

The fire detection system shall be utilized for the control of the automatic gas extinguishing system installed in several areas and the detection of fire in non-protected areas.

The Fire Detection system will comply with the SANS 10139-2005 and the BS6266 as amended.

Disaster Recovery Areas will have a standalone detection panel that will be linked to the master or other detection panels in the building.

The information on the panels will be made available on the MTN corporate LAN.

ABP.30.2 Special Notes to Tenderers

The fire detection system specified below and shown on the drawings has been designed with the following assumptions:

All detection loops shall be capable of supporting ± 100 addressable devices including detectors, sirens, break glass units, isolators, I/O units etc. The conduit layout shall be designed according to these criteria. Should the system offered by the tenderer support more or less devices per loop this should be indicated on the accompanying drawings and the effect thereof clearly stated and included in the tender price.

All sirens will be addressable and will be powered by the system. Thus, no provision will be made for separate power supplies or address units to the sirens. Should the items offered require any additional equipment, it should be clearly stated and included in the tender price.

Tenderers shall submit with their tenders all the requirements regarding temperature and humidity control required for the master and remote fire panels, if special environmental conditions are required. Should no special conditions be required, the tenderer shall clearly state this in the covering letter.

Tenderers are allowed to propose alternative designs or technologies than what is described in this specification. These alternatives must however incorporate the design philosophy described in the specification and accompanying drawings.

Tenderers must provide full details, design calculations and the advantages and disadvantages of their alternative proposals with their tender. A detail bill of quantities must also accompany their proposal.

Alternatives will be evaluated at the discretion of the engineer and aspects such as price, technical capabilities etc. will be considered.

ABP.30.3 Detection System

ABP.30.3.1 General Description

The smoke detection system shall consist of a central control unit (main fire panel) connected to field devices such as control units, detectors, break glass units and fire sirens. All the above shall be of the analogue addressable type. The high sensitivity aspirating smoke detection systems will be linked to the loop via Input/Output units to ensure that it is addressable. The I/O units for these shall not be measured separately and is seen as part of each HSSD system.

The panel shall be selected at 80% of its capacity in terms of devices for future expansion. The panel will be a 2, 4, 6 or 8 loop panel, depending on the number of detectors needed.

The main fire panel shall continuously monitor the analogue state of the sensing devices and make all decisions regarding the state of the system. The system shall incorporate self-monitoring and sensor self-test facilities, which will report immediately if any part of the system does not respond correctly.

Alarm management of the system shall be field programmable to enable specific customer requirements to be met. This configuration shall be maintained under power failure conditions for at least 24 hrs.

The main fire panel shall have a front panel consisting of indication LED's, display unit and a control keyboard from which all alarms and programming can be viewed and controlled.

The system shall be of a modular design and shall be able to operate as a stand-alone unit or part of a network if required.

The system shall endeavour to prevent false alarms by using a floating background with automatic level compensation, day/night sensitivity setting and a coincidence mode within and between zones. A soak test facility shall also be available to follow up suspect devices.

ABP.30.4 Standards

All materials, components and equipment used shall be new and of professional quality and shall comply with the requirements of the relevant SABS, BS, DIN or IES specifications.

The latest issues of the following standards form part of this specification:

- SANS 10139: Code of practice for the prevention, automatic detection and extinguishing of fires in buildings.
- SABS 5839: Code of practice for the installation and servicing of fire detection and alarm systems in buildings.
- SABS 6266: Code of practice for fire protection for electronic data processing installations.
- SANS 10142: Code of practice for the wiring of premises.

Any conflict between the requirements of this specification and any of the above standards shall be referred to the Engineer for a ruling.

Equipment shall be standardized throughout the installation and the number of different assemblies used shall be limited to a minimum. Replacement of assemblies and units on a plug-in basis is regarded as essential to facilitate maintenance and to enable staff to do repairs. It will thus be preferred if the address of all the devices is situated in the base and not the head of the detectors.

All materials and equipment shall be suitable for the conditions on site. These conditions shall include weather conditions as well as conditions under which the materials are

installed and used. Should the materials or components not be suitable for use under temporary site conditions then the subcontractor shall, at his own expense, provide protection until these unfavourable site conditions cease to exist.

Samples of all equipment shall, upon request of the Engineer, be submitted for approval before installation is commenced with. All such samples may be retained until completion of the contract.

ABP.30.5 System operations

The system shall be designed to operate with the minimum of operator training. Basic fire alarm functions shall be self-explanatory and the occurrence of a fire or fault alarm shall indicate all relevant information without operator intervention.

In the event of a fire being detected or a break glass unit being activated or upon any other alarm input, an alarm signal shall be raised at the main fire panel. This shall be accomplished by displaying 40 characters of user programmable text, the type of device, zone number, loop number, device number and time and date on the display unit. Audible alarms shall also be activated in the affected fire zones only, programmed relays shall be triggered to turn air conditioning unit off after the second knock, to activate evacuation notices and to release extinguishing gas as required. These controlled outputs shall originate from the main fire panel and shall activate automatically under emergency conditions.

The main fire panel shall be of the analogue addressable type and shall be fully microprocessor controlled. This panel shall be housed in a suitably ventilated, aesthetically pleasing enclosure complete with a key, lock and tamper monitor.

A faulty device, or a detector already in an alarm state, shall not inhibit other detectors in the same zone or line from reporting faults or alarms.

The alarm line shall be monitored for short-circuit, earth fault and open circuit conditions and all faults shall be reported. Alarm indications shall be differentiated from line fault conditions.

The following device states shall be recognized by the fire panel:

- Normal conditions.
- maintenance alarm caused by performance deterioration of the detector due to contamination.
- fire state.
- fault state.

A fault alarm shall cause the master panel to identify the fault fully by displaying 40 characters of user programmable text, the type of device, zone number, loop number, device number and time and date on the display unit.

If a detector head is removed from the base, it shall generate a fault alarm on the panel which can only be reset by replacing the missing device. Removal of a unit shall not restrict the normal operation of the rest of the panel.

Should a detector become contaminated, a maintenance alarm shall be indicated and logged as follows:

- The maintenance alarm LED shall be illuminated.
- the LCD display shall indicate at least the following information: Type of alarm, Zone number, Device number, Type of device, Time and date, 40 characters of user programmable text.
- the panel buzzer shall be activated.
- it shall be possible to isolate a zone or a device from the fire panel without affecting any of the other zones or devices of the system. Isolation of devices shall be under software control.

All loop lines shall be provided with suitable surge protection equipment.

The panel shall be equipped with a keypad to enable control and programming of the panel and this keypad shall normally be disabled and access to this facility shall be protected by means of a software access code.

Indicators LED's to be provided on the faceplate shall, amongst others indicate the following:

- Fire conditions.
- Maintenance alarms.
- Faults on the normal power supply to the panel.
- Power supply to the panel healthy.
- Processor fault.
- System fault.
- An alarm has been silenced.
- A device has been isolated.

It shall be possible to determine the state of each device from the main fire panel.

The main fire panel shall be equipped with backup batteries to maintain the smoke detection system in a fully operational state in the event of a power failure.

The backup batteries shall form an integral part of the main fire panel and it shall be rated to supply emergency power to the system for a continuous period of at least 24 hours.

The main fire panel shall also be equipped with a suitable battery charging circuit to continually maintain the batteries in a fully charged state.

ABP.30.6 Detectors, Manual Alarms and Audible & Visual Alarms

ABP.30.6.1 General

All detectors, break glass units and fire sirens required for this installation shall be of the analogue addressable type. Detectors used shall be approved by at least two of the following internationally recognized laboratories:

- Underwriters Laboratories (UL).
- Verband der Schass Versekerer, Germany VDS.
- British Standards, Great Britain (BS).
- Underwriters Laboratories, Canada (ULC).
- Factory Mutual (FM).

ABP.30.6.2 Multi-sensor detectors

All point type detectors shall be of the multi-sensor type incorporating at least two fire sensing elements (optical and heat). Inputs from both sensing elements shall be used and analysed by the detector's microprocessor with respect to time. On board algorithms should compare historical time readings, time patterns and known fire characteristics to make an alarm decision.

The detector shall continually monitor any changes in sensitivity due to environmental effects of dirt, smoke, temperature, aging and humidity. It shall also be possible to adjust the sensitivity level of each individual detector to suit environmental needs.

The detector shall be equipped with indication LED's which will discriminate between when the detector is in monitoring state (LED flashing). Detectors shall be installed so that the LED is visible from the main entrance to the room or office.

All detectors shall be complete with the necessary communications circuitry required for communication with the master fire panel. The communications circuitry shall form an integral part of the detector and shall be factory fitted by the original manufacturer of the detector.

Each detector shall be supplied with a separate base, which will allow for the removal of the detectors head for maintenance purposes.

The unique address of each detector shall be set by means of a coded plastic card fitted to the detector base or DIP switches in the detector head. Preference shall however be given to detectors that are software programmable.

The detector shall be suitable for operation within the following minimum conditions:

- Temperature: -10 to +60 °C.
- Humidity: 0% to 95% RH.
- Wind resistance: Up to 10 meters per second.

The detector and detector base shall be constructed from white, self-extinguishing

polycarbonate plastic and all smoke entry points must be protected against dust and insect ingress by means of corrosion resistant gauze.

ABP.30.7 Break Glass Units

These units shall be manufactured from red self-extinguishing polycarbonate plastic and shall be suitable for surface mounting over flush mounted round conduit boxes.

These units shall be addressable and shall be complete with the necessary communications module and an indication LED, which will illuminate when the unit is activated. Means shall be provided to test the individual units without removing the glass front cover of the unit.

The break glass units shall be equipped with a normal open soft contact with a mounting plate and a glass front. The words "IN CASE OF FIRE BREAK GLASS" or any other similar wording approved by the engineer must be clearly marked on front of the unit.

To avoid accidental operation the break glass unit must be fitted with a clear plastic cover. This cover shall be hinged at the top and has to be raised before operation is possible.

ABP.30.8 Audible Alarms

Fire sirens shall comprise an audio frequency generator, an amplifier and a pressure chamber loudspeaker. The unit shall be suitable for surface mounting and shall comply with the following:

- Operating voltage: To suit control panel output.
- Sound level at 1 meter: 100dBA.
- Duty cycle: 100%.
- Permissible temperature: -15°C to +50°C.
- Frequency: Auto switching between high and low tone in frequencies of 2500 – 3000 Hz.
- Alarm bells shall be provided in the gas-protected areas as indicated on the tender drawings. Bell alarms shall be 150mm in diameter and shall be installed on a height of 500mm below ceiling level.

ABP.30.9 Visual alarms

Evacuation signs shall be provided and installed above, or if this is not possible, next to the doors leading out of the gas protected areas, as indicated on the drawing. These signs must not be legible under normal circumstances, but on receipt of the first fire detection signals the sign shall become legible illuminated by a flashing light. The light shall illuminate the sign permanently upon the receipt of the second fire detection signal.

The lettering of the sign shall be at least 40mm in height and the wording shall be as

indicated on the drawing.

ABP.30.10 Fire Detection Zones

The system shall be configured to allow separate fire zones with multi sensors for each of the areas as shown on the drawings:

ABP.30.11 Interface to other Systems

The smoke detection system shall provide the control for disabling of the air-conditioning system, opening and closing of pressure relief dampers and opening of fire dampers. This interfacing shall be done by means of analogue addressable relays.

ABP.30.12 Testing and training of the end-user

The contractor shall be responsible to train 3 operators per site. The operators shall be trained to operate the system, to configure the system, to program the fire panels and any other functions required to enable independent operation of the system in all respects.

Three sets of operating and instruction manuals shall be supplied as part of this contract. These manuals shall contain a complete set of as-built drawings shall contain scanned images of the system with detailed descriptions of the operating thereof.

ABP.30.13 Testing and Maintenance:

The installation shall be completely tested in accordance with the requirements of NFPA2001.

The engineer shall do spot checks on the performance of the system.

The assistance of the SANS will be obtained when any dispute arises as to the interpretation of results.

The successful tenderer shall be required to supply all equipment and material to test the smoke detection system in its entirety.

Smoke detection system shall be done with the gas control unit in manual mode.

All pages will be laminated and contained in a 4-lever file.

ABP.30.14 Cabling, Wiring and Conduit

Unless otherwise specified, wiring shall be carried in conduit throughout. All conduits for the fire detection system shall be provided and installed by the tenderer according to the attached drawings and bill of quantities.

The loop-in system shall be followed throughout, and no joints of any description will be permitted.

All cabling between panels and devices will be fire retardant (FR 20) and will be of the multi strand type at least 0.8mm². The cabling will be adequately sized to ensure the minimum power loss in the cable. Cabling between panels and network points will be Fire retardant CAT 5 cable.

ABP.30.15 SCHEDULE OF TECHNICAL INFORMATION

The tenderer is required to fill in the information as requested below. Incomplete schedules will render the tender non-responsive.

Fire Protection System: _____
Commercial Name of Gas System: _____
Authorised by: _____
Design Concentration of gas: _____
The complete installation will comply with NFPA 2001 _____ Yes /No
Fire Detection System: _____
Type of system: _____
Type of detectors to be used: _____ Heat/Ionisation/Multi/Optical
Loop system to be used: _____ Class A/Class B
Detectors individually addressable: _____ Yes/ No
Fire Detection Panel: _____
Gas Control Units: _____
Cabling: _____

ABP.31 DATA CABLING SPECIFICATION

ABP.31.1 GENERAL

This specification covers the supply, delivery, installation, testing, commissioning and maintenance during the guarantee period of the Data Cabling Installation covered under the scope of works for the Proposed New Development for the above-mentioned building.

ABP.31.2 SCOPE OF WORKS

ABP.31.2.1 DATA

This specification covers the supply, delivery, installation, testing, commissioning and maintenance during the guarantee period of the Data Installation, described below, for the Proposed New Development for the above-mentioned building.

1. Backbone infrastructure in the form of fibre-optic cabling to be able to provide the bandwidth specified.
2. Fiber Optic from each server building to Block A.
3. 42U racks as specified.
4. 12 U Swing frame cabinet (12U X 600 X 500).
5. Cat 6 cabling between workstations and patch panels including terminations and plugs in power skirting.
6. Patch panels as specified.
7. Patch leads to switches.
8. Labelling as specified.

ABP.31.2.2 MEASUREMENT

The attached Bill of quantities will be a guideline based on this specification and the accompanying drawings. The tenderer is to measure off the drawings for tender purposes, however, on award of contract the contractor shall measure on site quantities needed for installation. The tenderer is to provide a breakdown of his tender on the tender schedule page. The quantities provided can be adjusted and are for information only.

ABP.31.3 FORM OF CONTRACT

The successful tenderer shall enter into a selected subcontract agreement with the electrical contractor under the JBCC contract.

ABP.31.4 RELATED WORK BY OTHERS

N/A to this project.

ABP.31.5 STRUCTURED CABLING REQUIREMENTS GUIDELINE

ABP.31.5.1 COMPLIANCE

This Structured Cabling Systems (SCS) guideline, as outlined in the pages to follow, is mandatory in terms of the acceptance of work done in or on School premises and facilities.

The acceptance requirements as outlined in this document are mandatory. No variation will be tolerated nor accepted.

The design of the Structured Cabling System shall comply with the requirements of ISO 11801: 2002, and TIA 568-B.

Copper transmission performance shall exceed the specification for a Category 6 link as defined by the above standards.

The Quality Assurance provisions applied to the installation shall be compliant with BS EN 50174-1 and the Molex Premise Networks Global Warranty requirements.

Installation practices shall be compliant with ANSI/NECA/BICSI-568-2006, Standard for Installing Commercial Building Telecommunications Cabling and shall be wholly compliant with the installation practices laid down by Molex Premise Networks.

Installation practices shall also meet all applicable local and national codes, standards and ordinances. Where a conflict exists between these standards, it is the responsibility of the contractor to detail these conflicts to the client prior to installation commencing.

ABP.31.5.2 DOCUMENT SCOPE

This document is intended as a guideline and therefore does not supersede the International Standards on which it is based. The purpose of the document is to provide the contractor with information specific to the implementation of Standards based generic structured cabling as per the requirements of the University Network environment and the support/maintenance thereof.

ABP.31.5.3 CONTRACTOR MINIMUM QUALIFICATIONS REQUIREMENTS

1. The contractor shall be Molex certified and possess a valid, authenticated Molex Certified Installer or Molex Business Partner certificate in order that the final installation be certified in accordance with the Molex Global Warranty program requirements.
2. The contractor shall provide only skilled labour to complete work within the agreed upon time frame.

3. The contractor is responsible for the provision of all tools required to full fill his installation obligations in accordance with task at hand at his cost. This includes specialist tools such as core drills etc.
4. By means of the submittal of a quotation and the acceptance of the relevant order number, the contractor is solely responsible for the successful delivery of all documentation pertaining to installed components. E.g. Floor plans, excel sheets and test results to Ingcali Consulting engineers.
5. The contractor is solely responsible for the thorough pre-quotation inspection and installation evaluation of any given project for which a quotation is submitted. Any over-sites on the part of the contractor are for his account.

ABP.31.5.4 100 OHM UTP STRUCTURED CABLING SYSTEMS (SCS) GENERAL PRODUCT CONFORMANCE REQUIREMENTS

1. The minimum acceptable cable performance category to be installed on premises shall be ANSI/TIA/EIA-568-B Category 5e / ISO 11801 Class E (2002) compliant.
2. Only cable and connecting hardware specified for the Molex Premise Networks Structured Cabling Solution shall be used.
3. All installed components shall be new, complete, in good condition and unused albeit for demonstration purposes.
4. All cable reels are to be visually inspected for damage incurred during shipping and transit prior to installation.
5. Cable and connecting components found to be damaged or defective prior and during the installation process are to be removed immediately and returned to the supplier at no additional cost to the Client.

ABP.31.5.5 GENERAL PRODUCT PERFORMANCE REQUIREMENTS

The supplied product shall, once installed, conform to ISO 11801 Class E -2002 electrical characteristics for the purposes of Vendor warranty.

It is expected that installed products be capable of supporting voice and data communications applications and protocols from baseline 56Kbps to ISDN PRI for Analogue and Digital Voice and 10Base T to 1000 Base T for data as per the supported applications of ISO 11801 Class E (2002).

The project will be completed and signed off in 7 different phases by the Contractor and Ingcali Project Manager:

Phase 1: Category 6 Data cable Installation:

This comprises the horizontal cabling, extending from the patch panel in the rack or cabinet to the consolidation point if applicable and extending to the telecommunications outlet in the work area. This is the part of the horizontal cabling referred to by the standards as the Permanent Link. Both ends of the cable must be terminated to specification and labelled at both ends by means of a legible, permanent label. Where applicable, the portion of the horizontal cable extending from the patch panel in the cabinet to a consolidation point, intended for future extension to the telecommunications outlet, will be accepted.

Installation	Colour of Cat6
Data	Blue
CCTV	Green
Wireless points	Black

Phase 2: Category 6 Patch leads:

Provide patch leads from the patch panels to the switches and panels.

Installation	Colour of Cat6
Data	Blue
CCTV	Green
Wireless points	Black

Phase 3: The Main Fibre Optic Installation:

The installation of a 12 Fibre Multi Mode Heavy Duty Duct Cable cabling, extending from the patch panel in the rack in the main administration building to the patch panel in the cabinets in the other blocks.

Phase 4: Installation of all equipment such as network points, cameras etc. The Main Fibre Optic Installation:

Phase 5: Testing and Labelling:

All outlets will be tested using the appropriate Level 3 test equipment, set to the ISO 11801 Class E Permanent Link setting. All links shall be permanently labelled at both ends of the cable, on the telecommunications outlet fascia and directly above or under the patch panel port as per the labelling requirements set out as specifications in this tender document.

Phase 6: Warranties:

All test results and floor plans will be submitted to Molex Premise Networks' INSIGHT on-line warranty registration program in electronic format for Warranty purposes. The contractor must furnish the INSIGHT reference number to the Ingcali Project Manager.

Phase 7: Final Handover:

The contractor will hand over all documentation, including, updated floor plans (as installed), test results and authenticated 25-year Molex System Performance Warranty Certificate to the INGCALI Project Manager, who will then sign off the installation.

ABP.31.5.6 GENERAL INSTALLATION PRACTICE REQUIREMENTS

1. During the cable installation process, the manufacturer's maximum tensile load recommendations may not be exceeded. This is typically specified as 110N but should be verified with the manufacturer.
2. Cable being pulled in should be always handled by no less than two individuals to avoid damage to the cable by means of kinks, twisting along its own axis, getting snagged etc. It is recommended that three installers co-operate in the pulling in of any given cable run, one on each end and another in the middle or positioned near any obstructions to feed slack and thus avoid undue stress on the cable.
3. Whenever possible cable should be placed into pathways rather than be pulled in under tension.

4. Care should be taken not to score conductors during the removal of the outer insulating sleeve of the cable when preparing to terminate pairs.
5. Cables should not be subjected to a bend radius of less than 50mm when under tension (during installation) and the bend radius should not be less than 25mm when once installed.
6. During the installation process, installers are required to visually inspect cable and connecting hardware components for damage. If such damage is found, e.g. tears in the outer jacket of the cable, severe kinks as identified by white/grey bands of discoloration on cable jacket, these components are to be replaced immediately.
7. The installer is to make use of best practices when handling unjacketed conductors. Care is to be taken as not to create pair spread, pair wrapping, pair separation and the re-twisting of pairs.
8. Pair twists must be maintained up to the point of termination. Under no circumstances may pair untwist of more than 6 mm be allowed. The sheath should be trimmed such that no more than 25mm of wire may be exposed after termination.
9. All cabling shall be clearly labelled at both ends to the rear of the point of termination no more than 100mm from such a termination point.
10. All patch panel ports, and workstation outlets shall be clearly labelled by means of appropriately secured printed labels (handwritten labels are not acceptable).
11. All patch and workstation outlet cables shall be clearly labelled by means of an appropriately secured printed label.
12. All labelling schemes shall be confirmed with the appropriate representative of Ingcali/Project Manager before being applied.
13. The maximum number of screws or bolts as provided for by the design of connecting hardware or SCS components and accessories are to be used without exception.

ABP.31.5.7 DUCTING AND SUPPORTING STRUCTURES

1. Where support structures are used, such structures are to provide support at a maximum of 1.5 meters along the length of the run as to

avoid cable tension because of the cumulative weight of such cable acting upon itself at the next point of support.

2. The surface of such support structures e.g. Cable hangers will not pose a risk of damaging cable due to sharp edges or angular surfaces which would act against the symmetry of wire pairs within the cable or a risk to installers e.g. Cuts.
3. Where cable ties are used, they are to be securely fastened but still permit for cable movement if tugged upon making use of reasonable force.
4. Cable ties are to be used at set intervals of 300mm for all cable bundles where exposed to present a uniform appearance. In concealed spaces, the bundles may be tied at nominal 1m intervals.
5. Under no circumstances shall any cable/s hang unsupported, vertical runs are to be supported are no greater than 300mm intervals.
6. When cable ties are cut; once appropriately fastened around cable bundles, to remove protrusions beyond the buckle, the installer will ensure that such a cut is clean and that no sharp edges are created which would damage other cable being pulled past it or injure installers and support staff.
7. Cable shall under no circumstances be strapped to PVC electrical conduit or any structures belonging to an unrelated functional unit such as an air conditioning drainpipe as future maintenance by associated maintenance staff may result in damage or removal to facilitate work.
8. Where purpose-installed conduits are to be used for structured cabling, such conduits may never be filled beyond 40% of capacity and should bend at a radius of no less than 6 times the outside diameter of such conduit, nor shall more than two 90-degree bends along the total span of such a conduit. No continuous conduit run may exceed 15 meters without an appropriate draw box.
9. Cable is at no point to be placed directly on top of suspended ceiling tiles.
10. Contractors are to ensure that cable is not installed in areas such as roof spaces or in direct sunlight where temperature ranges might exceed the manufactures operating temperate specifications (typically not in spaces where temperatures exceed 60 degrees Celsius.).

11. All metallic support structures, be it conduit, ducting or trays, shall be grounded in accordance with national electric regulations.
12. Ducting systems shall be securely fastened to walls by means of the appropriate fixing hardware to ensure a sound and durable installation.
13. Ducting system covers are to be fitted securely and any portion of the ducting system found to be cracked or damaged is to be immediately replaced.

ABP.31.5.8 POWER AND EMI SOURCE SEPARATION

1. Cable may be laid adjacent to sources of interference such as 240V electrical branch circuits with a minimum separation 75mm where:
 - a. A continuous grounded metallic barrier exists between electric cable and structured cabling.
 - b. A durable non-metallic insulation exists, other than the insulation material of the cable.
2. At no point may data cabling cross the path of any power or broadband cable, LED lighting unit (where suspension is used as a means of separation) at an angle less or greater than 90 degrees.
3. The installer is to ensure that electrostatic devices such as photocopiers and sources of radiation such as x-ray devices, radio transmitters, their antennae and associated broadband cables are to be avoided when routing cable.

ABP.31.5.9 POST-INSTALLATION TEST AND CERTIFICATION

General Requirements

1. Every cabling link is to be tested and must meet with the requirements of ISO 11801 Class E (2002) Permanent Link model across the full length of the link.
2. Test requirements are as per Permanent Link certification requirement for which the appropriate test adapters are to be used.
3. The contractor will ensure that the full plot data is stored for each test.

4. The test results shall also be in in the test equipment native software format (e.g. Fluke Networks Linkware format (.flw)).
5. Test results are to be stored and provided to Ingcali/Project Manager staff in electronic format in .csv and .flw. When submitting to Molex Premise Networks, the test results must be in the test equipment's native software format.
6. Only Fluke DTX series testers will be used to certify University SCS's or their subcomponents running the current firmware.
7. The test equipment is to be well maintained and in good working order. Ingcali/Project Manager staff reserves the right to insist on an annual factory calibration certificate for the instrument to be used for testing.
8. Ingcali/Project Manager staff further reserves the right to insist on being present during the self-calibration of the test unit and the instruments initial configuration prior to test and during the test process itself.
9. The contractor is to advise Ingcali/Project Manager staff within 3 working days of intent to commence testing in order that such a staff member may make himself available to attend testing procedures.
10. The contractor is required to make available the test equipment and necessary personnel at no extra cost should a member of Ingcali/Project Manager wish to perform random acceptance testing on approximately 10% of the installed cabling infrastructure.
11. Ingcali/Project Manager staff reserves the right to decline acceptance of marginal performing cables irrespective of their having passed testing based on risk of future degradation over the life span of the installed product.
12. Where it is found that the random tests do not match those presented, Ingcali/Project Manager staff reserves the right to insist on a supervised re-test of any or all installed cables prior to acceptance.
13. It is the sole responsibility of the contractor to ensure that the appropriate Vendor test and documentation requirements are met in order that Ingcali/Project Manager be provided with a warranty certificate issued by the SCS Vendor.

14. Any contention regarding Vendor warranty requirements is to be resolved between the Vendor and the contractor and has thus no bearing on Ingcali's requirements as outlined here.
15. Documentation is to conform to the guidelines of EIA/TIA 606-A and provided in 4 parts:
 - a. An excel sheet indicating cable label, location of work area and Telecommunications closet termination points etc in electronic format.
 - b. Detailed test results in .flw (Fluke Networks Linkware) or similar native software format inclusive of all plot data.
 - c. A floor plan or site diagram reflecting the routes taken to and location of all installed cables in electronic format.
 - d. Laminated A3 sheets showing the floor plans for the area covered per rack and labelled voice & data points, to be placed inside each rack.

ABP.31.6 INTERCONNECTING BANDWIDTH

Backbone connectivity

The minimum bandwidth specification will cope with an Ethernet backbone operating at 10 GB/s as per the IEEE 802.3ae specification. OS1 Single mode Fibre of appropriate physical construction suitable for the intended environment may be used.

ABP.31.7 INTERCONNECTIONS

Sites

All buildings will be provided with a 12 pair, 24 cores fibre optical cable from the building to the main admin building

A dedicated fibre 6 pair, 12 cores link will be installed from the Main Admin Building to the security building.

Users

The maximum length from the patch panel in a distribution centre to the user wall socket will be 85 meters.

ABP.31.8 GENERAL

1 x 42 U rack will be provided. This rack will contain a 5 kVA rack mount UPS modules as well as the switches and interconnection to cope with voice and telephony requirements for the users. Each rack will have two separate (i.e. fed from different phase), 5 kVA UPS backed power supplies that provides 220V, 50 Hz, sine wave power with a 5% tolerance on the stated measures.

Each rack will have the power connections from the top of the rack and the data connections will come from behind and the bottom.

There will be walkway of 800 mm width in front and behind the cabinet(s) as depicted in figure 1 below.

ABP.31.9 RACK SPECIFICATIONS

- 42u x 1000mm deep.
- 1 x 4-Way extractor fan tray mounted to the top of the rack.
- 2 x 5-way dedicated Power Distribution Units (PDUs) mounted inside the racks
- Solid lockable doors on the back and sides, and lockable glass door on the front.
- Standard colour rack – goose grey.

ABP.31.10 CABLE COLOURS

- The horizontal Data cables must be Standard RAL Blue colour PVC.
- The horizontal camera cables must be Standard RAL Green colour PVC.
- The horizontal Wireless access point cables must be Standard RAL Black colour PVC.

ABP.31.11 FIBRE

- SC duplex connectors on all fibre trays.
- 3m SC to LC fibre patch leads to be provided.

ABH31.12 PATCH PANELS

- Only Molex 1U 24-port Harmonica patch panels to be used.

- All the cables will be patched in separate panel. Switches will be installed in separate panel and connected with patch leads.

ABH31.13 LABELLING OF DATA, VOICE, FIBRE CCTV and WIRELESS POINTS

- First patch panel begins with letter A, Points 1-24.
- Second patch panel begins with letter B, Points 1-24.
- Continues to Z, Points 1-24.
- Then starts with AA, Points 1-24.
- Next panel is AB, Points 1-24.

ABP.31.14 SCHEDULE OF DATA/TELEPHONE OUTLETS

CAT 6 CABLING

See Bill of Quantities.

ABP.31.15 FIBRE OPTIC CABLING

The distance From Block A to any of the buildings is below 500m which makes the use of multi-mode fibre possible.

ABP.32 INTRUDER ALARM

The specification for the intruder alarm system is directly based on the requirements from the South African Intruder Detection Services Association (SAIDSA).

This specification lays down the minimum requirements for the construction, installation, operation and maintenance of intruder alarm systems in buildings. Specifications herein contain requirements to be applied in the aforesaid. Any deviation is to be indicated on the installation certificate and such deviation should not be seen as an acceptance of compliance.

ABP.32.1 CONSTRUCTION

The intruder alarm system shall consist of detection circuits, various detection devices, control equipment, one or more signalling circuits, signalling equipment and the necessary power supply equipment.

ABP.32.2 PRECAUTIONS AGAINST TAMPERING

- The control panel housing cover and electronic detection devices e.g. PIR, glass break, etc must be tamper protected on a 24 hour zone in retail, commercial, industrial and high risk domestic installations.
- The communication devices, antenna, control panel and power supply must be in a protected area.
- Wiring of electronic detectors may not use a common negative.
- The detection devices and other parts of the alarm system shall be so mounted and located that the possibility of interference by mechanical or magnetic means is reduced to a minimum. Where the frame of a protected door, window or other entry exit point can be readily displaced, this displacement must create an alarm condition.
-

ABP.32.3 DETECTION CIRCUITS

Every detection circuit forming part of the intruder alarm system shall be so arranged that failure of the power supply to the circuit displays a fault condition during arming.

ABP.32.3 CONTROL EQUIPMENT

ABP.32.3.1 LOCATION AND ENCLOSURE

Where ceiling access is possible, the control panel, radio and antenna shall be installed a minimum of 1,5m below the ceiling, or in an area that is not vulnerable to tampering from within the ceiling void. These devices must be protected by a volumetric detector on an instant zone and must not be visible from the outside of the premises. This will not apply in the stay mode.

ABP.32.3.2 SYSTEM CONTROL FACILITIES

- Digital keypads are to be of the data transfer technology type.
- The use of a mechanical key switch alone, is prohibited.
- In the case of an intruder alarm system having a keypad as an integral part of the enclosure, it may not be part of the entry/exit area. In the armed state, a person must not be able to gain access to the control panel within the entry delay period. The control panel and battery must not be in an entry/exit delay zone. It is recommended that remote arming or a second keypad be used.
- Remote Arming (Also called key fob arming) All remote arming transmitters must be of the Encrypted Rolling code type. In commercial installations, remote arming is only permissible if the code verification takes place within the control panel using a unique user/engineer identification.
- The client must be clearly informed of any possible risks associated with the use

of remote arming.

ABP.32.3.3 DISARMING

When using a time delay on a zone protecting the keypad, such entry delay shall not exceed 30 seconds.

ABP.32.3.4 ARMING

- During the arming period procedure, the status of all isolated circuits or faulted circuits shall be easily accessible.
- Circuit Identification.
- Where more than one detection circuit is used, the control equipment shall be capable of indicating immediately the individual circuit in which the alarm condition occurred, on disarming the control panel.
- Bypass/Isolation.
- Once armed, no bypassed zones shall be indicated on the keypad.

ABP.32.3.5 POWER SUPPLY EQUIPMENT

- The mains transformer must be a minimum of 40VA, fused, surge protected and should not be less than the control panel manufacturer's specification. Due consideration must be given to the current draw of all devices connected to the control panel. All transformers shall have internal PTC's and/or thermal fuses for protection against short circuits.
- The control panel back-up battery must have a minimum capacity of 7.0AH and be of the sealed type or have a minimum standby time of six hours for any part of the system. The control panel must provide a low battery cut-off of a minimum of 10.2V (Exclusive of wireless systems).
- The battery charger shall be sufficient to recharge the battery to the required capacity within 24 hours.
- The use of liquid electrolyte lead acid type or car batteries is not permitted.
- A mains failure or low battery signal shall be transmitted to the central station.
- The cable from the transformer to the control panel must have a minimum core diameter of 0.5mm (Cabtyre) .
- All power supply equipment shall be correctly earthed according to manufacturer's instructions using an electrical earth.

Audible sounders

- The audible sounders shall be capable of sounding for a minimum period of three (3) minutes and must comply with the relevant Municipal Regulation.

- All sounders must be audible unless agreed to in writing between the client and the installation company.
- External sounders shall have their cables monitored for tamper by the control panel.

To Central Stations/Control rooms.

- The following methods are considered acceptable. Use can be made of one or more of the following. Dual monitoring using different technologies or carrier mediums is recommended.
- PSTN.
- Radio.
- GSM Communication.
- SWIFTNET.
- TCP/IP.
- Spread Spectrum.
- Minimum signals i.e. burglary and panic must be monitored separately.
- The radio transmitter and antenna must be correctly installed to manufacturers specifications.
- The DC power cable from the Radio transmitter to the control panel must have a minimum core diameter of 0.5mm (Cabtyre or Ripcord).
- Where required, all communication equipment shall be ICASA approved.
- Where any communication mediums are vulnerable or unreliable, a second or alternate method of signalling must be used.

GSM Requirements

- Where GSM transmitters are used, the GPRS should revert to another network or to SMS signals where signals are weak or high volumes of traffic exist on the network.
- No pre-paid SIM cards will be permitted.
- Only Private Networks (APNs) may be used.
- GSM Clients should be clearly informed that they are being monitored by GSM technology as well as any risks associated with the connection of this equipment to the cellular network.
- Commercial, Retail, Industrial and high-risk domestic installations must have Dual monitoring, using different carrier mediums.

General Requirement

Communication cable shall not form part of main wiring harness and shall be run in such a manner as to protect them from tampering or physical damage. Cables to the communications devices must be wired below the ceiling.

ABP.32.3.6 INSTALLATION AND DETECTION DEVICES

- Detection circuit restriction
- A detection circuit/zone must consist of only one of the following combinations:

ABP.33 IP SURVEILLANCE AND DIGITAL VIDEO RECORDING SPECIFICATION

ABP.33.1 GENERAL

- This part of the specification covers the design, supply, installation and commissioning of all equipment for the IP Surveillance system. The entire installation shall function as a single integrated IP Surveillance system.
- The IP Surveillance system shall be capable of being fully integrated with the SMS via a bi-directional high-level interface to allow monitoring of all cameras by the SMS and to allow the intercom calls to trigger the IP Surveillance system camera and display the video of door and/or gate to the SMS operator terminals, in a picture-in-picture format.
- The IP Surveillance system shall consist of IP Cameras connected to Video Encoders.
- From a very general point of view, IP Surveillance system cannot be considered as a Security matter such as physical Security, Anti Intrusion or Access control are to be.
- IP Surveillance must be considered as an add-on module to existing Security devices.
- It is considered that pictures must be used for general purpose, remote management and archiving as to cover the direct staff process followed by the operators.
- This means that, normally, the IP Surveillance system will be designed as a dedicated video server allowing surveillance of activities, general surveillance activities on separate and / or shared cameras and allowing remote use.

The following components of the system shall form part of this Contract:

- Indoor and Outdoor IP Colour cameras, housings and mountings.
- Cat-6 FTP cabling.
- Digital Video Encoders.
- Digital Video Recording Servers.
- Power supply units.
- Equipment rack cabinets.

ABP.33.2 SYSTEM DESCRIPTION

- All cameras will be digital IP with IP Video Encoder type. The cameras shall be selected for suitability for internal and external surveillance.
- All cameras will be from the colour type and if the lighting conditions are too poor, Day/Night cameras will be used.

- Indoor cameras shall be standard vandal resistant ceiling/wall mount fixed dome and fitted with built in variable focal, auto iris lenses to ensure optimal optical efficiency. Where no false ceiling is available, cameras will be mounted against wall in vandal proof dome housing.
- Outdoor cameras shall be mounted in purpose made weatherproof housings to protect camera from dust, rain and strong winds.
- All cameras shall be fitted with surge protection against possible lightning and electrical interference.
- All camera signal, data and power cable will be wired to the equipment cupboard closest to its position. The video data signal cable (Cat6 FTP) will be terminated to the server cabinets located around the site. All cameras and switches will be Power-Over-Ethernet compliant.
- A suitable communication path shall be provided to ensure reliable transmission.
- The system shall be motion detection activated. All activities shall be recorded on a centralized archive storage facility.
- All signal, control and power cables shall be installed inside conduit, trunking and cables racks/baskets. The Contractor shall agree with the Engineer all routes. All cables shall be protected against lightning damage.
- All camera lenses shall be 1/3" vari-focal, DC or Video Iris type. All lenses shall be of Day/Night optics type. The correct angles of view will be set up for each individual camera. All lenses shall be of glass type lens and not plastic.

ABP.33.3 CAMERAS

Outdoor Fixed Cameras (IP Type):

	Item	Description
	Type/Imager	6mm" High Resolution CCD
	Max resolution	2688 x 1520
	Signal Processing	Digital Signal Processing
	Video	Standard PAL/ NTCS; M-JPEG/ MPEG4; 1-to-25 IPS
	Data Rate	32 Kbps to 8Mbps
	Network Protocols	TCP/IP, ICMP, HTTP, HTTPS, FTP, DHCP, DNS, DDNS, RTP, RTSP, NTP, UPnP, SMTP.
	Ethernet	10/100 Base T Auto Sensing, Half/Full Duplex, RJ 45
	S/N Ratio	>52dB

	Max illumination	Colour: 0.0005 Lux @ (F1.0, AGC ON), 0 Lux with white light
	Day/Night Mode	Auto
	Lens Mount	C or CS Type
	Power Input	PoE IEEE 802.3af compliant
	Lenses	6 mm, horizontal FOV 58°, vertical FOV 31°, diagonal FOV 69°
	Housing	Outdoor Weatherproof IP65

AB.H33.4 VIDEO SURVEILLANCE CONTROLLING AND RECORDING SYSTEM

System Description

- The product described in this specification shall be a pure Digital IP Based Video Management System (VMS) that shall be established on one or multiple standard Intel XEON, multi-CPU's, standard PC platform, with 100Mbit or 1/10 GBit network interface. The Contractor shall ensure that the computer equipment supplied including Workstations and Servers are appropriately sized for high quality, robust, real time CCTV performance. The CPU, RAM and hard disk storage will be sized according to the intended integrated applications' needs - the CPU and memory usage will never exceed 80% utilisation when used under full system load. The Bidder shall include the above requirement in its pricing offered and no additional claims shall be entertained.
- The solution must work on open standard, camera control software with multi-channel and multi-vendor support, using standard IP network cameras.
- The solution must be fully scalable in both number of cameras, recording PC's, recorded frames per second on the entire system, and scalable in the recording capacity, with both local storage and network storage.
- The VMS system shall be designed as a distributed architecture for a full redundant operation.
- The VMS system shall support IP cameras and IP domes.
- The VMS shall be based on a 10/100/1000 Ethernet networked based video and shall not utilize DVR technology.
- The VMS shall be a software-based solution running Ethernet network

communication protocol between all IP cameras, camera encoders, operator stations and the network video archive server.

- The VMS system shall be based on high quality directly network-attached cameras. The VMS shall support these video compressions simultaneously.
- The VMS system shall sustain full operation using CIF, 2CIF, VGA, 4CIF and Mega-pixel video resolutions. The system shall support all cameras at maximum frame rate and resolution while maintaining less than 80% load on the server.
- The VMS video recording server(s) (video archive server) shall as a minimum provide multi-video compression support and shall simultaneously record video and provide these signals for live monitoring or archive playback. These recorders shall have a 1000/10000Mb network interface and shall only be of a major brand name manufacturer of computers and servers. Servers and computers which are not designed and built by major brand name manufacturer will not be considered as an approved equal.
- All network equipment shall be based on a major brand name manufacturer and shall be of Layer-2 and as a minimum. The IP network shall support Multicasting between all ports and shall allow Multicast streams to be routed between networks.
- The VMS storage system shall be based on advanced recording methods and shall not rely on the Windows Operating System to manage storage. The VMS storage as a minimum shall provide RAID-5 redundancy. The storage shall provide for hot swap spare hard drive. The system shall be of DAS (Direct Attached Storage), NAS (Network Attached Storage) or SAN (Storage Area Network) system. Storage not designed and build by major brand name manufacturer will not be considered.
- The system shall be flexible and as a minimum the compression scheme shall be able to run in one of several bandwidth selections. Each stream bit rate target shall be configurable but not limited to be between 32kbps and 4096kbps.
- The system shall allow the recording, live monitoring, playback of archived video and data simultaneously.
- The VMS shall record all video from all IP cameras and encoders to the Hard Drive of the recording system and simultaneously be capable of recording to an external archiving system if required.
- The solution must be able to support up to 64 cameras per recording video archive server, multiple servers or multiple sites, each at 25 images per second 2688 x 1520 video resolutions, for a period of 7 days available for online viewing. Each camera shall have an option for independent retention period.
- The VMS shall be able to set each camera frame rate, bit rate and resolution

independently from other cameras in the system and altering these settings shall not affect the recording and display settings of other cameras.

- The VMS shall provide a multicast network communication for video monitoring. This video stream shall be independently setup from the recording stream.
- The VMS shall allow the user to view live video.
- The VMS shall allow for multiple Flat-panel monitors to be connected to a single computer. Each monitor shall have independent controls and shall support multi views up to 16 real time camera views.
- The VMS shall provide a reporting utility for tracking but not limited to the following options. Video and images shall be stored with reports for documenting events:
 - Alarms
 - Incidents
 - Operator logs
 - Service requests
- The VMS shall provide file export tool for export of single frames of video in J-PEG, BMP, etc. file formats and for export of motion video files in AVI, MPEG, etc. file format for transport and playback on computers utilizing a Windows environment.
- The Contractor shall provide the required computers for the VMS client and servers. These computers shall be of the most current state of the art technology available at the time of installation and as minimum shall support the minimum requirements of the Video Management System (VMS) manufacturer.
- The VMS shall allow for each of the system Media Archive to be set for fail over recording or redundant recording independently.
- The VMS shall allow for installation of Anti-Virus and network security Software.
- The VMS shall have the capability to program each IP viewing station to view and control selected cameras only.
- The VMS shall provide a Windows based GUI (Graphical User Interface).

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 waterproofing 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, waterproofing, fascias and barge boards. This specification also includes minor work related to trusses, purlins, paintwork, minor plumbing work and waterproofing 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	-	Construction Specifications Aug 2014 & Dec 2015
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
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 0,58 mm thick galvanised (or Chromadek) IBR or equivalent approved for roof slopes exceeding 15°. Concealed fixed type Chromadek 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 (or Chromadek), complete with poly-closers 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 Chromadek 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 agricultural sheds and 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/Chromadek 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/Chromadek 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 Chromadek/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

Dektite 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 Dektite silicone sealant and fastening of flashing to surface with TEKS or equivalent approved self-drilling fasteners.

BA 02.3.7 Insulation

In certain cases insulation may be necessary to reduce heat load or to comply with hygiene requirements. Refer to PW 371.

Specification for non-visible roof insulation material:

Super Sisalation 420 RSA or equivalent approved reinforced 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 Alucushion (code 2906) or equivalent approved white bubble foil on Aluminium foil backing 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 Chromadek) IBR or equivalent approved. The cladding must be laid in long lengths without end overlaps. Metal closers 0,8 mm thick galvanised (or Chromadek), 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 Chromadek 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/Chromadek 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/Chromadek 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:

125 x 100 x 0,8 thick standard Chromadek non-supporting beaded gutter. Galvanised brackets to be provided at every truss. Brackets to be painted to specification in the Schedule of Quantities.

Typical size for other buildings:

125 x 100 x 0,8 thick standard Chromadek self-supporting beaded gutter.

Dark colours to Consultant's specification.

Refer to specification PW 371.

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 Chromadek finished end stops joined to gutter on site and sealed as for joints in gutters.

Outlets: 0,8 mm thick Chromadek 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:

125 x 100 x 0,6 thick Chromadek down pipes

125 x 100 x 0,8 thick Chromadek 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 accessories

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 Chromadek 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 Chromadek 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 Chromadek broad flute metal closers. Bend up trough to form a dam.
0,8 mm thick Galvanised 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 fixed and 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 broad flute metal closers. Bend up trough to form a dam.
0,6 mm thick Chromadek Eaves Closer	Fix standard serrated narrow flute eaves closer to timber purlin. Patch plaster and touch up paint work.
0,8 mm thick Chromadek 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 Chromadek broad flute metal closers. Bend up trough to form a dam.
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 Chromadek 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 Chromadek broad flute metal closer. Bend up trough to form a dam. 154 mm girth (114 + 25 + 15 lip @ 15°) Chromadek 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.
0,8 mm thick Galvanised 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 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 broad flute metal closer. Bend up trough to form a dam. 154 mm girth (114 +

	25 + 15 lip @ 15° galvanised 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 Chromadek 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 Chromadek broad flute metal closers on rake. Bend up trough to form a dam.
0,8 mm thick Galvanised 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 Chromadek broad flute metal closers on rake. Bend up trough to form a dam.
0,8 mm thick Chromadek 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 Chromadek broad flute metal closer. Bend up trough to form a dam.
0,8 mm thick Galvanised 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 broad flute metal closer. Bend up trough to form a dam.
0,8 mm thick Chromadek 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 Chromadek 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 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 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 Chromadek 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	308 mm girth (262 + 46 vertical), 3 x bends (2 are shallow bends). Fix flashing

Galvanised Gable Flashing (residential type)	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 Chromadek 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 Chromadek broad flute metal closer on side wall cladding. Provide one row of continuous silicone on rib.

0,8 mm thick Galvanised 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 broad flute metal closer on side wall cladding. Provide one row of continuous silicone on rib.
0,8 mm thick Chromadek 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°) Chromadek 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 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 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 Chromadek broad flute metal closer bedded in a row of silicone. Bend up trough to form a dam.
0,8 mm thick Chromadek 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 broad flute metal closer bedded in a row of silicone. Bend up trough to form a dam.

0,8 mm thick Chromadek 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 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 Chromadek 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 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 Chromadek 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°) Chromadek 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 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 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 Chromadek 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.
0,8 mm thick Galvanised 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 Chromadek 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 External 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 Chromadek 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 Chromadek Drip Flashing	154 mm girth (64 vertical + 50 + 20 vertical + 20) standard drip flashing to suit roof sheet, 3 x bends. Fix flashing to girts or roof sheeting with sealed type Aluminium blind pop rivets or Posidriv screws with washers. 50 mm overlap sealed with one row of silicone and stitched together with sealed Aluminium blind type pop rivets.
0,8 mm thick Galvanised Drip Flashing	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 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 Chromadek 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 Chromadek broad flute metal closer for sill flashing.
0,8 mm thick Galvanised 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 broad flute metal closer for sill flashing.
0,8 mm thick Chromadek 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 chromadek broad flute metal closer for sill flashing
0,8 mm thick Galvanised 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 broad flute metal closer for sill flashing
0,8 mm thick Chromadek 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 Chromadek broad flute metal closer on side wall cladding. Provide one row of continuous silicone on rib. Contractor to measure radius on site prior manufacturing.
0,8 mm thick Galvanised Bull	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

Nose Flashing	silicone. 1 row x 0,6 mm thick Galvanised 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 Chromadek 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 Chromadek down pipes; height < 3 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.
100 x 75 x 0,6 mm thick Chromadek down pipes; 3 m < 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 Chromadek 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 Chromadek 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 Chromadek 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.)	
Dektite 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 Dektite no. 2 for pipe diameters 40 - 80 mm and Dektite no. 4 for pipe diameters 80 - 150 mm. Dektite flashings are made of E.P.D.M. rubber compound of a carbon black colour.
0,8 mm thick Chromadek 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	<u>Re-routing of roof void geyser pipework:</u> Disconnect and remove existing overflow pipe 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. <u>Ventilation pipework:</u> 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 manufacturers specifications. Standard primer, one coat undercoat and two coats of super acrylic paint to exposed pipework to match existing paint system and colour.

BA 03.2 SCHEDULED ITEMS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The rate shall cover the cost of removing of existing roof sheeting or side cladding inclusive of flashings and sundry items from timber or steel purlins, the temporary storage of the removed sheeting or cladding at a store area (position of store area to be indicated on site). The rate shall also cover the cost of any scaffolding, temporary supports, hoisting facilities etc. The rate shall also cover all temporary necessary dust screens, sheets, plastic linings, etc laid horizontal or vertical inside existing roof spaces or voids on top of ceilings, trusses, etc to protect all contents inside the buildings while replacing or repairing the roof coverings.

BA.05 Re-erect: Stockpiled 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 fasteners, 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: m²

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 chromadek 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 Leak King or 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 Leak King 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 bird proofing: _____ 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 preparing existing roof sheeting to receive new "MEP10 primer coat and one coat Roof Gard as supplied by Chemicals tel (0331) 69384/5/6 or equivalent" approved water-based acrylic roof paint, supplying, delivery and applying new primer and finishing coat, etc, without distinguishing between roof sheeting, side cladding, profile, finish, etc.

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

TECHNICAL SPECIFICATION

BB CARPENTRY AND JOINERY FOR ROOFS AND CEILINGS

CONTENTS

BB 01	SCOPE
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BB 01 SCOPE

Carpentry and joinery shall mean the scope of work to repair and maintain materials and components such as removal of existing timber roof trusses, purlins, ceilings, etc, and the installation of new timber trusses and other timber roof members, structural beams, purlins, battens and ceilings. This specification does not include work related to roof coverings and paintwork, which are specified elsewhere.

This specification covers the repair of existing timber members in roof trusses, the removal and replacement of existing timber members from roof trusses and associated timber roof members and ceilings. This specification also covers the supply, delivery and installation of new timber trusses, purlins, battens and beams for various types of timber related structures and ceilings.

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

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	-	Construction Specifications Aug 2014 & Dec 2015
SANS 10243	-	The 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 waness 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 65 mm of a connector plate of 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 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 PW 371, or SANS 0234, 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 PW 371.

(a) Branderling to ceilings

Branderling to ceilings shall be replaced where:

- (i) Ceiling boards are replaced.
- (ii) Branderling is broken, rotten and beyond any further use.

New brandering shall be provided in accordance with 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. Branderling 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 brundering 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 brundering 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 0163 (1980).
- (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 failure cases 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**

No maintenance will be required for carpentry and joinery for roofs and ceilings under this contract.

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

All components forming part of this specification for carpentry and joinery for roofs and ceilings shall be maintained as part of the maintenance of installations as defined in Additional Specification SA: General Maintenance.

Maintenance shall include all repair work, replacing of components, routine inspections, fixing of defects or any other actions or rectifying measures necessary to maintain the perfect functional condition of carpentry and joinery for roofs according to the operation and maintenance manuals and as specified in this specification.

All timber trusses and members of timber roofs shall be preserved in a good condition, i.e. failure free, free from insect attack and decay due to exposure to moisture.

Maintenance on the carpentry and joinery for roofs shall also include all other actions related to (or resulting from) maintenance, such as:

- Cleaning of the site and ceiling voids of rubbish and dirt;
- Replacing any element that has failed;
- Tightening, fixing or replacing of loose fasteners, premature corrosion of galvanised items like screws, nail plates, etc.

Remuneration for maintenance of the complete carpentry and joinery for roofs shall be deemed included in the tendered monthly payment for maintenance of the applicable installation.

BB 06 MEASUREMENT AND PAYMENT**BB 06.01 MEASUREMENT AND RATES****BB 06.01.01 General inclusion of costs****Notes:**

All material scheduled to be removed shall be deemed to be existing damaged materials in small or large sections. All such redundant material shall become the property of the Contractor and must be removed from site immediately.

All new material 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 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: m², 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: m²

(ii) Etc, for other items measured by area

The units of measurement shall be the number, metre or square metre of each type and/or size of joinery item specified and installed complete.

The tendered rates shall include full compensation for the supply of all materials, manufacture, cutting, waste, fixing, scaffolding, temporary supports, hoisting facilities and installation of the joinery items.

Ironmongery to be included in the rates tendered for doors shall be as specified in the Technical Specification 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: m³, m², 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 members 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) Item 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.

BB.07 Painting to top cords of timber trusses**In roof voids:..... Unit: m**

The unit of measurement shall be the metre.

The Tendered rate shall include full compensation to prepare existing top cords (where applicable) to receive one coat creosote. No distinction will be made for size, type, new or existing members. The rate shall also cover the cost for waste, all scaffolding, etc.

BB.08 **Painting of existing members in overhangs:** Unit: m

The unit of measurement shall be the metre.

Separate items will be listed for paint and/or creosote as specified.

The tendered rate shall include full compensation to prepare existing overhangs to receive paint or creosote as specified. No distinction will be made for size of existing members. The rate shall also cover the cost for waste, all scaffolding, etc.

TECHNICAL SPECIFICATION

BC WATERPROOFING OF CONCRETE ROOFS

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BC 01	SCOPE
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BC 01 SCOPE

This specification covers the repair/replacement of existing cement screeds and waterproofing, including all sundries, the removal of waterproofing and the supply, delivery, installation of new cement screeds, waterproofing and sundries for various types of concrete roofs.

Waterproofing shall mean the work to be carried out to repair/replace and maintain waterproofing materials and components, such as the repair/removal and maintenance of existing cement screeds and waterproofing and the installation of new cement screeds and waterproofing. This specification does not include work related to concrete work, plastering, gutters and 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	-	Construction Specifications Aug 2014 & Dec 2015
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**

Specification 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 roof edges, as relevant. Attention shall be given to the detailed design of openings, projections, gutters, down pipes and finishes to make adequate provision for run-off water and to minimize blockages.

Corners and edges shall be covered or angle rounded. Run-off over the edges of slabs shall be eliminated as this causes stains to the building. Fillets of 75 x 75 mm shall be provided at up stand corners.

The necessary gradient for waterproof membranes is 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 SABS 836.
- (d) Minimum screed thickness of 40 mm.
- (e) Maximum moisture content of screeds:
 - (i) Applications with a density of less than 500 kg/m³ : 10 %
 - (ii) Applications with a density exceeding 500 kg/m³: 7 %.

The screed should be cast or sawn into panels that do not exceed 9 m² to cater for drying shrinkage and to control cracking.

BC 03.02 MATERIALS

The more commonly used waterproofing materials are listed below, as well as some general comments on these materials. It is suggested that the manufacturers be consulted with regard to specific products. The Engineer's approval of the selected product shall be obtained prior to ordering.

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

[Note: There will be no maintenance work required for waterproofing of concrete roofs in this contract.]

This specification shall be read in conjunction with Additional Specifications SA: General Maintenance.

All components that form part of the waterproofing of concrete roofs shall be maintained during the maintenance phase of the Contract.

Maintenance shall include all repair work, replacing of components, routine inspections, repairing of defects or other actions or rectifying measures required to maintain the perfect functional condition of waterproofing on concrete roofs in accordance with the operation and maintenance manuals and as specified. All roofs shall be kept leak-free and watertight.

Maintenance of the waterproofed concrete roofs shall include all related actions such as replacing/repairing loose and blistering waterproofing, including cracked waterproofing membranes, loose seams, painting of waterproofing membranes, and cleaning and removing rubbish from waterproofed concrete roofs.

Remuneration for maintenance of the complete waterproofing of concrete roofs shall be deemed included in the tendered monthly payment for the maintenance thereof.

BC 06 MEASUREMENT AND PAYMENT**BC.01 MEASUREMENT AND RATES****BC.01.01 General inclusion of costs****Notes:**

New waterproofing material scheduled shall be deemed to include all preparation of existing concrete or waterproofed areas and jointing of new to existing material. Where new material is to join existing material, the new material shall be of the same type and system as the existing waterproofing system. All waterproofing shall come

with a ten-year written guarantee for water-tightness and the cost of such guarantee shall be deemed to be included in the applicable tendered rates.

BC.02 **SCHEDULED ITEMS**

NEW WORK

BC.02.01 **Approved waterproofing system to:**

(a) Description of waterproofing system:

- (i) Area of application or description of detailed item Unit : m², m, number

The unit of measurement shall be the square metre, meter or number of areas or items waterproofed as specified and scheduled.

The tendered rates shall include full compensation for the supplying, delivering, storing on site, handling, moving, applying or installing and fixing the waterproofing system complete with all necessary sundry items, such as forming turn-ups or turn-downs, any flashing strips, dressing waterproofing around pipes and into outlets and channels.

The tendered rates shall also cover the cost for cutting and waste and for scaffolding, hoisting facilities, etc. All turn-ups and turn-downs will be deemed to be included in the area measured for the waterproofing and will not be paid for separately.

ALTERATION WORK

BC.02.02 **Remove existing waterproofing and sundry items:**

- (a) Description of waterproofing material to be removed and location Unit: 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 repair and maintenance of existing interior and exterior walls including all related building elements such as plastering, partitioning, wall tiling, windows, doors, etc, which form an integral part of an installation.

In determining the remedy for any repair work, the Engineer must take the climatic conditions in which all building elements have to function into consideration. Allowance should be made accordingly for the strength and durability of all components in relation to their purpose and application.

This specification does not include any work related to paintwork as this is specified elsewhere.

The complete scope of repair work shall be in accordance with the section: Detail of repair work.

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	-	Construction Specifications Aug 2014 & Dec 2015
SANS 22	-	Glazed ceramic wall tiles and fittings.
SANS 227	-	Burnt clay masonry units
SANS 545	-	Wooden doors
SANS 622	-	Gypsum cove cornice
SANS 680	-	Glazing putty for wooden and metal window frames
SANS 727	-	Windows and doors made from rolled mill steel sections
SANS 10107	-	The design and installation of ceramic tiling
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 PW 371. All plastering shall be painted in accordance with Technical Specification BJ: Paintwork, or tiled according to this specification BD.

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

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

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

After the pipe has been put in place, the void shall be filled with a non-shrink cement grout of 60 MPa compressive strength at 28 days. The chases shall then be covered by fixing with shot-fired nails a weld mesh strip (30 mm longways x 10 mm shortway x 0,5 mm thick expanded metal lath) before applying the final plaster.

BD 03.01.03 Plastering: Walls of wet areas

Where necessary, hack off and remove existing internal plaster to walls. The substrates must be prepared to be sound, free from cement, grout, laitance, loose or segregated materials, voids or flaws and substances that could interfere with bonding of the new plaster. This preparation work can be done by means of clipping away with a chisel, steel-wire brush and angle grinders to the satisfaction of the Engineer. Smooth concrete must be chipped mechanically to prepare for bonding of new plaster. Before plastering commences, the substrates must be well wetted with clean water.

Only approved ready-mixed or pre-mixed bagged plaster mortar with 10 MPa compressive strength or equivalent may be used for plastering. Mix a liquid waterproofing admixture in a dilution of one part by volume with ten parts by volume of clean water. The diluted admixture is added to the appropriate dry cement/sand mixture. The mortar shall be produced in such quantities that will be used within one hour after mixing. The finished plasterwork shall be of an even and smooth towel surface finish.

When dry, apply two coats of an approved water dispersed epoxy resin coating to the plastered surfaces of the walls that are to be painted.

BD 03.01.04 External plastering

The Engineer shall mark out areas that need to be renovated. The Contractor shall neatly cut with an angle grinder in straight lines the edges of the poor patches of plaster that must be removed.

The substrate of the brick walls must be prepared to be sound, free from cement grout, laitance, loose or segregated material, voids or flaws and substances that might interfere with the bonding of the new plaster.

The surface must not be powdery or crumbly and must exhibit adequate tensile strength. The preparation work can be done by means of chipping away with a chisel, steel-wire brush and angle grinders to the satisfaction of the Engineer.

Smooth surfaces must be chipped to provide mechanical bonding for new plaster. Before plastering commences the substrate must be well wetted with clean water.

Only approved ready-mixed or pre-mixed bagged plaster mortar with 5 MPa compressive strength or approved equivalent may be used for plastering. The Contractor shall submit the design mix with the volume of water to be added to the mortar mix for approval by the Engineer. An approved bonding agent must be added to the mortar mix.

The mortar shall be produced in quantities that will be used within one hour after mixing. Care shall be taken not to mix old mortar into any new batch.

The finished plasterwork shall be of an even and smooth wooden trowel (surface finish with rounded edges at sharp corners) to the satisfaction of the Engineer. The plasterwork shall be cured for seven days by any approved method to prevent loss of moisture.

Three (3) test cubes per sampling shall be taken at a frequency for every 15 m² plaster area. Cube moulds for nominal size 100 mm complying with the requirements of SANS Method 863 must be used. Final instructions for sampling, moulding, cutting and testing will be issued to the Contractor on site.

BD 03.01.05 Rough-cast plaster

Rough-cast plaster shall be applied in two coats. The undercoat shall be composed of one part cement and five parts sand finished with a wooden float. The finishing coat shall be composed of one part cement and three parts stone aggregate that will pass through a 4 mm sieve. The finishing coat shall be flicked on with a machine before the undercoat has set to obtain an even texture to match the existing rough- cast plaster.

Where the undercoat has already been plastered, the undercoat shall be prepared to receive the finishing coat. The surface of the undercoat plaster shall be chipped adequately to form a key and wetted before the finishing coat is applied.

BD 03.01.06 Fine rough-cast plaster

Fine rough-cast plaster shall be as for rough-cast plaster but the finishing coat shall be composed of one part cement and three parts coarse sand.

BD 03.01.07 Internal plastering

The surface of internal plaster shall be steel trowelled to a smooth, even and true finish. External plaster shall be finished to a true and even surface with a wood float. All plaster surfaces shall be free from blemishes, cracks, blisters or other defects. Plaster shall return into reveals and soffits of openings, and all angles shall be true and straight with salient angles slightly rounded.

Plastering of a surface shall be executed in one operation, as no joint marks will be allowed. Plaster on walls shall not be less than 12 mm or more than 20 mm thick and plaster on concrete shall be not less than 10 mm or more than 15 mm thick, except where specifically specified otherwise.

Only approved ready-mixed or pre-mixed bagged plaster mortar with 5 MPa compressive strength or approved equivalent may be used for plastering. The Contractor must submit the design mix with the volume of water that will be added to the mortar mix to the Engineer for approval.

BD 03.02 PARTITIONS

All internal non-load-bearing walls shall be inspected and the Engineer shall determine whether partitioning such as laminated plastic particleboard, polyester painted steel, vinyl clad gypsum panels or any other demountable partitioning should be replaced.

Where partitioning must be relocated or replaced, such new partitioning shall be non-combustible, provide acoustical privacy and comply with SANS 10400.

All new partitions shall assemble into a rigid structure and all units shall be readily removable from either side without disturbing adjacent units.

All exposed trims for doorframes, glazing and skirting are to be of aluminium, or alternatively be painted in accordance with Technical Specification BJ: Paintwork.

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

BD 03.03 WALL CRACKS

Wall cracks shall be evaluated to determine the nature and severity of the occurrence of the cracks. The Engineer shall inspect all plastered and unplastered walls and identify the underlying factors causing cracks. Repairs shall be carried out in accordance with the Particular Specifications.

BD 03.04 FACE BRICKS

Face bricks shall be inspected for dirt, efflorescence, staining, oil, paint, lichens and mosses, water, smoke and soot, rust, or damage caused by chemical reaction.

Where efflorescence appears, light brushing and hosing down with clean water is recommended for most cases. The brickwork must be saturated with clean water before applying any chemical and washed down with clean water afterwards. Cleaning can also be achieved with scrubbing, water jetting with cleaning agents and soaps, etc. Staining caused by non-water-soluble salts, such as vanadium, manganese and iron, shall be treated as follows:

- (a) Remove vanadium staining by washing the wall with a solution of 100 g to 1 litre of water using caustic soda. (Use the corresponding secondary potassium salts where available, as these will be less likely to cause visible secondary efflorescence.) If secondary efflorescence occurs, wash it off with clean water.

- (b) Manganese stains must be removed using proprietary brand chemical compounds based on hydrochloric acid with modifiers and sodium fluoride. These solutions should be applied using full strength as recommended by the manufacturer.
- (c) Where rust/iron stains occur, wash the affected area with a solution of 50 g oxalic acid, 20 g sodium fluoride, 15 g citric acid in 1 litre of fresh, clean water. Apply the solution to a dry wall and leave it on the wall until the stain has dissolved. Wash down using a solution of 50 g bicarbonate of soda in one litre of water.

External environmental stains and smears caused by soot, smoke, industrial pollution and spillage of oil, paint and other compounds, including micro-organic growths such as fungi, lichens and mosses on brickwork, must be identified and dealt with in an appropriate and approved way.

Care shall be taken to test the effect of some of the chemicals and compounds for possible harmful effects on the colours of the brickwork and on adjacent materials, as well as for possible toxicity to human, animal and plant life. All cleaning procedures shall be carried out with full knowledge of all the potential dangers to human and animal health, and the appropriate safeguarding and precautionary measures shall be put in place.

BD 03.05 WALL TILING

BD 03.05.01 General

Tiling shall comply with the requirements of SANS Standard Specification 22 and PW 371. The code of practice for the fixing of glazed wall tiles, SANS 10107 and the recommendations of the South African Ceramic Tile Manufacturer's Association (SACTMA) must be adhered to.

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

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

BD 03.05.02 Glazed wall tiling

Glazed tiles, 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 10137.

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 the MANANGA LAND 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 PW 371.

All new external doors are to be fitted with 1½ pair heavy duty hinges.

Door signage, such as door numbers, etc, shall be in accordance with Technical Specification BH: Fittings, and the Schedule of Quantities.

Special attention shall be given to the condition of striker plates and hinges that need to be replaced, or properly secured where possible. Doors shall be painted to the requirements of Technical Specification BJ: Paintwork.

BD 03.08.02 Doors, sidelights and fanlights

All wooden stock doors shall comply with the requirements of SANS Standard Specification 545 and PW 371.

BD 03.08.03 Flush doors

The Contractor shall inspect all doors, internal and external. Where any door needs to be replaced, such door shall be a 40 mm thick solid laminated door as specified for interior or exterior use and shall be capable of withstanding the raking, deflection, puncture and moisture resistance tests for the desired application.

Unless otherwise specified, face veneer shall be rotary cut, and shall be of the timber specified, or where doors are to be painted, shall be of timber suitable for painting. Painting shall be done in accordance with Technical Specification BJ: Paintwork, and the Schedule of Quantities.

Edge strips for concealing the vertical edges of doors shall be of the same timber as the face veneer and for single doors and hinge edges of double doors not be less than 10 mm thick, and for rebated meeting edges of double doors not less than 20 mm thick. The top and bottom edges of doors showing end grain shall be sealed with lacquer or other suitable material if the edges were disturbed in any way.

BD 03.08.04 Toilet doors in ablutions

Doors showing signs of erosion due to water penetration shall be either replaced or cut short 150 mm from finished floor level. If the existing semi-solid door panel is to be retained, it should be cut short 150 mm from the floor level. A 38 x 50 mm SAP insert must be glued and nailed in at the bottom edge. The steel frame must also be cut short and filled in with grout at the cut edges and fixed to the wall with 2 x 8 mm diameter heavy duty impact nails.

BD 03.09 IRONMONGERY**BD 03.09.01 General**

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

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

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

BD 03.09.02 Door locks

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

BD 03.09.03 Cupboard doors

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

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

BD 04 DETAIL OF REPAIR WORK

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

BD 05 MAINTENANCE

No maintenance will be required for walls under this contract.

BD 06 MEASUREMENT AND PAYMENT

BD 06.01 MEASUREMENT AND RATES

BD 06.01.01 General inclusion of costs and specific specifications

Notes:

Where applicable, standard SANS 1200 measurement and payment items shall be used for Earthworks (Small Works) (1200 DA), Site Clearance (1200 C) and Concrete (Structural) (1200 G).

All material scheduled to be removed shall be deemed to be existing damaged materials in small or large sections. All such redundant material shall become the property of the Contractor and must be removed from site immediately.

All new material shall be deemed to be in patchwork and shall be of approved equal quality, colours, profiles, thickness, etc and shall in all cases match the existing materials and shall be fixed (internally or externally) to existing material, frames or surfaces.

All replacement, removal and repair work shall be done carefully as to not damage any adjacent or other material or work. Any damage to other or adjacent materials or areas caused by the negligence of the Contractor shall be repaired by him free of charge.

All work scheduled to be replaced shall be deemed to include for the careful removal of the damaged existing material as a whole or partly, as specified, for the cleaning and preparation of the remaining surface(s), frames, etc as well as for the new material scheduled or specified to replace the damaged material.

All work scheduled to be removed, hacked off, or taken out shall be deemed to include the cleaning and preparation of the remaining surfaces, areas where material were removed, or remaining work to receive new material or work specified.

Repair and service work shall also include all removing, cutting, grinding, cutting into, welding, bending, strengthening, drilling, tightening, fastening, oiling, greasing, adjusting and providing missing or damaged screws or bolts, etc to repair and service or to improve the items or areas as new and to match the existing. The servicing of

windows will be measured in number irrespective of the type of window or the number 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.

Tilework to walls shall include all cutting, spacers, waste, jointing, mitres, corners, epoxy grout and joint filler.

Ordering of certain specified material i.e. NCI industrial type wall tiles needs special and urgent attendance and should be ordered timeously as to prevent any construction delays.

All new glass mirrors shall be silvered float glass copper backed mirrors with polished edges all round and shall, unless otherwise scheduled, be fixed to walls with chromium plated dome capped mirror screws with rubber buffers.

Specific specification : Repairs to IBR roofs

Repairs to the workshops and storeroom 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 $\pm 30\%$ 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 Chromadek rainwater down pipes spaced at approximately 6 to 7 m intervals.

Specific specification : Repairs to concrete gutters

- (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 "Cordex" or equivalent approved backing cord for 25 mm wide joint. Prime joint

and seal joints with 25 mm wide x 15 mm thick approved poly-urethane joint sealant applied strictly according to manufacturer's specifications. The top surface of the joint sealant must be recessed adequately into joint to allow for a closed cell polyethylene foam strip that will accommodate movement of the waterproofing membrane.

Dressing to expansion joint will comprise of additional strips of reinforced waterproofing membranes that are lapped and sealed to manufacturer's specifications. The Contractor must submit detail for approval to the Engineer prior installation.

Specific specification : Repairs to roller shutter doors

- (a) Replace the whole bottom T-bar including the bottom ± 17 galvanised slats of the existing roller shutter doors with a new galvanised T-bar (bottom rail) with neoprene weather strip. The Contractor must measure the width of the door (approximately 3000 mm) and the opening width of the 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 ratchet and pawls, and brackets. Loose bracket bolts that have broken out of walls shall be replaced with 175 mm long x 12 mm diameter threaded rods that must be anchored to the walls with an approved epoxy grout.
- (d) Repairing bent and fixing of damaged steel plates of canopy covers.
- (e) Repairing gearbox, gear handle, drive shaft, pinions and bevel gears.

Specific specification: Servicing and adjustments to roller shutter doors

- (a) All other door components shall be serviced, adjusted, repaired and replaced, but not restricted to, for the full repair of the complete door installation to a smooth working condition. The door sizes is approximately 3000 mm wide x 3500 mm high. The existing interlocking slats are 76 mm wide.
- (b) Servicing shall include cleaning and oiling of hinges, rollers, bearings, gears, channel guides and locks. Interlocking slats of the roller shutter curtains shall only be washed with a high-pressure water jet and detergent to remove all dirt, grease, etc.
- (c) Adjusting, fixing and realigning of door guides. The existing channel guides, approximately 76 mm wide shall be bent straight to allow free and smooth movement of the roller shutter door slats. The Engineer shall give the necessary instructions where severely damaged channel guides must be replaced.
- (d) Adjusting and balancing torsion springs, barrel collar and counterbalance.

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 twofold, 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 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 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, windowsills 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, m², number

The unit of measurement shall be the number, metre, etc for each item as scheduled.

The tendered rates shall include full compensation for all costs of material, waste, labour, plant, transport, delivery, access, scaffolding, fuel, etc to install the material as specified and to match the existing to the Engineer's approval.

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: m²

(ii) Etc, for other items measured by area

The units of measurement shall be the number, metre or square metre of each type and/or size of joinery item specified.

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: m²
- (ii) Etc

The unit of measurement shall be the number, metre or square metre as applicable to each item.

The tendered rates shall include full compensation for manufacturing, providing and installing each item to new or existing steel, wood or plaster complete as per specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material, waste, plant, transport, delivery, access, scaffolding, fuel, etc to the Engineer's approval.

ALTERATION WORK**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: m³, m², m, number

The unit of measurement for items repaired, replaced, altered, removed, sealed, etc shall be the cubic metre, square metre, metre or number for each item as scheduled.

The tendered rates shall include full compensation for all costs to repair, replace, refix, remove, cutting into, re-align, taking off, temporary store, etc as specified in the Standard and Technical Specifications and shall allow for all necessary labour, plant and new material needed to do the specified work and to leave the scheduled items as new and to the approval of the Engineer. Refer also to the general inclusion of costs in 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 repair and 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	-	Construction Specifications Aug 2014 & Dec 2015
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 installation of resilient 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 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 10043 and PW 371.

The laying of wood block and wood mosaic flooring shall be carried out in accordance with SANS 10043 and 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 10070 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. Reinstall 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 10043 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 10043. 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 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.

(c) In abattoirs

Clean and dry all tile surfaces. All loose material must be removed by means of a wire brush or by water while all tile adhesives are cleaned from the edges of the tiles.

Ensure that all traces of release agents, curing compounds and existing joint sealant compounds are removed. Install a suitable closed-cell expanded polyethylene bond breaker cord in the expansion and isolation joints after which the complete substrate is primed with a component solvent free primer which penetrate into the tile and pull all dust particles with it. Proceed with the final application of an approved one part grey polyurethane sealant with a shore hardness of A45 and an elongation of 400 %. The 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 cannot be repaired. Different paving types exist, e.g. concrete, precast paving segmental and regular blocks, bricks and slasto. This specification only covers pedestrian paving around buildings.

The Engineer shall identify the paving areas that are to be repaired. Defects to paving will include but not be limited to the following aspects:

- (a) Failure of subbase material and subsidence of sub-soil due to excessive water erosion.
- (b) Broken and severely damaged paving.
- (c) Distorted and disturbed paving.
- (d) Drainage problems, e.g. ponding of water on the paving and in drainage channels, incorrect falls, etc.
- (e) The omission of edge restraint.
- (f) Intrusion of weed or hostile root penetration.

BE 03.02.01 Preparing foundation.

If the subbase and/or 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, levelled, 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 subbase surface. Where specified, plastic sheeting must be provided below the bedding sand layer. Refer also to BE 03.02.06.

The Contractor shall be responsible for carrying out all necessary process control tests on the density and moisture content of the completed sub grade, subbase, etc, to ensure that the required compaction is being attained.

BE 03.02.02 Laying of segmental block paving.

The existing blocks shall be pre-selected for re-use. Broken and severely damaged paving blocks shall be replaced. New paving blocks shall comply with SANS 1058 Class 30 compressive strength. All blocks shall be laid true to line and level. Care shall be taken to ensure that joint lines are straight and square. The blocks shall have a minimum thickness of 60 mm.

After laying the blocks, the paving shall be compacted by means of vibrating plate compactor with joints between the blocks filled in, after compaction, by sweeping in fine sand. The jointing sand shall have a pass of 1,18 mm sieve and contain 10-50 % material passing the 75-micron sieve. The sand shall be free of all soluble salts or contaminants likely to cause efflorescence or staining.

Areas against curbs, manholes, etc, that require infilling, and which exceed 25 % of a full block unit shall be filled with units cut to size using a mechanical or hydraulic guillotine, bolster or angle grinder. Infill areas constituting less than 25 % of a full block area 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 pre-selected for re-use. Broken and severely damaged paving blocks shall be replaced. All blocks shall be laid true to line and level. Care shall be taken that joint lines are straight and square. Slasto shall be laid in the same pattern to match existing.

After laying the blocks, the paving shall be compacted by means of vibrating plate compactor. Clean the top of the blocks before and after compaction. Thoroughly wet compacted area after compaction and leave 24 hours to dry. The joints between the blocks must be filled in, after compaction, with a 1:4 cement mortar. The joints shall be pointed with a steel tool to a smooth surface finish.

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 weeds killing shall be carried out:

- (a) Mixing weed killer to subbase for rehabilitated paving.
- (b) Spraying existing paving excluding concrete paving.

After the base course has been approved and the curbing completed, the prepared base must be treated with a weed killer similar or equal to HYVAR X at a rate of 4 kg/m². Plastic sheeting with a thickness of 375 micron shall be laid to prevent the penetration of grass underneath the segmental paving.

BE 03.02.07 Site clearance.

Excess sand and all other debris shall be removed before the pavement is opened to traffic. The site shall be left in a tidy condition.

BE 04 DETAIL OF REPAIR WORK

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

BE 04 MAINTENANCE

No maintenance will be required for floors under this contract.

BE 06 MEASUREMENT AND PAYMENT

BE 06.01 MEASUREMENT AND RATES

BE 06.01.01 General inclusion of costs and specific specifications

Notes:

Where applicable, standard SANS 1200 measurement and payment items shall be used for Earthworks (Small Works) (1200 DA), Site Clearance (1200 C) and Concrete (Structural) (1200 G).

All material scheduled to be removed shall be deemed to be existing damaged materials in small or large sections. All such redundant material shall become the property of the Contractor and must be removed from site immediately.

All new material shall be deemed to be in patchwork and shall be of approved equal quality, colours, profiles, thickness, etc and shall in all cases match the existing materials and shall be fixed (internally or externally) to existing material or surfaces.

All replacement, removal and repair work shall be done carefully as to not damage any adjacent or other material or work. Any damage to other or adjacent materials or areas caused by the negligence of the Contractor shall be repaired by him free of charge.

All work scheduled to be removed, hacked off or taken out shall be deemed to include the cleaning, removing of contact glue or bitumen and preparation of the remaining surfaces, areas where material were removed, or remaining work to receive new material or work specified.

Repair work shall also include all cutting, grinding, cutting into, welding, bending, strengthening, drilling, etc to repair or to improve the items or areas as new and to match the existing.

Work scheduled to be realigned and 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 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 i.e. NCI industrial type 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: m²

(b) Etc for other thicknesses

The unit of measurement shall be the square metre of floor screed laid, as specified, on floors, steps or areas shown on the Drawings or as designated by the Engineer.

The tendered rates shall include full compensation for the construction of the floor screeds, including the supply of all materials, mixing, laying, finishing, the forming of nosing, 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: m²
- (ii) Etc, for other items measured by area

The units of measurement shall be the number, metre or square metre of each type and/or size of joinery item specified.

The tendered rates shall include full compensation for the supply of all materials, manufacture, cutting, waste, fixing and installation of the joinery items.

BE.03**Floor tiling and finishes, etc:**(a) Measured by number:

(i) (Description of item).....Unit: number

(b) Measured by linear metre:

(i) (Description of item).....Unit: m

(c) Measured by area:(i) (Description of item).....Unit: m²

The unit of measurement shall be the number, metre or square metre as applicable to each item.

The tendered rates shall include full compensation for manufacturing, providing and installing each item complete as per specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material, waste, plant, transport, delivery, access, scaffolding, fuel, etc to the Engineer's approval.

ALTERATION WORK**BE.04****Alterations and repairs to existing structures:**(a) Indicate if repairs, alterations, removal or sealing, etc:(i) Description of individual items to be repaired,
altered, removed, sealed, etc.....Unit: m³, m², m, number

The unit of measurement for items repaired, altered, removed, sealed, etc shall be cubic metre, square metre, metre or number as scheduled.

The tendered rates shall include full compensation for all costs to repair, refix, remove, cutting into, realign, taking off, temporary store, etc as specified in the Standard and Technical Specifications and shall allow for all necessary labour, plant and new material needed to leave the scheduled items as new and to the approval of the Engineer. Refer also to the general inclusion of costs in BE 06.01.01.

TECHNICAL SPECIFICATION

BH FITTINGS

CONTENTS

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

BH 01 SCOPE

Fittings shall mean the scope of work to repair materials and components related to cupboards, shelving, signage and counters.

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

BH 02 STANDARD SPECIFICATIONS

BH 02.01 GENERAL STANDARD SPECIFICATIONS

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

PW 371	-	Construction Specifications Aug 2014 & Dec 2015
SANS 929	-	Plywood and composite board
SANS 1099	-	Hardwood furniture timber
SANS 1783-3	-	Softwood timber for industrial use
SANS 1385	-	Kitchen cupboards: Built-in and free-standing

BH 02.02 ADDITIONAL SPECIFICATIONS

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

BH 03 VARIATIONS AND ADDITIONS TO STANDARD SPECIFICATIONS

BH 03.01 ADDITIONAL REQUIREMENTS FOR REPAIR OF FITTINGS

BH 03.01.01 Built-in cupboards

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

- (a) Severely chipped or damaged block board;
- (b) Severely chipped or damaged decorative laminates;
- (c) Inadequacy of design, e.g. strength of hinges, failure of door furniture, etc;
- (d) Corroded steel elements.

Fixing of defects will include repairing or replacing damaged, corroded and worn-out fittings, e.g. door handles knobs and hinges, door catches and holders, door locks, cupboard door vents, drawer slide rails, drawer handles, knobs and locks. Moving parts shall be serviced by cleaning, oiling, tightening loose screws, reinstating missing screws or aluminium pop rivets, etc. Refer to BD 03.08 and BD 03.09 of Technical Specification BD: Walls, for repairs or replacements of cupboard doors and ironmongery.

BH 03.01.02 Kitchen cupboards

Kitchen cupboards shall be inspected for defects. Defects will include repairing or replacing damaged, corroded and worn-out fittings, e.g. door handles, knobs and hinges, door catches and holders, door locks, cupboard door vents, drawer slide rails, drawer handles, knobs and locks. Moving parts shall be serviced by cleaning, oiling, tightening loose screws, reinstating missing screws or aluminium pop rivets, etc. Where the baked enamel of steel cupboards is scratched and worn off, the steel surface shall be sanded and painted with an approved gloss epoxy paint to match the existing colour. Severely corroded or damaged steel cupboards shall be replaced with approved new steel cupboards complying with SANS 1385, with the baked enamel complying with SANS 783 Type II.

Damaged kitchen cupboards manufactured from composite board with laminated plastic covering shall be repaired where possible by gluing loose laminated plastic covering or replacing components with new similar matching finished elements.

Damaged kitchen cupboards manufactured from timber shall be repaired by replacing cracked and broken timber components. Painted surfaces shall be varnished with water-resistant varnish (with matching stain) or painted with approved polyurethane paint. Refer to Technical Specification BJ: Paintwork.

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

Work tops and sinks against walls shall be sealed with an approved white one part polyurethane sealant. The sealant shall be applied strictly according to the manufacturer's specifications. Old worn-out and damaged sealant shall also be replaced. Drop-in sink bowls shall also be sealed with this approved polyurethane sealant. Where the possibility exists that water can penetrate composite board, these joints in the 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, e.g. steel tubing struts, additional timber bearers, steel brackets, etc.

Broken timber shelving shall be replaced with approved wrought hardwood or solid laminated pine varnished or painted to specification. Composite board will not be permitted. Shelves shall be in single lengths. Heads of nails and brass countersunk screws in exposed faces of joinery shall be sunk and plated.

BH 03.01.04 Signage

Safety signs shall comply with the requirements of SANS 1186.

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 approved wood filler; all blemishes removed and then finished off in order to restore the wood to its original state.

Steel tops that have been damaged excessively shall be replaced.

BH 04 DETAIL OF REPAIR WORK

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

BH 05 MAINTENANCE

No maintenance will be required for fittings under this contract.

BH 06 MEASUREMENT AND PAYMENT

BH 06.01 MEASUREMENT AND RATES

BH 06.01.01 General inclusion of costs

Notes:

All material scheduled to be removed shall be deemed to be existing damaged materials in small or large sections. All such redundant material shall become the property of the Contractor and must be removed from site immediately.

All new material shall be deemed to be in patchwork and shall be of approved equal quality, colours, profiles, thickness, etc and shall in all cases match the existing materials and shall be fixed (internally or externally) to existing material or surfaces.

All replacement, removal and repair work shall be done carefully as to not damage any adjacent or other material or work. Any damage to other or adjacent materials or areas caused by the negligence of the Contractor shall be repaired by him free of charge.

All work scheduled to be removed or taken out shall be deemed to include the cleaning and preparation of the remaining sections, areas, or work to receive the new material or work specified.

Repair and service work shall also include all removing, cutting, grinding, cutting into, welding, bending, strengthening, drilling, tightening, fastening, oiling, greasing, adjusting, and providing missing or damaged screws or bolts, etc to repair or to

improve the items or areas as new and to match the existing. The service of cupboard doors and drawers shall be deemed to include for servicing all locks, hinges, glides, tracks, etc.

Work scheduled to be realigned and 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 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 back plate 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: m²

- (ii) Etc, for other items measured by area

The units of measurement shall be the number, metre or square metre of each type and/or size of joinery item specified.

The tendered rates shall include full compensation for the manufacturing and supplying of all materials, for transport, labour, cutting, waste, fixing, screws, bolts, clamps, etc and installation of the joinery items.

BH.02

Steelwork:

(a) Items measured by number:

- (i) Steel cupboard or locker doors, shelves, complete cupboards, etc (type and size indicated) Unit : number or units
- (ii) Etc, for other items measured by number

(b) Items measured by linear metre:

- (i) Steel rails, shelves, frames, etc (size indicated) Unit : m
- (ii) Etc, for other items measured by length

(c) Items measured by area:

- (i) Shelves, plates, etc (type and thickness indicated) Unit : m²
- (ii) Etc, for other items measured by area

The unit of measurement shall be the number, metre or square metre of each type and/or size of steelwork item specified.

The tendered rates shall include full compensation for the manufacturing, supplying of all materials and transport, and for all labour, cutting, welding, waste, fixing and installation of the steelwork items complete with a red oxide or equal approved steelwork primer or baked enamel paint finishing as specified.

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: m³, m², m, number

The unit of measurement for items repaired, altered, removed, sealed, etc shall be cubic metre, square metre, metre or number as scheduled.

The tendered rates shall include full compensation for all costs to repair, refix, remove, cutting into, realign, taking off, temporary store, etc as specified in the Standard and Technical Specifications and shall allow for all necessary labour, plant and new material needed to leave the scheduled items as new and to the approval of the Engineer. Refer also to the general inclusion of costs in BH 06.01.01.

TECHNICAL SPECIFICATION

BJ PAINTWORK

CONTENTS

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BJ 01 SCOPE

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

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

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

BJ 02 STANDARD SPECIFICATIONS

BJ 02.01 GENERAL STANDARD SPECIFICATIONS

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

SANS 515	-	Decorative paint for interior use
SANS 630	-	Decorative high gloss enamel paints
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
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 064	-	The preparation of steel surfaces for coating
PW 371	-	Construction Specifications Aug 2014 & Dec 2015

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 and tear excepted). The Contractor shall be liable for any peeling or flaking of the paint applied and shall execute all repair work, rectification and making good of the painted surfaces as may be ordered in writing by the Engineer. The manufacturer must carry out inspections at regular intervals during the repair and 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 discolorations and blemishes and shall be stopped with tinted stopping and rubbed down.

(d) General

- (i) Colours: All colours and tints are to be submitted to the Engineer for approval. Sample colours are to be prepared in all cases for the final coat and all work must be finished to colour approved by the Engineer. Where necessary, universal undercoat must be tinted to a shade lighter than the finishing coat.

- (ii) Doors and windows: All doors and opening sections of windows must be left ajar after painting or varnishing until the paint is perfectly dry.
- (iii) Protection and cleaning off: All necessary precautions are to be taken for the protection of all finished work and other trades during painting, and all ironmongery shall be removed where possible prior to the commencement of painting and re-fixed after completion. All paint spots, stains, etc, are to be cleaned off floors, walls, glass, etc, after completion.

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 hypochlorite and allowed to react for 15 minutes before washing down with water. Once dry, primer and finishing coats may be applied.

(2) Exterior

Not applicable.

(b) Woodwork truss/rafters (overhangs)(i) New work(1) Interior

Not applicable.

(2) Exterior

- Eggshell/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) ExteriorWoodwork truss/rafters (overhangs) previously painted, in good condition (to be painted in eggshell/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.

(2) Exterior

Previously painted metalwork, in good condition:

Preparation: Wash down with sugar soap, followed by light sand-papery. 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).

(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 (i.e. peeling, crazing, etc, not previously limewashed):

Preparation: Remove all paint and fill with suitable exterior crack filler.

Priming coat: Prime with one coat bonding liquid, allow to dry for a minimum of 24 hours and a maximum of 72 hours.

Finishing coat: Apply similar paints to suit as specified in BJ 03.01.03(e)(i).

(f) Fibre cement board (fascias and ceilings)

(i) New work

(1) Interior

New and wet asbestos sheets shall be allowed to dry out before painting is commenced.

Ceiling boards must be well primed on both sides with an approved sealer/undercoat before fixing.

- Super acrylic PVA:
Prepare and apply one coat of sealer/undercoat. Prime nail heads with metal primer. Stop with filler. Apply two coats of super acrylic copolymer PVA.

(2) Exterior

New and wet asbestos sheets shall be allowed to dry out before painting is commenced.

Fascia boards and barge boards shall be well primed on both sides and edges painted with sealer/undercoat before fixing.

All sides of fascia boards must receive final coatings.

- Super acrylic PVA:
Prepare and apply one coat sealer/undercoat. Prime nail heads with zinc phosphate metal primer. Stop with filler. Apply two coats of super acrylic copolymer PVA.

(ii) Renovation (existing) work

(1) Interior

Previously painted fibre cement board with emulsion paint, in good condition:

Preparation: Clean down thoroughly to remove any signs of dirt or grease. Fill all screw heads with a flexible resistant filler after screw heads have been primed.

Finishing: Apply two coats of super acrylic copolymer PVA paint.

Previously painted fibre cement board in poor condition:

Preparation: Remove previous paint coatings with super paint stripper. Thoroughly wash down with sugar soap and rinse with clean water. Prime nail and screw heads with zinc phosphate metal primer. Allow to dry.

Primer: Apply one coat of synthetic copolymer primer to all surfaces including back and edges, allow to dry. Fill all screw heads with weather resistant filler, allow to dry, sandpaper smooth and touch up with primer.

Finishing: Apply two coats of super acrylic copolymer PVA paint.

(2) Exterior

Previously painted fibre cement board with emulsion paint in good condition:

Preparation: Clean down thoroughly to remove any signs of dirt or grease. Fill all screw heads with a flexible weather resistant filler after screw heads have been primed.

Finishing: Apply two coats of super acrylic copolymer 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 (i.e. flaking, peeling and rusting):

Preparation: Remove all previous paint coatings with steel wire brushes, plumber's egg-shaped lead scrapers, and coarse floor sandpaper. Remove all traces of rust with emery cloth back to bright metal and apply approved rust converter. Thoroughly scrub down using galvanised iron cleaner and rinse with clean water.

Primer: Apply one coat of galvanised metal primer. Allow a minimum of 5 hours and a maximum of 72 hours for drying.

Finishing coat: Apply one coat of water-based pure acrylic emulsion paint with non-fading pigment.

(h) Timber (doors, cornices, window frames, counters, skirtings, etc)

(i) New work

(1) Interior

- Polyurethane alkyd enamel (wet areas, kitchens, etc):
Prepare knots with spirit soluble resin type knotting. Prime with primer (sanding sealer) for wood. Fill imperfections where necessary with wood filler. Apply one coat of universal undercoat. Apply two coats of polyurethane alkyd enamel.
- High-gloss/egg-shell enamel:

Prepare knots with spirit soluble resin type knotting. Prime with primer (sanding sealer) for wood. Fill imperfections where necessary with wood filler. Apply one coat of universal undercoat. Apply two coats of enamel.

- Gloss/suede varnish (interior quality solvent based):
Prepare knots with spirit soluble resin type knotting. Fill imperfections with wood filler. Sand surfaces to a smooth finish in grain direction and dust off.
Thin first coat down in a ratio of 3 parts varnish to 1 part mineral turpentine and apply. Allow to dry for 24 hours. Apply two full-strength final coats with 24 hours drying time between applications.

(2) Exterior

- High-gloss/egg-shell enamel:
Prepare with spirit soluble resin type knotting. Apply one coat of primer for wood. Fill where necessary with wood filler. Apply one coat of universal undercoat. Apply two coats of high gloss enamel.
- Gloss/suede varnish (exterior quality ultraviolet resistant solvent based):
Prepare knots with spirit soluble resin type knotting. Fill imperfections with wood filler. Sand surfaces to a smooth finish in grain direction and dust off.
Thin first coat down in a ratio of 3 parts varnish to 1 part mineral turpentine and apply. Allow to dry for 24 hours. Apply two full-strength final coats with 24 hours drying time between applications.

(ii) Renovation (existing) work

(1) Interior

Previously painted woodwork, in good condition (to be finished in polyurethane alkyd enamel):

Preparation: Wash 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 face brick walls and concrete surfaces where damp penetration is evident

(i) Renovation

Exterior and interior

Preparation: Remove all damaged paintwork, efflorescence, loose friable material, etc, back to bare and sound substrate. Repair all damaged surfaces with suitable approved materials to match original surface.

Surfaces may remain damp and in some cases will require additional wetting, depending on the particular coating used.

Damp sealing coats: Apply two coats approved synthetic polymer modified water barrier coating in strict accordance with the particular product manufacturer's specifications. Allow 24 hours between coats unless otherwise specified.

Finishing coats: Apply decorative finishing coats to suit, as in BJ 03.01.03(e).

BJ 04 DETAIL OF REPAIR WORK

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

BJ 05 MAINTENANCE

No maintenance will be required for paintwork under this contract.

BJ 06 MEASUREMENT AND PAYMENT**BJ 06.01 MEASUREMENT AND RATES****BJ 06.01.01 General inclusion of costs and specific specifications**

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: m², m, number
- (b) Etc, for other areas or items

The unit of measurement shall be the number, metre or square metre as applicable to each item.

The tendered rates shall include full compensation for manufacturing, providing and applying each item complete as per specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material, preparation work, waste, plant, transport, delivery, access, scaffolding, fuel, miscellaneous items and material, etc to the Engineer's approval.

PREVIOUSLY PAINTED SURFACES:

BJ.02

Paint to previously painted surfaces:

(a) Description of surface:

(i) Brief description of final paint type:

- (a) Description of application area or item
to be painted..... Unit: m², m, number
- (b) Etc, for other areas or items

The unit of measurement shall be the number, metre or square metre as applicable to each item.

The tendered rates shall include full compensation for manufacturing, providing and applying each item complete as per specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material, preparation work, waste, plant, transport, delivery, access, scaffolding, fuel, miscellaneous items and material, etc to the Engineer's approval.

PREVIOUSLY PAINTED SURFACES IN POOR CONDITION:

BJ.03

Paint to previously painted surfaces in poor condition:

(a) Description of surface:

(i) Brief description of final paint type:

- (a) Description of application area or item
to be painted..... Unit: m², m, number
- (b) Etc, for other areas or items

The unit of measurement shall be the number, metre or square metre as applicable to each item. The tendered rates shall include full compensation for manufacturing, providing and applying each item complete as per specifications, drawings, descriptions as scheduled or as the existing and shall include for all labour, material, preparation work, waste, plant, transport, delivery, access, scaffolding, fuel, miscellaneous items and material, etc to the Engineer's approval.

TECHNICAL SPECIFICATION

CA ROADS

CONTENTS

CA 01	SCOPE
CA 02	STANDARD SPECIFICATIONS
CA 03	EXECUTION OF REPAIR WORK
CA 04	MEASUREMENT AND PAYMENT

CA 01 SCOPE

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

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

CA 02 STANDARD SPECIFICATIONS

CA 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

PW 371	-	Construction Specifications Aug 2014 & Dec 2015
SANS 1200 D	-	Earthworks
SANS 1200 DM	-	Earthworks (roads, sub grade)
SANS 1200 M	-	Roads (general)
SANS 1200 ME	-	Sub base
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 roadwork
COTO	-	Standard specifications for Road and Bridge Works

CA 03 EXECUTION OF REPAIR WORK**CA 03.01 GENERAL**

The Contractor shall investigate and inspect all areas of the installation to confirm the extent of the repair work required and shall report to the Engineer. The Engineer will thereafter demarcate any areas to be repaired and shall instruct the Contractor regarding 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. This repair work shall include but not be limited to the details specified in the Technical 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 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
- (b) Surface repairs of concrete pavements
- (c) Pavement layers and surface repairs
- (d) Erection and repair of permanent road traffic signs
- (e) Road markings
- (f) Chemical control of vegetation and eradication of undesirable vegetation.

CA 03.02 REPAIR OF GRAVEL WEARING COURSE

This section covers the reprocessing or replacement of an existing gravel wearing course over part of or over the full road width.

CA 03.02.01 Construction

The Engineer will demarcate all areas to be repaired and shall instruct the Contractor regarding 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 to achieve the correct road profile.

CA . 3

Unsuitable or excess material from the road prism shall be removed from the site of 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 03.02.02 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 03.02.03 Materials

The materials shall comply with SANS 1200 ME and the additional requirements detailed below:

Additional material requirements for wearing course - natural gravel.

Maximum size	37,5 mm
Oversize index (I_o) ^a	≤ 5 per cent
Shrinkage product (S_p) ^b	100 - 365 (maximum of 240 preferable)
Grading coefficient (G_c) ^c	16 - 34
CBR: } at } 95 per cent modified AASHTO compaction and OMC ^d	

- a) I_o = Oversize index (per cent retained on 37,5 mm sieve)
- b) S_p = Linear shrinkage x per cent passing 0,425 mm sieve
- c) G_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 03.03 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 03.03.01 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, re-facing 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 sub clause CA 04.03.01(a)(i) above.

A groove of at least 12 mm wide by 18 mm deep shall be made along the crack with a machine capable of closely following the path of the crack without causing excessive spalling or other damage to the adjacent concrete. Cleaning of the cracks after the grooving operation shall be done as described in subclause CA 04.03.01(a)(i) above.

(b) Patching of concrete

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

Unless otherwise instructed by the Engineer, the patching shall have a neat rectangular shape with sides parallel to existing joints. The concrete within the area to be patched shall be broken up and removed to its full depth. The vertical face of the existing concrete adjacent to the patch shall be 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 03.03.02 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 03.03.03 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 03.04 PAVEMENT LAYERS AND SURFACE REPAIRS

CA 03.04.01 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 03.04.02 Execution of work

(a) Removal of distressed pavement layers

The Engineer will demarcate any failed areas to be repaired and shall instruct the Contractor about 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:

Base	(0 - 150mm below wearing course level)	98%
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 reuse 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 stabilized material excavated from the existing pavement as backfilling, either for subbase layers only or for both subbase and base course layers.

Material shall be broken down and 65 kg/m³ of ordinary Portland cement shall be added. Water shall be uniformly mixed into the material. The material shall then be returned to the road and compacted to 95% of modified AASHTO density for the subbase layers and to 98% 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. Ordinary Portland cement or Portland blast furnace cement shall be added at a rate of 25 kg/m³ and mixed off the road by means of a concrete mixer or hand labour if approved by the Engineer. All mixing shall result in a homogenous mixture of additives and parent material which is to the satisfaction of the Engineer.

Thereafter the material shall be treated with a 60% anionic stable-grade bitumen emulsion diluted with five parts water to one part emulsion and added at a rate of 70 litres/m³ of crushed stone. All mixing shall result

in a 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/m² of the diluted 60% bitumen emulsion shall be applied to the base or layer to ensure a sealed surface.

The density of the backfilling of the base layer shall be at least 100% of modified AASHTO density.

- (iii) Where required by the Engineer the backfilling of the base layer shall be done with continuously graded asphalt base compacted to 95% of Marshall density.

The excavated areas shall be tacked at a spray rate of 0,40 litre/m² using 60% cationic emulsion. The asphalt base material shall be spread and compacted so that the final surface is neat and uniform.

- (iv) All the backfilling shall be completed in geometric patterns of squares or rectangles and in each case it shall be finished off neatly to 40 mm $\pm$ 10 mm below the levels of the surrounding sound road surface.

(c) Surfacing

A tack coat of 60% cationic emulsion shall be applied to the floor at top of base layer level at a rate of 0,4 litre/m² before backfilling is commenced or as otherwise instructed by the Engineer.

A layer of hot continuously graded medium asphalt shall be applied, compacted to 94% of Marshall density to bring the level of the patch up to final road level.

(d) Alternative for application of surfacing layer for limited localised repair work

- (i) Where instructed by the Engineer, a cold premixed bituminous mixture may be used for application of the surfacing layer for minor repair works. The mixture shall either be an approved cold mix from commercial sources, or can be prepared and mixed in a suitable concrete or other type of mixer, and shall have the following mix proportions:

- (i) 9,5 mm nominal sized aggregate: 1 part
- (ii) 6,7 mm nominal sized aggregate: 1 part
- (iii) Crusher sand (fine grade): 1 part
- (iv) 60% stable mix-grade emulsion
(prepared from 80/100 penetration grade: between 75 and 90 litre/m³ aggregate mix bitumen)

Before spreading the mixture, the surface shall be prepared by painting it with one layer of bituminous emulsion at a rate of 0,6 litre/m², which must be allowed to dry. The mixture shall then be placed on the areas to be sealed and screeded off in a layer of uniform thickness. After the emulsion has broken and the layer has attained sufficient stability, it shall be rolled with a small steel wheeled roller to obtain compaction. The thickness of the layer shall be the same as that of the adjacent seal.

- (ii) Where instructed by the engineer, a commercially available pre-fabricated stone seal with a bitumen rubber binder may be used as final surfacing on minor repair works. The material shall consist of pre-coated 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 nighttime. No area that is to be prepared, shall be left exposed if rain is imminent.

The asphalt base material shall be placed in layers not exceeding 80 mm and crushed stone material be placed in layers not exceeding 100 mm measured in the loose. The surfacing material shall be placed in one layer at a thickness of 40 mm $\pm$ 10 mm.

(f) Testing

Modified AASHTO densities shall be determined using TMHI Method A16T (Preparation of Material) and Method A7 (Compaction of Material).

CA 03.04.03 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 $\pm$ 10 mm.

The cross-fall of the completed area shall be equal to that of the adjacent surface to within a tolerance of $\pm$ 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 03.04.04 Plant and equipment

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

Only approved cutting or sawing equipment may be used for cutting or sawing asphalt layers. The equipment must be capable of cutting asphalt layers to depths of 200 mm in one operation without fragmenting the material, and in straight lines within the required tolerances.

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

- (a) A vibratory roller having a mass approximately equal to that of a Bomag 90 or similar vibratory roller, with an adjustable amplitude and frequency of vibration;
- (b) A mobile compressor capable of producing at least 3 m³/minute compressed air at 750 kPa;
- (c) Appropriate paving breakers;
- (d) Manually operated pneumatic compactors as required, and
- (e) Appropriate concrete mixers.

CA 03.04.05 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 1083/2014 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:

<u>Sieve size</u>	<u>Percentage passing (mass)</u>
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 ordinary Portland cement 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 03.04.05/1: 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 03.04.05/2.

TABLE CA 03.04.05/2: GRADING LIMITS AND MIX PROPORTIONS FOR CONTINUOUSLY GRADED ASPHALT BASE AND SURFACINGS

PERCENTAGE PASSING THROUGH SIEVE BY MASS					
SIEVE SIZE (mm)	ASPHALT BASE		ASPHALT SURFACING		
	37,5 mm maximum	26,5 mm maximum	COARSE	MEDIUM	FINE
53,000	-	-	-	-	-
37,500	100	-	-	-	-
26,500	84 - 94	100	100	-	-
19,000	71 - 84	85 - 95	85 - 100	-	-
13,200		71 - 86	71 - 84	100	
9,500	50 - 67	62 - 78	62 - 76	82 - 100	100
6,700			-	-	-
4,750	36 - 53	42 - 60	42 - 60	54 - 75	64 - 88
2,360	25 - 42	30 - 48	30 - 48	-	-
1,180	17 - 34	22 - 38	22 - 38	27 - 42	35 - 54
0,600		16 - 28	16 - 28	18 - 32	24 - 40
0,300	10 - 22	12 - 20	12 - 20	11 - 23	16 - 28
0,150		8 - 15	8 - 15	7 - 16	10 - 20
0,075	5 - 12	5 - 10	4 - 10	4 - 10	4 - 12
NOMINAL MIX PROPORTIONS (BY MASS)					
Aggregate	94,5%		93,5%	93,0%	93,0%
Bitumen	5%		5,5%	6,0%	6,0%
Active filler	0,5%		1,0%	1,0%	1,0%

(d) Tack coat

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

CA 03.04.06 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 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 03.05 ERECTION AND REPAIR OF PERMANENT ROAD TRAFFIC SIGNS

CA 03.05.01 General

This section covers the erection of permanent road traffic signs. It includes the repair and replacement of faded, damaged or not clearly visible existing signboards and reference marker boards.

Specifications relating to manufacturing of road signs are not included in this document, as relevant specifications regarding manufacturing will be issued to a nominated subcontractor who shall be a recognised manufacturer of road signs.

The signs shall be the standard regulatory, guidance, warning and information signs and fabricated in accordance with the South African Road Traffic Signs Manual (July 1993) except where otherwise specified, indicated on drawings or directed by the Engineer.

The erection and placement of any signs, whether temporary or permanent, shall be in accordance with the South African Road Traffic Signs Manual (May 2012).

CA 03.05.02 Storage and handling

All road signs or parts of road signs shall be transported, handled and stored in a weather-proof storeroom in such a manner as to prevent any damage and deformation.

Sign boards shall be stored on blocks in the vertical position so that the signs are not in contact with the ground. There shall be sufficient space between the finished road sign boards to permit free air circulation and moisture evaporation. Contact of road sign boards with treated timber and diesel, or storage where road sign boards come into contact with dirt or water will not be permitted.

When required, existing or newly erected road signs shall be fully or partially covered with burlap or other approved adequately ventilated material to obscure destinations that are temporarily inapplicable or irrelevant. The covers shall be neatly and firmly fixed in position so that they will be able to withstand strong gusts of wind or eddies caused by passing traffic. The fixing shall be done in a way that will not cause any damage to the road sign face.

CA 03.05.03 Execution of the work**(a) Position**

Road signs shall be erected in the positions shown on the drawings or indicated by the Engineer.

(b) Excavation and backfilling

Excavations for the erection of road signs shall be made according to the dimensions shown on the drawings. Where the excavations are to be backfilled with soil, a 1:10 cement/soil mixture (soilcrete) shall be prepared if instructed by the Engineer. The soil or soil-cement mixture shall then be placed at optimum moisture content in 100 mm thick layers in the excavation and shall be compacted to a minimum of 90% of modified AASHTO density.

Where posts or structures are to be fixed in concrete, or where concrete footings are to be cast, the concrete, formwork and reinforcement shall comply with the relevant requirements. The holes shall be filled with concrete up to the level shown on the drawings or indicated by the Engineer. The upper surface of the concrete shall be neatly finished with sufficient fall to ensure proper drainage.

This subclause shall apply to ground-mounted signs only. Excavating and backfilling for the foundations of overhead steel structures are specified and regarded as specialised structural work.

Excavation in rock shall be paid for under item CA.07.05.

Where material from the excavations is not suitable for backfilling or for the preparation of soilcrete, suitable material shall be obtained as instructed by the Engineer.

(c) Erection

Road sign boards must be inspected by the Engineer and approved in writing before the boards are taken from the camp site to the erection site. The Contractor shall notify the Engineer at least one (1) week before the said inspections are required.

Road signs shall be erected strictly in accordance with the details and instructions on the drawings and as directed by the Engineer.

During erection the structural steelwork shall be firmly bolted and protected to prevent buckling or damage being caused during erection, or by the equipment used for erection.

Posts to which road signs are to be fixed shall be vertical and the undersides of road signs shall be horizontal after having been erected.

Where timber posts are used for erecting the signs, all holes that are drilled in the timber shall be retreated with the approved preservative. A road sign identification number (as indicated on the layout drawings) shall be painted with white enamel paint on the reverse side of the road sign board, above the month and year of manufacture, in 50 mm high letters and numbers on the side closest to the road shoulder as directed by the Engineer.

Any sign damaged during transit to the erection site or during the erection process shall be replaced or repaired to the satisfaction of the Engineer at no extra cost to the Employer.

(d) Field welding

All welding done during erection shall comply with the requirements for welding during manufacture.

(e) On-site painting

All painting done after the road signs have been erected shall comply with the requirements for painting during manufacture.

All places where the paintwork has been damaged during erection shall be repaired by the Contractor at his own cost to the satisfaction of the Engineer.

(f) Time of erection

Road signs shall be erected immediately prior to the road being opened to public traffic, unless otherwise decided by the Engineer.

(g) Attachment of overlays

The type of overlay to be used will be specified by the Engineer and will consist either of 1 mm thick Chromadek plate, pop-riveted onto the existing sign plate, or System 5 overlay or similar approved.

Before the application of the overlay to any structure, the existing sign board shall be thoroughly cleaned.

(h) Repair of signs

The Engineer may require that certain existing signs be dismantled for repair work or storage and later re-erected. The signs shall be repainted or repaired by replacing the 200 mm profiles or straightening the sheet metal as specified during the manufacturing process. New materials shall be used for part or all the supporting structure. This work shall be done with as little damage as possible to the signs.

CA 03.05.04 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 03.05.05 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 have 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 03.05.06 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 03.06 ROAD MARKINGS**CA 03.06.01 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 03.06.02 Materials**(a) Plant****(i) Road-marking paint**

Road-marking paint shall comply with the requirements of SANS 731-1 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 731-1.

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 731-1.

(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 731-1.

(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 National Standard (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 always have a 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 03.06.03 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 03.06.04 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 03.06.05 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 three 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, sweeping or compressed air if required.

Particular care shall be taken to ensure that the surface shall be clean, where roadstuds are to be fixed.

The Contractor shall take note of conditions which he is unable to rectify by himself and may affect the durability of the paint, and he shall point out these conditions to the Engineer in writing. Disputes arising from such conditions shall be referred to the relevant Regional Engineer for arbitration before road marking commences.

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

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

The material shall not be laid over loose debris, mud or similar extraneous matter or

over old flaking markings of paint or thermoplastic material. If the road surface is at a temperature of less than 5 °C, or if it is wet, it shall be warmed carefully by a road heater so that, when the material is laid, the surface temperature is above 5 °C and the surface dry.

CA 03.06.06 Setting out the road markings

The lines, symbols, figures or marks shall be premarked by means of paint spots of the same colour as that of the final lines and marks. These paint spots shall be at such intervals as will ensure that the traffic-markings can be accurately applied, and in no case shall they be more than 1,5 m apart. Normally spots of approximately 10 mm in diameter should be sufficient.

The dimensions and positions of road-markings shall be as indicated by the Engineer, specified in the appropriate statutory provisions and the South African Road Traffic Signs Manual.

The repainting of a roadway after the application of a fogspray shall only be done once it is possible to determine the beginning and positions of individual broken line segments. Premarking of such a roadway shall entail the searching for and marking of such broken line segments. Painting shall thereafter be done to the same tolerances as prescribed in CA 04.09.10.

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

The position and outlines of special markings shall be produced on the finished road in chalk and shall be approved by the Engineer before the markings are painted. Approved templates may be used on condition that the positioning of the marking is approved by the Engineer before painting is commenced.

The positions for the beginning and end of all barrier-line road-markings must be suitably indicated by the Engineer before the marking of the road commences.

CA 03.06.07 Applying the paint

The figures, letters, signs, symbols, broken or unbroken lines or other marks shall be painted as shown on the drawings or as directed by the Engineer.

Where the paint is applied by machine, it shall be applied in one layer. Before the road-marking machine is used on the permanent works, the satisfactory operation of the machine shall be demonstrated on a suitable site which is not part of the permanent works. Adjustments to the machine shall be followed by further testing. Only when the machine has been correctly adjusted and its use has been approved by the Engineer after testing, may the machine be used on the permanent work. The operator shall be experienced in the use of the machine.

After the machine has been satisfactorily adjusted, the rate of application shall be checked and adjusted, if necessary, before application on a large scale is commenced.

Where two or three lines are required next to each other, the lines shall be applied simultaneously by the same machine. The paint shall be stirred before application in accordance with the manufacturer's instructions. Paint shall be applied without the addition of thinners.

Where, under special circumstances, painting is done by hand, it shall be applied in two layers, and the second layer shall not be applied before the first layer has dried out sufficiently. As most road-marking paint reacts with the bitumen surface of the road, the paint shall be applied with one stroke only of the brush or roller.

Ordinary road-marking paint shall be applied at a rate not less than 0,42 litre/m².

Unless otherwise instructed by the Engineer, the road-marking shall be completed before a particular section of the road is opened to traffic. Each layer of paint shall be continuous over the entire area being painted.

Control sheets with details of the order number, work dates, quantities of paint used and surface areas painted shall be completed by the Contractor for every section of road included in an order. One set of copies of these sheets shall be handed to the Engineer on completion of every individual order.

CA 03.06.08 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 03.06.09 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 03.06.10 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 03.06.11 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 03.06.12 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 03.07 CHEMICAL CONTROL OF VEGETATION AND ERADICATION OF UNDESIRABLE VEGETATION

CA 03.07.01 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 03.07.02 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 because 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

Subject to written approval by the Engineer beforehand, spraying shall be executed in the following designated areas:

- (i) Shoulder weed spray shall comprise the spraying of a 300 mm wide strip of herbicide directly adjacent to the road shoulder. The spraying of shoulders may take place only after the shoulder strips have been cut.
- (ii) Where vegetation is encroaching onto the road shoulder an increased width of 500 mm shall be sprayed along the edge with 200 mm on the black top surface and 300 mm on the shoulder vegetation.
- (iii) Vegetation under guard-rails shall be controlled by spraying under the guard-rail to a width of 500 mm;
- (iv) Openings, cracks and joints between the road pavement and concrete, as well as between paving stones and concrete blocks – shall be measured only for the area between joints, cracks or openings treated;
- (v) Up to a maximum distance of 500 mm around the poles at kilometre markers, road signs and guard-rail posts;
- (vi) Between the road reserve fence and a neighbouring solid wall. Here the Contractor may use only contact herbicides which are absorbed by the leaves and which do not have a detrimental effect on the soil;
- (vii) Entire areas invaded by weeds; Where interlocking paving areas are to be treated, a quantity of one third (1/3) of the entire surface shall be measured for payment.
- (viii) On block paved areas adjacent to concrete median barriers or steel guard-rails. These areas may have slopes to 1:1 grades.

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 in the road reserve during the contract period over the whole length of the sections of road involved, 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 because of the application of the herbicides, either during or after application. This also includes areas outside the road reserve.

The type of weed killer to be used, the correct application rates and when applied, shall be as specified and according to the manufacturer's instructions.

CA 03.07.03 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 03.07.04 Plant and equipment

Vegetation shall be eradicated using knapsacks or portable weed spray 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 to prevent mist spray blowing away and killing plants which must remain. The equipment shall also be safe for the workers, as well as for the travelling public.

CA 04 MEASUREMENT AND PAYMENT

CA.01 REPAIR OF GRAVEL WEARING COURSE

CA.01.01 Reshaping the wearing course by:

- (a) Grading only Unit: square metre (m²)
- (b) Ripping, redistributing and compacting Unit: square metre (m²)
- (c) Importing, placing and compacting material from commercial sources Unit: cubic metre (m³)

The unit of measurement for CA.01.01 (a) and (b) shall be the square metre surface area graded or ripped and re-compacted 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 Overhaul on surplus material Unit: cubic metre kilometre (m³-km)

The unit of measurement shall be the cubic metre of material hauled in excess of 1,0 km, the volume determined from the rated capacity of the truck multiplied by the overhaul distance. All trucks shall be fully loaded to their rated capacity.

The tendered rate shall include full compensation for hauling the material more than the free-haul distance.

CA 02 SURFACE REPAIRS OF CONCRETE PAVEMENTS

CA.02.01 Preparation and sealing or resealing of old joints and cracks in existing concrete pavements:

(a) Expansion joints..... Unit: metre (m)

(b) Construction joints and weakened plane joints:

(i) (Width stated) Unit: metre (m)

(ii) Etc for other widths Unit: metre (m)

(c) Cracks:

(i) (Width stated) Unit: metre (m)

(ii) Etc for other widths Unit: metre (m)

The unit of measurement shall be the metre of each type of joint or crack prepared and sealed or resealed. No distinction will be made between joints or cracks through areas where the concrete has been repaired and other joints or cracks.

The tendered rates shall include full compensation for all labour plant, equipment, tools and materials, removing old sealant, backing material and any foreign material, re-facing or enlarging the faces by sawing, routing of cracks to the specified dimensions, disposing of all debris, all cleaning work involved, installing back-up material where required, installing the bond breaker, applying the primer and mixing and applying the sealant, ensuring acceptable bond with existing work, and for any other operation needed to complete the work as specified and shown on the drawings.

CA.02.02 Patching of concrete:

(a) (Thickness stated) Unit: square metre (m²)

(b) Etc for other thicknesses Unit: square metre (m²)

The unit of measurement shall be the square metre of new concrete installed.

The tendered rates shall include full compensation for all the necessary labour, plant, equipment, tools and materials required for breaking out the existing concrete, disposing of the debris, compacting the exposed pavement layer, supplying, placing and finishing off the new concrete, and constructing isolation joints. The tendered rates shall also include full compensation for providing adequate accommodation of traffic where necessary. No separate payment shall be made for breaking out the existing concrete, sealing the joints and disposing of material removed.

CA.03 PAVEMENT LAYERS AND SURFACE REPAIR

CA.03.01 Excavation in existing pavements for patching Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of material excavated from the existing pavement irrespective of the type of material. The quantity shall be computed in accordance with the authorised dimensions of the excavation.

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

Payment will not distinguish between the different types of pavement material excavated.

CA.03.02 Backfilling of excavations for patching with:

- (a) Chemically stabilized gravel excavated from the existing pavement:
 - (i) Areas up to and including 10 m² Unit: cubic metre (m³)
 - (ii) Areas larger than 10 m² up to and including 50 m² Unit: cubic metre (m³)
 - (iii) Areas larger than 50 m² Unit: cubic metre (m³)
- (b) Emulsion-treated crushed stone pavement:
 - (i) Areas up to and including 10 m² Unit: cubic metre (m³)
 - (ii) Areas larger than 10 m² up to and including 50 m² Unit: cubic metre (m³)
 - (iii) Areas larger than 50 m² Unit: cubic metre (m³)
- (c) Asphalt base (hot mixed)..... Unit: ton (t)
- (d) Asphalt surfacing (continuously graded medium)..... Unit: ton (t)

The unit of measurement shall be the cubic metre of chemically stabilized gravel or emulsion-treated crushed stone or the ton of asphalt placed in accordance with the specified requirements. The quantity will be computed in accordance with the authorised dimensions of the layer in the case of gravel or crushed stone and in accordance with the certified weighbridge tickets issued in the case of asphalt. Payment will not be made for wasted material.

The tendered rates shall include full compensation for providing all the material, irrespective of its origin, for all mixing, placing, compacting, including the floor, and finishing as specified in this section and other sections of the appropriate specifications, for all transport, work in restricted areas, and for all machinery, equipment, labour, tack coat, supervision and other incidentals for executing the work as specified.

The tendered rates for chemically stabilized gravel shall also include full compensation for stabilizing and providing the stabilizing agent.

The tendered rates for emulsion-treated crushed stone shall also include full compensation for supplying and mixing with emulsion, stabilizing and providing the stabilizing agent.

Payment for hot-mixed asphalt base and surfacing will not distinguish between the various types of asphalt and will allow for priming.

CA.04 SURFACE PATCHING OF SURFACED ROADS

CA.04.01 Trimming the edges and edge breaks of the existing surfacing Unit: metre (m)

The unit of measurement for trimming the edges shall be a metre of pavement edge cut back and trimmed as specified measured along the centre line of the road.

The tendered rate for trimming the edges shall include full compensation for cutting back the edges in accordance with instructions, excavating the material to the specified depth

and removing all excavated and loose material. Payment for the backfilling of the edge breaks with hot-mix continuously graded asphalt will be made under item CA.04.04.

The tendered rates shall include full compensation for all transport, handling, labour, material and all incidentals necessary for completing all the work in accordance with the specifications, and also for work in restricted areas.

CA.04.02 Pothole repair using hot-mix continuously graded asphalt Unit: ton (t)

The unit of measurement for repairing surfacing shall be the ton of asphalt applied for the repair of the surfacing, irrespective of the thickness or number of layers.

The tendered rates shall include full compensation for procuring, furnishing, and storing of all materials, providing and transporting all plant, labour and equipment necessary for cutting back the edges, excavation, removing excavated and loose material and disposal thereof, priming, backfilling with the approved product, compaction and trimming as specified in this section.

The quantity shall be calculated by measuring the volume of material used, multiplied by the density of the compacted material.

CA.04.03 Pothole repair using cold mix asphalt surfacing from the following sources:

(a) Commercial sources Unit: ton (t)

(b) Mixed on site as specified Unit: ton (t)

The unit of measurement for surfacing repair shall be the ton of cold mix asphalt applied for the repair of surfacing, irrespective of the thickness or number of layers.

The tendered rates shall include full compensation for procuring, furnishing, and storing of all materials, providing and transporting all plant, labour and equipment necessary for cutting back the edges, excavation, removing excavated and loose material and disposal thereof, priming, backfilling with the approved product, compaction and trimming as specified in this section.

The quantity shall be calculated by measuring the volume of material used, multiplied by the density of the compacted material.

CA.04.04 Repairing edge breaks using hot-mix continuously graded asphalt - medium grade Unit: ton (t)

The unit of measurement for repairing edge breaks shall be the ton of asphalt applied for the repair of edge breaks, irrespective of the thickness or number of layers.

The tendered rates shall include full compensation for compacting the surface on which the new edge is to be constructed, procuring, furnishing, and mixing all materials and compacting and trimming the asphalt to the required lines and levels. It shall also include full compensation for applying a tack coat of emulsion to the surface to be treated.

The tendered rates shall include full compensation for all transport, handling, labour, material and all incidentals necessary to complete all the work as specified.

The quantity shall be calculated by measuring the volume of material used, multiplied by the density of the compacted material. No extra payment will be made regarding this item for producing small quantities of asphalt.

CA.04.05 Mechanical sweeping of road surfaces Unit: square metre (m²)

The unit of measurement for the mechanical sweeping of the road surface shall be the area of road swept, measured in square metres.

The tendered rate shall include full compensation for the provision of all equipment, use and maintenance thereof and all labour costs.

CA.05 ERECTION AND REPAIR OF PERMANENT ROAD TRAFFIC SIGNS

CA.05.01 Erection or reinstatement of road sign boards

(a) Area not exceeding 2 m² Unit: square metre (m²)

The unit of measurement shall be the square metre of completed road sign erected as required in the Project Specification, instructions or drawings issued by the Engineer.

The tendered rates shall include full compensation for attaching the road signboard to a road sign support structure, or to an overhead road sign support structure or to an overbridge and for all equipment, labour, supervision, nuts, bolts, transport, handling, etc, necessary for the installation of the road sign board.

CA.05.02 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 for CA.07.02(a) for erecting supporting structures manufactured from steel tubing 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.05.03 Excavation and backfilling for road sign supports Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of excavation measured in place according to the neat dimensions of the footings or excavations as shown on the drawings or directed by the Engineer. In the case of timber posts not in concrete, the plan area of the excavated hole shall be taken as 0,15 m², irrespective of the actual size of the excavated hole.

The tendered rate shall be in 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.05.04 Extra over item CA.07.03 for cement-treated soil backfill Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre.

The tendered rate shall include full compensation for the additional cost of providing and mixing in cement.

CA.05.05 Extra over item CA.07.03 for rock excavation Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre.

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

CA.05.06 Gravel drainage layer below road sign footings Unit: cubic metre (m³)

The unit of measurement is the cubic metre of compacted gravel placed below road sign footings in accordance with the details on the drawings. The quantity will be calculated from the authorised dimensions, and gravel placed outside the authorised dimensions will not be measured for payment.

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

CA.05.07 Hazard plates (600 x 150 mm) Unit: number

The unit of measurement is the number of each size of hazard plate erected complete in accordance with the details on the drawings.

The tendered rate shall include full compensation for excavating, disposing of excavated material (including all haul), erecting and for placing and compacting the soilcrete backfilling.

CA.05.08 Repair of road sign faces Unit: square metre (m²)

The unit of measurement shall be the square metre of sign face repaired on the instruction of the Engineer. Only the portion of the sign face repaired shall be measured for payment.

The tendered rate shall include full compensation for procuring and furnishing all the necessary material, labour and equipment and for repairing as specified.

CA.06 ROAD MARKINGS

CA.06.01 Retro-reflective road-marking paint

(a) Longitudinal lines:

(i) 100 mm wide broken or unbroken lines,
white, yellow or red..... Unit: metre (m)

(ii) 150 mm wide broken or unbroken lines,
white, yellow or red..... Unit: metre (m)

(iii) Broken or unbroken lines, white or yellow,
other widths Unit: metre (m)

(b) Transverse lines and other markings:

(i) Broken or unbroken lines, white
or yellow..... Unit: square metre (m²)

(ii) Lettering and symbols, white
or yellow, repainting existing
markings Unit: square metre (m²)

(iii) Lettering and symbols, white
or yellow, new markings Unit: square metre (m²)

(iv) Traffic island markings, white or yellow
repainting existing markings Unit: square metre (m²)

- (v) Traffic island markings, white or yellow
new markings Unit: square metre (m²)

The unit of measurement for subitem CA.08.01(a) shall be a metre of line of each specified width of line, for widths not exceeding 150 mm, and the quantity paid for shall be the actual length of line painted in terms of an official order, measured to the nearest metre. The length of gaps in broken lines shall not be measured for payment.

The unit of measurement for subitem CA.08.01(b) shall be a square metre and the quantity to be paid for shall be the actual surface area of the lettering, symbols, traffic island markings or lines completed in terms of an official order, measured to the nearest tenth of a square metre.

The tendered rate per metre or per square metre, as the case may be, shall include compensation for procuring and providing all the necessary labour, constructional plant, tools, equipment and materials, including the retro-reflective beads. The tendered rate shall also include full compensation for surface preparation, for painting the road markings and applying the retro-reflective beads, for protection and temporary traffic control facilities, maintenance, and for all incidentals necessary to complete and maintain the road markings in accordance with the provisions of the contract, including the setting-out of lettering, symbols and traffic island markings, but excluding setting out and pre-marking the lines.

**CA.06.02 Setting out and pre-marking of lines
(excluding traffic island markings, lettering
and symbols) Unit: kilometre (km)**

The unit of measurement for setting out and pre-marking lines shall be a kilometre of line set out and premarked. If two or more parallel lines lie in a strip with a maximum width of 1,0 m the setting out and pre-marking of the lines will be measured once only as if it is a single line.

The tendered rate shall include full compensation for setting out and pre-marking the lines in accordance with an official order, including all materials, and measured to the nearest tenth of a kilometre.

CA.06.03 Removal of road markings:

(a) Removal of markings by means of
grit-blasting Unit: square metre (m²)

(b) Removal of markings by other mechanical
methods (The tenderer shall state the method
he intends to use) Unit: square metre (m²)

(c) Removal of markings by chemical methods
(The tenderer shall state the method he intends
to use) Unit: square metre (m²)

The unit of measurement for the removal of road markings shall be a square metre and the quantity paid for is the actual surface area of the markings removed in terms of an official order, measured to the nearest tenth of a square metre.

The tendered rate shall include full compensation for removing the markings, including all material.

CA.07 CHEMICAL CONTROL OF VEGETATION AND ERADICATION OF UNDESIRABLE VEGETATION

CA.07.01 Chemical control of vegetation:

- (a) 300 mm wide strip Unit: kilometre (km)
- (b) 500 mm wide strip Unit: kilometre (km)
- (c) Cracks and joints between road pavement and concrete drains, paving stones or concrete blocks.....Unit: metre (m)
- (d) Around kilometre markers, road signs and guardrail posts.....Unit: square metre (m²)
- (e) Between road reserve fence and a solid wall.....Unit: square metre (m²)
- (f) Area covered by interlocking blocks Unit: square metre (m²)
- (g) Entire area invaded by weeds Unit: square metre (m²)
- (h) (Any other area as specified)

The unit of measurement for items CA.09.01(a) and (b) above shall be the kilometre of road treated as described in these specifications. The distance treated will be measured once for each strip so treated. The unit of measurement for item CA.09.01(c) above shall be the length of crack or joint treated as described in these specifications. The length treated will be measured once along the length of the crack. The unit of measurement for items CA.09.01(d), (e), (f) and (g) above shall be the square metre of road reserve treated as described in these specifications.

The Contractor is to assess the number of different types of places where application of chemicals will be required and to make provision accordingly for the fluctuating chemical demand per kilometre of road.

The tendered rate shall include full compensation for the supply of chemicals, plant, equipment and labour for the spraying of the chemical liquids in accord with the manufacturers specifications.

The tendered rates shall be fully inclusive of any costs arising from restricted working conditions due to the nature of the site or traffic flow.

Payment will be made as follows:

- (a) 60% will be payable after application
- (b) The remaining 40% will be payable once 90% of the vegetation has been controlled to the satisfaction of the Engineer.

CA.07.02 Eradication of weeds (chemical).....Unit: square metre (m²)

The unit of measurement for the eradication of weeds by means of spraying will be the square metre treated in this way by a selected subcontractor.

The tendered rate shall include full compensation for the supply of all chemicals, machinery, labour and equipment to spray the herbicides according to the instructions of the manufacturers.

Payment of 60% of the value of the spraying done will be made when visible results are obtained (usually 14 days after application). The remaining 40% of the value of the work will be payable when at least 90% of unwanted growth has been destroyed.

CA.08 CONCRETE SPEED HUMPS**CA.08.01 Repair of concrete speed humps.....Unit: number**

The unit of measurement shall be the number of speed humps repaired.

The tendered rate shall include for the removal of the remainder of the existing speed hump and the replacement with a 150 mm high concrete speed hump to the Engineer's satisfaction. The width and length of the speed hump shall be the same as for the original, unless otherwise directed by the Engineer, and the concrete shall be of the same type and strength as used for concrete patching.

The tendered rate shall also be fully inclusive of all materials, machinery and labour costs.

CA.09 SEGMENTED PAVING**CA.09.01 Repair of segmented concrete block paving.....Unit: square metre (m²)**

The unit of measurement shall be the square metre completed segmented concrete block paving removed, material excavated from the existing pavement to a depth of 400mm, backfilling, stabilising and compacting layers of 150mm, supply of bedding sand, and installation of new concrete block paving similar to existing.

The tendered rate shall include full compensation for demarcating the excavation and excavating and disposing of the material, backfilling and stabilising material, compaction, bedding sand and concrete block paving.

CA.09.02 Replacement of jointing sand.....Unit: square metre (m²)

The unit of measurement for the replacement of jointing sand shall be square metre of existing paving area treated.

The tendered rate shall include full compensation for supplying, delivering, placing, and spreading of jointing sand, brooming into joints, compacting using a plate compactor as specified and removal of excess sand from the pavement. The tendered rate shall also include full compensation for all labour, transport, incidentals and equipment required to perform the work according to the specifications.

TECHNICAL SPECIFICATION

CB STORMWATER DRAINAGE

CONTENTS

CB 01	SCOPE
CB 02	STANDARD SPECIFICATIONS
CB 03	EXECUTION OF REPAIR WORK
CB 04	MEASUREMENT AND PAYMENT

CB 01 SCOPE

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

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	-	Construction Specifications Aug 2014 & Dec 2015
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 03 EXECUTION OF REPAIR WORK

CB 03.01 GENERAL

The Contractor shall investigate and inspect all areas of the installation to confirm the extent of the repair work required and shall report to the Engineer. The Engineer will thereafter 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.

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 specifications included in this document.

All new, materials and systems shall be furnished with a written guarantee with a defects liability period of twelve (12) months from date of completion of repair work. These guarantees shall be furnished in favour of the Department of Public Works. On completion of the required and specified repair work the systems, installations and equipment shall be commissioned and handed over to the satisfaction of the Engineer.

Repair work items for the stormwater drainage systems shall be categorised under the following headings:

- (a) Prefabricated culvert installation and repair of existing culverts and structures.
- (b) Cleaning of prefabricated culverts.
- (c) Concrete channel construction and repair of existing channels.
- (d) Cleaning of concrete drains and channels.
- (e) Cleaning of earth channels.
- (f) Construction and repair of brickwork inlet structures.
- (g) Provision of lockable stormwater grid inlets.
- (h) Cleaning of pipelines.

CB 03.02 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 03.02.01 Construction

Prefabricated culverts shall be constructed or replaced in accordance with the specifications at the locations indicated by the Engineer.

(a) Excavation

The width of the excavation shall be sufficient to allow the proper laying, bedding and backfilling of culverts. The widths of the excavation for each type and size of culvert shall be as set out in SANS 1200 DB.

The depth of the excavation for each type and size of culvert shall depend on site conditions and the amount by which the excavation is to exceed the proposed level of the invert of the culvert and shall be sufficient to allow the type and thickness of bedding material instructed by the Engineer.

Where excavation is to be carried out through asphalt premix or concrete, the asphalt/concrete shall be cut neatly and vertically with approved sawing equipment before the asphalt/concrete is removed.

Excavations shall commence from the outlet end of culverts to be installed.

(b) Classification of excavation

All excavations shall be classified as follows for payment purposes:

(i) Hard material

Material which cannot be excavated except by drilling and blasting, or with the use of pneumatic tools or mechanical breakers, and boulders exceeding 0,10 m³ shall be classified as hard material.

Where more than 40% of any material (by volume) consists of boulders each exceeding 0,10 m³ in size, the material shall be classified as hard material.

(ii) Soft material

All material not classified as hard material shall be classified as soft material.

Notwithstanding the above classification, all material excavated from previously constructed fills, subgrades and subbases shall be classified as soft material.

(c) Disposal of excavated material

Where excavated material does not comply with the requirements for backfilling material as specified or is surplus to backfilling requirements, such excavated material shall be removed from the site and disposed of.

Material suitable for use in the works, however, shall be used as prescribed.

(d) Removal of damaged culverts

Where indicated by the Engineer damaged sections of prefabricated culverts shall be completely removed and replaced with new units.

Excavation shall be carried out as described for new culvert installation and the excavated material shall be, if suitable, preserved for backfilling. The damaged culvert units shall be disposed of.

(e) Laying of concrete pipe culverts

Concrete pipe culverts shall be laid on class A or B bedding as directed by the Engineer. The inside of the culverts shall be smooth and without any displacement and all pipes shall be laid true to line and level with a minimum slope of 2% or as directed by the Engineer.

(i) Class A bedding - see SANS 1200 LB

(ii) Class B bedding - see SANS 1200 LB

(iii) Rock foundation

Where rock, shale or hard material is encountered on the bottom of excavations a bed of fine material as required for class B bedding shall be placed before laying the pipe.

(iv) Concrete casing

Where ordered by the Engineer a pipe shall be encased in concrete according to the Engineer's instructions.

(f) Laying of concrete portal culverts

Portal culverts shall be laid on prefabricated floor slabs. A layer of fine-grained material of at least 75 mm thick shall be placed on the bottom of the excavation, levelled, compacted and trimmed to line and grade to form a bed to receive the precast slabs.

The portal portions of portal culverts shall be placed accurately and symmetrically on the floor slabs with a thin layer of mortar of one part of cement and six parts of sand between the contact surfaces to ensure a firm and uniform support.

(g) Extension of existing culverts

Where existing culverts require extension or where damaged sections are replaced the new sections shall be placed at the same grade and, where it joins the existing structure, at the same level as the existing structure.

Any sections of existing wing walls, approach slabs and head walls which may obstruct any new work shall be demolished and removed. The demolition and reconstruction of new inlet and outlet structures shall be paid for under the relevant sections in the specification.

(h) Construction of culverts in half widths in existing roads

To allow the free flow of traffic at all times the culverts shall be constructed in half widths. The downstream section shall be constructed first and the end of the excavation adjoining the traffic lane shall be properly supported to prevent displacement from occurring.

(i) Repairing of cracks and joints

Where instructed by the Engineer cracks in existing culverts and culvert joints which have opened shall be caulked with material specified in the 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 03.02.02 Quality standard

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

CB 03.02.03 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 03.03 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 03.03.01 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 03.03.02 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 03.04 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 03.04.01 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 channelling 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.

(c) Half-round channels

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

(d) Kerbing and channelling

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

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

(e) Concrete cast against existing surfaced edges

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

(f) Reinstatement of damaged existing structures

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

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

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

(g) Inlet and outlet structures

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

CB 03.04.02 **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 03.04.03 **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 03.05 **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 concrete drains and channels constructed from any type of material.

CB 03.05.01 **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 re-growth.

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 03.05.02 Quality standard

Concrete drainage channels shall be clear of any obstruction such that the concrete surfaces are clearly visible.

CB 03.06 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 03.06.01 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 03.06.02 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 03.07 CONSTRUCTION AND REPAIR OF BRICKWORK INLET STRUCTURES

CB 03.07.01 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 03.07.02 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 03.08 PROVISION OF LOCKABLE STORMWATER GRID INLETS

Stormwater inlet structures shall be provided with lockable grids where required by the Engineer. 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 03.09 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 03.09.01 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 03.09.02 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 04 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 (m³)
- (ii) Exceeding 1,5 m up to and including 3,0 m Unit: cubic metre (m³)
- (iii) Exceeding 3,0 m up to and including 4,5 m Unit: cubic metre (m³)
- (iv) Etc in increments of 1,5 m

- (b) Excavating hard material irrespective of depth Unit: cubic metre (m³)

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 (m³)
- (b) Selected layers compacted to 93% of modified AASHTO density Unit: cubic metre (m³)
- (c) Cement stabilized subbase layer compacted to 95% of modified AASHTO density Unit: cubic metre (m³)

The unit of measurement for CB.01.02(a) and (b) shall be the cubic metre of gravel material placed and compacted according to authorised dimensions on drawings.

The unit of measurement for CB.01.02(c) shall be the cubic metre of stabilized material placed and compacted according to authorised dimensions.

The tendered rates shall include full compensation for procuring and furnishing, placing, compaction and finishing of materials, labour, tools and equipment for executing the work to the satisfaction of the Engineer.

CB.01.03 Prefabricated culverts:

- (a) On class A bedding (type and diameter indicated)..... Unit: metre (m)
- (b) On class B bedding (type and diameter indicated)..... Unit: metre (m)
- (c) Portal culverts with prefabricated floor slabs (type and size indicated)..... Unit: metre (m)

The unit of measurement for prefabricated culverts shall be the metre of culvert laid. The length shall be measured along the soffit of the culvert.

The tendered rates shall include full compensation for providing, testing, loading, transporting and unloading the culverts, for providing and placing the bedding material where required, and for the installation, laying and jointing of the culverts as specified including cutting them on the site and removing any waste.

CB.01.04 Cast in-situ concrete and formwork in stormwater structures:

- (a) Class 20 concrete Unit: cubic metre (m³)
- (b) Class 25 concrete Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of concrete in place. Quantities shall be calculated from the dimensions shown on the drawings or as authorised.

The tendered rates shall include full compensation for procuring and furnishing all the materials, storing the materials, providing all plant, mixing, transporting, placing and compacting the concrete, forming the inserts, construction joints and contraction joints, curing and protecting the concrete, repairing defective surfaces and finishing the concrete surface as specified.

CB.01.05 Replacement of manhole covers, grid inlets, etc

- (a) SANS 558 Type 4 - covers, grids, etc:
 - (i) Maximum dimension up to and including 300 mm Unit: number
 - (ii) Maximum dimension 301 mm to 600 mm..... Unit: number
 - (iii) Maximum dimension 601 mm to 900 mm..... Unit: number
 - (iv) Maximum dimension over 900 mm Unit: number
- (b) SANS 558 Type 4 - frames only for covers, grids, etc:
 - (i) Maximum dimension up to and including 300 mm Unit: number
 - (ii) Maximum dimension 301 mm to 600 mm..... Unit: number
 - (iii) Maximum dimension 601 mm to 900 mm..... Unit: number
 - (iv) Maximum dimension over 900 mm Unit: number
- (c) SANS 558 Type 2A - covers, grids, etc:
 - (i) Maximum dimension up to and including 300 mm Unit: number
 - (ii) Maximum dimension 301 mm to 600 mm..... Unit: number
 - (iii) Maximum dimension 601 mm to 900 mm..... Unit: number

- (iv) Maximum dimension over 900 mm Unit: number
- (d) SANS 558 Type 2A - frames only for covers, grids, etc:
- (i) Maximum dimension up to and including 300 mm Unit: number
- (ii) Maximum dimension 301 mm to 600 mm..... Unit: number
- (iii) Maximum dimension 601 mm to 900 mm..... Unit: number
- (iv) Maximum dimension over 900 mm Unit: number

The unit of measurement shall be the number of covers or frames installed. The classification of the size of each cover or frame will be based on the nominal dimensions of the unit and not on the actual dimensions.

The tendered rates shall include full compensation for procuring, furnishing and placing the new covers, grids and/or frames. The tendered rates shall also include full compensation for removing and disposing of the damaged covers, grids and/or frames.

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:
- (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:
- (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:

- (i) Up to and including 500 mm Unit: metre (m³)
- (ii) 501 mm to 750 mm Unit: metre (m³)
- (iii) 751 mm to 950 mm Unit: metre (m³)
- (iv) 951 mm to 1250 mm Unit: metre (m³)
- (v) 1251 mm to 1500 mm Unit: metre (m³)
- (vi) 1501 mm to 2100 mm Unit: metre (m³)

(b) Prefabricated corrugated metal culverts:

- (i) Up to and including 500 mm Unit: metre (m³)
- (ii) 501 mm to 750 mm Unit: metre (m³)
- (iii) 751 mm to 950 mm Unit: metre (m³)
- (iv) 951 mm to 1250 mm Unit: metre (m³)
- (v) 1251 mm to 1500 mm Unit: metre (m³)

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) For open drains:

- (i) Soft material Unit: cubic metre (m³)
- (ii) Hard material Unit: cubic metre (m³)

(b) For half-round channels and kerbing and channelling:

- (i) Soft material Unit: cubic metre (m³)
- (ii) Hard material Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of material excavated in accordance with the authorised dimensions measured in place.

The tendered rates shall include full compensation for all plant, labour and tools necessary for excavating the material to the required dimensions, including trimming the excavation before placing concrete, disposing of the material from the site.

CB.03.02 Cast in-situ concrete:

- (a) Linings (class indicated) Unit: cubic metre (m³)
- (b) Half-round channels Unit: cubic metre (m³)
- (c) Channels for kerb and channel (class indicated) Unit: cubic metre (m³)
- (d) Speed humps (class indicated) Unit: cubic metre (m³)
- (e) Inlet cover slabs (class indicated) Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of concrete placed in situ. The quantity shall be calculated in accordance with the authorised dimensions.

The 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 (m³)

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 (m³)
- (b) Reinforced concrete Unit: cubic metre (m³)
- (c) Kerbing and channelling Unit: metre (m)
- (d) Half-round channels Unit: metre (m)

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 unit of measurement for CB.03.07 (c) and (d) shall be the metre length of kerbing and channelling or half-round channels removed.

The tendered rates shall include full compensation for all labour, equipment and tools for removal of the damaged sections, trimming the bedding and for loading, transporting and disposing of the material 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 (m³)

The unit of measurement shall be the cubic metre of concrete in side beams constructed as instructed.

The tendered rate shall include full compensation for furnishing all material and labour including formwork as necessary, placing concrete and shaping all surfaces and all excavations required.

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

- (a) Excavated material to spoil Unit: cubic metre kilometer (m³-km)
- (b) Existing structures demolished Unit: cubic metre kilometer (m³-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 Cleaning of concrete drainage channels:**

- (a) Remove material and load for spoil:
- (i) Channels in kerbing-channelling combinations and side drains..... Unit: metre (m)
 - (ii) Other drains and channels within the following invert width ranges:
 - (1) Less than 1,0 m Unit: metre (m)
 - (2) 1,0 m up to and including 2,0 m Unit: metre (m)
 - (3) Exceeding 2,0 m up to and including 3,0 m Unit: metre (m)
- (b) Remove material and dispose of adjacent to channels:
- (i) Channels in kerbing-channelling combinations and side drains Unit: metre (m)
 - (ii) Other drains and channels within the following invert width ranges:
 - (1) Less than 1,0 m Unit: metre (m)
 - (2) 1,0 m up to and including 2,0 m Unit: metre (m)
 - (3) Exceeding 2,0 m up to and including 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 (m³-km)

The unit of measurement shall be the cubic metre of material hauled to spoil, the volume to be determined from the rated capacity of the truck multiplied by the average overhaul distance. All trucks shall be fully loaded to their rated capacity.

The tendered rate shall include full compensation for hauling the material the average overhaul distance to the designated spoil site.

CB.05 CLEANING AND MAINTENANCE OF EXISTING EARTH CHANNELS

CB.05.01 Cleaning earth drains and channels Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of material cleaned out of the drain.

The tendered rate shall include full compensation for all labour and equipment required for removing the obstruction from drains, irrespective of depth of silt and debris and disposal of the excavated material as described.

CB.05.02 Repairing of earth drains and channels Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of compacted material calculated from the dimensions measured in place.

The tendered rate shall include full compensation for trimming the eroded area to firm surrounding material, for procuring, transporting placing and compacting the backfill material.

CB.05.03 Banks and dykes Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of in place in banks or dykes, calculated in accordance with authorised dimensions.

The tendered rate shall include full compensation for procuring, transporting furnishing, placing, watering, compacting, shaping and trimming of material in the banks and dykes.

CB.05.04 Cleaning of vegetation at inlet and outlet structures (5 m x 5 m) Unit: square metre (m²)

The unit of measurement shall be the area measured in square metres, cleared of all vegetation blocking the inlet and outlet structures.

The tendered rate shall include for labour, clearing of vegetation, removing 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 (m³-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 (m³)**

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 labelled keys to the User Client.

CB.08 CLEANING OF PIPELINES**CB.08.01 Cleaning of pipes and inlet structures (average depth of material removed not exceeding 100 mm):**

(a) Up to and including 300 mm Unit: metre (m)

(b) Exceeding 300 mm up to and including 450 mm Unit: metre (m)

(c) Exceeding 450 mm up to and including 600 mm Unit: metre (m)

(d) Exceeding 600 mm up to and including 800 mm Unit: metre (m)

(e) Exceeding 800 mm up to and including 1000 mm Unit: metre (m)

The unit of measurement shall be the metre of pipe cleaned, (depth of material removed is on average not more than 100 mm) measured once along the soffit of

the pipe. For multiple pipes each individual pipe shall be measured separately.

The tendered rates shall include full compensation for removing the material, for disposing of the material in an appropriate manner and ensuring that the material will not wash into drainage trenches.

CB.08.02 Cleaning of pipes and inlet and outlet structures (average depth of material removed exceeding 100 mm):

- (a) Up to and including 300 mm Unit: metre (m³)
- (b) Exceeding 300 mm up to and including 450 mm Unit: metre (m³)
- (c) Exceeding 450 mm up to and including 600 mm Unit: metre (m³)
- (d) Exceeding 600 mm up to and including 800 mm Unit: metre (m³)
- (e) Exceeding 800 mm up to and including 1000 mm Unit: metre (m³)

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 pipe.

The tendered rates shall include full compensation for removing the material from the pipe for loading the material onto trucks and for transporting the material from the site.

CB.08.03 Overhaul of material hauled in excess of 1,0 km free-haul distance Unit: cubic metre kilometre (m³-km)

The unit of measurement shall be the cubic metre of material hauled to spoil in excess of the free-haul distance of 1,0 km, 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 in excess of the free-haul distance.

CB.08.04 Provision of equipment for visual inspection of underground pipe network Unit: sum

The tendered sum shall include full compensation for the provision of suitable equipment, such as torches, lights and TV surveillance equipment, etc, to enable a basic visual inspection of the pipe network.

CB.08.05 Visual inspection of underground pipe network Unit: metre (m)

The tendered rate shall include full compensation for all processes necessary to complete a thorough check of the stormwater network including lifting and replacing manhole covers and inlet covers, using relevant equipment and any clearing necessary to allow the visual inspection to proceed.

TECHNICAL SPECIFICATION

CC FENCING AND GATES

CONTENTS

CC 01	SCOPE
CC 02	STANDARD SPECIFICATIONS
CC 03	EXECUTION OF WORK
CC 04	QUALITY STANDARD
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CC 06	MEASUREMENT AND PAYMENT

CC 01 SCOPE

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

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.

CC 02 STANDARD SPECIFICATIONS

CC 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

- SANS 121 - Hot-dip (galvanised) zinc coatings (other than on continuously zinc-coated sheet and wire) (1988)
- SANS 675 - Zinc-coated fencing wires (plain and barbed) (1993)
- SANS 1373 - Chain-link fencing and its wire accessories (1983)

CC 02.02 OCCUPATIONAL HEALTH AND SAFETY ACT

All regulations and statutory requirements as laid down in the latest edition of the Occupational Health and Safety Act, 1993: Construction Regulations, 2014 as promulgated in Government Gazette No 10113 and Regulation Gazette No 37305 of 7 February 2014 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 03 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 new fences are to be erected, or where repairs are necessary.

Wherever an opening has been made in the fence while repairing it, the area shall be guarded by a guard of the User Client. Under no circumstances shall a fence be left open or unattended at any time. Whenever a part of the fence is taken down to repair/replace it, it will be replaced within 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 03.01 SCOPE OF WORK

The scope of the work is repair and/or replacement of existing fences. The Ports of Entry consist of various sections of fencing, as listed in specification **SS: Site Specific Inventory**, which forms part of the contract for fencing, cleaning and site keeping.

CC 03.02 CLEARING THE FENCE ROUTE

The fence route shall be cleared over a width of at least 0,5m 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 removal of trees within the specified width interfering with the integrity of the fence up to a diameter of trunk of 200mm (measured 0,5m above ground level) shall be deemed included in the rate.

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

The rate should also make provision for the placing, and compacting of small quantities of fill material should the surface irregularities be of such an extent that the 50mm restriction of fence above ground level cannot be achieved. The imported material shall be measured for payment separately.

CC 03.03 INSTALLATION OF POSTS AND STANDARDS

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

Holes shall be dug to their full specified depth.

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

CC 03.04 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 03.05 ERECTING DIAMOND MESH OR WELDED MESH

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 03.06 CLOSING OPENINGS UNDER FENCES

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

CC 03.07 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.

CC 03.08 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 gate-post when closed. The clearance below the gates shall not exceed 75 mm with the gates closed.

CC 03.09 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 03.10 ERECTING NEW FENCING MATERIAL

All new material used to replace old material shall be similar to the old material replaced unless a new material is specified by the Engineer. In the event of a fence being replaced with a new fence, the removal- and disposal of all previous redundant material shall be deemed *included* in the rate for the new fencing material.

CC 04 **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 05 **MATERIALS****CC 05.01** **POSTS****CC 05.01.01** **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 capped, galvanised in accordance with SANS 763 for Class B1 articles as specified and have a minimum wall thickness of 2,00 mm and diameter of 110mm (or as approved by the Engineer). The replacement of a post shall include the removal of the old post as well as the concrete footing and disposing thereof as part of the rate. All new posts shall be founded in concrete as per DPW specification and shall be deemed included in the rate. Tubular stays shall have a minimal bore of at least 60 mm and a wall thickness of at least 2,00 mm. These stays shall be galvanised as specified in SANS 121.

CC 05.02 **WIRE****CC 05.02.01** **Barbed wire**

Barbed wire shall comply with the requirements of SANS 675 and shall be:

- (a) High-steel grade, oval shaped, single-strand wire, 3,15mm x 2,50mm (2,81mm equivalent diameter), and fully galvanised.
- (b) Barbs shall be manufactured from 2,0 mm galvanised wire and shall be spaced at not more than 152 mm.
- (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.

CC 05.02.02 **Barbed tape coil**

Barbed tape coil shall comply with the requirements for type A in CKS 592 and shall consist of close-coiled, high-tensile wire with a continuous strip of flat steel barbs (barbed tape) crimped to the wire along the entire length of the wire.

The high-tensile wire shall be Class B galvanized. The barbed tape shall be made of cold-roller carbon steel and galvanized to Class 2450.

CC 05.02.03 **Smooth wire**

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

- (a) Straining wire shall be 4,0 mm diameter and fully galvanised.
- (b) Fencing wire shall be high-tensile grade, 2,24 mm diameter wire fully galvanised.
- (c) Tying wire shall be 2,50 mm diameter, mild steel, galvanised wire for tying fencing wire to standards and droppers, and 1,60 mm diameter, mild steel, galvanised wire for tying netting and mesh wire to fencing wire.

CC 05.03 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 50mm x 50mm or 64 x 64 mm.
- (c) The wire shall be fully galvanised.

CC 05.04 WELDED MESH

Welded mesh fences shall be fully galvanised with mild steel wire with a minimum diameter of 1,8 mm and 75 mm mesh or similar to the existing fence being repaired.

CC 05.05 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 - 4,0 mm	0,10 mm

CC 05.06 GATES

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

CC 06 MEASUREMENT AND PAYMENT**CC.01 CLEARING FENCE ROUTE 1 m WIDE STRIP..... Unit: metre (m)**

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

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

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

- (a) Barbed wire Unit: metre (m)
- (b) Straining wire..... Unit: metre (m)
- (c) Diamond mesh Unit: metre (m)
- (d) Wire netting..... Unit: metre (m)
- (e) Barbed tape coil Unit: metre (m)

- (f) Posts..... Unit: number
- (g) Gates Unit: number
- (h) Y-standards Unit: number
- (h) Reinforced concrete fence post with overhang Unit: number
- (i) BTC coil..... Unit: metre (m)

The quantity of material used shall be determined by measuring the quantities of individual items of material installed in the completed fence. Clearing of the fence line will be paid for under item CC.01. Removal and disposing of the existing fencing material shall be deemed included in the rate for new material.

The applicable units of measurement are as follows:

- (a) Fencing wire and barbed tape coil (BTC)

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. Barbed tape coil shall not be measured along the coiled wire but also between end posts.

- (b) Diamond mesh and wire netting

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

- (c) Posts

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

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

- (d) Gates

The unit of measurement shall be the number of each type of gate repaired or replaced. Gate posts for new gates shall not be measured for payment and shall be deemed included in the rate.

CC.03

REMOVAL OF TREES

- (a) Tree with diameter up to 200mm Unit: number
- (b) Tree with diameter up to 450mm Unit: number
- (c) Tree with diameter up to 700mm..... Unit: number
- (d) Tree with diameter up to 1000mm Unit: number
- (e) Tree with diameter up to 1500mm Unit: number

The diameter of the tree trunk shall be measured 500mm above ground level. Removal and disposing of the tree, branches, roots etc. shall be deemed included in the rate. All roots shall be removed within a distance of 1000mm from the trunk up to a depth of 1000mm below ground level. Other tree roots shall be removed as far as physically possible. The Engineer shall give written instruction for each tree that has to be removed. No additional excavation shall be measured for payment.

CC.04 **REDRESS, SERVICE, TENSIONING AND TIGHTENING OF FENCE**.....Unit: metre (m)

The unit of measurement for the redressing (servicing, tightening, tensioning, repairing and patching) the fence line (including all gates, posts, poles and overhangs) shall be the metre of fence line measured along each fence line.

The tendered rate shall include full compensation for servicing, tensioning, performing minor repairs, tightening the fence and patching damaged areas..

CC.05 **TREATING AND PAINTING OF POLES**..... Unit: metre (m)

The unit of measurement for the treating and painting of poles shall be the metre of pole as instructed by the Engineer.

(a) For steel posts

The tendered rate shall include full compensation for treating the existing poles with an approved **rust remover/inhibitor** and the applying **cold galvanising** or **bitumen aluminium paint** as specified by the Engineer.

(b) For timber posts

The tendered rate shall include full compensation for treating the existing poles with approved **timber treatment paint** in accordance with SANS 457 such as carbolineum treatment as specified by the Engineer.

TECHNICAL SPECIFICATION

CE WATER DISTRIBUTION NETWORKS

CONTENTS

CE 01	SCOPE
CE 02	STANDARD SPECIFICATIONS
CE 03	EXECUTION OF REPAIR WORK
CE 04	TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK
CE 05	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) Valves
- (c) Bulk water meters
- (d) Domestic water meters
- (e) Chambers
- (f) Pumping stations
- (g) Borehole installations
- (h) Reservoirs
- (i) Irrigation pipe networks and sprinklers.

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, 1993: Construction Regulations, 2014 as promulgated in Government Gazette No 10113 and Regulation Gazette No 37305 of 7 February 2014 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 03 EXECUTION OF REPAIR WORK

CE 03.01 GENERAL

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

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 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 03.02 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 03.02.01 General

Repair work to the water distribution system may include but not be limited to the following:

CE . 3

- (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 03.02.02 Construction

The Engineer will indicate the pipeline sections in need of repair and shall instruct the Contractor with regard to the repair work to be done.

(a) Excavation

The width of the excavation shall be sufficient to allow the proper laying, bedding and backfilling of the pipelines. The width of the excavation for each type and size of pipeline shall be as set out in SANS 1200 DB.

The depth of the excavation for each type and size of pipeline shall depend on site conditions and the amount by which the excavation is to exceed the proposed level of the invert of the pipeline and shall be sufficient to allow the type and thickness of bedding material instructed by the Engineer.

Where excavation is to be carried out through asphalt premix or concrete, the asphalt/concrete shall be cut neatly and vertically with approved sawing equipment before the asphalt/concrete is removed.

Cutting, breaking out and replacing of concrete pavements will be paid under Subclause CA.02.

Excavations shall extend such that, where possible cut in may be reduced by lifting adjacent pipes.

(b) Classification of excavation

All excavations shall be classified as follows for payment purposes:

(i) Hard material

Material which cannot be excavated except by drilling and blasting or with the use of pneumatic tools or mechanical breakers and boulders exceeding 0,10 m³ shall be classified as hard material.

Where more than 40% of any material (by volume) consists of boulders each exceeding 0,10 m³ in size, the material shall be classified as hard material.

(ii) Soft material

All material not classified as hard material shall be classified as soft material.

Notwithstanding the above classification, all material excavated from previously constructed fills, sub grades and sub bases 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 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 03.02.03 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 03.02.04 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) Super cast cast-iron pipes and fittings

Super cast 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

Prefabricated galvanised 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, galvanised to SANS 763. 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) 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 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, holder bats, 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 (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 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 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 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	Soil Crete
Under surface bed	600		Soil Crete
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	Soil Crete
Under surface bed	600		Soil Crete
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 soil Crete 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 sideways 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 SABS 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 angle 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 SABS 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 SABS 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 iron 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 SABS 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 SABS 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 (m³) 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 03.03 FIRE WATER PIPED RETICULATION NETWORKS

CE 03.03.01 General

Repair work to the fire water piped reticulation networks is detailed in the Particular Specification and shall include but not be limited to the work described below. This specification only covers the water piped reticulation for the fire water protection system, 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 firefighting 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 03.03.02 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 03.04 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 03.04.01 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 03.04.02 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 03.05 REPAIR OF FITTINGS

CE 03.05.01 Construction

The Engineer will indicate the fittings that are to be repaired or replaced.

The repair / replacement 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 03.06 REPAIR OF STRUCTURES

The Engineer will indicate the structures that are to be repaired.

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

The reinstatement of damaged structures shall be carried out to the same standards prescribed for new construction.

CE 04 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 hour's 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 05 MEASUREMENT AND PAYMENT**CE.01 WATER DISTRIBUTION PIPELINES****CE.01.01 Repair / Replace 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 (in all material types except *hard rock excavation* which shall be measured for payment elsewhere), the removal of the existing pipeline and fittings, dealing with water logged conditions, provision of bedding and additional backfill material, 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 and haul of surplus materials.

The provision of the pipes and fittings 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) SABS 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) SABS 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) SABS 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) SABS 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 rate 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.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 valve 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.05 REPAIR OF STRUCTURES

CE.05.01 Demolition and removal of damaged existing structures

- (a) Plain concrete Unit: cubic metre (m³)
- (b) Reinforced concrete Unit: cubic metre (m³)
- (c) Brickwork Unit: square metre (m²)
- (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 Overhaul on material for haul in excess of 1,0 km

- (a) Excavated material to spoil Unit: cubic metre kilometre (m³-km)
- (b) Existing structures demolished Unit: cubic metre kilometre (m³-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.05.03 Repair of structures

- (a) Brickwork..... Unit: square metre (m²)
- (b) Concrete..... Unit: cubic metre (m³)
- (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.05.04 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.05.05 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.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.07

STERILIZATION OF RESERVOIR

Before the reservoir is sterilized, the pipelines serving the reservoir shall have been sterilized. The reservoir shall then be thoroughly cleaned out and washed down with clean water.

The roof and walls shall thereafter be thoroughly sprayed down, using pressurised equipment, and the walls, roof and floors shall be scrubbed with the solution specified in subclause 5.10 of SABS 1200 L.

On completion of the sterilization, the sterilizing solution shall be run to waste before the reservoir is filled for testing water tightness.

Should additional work be required to be done inside the reservoir after the water tightness tests has been completed, the reservoir shall be resterilized at the Contractor's expense.

TECHNICAL SPECIFICATION

CF SEWERAGE NETWORKS

CONTENTS

CF 01	SCOPE
CF 02	STANDARD SPECIFICATIONS
CF 03	EXECUTION OF REPAIR WORK
CF 04	TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK
CF 05	MEASUREMENT AND PAYMENT

CF 01 SCOPE

This specification covers all aspects regarding the general repair and maintenance of sewerage networks which may include the following installations:

- (a) Sewer pipelines and manholes
- (b) Open sewerage channels
- (c) Septic tanks.

CF 02 STANDARD SPECIFICATIONS

CF 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

- SANS 1200 D - Earthworks
- SANS 1200 DB - Earthworks (pipe trenches)
- SANS 1200 L - Medium-pressure pipelines
- SANS 1200 LB - Bedding (pipes)
- SANS 1200 LC - Cable ducts
- SANS 1200 LD - Sewers

CF 03 EXECUTION OF REPAIR WORK**CF 03.01 GENERAL**

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

At the start of the repair and maintenance contract all the systems, installations and equipment shall be repaired as specified in the Particular Specification. This repair work shall include but not be limited to the details specified in the Particular Specification.

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

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

The said repair work shall be executed in accordance with the relevant codes of practice, standards, regulations, municipal laws and by-laws, manufacturer's specifications and codes of practice and all Additional and Particular Specifications included in this document.

All repair work shall be executed within the approved period for repairs to be agreed at the start of the Contract period. All new equipment, materials and systems shall be furnished with a written guarantee with a defects liability period of twelve (12) months from date of completion of repair work. These guarantees shall be furnished in favour of the Department of Public Works. On completion of the required and specified repair work the systems, installations and equipment shall be commissioned and handed over to the satisfaction of the Engineer.

CF 03.02 REPAIR OF EXISTING PIPELINES AND STRUCTURES

This section covers the work in connection with the construction of sewerage networks and associated sewerage structures such as manholes, cleaning eyes and the like. It also covers the removal and replacement of damaged and broken pipes and sewerage structures, as well as repairs to existing pipes and structures.

CF 03.02.01 General

Repair work to the soil and wastewater drainage system shall be detailed in the Specification and may include the following:

- (a) Replacement of damaged, broken, leaking, corroded above-ground and underground pipework and fittings;
- (b) Replacement of damaged, broken and missing gully gratings, manhole covers and frames, cleaning eye covers, screws and bolts, inspection of eye covers, screws and bolts, end caps and vent cowl;
- (c) Repair work to damaged manholes, gullies, cleaning eyes, etc, including builder's work and benching;
- (d) Initial unblocking and cleaning of all drainage pipework, traps and gullies;

- (e) Repair of sewerage system where necessary;
- (f) Provision of additional connections to the sewerage system;
- (g) Reinstatement and making good of walls, concrete, road surfaces, etc, to an approved acceptable level where any repair and/or service work have been executed;
- (h) Video surveying of all underground drainage pipework to establish root ingress, damaged pipework, fat build-up, blockages, incorrect falls, sagging and as-built information. This survey shall be utilised to establish the extent of repair and upgrade work to be executed;
- (i) Test pipe system and equipment for leakage;
- (j) Sewerage pipes are to be sampled for corrosion and scaling. The Engineer will evaluate the actions to be followed if the outcome of this sampling requires attention;
- (k) Reinstatement and making good of walls, tiling, floors, concrete, finishes, holes, chases, surfaces, etc, to an acceptable level where repair and/or service work have been executed.

CF 03.02.02

Construction

The Engineer will indicate the location at which sections of pipeline are in need of repair after the appropriate surveys have been completed by the Contractor.

(a) Excavation

The width of the excavation shall be sufficient to allow the proper laying, bedding and backfilling of the pipelines. The width of the excavation for each type and size of pipeline shall be as specified in SANS 1200 DB.

The depth of the excavation for each type and size of pipeline shall depend on site conditions and the amount by which the excavation is to exceed the proposed level of the invert of the pipeline and shall be sufficient to allow for the type and thickness of bedding material as instructed by the Engineer.

Where excavation is to be carried out through asphalt premix or concrete, the asphalt/concrete shall be cut neatly and vertically with approved sawing equipment before the asphalt/concrete is removed.

Excavations shall extend such that, where possible, cut in may be reduced by lifting adjacent pipes.

(b) Classification of excavation

All excavations shall be classified as follows for payment purposes:

(i) Hard material

Material which cannot be excavated except by drilling and blasting, or with the use of pneumatic tools or mechanical breakers and boulders exceeding 0,10 m³ shall be classified as hard material.

Where more than 40 % of any material (by volume) consists of boulders each exceeding 0,10 m³ in size, the material shall be classified as hard material.

(ii) Soft material

All material not classified as hard material shall be classified as soft material.

Notwithstanding the above classification, all material excavated from previously constructed fills, subgrades and subbases shall be classified as soft material.

(c) Disposal of excavated material

Where excavated material does not comply with the requirements for backfilling material as specified or is surplus to backfilling requirements, such excavated material shall be removed from the site.

Material suitable for use in the works, however, shall be used as prescribed.

(d) Removal of damaged pipelines

Where indicated by the Engineer damaged sections of pipelines shall be completely removed and replaced.

Excavation shall be carried out as described for new pipeline installation and the excavated material shall be, if suitable, preserved for backfilling. The damaged pipe materials shall be disposed of where instructed by the Engineer.

(e) Pipe couplings

Repair sections shall be joined utilising existing pipe sockets and collars where possible.

Repair couplings shall be used with the approval of the Engineer.

(f) Laying of PVC pipes and fittings

New sections of PVC pipelines shall be laid on 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.

(g) Rock foundation

Where rock, shale or hard material is encountered on the bottom of excavations a bed of fine material as required for class B bedding shall be placed before laying the pipe.

(h) Concrete encasement

Where instructed by the Engineer pipes shall be encased in concrete. All such encasing shall be done in accordance with the Engineer's instructions and sufficient allowance shall be made for movement joints.

(i) Extension of existing pipelines

Where existing pipelines require extension or where damaged sections are replaced the new sections shall be placed at the same grade and, where they join the existing service, at the same level as the existing pipeline.

Existing chambers or other structures which may obstruct any new work shall be demolished and removed. The demolition and reconstruction of new structures shall be paid for under the relevant sections in the specification.

(j) Construction in existing roads

Road crossings will either be constructed utilising sufficient provision of bypass roads, or they will be done utilising the half width of the road. At all times a through route shall be maintained for all traffic.

(k) Repairing of leaks

Where leaks occur at pipe sockets or collars the effected section will be cut from the pipeline and repaired using repair couplings.

Where obvious leaks occur due to displaced sealing rubbers they will be replaced if the replacement can be done economically by lifting adjacent pipes.

(l) Sewer manholes

All manhole cover frames shall be cast into the concrete cover slabs.

Manholes in trafficable areas shall be provided with heavy duty covers and frames and surrounded by concrete slabs.

(m) Steep sewers

Sewer pipes in the ground with a slope steeper than 1:5 and under surface beds shall be encased in concrete.

(n) External sewers

The sewer outside the boundary of the building complex shall be constructed strictly in accordance with the details and specifications of the Local Authority.

(o) As-built services

Existing drainage invert levels and positions are to be checked against invert levels given on the drawings before work commences. The Engineer must be informed immediately of any discrepancy.

The Contractor shall be responsible for the compilation of as-built plans of sewerage network, showing all pipes, pipe diameters, invert levels and associated structures.

All existing services are to be located and opened before the proposed drainage work commences.

(p) Testing

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

(q) Ingress of foreign material

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

(r) CCTV surveys

Modern technology video surveying equipment and detection equipment shall be utilised to establish blockage problems and positions of such problems.

(s) Proximity to buildings

Any drainage pipe within the 45° range below building foundations shall be encased in concrete or soilcrete as specified.

(t) Repair to existing structures

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

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

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

(u) Repair to existing channels

Existing channels shall be cleaned. Broken sections of lined channels shall be repaired. Such repair work shall comprise patching of concrete and replacement of precast sections.

CF 03.02.03 Quality standard

Pipelines shall be laid at even gradients to the satisfaction of the Engineer and the applicable specifications.

CF 03.02.04 Materials

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

(a) Manhole covers

Manhole covers, etc, shall have covers and frames complying with SANS 558.

(b) uPVC pipe and fittings

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

The joining method to be used shall be polypropylene couplings with integral rubber seal similar or equal to Vitrosleeve in accordance with SANS 50295:.

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

All fittings underground shall consist of uPVC.

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

CF 03.02.05

Air test for sewer and drains

The following air test as specified in the NBRI information sheet X/BOU 2-34 shall be applicable to all air tests on new sewers and drains installed under the repair Contract and shall be executed by the Contractor and witnessed by the Engineer.

(a) Method of air testing

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

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

- (i) Air-permeable pipelines such as vitrified clay or asbestos cement should preferably be tested when moist or wet.
- (ii) The trench shall be partially backfilled before the test is carried out. This is required to stop possible temperature variations and to prevent damage to the pipeline during subsequent backfilling operations.
- (iii) The testing equipment shall be shielded from the direct rays of the sun.
- (iv) Flexible joints are recommended for sewer and drain pipelines. Good quality flexible joints are superior to cement caulked joints and they also provide the pipeline with flexibility to prevent cracking due to subsequent soil movement.
- (v) The test method is very sensitive to flaws in the pipeline, such as cracks or leaking joints. The actual positions of flaws along the pipeline can be determined by using the specialised equipment.
- (vi) If the pipeline is below the water table and subjected to external water pressure, the test method should be modified by the Engineer to ensure that the final pressure value is higher than that of the external water pressure acting on the lowest part of the installation.

The minimum times for pressure drop of 250 mm to 125 mm water gauge are given in table CF 04.02.05/1 below.

TABLE CF 04.02.05/1

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

CF 03.03**CLEANING OF SEWERAGE NETWORK**

The work involved under this section is the removal of silt, debris and vegetation from within the pipelines and manholes and the general cleaning of areas where leakage has occurred. This can be done either mechanically or chemically according to the more appropriate method as specified by the Engineer.

CF 03.03.01**Construction**

The Contractor shall arrange with the Engineer for an inspection of the pipe route before the cleaning of any pipeline sections is carried out. Based on the inspection, the Engineer will instruct the Contractor as to which sections of the network require cleaning.

Visual inspections utilising closed-circuit TV cameras will not be required unless deemed essential and will be specifically requested by the Engineer.

Sections of the pipeline may be removed for a more detailed inspection. Such sections shall be repaired as specified in Subclause CF 04.02.02. Sections shall only be cut from the pipeline where specifically instructed by the Engineer.

The method to be applied for the cleaning of the pipelines shall be chemical or mechanical. The method to be used for each section of the pipeline will be instructed by the Engineer.

Material removed from the culverts shall be disposed of as instructed by the Engineer.

Where insufficient scour values are present, the method for scouring of the pipelines shall be discussed and agreed with the Engineer prior to implementation.

CF 03.04 REPAIR OF FITTINGS**CF 03.04.01 Construction**

The Engineer will indicate the fittings that are to be repaired, but these fittings shall not be limited to those specifically indicated by the Engineer.

Repair of the following fittings may be required:

- (a) Cleaning eyes
- (b) Permanent plug stoppers
- (c) Channel sections.

CF 04 TESTS AND INSPECTIONS ON COMPLETION OF REPAIR WORK

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

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

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

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

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

The Contractor shall submit certificates of tests carried out to prove the quality and proper functioning of all equipment and also certificates to be obtained from all relevant authorities and statutory bodies, etc.

CF 05 MEASUREMENT AND PAYMENT**CF.01 SEWERAGE NETWORKS****CF.01.01 Repair / Replace 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 (in all material types except *hard rock excavation* which shall be measured for payment elsewhere), the removal of existing pipeline and fittings, dealing with water logged conditions, provision of bedding and additional backfill material, bedding and back filling of replacement pipeline, cutting to length,

finishing, repair of kerbs, road surfaces, accommodation of traffic, excavation in all materials, removal of unsuitable material from the trench and disposal of surplus materials.

The tendered rate shall include full compensation for all material, plant and labour required to temporarily by-pass (if required) the pipe section being replaced.

The provision of the materials will be measured separately under CF. 01.02.

CF.01.02 Provision of materials

(a) Pipelines Unit: metre (m)

The unit of measurement shall be the metre of pipe replaced.

(b) Fittings Unit: number

The unit of measurement shall be the number of fittings installed.

The tendered rates shall include full compensation for all transport to the place of installation, storage, labour costs.

Separate pay items shall be listed for the pipe materials and fittings per diameter and class and for the class of bedding to be used.

CF.01.03 Replacement of manhole covers, grid inlets and the like

(a) SANS 558 Type 4 - covers, grids, etc, only:

- (i) Maximum dimension up to 300 mm Unit: number
- (ii) Maximum dimension 301 mm - 600 mm Unit: number
- (iii) Maximum dimension 601 mm - 900 mm Unit: number
- (iv) Maximum dimension over 900 mm Unit: number

(b) SANS 558 Type 4 - frames only for covers, grids, etc:

- (i) Maximum dimension up to 300 mm Unit: number
- (ii) Maximum dimension 301 mm - 600 mm.....Unit: number
- (iii) Maximum dimension 601 mm - 900 mm.....Unit: number
- (iv) Maximum dimension over 900 mm.....Unit: number

(c) SANS 558 Type 2A - covers, grids, etc, only:

- (i) Maximum dimension up to 300 mm Unit: number
- (ii) Maximum dimension 301 mm - 600 mm.....Unit: number
- (iii) Maximum dimension 601 mm - 900 mm.....Unit: number
- (iv) Maximum dimension over 900 mm.....Unit: number

(d) SANS 558 Type 2A - frames only for covers, grids, etc:

- (i) Maximum dimension up to 300 mm Unit: number
- (ii) Maximum dimension 301 mm - 600 mm.....Unit: number
- (iii) Maximum dimension 601 mm - 900 mm.....Unit: number
- (iv) Maximum dimension over 900 mm.....Unit: number

The unit of measurement shall be the number of covers or frames installed. The classification of the size of each cover or frame will be based on the nominal dimensions of the cover/unit and not on the actual dimensions.

The tendered rates shall include full compensation for procuring, furnishing and placing the new covers, grids and/or frames. The tendered rates shall also include full compensation for removing and disposing of the damaged covers, grids and/or frames from the site.

CF.01.04 Manholes and inspection chambers

CF.01.04.01 Raising or lowering of existing manholes or inspection chambers of all types:

(a) Raise/lower 0 m up to and including 0,5 m Unit: number

(b) Raise/lower exceeding 0,5 m up to and including 1 m Unit: number

The unit of measurement shall be the number of manholes/inspection chambers raised/lowered within the specified dimensions.

The tendered rates shall include full compensation for all excavation (including around structures), levelling, temporary timbering, shoring and strutting, for preparing the bottom of the excavation for the manhole beds, the disposal of material, dealing with subsurface or surface water, benching and for other operations necessary for completing the work as specified.

Payment shall distinguish between soft and hard material. The tendered rates shall include full compensation for transporting the excavated material from the site.

CF.01.04.02 Breaking into existing sewer and building a new manhole

(a) Precast concrete manhole:

(1) Depth exceeding 0,5 m up to and including 1,0 m Unit: number

(2) Depth exceeding 1,0 m up to and including 1,5 m Unit: number

(3) Depth exceeding 1,5 m up to 2,0 m Unit: number

The unit of measurement shall be the number of manholes constructed within the specified dimensions.

The tendered rate shall include full compensation for excavation, building a new manhole over the sewer, breaking into the existing sewer, building the channelization under wet conditions, ensuring the water tightness of the new connection, supplying all the necessary materials, removing surplus material, all labour and equipment required to make the connection, and liaison with the local authorities. Provision for manhole covers shall be made under CF 01.03 payment.

CF.01.04.03 Connecting to existing sewer Unit: sum

The tendered sum shall include full compensation for excavation, making an opening in the existing manhole, installing new pipes in the new opening, for breaking out and modifying the channelization inside the manhole to suit the new pipe layout, ensuring the water tightness of the new connection, supplying all the necessary materials, removing surplus material and debris all labour and equipment required to make the connection, and liaison with the local authorities.

CF.01.04.04 Repair of channels..... Unit: metre (m)

The unit of measurement shall be the length of channel section repaired.

The tendered rate shall include full compensation for cleaning, patching, repairing of existing channels, irrespective of diameter and position. The rate shall also include all necessary materials, equipment and labour required.

CF.02 CLEANING OF SEWERAGE NETWORK**CF.02.01 Mechanical cleaning of sewer pipes and structures:**

- (a) Up to 150 mm..... Unit: metre
- (b) 151 mm to 300 mm..... Unit: metre
- (c) 301 mm to 450 mm..... Unit: metre
- (d) More than 450 mm Unit: metre

The unit of measurement shall be the metre of pipe cleaned, measured once along the soffit of the culvert. For multiple pipes each individual pipe shall be measured separately.

The tendered rates shall include full compensation for removing the material, for disposing of the material in an approved manner and ensuring that the material will not wash into drainage trenches.

CF.02.02 Chemical cleaning of sewer pipes and structures:

- (a) Up to and including 150 mm Unit: metre
- (b) 151 mm to 300 mm..... Unit: metre
- (c) 301 mm to 450 mm..... Unit: metre
- (d) More than 450 mm Unit: metre

The unit of measurement shall be the metre of pipe cleaned, measured once along the soffit of the culvert. For multiple pipes each individual pipe shall be measured separately.

The tendered rates shall include full compensation for supply of chemical agents, equipment, labour and the effective application of the cleaning process.

CF.02.03 Provision of equipment for visual inspection of underground pipe networks..... Unit: lump sum

The tendered sum shall include full compensation for the provision of suitable equipment, such as TV surveillance equipment, torches, lights and mirrors, etc, to enable a thorough visual inspection of the pipe network.

CF.02.04 Use of CCTV surveillance equipment..... Unit: metre (m)

The unit of measurement shall be the metre of pipe inspected.

The rate shall be fully inclusive of all associated equipment and interpipe moves and recording equipment.

CF.02.05 Visual inspection of underground pipe network.....Unit: sum

The tendered sum shall include full compensation for all processes necessary to complete a thorough check of the sewer network including lifting and replacing manhole covers, using relevant equipment and any clearing necessary to allow the visual inspection to proceed.

CF.02.06 Demolition and removal of damaged existing structures:

(a) Plain concrete..... Unit: cubic metre (m³)

(b) Reinforced concrete Unit: cubic metre (m³)

(c) Kerbing and channelling Unit: metre (m)

(d) Pipework Unit: metre (m)

The unit of measurement for CF.02.06(a) and (b) shall be the cubic metre of existing material demolished, determined from 70 % of the rates cubic metre capacity of the truck used to remove the material.

The unit of measurement for CF.02.06(c) and (d) shall be the metre length of kerbing and channelling or pipework removed.

The tendered rates shall include full compensation for all labour, equipment and tools for removal of the damaged sections, trimming the bedding and for loading, transporting and disposing of the material.

The reinstatement of damaged sections shall be paid for under the relevant items for constructing new structures.

CF.03 TESTS AND INSPECTIONS

(a) Pressure testing of pipelines Unit: metre

The unit of measurement shall be the length of sewer pipeline tested.

(b) Testing of manholes.....Unit: number

The unit of measurement shall be the number of manholes tested after repair.

The tendered rates shall include full compensation for all labour, materials, power, fuel, accessories and properly calibrated and certified instruments necessary for carrying out relevant tests as per SANS 1200. Submission of certificates from tests and equipment and any costs involved in obtaining such from relevant authorities shall also be included in the tendered sum.

TECHNICAL SPECIFICATION

CG REFUSE REMOVAL AND PEST CONTROL

CONTENTS

CG 01	SCOPE
CG 02	DETAIL OF REPAIR, MAINTENANCE AND SERVICING WORK
CG 03	MEASUREMENT AND PAYMENT

CG 01 SCOPE

This specification covers the requirements for maintenance and facility management work related to solid waste management, refuse removal and pest control.

CG 02 DETAIL OF REPAIR, MAINTENANCE AND SERVICING WORK

The Contractor shall ensure that the necessary materials, skilled personnel, tools and equipment are available at all times to perform his duties. The work shall include the collection and removal of existing litter, rubble and other solid waste across the entire site. The Contractor shall be responsible for removing all scattered waste that existed prior to the contractor commencing with maintenance and servicing work in order to clean the entire site to a clean and healthy state. Collection of solid waste shall be performed under the guidance of the Engineer.

The Contractor shall transport solid waste collected across the entire site to a central container for removal to a disposal site off site. Removal of solid waste from the central container to a disposal site off site (to a registered solid waste dumping site) shall be the responsibility of the Contractor as part of monthly maintenance tasks.

CG 02.01 LITTER COLLECTION

All litter and rubble shall be collected within the external perimeter fences of MANANGA LAND PORT OF ENTRY and removed and disposed of.

CG 02.02 WASTE COLLECTION

Waste bins are provided at each residential unit, offices and service buildings. The waste bins at all residential units shall be cleaned out on a weekly basis. Waste bins in public areas shall be cleaned out daily. The storage of the solid waste at the solid waste disposal area until such time as it is removed from site will be the responsibility of the Contractor in a skip (on-site) at a central location within the site.

CG 02.03 REMOVAL OF SOLID WASTE

Removal of solid waste from the central solid waste container (skip) to a formal solid waste facility shall be the responsibility of the Contractor.

CG 02.04**GRASS SODDING**

The laying of new 'instant lawn' shall be performed for the area specified. *Kikuyu* grass for sunny areas and *LM* grass for shaded areas (or similar approved by Engineer). The final finished level should be approximately 30mm below sidewalks, sprinkler heads, etc. (below the level desired for the final grass lawn.) The soil shall be moist and loose - accomplished by watering a day or two before installation. Rake the top soil with a final levelling action to create loose soil particles for new sod roots. Lay sods on newly prepared lawn area. Start laying sod along a straight line such as a sidewalk or driveway. As each piece is laid in a row, firmly push the ends together so the spaces between the pieces of sod are minimized. Each row should be staggered so that the joints are at different locations than the adjoining row. After sods have been placed, it shall be rolled. The new lawn area shall be watered on a regular basis (at least daily for first 10 days), and finally treated with an approved fertilizer (3:2:1 SR) spreaded at a coverage of minimum 0.1kg/m².

CG 02.05**PEST CONTROL**

The implementation of Pest and Rodent control by a specialised subcontractor shall be measured separately for internal and external applications for the areas identified by the Engineer based on the Pest Control Plan submitted by the Contractor.

GENERAL

Integrated Pest Management (IPM) is a process for achieving long-term, environmentally sound pest suppression and prevention through the use of a wide variety of technological and management practices. Control strategies in an IPM program include:

- Structural and procedural modifications to reduce food, water, harborage, and access used by pests.
- Pesticide compounds, formulations, and application methods that present the lowest potential hazard to humans and the environment.
- Non-pesticide technologies such as trapping and monitoring devices.
- Coordination among all facilities management programs that have a bearing on the pest control effort.

The Contractor shall furnish all supervision, labour, materials, and equipment necessary to accomplish the monitoring, trapping, pesticide application, and pest removal components of the IPM program.

PESTS INCLUDED AND EXCLUDED

The Contractor Shall Adequately Suppress the Following Pests:

1. Indoor populations of rodents, insects, arachnids, and other arthropods.
2. Outdoor populations of potentially indoor-infesting species that are within the property boundaries of the specified buildings.
3. Nests of stinging insects within the property boundaries of the specified buildings.
4. Individuals of all excluded pest populations that are incidental invaders inside the specified buildings, including winged termite swarmers emerging indoors.
5. Termites and other wood-destroying organisms.

Populations of the Following Pests are excluded from this contract:

1. Birds, bats, snakes, and all other vertebrates other than commensal rodents.
2. Mosquitoes.
3. Pests that primarily feed on outdoor vegetation.

INITIAL BUILDING INSPECTIONS

The Contractor shall complete a thorough, initial inspection of each building or site at least ten (10) working days prior to the starting date of the application. The purpose of the initial inspections is for the Contractor to evaluate the pest control needs of all locations and to identify problem areas and any equipment, structural features, or management practices that are contributing to pest infestations.

PEST CONTROL PLAN

The Contractor shall submit a Pest Control Plan at least five (5) working days prior to the starting date of the application. Upon receipt of the Pest Control Plan, the Engineer will render a decision regarding its acceptability within two (2) working days. If aspects of the Pest Control Plan are incomplete or disapproved, the Contractor shall have two (2) working days to submit revisions. The Contractor shall be on-site to perform the initial service visit for each building within the first five (5) working days of the contract.

The Pest Control Plan shall consist of five parts as follows:

1. Proposed Materials and Equipment for Service: The Contractor shall provide current labels and Material Safety Data Sheets for all pesticides to be used, and brand names of pesticide application equipment, rodent bait boxes, insect and rodent trapping devices, pest monitoring devices, pest detection equipment, and any other pest control devices or equipment that may be used to provide service.
2. Proposed Methods for Monitoring and Detection: The Contractor shall describe methods and procedures to be used for identifying sites of pest harborage and access, and for making objective assessments of pest population levels throughout the term of the contract.
3. Service Schedule for Each Building or Site: The Contractor shall provide complete service schedules that include weekly or monthly frequency of Contractor visits, specific day(s) of the week of Contractor visits, and approximate duration of each visit.
4. Description of any Structural or Operational Changes That Would Facilitate the Pest Control Effort: The Contractor shall describe site-specific solutions for observed sources of pest food, water, harborage, and access.
5. Commercial Pesticide Applicator Certificates or Licenses: The Contractor shall provide photocopies of Commercial Pesticide Applicator Certificates or Licenses for every Contractor employee who will be performing on-site service under this contract.

The Contractor shall be responsible for carrying out work according to the approved Pest Control Plan. The Contractor shall receive the concurrence of the Engineer prior to implementing any subsequent changes to the approved Pest Control Plan, including additional or replacement pesticides and on-site service personnel.

RECORD KEEPING

The Contractor shall be responsible for maintaining a pest control logbook or file for each building or site specified in this contract (included in monthly remuneration for maintenance of fencing, cleaning and site keeping). These records shall be kept on-site and maintained on each visit by the Contractor.

USE OF PESTICIDES

The Contractor shall be responsible for application of pesticides according to the label. All pesticides used by the Contractor must be registered. Transport,

handling, and use of all pesticides shall be in strict accordance with the manufacturer's label instructions and all local laws and regulations.

The Contractor shall adhere to the following rules for pesticide use:

- A. Approved Products: The Contractor shall not apply any pesticide product that has not been included in the Pest Control Plan or approved in writing by the Engineer.
- B. Pesticide Storage: The Contractor shall not store any pesticide product in the buildings specified in this contract.
- C. Application by Need: Pesticide application shall be according to need and not by schedule.
- D. Minimization of Risk: When pesticide use is necessary, the Contractor shall employ the least hazardous material, most precise application technique, and minimum quantity of pesticide necessary to achieve control.

QUALITY CONTROL

The Contractor shall establish a complete quality control program to assure the requirements of the contract are provided as specified. The program shall include at least the following items:

A. Inspection System:

The Contractor's quality control inspection system shall cover all the services stated in this contract. The purpose of the system is to detect and correct deficiencies in the quality of services before the level of performance becomes unacceptable and/or the Engineer identifies the deficiencies.

B. Checklist:

A quality control checklist shall be used in evaluating contract performance during regularly scheduled and unscheduled inspections. The checklist shall include every building or site serviced by the Contractor as well as every task required to be performed.

C. File:

A quality control file shall contain a record of all inspections conducted by the Contractor and any corrective actions taken. The file shall be maintained throughout the term of the contract and made available to the Engineer upon request.

D. Inspector(s):

The Contractor shall state the name(s) of the individual(s) responsible for performing the quality control inspections.

CG 02.06

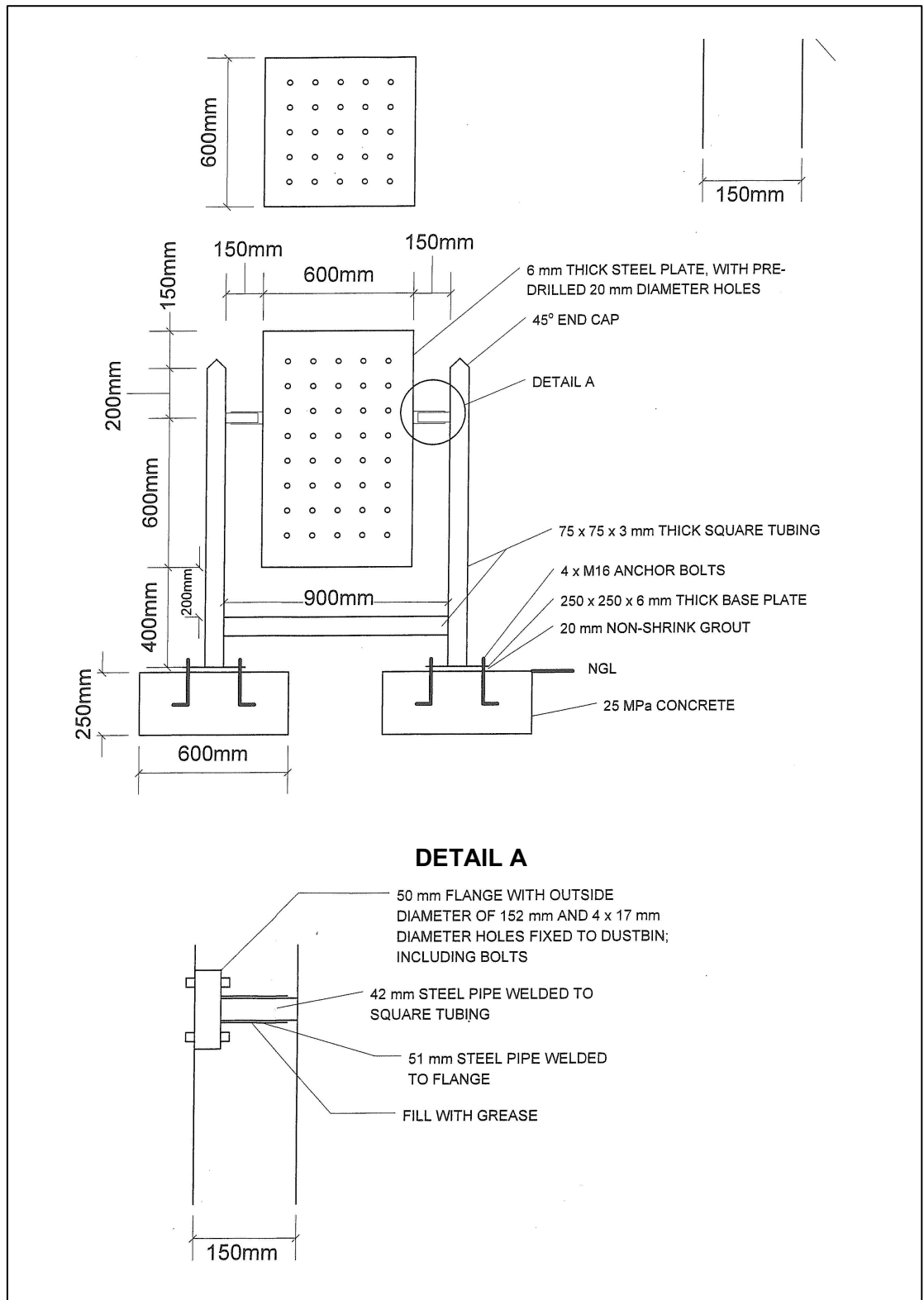
PLANTING OF TREES

The planting of *indigenous* trees shall be performed in accordance with **COLTO Clause 5807**. The trees shall be either one of the following (depending on availability and engineer's approval):

- Mountain Karee Tree (*Rhus leptodictya*)
- Wild plum (*Harpephyllum caffrum*)
- White Stinkwood (*Celtis Africana*)

STEEL SWING WASTE BINS

The manufacture, supply and installation of Steel Swing Bins shall in accordance with drawing CG 02.07 below. All steel work shall be welded with 6mm continuous joints. Steel work shall be painted with high gloss enamel paint, colour to be approved by the Engineer.



CG 02.07: STEEL SWING WASTE BINS

CG 03 MEASUREMENT AND PAYMENT

CG.01 REFUSE REMOVAL Unit: month

The unit of measurement shall be the month for which refuse and waste material is removed from waste-skip on site, irrespective of the type of material and contents on a weekly basis.

The tendered rate shall include full compensation for all labour, equipment and tools for collecting, loading, transporting and disposing of the material from the site to an approved dumping site, off site.

CG.02 DISPOSAL OF LITTER Unit: cubic metre (m³)

The unit of measurement shall be the cubic metre of existing litter, old building rubble and other waste material removed from the site, irrespective of the type of material. The quantity shall be determined from 70 % of the rated cubic metre capacity of the truck used to remove the material. This item shall only be paid for existing solid waste at the moment the contractor takes access to the site. This item only makes provision for existing litter, rubble and old building material. This item shall not be utilised for payment of removal of building rubble and litter arising from the contractor's repair work. No separate payment shall be made for the removal of litter and rubble as part of the repair work or maintenance.

Only litter, building rubble and other waste removed on instruction from the Engineer shall be measured for payment.

The tendered rate shall include full compensation for all labour, equipment and tools for collecting, loading, transporting and disposing of the material from the site to an approved dumping site, off site.

CG.03 SUPPLY OF WASTE BINS Unit: number

The unit of measurement shall be the number of municipal-type waste bins supplied as described in the schedule of quantities. The tendered rate shall include full compensation for the supply, transportation and placing of the waste bins. The waste bins to be supplied shall have roller wheels and shall have a capacity of 240 litres.

CG.04 WASTE COLLECTION SKIP Unit: number

The unit of measurement shall be the number for the provision of a single skip at a central location within the site.

The tendered rate shall be fully inclusive of supply and installation of the skip to the site required including 1.8m high diamond fence around the skip with a lockable gate.

CG.05 PEST CONTROL PLAN (INTERNAL & EXTERNAL) Unit: number

The unit of measurement shall be the number pest control plans compiled and submitted (one per site) - in accordance with the specification prior to implementation of pest control. This plan shall also be incorporated in the contractor's maintenance control plan.

The tendered rate shall include full compensation for travelling, subsistence and labour and printing required for compiling the report.

CG.06 PEST CONTROL (INTERNAL) Unit: number

The unit of measurement shall be the number of internal pest control performed (all buildings on the premises) Pest, termite and rodent control performed as instructed by the Engineer.

CG.07 PEST CONTROL (EXTERNAL) Unit: number

The unit of measurement shall be the area of external pest control performed (entire premises and open areas) Pest, termite and rodent control performed as instructed by the Engineer.

**CG.08 OVERHAUL ON MATERIAL FOR HAUL
IN EXCESS OF 1,0 KM: Unit: cubic metre kilometre (m³-km)**

The unit of measurement shall be the cubic metre of material hauled in excess of 1,0 km, measured according to the rated capacity of the truck used, multiplied by the average overhaul distance.

The tendered rate shall include full compensation for hauling the material in excess of the free-haul distance.

CG.09 LEVELLING OF SITE Unit: m²

The unit of measurement shall be the surface area of the site to be graded and levelled as demarcated and instructed for by the Engineer **only**.

The importation of additional material shall be paid under CG.03.

CG.10 IMPORTATION OF FILL MATERIAL Unit: m³

The unit of measurement shall be cubic metres of fill measured as the transported volume. The rate shall be inclusive of excavation, transport, and the distribution of the material at the disposal site.

CG.11 SITE REHABILITATION

(a) Lime cover Unit: m²

The unit of measurement shall be the square metre of area covered with lime.

The tendered rate shall include provision of lime (supply and delivery), spreading and finishing of the lime to a minimum depth of 20 mm.

(b) Topsoil cover Unit: m²

The unit of measurement shall be the square metre of area of topsoil placed.

The tendered rate shall include provision of topsoil (supply and delivery), spreading and finishing of the material to a depth of 300 mm.

(c) Sodding (grass sods) Unit: m²

The unit of measurement shall be the square metre of area of grass sods placed.

The tendered rate shall include provision of grass sods (supply and delivery), levelling of topsoil, planting and finishing, rolling, watering and fertilizing of the new grass sods.

TECHNICAL SPECIFICATION

CJ SITE KEEPING AND CLEANING

CONTENTS

CJ 01	SCOPE
CJ 02	EXECUTION OF WORK
CJ 03	SCOPE OF WORK
CJ 04	GENERAL DESCRIPTION OF INSTALLATION
CJ 05	CLEANING
CJ 06	REPAIR
CJ 07	MEASUREMENT AND PAYMENT
CJ 08	MAINTENANCE

CJ 01 SCOPE

This specification covers the cleaning and site keeping of the facilities at MANANGA LAND PORT OF ENTRY

CJ 02 EXECUTION OF WORK

The Contractor shall ensure that the necessary materials, skilled personnel, tools and equipment are available at all times to accommodate the site keeping and cleaning of the facilities.

CJ 03 SCOPE OF WORK

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

Site Keeping

The area where site keeping is to be performed includes the area included within the perimeter fences of MANANGA LAND PORT OF ENTRY including all areas falling within fenced-in residential properties. Site keeping will include removal of rubble, removal of weeds, shrubs and other objects and regular cutting of the grass, as well as keeping all gardens weed-free, neat and in an acceptable condition.

Cleaning of Offices and Support Facilities (Residential facilities EXCLUDED)

All offices and support buildings (i.e. Administration and Support buildings, Storerooms, Cell block, Public Ablutions and recreation buildings) are to be cleaned and maintained in a sanitary condition at all times.

CJ 04 GENERAL DESCRIPTION OF INSTALLATION

The installation includes the following facilities where site keeping and cleaning are to be executed:

TABLE CJ 04.01: BUILDINGS TO BE CLEANED

	POE	BUILDINGS / FACILITIES
1	MANANGA LAND PORT OF ENTRY	■ Administration Offices and Buildings ■ Gate House ■ Cell Block ■ Public Ablutions Facilities ■ Conference Room ■ Storerooms ■ Administration Garages ■ Recreation Building

TABLE CJ 04.02: OPEN AREAS

	SAPS	APPROX. AREA	DESCRIPTION
1	MANANGA LAND PORT OF ENTRY	44 400 m ²	All open areas, roads, gardens, surfaced areas and lawns within the perimeter fence.

CJ 05 CLEANING

A description of all the office buildings and support facilities to be cleaned and maintained in a sanitary condition are set out in paragraph CJ 04.

CJ 06 REPAIR

Each abluion facility shall be equipped with the following equipment:

- Hand Dryer
- Stainless steel air freshener
- Stainless steel toilet paper dispenser units
- Stainless steel she bins
- Stainless steel hand soap dispensers
- Stainless steel urinal dispensers
- Stainless steel paper towel dispenser
- Stainless steel wall bin

CJ 06.01 HAND DRYERS

The hand dryer unit shall comply with at least the following specifications:

Blower Output: 450 Watt @ 20,000 rpm

Air Heater Output: 900 W

Air Flow Rate: 81 meters per second @ 100 mm from the air outlet nozzle

Air Temperature: 55 °C @ 100 mm from the air outlet nozzle

The hand dryers units shall be of the wall mounted kind and shall be installed in accordance with the manufacturer's specifications.

CJ 06.02 AIR FRESHENER DOZERS

The stainless-steel air freshener dosing units shall be wall mounted and lockable. The device shall possess an adjustable automatic timer and the aerosol spray shall be metered.

CJ 06.03 TOILET PAPER DISPENSING UNITS

The stainless-steel toilet paper dispensing unit must accommodate two toilet paper rolls and shall be lockable. The device shall be wall mounted.

CJ 06.04 SHE BINS

One stainless steel 'she-bin' shall be supplied for each of the female ablutions. The she bins shall possess a self-closing lid and shall accommodate for plastic bag liners which may be removed and replaced with a new liner.

CJ 06.05 HAND SOAP DISPENSER

There shall be at least one stainless steel liquid hand soap dispenser per ablution. The liquid soap dispenser shall be of the wall mounted kind. The dispenser shall dispense a metered amount of liquid soap.

CJ 06.06 URINAL SANITIZER

There shall be one stainless steel urinal sanitizer per urinal. The urinal sanitizer shall be of the wall mounted kind.

CJ 06.07 PAPER TOWEL DISPENSER

There shall be one stainless steel paper towel dispenser per ablution. The paper towel dispenser shall be of the wall mounted kind.

CJ 06.08 WALL BINS

There shall be one stainless steel wall bin per ablution. The wall bin shall possess a self-closing lid and shall accommodate for plastic bag liners which may be removed and replaced with a new liner. The device shall be wall mounted.

CJ 07 MEASUREMENT AND PAYMENT**CJ.07.01 HAND DRYERS**

Unit
No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

CJ.07.02 AIR FRESHENER DOZERS

Unit
No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

Unit

<u>CJ.07.03</u>	<u>TOILET PAPER DISPENSING UNITS</u>	No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

<u>CJ.07.04</u>	<u>SHE BINS</u>	<u>Unit</u> No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

<u>CJ.07.05</u>	<u>HAND SOAP DISPENSER</u>	<u>Unit</u> No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

<u>CJ.07.06</u>	<u>URINAL SANITIZER</u>	<u>Unit</u> No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

<u>CJ.07.07</u>	<u>PAPER TOWEL DISPENSER</u>	<u>Unit</u> No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

<u>CJ.07.08</u>	<u>WALL BINS</u>	<u>Unit</u> No

The tendered rate shall include full compensation for the supply, delivery, labour, installation and commissioning of the unit. The unit shall be installed in accordance with the manufacturer's instructions.

<u>CJ.07.09</u>	<u>GRASS CUTTING EQUIPMENT</u>

The tendered rate shall include full compensation for the supply, delivery of the specified grass cutting equipment. The tendered rate shall further include full compensation for the servicing and the maintenance of the grass cutting equipment in accordance with the manufacturer's specification and instructions.

<u>CJ 08</u>	<u>MAINTENANCE</u>

This specification must be read in conjunction with Additional Specification SA: General Maintenance. The work included in this specification forms part of the contractor's monthly maintenance rumination (prior to practical completion and after practical completion). No additional payment shall be made other that specified in this specification.

The scope of the maintenance work for the site keeping and cleaning installation comprises of the following:

- (a) Cleaning of approximately **779 m²** of offices, support buildings, and public ablution facilities, and

(b) Site keeping of approximately **44 400 m²** of open areas.

The above description of the cleaning and site keeping installation 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 the cleaning and site keeping installation shall commence with access to the site. There will be no repair phase for the cleaning and site keeping installation.

Maintenance implies and shall include monthly routine preventative maintenance, corrective maintenance, as well as breakdown maintenance on all components of the specified installation. Maintenance shall include any actions or rectifying measures necessary for keeping the installation clean, free of litter and any growth or any other element interfering with the function or integrity of the system. The contractor shall further be responsible for maintaining the grass cutting equipment in a perfect working condition. The grass cutting equipment remains the property of the Department of Public Works and shall be handed back in a perfect working condition at the end of the contract.

Remuneration for maintenance of the cleaning and site keeping will be deemed included in the monthly remuneration based on the point system, as tendered for maintenance of Installation: Cleaning and Site Keeping.

TECHNICAL SPECIFICATION

CK SUPPLY OF WATER BY TRANSPORT CONTENTS

CONTENTS

CK 01	SCOPE
CK 02	STANDARDS AND REQUIREMENTS
CK 03	DETAIL OF WORK
CK 04	MONITORING OF STORAGE TANK ON SITE
CK 05	MEASUREMENT AND PAYMENT

CK 01 SCOPE

This specification covers the supply of adequate potable water into the existing storage tanks at the Ports of Entry should a water shortage be experienced.

The Contractor shall be responsible for the purchase, transport to site, testing and delivery of water of an acceptable potable standard.

CK 02 STANDARD AND REQUIREMENTS

These specifications shall be read in conjunction with the following documents:

SANS 241: Drinking Water
SANS 295: Calcium hypochlorite

CK 03 DETAIL OF WORK

Potable water, suitably disinfected, shall be delivered to the Port of Entry as specified in the Schedule of Quantities on an ad-hoc basis **(on instruction from the Engineer)** and pumped into an existing storage tank.

The contractor shall be responsible for the monitoring of the water level in the storage tank, testing as well as all aspects of the supply of water.

CK 04 MONITORING OF STORAGE TANK ON SITE

The Contractor shall be responsible for the *monitoring* of the levels of the water storage tanks at the Ports of Entry on the following points:

- (i) Level — *minimum* level 40% of capacity.

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- (ii) Hygiene — Sample of water must be tested on a monthly basis for the chemical and bacteriological state of the water (SANS 241) – paid for separately, and NOT part of the potable water supplied (delivered) to site by means of carting it to site (refer item CK.01)
- (iii) Leakage — all leaks on tank must be rectified.

Written record of the above must be submitted monthly for the duration of the Contract as part of the monthly updated maintenance control plan

CK 05 MEASUREMENT AND PAYMENT

CK.01 WATER SUPPLY Unit: kilolitre

The tendered rate shall include full compensation for the supply of water *per kilolitre* deliver to the specified Port of Entry including all costs for acquisition, transport, delivery, labour and pumping into existing reservoir. The tendered rate shall also include for testing to ensure no bacteriological contamination has occurred during loading and transporting of the water by testing for the residual chlorine contents of the load to be between 0.5 – 0.05 mg/l. *[Note: This is NOT the monthly test, and the contractor shall not be paid additional for any such testing]*. Each and every load delivered to site, shall, before pumped into the storage tank, be tested for residual chlorine content. Should the result indicate a deviation from the 0.5 to 0.05 mg/l envelope, that specific load will be unacceptable. Records must be kept of each and every load's Cl₂ content, with date and time. Should a load contains more than 0.5 mg/l Cl₂, it may be transferred to an acceptable holding tank to mature until it complies, where after it can be pumped into the supply system. Should a load contains less than 0.05 mg/l Cl₂, that load then needs to be chlorinated/disinfected to meet the required envelope; or it shall be rejected and discharged into the storm water system.

CK.02 POTABLE WATER TESTING Unit: number

The unit of measurement shall be the number of potable water tests performed in accordance with South African National Standards (SANS) 241:2006 for drinking water. All tests shall be performed by an authorised approved testing laboratory.

CK.03 MONITORING OF POTABLE WATER LEVELS Unit: month

The unit of measurement shall be the complete month on which the contractor provide daily water levels of the storage reservoir and recorded on the prescribed format.

TECHNICAL SPECIFICATION

EA BOREHOLE PUMP SYSTEMS

CONTENTS

EA 01	SCOPE
EA 02	STANDARD SPECIFICATIONS
EA 03	DESCRIPTION OF SERVICING AND TESTING WORK
EA 04	TESTING AND COMMISSIONING
EA 05	MEASUREMENT AND PAYMENT

EA 01 SCOPE

This specification covers the decommissioning, removal, service and reconditioning, installation, testing, commissioning and maintenance of borehole pumping equipment, motor control devices and low-voltage cables. It also includes the pump testing of all boreholes to determine the borehole yield and optimum use of each borehole. The function of borehole pump systems shall be delivery of raw water at a specified flow rate and head to the required location.

EA 02 STANDARD SPECIFICATIONS

EA 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

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 by IP code
BS 4999	- General requirements for rotating electrical machines
ISO 281/1	- Rolling bearings – dynamic load ratings and rating life.

EA 03 DESCRIPTION OF SERVICING AND TESTING WORK

EA 03.01 PUMP TESTING OF BOREHOLES

This section covers the requirements of the pump testing of the boreholes.

EA 03.01.01 Testing

It will be the responsibility of the Contractor to arrive on site with all equipment and materials required to complete the work without interruption.

The Contractor shall provide suitable plant to enable the installed pumping equipment to be removed and reinstalled. This includes the removal and reinstallation of motorised pumps and may also include the recovery of existing pumping equipment previously lowered into a borehole.

(a) Arrival-on-site actions

The Contractor shall firstly establish whether or not the borehole is equipped. If so, the Contractor will be required to:

- (1) Remove the equipment, taking care not to damage either the equipment or the installation,
- (2) inspect the equipment for defects, and
- (3) note down all particulars regarding the equipment and the installation.

The latter shall include but not be limited to the make and type of pump (and motor if motorised), the depth to which the pump was installed, the power rating of the motor and the diameter, length and quantity of pump column sections.

The Contractor shall next establish whether there are any other boreholes in the vicinity that need to be tested. Should this be the case, the following information shall be gathered and recorded for each borehole:

- (1) The straight-line distance (in metres) between each such borehole to be tested;
- (2) whether the borehole is equipped, open or sealed and, if equipped,
- (3) whether the installation is operational or not.

Depending on the degree of access available to such a borehole, the Contractor shall improve the access until it is adequate to reach the borehole and establish whether there is water in the borehole and if so, measure and record:

- (1) The depth to the ground-water rest level;
- (2) the height of the borehole collar above ground level, and
- (3) the depth of the borehole.

The final activities to be carried out prior to the actual installation of the test pump into the borehole to be tested shall comprise measuring and recording:

- (1) The diameter of the borehole;
- (2) the depth of the borehole as determined by means of a weighted line or plumb bob, and
- (3) the depth to the ground-water rest level in the borehole, with reference to a date level.

(b) Test pump installation

The conduit tube shall be attached and secured to the first section of pump column behind the pump element and the test pump installed to the required depth, attaching and securing the conduit tube to the riser main every 2 to 3 metres. If the pump installation depth has not been specified by the Engineer beforehand, then the depth must be determined on the basis of the guidelines provided.

GUIDELINES FOR TEST PUMP INSTALLATION DEPTH IF NOT SPECIFIED

DEPTH OF WATER IN BOREHOLE	TEST PUMP INSTALLATION DEPTH
Less than 5 m	Do not install the test pump
Between 5 m and 30 m	± 2 m above the bottom of the borehole
Between 30 m and 60 m	± 3 m above the bottom of the borehole
Between 60 m and 90 m	± 4 m above the bottom of the borehole
More than 90 m	± 5 m above the bottom of the borehole
NOTE: 1. Depth of water in borehole is calculated as the difference between the total depth of the borehole and the depth to the ground-water rest level as measured. 2. $\pm$ denotes a variation of not more than 0,5 m either way.	

(c) Equipment set-up and pre-test actions

Where possible, the discharge pipe must be laid in a downhill direction from the borehole to be tested, provided this will take the pipe in the direction of or past another borehole located in the vicinity of the borehole to be tested. In such instances, lay the discharge pipe in a downhill direction that will take its furthest end as far as possible away from any other borehole in the vicinity.

In field situations where the terrain is extremely flat, the length of the discharge pipe shall be extended from 50 m to at least 300 m if any possibility exists that the discharged water may infiltrate to the ground-water resource within the radius of influence of the test. The dip meter should be inserted into the installed conduit tube and run down this tube to the bottom. Make sure that it passes freely down the full length of the tube. If the dip meter used is not graduated to an accuracy of 0,01 m, the position is to be marked on the dip meter cable indicating the depth to the ground-water rest level, and the end of the graduated tape attached at this position on the cable ensuring that the zero mark of the graduated tape corresponds exactly to this mark. Slowly lower the dip meter and graduated tape down the conduit tube, in the process securing the tape to the dip meter cable every 2 to 3 metres. Ensure that there is no slack between each point where the tape is secured to the dip meter cable. Also make sure that the dip meter cable and graduated tape combination passes freely along the full length of the conduit tube.

The Contractor will be remunerated for this work per set-up at the rate tendered for one such activity as set out in the Schedule of Quantities.

(d) Final pre-test measurements

The Contractor shall ensure that all the basic information required on the field data sheet is collected and recorded as completely as possible. The basic information data entry fields can be used as a checklist for information to be measured/collected and recorded. The Contractor shall not guess any information which has not been measured.

Payment for this work shall be incorporated into the payment for data recording as described below.

(e) Data recording

(i) Discharge measurements

The measurement of discharge (yield or pumping rate) must be consistently accurate and reliable and shall be appropriate to meet this requirement. Where volumetric calculation methods are applied, time will be measured using a stopwatch and the container volume must be accurately known. The volumetrically measured yields recorded on the field data sheets shall be based on the average obtained from a set of three sequential measurements. Guidelines for the number and periodicity of discharge rate measurements for each type of test are given below.

NUMBER OF PERIODICITY OF DISCHARGE RATE MEASUREMENTS

TYPE OF TEST	DISCHARGE RATE MEASUREMENTS	
	NUMBER	PERIODICITY
Calibration test	2 per step	At ± 5 and ± 10 minutes into each step
Stepped discharge test	5 per step	At ± 5 , ± 15 , ± 30 , ± 60 and ± 90 minutes into each step
Constant discharge test	See periodicity column	At ± 5 , ± 15 , ± 30 , ± 60 , ± 90 and ± 120 minutes into test and every 60 minutes thereafter for the full duration of pumping

(ii) Water-level measurements

Rigid guidelines for the periodicity of water-level measurements for each type of test are given in table EA 04.02.01/3. This information can be found duplicated on the field data sheets which must be filled in as a record of all data collection activities carried out for a pumping test. The type of water-level measurement values required to be recorded on the field data sheets are the actual (or true) draw down values. These values represent measurements which reflect the depth of the water level below the ground-water rest level depth, ie which already take into account the ground-water rest level depth below the reference measuring point. It shall be noted that the more basic type of measurement which reports the depth of the dynamic water level as a distance below the reference measuring point, ie which combines the depth of the water level below the ground-water rest level depth and the depth of the ground-water rest level below the reference measuring point, gives only an apparent (or false) draw down value. All water-level measurements must be measured to an accuracy of at least 0,01 m (10 mm). The water-level data shall be plotted on the semi-logarithmic graph paper provided with each set of field data sheets. The plotting of the data shall be done as the test proceeds, ie each water-level measurement shall be plotted on the graph as soon as possible after measuring. The field data sheets and accompanying water-level graphs shall be shown to authorised supervisory personnel at request and shall be up-to-date at the time of such request.

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(iii) Other information

The Contractor shall also record any extraordinary observations made during the test. These may include:

- (1) Changes in the colour of the discharged water;
- (2) changes in the turbidity of the discharged water;
- (3) the presence of air in the discharged water, and
- (4) rainfall events which occur during a test.

PERIODICITY (IN MINUTES) OF MEASUREMENTS DURING PUMPING TESTS

CALIBRATION TEST	STEPPED DISCHARGE TEST	CONSTANT DISCHARGE TEST	RECOVERY TEST
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
7	7	7	7
9	9	9	9
12	12	12	12
15	15	15	15
	20	20	20
	25	25	25
	30	30	30
	40	40	40
	50	50	50
	60	60	60
	70	70	70
	80	80	80
	90	90	90
	100	120	120
		150	150
		180	180
		210	210
		240	240

EA 03.01.02

Equipment and materials

This represents the test unit and all ancillary equipment and materials required to accurately and efficiently perform borehole testing. Details are provided below.

(a) Test unit

The test unit shall comprise a positive displacement (PD) type pump element and a pump head driven by a motor fitted with an accelerator, gearbox and clutch. The unit must be in good working order and capable of maintaining a minimum of 72 hours of continuous operation.

The unit must be capable of delivering water at a rate in excess of the expected maximum yield of the borehole to be tested. It may be acceptable under certain circumstances to employ a submersible pump for testing purposes. This must, however, be identified in the tender enquiry document. It is imperative that any submersible pump used for testing purposes be equipped with a non-return valve fitted at the bottom of the pump column (rising main).

(b) Discharge piping

Discharge piping comprises both the pipe (rising main or pump column) which brings the water to surface and the pipe (discharge hose) used to lead the pumped water away from the borehole being tested. The Contractor shall supply sufficient rising main to set the test pump at a depth of at least 100 m below the surface. It may, however, be required under certain circumstances to set the test pump at a greater depth in the borehole. Where necessary it shall be discussed with the Engineer prior to the installation of the test pump. The pump column must be of uniform diameter throughout. The Contractor shall also provide at least 50 m discharge piping. This must be free of leaks for its entire length. It may again, under certain circumstances, be required to discharge the pumped water at a point further away than 50 m (possibly in excess of 300 m) from the borehole being tested. In such instances, a similar procedure to that discussed above in regard to the rising main must be followed.

(c) Discharge measuring equipment/Instrumentation

This equipment/instrumentation must be adequate to accurately measure the pumping rate within the range of yields expected from successful project boreholes. If volumetric methods are used, a stopwatch for measuring time to an accuracy of at least one-tenth of a second is required. The full capacity of each container shall be determined accurately. The Contractor shall also ensure that a container stands level when used for discharge measurements. Guidelines regarding the use of different size containers for volumetric discharge rate measurements in specific yield ranges are given in table below. 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

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entrained air bubbles at the time of pressure head measurement. The latter measurement must be at least three times the diameter of the orifice.

YIELD RANGE VERSUS CONTAINER SIZE FOR VOLUMETRIC MEASUREMENTS

YIELD RANGE	CONTAINER SIZE
Less than 2 litre/s	20 litre
2 litre/s to 5 litre/s	50 litre
5 litre/s to 20 litre/s	210 litre
20 litre/s to 30 litre/s	500 litre
30 litre/s to 50 litre/s	1000 litre
More than 50 litre/s	Other suitable methods

The orifice weir equipment must be calibrated for various combinations of approach tube and orifice diameters so that pressure head readings can be converted to accurate discharge measurements.

(ii) Flow meters

Flow meters must be calibrated and of similar diameter to that of the discharge pipe. The latter must be straight and of uniform diameter for a distance of four times the diameter of the pipe before the position of the meter. There must be no turbulent flow or entrained air in the discharge pipe before the meter. The discharged water must be free of solid material carried in suspension.

It is recognised that some water leakage will generally occur especially at the borehead during pumping. This is acceptable provided that: (1) such leakage does not interfere with any water-level monitoring and (2) the total amount of leakage to the end of the discharge pipeline does not exceed one per cent of the pumping rate as measured at the end of this pipeline.

(d) Water-level measuring equipment/instrumentation

The Contractor shall provide at least three water-level measuring devices which are each capable of providing an accuracy of at least 0,01 m (10 mm) and are of sufficient length to match the pump installation depth. If ungraduated electrical contact meters (dip meters) are used for this purpose, each such instrument must be equipped with a measuring tape of an acceptable length and approved standard and which is graduated to an accuracy of at least 0,01 m (10 mm). These instruments must be in good working order and number at least one spare for each two on site.

The Contractor shall further provide conduit tubing of sufficient length to match the pump installation depth. The diameter of this tube must be large enough (minimum 15 mm) to allow free movement of the dip meter probe and cable therein. The tubing must be made of material strong enough to withstand reasonable pressure on its sidewall which might cause a constriction. The tube must be open at its lower end to allow the free entrance of water into the tube. This is facilitated by perforating the

bottom section of the conduit tube sidewall. Precautions shall also be taken to prevent the dip meter probe from passing beyond the bottom end of the conduit tube and, as a result of entanglement, not able to be withdrawn.

(e) Other materials

No pumping test should commence without field data sheets on which to record all data and information relevant to the test pumping activities in an acceptable format. These can either be provided by the Contractor or the Engineer.

EA 04 TESTING AND COMMISSIONING

EA 04.01 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.

EA 04.02 PUMP OPERATING POINT

During the day 1 commissioning tests the pump operating point shall be determined by observing the following:

- (a) Pump delivery and suction pressures, and
- (b) Electric motor power consumption.

If no efficiency tests are required in the detail specification then the motor power consumption shall be calculated from the voltage and current measurements obtained during the commissioning test.

The Contractor shall supply the necessary adaptors, fittings and pressure gauges to measure the suction and delivery pressures. If no gauge fittings exist on the suction side, then the suction pressure conditions will be calculated from the system properties.

EA 04.03 FLOW RATE (DELIVERY), EFFICIENCY AND NPSH TESTS

- (a) Testing will be done in accordance with BS 5316 Part 1, class C tests.
- (b) Power consumption of electric motors shall be as determined by the three-

wattmeter method where efficiency tests are required in the detail specification.

EA 04.04 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.

EA 05 MEASUREMENT AND PAYMENT

EA.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.

Extra over EA.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) 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) 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. 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.

EA.02 CLEAN AREA 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 10 m x 10 m around each borehole.

EA.03 SERVICING OF EQUIPMENT**EA.03.01** 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.

EA.03.02 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.

EA.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 requirements in this document.

EA.03.04 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 re-installation and commissioning of each borehole installation.

TECHNICAL SPECIFICATION

EAW WASTEWATER INLET WORKS

CONTENTS

EAW 01	SCOPE
EAW 02	STANDARD SPECIFICATIONS
EAW 03	ADDITIONAL REQUIREMENTS FOR REPAIR AND INSTALLATION OF WASTEWATER INLET WORKS EQUIPMENT
EAW 04	OPERATION AND MAINTENANCE MANUALS
EAW 05	DETAIL OF REPAIR WORK
EAW 06	MAINTENANCE
EAW 07	MEASUREMENT AND PAYMENT

EAW 01 SCOPE

Wastewater inlet works shall mean all materials, units, components and equipment, and their relation to each other, employed to enable reliable screening, grit deposition and flow measurement of water at a variety of flow rates.

This specification covers the supply, delivery, repair, installation, testing and commissioning, as well as the maintenance of wastewater inlet works and equipment such as hand raked screens, hand stops and open channel sluices, grit channels, as well as flow measurement sensors and converter devices.

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

The Contractor shall also be responsible to manage and maintain the wastewater inlet works in accordance with the prescriptions in this specification. The repair work and maintenance of the particular wastewater inlet works is specified in the relevant clauses on detail of repair work and maintenance in this specification.

EAW 02 STANDARD SPECIFICATIONS

EAW 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

EAW 03 ADDITIONAL REQUIREMENTS FOR REPAIR AND INSTALLATION OF WASTEWATER INLET WORKS EQUIPMENT

The specifications in EAW 03 are of a general nature and if not referred to in Clause EAW 05: Detail of Repair Work, are not considered part of this Contract.

EAW 03.01 FLOW MEASUREMENT REQUIREMENTS

In an open channel the flow rate shall be measured via the head caused by an obstruction such as a Parshall or long-throated flume, for which the relevant standardised head/flow rate conversion formulae, shall be applied.

In a closed pipe the closed pipe flow shall be measured by the Doppler effect on the ultrasonic pulses passing through the liquid in the pipe.

Ultrasonic sensors shall be used to measure the Doppler effect, and an electronic converter device shall be employed to calculate the flow rate.

Apart from electronic flow measurement, a metal level indicator shall be installed in the channel at the correct position for measuring the depth (head). The level indicator shall be a ruler that shows both depth and flow rate on separate scales. The ruler shall have a black background and figures shall be yellow and clearly visible for people with normal eyesight from a standing position. The units of the ruler shall be millimetre for depth and m³/h for flow rate. The scales shall be such that at least ten figures for each scale can be shown on the ruler.

EAW 03.02 ULTRASONIC FLOW METERS AND LEVEL METERS

EAW 03.02.01 General

All ultrasonic flow meters shall be microprocessor-based, non-contact meters and be able to be programmed to read flow accurately passing through any pipe or type of flume or over any type of weir, or to read level/volume accurately in an irregularly shaped container.

EAW 03.02.02 Operating principle in Open Channels and Closed Pipes

In open channels a burst of ultrasonic pulses is transmitted from a transducer, which is not in contact with the medium. These pulses are reflected off the top surface of the medium and received by the same transducer. The time delay between the transmitted and received signal is proportional to the level between the transmitter/receiver, which is fixed, and the medium, which is variable. To compensate for the temperature dependence of the ultrasonic signal, the ambient temperature shall be measured at the transducer and shall be taken into consideration when the level difference is calculated between transmitter and medium.

In a closed pipe pulses pass through the wall of the pipe and through the liquid. The movement of liquid changes the characteristics of the pulses which are detected and calibrated to indicate a flow rate.

EAW 03.02.03 Constructional requirements

The ultrasonic transducer shall include a built-in temperature sensor and shall have a minimum enclosure rating of IP 65. The transducer shall be corrosion protected, as well as immune to ultra-violet radiation.

The flow calculation shall be temperature compensated.

For flow application, the instrument shall provide for the following standard primary flow elements:

- (a) Venturi flumes
- (b) V-notched weirs

- (c) Parshall flumes
- (d) Broad crested weirs, or
- (e) Any special obstruction with a known relationship between height of medium and flow rate.
- (f) Closed, full flow pipes.

For this open channel applications a ten point look-up table with linear interpolation is deemed satisfactory.

For flow applications the instrument shall be equipped with a local flow rate indicator and an 8-digit totaliser. If the totaliser is fed from the microprocessor, it shall be supplied with a minimum of 24-hour battery backup to prevent data loss in the event of power failure.

In addition to the above, for flow meter applications a galvanically isolated pulsed output shall be provided for remote totalising.

A galvanically isolated 4-20 mA output, linear to flow or level shall be provided for remote indication and processing.

In open channel conditions where no stilling well is provided as part of the measuring structure, a suitably dimensioned stilling well shall be supplied as part of the instrument.

The control unit shall be supplied complete with battery backup to prevent loss of set-up data in the event of a power failure.

The control unit and associated power supplies and surge protection shall be housed in the previously detailed instrument enclosure.

For level measurement and/or multiple pump sump level control, the instrument shall be equipped and configured as follows:

(a) Control relays

A minimum of three single pole changeover (SPCO) relays shall be provided for pump control or level alarms. The on and off points for each relay shall be separately programmable.

Each relay shall have a battery backed four-digit (min) hours run time counter.

Time delay between individual relay on signals shall be possible to prevent electric or hydraulic shock loads.

The above relays shall be programmable as rate of rise or fall alarms.

(b) Alarm relay

A single-pole change-over relay shall be provided to signal mains failure, echo loss or any other instrument fault or high or low alarm as required.

(c) Current output

A galvanically isolated 4-20 mA signal linear to the tank/sump level shall be provided. The apron shall be selectable to be rising or falling with level and shall be selectable as part of or the full range of the instrument.

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(d) Pumped volume indicator

By means of a minimum 8-digit totaliser, the instrument shall record the approximate pumped volume through a sump. An isolated pulsed output shall be provided for remote indication of this information.

(e) Auto test routine

An auto test routine shall be provided for level instruments used for pump sump control whereby a rising from zero level to transducer face and back again, can be simulated to check the operation of the level control system.

EAW 03.02.04 Installation requirements

The ultrasonic transducer shall be supplied complete with mounting bracket and frame. The mounting frame shall be rigid and made from stainless steel. The transducer shall be mounted in such a way that it is free from all handrails, walkways, etc. Passing traffic and the operation of other machines in the vicinity of the transducer shall have no influence on the transducer.

The installation shall include all required interconnections and sundries between the sensor and control unit.

All equipment shall be installed according to the manufacturer's requirements.

EAW 03.02.05 Accuracy

The accuracy of the measurement shall be better than 0,25 % of full scale.

EAW 03.03 REQUIREMENTS FOR HAND RAKED SCREENS

Hand raked screens to be supplied under this Contract shall be manufactured from stainless steel. Screens shall be installed with stainless steel Rawl bolts in the channel floor and against the wall. The screen shall be installed at an inclination of 70° with the horizontal. The screen shall be manufactured and installed as illustrated on the drawings.

EAW 03.04 REQUIREMENTS FOR GRIT CHANNELS

Grit channels shall be repaired where the concrete surfaces of the channel floor and walls have corroded. All corroded surfaces shall be repaired by applying a layer of quick setting epoxy grouting to the surfaces.

Grit channel sluice gates to be supplied under this Contract shall be manufactured from stainless steel to fit the channel dimensions. Sluices shall have a stainless steel cable, which connects them to the channel.

EAW 04 OPERATING AND MAINTENANCE MANUALS

The Contractor shall at the start of the Contract be given all available as-built information and operating and maintenance manuals.

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

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

EAW 05 DETAIL OF REPAIR WORK

EAW 05.01 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.

EAW 05.02 INLET SUMP AND RAW-WATER SEWERAGE

Repair work to the inlet sump and raw-water sewerage shall include the following:

- (a) *Clean and corrosion protect strainer basket and lubricate guide rails and strainer guides;*
- (b) *Clean and corrosion protect pulley assembly and lubricate crank handles;*
- (c) *Remove, recondition and recommission pumps;*
- (d) *Remove, recondition and recommission float switches.*
- (e) *Corrosion protection for valves and pipework;*
- (f) *Clean MCC panels, etc, for domestic electricity and instrumentation of the raw-water sewerage pump station. Replacement and reconditioning of MCC panels will be measured under Specification EB: Wastewater pump systems.*
- (g) *Flush all gravity pipelines.*

EAW 06 MAINTENANCE

EAW 06.01 GENERAL

Maintenance shall include all repair work, replacing of components, routine setting, fixing of leaks, general corrosion protection or any other actions or rectifying measures necessary for complete operation of wastewater works. Routine preventative maintenance according to the manufacturer's specification as set out in the operating and maintenance manual, as well as unforeseen repair work or replacement, shall be carried out.

Remuneration for maintenance of the complete wastewater inlet works shall be deemed included in ten points for the tendered rate for monthly payment of maintenance of the installation of which it forms part.

EAW 06.02 ROUTINE PREVENTATIVE MAINTENANCE

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

The routine maintenance work to be performed and executed shall include, but not be limited to the items listed in table EAW 06.02/1 below.

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

TABLE EA 06.02/1

NO	ROUTINE PREVENTATIVE MAINTENANCE OF INLET WORKS	MAINTENANCE FREQUENCY
1	Check and lubricate strainer basket guide rails and cable and pulley assembly	Monthly
2	Check, repair or service self priming pumps, float switches and hour metres.	Four-monthly
4	Clean and calibrate flow rate measurement device	Monthly

EAW 06.03 FLOW RATE MEASUREMENT

The Contractor shall be responsible for the proper performance of flow measurement devices. To ensure a perfect functional condition, the flow measuring devices shall be cleaned and calibrated monthly. The measuring devices shall be calibrated regularly by a manufacturer's representative according to his specification. Apart from regular calibration, the Contractor shall keep records of flow measurements to establish base line data that will be used for future monitoring and periodic maintenance calibration.

EAW 07 MEASUREMENT AND PAYMENT**EAW.07.01 SUPPLY AND DELIVERY OF SCREENING EQUIPMENT Unit : number**

The unit of measurement shall be the number of specified units of screening equipment supplied and delivered.

The tendered rates shall include full compensation for the design, manufacture, corrosion protection, patent rights, pre-delivery testing and test certificates, transport for delivery to site and off-loading, including all handling of the equipment. The equipment shall include the following:

- (a) The wastewater screen
- (b) Two hand rakes
- (c) Stainless steel cable to lock hand rake to screen.

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

EAW.07.02 SUPPLY AND DELIVERY OF FLOW MEASURING EQUIPMENT Unit : number

The unit of measurement shall be the number of specified units of flow measuring equipment supplied and delivered.

The tendered rates shall include full compensation for the design, manufacture, corrosion protection, patent rights, pre-delivery testing and test certificates, transport for delivery to site and off-loading, including all handling of the equipment. The equipment shall include the following:

- (a) The flow sensor
- (b) The converter device and transducer.

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

EAW.07.03 INSTALLATION, TESTING AND COMMISSIONING OF FLOW MEASURING EQUIPMENT Unit : number

The unit of measurement shall be the number of flow measuring devices 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 the flow measuring sensor;
- (b) Installation of the converter device;
- (c) All required installation materials, labour and consumables to render a complete and working installation.

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

EAW.07.04 INSTALLATION, TESTING AND COMMISSIONING OF SCREENING EQUIPMENT Unit : number

The unit of measurement shall be the number of screens tested and commissioned.

The tendered rates shall include full compensation for the site handling and positioning of the equipment, including the fastening of the equipment in its designated position. The following shall also be included in the tendered rates:

- (a) Installation of the screen;
- (b) All required installation materials, labour and consumables to render a complete and working installation.

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

EAW.07.05 DECOMMISSIONING AND REMOVAL OF WASTEWATER INLET WORK EQUIPMENT Unit : number

The unit of measurement shall be the number of specified units of wastewater inlet works equipment decommissioned and removed.

The tendered rates shall include full compensation for all labour, machinery, tools, transport and site handling necessary for the decommissioning and removal equipment.

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

EAW.07.06 RECONDITIONING OF WASTEWATER INLET WORKS 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 conformance with the specifications in Clause EA 05, Detail of repair work.

TECHNICAL SPECIFICATION

EB WASTEWATER PUMP SYSTEMS

CONTENTS

EB 01	SCOPE
EB 02	STANDARD SPECIFICATIONS
EB 03	PUMP DESIGN AND REQUIREMENTS
EB 04	MOTOR DESIGN AND REQUIREMENTS
EB 05	WORKING VOLTAGE AND SUPPLY SYSTEMS
EB 06	PROTECTION AND CONTROL DEVICES
EB 07	DETAIL OF WORK
EB 08	MEASUREMENT AND PAYMENT

EB 01 SCOPE

This specification covers the decommissioning, removal, servicing, reconditioning, installation, testing, commissioning and maintenance of pumping equipment, motor control devices and low voltage cables.

EB 02 STANDARD SPECIFICATIONS

EB 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

BS 5316, Part 1	-	Acceptance tests for centrifugal, mixed flow and axial pumps
SANS 948	-	Three-phase induction motors
SANS 1222	-	Enclosures for electrical equipment (classified according to the degree of protection that the enclosure provides)
BS 4999	-	General requirements for rotating electrical machines
BS 1486, Part 2	-	Heavy-duty lubrication nipples
ISO 281/1	-	Rolling bearings – dynamic load ratings and rating life.

EB 03 PUMP DESIGN AND REQUIREMENTS

- (a) Submersible pumps shall be designed to be suitable for submersion in sewage up to a depth of 5 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 07: 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) Performance curves shall be based on a reproducible and certified test carried out in an approved testing facility, such as the SANS.
- (i) The flow rate at break-off point of the curve for the impeller selected shall be at least 1,5 times that of the maximum flow rate specified.
- (j) The head at zero delivery of the curve from the impeller selected shall be at least 1,2 times the maximum head in the pump's operational range.
- (k) 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.
- (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 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.
- (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 %.

EB 04 MOTOR DESIGN AND REQUIREMENTS

- (a) Electric motors shall comply with the requirements of SANS 948.
- (b) 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.
- (c) All motors shall have dynamically balanced rotors supported by maintenance-free, sealed-for-life ball bearings.
- (d) All motors shall be suitably coated to ensure the satisfactory operation of the motor under the specified class of service.
- (e) All terminal boxes shall be waterproof and suited for submersion up to the depth as specified for the pumps.
- (f) 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.
- (g) Thermistor protection or Klaxon type temperature switches shall be provided for submersible motors.
- (h) 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 05 WORKING VOLTAGE AND SUPPLY SYSTEMS

The motors shall be capable of operating within $\pm 10\%$ 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 $\pm 10\%$ 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 $\pm 5\%$ of the nominal supply voltage.

The slip-in speed of any motor at 80 % of the nominal voltage at 50 Hz shall not exceed a percentage agreed on by the Engineer, and the motors shall be capable of operating at this voltage for a period of five minutes without deleterious heating.

EB 06 PROTECTION AND CONTROL DEVICES

Submersible pumping equipment shall have float switches to switch the pump motor on and off, according to the level of the liquid. Switches shall operate freely and 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 07 **DETAIL OF WORK**

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

Reconditioning or service of pumps shall be carried out where necessary.

EB 07.01 **PUMPING EQUIPMENT**

The following reconditioning and servicing work shall be done and the detail of work is described in the bill of quantities:

- Decommissioning and removal of pumping equipment.
- Reconditioning of pumping equipment
- Servicing of pumping equipment
- Installation, testing and commissioning of pumping equipment
- Testing, repair and commissioning of level float switches
- Cleaning of pump sumps, removal and disposal of sludge.
- Inspect and repair pump fixtures.

EB 07.02 **MOTOR CONTROL CENTRES**

- (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 board with parts similar and equal to the existing types on the panel.

EB 08 MEASUREMENT AND PAYMENT**EB.01 DECOMMISSIONING AND REMOVAL 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 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.

EB.02 SERVICE OF PUMPING EQUIPMENT (PUMPS & MOTORS).....Unit: number

The unit of measurement shall be the number of pumps and motors serviced (full service as per manufacturers specifications).

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 .

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

EB.03 MOTOR CONTROL CENTRES Unit: number

The unit of measurement shall be the number of motor control centres serviced (full service as per EB 07.02).

The tendered rate shall include full compensation for all labour, materials and service as required.

EB.04 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.

TECHNICAL SPECIFICATION

EG SEPTIC TANK FACILITIES

CONTENTS

EG 01	SCOPE
EG 02	STANDARD SPECIFICATIONS
EG 03	INFORMATION REQUIREMENTS FOR SEPTIC TANK SYSTEMS
EG 04	DETAIL OF REPAIR AND MAINTENANCE
EG 05	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.

The following tasks shall be performed on instruction by the Engineer:

- Prepare temporary sludge disposal facility – the more appropriate of the following:
 - Drying bed/pond (approved by Engineer).
 - 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. 1m³ 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 02 STANDARD SPECIFICATIONS

EG 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

SANS 1200 - Standardized specification for civil engineering construction

EG 03 INFORMATION REQUIREMENTS FOR SEPTIC TANK SYSTEMS

The specifications in EG 03 are of a general nature and if not referred to in Clause EG 04: Detail of Repair and Maintenance are not considered part of this Contract.

EG 03.01 SPECIFIC INFORMATION REQUIREMENTS

Specific information requirements re each ST facility include:

- Current and projected design population, incorporating appropriate design factors for domestic, public and institutional sanitation facilities (with/without detention cells).
- Dimensions and capacities of existing STs and FDs.
- ST emptying frequency and period since previous emptying event.
- Required ST and FD capacities.
- Integrity and serviceability of existing ST and FD structures and accessories (in/outlet fittings, baffle walls, rodding eyes on connecting pipes, etc.).
- Type and frequency of operational problems experienced, including resultant nuisance conditions.
- Contravention of applicable legal requirements.
- Availability and 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.

EG 04 DETAIL OF REPAIR AND MAINTENANCE

EG 04.01 ALL INSTALLATIONS

The following general/repair and maintenance tasks shall be performed on all installations, whether specific problems are experienced, or not:

- Assess category in which the installation falls: Maintenance (no specific problems – largely applicable to FDs), Emergency repair and Repair (problematic cases – largely applicable to FDs), and/or Upgrading (applicable to STs or FDs, depending on design population). Measure internal length and width of tank, as well as depth from top of roof slab to top levels (TLs) of scum layer, 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. 1m³ 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*.

EG . 4

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 field is perceived to be blocked, as evidenced by effluent seeping to the surface:
 - Remove the stone media from the drain, wash off accumulated biomass and allow the media to dry.
 - Strip a 100mm mantle of blocked soil from the sides and bottom of the drain and dispose of the spoil by on-site burial.
 - Return the stone media to the drain and replenish shortages.
- Pipework:
 - In either case (new or refurbished FD), install flow distribution pipe horizontally at correct level and with percolation holes located such that flow will be spread evenly over the length and width of the drain.
 - Install vertical inspection pipe (from floor level to 1m above ground level) to enable assessment of water level in drain.
- The ST site must at all times be maintained in a neat and acceptable condition.

EG 04.03 Six monthly maintenance shall include the measurement and recording of sludge levels in the septic tank. Sludge removal shall be at frequencies as follows:

Population served:	10	-	30 persons	-	2 years
	50	-	200 persons	-	1 year
	200	-	500 persons	-	6 months
	Single Household	-		-	3 years

EG 04.04 OTHER MEANS OF DISPOSAL OF ST EFFLUENT

Where geological conditions are such that ST effluent disposal by means of subsurface percolation is not feasible, the following alternative disposal methods may be considered:

- Evapo-transpiration beds, either as a stand-alone facility, or supplementary to a FD system.
- Reedbeds.
- Hydroponic systems.

EG 05 RESOURCES REQUIRED

- Apparatus for measuring sludge and scum layers in STs.
- Apparatus for performing percolation tests.
- Excavator.
- Sludge pump.
- Stirrer/bacterial aids for breaking up of sludge and scum layers.
- Geo-hydrologist.

EG 06 MEASUREMENT AND PAYMENT

**EG 06.01 MEASUREMENT AND PAYMENT FOR
DESLUDGE AND GENERAL REPAIR
OF SEPTIC TANKS Unit : Number**

The unit of measurement shall be for the procedure described in EG 04.01 as well as for site specific requirements to achieve a clean and operational septic tank.

The tendered rate shall include full compensation for cleaning, excavation, installation, removing of obsolete material and rubble, dealing with water logged conditions, execution of the Environmental Measurement Plan during repair, provision of backfill and by-pass tanks and pipes and the disposal of sludge and surplus material. All labour shall also be included in the tendered rate.

**EG 06.02 MEASUREMENT AND PAYMENT FOR REHABILITATION
OF FRENCH DRAIN SYSTEM 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 MEASUREMENT AND PAYMENT FOR 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.

TECHNICAL SPECIFICATION

EH OXIDATION PONDS

CONTENTS

EH 01	SCOPE
EH 02	STANDARD SPECIFICATIONS AND ADDITIONAL SPECIFICATIONS AND REQUIREMENTS
EH 03	DETAIL OF WORK
EH 04	MEASUREMENT AND PAYMENT

EH 01 SCOPE

This specification covers the requirements for responsibilities for oxidation ponds.

The function of oxidation ponds as part of a wastewater works is polishing of secondary sedimentation tank effluent as part of the whole process of chemical oxygen demand reduction.

EH 02 STANDARD SPECIFICATIONS AND ADDITIONAL SPECIFICATIONS AND REQUIREMENTS

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:

EH 02.01 GENERAL STANDARD SPECIFICATION

Ponds are usually earth dams with concrete linings, to which the following specification shall apply:

SANS 1200 Standardized Specification for civil engineering construction.

EH 02.02 ADDITIONAL REQUIREMENTS

Ponds shall have positive overflow weirs. The overflow structure of all ponds shall be such that water is free to fall into the next pond's inflow structure. Where outflows between ponds are submerged, aquatic growths are not allowed to exit the system naturally and tend to accumulate.

EH 03 DETAIL OF REPAIR WORK**EH 03.01 GENERAL**

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

EH 03.02 ACCOMMODATION OF EXISTING FLOW

Incoming existing flow shall be accommodated by means of temporary submersible pumps or mobile self-priming pumps and pipework. The Contractor shall supply temporary pumping equipment to discharge to various positions on site, as specified below.

EH 03.03 OXIDATION PONDS

The oxidation ponds shall be emptied completely while existing flow is accommodated at the same time, either by pumping incoming flow into the pump sump of the other oxidation pond, or by pumping into the oxidation pond directly. No water shall be let out through the emergency overflow line as part of this action.

After emptying each oxidation pond, it shall be left to allow sediment to dry completely, after which all residue and organic mass that may have settled to the bottom will be removed and buried with dried sludge.

EH 04 MEASUREMENT AND PAYMENT**EH.01 EMPTY OXIDATION PONDS AND REMOVE SLUDGE..... Unit: cubic metre (m³)**

The unit of measurement shall be the cubic metre determined by the surface area of the pond times the average depth of excavation.

The tendered rate shall include full compensation for the excavation and for removal to and dumping the excavated material at a solid waste disposal site.

EH.02 EMPTY AND CLEAN OXIDATION PONDS..... Unit: Number

The unit of measurement shall be per pond.

The tendered rate shall include full compensation for the cleaning of the oxidation ponds as per method statement below.

Method Statement

- 1 Divert incoming effluent from pump station to Pond 2 and pump liquid contents (not sludge) of Pond 1 into Pond 2. Remove sludge from Pond 1 to existing sludge drying bed adjacent to ponds. Allow for removal of dried sludge to approved disposal site within 500m of the ponds.
- 2 Divert incoming effluent back to Pond 1 and repeat process for Pond 2, by pumping the liquid contents of Pond 2 to Pond 3 and removing all sludge from Pond 2 to sludge drying bed adjacent to ponds. Allow for removal of dried sludge to approved disposal site within 500m of the ponds.

- 3 Pump liquid contents of Pond 3 into Pond 2 and remove sludge from Pond 3 to sludge drying bed adjacent to ponds. Allow for removal of dried sludge to approved disposal site within 500m of the ponds.
- 4 Allow for temporarily irrigating all surplus effluent from any of the ponds during this process on the site adjacent to the ponds to ensure that no effluent is disposed of onto the adjacent farmland.

TECHNICAL SPECIFICATION

EJ WASTEWATER AND POTABLE WATER QUALITY MEASUREMENT AND TESTING

CONTENTS

EJ 01	SCOPE
EJ 02	STANDARD SPECIFICATIONS
EJ 03	TEST METHODS
EJ 04	DETAIL OF WORK
EJ 05	TESTING BY AUTHORITIES
EJ 06	MEASUREMENT AND PAYMENT

EJ 01 SCOPE

This specification covers requirements for effluent standards and potable water quality, as well as testing procedures and equipment to verify these standards.

The specification covers requirements for sewage effluent standards as well as potable water standards. Testing procedures and equipment to verify these standards are also covered.

EJ 02 STANDARD SPECIFICATIONS

EJ 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

SANS 5667-2	- Water quality sampling, part 2: Guidance on sampling techniques
SANS 5667-2	- Water quality sampling, part 10: Guidance on sampling of wastewater.
SANS 5011	- Water - pH value
SANS 5217	- Water - free and saline ammonia content
SANS 6048	- Water - chemical oxygen demand
SANS 6049	- Water - suspended solids content
SANS 6057	- Electrical conductivity of water
SANS 4831	- Microbiology: General guidance for the enumeration of coliforms: Most probable number technique
SANS 4833	- Microbiology: General guidance for the enumeration of coliforms: Colony count technique at 30 °
SANS 241:2015	Drinking water

EJ 03 TEST METHODS**EJ 03.01 SETTLEABLE SOLIDS CONTENT**

Imhoff tests shall be carried out on the water flowing out of primary settling tanks.

EJ 03.02 pH VALUE OF WATER

pH shall be tested on site. The contractor shall be responsible for maintaining the apparatus for measuring pH and shall take measurements as often as necessary. The pH of sewage final effluent shall be in range of 5.5 to 9.5 and that of potable water shall be in the range of 5.5 to 9.5. For irrigation of 50 cubic metres of effluent the PH value shall not be less than 6 or more than 9 pH units.

The addition of chemicals (lime to increase the pH and carbon dioxide or acids to decrease the pH) shall be used to achieve the pH limits.

EJ 03.03 NITROGEN CONTENT OF WATER

An approved testing authority shall measure ammonia content of water. The effluent sample shall be submitted to the testing authority according to prescription.

The value of ammonia (ionised and un- ionised) in the final effluent shall not be more than 6 mg/litre. The value of nitrate/nitrite shall not be more than 15 mg/l.

EJ 03.04 CHEMICAL OXYGEN DEMAND OF WATER

An approved testing authority shall measure the chemical oxygen demand of final effluent. The effluent sample shall be submitted to the testing authority according to prescription.

The value of chemical oxygen demand in the effluent shall not exceed 30 mg/litre. For irrigation of 50 cubic metres of effluent the COD value shall not exceed 5000 mg/l after removal of algae.

EJ 03.05 SUSPENDED SOLIDS CONTENT OF WATER

An approved testing authority shall measure the suspended solids content of final effluent. The effluent sample shall be submitted to the testing authority according to prescription.

The value of suspended solids in the effluent shall not exceed 10 mg/litre.

EJ 03.06 ELECTRICAL CONDUCTIVITY OF WATER

The value of electrical conductivity shall be tested on site. The Contractor shall be responsible for maintaining the apparatus for measuring the value of electrical conductivity and shall take measurements as often as necessary. The limit value of electrical conductivity in the effluent shall not exceed 50 mS/m above background receiving water, to a maximum of 100 mS/m. For irrigation of 50 cubic metres of effluent the EC value shall not exceed 200 milliSiemens per metre (mS/m).

EJ 03.07 SETTLEABLE SOLIDS

The Contractor shall measure the value of settleable solids daily. A spot sample of the water flowing into the settled sewage sump shall be taken. The sample shall be left to settle for 45 minutes and then stirred with a glass stirrer.

The sample shall be left to settle for exactly 15 minutes and the value of settleable solids determined. The value of settleable solids shall not exceed 0,4 millilitre/litre.

The Contractor shall make use of this test to adjust the sludge withdrawal rate from primary sedimentation tanks.

EJ 03.08 ORTHO-PHOSPHATE AS PHOSPHORUS

An approved testing authority, such as SABS, shall measure the ortho-phosphate content of final effluent. The effluent sample shall be submitted to the testing authority according to prescription.

The value of ortho-phosphate (as P) in the effluent shall not exceed 10 mg/litre.

EJ 03.09 FREE AND SALINE AMMONIA CONTENT OF WATER

An approved testing authority, such as the SABS, shall measure ammonia content of water. The effluent sample shall be submitted to the testing authority according to prescription.

The value of ammonia in the final effluent shall not be more than 2 mg/litre.

EJ 03.10 FAECAL COLIFORM COUNT

No provision is made under this Contract for disinfection of water, and the value of faecal coliform counts will not be considered as a performance indicator. However, the value of faecal coliforms shall be determined and recorded monthly.

For irrigation of 50 cubic metres of effluent the FCC value shall not exceed 100,000 per 100 ml.

EJ 03.11 FLOW MEASUREMENT

Flow rate shall be measured and recorded daily to populate a database of the following parameters:

- (a) Total flow
- (b) Maximum flow (peak flow)
- (c) Minimum flow (night flow).

EJ 04 DETAIL OF WORK

EJ 04.01 GENERAL

As part of the operational responsibilities on this project the Contractor shall regularly test wastewater and effluent quality as specified in the following clauses.

Operation shall include maintaining all testing equipment, including equipment not supplied as part of the Contract, in a clean and perfect functional condition.

EJ 04.02 TEST LABORATORY

The existing buildings shall be utilised as a site laboratory. Should the Contractor require more space, it shall be provided at his cost.

EJ 04.03 TEST EQUIPMENT

The contractor shall provide for the following analytical glassware and testing apparatus as part of this Contract:

- (a) Bench top pH, accurate and precise to at least 0,1 pH unit, including reference electrode and glass sensor or combination electrode.
- (b) Turbidity meter.
- (c) Chlorine meter
- (d) Electrical conductivity meter, with error not exceeding 1 % or 0,1 m S/m;
- (e) Magnetic stirrer with PTFE (Teflon) stirring bars.
- (f) 3 x 1 000 millilitre Imhoff cones with wooden rack.
- (g) 2 x 500 millilitre volumetric flasks.
- (h) 3 x pipettes (glass);
- (i) 5 x 500ml glass beakers
- (j) 2 x 1000ml plastic beakers
- (k) 3 X 1000 ml graduated measuring cylinders

EJ 04.04**POTABLE WATER QUALITY TESTS**

An approved testing authority shall analyse the potable water on a monthly basis as per the analysis schedule. Provision shall be made for a full Physical, organoleptic, and chemical requirements analysis once during the contract period. The sample shall be submitted to the testing authority according to prescription. The water distributed to consumers shall comply with the SANS 241:2015 Specification for the standards of drinking water. Only Class 1(recommended operational limit) water shall be distributed for human consumption.

The following analysis shall be performed by an approved authority on a monthly basis on the water delivered to the consumers.

MICROBIOLOGICAL ANALYSIS OF THE WATER IN ACCORDANCE WITH THE MICROBIOLOGICAL SAFETY REQUIREMENTS ACCORDING TO THE SANS 241:2015

The following analysis shall be performed by an approved authority on a monthly basis on the water delivered to the consumers.

Turbidity (NTU)
 Calcium as Ca (mg/l)
 Chloride as Cl⁻ (mg/l)
 pH value
 Electrical conductivity
 Dissolved solids (mg/l)
 Sodium as Na (mg/l)
 Nitrate as N (mg/l)
 Magnesium as Mg (mg/l)
 Sulphate as SO₄⁼ (mg/l)
 Aluminium as Al (µg/l)
 Iron as Fe (µg/l)
 Manganese as Mn (µg/l)
 Dissolved organic Carbon.

EJ 05 TESTING BY AUTHORITIES**EJ 05.01 POTABLE WATER QUALITY TESTS**

An approved testing authority, such as the SABS, shall measure the content of the potable water monthly (or as instructed for by the Engineer). The sample shall be submitted to the testing authority according to prescription. The water distributed to consumers shall comply with the SANS 241:2015 Specification for the standards of drinking water. Only class 1 (recommended operational limit) water shall be distributed for human consumption. The following analysis shall be performed by an approved authority on at least a monthly basis on the water delivered to the consumers.

The following analysis shall be performed by an approved authority on at least a monthly basis on the water delivered to the consumers in the following prescribed format:

SANS 241:2015	Unit	Class 1 (recommended values)
Chemical report		
pH		5.5 tot 9.5
Electrical conductivity	mS/m	150
Calcium as Ca	mg/L	150
Magnesium as Mg	mg/L	70
Sodium as Na	mg/L	200
Potassium as K	mg/L	50
P-Alkalinity	mg/L	
M-Alkalinity	mg/L	
Fluoride as F	mg/L	1
Chloride as Cl	mg/L	200
Bromide as Br	mg/L	**3
Nitrate as N	mg/L	10
Phosphate as PO ₄	mg/L	
Sulphate as SO ₄	mg/L	400
Calcium Hardness	mg/L	375
Magnesium Hardness	mg/L	287
Total Hardness as CaCO ₃	mg/L	662
Total Dissolved Solids	mg/L	1050
Aluminium as Al	mg/L	0.300
Arsenic as As	mg/L	0.010
Chromium as Cr	mg/L	0.100
Copper as Cu	mg/L	1.000
Iron as Fe	mg/L	0.200
Manganese as Mn	mg/L	0.100
Lead as Pb	mg/L	0.020
Zinc as Zn	mg/L	5.000
Bacterial report		
Heterotrophic plate count	cfu/ml	100
Total coliform	cfu/100ml	0
E. coli	cfu/100ml	0

EJ 05.02 WASTE WATER EFFLUENT QUALITY TEST

The final effluent of the sewage treatment plant shall comply with the general limit of the General Authorizations (Government Notice 399 of 26 March 2004) in terms of Section 39 of the water Act, 1998 (Act No. 36 of 1998)

The following analysis shall be performed by an approved authority on a monthly basis on the final effluent of the sewage works.

- Faecal coliforms (per 100ml)
- Chemical Oxygen demand (mg/l)
- pH
- Ammonia as Nitrogen (mg/l)
- Nitrate as nitrogen (mg/l)
- Chlorine as free chlorine (mg/l)
- Suspended solids (mg/l)
- Electrical conductivity (mS/m)
- Ortho-phosphate as phosphorus (mg/l)

EJ 06 MEASUREMENT AND PAYMENT**EJ.01 POTABLE WATER QUALITY TESTS Unit: number (no)**

The unit of measurement for the potable water quality tests shall be the number of completed tests performed *by an authorised testing authority* as per SANS 241 as detailed in specification EJ.05.01

The tendered rate shall include full compensation for sampling, testing, transport and reporting to the Engineer.

EJ.02 WASTEWATER EFFLUENT QUALITY TESTS Unit: number (no)

The unit of measurement for the wastewater effluent quality tests shall be the number of completed test sets performed *by an authorised testing authority* as detailed in specification EJ.05.02

The tendered rate shall include full compensation for sampling, testing, transport and reporting to the Engineer.

TECHNICAL SPECIFICATION

EM OPERATION OF WASTEWATER WORKS

CONTENTS

EM 01	SCOPE
EM 02	STANDARD SPECIFICATION AND REGULATIONS
EM 03	LEGAL AND GENERAL REQUIREMENTS
EM 04	OPERATION
EM 05	MONITORING AND REPORTING
EM 06	MEASUREMENT AND PAYMENT

EM 01 SCOPE

Wastewater works shall mean all units, components, equipment and materials, and their relation to each other, employed to enable reliable and effective wastewater treatment.

This specification covers the operation of a wastewater works and equipment related to effective wastewater treatment.

The Contractor shall manage and operate the wastewater works in accordance with the prescriptions in this specification, the relevant operation and maintenance manuals and Additional Specification SF. Operation duties shall generally refer to all tasks and actions required to operate the process units and components of the following wastewater works and shall include (among others):

TABLE 1 : PROCESS UNITS FOR TYPICAL SYSTEM TYPES					
Septic Tanks System	Oxidation Pond system	Rotating Bio-contactor (RBC) System	Biological System	Filtration	Activated Sludge System
Septic tank(s)	Inlet works: Screening & degritting	Inlet works: Screening & degritting	Inlet works: Screening, degritting, flow measuring		Inlet works: Screening, degritting, flow measuring
French drain(s)	Floating solids trap	Sceptic tank(s)	Peak flow cut-off & storage/ balancing tank		Peak flow cut-off & storage/ balancing tank
	Oxidation ponds: primary & secondary	Biological reactor(s): rotating discs	Pump station(s)		Biological reactor(s): completely mixed, oxidation ditch, sequencing batch, multiple tanks.
	Surface aerator(s)	Humus tank(s)	Flow regulating facilities		Aerator(s): Vertical axis surface, horizontal axis surface, course/fine bubble
	Re-circulation facilities	Flow regulating facilities	Primary settling tank(s)		Waste activated sludge (RAS) facilities
	Flow measuring facilities	Flow measuring facilities	Bio filter(s)		Flow regulating facilities
	On site burial facility: grit & screenings	Maturation pond(s)	Humus tank(s) (Secondary settling tank SST)		Return activated sludge (RAS) facilities
		Reed bed(s)	Chemical phosphate removal facilities		Clarifier(s) (Secondary settling tank – SST)
		Sludge drying beds	Chlorine dosing & contact facilities		Chemical phosphate removal facilities
		On site burial facility: Grit & screenings	Flow measuring facilities		Biological nutrient removal facilities
		Sludge disposal facilities: Burial, lagoon storage, composting, co-disposal export	Maturation pond(s)		Chlorine dosing & contact facilities
			Anaerobic digester(s)		Flow measuring facilities
			Sludge drying beds		Maturation pond(s)
			On site burial facility: Grit & screenings		Sludge drying beds
			Sludge disposal facilities: Burial, lagoon storage, composting, co-disposal, export		On site burial facility: Grit & screenings
					Sludge disposal facilities: Burial, lagoon storage, composting, co-disposal, export

This specification covers requirements for effluent standards, as well as testing procedures and equipment to verify these standards.

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

Assessment of the following design parameters is a prerequisite for proper operation of the wastewater works:

TABLE 2 : KEY DESIGN PARAMETERS FOR PROCESSES AND UNITS				
NOTE: Acknowledged guidelines must be used for design & construction, e.g. WISA, 1988: Manual on the Design of Small Sewage Works				
Septic System	Tanks	Oxidation system	Pond	Rotating (RBC) System
Population served		Population served & per capita organic loads		Population served & per capita organic loads
Hydraulic retention time (combined building drainage system)		Average & peak dry & wet weather flow rates		Average & peak dry & wet weather flow rates
Sludge retention time		Hydraulic & organic loading rates		Hydraulic, organic & nutrient loading rates per surface area & bed volume
Desludging frequency		Hydraulic retention time		Type, size, volume, void ratio & depth of filter media
Type & permeability of subsoil		Availability of land for ponds & for effluent disposal by irrigation		Aeration rate of filter media
		Suitability of climatic conditions		Dosing rate of flow distribution assembly
		Proximity residential areas (Odours)		Rotational speed of flow distribution assembly
				Geometry & surface loading rates of TSTs, humus tanks & appurtenances
				Sludge & effluent return flow rates
				Effluent return flow rates
				Geometry & hydraulic retention time of anaerobic digester & appurtenances
				Surface and solids flux loading rates of clarifier (sludge volume index)
				Additional reactor volume & anaerobic/anoxic zones required for biological nutrient removal

EM 02

STANDARD SPECIFICATIONS AND REGULATIONS

EM 02.01

GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

SANS 1200	-	Standardised specification for civil engineering construction
SANS ISO 5667-2	-	Water quality sampling, part 2: Guidance on sampling techniques
SANS ISO 5667-2	-	Water quality sampling, part 10: Guidance on sampling of wastewater (when available)
SANS SM 11	-	Water – PH value
SANS SM 217	-	Water – free and saline ammonia content

SANS SM 1048	-	Water – chemical oxygen demand SANS
SM 1049	-	Water – suspended solids content SANS SM
1057	-	Electrical conductivity of water
SANS ISO 4831	-	Microbiology: General guidance for the enumeration of coliforms: Most probable number technique
SANS ISO 4833	-	Microbiology: General guidance for the enumeration of coliforms: Colony count technique at 30°C

EM 02.02 OTHER SPECIFICATIONS

The following Technical Specifications for repair and maintenance of wastewater process units shall be read in conjunction with this specification and shall be deemed to form part thereof:

EA	Wastewater inlet works
EB	Wastewater pump systems
EG	Septic tank and conservancy tanks and disposal fields
EH	Oxidation ponds
EJ	Wastewater quality measurement and testing

EM 02.03 ACTS, REGULATIONS AND STATUTORY REQUIREMENTS

All relevant regulations and statutory requirements as laid down in the latest edition of the following acts shall be adhered to:

- Occupational Health and Safety Act, 1993 (No. 85 of 1993)
- National Water Act (No. 36 of 1998)
- Water Services Act (No. 108 of 1997)
- Environment Conservation Act (No. 73 of 1989)
- National Environmental Management Act (No. 107 of 1998)

EM 02.04 MANUFACTURERS' SPECIFICATIONS, CODES OF PRACTICE AND INSTALLATION INSTRUCTIONS

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

EM 03 LEGAL AND GENERAL REQUIREMENTS

EM 03.01 DEFINITION OF WATER USE

This specification covers the legal requirements for water use as regulated by the National Water Act (No. 36 of 1998). A large fraction of the activities performed by the Department of Public Works is covered by the general authorisation in

terms of Section 39 of the Water Act. The following categories of water use are scheduled:

- Taking of water and storage of water (Section 2 (a) and (b)) of the Water Act.
- Engaging in a controlled activity, identified as such in Section 37 (1) of the Water Act. Irrigation of any land with waste or water containing waste generated through any industrial activity or by a water works (Section 21 (e) of the Water Act).
- Discharging of waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit, and disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generating process.
- Disposing of waste in a manner which may detrimentally impact a water resource (Section 28 of the Water Act).

EM 03.02 REGISTRATION AND LICENCING OF A WATER USE

According to the Water Act (Act No 36 of 1998) a water use must be registered and/or licenced with the Department of Water and Sanitation (DWS). The registration/licencing process is done on the Department of Water and Sanitation e-WULAAS Website ([e-WULAAS - Home \(dws.gov.za\)](http://e-WULAAS - Home (dws.gov.za))).

The Contractor will appoint an approved Consultant to facilitate this web-based process and a Provisional Sum will be provided in the Bill of Quantities for the registration process.

Based on the information provided, the Department of Water and Sanitation might require the applicant to apply for a licence for the relevant water or wastewater works. The appointed consultant will facilitate this.

EM 03.03 OPERATOR REGISTRATION AND CLASSIFICATION OF WATER CARE WORKS

In the terms of Section 26 (f) of the Water Act (No. 36 of 1998) operators shall be registered with the Department of Water and Sanitation. The Contractor shall be responsible for the registration of workers/operators in terms of this requirement (See Regulation R2834 dated 27 December 1985). The water care works will be classified by the Engineer for tendering purposes.

EM 04 OPERATION

EM 04.01 GENERAL

Operation shall include all activities and all other actions or rectifying measures necessary for optimal operation of water care works.

Remuneration for operation of the complete water works shall be deemed included in ten points for the tendered rate of monthly payment of operation of the works.

EM 04.02 PREPARATORY OPERATIONAL TASKS

The preparatory tasks to be executed shall include, but shall not be limited to the items listed in the table below:

EM 04.02	PREPARATORY OPERATIONAL TASKS
01	Satisfy legal and general requirements.
02	Draft inventories of process units, components, materials, etc.
03	Draft process flow diagrams.
04	Derive from available information the design capacity and current load of the works.
05	Assess compliance with relevant design parameters to enable optimal operation of the plant according to its original functionality.
06	Draft plant-specific Operation and Maintenance manuals.
07	Institute required safety measures.
08	Draft template logbook.
09	Draft water balance of water and wastewater system.

EM 04.03 GENERAL OPERATION WORK

General operation of the water care works shall be done in accordance with this specification, with Additional Specification SF: General Operations and with the Particular Specification related to this work.

The general operation work to be performed and executed shall include, but shall not be limited to the items listed in the table below.

EM 04.03	GENERAL OPERATION WORK	FREQUENCY
01	General housekeeping: Keep site in neat and acceptable condition.	Daily
02	Control access to the site.	Daily
03	Maintain safety conditions on site.	Daily
04	Log and report spills, pollution events, power failures, extraordinary process phenomena, etc. Check auto-reset of power to mechanical equipment.	Event
05	Calibrate and set flow measuring to ensure equalised hydraulic loading rates on downstream process units.	Yearly
06	Calibrate and set flow measuring equipment to ensure accurate flow data.	6 Months
07	Calibrate and set peak wet weather flow cut-off weirs at inlet works.	Yearly
08	Synchronise, by means of mathematical modelling and measurement, process units in integrated	6 Months

	systems with recycling (such as activated sludge systems) and make adjustments where necessary.	
09	Develop a feel for effective treatment by means of visual indicators of good/bad plant performance: Colour, odour, foam, algae growth, aerator spray patterns, effluent clarity, bubbles, floating material, solids accumulation, flow patterns, turbulence, touch.	Daily
10	Record operating hours and kW-hours of all mechanical equipment.	Daily
11	Check operation of all valves and sluices.	Monthly

EM 04.04 OPERATION OF SPECIFIC PROCESSES AND UNITS

Operation of specific processes, units and components of the water care works shall be done in accordance with this specification, with Additional Specification SF: General Operations and with the Particular Specification related to this work.

The specific operation work to be performed and executed shall include, but shall not be limited to the items listed in the table below.

EM 04.04.--		OPERATION OF SPECIFIC PROCESSES AND UNITS	FREQUENCY
01		Septic tanks and French drains	
	01	Check and log scum, water and sludge depths in tank.	6 Months
	02	Empty tank at specified frequencies (max. 3 years) or when full.	3 Years
	03	Inspect French drain for accumulation of water or for seepage to surface. If positive, repair drain.	3 Months
	04	Clean connecting pipes and accessories and remove tree and grass roots from pipes.	3 Months
02		Inlet works	
	01	Hand-raked screens: Remove screenings (rags, plastics, etc), ensuring that only degradable material is passed on to subsequent process units. (Last removal after evening peak flow)	2 hours during day
	02	Mechanical screens: Inspect for proper operation and ensure automatic functioning overnight.	2 hours during day
	03	Alternate flow through grit channels and remove grit from isolated channel.	Daily
	04	Wash screenings and grit, and return degradable material to treatment train.	Hourly
	05	Dispose of screenings and grit by on-site burial.	Daily
03		Oxidation/maturation ponds	
	01	Remove floating material from trap at inlet to pond and dispose of by on-site burial.	Daily
	02	Remove tree and grass roots from verges of ponds.	Monthly
	03	Check leak detection facilities (if provided) for signs of leakage.	Monthly

	04	Check presence of sluice gates to by-pass channels and whether they are set correctly.	Monthly
	05	Ensure that surface growths are not accumulated in ponds.	Monthly
04	Aeration facilities		
	01	Check whether all aerators are operating.	Daily
	02	Check spray pattern of aerators and degree of turbulence in reactor.	Daily
	03	Check whether waste and return flow pumps are operating.	Daily
	04	Check waste activated sludge (WAS) and return activated sludge (RAS) flow rates.	Daily
	05	Measure and record dissolved oxygen levels in reactor (average values and variations).	Daily
	06	Check dissolved oxygen levels for sudden drops (organic shock load), sudden increases (acute toxicity) or slow increase (chronic toxicity).	Daily
05	Re-circulation facilities		
	01	Check whether pumps are operating.	Daily
	02	Check return flow rates.	Monthly
06	Flow measuring facilities		
	01	Check whether measuring facilities are operating: Level sensor, integrating flow meter, data logger.	Daily
	02	Keep flume/weir and stilling chamber free of floating/settling material.	Daily
	03	At flumes/weirs where continuous recording equipment is not available, measure and record flow depth and time daily at visually observed peak flows, and at least once per month at minimum night flow.	Daily
07	On-site burial of solids		
	01	Ensure daily covering with soil of disposed material.	Daily
	02	Attend to nuisance conditions at disposal site.	Event
08	Rotating bio-contactors (RBC)		
	01	Check whether RBC rotors are operating	Daily
	02	Check whether return flow pumps are operating.	Daily
	03	Measure and record return flow rate.	Monthly
	04	Scour humus tank and check for clumps of floating sludge.	Twice Daily
	05	Remove scum and clean overflow weir.	Daily
	06	Check and log scum, water and sludge depths in septic tank. If sludge depth exceeds 50% of tank depth, desludge the tank. Desludge tank at least once per year.	Monthly
09	Primary and secondary settling tanks.		
	01	Scour settling tank and check for clumps of floating sludge.	Daily
	02	Remove scum and clean overflow weirs.	Daily
	03	Clean submerged portion of settling tank walls by pushing settled sludge on inclined surfaces down to the apex of the cone.	Monthly
10	Flow regulating facilities		
	01	Keep flow-routing chambers free of accumulating solids.	Daily

	02	Calibrate and set flow-splitting facilities to ensure equalised hydraulic loading rates on downstream process units.	Yearly
	03	Check operation of flow dosing siphons and keep snifter pipes free of blockages.	Daily
11	Sludge drying beds		
	01	Apply sludge to drying beds in depths to suit climatic conditions and remove when adequately dried.	Daily
	02	Keep sludge beds free of weed growth.	Daily
	03	Replenish filter media when required.	Event
12	Sludge disposal facilities		
	01	Remove tree and grass roots from verges of sludge lagoon.	Monthly
	02	Check leak detection facilities (if provided) for signs of leakage from lagoon.	Monthly
	03	Maintain hygienic conditions at sludge handling facilities.	Daily
13	Peak-flow cut-off and storage/balancing tanks		
	01	Check operation of return-flow pumps.	Weekly
	02	Maintain hygienic conditions in storage/balancing tank.	Event
14	Pump stations		
	01	Check operation and correct switching of pumps.	Daily
	02	Clean pump sumps.	Weekly
15	Bio filters		
	01	Check operation of dosing siphons and snifter pipes.	Daily
	02	Check operation of flow distribution arms.	Daily
	03	Flush flow distribution pipes.	Weekly
	04	Check spread of flow and clean distribution nozzles/holes.	Weekly
	05	Evaluate, by means of measurement and calculation, flushing rates, frequency and duration.	6 Months
	06	Inspect health of biological growth on filter media.	Weekly
	07	Check occurrence of blockages, ponding and nuisance conditions on filter media.	Monthly
	08	Check operation of dosing and re-circulation pumps.	Daily
16	Chemical phosphate removal		
	01	Check operation of dosing equipment.	Daily
	02	Select chemicals and dosing rates by means of beaker tests. Ensure correct calculation of dosage concentration and dosing rates.	6 Months
	03	Check, by means of measurement and calculation, the accuracy of dosing rates and their control proportional to flow rate.	6 Months
	04	Manage provision, storage and control of chemicals.	Daily
	05	Ensure continuous dosing – avoid pulsing of dosing stream.	Daily
17	Disinfection		
	01	Check operation of chlorination facilities.	Daily
	02	Clean chlorine contact tank.	4 Months
	03	Ensure chlorine-dosing proportional to flow rate.	Weekly
18	Anaerobic digestion		
	01	Check operation of mixing and re-circulation equipment.	Daily

	02	Check efficiency of digester mixing and heating by means of measurement and analysis.	Monthly
	03	Check, by means of measurement and calculation, sludge feed rate, digester loading, hydraulic retention time, sludge and supernatant withdrawal rates (according to schedule), etc.	6 Months
	04	Ensure proper control of the anaerobic digestion process by means of measuring process control indicators and adjusting the process accordingly: Volatile acids, alkalinity, pH, biogas production rate and composition, temperature, hydraulic retention time, sensory evaluation and sludge solids mass balance.	Weekly
19	Activated sludge process		
	01	Ensure hydraulic control of sludge age in reactor by means of wasting activated sludge from reactor (instead of from clarifier underflow): $WAS\ rate = (reactor\ volume) / (operating\ sludge\ age)$ – most important control in activated sludge system. Note that process response will show only after about 60 – 75% of sludge age.	Monthly
	02	Check operation and accuracy of sludge wasting facility.	Daily
	03	Ensure continuous (steady) flow through clarifier at appropriate RAS rate for proper operation of clarification and thickening functions of clarifier.	Monthly
	04	Evaluate, by means of measurement, analysis and mathematical modelling, the efficiency of clarification and thickening functions of clarifier.	6 Months
	05	Control MLSS by means of controlling sludge age.	Daily
	06	Check settleability of sludge by means of sludge volume index (SVI) – lower SVI indicates better settling.	Daily
	07	Check MLSS for signs of sludge bulking, identify cause and institute rectifying measures.	Weekly
	08	Assess efficiency of nitrification and improve, if necessary, by means of sludge age control and dissolved oxygen control.	Daily
	09	Check operation of aerators and mixers.	Daily
	10	Check for accumulation of settled material in corners of reactor.	Monthly
	11	Control of dissolved oxygen in reactor within operating range by means of controlling water level in reactor (altering immersion depth of aerators), or by switching aerators on/off.	Daily
	12	Biological nutrient removal (BNR): Apply operation and control measures additional to those required for non-BNR activated sludge plants.	Daily
20	Effluent disposal facilities		
	01	Oxidation ponds: Manage irrigation of effluent as means of disposal.	Daily
	02	Ensure erosion free discharge to receiving water body.	Monthly
21	Power supply		
	01	Check operation of stand-by generator where applicable.	Monthly

EM 05

MONITORING AND REPORTING

The contractor shall keep a written record of all measurements taken and analyses done for process control and for reporting to relevant authorities in terms of legal or project management requirements.

A logbook shall be kept for daily recording of failures, malfunctions, spills, pollution events, power failures and detail of measures taken.

The monitoring programme for the above measurements and analyses shall include, but shall not be limited to the items listed in the table below

TECHNICAL SPECIFICATION

EN LICENSING OF WATER USE AND REGISTRATION OF WATER WORKS

CONTENTS

EN 01	SCOPE
EN 02	LICENSING OF A WATER USE (BOTH DRINKING WATER AND WASTEWATER)
EN 03	REGISTRATION OF A WATER WORKS (BOTH DRINKING WATER AND WASTEWATER)
EN 04	COMPULSORY NATIONAL STANDARDS AND MEASURES TO CONSERVE WATER (REGULATION R.509 OF 8 JUNE 2001) (DRINKING WATER ONLY)
EN 05	POLLUTION PREVENTION (WASTEWATER AND DRINKING WATER)
EN 06	MEASUREMENT AND PAYMENT

EN 01 SCOPE

This specification covers the Licensing of a water use and registration of a water works which are two separate activities that must be adhered to by the owner of the land on which a water works and is constructed and operated.

EN 02 LICENSING OF A WATER USE (BOTH DRINKING WATER AND WASTEWATER)

The National Water Act, 1998 (Act 36 of 1998) regulates the use of water. Various uses of water were identified and were taken up in the Water Act as activities which must be licensed by the Department of Water and Environmental Affairs (DWAE) unless:

- it is listed in Schedule I
- it is an existing lawful use
- it is permissible under the General Authorisations; or
- if the responsible authority waives the need for a license

Regulation No. R. 1352 issued in terms section 26(1) (c) of the Water Act, 1998 includes all water uses (i.e. existing lawful water uses in terms section of 34(2) of the Water Act, 1998 as well as general authorisations in terms of section 29 (1)(b)(vi) of the Water Act, 1998).

In section 21 of the National Water Act a water use is defined as the following:

- taking water from a water resource
- storing water
- impeding or diverting the flow of water in a water course
- engaging in a stream flow reduction activity (as in section 36 of the National Water Act)
- engaging in a controlled activity identified as such in section 37 (1) or declared under section 38(1) of the National Water Act
- discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit
- disposing of waste in a manner which may detrimentally impact on a water resource

- disposing in a manner of water which contains waste from, or which has been heated in, any industrial or power generating process
- altering the bed, banks, course or characteristics of a water course
- removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
- using water for recreational purposes

EN 03 REGISTRATION OF A WATER WORKS (BOTH DRINKING WATER AND WASTEWATER)

The registration of water works, whether it is a drinking water purification plant or a wastewater treatment plant, is a regulatory requirement which must be adhered to as stipulated by the National Water Act, 1998 (Act No. 36 of 1998).

In terms of Regulation R2834 dated 27 December 1985 which was issued in terms of the Water Act of 1956, a **water works and the operators** (process controllers) must be registered after classification of the water works at the relevant authority which is the Department of Water and Environmental Affairs (DWAE).

Regulation R2834 is now under revision and it is still valid. Draft regulations were published under both the Water Services Act, 1997 (Regulation No. R.17 of 2008) as well as the Water Act, 1998 (Regulation No. R.180 of 24 February 1998).

EN 04 COMPULSORY NATIONAL STANDARDS AND MEASURES TO CONSERVE WATER (REGULATION R.509 OF 8 JUNE 2001) (DRINKING WATER ONLY)

Regulation R.509 of 8 June 2001 was issued in terms of the Water Services Act, 1997 (Act No. 108 of 1997). The regulation is inter alia related to compulsory national standards for drinking water.

The quality of drinking water is by law regulated by two standards:

- The South African National Standard 241:2006 Edition 6.1; or
- The South African Quality Guidelines Published by the Department of Water and Environmental Affairs.

Results from testing samples must be compared to the specified limits and it must then be identified whether the water tested, poses a health risk or not. Should the water poses a health risk the water services institution must inform the relevant authorities (Department of Water and Environmental Affairs and the Provincial Department of Health) and it must take steps to inform the consumers of the following:

- that the water supplied poses a health risk
- of the reasons of the health risk
- of precautions to be taken by the consumers
- of the time frame, if any, within which it may be expected that water of a safe quality will be provided.

EN 05 POLLUTION PREVENTION (WASTEWATER AND DRINKING WATER)

In terms of section 19 of the National Water Act, 1998 (Act No. 36 of 1998) the prevention of pollution of land and water resources is the responsibility of the person who owns or uses the land.

In a situation where pollution of land or water resources occurs or might occur the person who owns, controls, occupies or uses the land is responsible for taking measures to prevent pollution of water resources. If measures are not taken the relevant authority may do whatever it takes to prevent or remedy the situation and then recover the costs from the persons responsible for the pollution.

Section 19 of the National Water Act, 1998 (Act No. 36 of 1998) reads as follows:

19. (1) *An owner of land, a person in control of land or a person who occupies or uses the land on which-*

- (a) any activity or process is or was performed or undertaken; or*
- (b) any other situation exists, which causes, has caused or is likely to cause pollution of a water resource, must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring.*
- (2) The measures referred to in subsection (1) may include measures to-*
 - (a) cease, modify or control any act or process causing the pollution;*
 - (b) comply with any prescribed waste standard or management practice;*
 - (c) contain or prevent the movement of pollutants;*
 - (d) eliminate any source of the pollution;*
 - (e) remedy the effects of the pollution; and*
 - (f) remedy the effects of any disturbance to the bed and banks of a watercourse.*
- (3) A catchment management agency may direct any person who fails to take the measures required under subsection (1) to-*
 - (a) commence taking specific measures before a given date;*
 - (b) diligently continue with those measures; and*
- (4) Should a person fail to comply, or comply inadequately with a directive given under subsection (3), the catchment management agency may take the measures it considers necessary to remedy the situation.*
- (5) Subject to subsection (6), a catchment management agency may recover all costs incurred as a result of it acting under subsection (4) jointly and severally from the following persons:*
 - (a) Any person who is or was responsible for, or who directly or indirectly contributed to, the pollution or the potential pollution;*
 - (b) The owner of the land at the time when the pollution or the potential for pollution occurred, or that owner's successor-in-title;*
 - (c) The person in control of the land or any person who has a right to use the land at the time when-*
 - (i) the activity or the process is or was performed or undertaken; or*
 - (ii) the situation came about; or*
 - (d) Any person who negligently failed to prevent-*
 - (i) the activity or the process being performed or undertaken; or*
 - (ii) the situation from coming about.*
- (6) The catchment management agency may in respect of the recovery of costs under subsection (5), claim from any other person who, in the opinion of the catchment management agency, benefited from the measures undertaken under subsection (4), to the extent of such benefit.*
- (7) The costs claimed under subsection (5) must be reasonable and may include, without being limited to, labour, administrative and overhead costs.*
- (c) If more than one person is liable in terms of subsection (5), the catchment management agency must, at the request of any of those persons, and after giving the others an opportunity to be heard, apportion the liability, but such apportionment does not relieve any of them of their joint and several liability for the full amount of the costs.*

EN 06 MEASUREMENT AND PAYMENT**EN.01 REGISTRATION OF A WATER USE Unit : Number**

The unit of measurement shall be the number of potable water and sewage treatment plants to be registered. Boreholes are registered as single units. Separate forms are necessary for individual properties, as it is registered at the Surveyor General under its own title deed number. Multiple boreholes on the same property can be registered on the same form by using a summary of the location of each borehole.

The tendered rates shall include full compensation to obtain all relevant information from different authorities (Surveyor General, for instance) to complete the forms. It shall also include full compensation to complete and dispatch the application forms, and ensure that registration is completed on behalf of the Department of Public Works.

TECHNICAL SPECIFICATIONS

FD HEATING VENTILATION AND AIR-CONDITIONING SYSTEMS

CONTENTS

FD 01	SCOPE
FD 02	STANDARD SPECIFICATIONS
FD 03	DETAIL OF MAINTENANCE WORK
FD 04	MEASUREMENT AND PAYMENT

FD 01 SCOPE

This specification encompasses all aspects regarding the particulars of the maintenance and servicing work to the Heating Ventilation and Air-conditioning systems at the Ports of Entry.

The Ports of Entry consists of various air-conditioning equipment, as listed in specification **SS: Site Specific Inventory**, which form part of the maintenance and servicing contract for heating, ventilation and air-conditioning.

FD 02 STANDARD SPECIFICATIONS

FD 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

FD 02.01.01 SANS and other specifications and codes

SANS 10400	-	The applications of the National Building Regulations
SANS 10142	-	Code of practice for the wiring of premises
Act 103	-	National Building Regulations and Building Standard Act, 1977 (Act No 103 of 1977) as amended

FD 02.01.02 Department of Public Works Specifications

PW 371	-	Specification of materials and methods to be used
STD.PWD.VIII	-	Standard specification for refrigeration services
STS 1	-	Standard specification for air conditioning services
STS 5	-	Standard specification for electrical installations and equipment pertaining to mechanical installations

FD 03 DETAIL OF REPAIR WORK**FD 03.01 GENERAL SERVICING 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 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.
- (c) 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.
- (d) 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.
- (e) 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.
- (f) All control equipment and serviceable items shall be installed and positioned such that they will be accessible and maintainable.
- (g) 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.

FD 03.02 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.
- (d) 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.
- (e) 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 NOISE AND VIBRATION

- (a) Equipment shall be mounted on vibration isolators of the correct type and selection depending on deflection requirement and vibrating frequency.

FD 03.05 SELF-CONTAINED AIR-CONDITIONING UNITS

- (a) The self-contained packaged unit shall be a fully catalogued product and documentation shall include performance curves and selection tables.
- (b) Self-contained room air-conditioning units consist of unit casing, compressor, evaporator and fan, condenser and fan, refrigerant pipework with expansion device and the relevant controls. The condenser unit shall form an integral part of the unit or be separate for split applications.
- (c) Unit casings shall be of sheet metal construction with a baked enamel finish to give a corrosion resistance. Units shall be suitably insulated to ensure quiet operation.
- (d) Evaporator fans shall be of the double inlet centrifugal type with integral motor or belt-driven. The fan assembly shall be isolated from the unit by means of rubber mounts and the unit shall operate without vibration.
- (e) Condensate trays shall be manufactured of non-corrosive materials and shall be insulated and condensate shall be piped to the nearest drain point.
- (f) Washable WP 77 filters shall be provided and installed behind the inlet grille and shall be easily removable.
- (g) Compressors shall be of the hermetically sealed dome type with crankcase heaters and suitable vibration isolators.
- (h) Condenser coils shall be copper tubes with aluminium fins for inland use. Condenser fans shall be propeller fans or of the centrifugal type.
- (i) Refrigerant piping shall be installed and repaired as specified in FD 03.

FD 03.06 SERVICING OF SELF-CONTAINED AIR-CONDITIONING UNITS

- Clean air intake screen.
- Replace filters.
- De-rust, neutralize and touch up paintwork.
- Replace canvas collars.
- Clean housing, ensure all panels are properly secured and door panels close properly.
- Check setting and operation of all pressure switches, reset if required.
- Check setting and operation of all safety switches, ie LP and HP switches, oil pressure switch.
- Check setting and operation of thermostats.
- Check timers and reset if required.
- Check operation of seven-day timer.
- Check running current of fans and compressor and settings and operation of overloads.
- Check tightness of all electrical terminals.
- Ensure operation of local and remote isolators.
- Check condition of all cables and whether cables are neatly strapped and reposition and strap if required.

- Ensure correct operation of emergency stop.
- Carry out a leak test on all refrigeration piping and components inclusive of evaporator and condenser.
- 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.
- The superheat setting of the thermostatic expansion valve shall be checked and adjusted if required (setting approximately 8 °C).
- The filter dryer shall be replaced.
- Check compressor vibration mounts.
- Test oil acidity.
- Check refrigerant charge sight glass being clear or flashing.
- Check moisture indication being dry.
- Clean condensate tray and test drainage operation.
- Clean evaporator and condenser blades and check unbalance.
- Replace suction line insulation.
- Check all service valves for full operation, replace caps if missing.

FD 04 MEASUREMENT AND PAYMENT

FD.01 Service Air-Conditioning unit..... Unit: Number (No)

The unit of measurement shall be the number of Air-Conditioning units completely serviced in accordance with FD 03.06.

The tendered rate shall include full compensation for the servicing of the units as per Manufacturer's instruction of filters, cleaning of the housing, checking of all switches, thermostat and compressors.

FD.02 Replace AC temperature controller (remote) Unit: Number (No)

The unit of measurement shall be the number of missing controllers replaced.

The tendered rate shall include full compensation for the supply and installation of the new controller as well as testing (including batteries).

FD.03 Replace AC remote batteries (per controller) Unit: Number (No)

The unit of measurement shall be the number of Air-conditioning remote controllers of which the full set of batteries have been replaced.

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

FD.04 Supply Temperature Data Logger..... Unit: Number (No)

The unit of measurement shall be the number of electronic temperature data loggers supplied to site for effective monitoring of temperatures (internal). The data logger is a portable electronic device that records data over time with a built in temperature sensor and enabling data transfer to a computer via USB cable. The units shall be small, battery powered, portable, and equipped with a microprocessor, internal memory for data storage, and sensors. Furthermore it shall interface with a personal computer and utilize software to view and analyze the collected data for a period of 7 days.

TECHNICAL SPECIFICATION

FN WATER PUMP SYSTEMS

CONTENTS

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

FN 01 SCOPE

This specification covers the decommissioning, removal, repair and reconditioning, installation, testing, commissioning and maintenance of pumping equipment, motor control devices and low-voltage cables. The function of water pump systems shall be the delivery of water at a specified flow rate and head to the required location.

FN 02 STANDARD SPECIFICATIONS

FN 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

BS 5316, Part 1	-	Acceptance tests for centrifugal, mixed flow and axial pumps
SANS 948	-	Three-phase induction motors
SANS 1222	-	Enclosures for electrical equipment classified by IP code
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 03 PUMP DESIGN AND REQUIREMENTS

- (a) The pump shaft shall be manufactured from stainless steel and shall be sealed where it enters the casing with double mechanical face seals.
- (b) The impeller shall be suitable for pumping the type of clear water as specified in Clause FN 08 (Detail of work) of this specification.
- (c) The impeller shall be manufactured from stainless steel or, in the case of other materials, it shall be coated with an approved material resistant to abrasion and corrosion prevalent to the conditions under which the impeller shall operate. For pumps rated below 2 kW non-metallic impellers may be utilised.
- (d) The impeller shall be statically, dynamically and hydraulically balanced. No holes may be drilled in the impeller to balance it with regard to mass distribution.

- (e) Only permanently sealed ball or roller bearings shall be installed.
- (f) Bearings shall have a B-10 life rating of 100 000 hours.
- (g) The pump shall be a currently catalogued product.
- (h) Performance curves shall be based on a reproducible and certified test carried out in an approved testing facility, such as the SANS.
- (i) The flow rate at break-off point of the curve for the impeller selected shall be at least 1,5 times that of the maximum flow rate specified.
- (j) The head at zero delivery of the curve of the impeller selected shall be at least 1,2 times the maximum head in the pump's operational range.
- (k) Each pump shall be clearly labelled. The label shall be a 0,5 mm thick stainless steel plate of dimensions 100 mm x 50 mm. The label shall be fixed to the pump exterior with an approved adhesive or other method after the completion of corrosion protection on the pump. It may be bent to follow the shape of the pump exterior but shall not be bent to accommodate sharp folds. Under no circumstances shall the stainless steel plate of the label influence, damage or otherwise have a detrimental effect on the corrosion protection system. The label shall include the following information:
 - pump rates
 - pump head
 - power required
 - NPSH (r) rotational speed
 - impeller detail.
- (l) All new submersible pumps shall be supplied with a length of power cable to suit the installation shown on the drawings.
- (m) All new pumps shall be fitted with double flush mechanical seals, which shall be included in the cost of the pumps. The pump shafts shall be hardened and accurately ground where the seal bears on the shaft. The rotating seal face shall be mounted on a flexible member, sealing on the shaft as well. The flexible member shall be manufactured from rubber, PTFE or equivalent material suitable for the operating environment.
- (n) Centrifugal pumps shall comply with relevant and applicable items under the clause on technical requirements regarding all pump types, as well as the following:
 - (i) Preference shall be given to pumps of the self-regulating type and where the power consumption characteristic is such that the power consumption decreases with an increase in delivery to beyond a certain limit, thus ensuring that the motor is not overloaded in the event of a large reduction in pumping head.
 - (ii) The casing for centrifugal pumps shall be horizontally or vertically split to allow removal of parts.
 - (iii) The efficiency of the pump shall not be less than 95 % of its maximum efficiency at the selected operating point, where the latter shall not be less than 80 %.

FN 04 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 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 Klaxon 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 05 WORKING VOLTAGE AND SUPPLY SYSTEMS

The motors shall be capable of operating within ± 10 % of the nominal supply voltage without risk of damage. All motors shall be suitable for operating continuously at the specified 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 06 PROTECTION AND CONTROL DEVICES

Submersible pumping equipment shall have float switches to switch the pump motor on and off, according to the level of the liquid. Switches shall operate freely and 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 07 DETAIL OF WORK

FN 07.01 GENERAL

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

FN 07.02 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 07.03 PUMPING EQUIPMENT

If no detail of the existing pumps is available, such detail shall be determined by removing the pumps.

Reconditioning or repair of pumping equipment shall be carried out if necessary.

FN 07.04 MOTOR CONTROL CENTRE

- (a) The inside and outside of all surfaces of the motor control centre must be thoroughly cleaned and metal surfaces treated for rust and corrosion and repainted to specification.
- (b) Float switches for level sensing shall be checked. Missing, damaged or faulty switches shall be replaced with new switches of similar and equal type. The switches must be installed and supported on suitable brackets to prevent the cables and switches from tangling, due to the inflow of the sewage water.
- (c) Check and tighten all terminations of all equipment.
- (d) Clean out all switchgear and equipment properly to remove dust and spider webs.
- (e) Dismantle and clean all moving parts and contacts of magnetic contactors and starters, reassemble, check overload trip units and adjust correctly. Test for correct functioning on completion of repair work.

- (f) Replace any damaged ammeters, switches and lamps on the control with parts similar and equal to the existing types on the panel.
- (g) Wiring diagrams of all electrical panels and MCC panels shall be compiled.

FN 07.05**MOTOR CONTROL CENTRE (BULK WATER)**

- (a) The existing motor control centre for the control of the water pumping equipment is situated in the raw water pump room or bore hole pump rooms. The existing motor control centre shall be replaced to comply with the following requirements:
- (b) The new replacement motor control centre for the 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 borehole pump shall be tested for conformity to be re-used. In the event that the cable might not pass such testing by the Contractor, the Contractor shall inform the Engineer in writing. The Engineer will instruct the Contractor with regard to a new cable to be installed. *Remuneration, in the event of a new power supply cable being required from the MCC to the borehole pump, will be measured under the re-measurable electrical repair quantities and must **not** be included in the payment item for the replacement and equipping of the Motor Control Centre!*
- (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) The existing level float switches will be tested and replaced if defective. The float control switches (2 off) shall be installed, tested and commissioned in the pressed steel tanks for the level sensing functions, as follows:
 - When the pressed steel tank is 50 % full, the pump shall start to fill the tank until it is full
 - When the pressed steel tank is full, the pump shall switch off
 - Where applicable the two pumps will be rotated every 8 hours
- (f) Switchgear and equipment shall be installed in the MCC to:
 - Automatically regulate the start and stop of the pump as set out in (e)
 - Indicate the time that the pump has been operating since commissioning (hour meters)
 - Start/ stop the pump manually.
 - Indicate that the pump is running
 - Indicate that the pump has tripped
 - Manually override the pump
 - Timer in order to alternate the pumps every 8 hours
- (g) Test for correct functioning on completion of electrical repair work.
- (h) Emergency stop buttons shall be installed at the borehole in all-weather box for emergency stop functions.

FN 08 TESTING AND COMMISSIONING**FN 08.01 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 08.02 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 08.03 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 08.04 TEST CONDITIONS

- (a) All tests shall be performed in situ.
- (b) The pumped medium or liquid shall be water.

FN 08.05 ADDITIONAL TESTS

Additional tests may be specified in the detail of work.

FN 09 MEASUREMENT AND PAYMENT**FN.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.

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 SERVICING OF PUMPING EQUIPMENT.....Unit: number

The unit of measurement shall be the number of pumps and motors serviced as per manufacturers specifications.

The tendered rates shall include full compensation for servicing of components and materials, and for tools, transport, site handling and labour necessary for the complete servicing of pumping equipment.

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

FN.05 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.06 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.07 RECONDITIONING OF MCC BOARDS OR OTHER
ELECTRICITY BOARDS Unit: number**

The unit of measurement shall be the number of MCC boards or other electricity boards reconditioned.

The tendered rates shall include full compensation for replacement of components and materials and for tools, transport, site handling and labour necessary for the complete reconditioning of all components of the board.

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

FN.08 COMPILATION OF WIRING DIAGRAMS Unit: number

The unit of measurement shall be the number of wiring diagrams compiled.

The tendered rates shall include full compensation for drawing, printing, computer time and any other associated costs necessary for the compilation of a wiring diagram.

PARTICULAR SPECIFICATION

PFN PUMP INSTALLATIONS AND MOTOR AND PUMP CONTROL

CONTENTS

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PFN 5	THE DIESEL ENGINE IN GENERAL
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PFN 01 SCOPE

This specification covers the installation, testing, commissioning and maintenance of pumping equipment, motor control devices, telemetric systems and low-voltage cables. The function of systems, installations and equipment indicated shall be for the processing and delivery of water and the treatment of wastewater at the domestic and piggery treatment plants.

PFN 02 STANDARD SPECIFICATIONS

PFN 02.01 GENERAL STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

BS 5316, Part 1	Acceptance tests for centrifugal, mixed flow and axial pumps
	Three-phase induction motors
	Enclosures for electrical equipment (classified according to the degree of protection that the enclosure provides)
	General requirements for rotating electrical machines
BS 1486, Part 2	Heavy duty lubrication nipples
	Rolling bearings – dynamic load ratings and rating life

PFN 02.02 OCCUPATIONAL HEALTH AND SAFETY

The Contractor shall be required to comply with the Occupational Health and Safety Act 85 of 1993, Construction Regulations 2014 and related regulations. Non-

compliance with these regulations, in any way whatsoever, will be adequate reason for suspending the Works.

PFN 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.

PFN 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.

PFN 03 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.

PFN 04 PUMP DESIGN AND REQUIREMENTS

- (a) The pump shaft shall be manufactured from stainless steel and shall be sealed where it enters the casing with double mechanical face seals.
- (b) The impeller shall be suitable for pumping the type of clear water as specified in Clause FN 03 (Detail of work) of this specification.
- (c) The impeller shall be manufactured from stainless steel or, in the case of other materials; it shall be coated with an approved material resistant to abrasion and corrosion prevalent to the conditions under which the impeller shall operate. For pumps rated below 2 kW non-metallic impellers may be utilised.
- (d) The impeller shall be statically, dynamically and hydraulically balanced. No holes may be drilled in the impeller to balance it with regard to mass distribution.
- (e) Only permanently sealed ball or roller bearings shall be installed.
- (f) Bearings shall have a B-10 life rating of 100 000 hours.
- (g) The pump shall be a currently catalogued product.
- (h) Performance curves shall be based on a reproducible and certified test carried out in an approved testing facility, such as the SABS.
- (i) The flow rate at break-off point of the curve for the impeller selected shall be at least 1,5 times that of the maximum flow rate specified.
- (j) The head at zero delivery of the curve of the impeller selected shall be at least 12 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 rate
 - Pump head
 - Power required
 - Rotational speed NPSH (r)
 - 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 %.
- (o) Materials:

Materials in general

All parts of the pump shall be manufactured of the most suitable material to prevent wear as far as possible. Full specification in this respect shall accompany the tender.

Design in general

All parts of the pump shall be designed so as to ensure easy dismantling for inspection and repair.

Casings

Pumps casings shall be of high grade cast iron or steel rigidly secured to a bed plate or bass.

Impellers

The pump impellers shall be manufactured from hard wearing high chrome cast steel or similar materials and shall be carefully bored and keyed. All parts inaccessible to machining shall be finished smooth.

Pump seals

The pump seals shall be fitted with mechanical seals with tungsten carbide or ceramic seats.

Bearings

Preference will be given to ball or roller bearings. In designing bearings, conservative loadings shall be applied to ensure absolute dependability and freedom from heating troubles.

Pump Shafts

Pump shafts shall preferably be manufactured from stainless steel. They shall be statically and dynamically balanced with their respective rotors, and impellers

PFN 05

THE DIESEL ENGINE IN GENERAL

It is an important requirement that spares will be available for a long period in the future and Tenderers must satisfy the Department that this would be the case. Engine having a high local content in their manufacture will receive preference.

The engine must be a well-designed and proved air-cooled diesel engine. The cooling must be effected by an axial blower driven via a double V-belt from the front crankshaft end. An air duct incorporated in the blower must direct the cooling air to the cylinders and the cylinder head. The hot air shall be duct to the outside of the pump house in an approved manner and of which full particulars are to be included in the tender. The V-belts must run on double V-pulleys. The belts must be of the highest quality and each belt must be strong enough to carry the full load so that the duplicate belt may be looked upon as a standby safety measure.

The engine shall have a pressure feed lubrication system for the main and crankpin bearings, timing gear, camshaft and valve gear.

The engine shall be equipped with a 12 Volt axial flywheel engaging starter motor and an oil pressure actuated safety starter motor disengagement. The pinion of the starter shall engage with the starter ring on the flywheel before the rotor revolves.

The engine shall also be equipped with a governor of the mechanical all-speed type, integral with the injection pump, and a stop control lever on the governor.

The rating of the engine shall be 10% more than the full load power absorbed by the pump when operating under any of the specified conditions.

Power absorbed by the plant in meeting the maximum duty required of the pump, must be considered in selecting a suitable diesel engine for this service, to ensure that it complies in all respects with the specification.

The engine shall be fitted with a flywheel coupling and guard or cover, fuel tank of 6 hours full load capacity, and exhaust pipe fitted with silencers. The exhaust shall be taken outside the pump house or terminate as specified elsewhere.

It must be the most reliable of its type, capable of running under full load for a minimum period of 6 hours. To ensure that it shall do so, it must therefore be rated in accordance with specifications B.S 649 or A to DIN 6270 for Internal Combustion Engines continuous rating + 10% overload).

PFN 06

MOTOR DESIGN AND REQUIREMENTS

- (a) Electric motors shall comply with the requirements of SANS 1804.
- (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 1804.
- (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 Klaxon 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.

PFN 07

WORKING VOLTAGE AND SUPPLY SYSTEMS

The motors shall be capable of operating within $\pm 10\%$ 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 $\pm 10\%$ 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 $\pm 5\%$ 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.

PFN 08

MOTOR CONTROL CENTRE DESIGN

All pumps will be controlled by the Motor Control Centre (MCC). Float- and pressure switches shall be used to switch the pump motors on and off, according to the applicable water levels.

- (a) New MCC for water pumps, sewer pumps, aerators, borehole pumps, mixers, motor drive valves etc. shall be wired to comply with the requirements as set out in this clause.

- (i) Wiring

Allowance shall be made for the entire electrical installation and wiring of the pumps and controls, including level control probes. Three phase supply cables must be supplied to the control boards of the pumping plants. The cable needed to supply power to the pump house from the nearest convenient point will be measured separately.

- (ii) Control Boards

The control boards housing the starting and control equipment shall be of the free standing, weatherproof, corrosion resistant, kiosk type.

Control boards shall be properly sealed by suitable rubber gaskets or similar materials.

The material must be of 2.0mm thick IP65, 3CR12, coated steel.

The face plate of the motor control centre must be inside the complete panel and the complete panel must have a lockable door, capable of locking with a padlock.

The faceplate of the motor control centre must have a lockable isolator to ensure that the panel is off when the face plate cover is opened.

An engraved labelling must be used on the door of the Control Board with the relevant MCC number on. The label shall be secured with screws and nuts.

All labelling on the face plates of the control board shall be engraved and must indicate all the functions of the Control Board on each section.

(iii) Hour meters

Hour meters as per clause 9.7 of the Standard Specifications for Electrical Equipment and Installation for Mechanical Services shall be provided for each pump

(iv) Earth leakage protection

The electrical motors for the pumps are not to be equipped with earth leakage protection. All other electrical fittings however must be provided with earth leakage protection as per clause 7.3 of the Standard Specifications.

(v) Flexible cables

Flexible cables between control boards and pumps shall have sufficient slack to enable the pumps to be withdrawn from the castings by at least 1m, without the necessity of disconnecting the cable.

(vi) Float switches

The float switches to be used in the contract, shall be of the hermetically sealed, mercury switch type.

(vii) Motor

The motor shall have a speed not exceeding 1500 r/min and shall be suitable for the pump offered. It shall be of sufficient capacity to bring the unit up to maximum speed against full load and shall have a rating of not less than 25% in excess of the maximum power required to drive the unit when working under normal maximum load.

(viii) Lightning arrester

The control boards shall be equipped with lightning/surge arresters.

(ix) Lightning and socket point

For external motor control a board lightning with an illumination of 200 lux and one industrial 3 pin outlet point is to be provided.

(x) Volt and Amp meter

Each MCC shall be equipped with one interchangeable (between L1, L2 & L3) voltmeter. Each electrical motor shall be equipped with one amp meter.

(xi) Adjustable 24 Hour Quarts Clock

If specified the electrical control panel is to be equipped with an adjustable (at half an hour intervals) 24 hour cycle quarts clock/time switch, which must be capable of activating the pump any number of timers per day (48 minimum) at any preselected time intervals. The timer shall only provide an on impulse when each of the preselected times is reached. If the pumps have not switched off and are still running when the next preselected time is reached, it must only be confirmed by the timer that the pump should be running. The quarts clock unit shall have its own nickel cadmium battery unit incorporated and must power itself for at least 72 hours in case of a power failure. The clock and battery unit shall be as MICOREX QT, R150 HOUR with reference no.926401 or similar approved (dimensions 52 x 102mm).

(xii) Electrical control panel and batteries for the diesel engines

The nickel cadmium batteries shall be capable of ten consecutive starts, each at least 5 seconds in duration, without recharging, against full compression.

The control panel shall be of the totally enclosed, floor mounted type incorporating 12 volt semi-sealed nickel cadmium battery, double wound air cooled transformer 220V/12V, full wave silicon rectifier, smoothing choke, low rate charging resistor, 12 Volt A.C. signal lamp to indicate "Mains On", 12 Volt D.C. signal lamp to indicate "High Charging Rate". The control equipment must have the necessary relays and electronic features to accommodate any of the requirements as specified.

The nickel cadmium battery offered is to be steel cased of the semi-sealed high power type as "SAFT KPH 50" or other approved.

The battery is to be provided with suitable approved sensing devices to monitor the battery voltage to ensure that the trickle charger automatically selects the correct high or low charging rate required to maintain the battery in perfect condition. The tenderer must submit a certificate from the battery supplier stating that he is fully aware of the requirements for the correct maintenance of the battery and that he is satisfied that all apparatus incorporated in the control equipment for monitoring and charging this battery, is suitable and fully approved by him.

It is essential that Performance Data for the battery offered be submitted for information of the Department, clearly indicating its discharge characteristics under peak load starting conditions when fully and 50% discharged, i.e. simulated repeat starting in accordance with the specification.

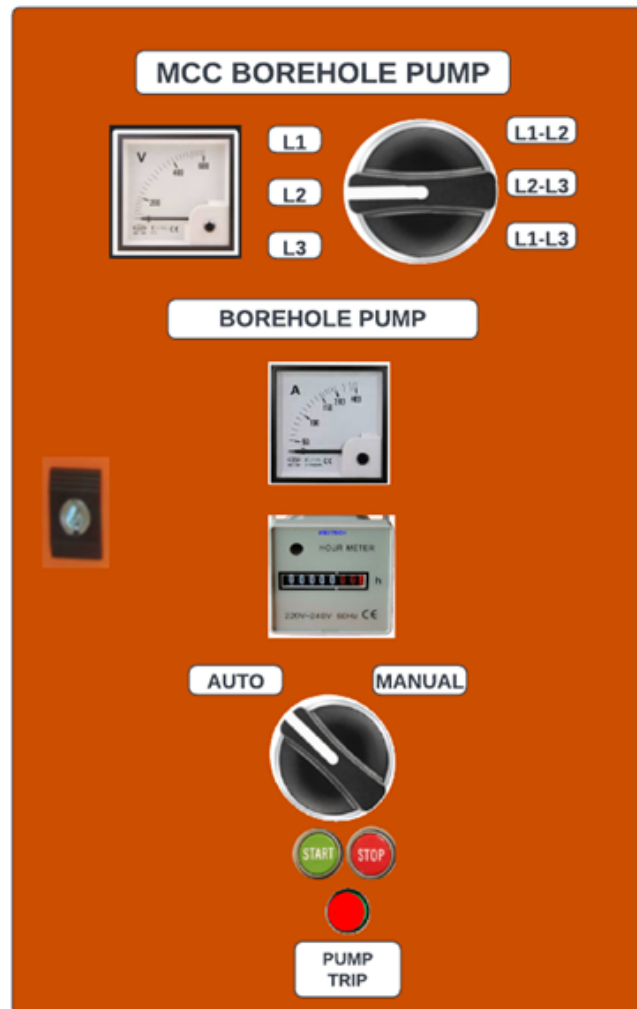
- (b) In the event of an existing MCC being replaced by a new MCC, the power supply cable from the MCC to the pump shall be tested for conformity to be re-used. In the event that the cable might not pass such testing by the Contractor, the Contractor shall inform the Engineer in writing. The Engineer will instruct the Contractor with regard to a new cable to be installed. Remuneration, in the event of a new power supply cable being required from the MCC to the borehole pump, will be measured under the re-measurable electrical repair quantities and must not be included in the payment item for the replacement and equipping of the MCC.
- (c) 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.
- (d) Switchgear and equipment shall be installed in the MCC to:
 - Automatically regulate the start and stop of the pump
 - Indicate the time that the pump has been operating since commissioning (hour meters)
 - Start/ stop the pump manually.
 - Indicate that the pump is running
 - Indicate that the pump has tripped
 - Manually override the pump
 - Timer in order to alternate the pumps every 8 hours
 - Indicate Amps for each pump
 - Indicate Main Supply Voltage (L1, L2 & L3) & ((L1/L2, L2/L3 & L3/L1)
 - Ensure Phase failure protection
 - Switchgear and equipment shall be installed in the MCC to:
- (e) Submersible equipment protection devices are installed separately to ensure the following:
 - Insulation resistance before start-up
 - Temperature (Tempcon, Pt sensor and PTC/thermal switch)
 - Overload/under load
 - Overvoltage/under voltage
 - Phase sequence
 - Power factor
 - Power consumption
 - Harmonic distortion
 - Run and start capacitor (single-phase)
 - Operating hours and number of starts
 - Lightning and surge protection

- (f) Test for correct functioning on completion of electrical repair work.
- (g) Emergency stop buttons shall be installed at the borehole installation in all-weather boxes for emergency stop functions.

PFN 08.01 SPECIFIC DESIGN REQUIREMENTS FOR ELECTRICAL EQUIPMENT

PFN 08.01.01 MIXERS, SUBMERSIBLE SEWAGE PUMPS, WATER SUPPLY PUMPS FOR WATER PURIFICATION, BULK SUPPLY IRRIGATION AND BOREHOLES

Where equipment forms part of one installation all of the relevant equipment will be housed in the same type of MCC's, which shall be of the free-standing weather and waterproofed kiosk type. The controls will be accessible from a single opening door and the panel will be divided in two halves one section of the control panel must be allocated for the incoming breaker and cables and the other section for selector switches specified controls. A typical example of a Motor Control Cabinet is shown below.



PFN 08.01.01.01 SUBMERSIBLE CENTRIFUGAL BOREHOLE PUMPS (UP TO 3 KW)

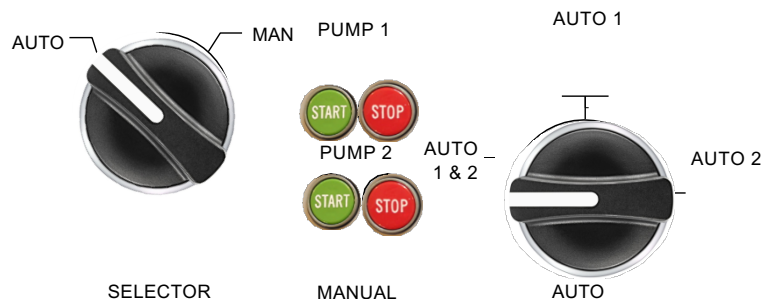
- (a) The pumps shall be controlled by both a pump selector switch and a mode selector switch mounted on the switchboard panel. These switches are shown below.



- (b) The pump shall be able to operate in both manual and automatic mode. In the manual mode the pump selected shall operate by means of push button ON/OFF switches incorporating LED lights. In addition the pumps shall however be stopped by means of a low level float control preventing the pumps from running dry.
- (c) In the automatic mode the pumps shall be activated by means of a 24 hour timer adjustable in 24 hour increments.

PFN 08.01.01.02 CONTROL OF INTSTALLATIONS FOR SETS OF TWO CLOSE COUPLED CENTRIFUGAL PUMPS FOR VARIOUS APPLICATIONS 2.5Kw

- (a) The pump set shall be controlled by both a pump selector and mode selector switch mounted on the control panel. Each installation consist of two electrical pumps, and the switches for each of these pump sets are as follow:



- (b) The pumps shall be able to operate in both manual and automatic mode. In the manual mode the pumps shall be operated by means of push buttons incorporating LED lights. The pumps will be switched off if the water level in the supply tank reaches a minimum level to prevent the pumps from running dry.

- (c) In the automatic mode both pumps shall be activated by means of a 24-hour time switch capable of switching the pumps ON and OFF at hour intervals.
- (d) The timer shall have the function to override the hour intervals to enable continuous 24-hour operation in the automatic mode if so required.
- (e) Due to the design of the purification process the pumps could operate continuously.

To prevent on-going operation of one pump, in addition to normal stopping and starting the pump shall be controlled by means of a 24-hour time switch adjustable in 1 hour increments.

In automatic mode the pump running after 10 hours continuous operation must be switched OFF, immediately starting the other pump to continue operation.

- (f) Due to on-going stopping and starting in automatic mode, automatic stepping between the pumps shall occur when the mode selector switch is set at AUTO Pump 1 and Pump 2. In the event of one pump failing to switch on, the other pump must automatically be switched on again.

PFN 08.01.01.03 IRRIGATION PUMP INSTALLATION (2.5 KW)

The control board must be a free standing weather and waterproofed kiosk type.

- a) The pumps shall be controlled by a mode selector switch mounted on the switch board panel. The switches are shown below:



- b) The pump shall be able to operate in both manual and automatic modes. In the manual mode the pump can be operated by means of push button ON/OFF switches incorporating LED lights.

In addition the pump shall however be switched off at the low level probe in the storage tank to prevent the pump from running dry.

- c) In the automatic mode the pump shall be switched on by means of a 24-hour time switch capable of switching the pump ON and OFF at half hour intervals.

In addition the pumps shall be switched of at the low level in the existing storage tank controlled by float switch. If the timer is in the switch on mode the pump will restart as soon as the water level in the sump reaches high level norm. The pump will keep on pumping until the set time period has run out.

PFN 09 TESTING AND COMMISSIONING

PFN 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.

PFN 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, then the suction pressure conditions will be calculated from the system properties.

PFN 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.

PFN 09.04 TEST CONDITIONS

- (a) All tests shall be performed in situ.
- (b) The pumped medium or liquid shall be water.

PFN 09.05 ADDITIONAL TESTS

Additional tests may be specified in the detail of work.

PFN 10 MAINTENANCE

PFN 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 repair work 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.

PFN 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.

NO	TABLE PFN 10.02/1 ROUTINE PREVENTATIVE MAINTENANCE OF CLEAR-WATER PUMP SYSTEMS	MAINTENANCE FREQUENCY
1	Visually inspect and report on the complete system	Monthly
2	Check, inspect, report and repair all leaks	Monthly
3	Log and record all meter readings for AMP, VOLTS, HOURS, ETC	Monthly
4	Check and verify the working conditions of floats switches and control devices.	Monthly
5	Check and verify the working condition of indication lights and replace if required	Monthly
6	Check and verify the working condition of selector switches and replace if required	Monthly

NO	TABLE PFN 10.02/1 ROUTINE PREVENTATIVE MAINTENANCE OF CLEAR-WATER PUMP SYSTEMS	MAINTENANCE FREQUENCY
7	Internal inspection of all motor control and power distribution panels and cleaning.	Monthly
8	Check and lubricate moving parts on pumps and motors and related equipment where required.	Four-monthly
9	Check and tighten all electrical connections on motor control centres	Four-monthly
10	Check, service, repair and clean all types of pumps and motors	At least Six-monthly
11	Check, service, repair and clean all types of pump and motor bearings, couplings, mountings and seals.	At least Six-monthly
12	Corrosion protect pumps, motors and surface piping	Annually

PFN 11 **MEASUREMENT AND PAYMENT**

PFN 11.01 **SUPPLY, DELIVERY AND INSTALLATION OF EQUIPMENT** Unit: number

The unit of measurement shall be the number of pumping and other equipment units supplied, delivered and installed.

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 the 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.
- (c) Installation of the guide rails and sealing frame;
- (d) Coupling of all required pipes flanges, including all required gaskets, nuts, bolts and washers;
- (e) Routing and fastening of the power cable up to the isolator box;
- (f) 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.

PFN 11.02 **REPAIR, SERVICE, TESTING AND COMMISSIONING OF EQUIPMENT** Unit: number

The unit of measurement shall be the number of pumping equipment unit's air blowers, dosing units, level switching controls etc. 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 tendered rates shall include full compensation for all preliminary tests, 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.

PFN 11.03 DECOMMISSIONING AND REMOVAL OF EQUIPMENT Unit: number/meter

The unit of measurement for the decommissioning and removal of pumping equipment shall be as follows:

Motors, pumps, valves, non-return valves Unit: number
Pipes, rods, cables..... Unit: meter

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.

PFN 11.04 SUPPLY AND INSTALLATION, TESTING AND COMMISSIONING OF MCC BOARDS OR OTHER ELECTRICITY BOARDS Unit: number

The unit of measurement shall be the number of MCC boards or other electricity boards manufactured and installed. The tendered rates shall include the compilation of shop drawings and line diagrams prior to delivery of the Control Board.

The tendered rates shall include full compensation for all components and materials and for tools, transport, site handling and labour necessary for the complete installation of all components of the board.

The unit of measurement shall be the number of MCC boards or other electricity boards tested and commissioned. Commissioning must be carried out as described in specification SC General Decommissioning, Testing and Commissioning Procedures.

Separate items will be listed in the Schedule of Quantities for different motor control systems.

PFN 11.05 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.

PFN 11.06 RECONDITIONING OF TELEMETRIC SYSTEMS Unit: number

The unit of measurement shall be the number of telemetric systems repaired/reconditioned.

The tendered rates shall include full compensation for the replacement of components and materials and for tools, transport, site handling and labour necessary for the complete reconditioning/repair of all components of the telemetric system.

PFN 11.07

DECOMMISSION, RECONDITION, TEST AND COMMISSION MCC BOARDS OR OTHER ELECTRICITY BOARDS AND RELATED EQUIPMENT.....Unit: number

The unit of measurement shall be the number of MCC boards or other electricity boards reconditioned/serviced.

The tendered rates shall include full compensation for the replacement of components and materials and for tools, transport, site handling and labour necessary for the complete reconditioning of all components of the board.

The tendered rate shall further include full compensation for the cleaning and opening of MCC or kiosk, vermin protection, checking of MCBs, checking and tightening of wire terminations, and fitting of labels and blank covers.

The tendered rate shall include for replacement of all defective components and parts on the face of the motor control centre which shall include selector switches, hour meters, AMP meters, Volt Meters, Pilot lights, push buttons, door control, hinges, rubbers and labels.

The replacement of electrical/electronic equipment within the motor control centre interior components shall be limited to all types of relays (time sequencing, level control, pump sequencing, on/off control, protection, monitoring, etc), wiring, phase sequencing and phase failure protection.

Contactors, PLCs, circuit breakers and all types of medium and low-voltage circuit breakers and contactors shall not be included in the rate.

Separate items will be listed in the Schedule of Quantities for different types and sizes of equipment or the location of the motor control centre. The condition of the existing motor control centre will be made evident during the compulsory site inspection but shall not limit the requirements of work to be executed to render the motor control centre in a complete working condition as per the intended design requirement.

TECHNICAL SPECIFICATION HA

HA - MEDIUM AND LOW VOLTAGE EQUIPMENT

CONTENTS

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HA 01 SCOPE

- HA 01.01 This specification covers the repair and maintenance of medium and low voltage distribution equipment. The equipment comprises of MV/LV distribution substations and miniature substations.
- HA 01.02 This specification forms an integral part of the repair and maintenance contract document and shall be read in conjunction with Portion 3, the Additional Specification included with this document.

HA 02 STANDARD SPECIFICATIONS, REGULATIONS AND CODES

- HA 02.01 The latest edition, including all amendments up to date of tender of the following specifications, publication and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof.
- HA 02.02 SANS Specifications
- a) SANS 10400
 - b) SANS 10142-1
 - c) Refer to the repair and maintenance procedures for the specific standards applicable to each procedure.
- HA 02.03 Department of Public Works Specifications
- a) PW 774
- HA 02.04 Occupational Health and Safety Act of 1993
- HA 02.05 Manufacturer's specifications and installation instructions

- HA 02.06 Additional requirements
- a) Equipment and material installed shall be new and unused.
 - b) The Contractor shall ensure that all safety regulations and measures are applied and enforced during repair and maintenance work on medium and low voltage equipment.
- HA 02.07 Additional standards, specifications, regulations and codes listed with the maintenance and repair procedures specified elsewhere in this document.
- HA 02.08 The Contractor shall familiarise himself with site and equipment conditions to ensure that all work can be performed in a safe manner.

HA 03 OPERATING AND MAINTENANCE MANUALS

HA 03.01 PROCUREMENT OF AVAILABLE AS-BUILT INFORMATION

- a) At the commencement of the contract, the Contractor shall obtain all available as-built documentation from the Engineer and from the various parties previously responsible for operations and maintenance tasks. These parties shall include employees of the Client, or external contracted personnel.
 - b) If this information is available the contractor shall attempt to obtain the internal wiring diagrams and associated operations and maintenance information from the manufacturers of all switchgear panels.
 - c) The contractor shall verify the correctness of all the above mentioned as-built information by surveying the installations. The surveying of the installation shall include the following:
 - i) The tracing (by sight only) of all equipment indicated on as-built information, excluding the instrumentation and/or control wiring of distribution equipment.
 - ii) The marking up of the as-built information to indicate the correctness or not of the as-built information. Equipment indicated on the drawings that are not installed on-site shall be indicated as non-existing, and equipment that exists on site but are not indicated on the as-built information shall be indicated as existing.
 - d) The contractor shall compile a complete single line or schematic diagram representation of the complete installations. This single line diagram shall indicate the distribution substations and miniature substations. The inter-connections between all the components of the distribution substation shall be shown, and the various components shall be labelled using names designated by the contractor.
 - e) All information that was verified and or compiled from existing sources as well as information that was compiled independently by the contractor shall be recorded in electronic format.
 - f) The contractor shall supply the Engineer with three sets of all the above mentioned information in electronic format, and three sets in hardcopy format. This information shall be compiled and completed during the repair phase of the contract, and shall be submitted not later than the end of the repair phase.
- HA 03.02 Over and above what is specified in the Additional Specification – SB Operating and Maintenance manuals, the Operating and Maintenance Manual to be compiled shall include the following maintenance data:

- a) A maintenance record of all materials and equipment replaced or worked on as part of this contract.
- b) Summary maintenance data recording the frequency of replacement of consumables and replacement material such as luminaires.

HA 04 TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK

- HA 04.01 Refer to the test and inspection requirements specified with each procedure.
- HA 04.02 The Contractor shall perform the following tests on completion of any work on medium voltage cables or cable terminations:
- a) Voltage tests

Each section of the cable installation between miniature substations shall be subjected to a preliminary voltage or insulation resistance test to prove the insulation resistance.
 - b) Continuity test

The resistance between each core and the lead sheath of the cable shall be measured for each section while the core and sheath is short circuited at the far end to ascertain if all connections have been correctly made.

All test instruments shall be of a high quality and shall, if required, be calibrated by the SANS or such body approved by the Engineer at the cost of the Contractor.
 - c) DC medium-voltage tests

Each cable circuit, including joints and terminations, shall be tested by means of a direct current voltage of 18kV between the different cores and between the cores and the lead sheath or copper tape screen for a period of 15 minutes. The voltage shall be gradually raised to 18kV and kept there for 15 minutes.
- HA 04.03 The Contractor shall undertake all repairs and replacements at his own cost in the event of the installation failing the above-mentioned tests. The tests shall be conducted in the presence of the Engineer before the Engineer shall agree to accept any part of the installation. The Contractor shall furthermore undertake any other tests the Engineer may prescribe to satisfy himself that the work is of an acceptable standard.
- HA 04.04 The Contractor shall upon request provide the Engineer with test and calibrating certificates to prove that the measuring and testing instruments have been tested and calibrated by an organisation that is acceptable to the Engineer.

HA 05 MAINTENANCE TOOLS AND SPARES

- HA 05.01 On commencement of the Repair and Maintenance Contract, the Contractor shall compile an inventory of the existing Tools and Spares in the presence of the Client.
- HA 05.02 The Contractor shall supply all tools and spares required to perform the specified maintenance tasks, and he/she shall ensure that adequate tools and spares are available at all times to enable efficient repair and maintenance.

HA 06 QUALITY ASSURANCE SYSTEM

- HA 06.01 Following formal approval of his Quality Assurance system by the Engineer, the Contractor shall implement the approved QA system.
- HA 06.02 Records of this QA system shall be kept throughout the duration of the contract and shall be submitted to the Engineer as required.

HA 07 RE-COMMISSIONING OF INSTALLATION

- HA 07.01 On completion of the initial repair work the installation shall be commissioned by the Contractor.

HA 08 MEASUREMENT AND PAYMENT

- HA 08.01 The following payment specifications apply to all the repair and maintenance procedures specified in this contract:
- For each of the repair and maintenance procedures, the tendered rate shall include full compensation for the following:
- a) All labour required to complete the procedure.
 - b) The supply, delivery, installation, testing and commissioning of all equipment and material required to complete the procedure. (Except where exclusions to this clause is specified in the remaining specifications that forms part of the specific procedure).
 - c) The prior arrangement by the contractor to obtain timely access to facilities and the shutting down of equipment by the responsible persons as may be required to complete the procedure.
 - d) All costs associated with the transportation to and no site, the operation of, and the insurance and safekeeping by the contractor of all specialised and other plant and equipment that may be required for the completion of the procedure.
 - e) The execution of all site and other tests that may be required from the contractor to prove compliance with the specified standard specifications, regulations and codes. These tests shall be specified elsewhere as part of the procedure, or can be requested by the Engineer, or national and other laws, bylaws and regulations may require such tests.
 - f) The supply of indisputable proof in documented format that all the equipment and material supplied and installed in terms of the procedure complies with the specified standard specifications, regulations and codes.

HA 09 REPAIR WORK TO MEDIUM AND LOW VOLTAGE EQUIPMENT

- HA 09.01 All components of the medium and low voltage network shall be repaired during the first phase of the repair and maintenance contract, except in cases where the repair actions are specified to require specific approval for execution.
- HA 09.02 The scope of the repair work shall include, but not be limited to the activities listed below.
- HA 09.03 The Contractor shall record the repair actions in tabular format before the maintenance phase commences.

HA.5

- HA 09.04 Repair work shall be executed within the approved period for repairs. This period shall be agreed at the start of the contract period.
- HA 09.05 New equipment and material shall be supplied with a written guarantee confirming a defects liability period of 12 months from date of hand-over. These guarantees shall be furnished in favour of the Department of Public Works.
- HA 09.06 The maintenance phase of this contract shall commence once the repair work on the installation has been commissioned and handed over to the satisfaction of the Engineer.
- HA 09.07 The repair actions are specified in the form of work procedures. These procedures comprise of step-by-step instructions on how to perform each repair action.

HA 10 MAINTENANCE OF MEDIUM AND LOW VOLTAGE EQUIPMENT

- HA 10.01 The electrical distribution network shall be maintained in accordance with Additional Specification SA – General Maintenance.
- HA 10.02 The following maintenance actions will be required under this phase of the contract:
- a) routine preventative maintenance
 - b) corrective maintenance
 - c) breakdown maintenance
- HA 10.03 The maintenance schedules and frequency of maintenance activities shall be developed under the maintenance control plan which will be instituted by the Contractor. The Contractors responsibility in this regard is specified in the Additional Specification SA – General Maintenance.

HA 11 DISTRIBUTION NETWORK : TECHNICAL DESCRIPTION

- HA 11.01 This section describes the electrical distribution network that will be repaired and maintained in terms of this contract.

HA 12 TECHNICAL DETAILS: INITIAL REPAIR PROCEDURES

- HA 12.01 This section contains the specifications for the initial repair procedures that will be completed as part of the contract. The contractor should note that the tendered rate for each procedure shall include both the supply, delivery, installation, testing and commissioning of equipment and material, and the labour and other costs associated with the completion of the procedure.
- HA 12.02 Scope of repair and maintenance work
- The repair and maintenance procedures are the following:
- RP01 Substation building clean-up.
 - RP02 Installation of hasp-and-latch door lock mechanism
 - RP03 Replacement of glass windowpanes
 - RP04 Installation of window-louvres
 - RP05 Installation of ventilation-louvres
 - RP06 Installation of padlocks

HA.6

RP07	Installation of steel cable trench cover plates
RP08	Installation of wooden cable trench cover planks
RP09	Equipment oil clean-up
RP10	Replacement of lighting equipment
RP11	Replacement of photocell and reinstallation of outdoor light fitting
RP12	Replacement of socket outlet cover plate
RP13	Clean-up of tar/bitumen spills
RP14	Replacement of MV switchgear fuses
RP15	Ring-main unit overhaul
RP16	Replace ring-main unit contacts and contact blades
RP17	Insulation oil sampling and analysis
RP18	On-site insulation oil reconditioning
RP19	Supply and installation of insulation oil
RP20	MV circuit breaker oil service
RP21	Replacement of a cover plate for medium voltage switchgear panel
RP22	Installation of a transformer earth conductor
RP23	Replacement of transformer oil gaskets
RP24	Reparation of transformer bushing insulation
RP25	Replacement of transformer dehydrating breather
RP26	Sealing of a low voltage cable trench and sleeve section.
RP27	General repairs to low voltage wiring in distribution panels.
RP28	Replacement of ammeters
RP29	Replacement of voltmeters
RP30	Replacement of instrumentation fuses
RP31	Secure LV panels to floor
RP32	Installation of LV cable clamps
RP33	Reinstallation of LV distribution board front panel
RP34	Replacement of DB board front cover panel
RP35	Replacement of LV circuit breaker
RP36	Reparation of insulation on low voltage busbar
RP37	Reparations and LV cable replacements at a miniature substation
RP38	Replacement and or reparation of MV cable terminations
RP39	Replacement of MV cable sections and the terminating of the cable
RP40	Reinstallation of a LV cable in a distribution kiosk

HA 12.03 The repair and maintenance tasks are specified in the following procedures :

1. Substation building clean-up
 - 1.1 Procedure Number RP01
 - 1.2 Scope

This procedure covers the internal clean-up of a substation building.
 - 1.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.
 - 1.4 Task Description

All tasks described in this procedure shall be carried out in all three rooms of the substation building (MV switchgear room, transformer room, LV room). Generator rooms are excluded from this task.

 - a) The contractor shall remove all loose refuse and other scrap materials and objects from the substation and dispose thereof off site at a suitable location (excluding any equipment, material or other objects which could be considered to be of value to the client).
 - b) The contractor shall clean the substation floors and remove all sand, dust and other loose particles.

- c) The contractor shall wash all walls using a suitable cleaning agent (water alone shall not be acceptable) and sponges, cloths and other cleaning materials as may be required. All smudge markings and other removable dirt marks shall be removed from the walls as part of this task.

1.5 Measurement and Payment

- a) The unit of measurement shall be the number of substations cleaned. All three rooms of a substation building shall be considered as one unit.
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the supply of all cleaning materials that may be required in the execution of this task.

2. Installation of hasp-and-latch door lock mechanism

2.1 Procedure Number RP02

2.2 Scope

This procedure covers the installation of steel clamping plates and a hasp-and-latch door lock mechanism, and the reinstallation of the existing door handles.

2.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.

2.4 Task Description

- a) The contractor shall remove the existing door handle and locking latch mechanism from both of the double external doors of the substation.
- b) The contractor shall supply and install two sets of clamping plates, one set on each of the two doors. Each set of clamping plates shall consist of two galvanised steel plates of minimum dimensions 2.5mm thickness x 200mm x 300mm. The clamping plates shall be installed in adjacent positions on the two adjacent double doors, and in a position such that it covers the area where the existing door handles are installed. Each set of clamping plates shall be installed at neatly aligned opposing sides of the door. The plates shall be secured with at least four bolts, washers and nuts, with a minimum bolt diameter of 8mm. The bolts shall be of the rounded head type and shall be installed with the rounded heads facing outdoors and the washer and nut ends facing indoors. The plates shall be aligned such that the edges of the plates do not protrude beyond the edges of the door, thereby preventing injury to persons opening and closing the doors.
- c) The contractor shall supply and install a hasp-and-latch combination onto the lower part of the clamping plates of the two doors. The hasp-and-latch unit shall be made of either stainless steel, galvanised steel, or chrome covered metal. The hasp-and-latch unit shall be of the type that closes onto itself, thereby completely covering all securing bolts and screws when in the closing position. The size of the hasp-and-latch unit shall be

such that it is suitable for locking with no smaller than a 75mm shackle type Viro lock.

- d) The contractor shall reinstall all the original door handles onto the upper part of the clamping plates of both doors. The contractor shall supply and install suitable fastening bolts and screws for this purpose.

2.5 Measurement and Payment

- a) The unit of measurement and payment shall be a lump sum.
- b) The lump sum shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the supply, delivery and installation of all material and equipment that is required for the completion of this task.

3. Replacement of Glass Windowpanes

3.1 Procedure Number RP03

3.2 Scope

This procedure covers the replacement of windowpanes in substation buildings.

3.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

3.4 Task Description

- a) The contractor shall remove all broken glass particles and fixing putty from the frame where a windowpane has been broken.
- b) The contractor shall install a new windowpane by installing the glass and the fixing putty. The fixing putty shall be worked off to a smooth and sloped finish.
- c) The contractor shall measure the windowpane to determine the exact dimensions required.
- d) The glass supplied shall have a minimum thickness of 5mm.

3.5 Measurement and Payment

- a) The unit of measurement shall be number of windowpanes installed. The schedule of quantities shall specify the type of equipment in terms of the dimensions of the windowpane. The different types are the following:
 - i) 1.0m wide x 1.5m high
 - ii) 1.5m wide x 2.5m high
 - ii) 0.2 m wide x 0.3m high
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the measurement on site of the dimensions of the windowpanes prior to the ordering of any material.

4. Installation of Window-louvres

4.1 Procedure Number RP04

4.2 Scope

This procedure covers the supply, delivery and installation of steel window-louvres to cover the outdoor side of substation building windowpanes. The reason for the installation is to protect the windowpanes from vandalism.

4.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.

4.4 Task Description

- a) The contractor shall permanently install frame mounted louvres on the outside of the substation windows. The frames shall be attached to the walls by means of anchor bolts.
- b) Each unit shall consist of a standard manufactured louvres arrangement and it (including the frame and fixing brackets) shall be manufactured from sheet metal painted with an anti-corrosive paint.
- c) The contractor shall measure the dimensions of each window frame, and the frame shall be manufactured according to these measurements to completely cover the exposed windowpane.
- d) The windowpane areas that shall be used to base the tender rates on shall be 1.0m wide by 1.5m high, and 1.5m wide by 2.5m high.

4.5 Measurement and Payment

- a) The unit of measurement shall be the number of louvres installed. The schedule of quantities shall specify the type of equipment in terms of the dimensions of the windowpane. The different types are the following:
 - i) 1.0m wide x 1.5m high
 - ii) 1.5 m wide x 2.5m high

5. Installation of Ventilation-louvres

5.1 Procedure Number RP05

5.2 Scope

This procedure covers the supply, delivery and installation of an inlet and outlet pair of wall mounted ventilation-louvres in the transformer room of a substation building. The installation shall include the breaking of a hole in the wall and the installation and cementing up of the installed louvres.

5.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with original equipment manufacturer's specifications, and operation and maintenance instructions.

5.4 Task Description

- a) The contractor shall install an inlet and outlet pair of sheet metal or aluminium ventilation louvres in the walls of the transformer room. The contractor shall break a suitably sized opening in the wall using suitable equipment, and the louvres shall be permanently installed inside the wall. The louvres shall not be surface mounted. The contractor shall finish off the sides of the opening with an approved building plaster after completion of the installation.
- b) The plaster work around the louvres shall be finished off to a smooth appearance and shall be repainted with a similar paint to that on the existing wall sections.
- c) The louvres installed shall be a Trox Model WKL Weather Louver or equivalent model. The louvres shall be medium sized and of the vermin proof type. The outlet louver shall be a third size larger than the inlet louver to enable efficient free air circulation.
- d) The two louvres shall be installed in two walls opposite from each other. The outlet louver shall be installed high in the wall and the inlet louver shall be installed at a suitably lower height to enable efficient free air circulation.

5.5 Measurement and Payment

- a) The unit of measurement and payment shall be the number of ventilation-louvre pairs installed. (One unit rate shall apply to the combination of an inlet/outlet pair of louvres).

6. Installation of Padlocks

6.1 Procedure Number RP06

6.2 Scope

This procedure covers the supply, delivery and installation of padlocks to secure substation doors and metal enclosure doors such as those of miniature substations and low voltage distribution kiosks.

6.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

6.4 Task Description

- a) The contractor shall remove the existing padlocks from the specified substation doors, or metal enclosure doors such as those of miniature substations and low voltage distribution kiosks. This shall be done using a suitable sized bolt cutter or other equipment. Care shall be taken not to damage the door handle, latch or other locking mechanism during the removal of the old locks.
- b) The contractor shall install the new padlocks and close the lock on installation.
- c) All padlocks supplied shall be of the 75mm shackle Viro type.
- d) All padlocks supplied shall be of a single batch and shall be operated using a single master key.
- e) The contractor shall retain a set of keys and supply the Engineer with a set consisting of twenty spare keys.

6.5 Measurement and Payment

- a) The unit of measurement shall be the number of padlocks supplied.
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the installation of the locks on the various substation and enclosure doors throughout the installations, and the removal of old locks in accordance with this procedure.

7. Installation of Steel Cable Trench Cover Plates

7.1 Procedure Number RP07

7.2 Scope

This procedure covers the supply, delivery and installation of steel cable-trench cover plates at sections of cable trenches in substation buildings where existing cable-trench cover plates have been removed.

7.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

7.4 Task Description

- a) The contractor shall manufacture and install sections of cable-trench cover plates to fit the sections in substations where old cover plates have been removed. The contractor shall measure up the cable trenches and manufacture the plates to fit exactly in the required sections. The dimensions specified in this procedure shall only be used as a basis to determine the tendered rate.
- b) The cover plates shall be manufactured from mild steel chequered plate with a base thickness of 4.5mm and a chequered stud thickness of 6.1mm. Each cover plate shall have two guiding lengths of angle iron welded to the bottom of the plate. The guiding angle irons shall be welded in positions parallel to the length of the cable trench. The guiding angle irons shall be positioned at the edges of the plate and shall form a tight fitting stop against the edges of the cable trench. The angle irons shall be mild steel with dimensions 40mm x 40mm x 3mm.
- c) Each cover plate shall be fitted with two mild steel lifting handles fitted at opposing ends of the plate (in line with the length of the cable trench). The handles shall be fitted through holes drilled in the plate and shall be such that they form irremovable parts of the plate.
- d) All metal edges shall be chamfered to remove all burrs so that the cover plates can be handled without injury.
- e) Each cover plate and its handles shall be painted with a suitable anti-corrosive primer after all welding and chamfering has been completed. All metal surfaces shall be cleaned (prior to painting) and painted in accordance with the paint manufacturer's recommendations.

7.5 Measurement and Payment

- a) The unit of measurement shall be the number of cable trench cover plates supplied, delivered and installed. The schedule of quantities shall specify the type of cover plate in terms of its dimensions. The following types shall be supplied:

- i) 0.6m wide x 0.5m long
- ii) 0.6m wide x 0.6m long
- iii) 0.6m wide x 0.8m long
- iv) 0.6m wide x 1.5m long
- v) 0.6m wide x 1.8m long
- vi) 0.7m wide x 0.3m long
- vii) 0.7m wide x 1.5m long

8. Installation of Wooden Cable Trench Planks

8.1 Procedure Number RP08

8.2 Scope

This procedure covers the supply, delivery and installation of wooden cable-trench cover planks at sections of cable trenches in substation buildings where existing cable-trench cover plates have been removed.

8.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

8.4 Task Description

- a) The contractor shall manufacture and install sections of wooden plank trench cover plates to fit the sections in substations where old cover planks have been removed. The contractor shall measure up the cable trenches and manufacture the planks to fit exactly in the required sections. The dimensions specified in this procedure shall only be used as a basis to determine the tendered rate.
- b) The planks shall be cut so that the length of the planks is equal to (or slightly less than) the width of the cable trenches inlet grooves. The planks shall be arranged at right angles to the length of the trench, with a number of parallel planks making up the cable trench covering.
- c) Each plank shall be fitted with two finger-lifting holes of 20mm diameter at opposing ends of the plank.
- d) The planks shall be made from newly cut Sapele wood with minimum thickness and width 38mm and 150mm respectively.
- e) All planks shall be treated with an oil-based weather proofing substance.
- f) Only one plank in any cable trench section may be narrower than the specified width, and this width shall be such that the trench cover section is properly and completely covered.

8.5 Measurement and Payment

- a) The unit of measurement shall be the number of cable trench sections covered. (The number of planks shall not be used as measurement). The schedule of quantities shall specify the dimensions of the cable trench sections. The dimensions of the cable sections are the following:
 - i) 0.3m wide x 0.6m long
 - ii) 0.3m wide x 1.5m long

9. Equipment Oil Cleanup

9.1 Procedure Number RP09

9.2 Scope

This procedure covers the clean-up of oil on an indoor T3 or ring-main unit switchgear bank or on a transformer.

9.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

9.4 Task Description

- a) The contractor shall use a suitable solvent to remove the surface oil from the transformer or the three or four panels of the indoor ring-main unit or T3 switchgear bank.

9.5 Measurement and Payment

- a) The unit of measurement shall be the number of switchgear banks or transformers cleaned. The schedule of quantities shall specify the type of equipment components in terms of the type and size of the components. The different types are the following:
 - i) Transformer clean-up
 - ii) Switchgear bank clean-up

10. Replacement of Lighting Equipment

10.1 Procedure Number RP10

10.2 Scope

This procedure covers the supply, delivery and installation of lighting equipment at various places.

10.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) SANS 10114
- c) SANS 163
- d) SANS 1012
- e) SANS 1084
- f) SANS 1250
- g) SANS 1279
- h) SANS 1777

10.4 Task Description

- a) The contractor shall remove the defective luminaires and or other equipment from their fittings.
- b) The contractor shall in install and reconnect the circuits to the newly installed lighting equipment.

- c) In cases where wiring defects are encountered, the contractor shall supply and install the required wiring and associated material to correct the defects.
- d) In cases where a complete light fitting (bayonet type or fluorescent tube luminaire) is installed, the contractor shall also be responsible for reconnecting the new light fitting with the existing light switch. The contractor shall be responsible to ensure that the newly installed light can be switched on and off using the existing light switch, and in cases where the existing light switch is defective or not in place, the contractor shall supply and install the necessary light switch, wiring and other fixing equipment and materials as part of the light fitting.

10.5 Measurement and Payment

- a) The unit of measurement shall be number of lighting equipment components supplied and installed. The schedule of quantities shall specify the type of equipment components in terms of the type and size of the components. The different types are the following:
 - i) Complete Light Fitting - Bayonet Luminaire Type

This component consists of a complete bayonet type luminaire unit. It includes a base unit for installation against a bulkhead or ceiling, a bayonet type globe, and a round globe of the type that screws into the base unit.
 - ii) Complete Light Fitting - Fluorescent tube Type

This component consists of a complete double tube fluorescent luminaire unit. It includes a base unit for installation against a bulkhead or ceiling (including a translucent cover unit to cover the luminaire tubes), two fluorescent tube luminaires (length 1.8m), and all the associated components such as starters and ballasts that form part of the luminaire unit.
 - iii) Fluorescent tube luminaire : Length 1.2m
 - iv) Fluorescent tube luminaire : Length 1.8m
 - v) Fluorescent tube luminaire : Length 2.4m
 - vi) Conventional size globe: 100W bayonet fitting
 - vii) Conventional size globe: 100W screw in fitting
 - viii) Fluorescent light starter: Length 1.2m
 - ix) Fluorescent light starter: Length 1.8m
 - x) Fluorescent light starter: Length 2.4m
 - xi) Fluorescent light ballast: Length 1.2m
 - xii) Fluorescent light ballast: Length 1.8m
 - xiii) Fluorescent light ballast: Length 2.4m

11. Replacement of photocell and reinstallation of outdoor light fitting

11.1 Procedure Number RP11

11.2 Scope

This procedure covers the replacement of a defective photocell, the reinstallation of an outdoor light fitting, and the reconnection of the light fitting and photocell to the internal distribution board of the substation building.

11.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

11.4 Task Description

- a) The contractor shall replace the defective photocell with a new and unused photocell. The contractor shall install the new photocell in a position that will ensure that the photocell is exposed to natural light in such a way that will correctly operate when exposed to outdoor light.
- b) The contractor shall reinstall the existing outdoor light fitting by means of the appropriate anchor bolts and/or other securing mechanisms.
- b) The contractor shall reconnect the photocell and outdoor light to the substation's internal distribution board and light switch. The contractor shall use (supply and install) a 20m length of surfix or equivalent type conductor (4mm² copper conductor) between the outdoor light and the internal substation distribution board and light switch. The contractor shall ensure that the surfix conductor is secured against the wall in a manner that complies with wiring regulations.
- c) The photocell shall comply with the following specifications :
 - i) The photocell shall be fitted with switch contacts able to carry no less than 5A.
 - ii) The photocell current shall not exceed 50mA during no-load conditions.
 - iii) The photocell shall be suited to 240V $\pm$ 6%, 50Hz single-phase alternating current.
 - iv) The units shall be weather proof and vibration-resistant.
 - v) The units shall be designed to withstand damage by either stone-throwers or hail. If the units do not possess this quality, separate wire screens shall be provided for this purpose.
 - vi) The units shall be supplied with a standard NEMA plug and socket. The socket shall have an arm for mounting on a pole.
 - viii) All parts shall be treated to be corrosion-proof.
 - ix) The units shall be capable of operating in dusty conditions between - 5°C and + 55°C.
 - x) The units shall switch on when the light intensity drops to 15 lux $\pm$ 20% and switch off when the light intensity reaches 40 lux $\pm$ 20%.
 - xi) When the unit is in the on position, there shall be a time delay of approximately one minute before it switches off due to a sudden increase in the light intensity.
 - xii) The design of the switch shall ensure a positive on and off switching at all times.

11.5 Measurement and Payment

- a) The unit of measurement shall be the number of photocell and outdoor light units replaced and reconnected. One unit shall be

considered a single combined photocell and outdoor light combination.

- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the 20m length of surfix or equivalent conductor as specified in this procedure.

12. Replacement of socket outlet cover plate

12.1 Procedure Number RP12

12.2 Scope

This procedure covers the supply and installation of a conventional socket outlet cover plate.

12.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes :

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) SANS code covering socket outlet cover plates.

12.4 Task Description

- a) The contractor shall supply and install a conventional socket outlet cover plate in the position where an existing cover plate is missing.
- b) The cover plate shall be a new and unused unit made of steel in compliance with the appropriate SANS code.

12.5 Measurement and Payment

- a) The unit of measurement shall be the number of socket outlet cover plates supplied and installed.

13. Cleanup of Tar/Bitumen Spills

13.1 Procedure Number RP13

13.2 Scope

This procedure covers the clean-up of tar/bitumen spills caused by leaking cable termination drums of indoor switchgear units.

13.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

13.4 Task Description

- a) The contractor shall clean-up the spill caused by the leakage of a tar/bitumen insulating cable termination box. The cable termination box as well as the floor underneath the cable termination box shall be cleaned.
- b) A suitable solvent shall be used and all traces of the tar/bitumen shall be removed.

13.5 Measurement and Payment

- a) The unit of measurement shall be the number of tar/bitumen spills cleaned.

14. Replacement of Switchgear Fuses

14.1 Procedure Number RP14

14.2 Scope

This procedure covers the replacement of fuses in ring-main units and T3's in both standalone and miniature substation units.

14.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) BS 2692: Fuses for voltages exceeding 1000 V a.c.
- c) BS 2692: Part 1 Current-limiting fuses
- d) BS 2692: Part 2 1956 Expulsion fuses
- e) BS 2692: Part 3 1990 Guide to the determination of short circuit power factor

14.4 Task Description

- a) The contractor shall replace blown fuses with new unused fuses.
- b) The fuse replacement procedure shall be done in strict accordance with the manufacturers operating and maintenance instructions.
- c) The fuses supplied shall be new 11kV HRC fuses, and if the switchgear enclosure allows this, a spare set of fuses shall mounted inside the equipment enclosure.
- d) The fuse rating shall be determined on the basis of the rating of the transformer supplied via the fuse.

14.5 Measurement and Payment

- a) The unit of measurement shall be the number of fuses replaced and installed. The same rate shall apply to all types of fuses.
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the supply and installation of a suitably rated fuse.

15. Ring-Main Unit Overhaul

15.1 Procedure Number RP15

15.2 Scope

This procedure includes all tasks associated with the complete overhaul of all three units of a three-legged ring main unit or T3. This includes opening the oil chambers and servicing the normally immersed components of the equipment, and the replacement of the insulation oil. This procedure applies to both the ring-main units of miniature substations and the standalone ring-main units or T3 units in the distribution substations.

15.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) BS 5730: 1979 Codes of practice for Maintenance of Insulating Oil
- c) BS 5263: 1975. Method for sampling liquid dielectrics
- d) SANS 555: 1985 : Standard Specification for Mineral insulating oil for transformers and switchgear (uninhibited)

15.4 Task Description

- a) Replacement of Insulating Oil
 - i) The contractor shall drain the existing oil from all the oil chambers and remove the oil from site using suitable storage methods.
 - ii) The contractor shall clean the interior of each oil chamber by means of a chamois leather cloth. All sediments shall be removed from the bottom of the oil chamber.
 - iii) The oil chamber shall be filled to the recommended level with new insulating oil in compliance with the abovementioned specifications.
 - iv) Care shall be taken to handle, transport, and store insulation oil in accordance with the abovementioned specifications
- b) Overhaul of major ring-main unit parts

The following major overhaul tasks shall be completed in addition to the insulating oil service:

 - i) The switching equipment shall be cleaned using only materials that comply with BS 5730: 1979, and thereafter the equipment shall be cleaned by means of blowing a dielectric cleaner onto the switching parts.
 - ii) The equipment shall be thoroughly inspected for signs of defects and or equipment damage. Should any defects be detected, these defects shall be reported to the Engineer in documented format. During the inspection specific attention shall be given to any signs of blade arcing.
 - iii) All moving parts (that are recommended by the original equipment manufacturer to be lubricated) shall be lubricated using a lubricant complying with the requirements of the original equipment manufacturer.

15.5 Measurement and Payment

- a) The unit of measurement shall be the number of ring-main units overhauled. A single rate shall apply to standalone ring-main units or T3's, and to the ring main units of miniature substations. All three or four switching components of a ring-main unit or T3 shall be considered one item in the schedule of quantities, and the tendered rate shall include the work done on all three or four components.
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the following:
 - i) All work associated with the overhaul of each piece of equipment as specified in this procedure, excluding the

reconditioning of insulating oil, which shall be considered another payment item.

- ii) The supply, delivery and installation of the full volume of new insulating oil required to fill all three or four oil chambers of the switching unit to the recommended level.

16. Replace Ring-Main Unit Contacts and Contact Blades

16.1 Procedure Number RP16

16.2 Scope

This procedure covers the replacement of defective contacts and contact blades on ring-main unit and T3 switchgear units (standalone and miniature substation applications).

16.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

16.4 Task Description

- a) The contractor shall replace defective contacts and contact blades if the inspection performed during the overhaul of the ring-main units proves that this replacement is required.
- b) The contractor shall remove defective contacts and shall supply and install new contacts and contact blades.
- c) The type of contacts and contact blades installed shall be as recommended by the original equipment manufacturer.

16.5 Measurement and Payment

- a) The unit of measurement shall be the number of sets of contacts and contact blades installed.

17. Insulation Oil Sampling and Analysis

17.1 Procedure Number RP17

17.2 Scope

The scope of this procedure includes all tasks required to analyse the condition of insulation oil in transformers. The transformers include both standalone and miniature substation transformers, and they are free breathing, dehydrator breathing, or hermetically sealed in type. These tasks include taking insulating oil samples from each separate oil unit, having tests done on each sample, and reporting the test results to the Engineer. All preparation tasks required for and associated with this work (such as arranging for and doing switching of electrical equipment) will be considered part of this task.

17.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) BS 5730: 1979 Codes of practice for Maintenance of Insulating Oil
- c) BS 5263: 1975 Method for sampling liquid dielectrics

- d) SANS 555: 1985 : Standard Specification for Mineral insulating oil for transformers and switchgear (uninhibited)

17.4 Task Description

- a) The contractor shall take oil samples from each unit of oil-immersed equipment that forms part of the facilities.
- b) Oil sampling shall be done in strict compliance with the operation and maintenance instructions of the manufacturers of the various units of equipment.
- c) Oil samples shall be taken from every single and separate oil unit of every piece of equipment, and each sample shall be separately labelled in order to discriminate between the result of different samples.
- d) Taking and handling of oil samples shall be done in strict compliance with the specifications outlined in BS 5263: Method for sampling liquid dielectrics.
- e) All oil samples shall be tested at a reputable laboratory (not on the Client's site) in accordance with the test procedures outlined in Appendix A of BS 5730.
- f) The following insulating oil characteristics shall be tested for according to the methods outlined in Appendix A of BS 5730:
 - i) Odour
 - ii) Appearance
 - iii) Colour
 - iv) Electric strength
 - v) Water content
 - vi) Acidity (neutralisation value)
 - vii) Resistivity (at 20°C)
 - viii) Sediment and/or precipitable sludge
 - ix) Dissolved gas analysis (DGA)
- g) The results of the tests shall be supplied to the Engineer in documented format.
- h) The test result report shall contain at least the following information:
 - i) Unique description of equipment from which of oil sample was taken.
 - ii) Date of sample,
 - iii) Name of person taking the sample.
 - iv) Test results for the sample in terms of each of the specified oil characteristics.
 - v) Recommendations on whether the oil from which the sample was taken should be replaced or reconditioned or not.
 - vi) Summary recommendation of the general condition of the oil samples tested.
 - vii) Name of person who conducted the tests.
 - viii) Name and contact details of the test laboratory.

- ix) Certification by the test laboratory that these specific tests have been conducted in compliance with BS 5730.
- i) The contractor shall make arrangements with the Engineer prior to taking samples in order to ensure that access can be gained to all required facilities, and that equipment may be switched off as is required.
- j) The contractor shall supply the Engineer with proof of his proficiency and experience in taking and analysing insulating oil samples, and of the reputability of the laboratory that will do the tests.
- k) The contractor shall, at his own expense familiarise himself with the type and manufacturer of the various equipment on site, as is required for the proper taking of samples in accordance with the manufacturer's requirements.

17.5 Measurement and Payment

- a) The unit of measurement shall be the number of transformers from which samples are taken and analysed. The same rate shall apply to all sizes of transformers.

18. On-site Insulating Oil Reconditioning

18.1 Procedure Number RP18

18.2 Scope

This procedure covers tasks that form part of the on-site reconditioning of insulating oil presently used in all transformer and switchgear equipment. The transformers include both standalone and miniature substation transformers of the free breathing, dehydrator breathing, or hermetically sealed in type. Oil immersed switchgear comprises of ring-main unit and or T3 units. In the case of transformers, the procedure also includes the servicing of the dehydrating breather of the transformer.

This task includes the supply (for the contractor's own use only) of oil reconditioning equipment, and the completion of the oil reconditioning task itself. All preparation tasks required for and associated with this work (such as arranging for and doing switching of electrical equipment) will be considered part of this task.

18.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes :

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) BS 5730 : 1979 Codes of practice for Maintenance of Insulating Oil
- c) BS 5263 : 1975. Method for sampling liquid dielectrics
- d) SANS 555 : 1985 : Standard Specification for Mineral insulating oil for transformers and switchgear (uninhibited)

18.4 Task Description

- a) The contractors shall recondition the insulating oil of the equipment that has been confirmed in writing by the Engineer to require reconditioning (based on the results of insulation oil tests that will be conducted). The contractor shall supply and install insulation oil and top up the oil chamber of the equipment in

cases where the present oil levels are below the maximum recommended oil level. The oil used for this purpose shall be in compliance with the insulation specifications as set out elsewhere in this document.

- b) The contractor shall use his own equipment for insulating oil reconditioning.
- c) The contractor shall submit details of the oil reconditioning equipment to the Engineer prior to commencing with any oil reconditioning. The contractor shall only be allowed to commence with oil reconditioning work once the Engineer has approved the equipment.
- d) The contractor shall recondition the full volume of insulation oil contained in each unit of equipment to the specified requirements.
- e) Oil reconditioning of transformers only shall be done on-load and without de-energising the transformer.
- f) The contractor shall ensure that the oil reconditioning equipment is properly used to ensure the maximum improvement of the oil characteristics. The contractor shall be required by the Engineer to perform on-site tests in order to demonstrate the condition of the reconditioned oil.
- g) The contractor shall ensure that the reconditioned oil conforms to the following minimum specifications:
 - i) Electric strength (minimum) 50kV
 - ii) Acidity (maximum) 0.1g KOH / mg of oil
 - iii) Water content (maximum) 30 p.p.m. (parts per million)
- h) The contractor shall familiarise himself with site conditions to ensure that an adequate electrical supply is available where required to operate the oil reconditioning equipment. The contractor shall be allowed to make use of the Client's facilities for this purpose provided that the contractor ensures safe operating practices for its own and the Client's personnel. Where no supply is available from the Client's electrical network, the contractor shall provide all generator equipment (including fuel and other consumable items) that is required for the oil reconditioning.
- i) The contractor shall familiarise himself with site conditions to ensure that adequate space is available where required to temporarily install and operate the oil reconditioning equipment.
- j) In the case of a transformer the contractor shall also do a complete service of the transformer's dehydrating breather. This service shall be done in accordance with the following specifications:
 - i) The contractor shall check the quantity and colour of the dehydrating agent (typically silica gel) and shall reactivate or replace it where necessary.
 - ii) The silica gel shall be considered to require replacement if its colour is pink or if the breather is not filled to the required level, and it shall be considered not to need replacement if its colour is deep blue and the breather is filled to the required level.

- iii) Silica gel used for replacement shall be new silica gel and shall comply with BS 3523.
- iv) The oil seal or bath at the base of the dehydrating breather shall be removed, cleaned out, and refilled with new insulation oil. The insulation oil used for this purpose shall be new insulation oil in compliance with SANS 555. The dehydrating breather shall be refilled with insulation oil to the level as prescribed in the manufacturer's maintenance instructions.

18.5 Measurement and Payment

- a) The unit of measurement shall be the number of transformers and the number of ring-main units reconditioned. The schedule of quantities shall specify the type of equipment to be oil reconditioned. A single rate shall apply to all sizes of transformers, and the tendered rates shall be based on an average transformer size of 200kVA. A single rate shall apply to all standalone ring-main units or T3's, and this rate shall include full compensation for the reconditioning of all three or four oil chambers. The different types are the following:
 - i) Transformer
 - ii) Ring-main unit or T3
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. The supply of insulation oil used for topping up purposes shall be provided for elsewhere under a separate payment item. In addition to this, the tendered rate shall also include full compensation for the dehydrating agent, and or dehydrating agent reactivating equipment that may be required during this operation.

19. Supply and Installation of Insulation Oil

19.1 Procedure Number RP19

19.2 Scope

This procedure covers the supply, delivery and installation of insulating oil for use in switchgear insulation chambers or in power transformers.

19.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) BS 5730 Codes of practice for Maintenance of Insulating Oil
- c) BS 5263 Method for sampling liquid dielectrics
- d) SANS 555 Standard Specification for Mineral insulating oil for transformers and switchgear (uninhibited)

19.4 Task Description

- a) The contractor shall supply, deliver and install insulation oil according to SANS 555.
- b) The oil shall be installed in transformer and or switchgear equipment in accordance with the applicable procedures elsewhere in this document.

- c) The contractor shall ensure that the transportation, handling, and storage of oil is done strictly in accordance with BS 5730.
- d) Oil shall only be supplied in terms of this procedure on the instruction of the Engineer. Oil shall further only be supplied if the existing insulating oil in equipment has leaked out or is below the required level. The contractor shall not replace existing insulating oil with new oil unless instructed so in writing by the Engineer.
- e) The oil chambers of the equipment being topped up shall be filled to the maximum level recommended by the original equipment manufacturer.

19.5 Measurement and Payment

- a) The unit of measurement and payment shall be litres of oil supplied and installed in either transformer or switchgear equipment.
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation all costs associated with the proper transportation, handling, and storage of oil in accordance with this procedure.

20. MV Circuit Breaker Oil Service

20.1 Procedure Number RP20

20.2 Scope

This procedure covers the tasks associated with the oil servicing of medium voltage metal-clad oil insulated switchgear panels. The service includes the draining and cleaning of the oil chambers and the replacement of the insulation oil.

20.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) BS 5730 Codes of practice for Maintenance of Insulating Oil
- c) BS 5263 Method for sampling liquid dielectrics
- d) SANS 555 Standard Specification for Mineral insulating oil for transformers and switchgear (uninhibited)

20.4 Task Description

This procedure applies to indoor oil insulated medium voltage circuit breakers.

- a) The contractor shall drain the existing oil and remove the oil from site using suitable storage methods.
- b) The contractors shall clean the interior of the circuit breaker oil chamber by means of a chamois leather cloth. All sediments shall be removed from the bottom of the oil chamber.
- c) The circuit breaker inside the oil chamber shall be serviced by means of blowing a dielectric cleaner onto the switching parts.

- d) The circuit breaker shall be thoroughly inspected for signs of faults and or equipment damage. Should any faults be detected, these faults shall be reported to the Engineer in documented format. Specific attention shall be given to any signs of blade arcing.
- e) All moving parts (that are recommended by the original equipment manufacturer to be lubricated) shall be lubricated using a lubricant complying with the requirements of the original equipment manufacturer.
- f) The oil chamber shall be filled to the recommended level with new insulation oil in compliance with the abovementioned specifications.
- g) Care shall be taken to handle, transport, and store insulation oil in accordance with the abovementioned specifications
- h) The circuit breaker shall be closed and the circuit breaker trolley and panel shall be restored to the normal operational state.

20.5 Measurement and Payment

- a) The unit of measurement and payment shall be the number of circuit breakers serviced in accordance with this procedure.
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for supply, delivery and installation of the volume of new insulating oil required to fill the oil chamber to the recommended level.

21. Replacement of cover a plate for a medium voltage switchgear panel

21.1 Procedure Number RP21

21.2 Scope

This procedure covers the supply and installation of a cover plate for a medium voltage switchgear panel.

21.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

21.4 Task Description

- a) The contractor shall supply and install a rear cable termination box cover plate for a switchgear panel.
- b) The cover plate shall be designed to fit perfectly onto the existing switchgear panel. The plate shall be made of the same type of steel as the original switchgear cubicle, and it shall be painted with an equal or higher quality anti corrosive paint. The steel cover plate shall be secured onto the existing switchgear cubicle using bolts and washers to suit the existing bolt and nut arrangement of the switchgear panel.
- c) The contractor shall obtain the exact dimensions of the switchgear panel and shall manufacture the cover plate in accordance with these dimensions.

21.5 Measurement and Payment

- a) The unit of measurement shall be number of switchgear panels for which cover plates are supplied and installed.

22. Replacement of transformer earth conductor

22.1 Procedure Number RP22

22.2 Scope

This procedure covers the supply and installation of an earth conductor between a transformer and the substation integral earth bar.

22.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes :

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) SANS 1063 Earth rods and couplers

22.4 Task Description

- a) The contractor shall supply, install and connect an earth conductor between the transformer and the substation integral earth bar.
- b) The earth conductor used shall be a bare stranded copper conductor with a 70mm² cross sectional area.
- c) The earth conductor shall be connected to the equipment and to the integral earth bar using properly sized connecting lugs.

22.5 Measurement and Payment

- a) The unit of measurement shall be the number of transformers that are connected to the substation integral earth bar.
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the following:
 - i) The supply and installation of a 15m length of earth conductor as specified in this procedure.
 - ii) The supply and installation of properly sized connecting lugs and connecting bolts, nuts and washers.

23. Replacement of Transformer Oil Gaskets

23.1 Procedure Number RP23

23.2 Scope

This procedure covers the supply, delivery and installation of various types of insulating oil gaskets for power transformers. The existing oil gaskets shall be removed on site and replaced with new gaskets that shall be cut to suit the transformer.

23.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) ASTM F104-95 : Standard Classification System for Non-metallic Gasket Materials

23.4 Task Description

- a) Only personnel with proven experience of previous transformer oil gasket replacement tasks shall perform this procedure. The contractor shall supply the Engineer with proof of the experience on previous projects.

- b) This procedure covers the replacement of the following types of gaskets on power transformers:

- main top gasket
- bushing gaskets (medium voltage)
- bushing gaskets (low voltage)
- sealing bolt / test plug gasket

The procedure for the replacement of the various types of gaskets are specified below. As part of this procedure (applicable to all types of gaskets specified) the contractor shall thoroughly clean the whole transformer and remove all oil spills and other dirt on the transformer's enclosure).

- c) Main top gasket

- i) The top gasket shall be removed and care shall be taken not to damage the gasket so that it may be used to determine the dimensions of the new gasket.
- ii) The contractor shall supply and deliver new gasket material of sufficient quantity to cut a new gasket using a single sheet of gasket material. The contractor shall determine the dimensions of the transformer on site by means of measurement.
- iii) The metal surfaces on the transformer enclosure and top cover plate on which the gasket is bedded shall be thoroughly cleaned and inspected for defects that may cause oil leaks. The contractor shall report any such defects to the Engineer.
- iv) A new gasket shall be cut and installed to fit neatly on the transformer gasket area.
- v) The gasket material supplied shall be a nitrile rubber compound of the Corkrite TF72 or equal and approved equivalent type according to ASTM F104-95. The thickness of the nitrile rubber sheet shall be 4.5mm. The contractor shall select the nitrile rubber sheet with a cork granule size that is in accordance with the manufacturer's specifications.
- vii) The installation of the gasket shall be done strictly in accordance with the transformer and gasket material manufacturers' specifications.
- viii) The contractor shall ensure that the transformer's top cover plate fastening bolts are tightened to the torque and in the sequence specified by the transformer manufacturer's specifications.
- ix) The contractor shall familiarise himself with any requirements for the handling and or disconnection and reconnection of cables onto and from the transformer, and all such work shall be done as part of this procedure.

- d) Bushing gasket (medium voltage)

This procedure applies to all three medium voltage bushings.

- i) The same procedure shall be followed except that only the bushings shall be removed instead of other components as specified in the procedure for the main top gasket.
- ii) The contractor shall be responsible for the removal of the conductors that are connected to the medium voltage bushings, and for the reconnection of these conductors on completion of the task.

e) Bushing gasket (low voltage)

This procedure applies to all four low voltage bushings.

- i) The same procedure shall be followed except that only the bushings shall be removed instead of other components as specified in the procedure for the main top gasket.
- ii) The contractor shall be responsible for the removal of the conductors that are connected to the low voltage bushings, and for the reconnection of these conductors on completion of the task.

f) Sealing bolt / test plug gasket

This procedure applies to sealing bolts and or test plugs on the transformer oil chamber that are sealed by means of oil gaskets.

- i) The same procedure shall be followed except that only the sealing bolts and or test plugs shall be removed instead of other components as specified in the procedure for the main top gasket.

23.5 Measurement and Payment

- a) The unit of measurement and payment shall be the number of sealing gaskets supplied and installed. In the case of bushing gaskets the unit of measurement shall be the number of three phase sets of bushings installed. (This means that one unit shall represent all three (in the case of medium voltage bushings) or all four (in the case of low voltage bushings) bushings of the transformer for which new gaskets were installed. The schedule of quantities shall specify the type of gaskets. The different types are the following:
 - i) Main top gasket
 - ii) Bushing gaskets (medium voltage)
 - iii) Bushing gaskets (low voltages)
 - iv) Sealing bolt / test plug gasket
- b) The tendered rates shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the following:
 - i) All the work associated with the shutting down of the transformer, the removal of the existing gasket(s), the installation of the new gasket(s), and the re-installation of the transformer's top cover plate and or other components.
 - ii) All the conductor handling work that may be required to complete this procedure.

24. Reparation of Transformer Bushing Insulation

24.1 Procedure Number RP24

24.2 Scope

This procedure covers the replacement of the covering insulation of transformer bushings with new insulating material.

24.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) SANS 122 Pressure sensitive adhesive tapes for electrical purposes.

24.4 Task Description

- a) The contractor shall clean and remove all existing insulation material from the three medium voltage or low voltage bushings of the transformer, whichever is specified. The procedure shall apply to all the bushings in either the set of medium or the set of low voltage bushings whichever is specified.
- b) The contractor shall install the following insulation material on all the bushings in the set:
 - i) After it has been cleaned and old insulating material removed, the bushings shall be taped with at least 1.5m of insulating putty. The insulating putty shall be on the Scotchfil Electrical Insulating Putty type or equal and approved equivalent. The tape thickness shall be 3.2mm and the width shall be 38mm. An oil-based insulating putty shall not be used.
 - ii) The insulation putty shall be covered with at least 4 layers self-fusing rubber tape of the Scotch No. 23 tape or equal and approved equivalent. Care shall be taken that this tape is not excessively stretched when applying it, as this may deform the insulation putty.
 - iii) The self-fusing rubber tape shall be covered with at least 2 layers of adhesive colour coded PVC insulation tape of the Scotch No. 35 type or equal and approved equivalent. The colour coding of the tape shall correspond to the bushing phases, and the colours used shall be red, white, blue and black (the latter colour for the earth conductor).

24.5 Measurement and Payment

- a) The unit of measurement shall be the number of bushing sets (one set is equivalent to either three medium voltage bushings or four low voltage bushings) of which the insulation been restored. The sets shall be specified to be either one of the following:

- i) Medium voltage bushings
- ii) Low voltage bushings

25. Replacement of transformer dehydrating breather

25.1 Procedure Number RP25

25.2 Scope

This procedure covers the supply and installation of a new dehydrating breather on a power transformer.

25.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

25.4 Task Description

- a) The contractor shall disassemble and remove the defective dehydrating breather from the transformer.
- b) The contractor shall supply and install a complete new and unused dehydrating breather equal or equivalent to the existing unit of the transformer.
- c) The contractor shall fill the new dehydrating breather with dehydrating agent and insulating oil to the levels specified by the manufacturer.
- d) The replacement dehydrating breather shall be of the type specified as replacement by the original equipment manufacturer.

25.5 Measurement and Payment

- a) The unit of measurement shall be the number of dehydrating breather units replaced.
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the supply and installation of the dehydrating agent and insulating oil that will be required as part of this task.

26. Sealing of a low voltage cable trench and sleeve section

26.1 Procedure Number RP26

26.2 Scope

This procedure covers the sealing of a low voltage cable trench and sleeve section on the side of a substation building.

26.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

26.4 Task Description

- a) The contractor shall clean up the section of the cable trench inside the building by removing all ground and other material from around the existing cables. Sufficient ground and other material shall be removed to enable the back filling of the area around the cables and directly underneath the substation wall with the specified back filling material to be carried out.

- b) After the cable trench has been cleaned up the cables shall be neatly laid out 50mm away from each other. If the cable trench dimensions do not allow such spacing then a lesser-optimised arrangement shall be used.
- c) The area around the cables and directly underneath the substation wall shall be bricked up with a weak mortar mixture. The mortar shall be a sound, cement and water mixture. The contractor shall ensure that the mortar mixture is sufficiently weak to allow it to be easily broken up if additional cables are to be installed at a later stage.
- d) The contractor shall not de-energise any of the cables during the process.

26.5 Measurement and Payment

- a) The unit of measurement shall be the number of cable entry sections refurbished. One cable entry section refers to the collective set of holes/sleeves through one wall where cables enter a cable trench.

27. General repairs to low voltage wiring in distribution panels

27.1 Procedure Number RP27

27.2 Scope

This procedure covers the general repair of the wiring in the low voltage distribution kiosk of a substation.

27.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) SANS 1507: Electric cable with extruded solid dielectric insulation for fixed installations (300/500V to 1900/3300V)

27.4 Task Description

- a) The contractor shall reconfigure all cable termination in order to neaten the wiring arrangement and cable terminations in the distribution kiosk. This work shall include the disconnection of cables, the repositioning of the circuit breakers, isolators and other devices, the rerouting of cables where required, and the reconnecting of the cables.
- b) The contractor shall insulate and seal all unused cable terminations using appropriate electrical insulation and shall tie these cable terminations in a neat manner inside the distribution kiosk.
- c) The contractor shall disconnect, install cable glands, and reconnect all cable terminations that are not fitted with cable glands.
- d) The contractor shall disconnect, install cable termination lugs, and reconnect all cable terminations that are not fitted with cable termination lugs.
- i) The cable glands shall be of the adjustable type, equal or similar to the Pratley gland and shall be suitable for use with PVC SWA PVC cables complying with the latest edition of SANS 1507. All glands shall be installed with non-deteriorating neoprene

shrouds. For all gland installations on armoured cable, the outer sheath of the cable shall be cut back in accordance with the gland manufacturers' recommendations, so that a minimum of armouring is exposed between the gland and the outer sheath after gland installation. The shroud shall seal on the outer sheath of the cable.

- ii) All cable termination lugs shall be bi-metallic aluminium-copper lugs, equal to or similar to SIMEL type ACX.

27.5 Measurement and Payment

- a) The unit of measurement shall be a lump sum.
- b) The tendered sum shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered sum shall also include full compensation for the supply and installation of all cable glands, terminating lugs and other wiring materials that shall be required as part of this task.

28. Replacement of Ammeters

28.1 Procedure Number RP28

28.2 Scope

This procedure covers the replacement of low voltage instrumentation ammeters in low voltage panels in substations and in miniature substations.

28.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) BS 89 Part 9 Direct acting indicating analogue electrical measuring instruments and their accessories. Recommended test methods.
- c) IEC 60051-1 (1997-12), IEC 60051-2 (1984-12), IEC 60051-8 (1984-12), IEC 60051-9 (1988-05)

28.4 Task Description

- a) Each faulty ammeter shall be disconnected and removed from the kiosk or enclosure. The contractor shall ensure that no secondary circuits are open circuited during this procedure.
- b) The replacement ammeter shall be installed in the same position from which the faulty ammeter was removed. All circuits shall be reconnected using appropriately sized lugs on all wire terminations.
- c) All ammeters supplied shall be maximum demand and instantaneous reading ammeters with maximum demand slave indicators. Ammeters shall be rated for the appropriate secondary current (1A or 5A) and shall be able to indicate up to 20% over full current rating.
- d) Ammeters shall comply with the following specifications:
 - i) Ammeters shall be rated for the supply voltage and frequency which is 400/230V and 50Hz respectively. All the ammeters supplied shall be from the range of a single reputable supplier and shall preferably have the same face

dimensions as the original ammeters. All ammeters shall comply with BS 89 Part 9 and/or IEC 60051.

- ii) Ammeters shall be screened against magnetic interference and shall have anti-static against magnetic interference.
- iii) Ammeters shall have anti-static impact resistant glass or "Macrolon" faces.
- iv) Ammeters shall be insulated to achieve a 2kV insulation resistance to earth.
- v) All instruments shall be splash proof and dust-proof unless more stringent requirements are specified for hazardous locations.
- vi) Instruments shall be sufficiently resistant to vibration that may be encountered in the specific application.
- vii) For normal environmental and supply conditions, instruments shall be suitable for use inside the limits specified in Tables III and VI of IEC 60051.
- viii) All instruments shall be capable of withstanding overloads of continuous or short duration in accordance with section 8.3 of IEC 60051.
- ix) Instruments shall be provided with studs for rear connection. Shrouds shall be provided to prevent accidental contact where instruments are to be installed in hinged panels of switchboards.
- x) Ammeters shall have a moving iron element to indicate instantaneous values.
- xi) Direct reading ammeters up to a maximum rating of 60 A may be used. Current transformer operated ammeters shall be 5 A full scale, calibrated to read actual primary circuit currents. The current transformer ratio shall be indicated on the faceplate.
- xii) A zero-adjustment screw shall be provided.
- xiii) Where combined maximum demand and indicating ammeters are specified, a bimetallic spiral element shall be provided in the same housing to indicate mean value over a 15-minute period.
- xiv) The bimetal element shall drive a residual pointer to indicate maximum mean current between resets. This pointer shall operate on the main scale and shall be of a distinctive colour. The pointer shall be resettable from the face of the meter.
- xv) The bimetal element shall be designed to compensate for limits of ambient temperature between -20°C and 70°C.
- xvi) Full load or rated current shall be clearly indicated, preferably with a red line. Unless specified to the contrary, a 100% condensed overscale shall be provided for instantaneous reading instruments and no overscale for combined maximum-demand ammeters.
- xvii) The intrinsic error, expressed in terms of the fiducial value in accordance with IEC 60051, shall be class 1,5 for the instantaneous readings and class 2,5 for the mean maxima.

- e) Each ammeter shall be supplied and installed with a faceplate with the correct current transformer scale ratio. The contractor shall verify the correct current transformer scale ratio prior to supplying and installing the ammeter.
- f) The contractor shall do all modifications that may be required to fit the new ammeter in the existing space, including the supply and installation of fixing brackets and material.

28.5 Measurement and Payment

- a) The unit of measurement shall be number of ammeters installed. The ammeter installation process shall be considered to include the removal of the existing ammeters.

29. Replacement of Voltmeters

29.1 Procedure Number RP29

29.2 Scope

This procedure covers the replacement of low voltage instrumentation voltmeters in low voltage panels in substations and in miniature substations.

29.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes:

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) BS 89 Part 9, Direct acting indicating analogue electrical measuring instruments and their accessories. Recommended test methods.
- c) IEC 60051-1 (1997-12), IEC 60051-2 (1984-12), IEC 60051-8 (1984-12), IEC 60051-9 (1988-05)

29.4 Task Description

- a) Each faulty voltmeter shall be disconnected and removed from the kiosk or enclosure.
- b) The replacement voltmeter shall be installed in the position from which the faulty voltmeter was removed. All circuits shall be reconnected using appropriately sized lugs on all wire terminations.
- c) Voltmeters shall comply with the following specifications:
 - i) Voltmeters shall be rated for the supply voltage and frequency which is 400/230V and 50Hz respectively. All the voltmeters supplied shall be from the range of a single reputable supplier and shall preferably have the same face dimensions as the original voltmeters. All voltmeters shall comply with BS 89 Part 9 and/or IEC 60051.
 - ii) Voltmeters shall be screened against magnetic interference and shall have anti-static against magnetic interference.
 - iii) Voltmeters shall have anti-static impact resistant glass or "Macrolon" faces.
 - iv) Voltmeters shall be insulated to achieve a 2kV insulation resistance to earth.

- v) All instruments shall be splash proof and dust-proof unless more stringent requirements are specified for hazardous locations.
- vi) Instruments shall be sufficiently resistant to vibration that may be encountered in the specific application.
- vii) For normal environmental and supply conditions, instruments shall be suitable for use inside the limits specified in Tables III and VI of IEC 60051.
- viii) All instruments shall be capable of withstanding overloads of continuous or short duration in accordance with section 8.3 of IEC 60051.
- ix) Instruments shall be provided with studs for rear connection. Shrouds shall be provided to prevent accidental contact where instruments are to be installed in hinged panels of switchboards.
- x) Voltmeters shall have a moving iron element to indicate instantaneous values.
- xi) A zero adjustment screw shall be provided.
- d) Each voltmeter shall be supplied and installed with a faceplate with the correct voltage transformer scale ratio. The contractor shall verify the correct voltage transformer scale ratio prior to supplying and installing the voltmeter.
- f) The contractor shall do all modifications that may be required to fit the new voltmeter in the existing space, including the supply and installation of fixing brackets and material.

29.5 Measurement and Payment

- a) The unit of measurement shall be number of voltmeters installed. The voltmeter installation process shall be considered to include the removal of the existing voltmeters.

30. Replacement of Instrumentation Fuses

30.1 Procedure Number RP30

30.2 Scope

This procedure covers the replacement of instrumentation fuses as used in voltmeters and ammeters.

30.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

30.4 Task Description

- a) The contractor shall replace the defective fuses with new unused fuses.
- b) The fuses shall be of the type and rating as specified by the original equipment manufacturer.

30.5 Measurement and Payment

- a) The unit of measurement shall be the number of fuses replaced.

31. Secure LV panels to floor

31.1 Procedure Number RP31

31.2 Scope

This procedure covers the securing of low voltage distribution panels to the floor of a substation building.

31.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

31.4 Task Description

- a) The contractor shall secure all the low voltage distribution panels of the substation to the floor by means of appropriately sized anchor bolts, or by means of attachment to the cable trench metalwork, whichever is the most practical.
- b) The contractor shall supply and install all anchor bolts, brackets and all other materials that will be required as part of this task.

31.5 Measurement and Payment

- a) The unit of measurement shall be a lump sum.

32. Installation of LV cable clamps

32.1 Procedure Number RP32

32.2 Scope

This procedure covers the supply and installation of two cable clamps for securing two low voltage cables at their points of entry into low voltage distribution kiosks.

32.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

32.4 Task Description

This procedure applies to two low voltage power cables at the point of entry into low voltage distribution kiosks. The two cables are both PVC insulated four core copper conductors with a cross sectional area of 180mm². At present the cables are not clamped within the kiosks and the full weight of the vertical section of the cables rest on the termination bushings.

- a) The contractor shall supply and install the two wooden cable clamps to support the weight of the cables by clamping onto the cable sleeve and securing onto the distribution kiosk. The clamps shall be shaped to facilitate the clamping onto the cable sleeves without damaging the sleeves.
- b) The contractor shall ensure that the installation is done in such a manner that the weight of the two cables is carried by the clamps and not by the cable termination lugs and bushings.

32.5 Measurement and Payment

- a) The unit of measurement shall be a lump sum.

33. Reinstallation of LV distribution board front panel

33.1 Procedure Number RP33

33.2 Scope

This procedure covers the reinstallation of the front cover panels of existing low voltage distribution boards. These panels have been removed from the distribution boards and the fastening bolts and screws are no longer in place.

33.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

33.4 Task Description

- a) The contractor shall reinstall the front cover panels of the low voltage distribution board in the substation where these are missing.
- b) The panels shall be secured by means of fastening bolts and brackets. Where possible the existing brackets, bolts and nuts of the original panels shall be used, however in cases where these are unusable the contractor shall manufacture, supply and install similar securing brackets, bolts, nuts and washers.

33.5 Measurement and Payment

- a) The unit of measurement shall be a lump sum. The lump sum tendered shall include full compensation for the reinstallation of the cover panels in a single substation.

34. Replacement of DB board front cover panel

34.1 Procedure Number RP34

34.2 Scope

This procedure covers the replacement of a front cover panel for an existing wall mounted distribution board.

34.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

34.4 Task Description

- a) The contractor shall supply and install a new cover panel for a twelve-way wall mounted distribution board.
- b) The contractor shall determine the exact dimensions of the front cover panel by measurement prior to the supply and installation thereof.

34.5 Measurement and Payment

- a) The unit of measurement and payment shall be the number of replacement front cover panels supplied and installed.

35. Replacement of LV circuit breaker

35.1 Procedure Number RP35

35.2 Scope

This procedure covers the supply and installation of a three phase three pole moulded case circuit breaker.

35.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

35.4 Task Description

- a) The contractor shall remove the defective circuit breaker from the circuit.
- b) The contractor shall determine the rating of the defective circuit breaker and shall replace it with a new moulded case circuit breaker with the same ratings as that of the defective circuit breaker. The contractor shall reconnect the circuit to the new circuit breaker.
- c) The type of circuit breaker is a moulded case three phase three pole circuit breaker. The circuit breaker shall be in compliance with the relevant SANS code.

35.5 Measurement and Payment

- a) The unit of measurement shall be the number of moulded case circuit breakers supplied and installed.

36. Reparation of insulation on low voltage busbar

36.1 Procedure Number RP36

36.2 Scope

This procedure covers the insulation of an exposed section of low voltage busbar conductor.

36.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

36.4 Task Description

- a) The contractors shall insulate the complete section of exposed busbar using the same procedure for the reparation of transformer bushing insulation (Procedure RP24).

36.5 Measurement and Payment

- a) The unit of measurement shall be a lump sum.

37. Reparations and LV cable replacements at a miniature substation

37.1 Procedure Number RP37

37.2 Scope

This procedure covers the reparation of a cable trench at a miniature substation, and the replacement of sections of exposed low voltage power cables that were damaged by a veld fire.

37.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

37.4 Task Description

The miniature substation to which this procedure applies is installed on ground level in an outdoor fenced off area. Four low voltage power cables are connected to the miniature substation and are installed in a

cable trench in the close proximity to the miniature substation. The cable trench section closest the miniature substation is not backfilled and the cables are therefore exposed. These cables have been exposed to a veld fire and this has resulted in damage to the outer sleeves and possibly to the internal insulation as well. The length of the exposed section of cable trench is approximately 2.5m.

- a) The contractor shall expose the damaged parts of the cables by removing backfilling material from the cable trench up to the full length required therefore.
- b) The contractor shall disconnect the four low voltage cables from the miniature substation and cut the exposed and damaged ends so that the damaged sections are completely removed.
- c) The contractor shall supply and install four sections of replacement cable, four cable joints and four cable terminations for the jointing and reconnection of the four cable sections. The replacement cable sections shall be PVC insulated, PVC sleeved, steel wire armoured copper conductor cables with four cores and a cross sectional area equal to that of the existing cable sections.
- d) The contractor shall backfill the cable trench with fine-grained sand in such a way that the cables are not damaged. The cables shall be completely covered by the backfilling material in order to prevent exposure to the atmosphere. The cables shall be installed at a minimum depth of 0.5m. The contractor shall excavate the cable trench if necessary to obtain this minimum cable depth.
- e) The cable joints and cable terminations shall comply with the following specifications:
 - i) The cable joints shall be of the epoxy-resin type.
 - ii) The cable glands shall be of the adjustable type, equal or similar to the Pratley gland and shall be suitable for use with PVC PVC SWA PVC cables complying with the latest edition of SANS 1507. All glands shall be installed with non-deteriorating neoprene shrouds. The cable glands shall be fitted with a nipple gasket and inner seal kit, rendering the gland suitable for type "e" equipment (increased safety equipment).
 - iii) For all gland installations on armoured cable, the outer sheath of the cable shall be cut back in accordance with the gland manufacturers' recommendations, so that a minimum of armouring is exposed between the gland and the outer sheath after gland installation. The shroud shall seal on the outer sheath of the cable.
 - iv) Bi-metallic aluminium-copper lugs, equal or similar to SIMEL type ACX, shall be used according to the manufacturer's specifications, where solid aluminium conductors are terminated onto copper busbars.

37.5 Measurement and Payment

- a) The unit of measurement shall be a lump sum.

38. Replacement and or Reparation of MV Cable Terminations

38.1 Procedure Number RP38

38.2 Scope

This procedure covers the replacement and or reparation of medium voltage cable terminations at both oil filled and tar/bitumen filled cable termination boxes of indoor switchgear equipment.

38.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

38.4 Task Description

This procedure applies to the cable terminations of indoor switchgear units (T3's and ring-main units). These units are either oil filled or tar/bitumen filled. Different procedures apply to the two cases, and these differences are specified in this procedure.

- a) The following procedure applies to oil immersed cable terminations:
 - i) The contractor shall drain the insulation oil from the oil chamber and shall remove the oil from site.
 - ii) The contractor shall remove the cable from the cable termination box and shall clean the cable section in preparation for the reinstallation of the lead cable seal.
 - iii) The contractor shall reposition the cable and shall reinstall the lead cable seal in accordance with generally accepted lead cable sealing practices. The seal shall be tested to ensure that it forms a tight oil seal between the cable and the cable termination panel.
 - iv) The contractor shall reassemble the cable termination box and shall refill the oil chamber with new insulation oil. The insulation oil shall be in accordance with the insulation oil specifications as set out elsewhere in this document.

- b) The following procedure applies to tar/bitumen immersed cable terminations:
- i) The contractor shall remove the cable termination cover panel and shall remove the cable termination from the cable termination box.
 - ii) The contractor shall disassemble and remove the complete cable termination box.
 - iii) The contractor shall manufacture and supply a new cable termination box. The new cable termination box shall be manufactured to fit in the place of the removed cable termination box and shall be made of the same steel and painted with the same or higher quality anti-corrosive paint as that of the rest of the switchgear metal work. The new cable termination box shall be manufactured to contain a Raychem/Systol heat shrink type cable termination. The cable termination box shall be equipped with a cover panel that can be removed by removing four fastening bolts, thereby offering access to the cable terminations without removing the complete cable termination box.
 - iv) The contractor shall cut off and remove a length of approximately 5m from the cable termination end of the cable.
 - v) The contractor shall supply and install a new section of cable of the same type and size as the original cable. The contractor shall also supply and install a cable joint and cable termination to join the new cable section to the old cable and to terminate the cable section onto the switchgear bushings in the newly installed cable termination box.
 - vi) The contractor shall supply and install a wooden clamp onto the cable at the bottom of the cable termination box to carry the weight of the cable, thereby preventing this weight from being carried by the switchgear bushings.
 - vii) The contractor shall reinstall the cover plate of the new cable termination box.
 - viii) The cable joints and cable terminations shall be of Raychem/Systol or equal and approved type. The size of the cable joints and terminations shall be selected to suit the cable size.
 - ix) The manufacturer's installation procedures and instructions shall be strictly adhered to.
 - ix) In cases where earth continuity conductors are installed on existing cable sections, and where these sections are replaced in terms of this procedure, the Contractor shall supply and install a new earth continuity conductor of equal or larger cross-sectional area. The earth continuity conductor installed shall comprise stranded copper conductors.
 - x) The Contractor shall conduct all the tests as specified in subclause HA 04.3 of this specification on completion of the cable termination installation.
 - xi) Upon request all jointers shall produce proof of training in the performing of cable joints.

38.5 Measurement and Payment

- a) The unit of measurement shall be the number of cable terminations replaced and or repaired. The schedule of quantities shall specify the type of task to be performed. The two types of tasks are the following:
 - i) Reparation of oil immersed cable termination
 - ii) Replacement of tar/bitumen immersed cable termination
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the following:
 - i) The supply of the lead and lead sealing equipment (in the case of oil immersed cable terminations only).
 - ii) The supply and installation of a cable joint and cable termination (in the case of tar/bitumen immersed cable terminations only).
 - iii) The supply and installation of five-meter section of medium voltage cable (in the case of tar/bitumen immersed cable terminations only).
 - iv) The design, manufacture, supply and installation of a complete new cable termination box (in the case of tar/bitumen immersed cable terminations only).

39. Replacement of a MV cable sections and the terminating of the cable

39.1 Procedure Number RP39

39.2 Scope

This procedure describes the replacement of a cable section between the transformer and switchgear unit of a substation building. The cable shall be terminated and reconnected onto the equipment at both cable ends.

39.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes :

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) SANS 97: Electric cables - impregnated-paper-insulated metal-sheathed cables for rated voltages from 3,3/3,3 kV up to 19/33 kV (excluding pressure assisted cables)
- c) SANS 1339: Electric cables: Cross-linked polyethylene (XLPE) – insulated cables for voltages from 3,8/6,6 kV to 19/33 kV

39.4 Task Description

- a) The contractor shall disconnect and remove the existing medium voltage cable from between the transformer and the switchgear unit. The contractor shall remove and dismantle the existing cable termination box of the tar/bitumen immersed cable termination switchgear unit. (This work shall be done in the manner specified as part of procedure RP38).
- b) The contractor shall design, manufacture, supply and install a new cable termination box for the switchgear unit. (This work shall be done in the manner specified as part of procedure RP38).

- c) The contractor shall supply and install a new section of medium voltage copper conductor XLPE cable of the same cross-sectional area as that of the existing cable. The contractor shall install two new and unused cable terminations on the two ends of this cable for connection onto the existing equipment.
- d) The contractor shall reconnect to the two cable terminations onto the transformer and switchgear unit respectively. The contractor shall supply and install two wooden cable clamps to carry the weight of the two respective cable ends.
- e) The cable terminations shall be of Raychem/Systol or equal and approved type. The size of the cable terminations shall be selected to suit the cable size.
- f) The contractor shall conduct all the tests as specified in subclause HA 04.3 of this specification on completion of the cable termination installation.
- g) Upon request the contractor shall produce proof of training in the performing of cable terminations.
- h) The medium voltage cable shall be a three core, copper conductor, XLPE insulated individually copper tape screened, galvanised steel armoured, PVC served medium voltage cable.

39.5 Measurement and Payment

- a) The unit of measurement shall be a lump sum.
- b) The lump sum shall include full compensation for all aspects specified in clause HA 08. In addition to this, the lump sum shall also include full compensation for the following :
 - i) The supply and installation of a 20m length of XLPE medium voltage cable.
 - ii) The supply and installation of two cable joints.
 - iii) The design, manufacture, supply and installation of a complete new cable termination box.

40. Reinstallation of a LV cable in a distribution kiosk

40.1 Procedure Number RP40

40.2 Scope

This procedure covers the removal of an externally installed loose low voltage cable, and the replacement thereof with a new low voltage copper conductor.

40.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

40.4 Task Description

- a) The contractor shall disconnect and remove the externally routed low voltage conductor.
- b) The contractor shall supply and install a new conductor in the place of the existing conductor. The conductor shall be installed, routed and secured inside the distribution panel. The conductor shall be a four-core PVC insulated, PVC sleeved, copper conductor with a cross-sectional area of at least 50mm².
- c) The conductor shall be terminated on both ends with appropriately sized cable glands and terminating lugs.

- d) The cable glands shall be of the adjustable type, equal or similar to the Pratley gland and shall be suitable for use with PVC SWA PVC cables complying with the latest edition of SANS 1507. All glands shall be installed with non-deteriorating neoprene shrouds. For all gland installations on armoured cable, the outer sheath of the cable shall be cut back in accordance with the gland manufacturers' recommendations, so that a minimum of armouring is exposed between the gland and the outer sheath after gland installation. The shroud shall seal on the outer sheath of the cable.
- e) All cable termination lugs shall be bi-metallic aluminium-copper lugs, equal to or similar to SIMEL type ACX.

40.5 Measurement and Payment

- a) The unit of measurement and payment shall be a lump sum.
- b) The lump sum shall include full compensation for all aspects specified in clause HA 08. In addition to this, the lump sum shall also include full compensation for the following :
 - i) The supply and installation of a 5m length of copper conductor as specified in this procedure.
 - iii) The supply and installation of cable glands and cable terminating lugs.

HA 13 TECHNICAL DETAILS : SCHEDULED MAINTENANCE WORK

HA 13.01 This section contains the specifications for the scheduled maintenance procedures that are to be carried out during the three year contract period. The scheduled maintenance tasks shall commence at the specified frequency once the initial repair work has been completed. The contractor should note that the tendered rate for each procedure shall include both the supply, delivery, installation, testing and commissioning of equipment and material, and the labour and other costs associated with the completion of the procedure.

HA 13.02 Scope of scheduled maintenance work.

HA 13.02.01 Monthly Maintenance Tasks

The following maintenance tasks shall be performed on a monthly basis :

- SM01 Standalone Power Transformer Service
- SM02 Miniature Substation Service
- SM03 Pole-mounted Transformer Service
- SM04 Distribution Substation Service

HA 13.03 All the scheduled maintenance work is specified in the following procedures :

- 1. Standalone Power Transformer Service
 - 1.1 Procedure Number : SM01
 - 1.2 Scope

This procedure describes the periodical service of standalone power transformers of ratings up to 200kVA. This procedure does not include the servicing of miniature substation transformers. The service includes the servicing of the dehydrating breathers (including the oil seal or bath).

1.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the following standard specifications, regulations and codes :

- a) The original equipment manufacturer's specifications, and operation and maintenance instructions.
- b) SANS 555 : Standard Specification for Unused and reclaimed mineral insulating oil for transformers and switchgear (uninhibited)
- c) BS 3523 : Specification for granular desiccant silica gel impregnated with cobalt chloride.

1.4 Task Description

a) General Service

The contractor shall complete the following actions :

- i) The transformer shall be checked for visible defects, and any such defects shall be reported in documented format to the Engineer.
- ii) The contractor shall maintain the transformer in a clean and dust-free condition using safe methods of cleaning and dusting.
- iii) The contractor shall check for and record any indication of oil leaks.
- iv) The contractor shall check for and record any indication of cracked bushings.
- v) The contractor shall maintain all cable terminations (MV and LV) in a good condition. All defects and deteriorated cable terminations shall be corrected and or replaced where necessary. Cable terminations shall be done in accordance with procedure RP13.

b) Dehydrating Breather Service

- i) The contractor shall check the quantity and colour of the dehydrating agent (typically silica gel) and reactivate or replace it where necessary.
- ii) The silica gel shall be considered to require replacement if its colour is pink or if the breather is not filled to the required level, and it shall be considered not to need replacement if its colour is deep blue and the breather is filled to the required level.
- iii) Silica gel used for replacement shall be new silica gel and shall comply with BS 3523.
- iv) The oil seal or bath at the base of the dehydrating breather shall be removed, cleaned out, and refilled with new insulation oil. The insulation oil used for this purpose shall be new insulation oil in compliance with SANS 555. The dehydrating breather shall be refilled with insulating oil to the level as prescribed in the manufacturer's maintenance instructions.

1.5 Measurement and Payment

- a) The unit of measurement shall be the number of time a standalone power transformer is serviced. A single rate shall

apply to all sizes of transformers, and the tendered rates shall be based on a transformer size of 200kVA. The unit rates shall be compiled and submitted in the point system format as specified elsewhere in the document.

- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for the following :
 - i) All work associated with the service of standalone power transformers, excluding the replacement of cable terminations, which shall be considered a separate payment item
 - ii) The supply of dehydrating breather and breather top up insulation oil as is required for the service of the dehydrating breather.

2. Miniature Substation Service

2.1 Procedure Number : SM02

2.2 Scope

This procedure describes the periodical service of miniature substations of ratings up to 630kVA.

2.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with original equipment manufacturer's specifications, and operation and maintenance instructions.

2.4 Task Description

- a) Metal Enclosure and Plinth
 - i) The contractor shall check the enclosure and plinth for visible defects. All defects shall be recorded in documented format.
 - ii) The contractor shall maintain all parts of the miniature substation in a clean and dust free condition.
 - iii) The contractor shall check that the miniature substation is properly installed on its plinth and that it does not lean over in any direction.
 - iv) The contractor shall check the condition of door hinges and that panel doors open and close correctly.
 - v) The contractor shall ensure that padlocks are installed on all lockable panel doors.
- b) Medium Voltage Compartment
 - i) The contractor shall check the MV compartment for visible defects. All defects shall be recorded in documented format.
 - ii) The contractor shall check all equipment components for looseness and bent or damaged brackets. All such defects shall be corrected.
 - iii) The contractor shall maintain all MV cable terminations in a good condition. All defects and deteriorated cable terminations shall be corrected and or replaced where necessary. Cable terminations shall be done in accordance with procedure RP13.

- iv) All miniature substation fuses shall be checked for condition and to ensure that they are correctly rated. Should any fuse be blown and or be incorrectly rated, it shall be replaced with the correct fuse. All fuse replacements shall be recorded, and used fuses that are not blown shall be handed over to the Engineer.
- c) Transformer Compartment
 - i) The transformer shall be checked for visible defects, and any such defects shall be reported in documented format to the Engineer.
 - ii) The contractor shall maintain the transformer in a clean and dust-free condition using safe methods of cleaning and dusting.
 - iii) The contractor shall check for and record any indication of oil leaks.
 - iv) The contractor shall check for and record any indication of cracked bushings.
 - v) The contractor shall maintain all cable terminations (MV and LV) in a good condition. All defects and deteriorated cable terminations shall be corrected and or replaced where necessary. Cable terminations shall be done in accordance with procedure RP13.
- d) Low Voltage Compartment
 - i) The transformer shall be checked for visible defects, and any such defects shall be reported in documented format to the Engineer.
 - ii) The contractor shall check all equipment components for looseness and bent or damaged brackets. All such defects shall be corrected.
 - iii) The contractor shall check all circuit breakers, isolators, fuse links and instrumentation for correct operation, and record and report all defects.

2.5 Measurement and Payment

- a) The unit of measurement shall be the number of times a miniature substation is serviced. A single rate shall apply to all sizes of miniature substation, and the tendered rates shall be based on a size of 630kVA. The unit rates shall be compiled and submitted in the point system format as specified elsewhere in the document.
- b) The tendered rate shall include full compensation for all aspects specified in clause HA 08. In addition to this, the tendered rate shall also include full compensation for all work associated with the service of miniature substations, excluding the replacement of cable terminations, which shall be considered a separate payment item.

3. Pole-mounted Transformer Service

3.1 Procedure Number : SM03

3.2 Scope

This procedure covers the service of pole-mounted transformers and the associated low voltage distribution kiosks.

3.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

3.4 Task Description

- a) The pole-mounted transformer installation shall be inspected for visible defects, and any such defects shall be reported in documented format to the Engineer.
- b) The contractor shall maintain the low voltage distribution kiosk in a clean, vermin and dust-free condition using safe methods of cleaning and dusting.
- c) The contractor shall check the transformer for and record any indication of oil leaks.
- d) The contractor shall check for and record any indication of cracked bushings.
- e) The contractor shall check the continuity of the low and medium voltage earth installations.

3.5 Measurement and Payment

- a) The unit of measurement shall be the number of times a transformer installation is serviced. The unit rates shall be compiled and submitted in the point system format as specified elsewhere in the document.

4. MV/LV Distribution Substation Maintenance Inspection

4.1 Procedure Number : SM04

4.2 Scope

The procedure comprises of a general inspection of the various MV/LV distribution substations. These substations are all brick buildings comprising of three sections : a MV section, a transformer section, and a LV section. The purpose of this procedure is to perform a routine inspection of the complete substation to determine the condition and status of equipment, and at the same time performing minor routine maintenance tasks.

4.3 Standard Specifications, Regulations and Codes

All work carried out and all equipment and material supplied in terms of this procedure shall comply with the original equipment manufacturer's specifications, and operation and maintenance instructions.

4.4 Task Description

The following items shall be inspected and serviced:

- a) General defects inspection.
- b) All rooms of the substation building shall be thoroughly cleaned using a broom to sweep the floor and other equipment to dust and clean equipment.
- c) All luminaires and lamps and their fittings shall be maintained in a good working order. The contractor shall supply and install luminaires, lamps and their fittings as is required to have all this equipment operational at all times.
- d) Low Voltage Distribution Board

The Low Voltage distribution board shall be kept in a clean and neat condition. The contractors shall inspect the low voltage distribution equipment and record all defects.

4.5 Measurement and Payment

- a) The unit of measurement shall be the number of times a substation installation is serviced. The unit rates shall be compiled and submitted in the point system format as specified elsewhere in the document.

TECHNICAL SPECIFICATION

HB STANDBY POWER SYSTEMS

CONTENTS

HB 01	SCOPE
HB 02	STANDARD SPECIFICATIONS, REGULATIONS, CODES AND ADDITIONAL SPECIFICATIONS
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HB 07	REPAIR WORK TO INSTALLATIONS
HB 08	DIESEL GENERATORS: TECHNICAL DETAILS

HB 01 SCOPE

HB 01.01 This specification comprises all aspects regarding the repair and maintenance of standby power systems. The new standby power sources consist of:

- i) One 200 kVA diesel generator

The Ports of Entry comprise of various Standby Power Systems, as listed in additional specification **SS: Site Specific Inventory**, which forms part of the maintenance and servicing contract for standby power systems.

HB 02 STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

HB 02.01 SANS Specifications

SANS 10400 : THE APPLICATION OF THE NATIONAL BUILDING REGULATIONS
SANS 10142-1: THE WIRING OF PREMISES PART 1: LOW-VOLTAGE
INSTALLATIONS

HB 03 TEST AND INSPECTIONS PRIOR TO COMPLETION OF REPAIR WORK

HB 03.01 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:

- output phase voltages
- output current per phase
- insulation testing at 500V
- system earthing resistance testing by means of Wheatstone bridge instrument
- load testing, utilising dummy loads

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

HB 04 LOGGING AND RECORDING PROCEDURES

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.

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:

Monthly inspection and maintenance actions.
 Scheduled services.
 Breakdown / call out reports.
 Major overhaul or battery replacements.

HB 05 MAINTENANCE TOOLS AND SPARES

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.

The Tools and Spares shall be kept safe in a lockable store room on site. The Contractor shall provide his own lock for the designated store room. The inventory of the Tools and Spares shall be verified on a monthly basis. Any short fall shall be replaced by the Contractor as part of his responsibility under this contract.

The Tools and Spares shall at least include the following:

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 20mm Ø diesel hose
 10mm² battery jumper cables : 1 pair
 First Aid Kit
 Industrial type wall mounted (aluminium) paper towel dispenser with paper cartridge per generator room similar or equal to "Kimberley Clark MP Wall Stand"

HB 06 RE-COMMISSIONING OF INSTALLATION

On practical completion of the repair work, battery replacement and services, the installations shall be put into operation.

HB 07 REPAIR WORK TO STANDBY POWER INSTALLATIONS

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

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

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

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

New equipment and material (e.g. batteries, fuel pumps, starter motor, etc shall be supplied with a written guarantee confirming a defects liability period of 12 months from date of practical completion. These guarantees shall be furnished in favour of the Department of Public Works

HB 08 STANDBY GENERATORS: TECHNICAL DETAILS

HB 08.01 Installation description

Refer to the specification SS:

HB 08.02 Scope of repair work: Generators

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 slip rings and inspect brush gear. Open alternator terminal box, clean and tighten terminations. Check and record earthing value as measured with resistance measuring instrument.

Service alarm and control panel and clean internally and externally. Simulate and verify all alarm and shut down conditions. Replace all inoperative lamps, sirens and meters. Check and complete all labelling and notices.

Repair lagging on exhaust system 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.

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.

Do witnessed dummy load test.

Service change-over switchgear. Disassemble contactors and clean. Test operation following service.

Add an 12/24 V DC fluorescent emergency light, with switch above the 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 08.03 Generator repair work : measurement and payment

HB 08.03.01 Repair plant room

The unit of measurement shall be a lump sum.

The tendered rate shall include full compensation for the repair and upgrade of the plant room. This includes repair work on luminaires, doors, locks including the fitting of new padlocks.

Walls and ceilings shall be washed with sugar soap. Floors shall be washed (Steam cleaned) and painted with grey 2-part industrial epoxy paint.

Cable trenches shall be cleaned and finally vacuumed. All cable sleeves shall be sealed with builders foam and chicken wire.

HB 08.03.02 Service genset

The unit of measurement shall be a lump sum.

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 and hoses as needed, 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 08.03.03 Diesel engine service

The unit of measurement shall be the number of mechanical services performed on diesel engines in the 50kW to 200kW 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.

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 08.03.04 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 08.03.05 Dummy load test

The unit of measurement shall be the number of on-site dummy load tests performed.

The tendered rate shall include full compensation for the opening of the alternator terminal box, connection of dummy load, 30-minute full load test, recording of test results and disconnection of load and reconnection of site load.

HB 08.03.06 Change-over switchgear service

The unit of measurement shall be the number of assemblies serviced.

The tendered rate shall include full compensation for the disassembly of the change-over contractor pair, cleaning and reinstallation as well as the testing following completion of the test.

Service alarm and control panel and clean internally and externally. Simulate and verify all alarm and shut down conditions. Replace all inoperative lamps, sirens and meters. Check and complete all labelling and notices.

HB 08.03.07 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 08.03.08 Supply of diesel fuel.

The unit of measurement shall be the quantity of diesel fuel supplied and transferred into day tanks upon instruction from the Engineer.

The tendered rate shall include full compensation for the supply, transport and transfer of diesel fuel.

HB 08.03.09 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 08.03.10 Repair alarm sounder

The unit of measurement shall be the number of alarm / flasher units installed. The tender rate shall include full compensation for the repair of the panel mounted alarm and circuit and the supply and installation of the specified external alarm/flasher unit, in full working order including all cabling to and from the Control panel.

HB 08.03.11 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 08.03.12 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.

HB 08.03.13 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 10.02

HB 08.03.14 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 08.03.15 Repair Exhaust

The unit of measurement shall be a sum for the removal of the existing exhaust and the supply and installation of the new exhaust similar to the existing.

The tendered rate shall include full compensation for the supply and installation of the new exhaust including, lagging, flexible connections and sealing of the room exit port.

HB 08.03.16 Replace existing control panel.

The unit of measurement shall be a lump sum for the replacement of the existing control panel of a Standby Generator.

The tendered rate shall include full compensation for the removal of the existing control panel, manufacturing of the new control panel, installation, testing and commissioning as specified below.

1. CONTROL PANEL

1.1 General

A switchboard must be supplied and installed to incorporate the equipment for the control and protection of the generating set and battery charging.

The switchboard must conform the specification as set out in the following paragraphs.

1.2 Construction

The switchboard shall be a totally enclosed, floor mounted unit, fabricated from steel panels, carried on and-substantial angle iron framework.

The board shall be flush fronted and all equipment to be mounted behind the front plate, on suitable supports.

All equipment, connections and terminals shall be easily accessible from the front. The front panels may be either hinged or removable and fixed with studs and chromium-plated cap nuts. Self-tapping screws shall be used in the construction of the board.

All pushbuttons, pilot lights, control switches, instrument and control fuses, shall be mounted on hinged panels with the control wires in flexible looms.

The steelwork of the boards must be thoroughly de-rusted, primed with zinc chromate and finished with two coats of signal red quality enamel, or a baked powder epoxy coating.

Suitably rated terminals must be provided for all main circuits and the control and protection circuits. Where cable lugs are used, these shall be crimped onto the cable strands. Screw terminals shall be of the type to prevent spreading of cable strands. All terminals shall be clearly marked.

For the control wiring, each wire shall be fitted with a cable or wire marker of approved type, and numbering of these markers must be shown on the wiring diagram on the switchboard. Control wiring shall be run in PVC trunking. The trunking shall be properly fixed to the switchboard steelwork. Adhesives shall not be acceptable for the fixing of trunking or looms.

The automatic control and protection equipment shall be mounted on a separate easily replaceable small panel with printed circuits. The equipment shall mainly be the "solid state" type. After mounting the equipment on the panel, the rear of this panel shall be sealed with epoxy-resin. However, other proven control systems may also be considered, but must be described in detail.

All equipment on the switchboard, such as contactors, isolators, busbars, etc., shall have ample current carrying capacity to handle at least 110% of the alternator full load current.

1.3 Protection and Alarm Devices

All switchboards shall be equipped with protection and alarm devices as described below.

A circuit breaker and an adjustable current limiting protection relay must be installed for protection of the alternator. The protection relay shall be of the type with inverse time characteristics. The relay shall cause contactor to isolate the alternator and stop the engine.

Protection must be provided for overload, high engine temperature, low lubricating oil pressure, over speed, start-failure, low water level.

Individual relays with reset pushed are required, to give a visible signal and stop the engine when any of the protective devices operate. In the case of manual operation of standby sets, it shall not be possible to restart the engine.

The indicators and re-set pushes must be marked clearly.

“OVERLOAD”
 “TEMPERATURE HIGH”
 “OIL PRESSURE LOW”
 “OVER-SPEED”
 “START FAILURE”
 “LOW WATER LEVEL”

In addition two relays with reset pushes must be fitted giving an audible and visible signal when :

- (a) The fuel level in the service tank is low. The reset push of this relay must be marked “FUEL LOW”

In addition, a low-low level sensor must be provided. At this level the engine must stop to prevent air entering the fuel system.

- (b) The battery charger failed. The reset push of this relay must be marked “CHARGER FAIL”

This is also applicable to the engine driven generator/alternator.

All relays must operate an alarm hooter. A pushbutton must be installed in the hooter circuit to stop the audible signal, but the fault indicating light on the control panel must remain lit until the fault has been rectified.

An on/off switch is not acceptable. After the hooter has been stopped, it must be re-set automatically, ready for a further alarm.

The hooter must be of the continuous duty and low consumption type. Both hooter and protection circuits must operate from the battery.

Potential free contacts from the alarm relay must be brought down to terminals for remote indication of alarm conditions.

A test pushbutton must be provided to test all indicators lamps.

1.4 Manual Starting

Each switchboard shall be equipped with two pushbuttons marked “START” and “STOP” for manual starting and stopping of the set.

1.5 Battery Starting Equipment

Each switchboard shall be equipped with battery charging equipment.

The charger shall operate automatically in accordance with the state of the battery and shall generally consist of an air-cooled transformer, a full wave solid state rectifier, and the necessary automatic control equipment of the constant voltage system.

The charger must be fed from the mains. An engine driven alternator must also be provided for charging the battery while the set is operational. Failure of this alternator must also activate the battery charger failure circuit.

1.6 Switchboard Instruments

Each generating set shall have a switchboard equipped as follows:

- (a) One flush square dial voltmeter, reading the alternator voltage, scaled as follows:

- (i) 0-300V for single phase generators.
 - (ii) 0-500V for three phase generators. In this case a six position and off selector switch must be installed for reading all phase and phase to neutral voltages.
- (b) A flush square dial combination maximum demand and instantaneous ampere meter for each phase, with resettable pointer suitably scaled 20% higher than the alternator rating. A red arc stripe above scale markings from 0-20A and a red radial line through the scale at full-load current, shall be provided. These instruments shall be supplied complete with the necessary current transformer.
 - (c) One flush square dial vibrating type frequency meter, indicating the alternator frequency.
 - (d) A six-digit running hour meter with digital counter, reading the number of hours the plant has been operating. The smallest figure on this meter must read $\frac{1}{10}$ hour.
 - (e) Fuses or m.c.b.'s for the potential voltage circuits of the meters.
 - (f) One flush square dial ampere meter suitably scaled for the battery charging current.
 - (g) One flush square dial voltmeter with a spring-loaded pushbutton or switch for the battery voltage.

1.7 Marking

All labels, markings or instructions on the switchgear shall be in both official languages.

1.8 Earthing

An earth bar must be fitted in the switchboard, to which all non-current carrying metal parts shall be bonded.

The neutral point of the alternator must be solidly connected this bar by means of a removable link labelled "EARTH". Suitable terminals must be provided on the earth bar for connection of up to three earth conductors, which will be supplied and installed by others.

1.9 Operation Selector Switch

A four-position selector switch must be provided on the switchboard marked "AUTO", "MANUAL", "TEST" and "OFF" - "AUTO",

With the selector on "AUTO", the set shall automatically start and stop, according to the mains supply being available or not.

With the selector on "TEST", it shall only be possible to start and stop the set with the pushbuttons, but the running set shall not be switched to the load.

With the selector on "MANUAL", the set must take the load when started with the pushbutton, but it must not be possible to switch the set on to the mains, or the mains onto the running set.

With the selector on "OFF", the set shall be completely disconnected from the automatic controls, for cleaning and maintenance of the engine.

1.10 Automatic Change-over System

A fully automatic change-over system must be provided to isolate the mains supply and connect the standby set to the outgoing feeder in case of a mains failure and reverse this procedure on return of the mains.

1.11 By-pass Switch and Main Isolator

The switchboard shall be equipped with an on-load isolator to isolate the mains and a manually operated on-load by-pass switch, which shall either connect the incoming mains to the automatic control gear or directly to the outgoing feeder. In the latter position the automatic control gear, including the main contractors, shall be isolated for maintenance purposes. It shall not be possible to start the engine except with the selector switch in the "TEST" position.

It is required that this by-pass switch and mains isolator be mounted away from the automatic control gear, in a separate compartment either on the side or in the lower portion of the switchboard cubicle, and that the switches operated from the front of the compartment.

1.12 Start Delay

Starting shall be automatic in event of a mains failure. A 0-15 second adjustable start delay timer shall be provided to prevent start-up on power trips or very short interruptions.

1.13 Stop Delay

A stop delay with timer is required for the set, to keep the set on load for an adjustable period of one to sixty seconds after the return of the mains supply, before changing back to the supply. An additional timer shall keep the set running for a further adjustable cooling period of 5 to 10 minutes at no-load before stopping.

2. INSTALLATION

Except for the supply of the incoming mains cable and outgoing feeder cables, the tenderer must include for the complete installation and wiring of the plant ready for operation, including the connection of the incoming cable and outgoing feeder cables.

The connecting of the cable and control cabling to the generator and the control terminals in the LV board remains the responsibility of the tenderer.

3. CONTROL FACILITIES

- 3.1 Two key operated switches, labelled as follows, shall be fitted on the generator control panel, located at the generator:

(a) <i>GEN AUTO START</i>	This switch shall have 2 positions. In the <i>Auto Start</i> position, the changeover sequence shall operate automatically as described. In the <i>Gen. Locked Out</i> position, the changeover sequence shall not be initiated if mains fail situation occurs. Remote alarm indication (on the control panel) is required if the switch is in the latter position.
(b) <i>SIMULATE MAINS FAIL</i>	This switch shall have 2 positions. In the <i>Simulate</i> position, a main failure shall be simulated. In the <i>Normal</i> position, the system is set to the normal auto standby mode.
(c) <i>MANUAL START & STOP</i>	

Auxiliary supplies for the changeover control circuiting must be supplied from the 24 V generator batteries.

- 3.2 A system schematic diagram (A2 size), indicating the phase failure sensing circuit and the generator change over and control circuit, shall be prepared and mounted on the main switch room wall behind 4 mm clear Perspex.

3.3 Statutory warning notices shall be installed inside the plant room and on the entrance doors.

3.4 The following pilot lights, with a lamp test facility, shall be provided on the generator control panel:

- Load on normal supply : Green
- Load on emergency supply : Blue
- Mains failure : Amber
- Engine run down cycle : Blue
- Genset in standby mode : Green
- Water jacket heater failure : Amber
- Low fuel level : Amber
- Engine start failure : Red
- Auto-start disabled : Red
- High engine temperature : Red
- Battery charger failure : Red
- Engine overspeed : Amber
- Engine underspeed : Amber
- Overvoltage : Amber
- Undervoltage : Amber

3.5 Critical alarms will shut the engine down. The critical (red) and non-critical (amber) alarms shall be wired in series. These two circuits shall each energise a relay in the normal mode. A 40 W 24 V siren and 24 V xenon strobe shall be mounted above the doors outside the plant room. These shall be activated in case of an alarm condition (critical and non-critical). Each of these relays shall be employed to provide the "generator critical" and "generator fault" alarms on the remote alarm panel.

3.6 Provision will be made to connect an alarm annunciator panel to voltage free contacts for each of the above alarms.

3.7 All timer relays shall be labelled according to their function, for ease of maintenance and future modifications, e.g.

- "Engine run down : Timer T7"; or
- "Mains return delay : Timer T5".

3.8 All sensors and timers shall be of the Rhomberg Slimline plug-in type, control relays shall be Omron.

HB 08.03.16 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 day tank 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 $\varnothing$ 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 mm² 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.

PARTICULAR SPECIFICATION

PHB SUPPLY DELIVERY AND INSTALLATION OF AN EMERGENCY GENERATOR SET

SECTION 1 – GENERAL

1. INTENT OF DOCUMENT

The specification is intended to cover the complete installation of the generator plant and associated electrical work. The minimum equipment requirements are outlined, but do not cover all the details of design and construction. Such details are recognised as being the exclusive responsibility of the contractor.

In all cases where a device or part of the equipment is referred to in the singular, it is intended that such reference shall apply to as many devices as are required to complete the installation.

2. STANDARDS AND CODES

All work and equipment shall be in accordance with the requirements of BS5514 and shall comply with the Occupational Health and Safety Act, No 85 of 1993 and current regulations of all other codes applicable to this work.

3. REGULATIONS

The installation shall be erected and tested in accordance with the following Acts and regulations:

- a) The latest issue of SANS 10142-1: "Code of Practice for the Wiring of Premises".
- b) The Occupational Health and Safety Act, 1993 (Act 85 of 1993) as amended.
- c) The Fire Brigade services Act 1993 Act 99 of 1987 as amended.
- d) Department of Public Works : Standard Specification for Standby Generators.

CONSTRUCTION WORKS SPECIFICATION

PORTION A

PROJECT SPECIFIC ELECTRICAL SPECIFICATIONS

PS 1 SCOPE OF WORKS

This specification covers the contract engineering, manufacture, supply, delivery, installation, wiring, commissioning, testing and handing over in complete working order for immediate use. A guarantee for twelve (12) months will be applicable on all equipment and workmanship from commissioning for the following:

- The installation of a new standby generator:

- 200kVA Generator
- Excavations and the installation of LV cables.
- All other associated work.
- All equipment must be for weather conditions at the site specified.
- Maintenance of the 200kVA generator will be performed for the remainder of the 36-month contract after installation and commissioning

PS 2 **STANDBY GENERATORS AND CONTROL PANELS**

2.1 **GENERAL**

This Specification covers the supply, delivery, factory testing and complete installation and re-testing on site and handover in full working order of the equipment and all associated equipment.

Full particulars, performance curves and illustrations of the equipment offered must be submitted with the tender. Contractors may quote for their standard equipment, complying as closely as possible with this Specification, but any deviations from the Specification must be fully detailed.

The questionnaire included in this document must be completed by bidders in all respects.

The Employer reserves the right not to bind itself to accept the lowest or any tender.

Each diesel alternator set called for in this Specification will be used as a Standby Unit for the continuity of electrical power supply to emergency services.

The following are a summary of the requirements and are additional to SABS standards:

Standby Capacity	: 200kVA
Generator Type Brushless	: Self excited, static regulated
IP rating	: Drip proof IP 22
Over speed capacity	: 50%

Voltage regulation	: ½% Steady state
	: 1% No Load to Full Load
Time	: Maximum time to “full on load” from time of mains failure: 15 Seconds (70% load) and 19 Seconds (Full load).
Frequency	: 50Hz
Voltage LV	: 400V, 3 Phase
Fuel tank	: Integrated fuel tank.
Additional equipment	: Heavy duty air cleaner : Air pre-cleaner : Battery chargers : Battery racks : Charging alternators : A single set of change-over contactors 1 x 350A N/O from standby generator 1 x 350A N/C from main supply.
Standby Panel	: Main feed to Standby Panel: 300A

2.2 REQUIREMENTS

The set shall be fully automatic, i.e. it shall start when any one phase of the main supply fails, and shall shut down when the normal supply is re-established. The set shall be capable of delivering the specified output continuously under the site conditions mentioned below, without overheating. The engine shall be capable of delivering an output of 100% of the specified output for 2 hours in any period of 3 hours consecutive running.

2.3 BASE REQUIREMENTS

The engine and alternator of the set shall be built together on a common Simplex type frame, which will have anti-vibration mountings/pads between the frame and concrete floor. The set shall be placed direct on a concrete floor.

2.4 OUTPUT AND VOLTAGE

Output voltage : 400/231V
Frequency : 50 Hz

2.5 DERATING

The engine must be de-rated for the site conditions as set out.

The de-rating of the engine for site conditions shall be strictly in accordance with B.S.S. 5514 of 1977 as amended to date. Any other methods of de-rating must have the approval of the Engineer and must be motivated in detail. Such de-rating must be guaranteed in writing and proved by the successful contractor at the site test.

2.6 DELIVERY & REMOVAL OF EQUIPMENT

Deliver to site and install.

2.7 ENGINE

The engine shall be a four stroke, full compression ignition, direct injection and of the readily available type industrial rated type diesel engine.

The standby generator will be manufactured with a **Volvo** or **Scania** engine.

The engine shall comply with the requirements laid down in B.S.S. 5514 and must be of the direct injection, compression ignition type, running at a speed not exceeding 1 500 rpm.

The engine shall be amply rated for the required electrical output of the set when running under the above-mentioned site conditions. The starting period for either manual or automatic switching-on until the taking over by the generating set, in one step, on a load equal to the specified site electrical output, shall not exceed 15 seconds.

2.8 RATING

The set shall be capable of delivering the specified output continuously under the site conditions, without overheating. The engine shall be capable of delivering an output of 110 % of the specified output for one hour in any period of 12 hours consecutive running in accordance with BS 5514.

2.9 DE-RATING

The engine must be de-rated for the site conditions as set out in the Technical Specification, Section 3 of this document.

The de-rating of the engine for site conditions shall be strictly in accordance with BS 5514 of 1977 as amended to date. Any other methods of de-rating must have the approval of the Engineer and SANBI and must be motivated in detail. Such de-rating must be guaranteed in writing and proved by the successful Tenderer at the site test.

2.10 STARTING AND STOPPING

The engine shall be easily started from cold, without the use of any special ignition devices, under summer as well as winter conditions, against full load.

Contractors must state what arrangements are provided to ensure easy starting in cold weather. Full details of this equipment must be submitted. In the case of water-cooled engines, any electric heaters shall be thermostatically controlled. The electrical circuit for such heaters shall be taken from the control panel and must be protected by a suitable circuit breaker.

An electric starter motor must be fitted to the engine.

Besides the automatic starting and stopping, provision must be made on the control board for manual starting and stopping of the set.

The automatic control shall make provision for three consecutive starting attempts. Thereafter the set must be switched off, and the start failure relay on the switchboard must give a visible and audible indication of the fault.

2.11 STARTER BATTERY

The set must be supplied with a fully charged "Lead Acid" type battery, complete with the necessary electrolyte. The battery must have sufficient capacity to provide the starting torque stipulated by the engine makers, and for at least six consecutive starting attempts.

The batteries will form an integral part of the generator or will be in separate panels that are of same external appearance as the main panel.

2.12 COOLING

The engine must be water-cooled type, a built-on heavy duty, tropical type pressurized radiator must be fitted.

All water-cooled engines shall be equipped with a centrifugal pump to circulate the water through the engine and radiators. The radiator and engine cooling system shall be filled with a rust inhibitor solution.

Protection must be provided against running at excessive temperatures. The operation of this protective device must give a visual and audible indication on the switchboard. All air ducts for the cooling of the engines are to be allowed for. An air duct shall be supplied from the radiator face to the air outlet louver.

Where louvers are to be fitted to accommodate the cooling system, such louvers shall be sized according to the requirements of the manufacturer of the Standby Alternator set.

Lubrication of the main bearing and other important moving parts shall be by forced feed system. An automatic low oil pressure cut-out must be fitted, operating the stop solenoid on the engine, and giving a visible and audible indication.

2.13 FUEL PUMP AND FUEL

Fuel injection equipment must be suitable for operation with the commercial brands of diesel fuel normally available locally.

2.14 FUEL TANK (200kVA GENERATOR)

A new lockable fuel tank should be provided. Also see details described under 2.1 above. Additional to the above the following will apply:

Should the fuel tank require a fuel cooler this must be fitted.

The lockable tank shall be fitted with a breather, a Rochester type fuel gauge, and a low-level alarm, giving an audible and visible signal on the switchboard and on the outside of the building via a siren and red rotating

signal light. A by-pass switch must be installed on the panel. A low level will be at 20% of the total fuel capacity.

An electric pump, fitted with a suitable length of oil-resistant hose, must be supplied, for filling the fuel tank from 200-liter drums placed at ground level or from a tanker at a distance of not less than 20m from the tank.

An electrical supply point must be installed at the electric pump of 16A and must consist of a watertight socket outlet unit. It will be supplied with a cable of 10mm² 2 Core Armoured dimensions. The supply point must be fed from the Standby Generator Panel via a 20A single phase Circuit Breaker.

2.15 GOVERNOR

The speed of the engine shall be controlled by an ELECTRONIC governor in accordance with Class A0 of BSS.5514.

When full load is suddenly switched off or on, the temporary speed variation shall not exceed 2%. The permanent speed variation shall not exceed +/- 0.8% of the nominal engine speed. External facilities must be provided on the engine to adjust the nominal speed setting.

2.16 FLYWHEEL

A suitable flywheel must be fitted, so that lights fed from the set will be free from any visible flicker.

The cyclic irregularity of the set must be within the limit laid down in B.S.S.5514 of 1958.

2.17 EXHAUST SYSTEM

SILENCERS

It is essential to keep the noise level as low as possible. An effective exhaust silencing system of the residential type is also to be provided, as specified in SABS 0103-1983, as amended.

The exhaust pipe shall be installed in such a way that the expelled exhaust fumes will not cause discomfort to the public. The exhaust pipe must be flexibly connected to the engine to take up vibrations transmitted from the engine, which may cause breakage.

Contractors shall quote for the supply & installation of silencers and baffles to ensure that the environment around the canopy is suitable for day-to-day work, without exceeding acceptable daily noise levels as applicable to a residential environment. The muffler and piping shall be manufactured from 3CR12

ATTENUATION

Sound attenuation must be provided to ensure that the maximum sound level generated by the unit when measured at a height of 1.2 meters at a distance of 7 meters in any direction from the outside of the unit must not exceed 80 dB when the plant is running at full load. All sound attenuation material must be of a non-flammable type.

2.18 ACCESSORIES

The engine must be supplied complete with all accessories, instruction manuals, spare parts lists, etc. A spare set of fuel filters is to be supplied with the necessary tools for removal and refitting.

2.19 SAFETY NOTICES

All safety notices as specified in the OHS Act must be fitted to the container and a suitable 9kg dry powder fire extinguisher must be provided adjacent to the generator.

A set of Laminated drawings of the switchboard/control panel must be affixed to the outside of the generator.

2.20 ALTERNATOR

The alternator shall be of the self-excited brushless type, with enclosed ventilated drip-proof housing, and must be capable of supplying the specified output continuously with a temperature rise not exceeding the limits laid down in **B.S.S. 2613 for rotor and starter windings with Class F or H insulation.**

Both windings must be fully impregnated for tropical climate and must have an oil resisting varnish finish.

2.21 RATING

Unless stated to the contrary, the alternator shall generate the specified voltages on three-phase and at 50 Hz. The alternator shall be rated for the specified output and power factor as detailed.

The alternator may be of the two bearing or single bearing type equipped with ball or roller bearings. The bearings must be pre-lubricated to ensure long service periods without attention.

The alternator must be equipped with damper windings, enabling the unit to accommodate an unbalanced load of at least 25% of full load at any load and at the normal operating conditions without incurring any damage. The alternator shall be rated for 200kVA

2.22 CONSTRUCTION

The rotor shall be dynamically balanced, and all the windings and rotating components shall be suitable to withstand an over speed of 50%.

2.23 EXCITATION

The excitation system shall be designed to promote rapid voltage recovery, following the sudden application of the full load. The voltage shall recover to within 2,5% of the steady state voltage within 0,3 seconds following the application of full load and the transient voltage dip shall not exceed 10%.

2.24 WAVE FORM

The voltage wave form of the alternator shall be such that the total voltage of the harmonic frequencies shall not exceed 5% of the voltage of the fundamental frequency over the range from no load to full load.

2.25 RADIO INTERFERENCE

The alternator shall be suppressed to comply fully with the requirements of BS 800 as revised, as well as with all South African Department of Posts and Telegraph requirements.

2.26 REGULATION

The alternator must be self-regulated, the inherent voltage regulation not exceeding plus or minus 2.5% of the nominal voltage specified above, at all loads with the power factor between unity and 0,8 and within the driving speed variations of 4.5% between no-load and full load.

2.27 PERFORMANCE

The excitation system shall be designed to promote rapid voltage recovery following the sudden application of the full load. The voltage shall recover to within 2½% of the steady state within 300 milli-seconds following the application of full load and the transient voltage dip shall not exceed 10%.

2.28 COUPLING

The engine and alternator must be directly coupled by means of a first-class quality flexible coupling, or acceptable disc drive coupling.

2.29 AUTOMATIC CONTROL CUBICLE

A set mounted automatic control cubicle shall be supplied, the cubicle to incorporate all equipment necessary for the control and protection of the generating set, the automatic change-over, and the battery charging.

The cubicle shall be a totally enclosed free standing unit, and shall consist of steel panels, carried on a substantial angle iron framework or pressed steel panels welded.

The cubicle shall be flush fronted; all equipment shall be mounted on the back of the front plate on suitable supports.

All equipment, connections and terminals shall be easily accessible. The front panels shall be hinged, with square key locking. Self-tapping screws shall not be used in the construction of the cubicle. The ironwork of the cubicle shall be thoroughly de-rusted, primed with zinc-chromate, and finished with two coats of first-class red enamel, or powder coated in Signal Red.

Suitably rated terminals shall be provided for all main circuits and for the control and protection circuits. Where cable lugs are used, these shall be crimped on the cable. All terminals shall be clearly marked.

For the fine wiring, each wire shall be fitted with a cable or wire marker of approved type, and the numbering of these markers shall be shown on the wiring diagram of the switchboard.

All equipment on the cubicle, such as contactors, isolators, bus-bars, etc., shall have ample current carrying capacity to handle the full load alternator current, as well as the rated fault current of the LV Panel.

2.30 SWITCHBOARD/CONTROL PANEL

A switchboard/control panel using a PLC type controller in preference to a Proprietary controller shall be used. Note; Relay logic panels are not acceptable. The switchboard will be positioned in the plant room and the following switchgear rated for a 35kA fault level must be provided.

300 Amp four pole draw out motorised isolator for isolation of the normal mains supply.

300 Amp four pole draw-out motorized circuit breaker with overload and short circuit protection suitable for switching and protection of the generator output.

Note: the above switches shall perform the changeover and must be electrically and mechanically interlocked.

The following alarm circuits with the necessary sensors must be provided on the control panel.

- START FAILURE
- LOW OIL PRESSURE
- HIGH ENGINE TEMPERATURE
- OVERSPEED
- UNDERSPEED
- LOW RADIATOR WATER LEVEL
- ABNORMAL GENERATOR VOLTAGE ($\pm 10\%$ OF NORMAL)
- LOW DAY TANK FUEL LEVEL
- UNIT NOT ON AUTO
- BATTERY CHARGE FAILURE

In addition to the above supervisory indication lamps for MAINS-LOAD and GENERATOR-LOAD to indicate which system is supplying the load must be provided.

Controls must be provided in the control panel to control the fuel replenishment pump.

2.31 EARTHING

An earth bar shall be fitted in the control panel.

The neutral point of the system must be solidly connected to the earth of the control panel.

Suitable terminals must be provided on the earth bar for connection of the main earth conductors, which will be supplied and installed by others.

OPERATIONAL REQUIREMENTS

An automatic changeover with electrical and mechanical interlocking shall be provided installed in an approved position in the control cubicle. This changeover switches shall open when the normal "supply" voltage is interrupted and will automatically close when the terminal voltage of the alternator reaches its nominal voltage, thereby connecting the alternator on load.

Voltage and frequency monitor shall be installed to monitor the normal "supply".

The starting cycle shall consist of three-time relays, with two relays which will be adjustable between 0- 30 seconds. The two-time relays shall perform the starting cycle. The starting cycle shall actuate the first-time relay, which will energize the starter motor of the engine for the pre-set time. The second time relay shall perform the "wait period" before the second and third starting attempt has been actuated.

After three unsuccessful starting cycles the third time relay shall be actuated to interrupt any further starting cycles and give an alarm "Start Failure". The third time relay shall have an adjustable time range of not less than 60 seconds.

When the alternator output voltage reaches the nominal value, the changeover contactor shall be activated to transfer load to the alternator.

A time delay shall be actuated when the supply network voltage is restored. This delay shall be adjustable between 0 - 10 minutes and shall actuate the changeover contactor to connect the load on back to the supply network.

After the load has been re-established to the supply network, the alternator set shall be switched off, by means of a run-down time, which will be adjustable between 0 - 10 minutes.

Should any of the above-mentioned control circuits or relays fail, the load shall be transferred automatically from the alternator to the supply network.

A siren must be of the continuous duty type or must be connected to an intermittent duty time relay.

A switch must be installed in the hooter circuit, to stop the audible signal. This switch shall be inside the cubicle with a suitable notice on the exterior.

The output terminals from the alarms in the AMF panel shall be wired to terminals in a flush mounted white 300 x 300, flush mount enclosure in the "manager's" office (maximum 300m from the generator room) indicating the following:

- Common Alarm
- Low fuel alarm
- Generator on Load indicator lamp.
- Mains on Load indicator lamp.
- Audible common alarm with cancel push button.

All indicator lamps shall be of the LED type or suitable connections for connecting to a building management system.

A stop delay with timer is required for the set, to keep the set running for an adjustable period of one to fifteen minutes after the return of the mains supply, before changing back to that supply and keep the set running for a further adjustable cooling period at no-load before stopping.

A four-position selector must be provided on the control panel, marked "Auto", "manual", "test" and "off".

With the selector on "auto", the set shall automatically start and stop, according to the mains supply being available or not.

With the selector on "test" it shall only be possible to start and stop the set with the push buttons, but the running set shall not be switched to the load.

With the selector on "manual", the set must take the load when started with the push button, but it must not be possible to switch the set on to the mains, or the mains on to the running set.

With the selector on "off", the set shall be completely disconnected from the automatic controls, for cleaning and maintenance of the engine.

2.33 BATTERY INSTALLATION

The starting batteries shall be adequately rated to suit the equipment provided. Battery terminals shall be coated with "Copraslip" or equivalent conductive grease. The battery shall preferably be mounted adjacent to the equipment.

Where electric starting is employed, the combination engine generator set shall be equipped with a fully charged lead-acid battery with the following requirements:

The battery shall have ample capacity for providing the starting torque stipulated by the engine manufacturer, and capacity for 3 such starts in a five-minute period.

The battery shall be supplied with a charger unit as described below.

2.34 BATTERY CHARGER

The switchboard detailed below shall contain facilities for charging the batteries from the mains.

The battery charger shall be of the fully automatic type and shall consist of an air-cooled transformer, silicon bridge rectifier, fuses and switching arrangement. All equipment shall be suitably rated and designed to automatically deliver a trickle or boost charge as determined by the battery voltage. The boost charge in amps shall not exceed 20% of the rated battery capacity.

A constant trickle charge facility is not acceptable. The charger shall switch off automatically when the battery is fully charged.

The charger must be provided with a Voltmeter and charge ammeter. These instruments must be mounted on the control panel door.

2.35 SWITCHBOARD/CONTROL PANEL

A switchboard / control panel must be provided for the control, metering and switching of the diesel alternator set.

Fault Level - The board and its equipment shall be rated at not less than the 380V asymmetrical prospective fault level specified in the detailed specification of the Electrical Installation, minimum 36 kA.

2.36 EQUIPMENT IN SWITCHBOARD

The following equipment is required on the board:

One flush 96 mm square dial voltmeter scaled 0 - 500V, reading the alternator voltage.

One flush voltmeter selector switch with three metering and one-off position, connecting the voltmeter between phases and neutral.

One flush 96mm square dial indicating type frequency meter, indicating the alternator frequency.

One hour meter with cyclometer counter, reading the number of hours the plant has been operating. The smallest figure on this meter is to read 1/10th hours.

One set of fuses or m.c.b.'s for potential circuits of the meters.

Three flush 96mm square dial ammeters for measuring the alternator current, scaled to suit, complete with the necessary current transformer - **combined instantaneous and maximum demand meters are required.**

- One triple pole circuit breaker for mains isolation.
- One set triple pole automatic change-over equipment with voltage and time delay relays, fitted with mechanical interlocks.
- One triple pole circuit breaker for alternator protection against overload and short circuit conditions.
- One four position operation selector switch, as specified.
- Two push buttons or one switch marked "START" and "STOP" for manual starting and stopping the set.
- One battery charger as specified, complete with flush ammeter and voltmeter.
- One stop delay as specified.
- Relays with reset push buttons as specified, for engine protection.
- Two low fuel level alarm devices.

- One warning hooter and one siren.
- One low battery voltage alarm device.
- Suitable terminals for incoming main and alternator cables, for the outgoing feeder, and for the earth connection.
- Any other equipment necessary for the correct and safe operation of the installation.
- A "General Alarm" output contact which will be in fail safe position, and will initiate general alarm should any one of the above-mentioned alarms be initiated.
- Panel lights to indicate: 1) Mains - Load; 2) Generator Load, to indicate which system is supplying the load.

2.37 MARKINGS

All labels, markings or instructions on the switchgear shall be as per the section on Coding, Labelling and Notices.

All timers or adjustable controls within the control panel shall be clearly labelled. A label indicating the settings of all adjustable controls shall be fitted inside the control panel.

2.38 INSTALLATION

Except for the supply and connection of the incoming main and outgoing feeder cables, tenderers must include for the complete installation and wiring of the plant in running order.

The installation must comply with the regulations of the "Factories, Machinery and Building Works Act" of 1941, as amended to date, and with the "Standard Regulations for the Wiring of Premises" second edition as amended, as well as the General Specification for Electrical Installations appended hereto, or available on request.

For the alternator circuit P V C SWA PVC sheathed cable shall be used. For the control circuits either multi-core P V C cable OR PVC insulated wires in conduit may be used. The neutral of the system must be solidly earthed.

Additional to the above, "Moving Machinery", "Noise" and "Danger" signs must be installed.

2.39 OCCUPATIONAL HEALTH & SAFETY ACT (OHSACT)

This installation shall comply in its entirety with the Occupational Health & Safety Act, and its amendments to date, and with all other regulations and specifications governing the works.

WARNING NOTICES

On the generator canopy, a clearly legible and indelible warning notice shall be mounted in a conspicuous position. The notice shall be made of

non-corrodible and non-deteriorating material, preferably plastic, and must read as follows:

This engine will start without notice. Turn selector switch on control board to "OFF" before working on the plant.

2.40 DRAWINGS

The successful tenderer will submit for approval within four weeks after adjudication of the Tender, three paper copies of the following drawings:

Complete detailed general layout drawing.

Working drawings of the cooling and exhaust systems.

Complete detailed and dimensional drawings of the alternator set with all auxiliary equipment.

Wiring diagrams of the control protection and alarm circuitries.

Detailed layout of the equipment to be installed on the control panel.

All drawings shall be drawn on CAD (Caddie) or DWG format and shall meet the requirements of SABS 0111-1980 as amended and SABS-1980 as amended, where applicable.

2.41 INFORMATION REQUIRED

Tenderers must furnish detailed descriptions and illustrations of the equipment offered and must complete the questionnaire following this specification. Failure to submit any of the information asked for may disqualify the tender.

2.42 GUARANTEE

The successful tenderer will be required to guarantee the complete plant for a period of 12 months from the date it has been taken over by the client, in running order.

If during this period the plant is not in working order, or not working satisfactorily owing to faulty material, design, or workmanship, the contractor shall be notified, and immediate steps shall be taken by him to rectify the defects and/or replace the affected parts on site, at his own expense.

2.43 MAINTENANCE

The successful tenderer shall be required to maintain the plant in good running condition to the approval of the Engineer for a period of 24 months.

All rates shall be as specified on the form of tender.

2.44 INSTRUCTION OF OPERATOR

After completion of the installation, and when the plant is in running order, the successful tenderer will be required to instruct an attendant in the operation of the plant, until he is fully conversant with the equipment and the handling thereof.

Three copies of maintenance, fault-localizing and operating manual are to be handed over to the representative on site.

One set of manuals with all drawings shall be fixed in a plastic jacket inside the panel.

2.45 INTERNAL LABELLING

An "Ozakling" type label showing the part number, description and setting of all removal relays, monitors and timers shall be affixed to the inside of the panel. Typical timer settings shall be noted.

All removable items shall be labelled both on the item, and on or adjacent to the plug-in base on the panel.

A full set of drawings, including schematics and general arrangement drawings shall be provided to SANBI.

2.46 TESTS

The following tests are to be carried out:

At the supplier's premises, before the generating set will be delivered to site. The Engineers may be present during the test to satisfy themselves that the generating set complies with the specification and delivers the specified output. The test must be carried out in accordance with B.S.S. 5514. The Engineer must be advised in time of the date of the test at least seven days prior to the test.

At the site after completion of the installation, all the instruments which may be required for the tests have to be provided by the successful tenderer.

Note that it will be necessary to conduct tests on load banks on site. On site tests shall be carried out for one hour on full load and one hour at 10% overload.

Test reports of both tests as specified under (a) and (b) are to be submitted to the Engineer.

2.47 LOCATION OF GENERATOR

The location of the generator is as per the Engineer's instructions.

2.48 MANUALS

Three copies of the complete set of manuals shall be provided to the full approval of the Engineer. The contract shall be deemed as "Incomplete" until all manuals, drawings and descriptive literature are received and approved by the Engineer and will result in a minimum of 10% of the contract moneys being withheld.

2.49 COMPLIANCE WITH SPECIFICATION

Tenderers are to provide a clause by clause written confirmation that their offer complies with the clauses of this document. Where their offer does not comply, it is to be clearly indicated in the compliance schedule.

2.50 SIGNAGE

All signage as required to comply with local Fire Regulations, as well as SABS-0142 & SABS 0400 shall be supplied and fitted on the outside.

PS 3 CABLE SLEEVE PIPES

Where cables cross under roadways, other services and where cables enter buildings, the cables shall be installed in PVC solid or flexible pipes with diameters suitable for the specified cables with additional space of 50%.

The electrical contractor will be responsible for all excavations, installation of sleeves, backfill and making neat of all.

The ends of all sleeves shall be sealed with a non-hardening watertight compound after the installation of cables. All sleeves intended for future use shall likewise be sealed.

The soil around the sleeves will be free of stones or any material that could damage the sleeves.

PS 4 NOTICES

All sign boards during construction in public areas will be installed according to regulations in order to limit accidents. All excavations shall be properly barricaded.

PS 5 ELECTRICAL EQUIPMENT

All equipment and fittings supplied must be in accordance with the approved quality specification, suitable for the relevant supply voltage and frequency and must be approved by the Client's representative.

PS 6 DRAWINGS

The drawings generally show the scope and extent of the proposed work and shall not be held as showing every detail of the work to be executed.

The position of power points, switches and light points that may be influenced by built-in furniture must be established on site, prior to these items being installed.

PS 7 BALANCING OF LOAD

The Electrical Contractor is required to balance the load as equally as possible over the multiphase supply, as well as the load balancing of the KRC and CBC buildings.

PS 8 WORK SEQUENCE

The sequence, in which the work must be carried out, must be established in consultation with the SANBI representative.

PS 9 SUPERVISION

The work shall at all times, for the duration of the contract be carried out under the supervision of a skilled and competent representative of the contractor, who will be able and authorised to receive and carry out instructions on behalf of the contractor. A sufficient number of workmen shall be employed at all times to ensure satisfactory progress of the work. **A qualified 3-phase electrician shall be permanently on site to supervise the work.**

PS 10 SUPPLY OF MATERIAL

The Client reserves the right to supply any item of material of equipment required for this service.

The Contractor shall take delivery and install such material or equipment.

PS 11 SERVICE CONDITIONS

All plant shall be designed for the climatic conditions appertaining to the service.

PS 12 SWITCHES AND SOCKET OUTLETS

The installation of switches and socket outlets must conform to the specifications, and shall be **CRABTREE**, or other approved type as per Engineer.

PS 13 EARTHING AND BONDING

The Contractor will be responsible for all earthing and bonding of installation; the earthing and bonding is to be carried out strictly to the specification and to the satisfaction of the Client's representative.

PS 14 INTERRUPTIONS OF ELECTRICAL SUPPLY

All interruptions of the electrical supply that may be necessary for the execution of the work will be subject to prior arrangement between the Contractor, the user Client, and the Client's representative.

PS 15 REGULATIONS AND CODES

The complete electrical installation shall be carried out in full compliance with the Wiring Code and with any Regulations or Codes of Practice in force or adopted in the area in which the contract is to be carried out. Tenderers shall familiarize themselves with all such Regulations or Codes before finalizing their prices; no price variations to the contract based on lack of knowledge or such Regulations or Codes will be allowed.

PS 16 CONDUIT AND WIRING

Conduit and conduit accessories shall be black enamelled/galvanised conduit or black enamelled/galvanised plain end conduit in accordance with SABS 162, 763 and 1007 respectively.

NOTE:

Where plain end conduit is offered, all switches and light fittings must be supplied with a permanent earth terminal for the connection of the earth wire.
Lugs held by switch fixing screws or self-tapping screws will not be acceptable.

PS 17 CABLES

Note: All LV cables will be PVC/SWA/PVC/CU.

The electrical contractor shall allow for the supply and complete installation of all distribution cables as indicated on the drawings, and listed in the Schedule of Cables.

Tenderers must base their tender on the amounts of cable, including earth conductors, as indicated in the Bill of Quantities. During the course of the work the actual lengths will be measured on site and adjustments will be made according to the price per meter length as inserted by the tenderer for the particular cable size concerned.

Tenderers must base their cost for trenching in earth; hard rock on the total quantities as indicated in the Bill of Quantities. The actual quantities, based on the dimensions as specified below for trenches for the applicable number of cables to be laid, will be measured on site during the course of the service and adjustments made according to the price per cubic meter as inserted by the tenderer. Payment for cable trenching having a greater volume than that specified for the purpose will not be considered except where extra excavations are necessary to by-pass obstacles such as water pipes, drains, large boulders etc. In all such instances the amount of the extra excavations must be agreed upon on site between the Engineer and the contractor.

Cables in soil will be buried 1,5m underground. Cables that are attached to roofs or walls will be tied with aluminium strapping (25mm) every 400mm to 100mm cable racks.

The storage, transportation, handling and laying of the cables shall be according to first class practice, and the contractor shall have adequate and suitable equipment and labour to ensure that no damage is done to cables during such operations.

The cable-trenches shall be excavated to a depth of 0,6m deep below ground level and shall be 450mm wide for one to three cables, and the width shall be increased where more than three cables are laid together so that the cables may be placed at least two cable diameters apart throughout the run. The bottom of the trench shall be level and clear and the bottom and sides free from rocks or stones liable to cause damage to the cable.

The contractor must take all necessary precautions to prevent the trenching work being in any way a hazard to the personnel and public and to safeguard all structures, roads, sewage works or other property on the site from any risk of subsidence and damage.

In the trenches made in soft and hard rock the cables shall be laid on a 75mm thick bed of earth and be covered with a 150mm layer of earth before the trench is filled in. No joints will be allowed in cables.

The laying of cables shall not be commenced until the trenches have been inspected and approved. The cable shall be removed from the drum in such a way that no twisting, tension or mechanical damage is caused and must be adequately supported at intervals during the whole operation. Particular care must be exercised where it is necessary to draw cables through pipes and ducts to avoid abrasion, elongation or

distortion of any kind. The ends of such pipes and ducts shall be sealed to approval after drawing in of the cables.

Backfilling (after bedding) of the trenches is to be carried out with a proper grading of the material to ensure settling without voids, and the material is to be tamped down after the addition of every 150mm. The surface is to be made good as required.

On each completed section of the laid and jointed cable, the insulation resistance shall be tested to approval with an approved "Megger" type instrument of not less than 500 V for low tension cables.

Earth continuity conductors are to be run with all underground cables constituting part of a low-tension distribution system. Such continuity conductors are to be stranded bare copper of a cross-sectional area equal to at least half that of one live conductor of the cable, but shall not be less than 4mm² or more than 70mm². A single earth wire may be used as earth continuity conductor for two or more cables run together, branch earth wires being brazed on where required.

PS 18 LAYING, JOINTING AND MAKING OFF OF ELECTRICAL CABLES

NB : The requirements specified hereafter, are aimed essentially at high tension cable but are also valid for low tension cable, where applicable.

18.1	The use of the term "Inspector" includes the engineer or inspector of the Client or an empowered person of the concerned supervising consulting engineer's firm.
18.2	No cable is to be laid before the cable trench is approved and the soil qualification of the excavation is agreed upon by the contractor and inspector.
18.3	After the cable has been laid and before the cable trench is backfilled the inspector must ensure that the cable is properly bedded and that there is no undesirable material included in the bedding layer.
18.4	All cable jointing and the making off of the cables must only be carried out by qualified experienced cable jointers. Helpers of the jointers may not saw, strip, cut, solder, etc. The cable and other work undertaken by them must be carried out under the strict and constant supervision of the joiner.
18.5	Before the contractor allows the joiner to commence with the jointing work or making off of the cable (making off is recognized as half a joint) he must take care and ensure: that he has adequate and suitable material available to complete the joint properly and efficiently. Special attention must be given to ensure the cable ferrules and cable lugs are of tinned copper and of sufficient size. The length of the jointing lugs must be at least six times the diameter of the conductor, that the joint pit is dry and that all loose stones and material are removed, that the walls and banks of the joint pit are reasonably firm and free from loose material which can fall into the pit,

that the necessary cofferdams or retaining walls are made to stop the flow of water into the joint pit,

that the joint pit is provided with suitable groundsheets so that the jointing work is carried out in clean conditions,

that the necessary tents or sails are installed over the joint pit to effectively avert unexpected rainfall and that sufficient light or lighting is provided,

that the necessary means are available to efficiently seal the jointing or cable end when an unexpected storm or cloudburst occurs, regardless of how far the work has progressed,

that the cables and other materials are dry, undamaged and in all respects are suitable for the joint work or making off,

that the heating of cable oil, cable compound, plumbers metal and solder is arranged that they are at the correct temperature when required so that the cable is not unnecessarily exposed to the atmosphere and consequently the ingress of moisture (care must be taken of overheating).

- 18.6 Before the paper insulated cables are joined, they must be tested for the presence of moisture by the cable jointers test. This consists of the insertion of a piece of unhandled insulated impregnated paper tape in warm cable oil heated to a temperature of $130^{\circ}\text{C} \pm 5^{\circ}\text{C}$. Froth on the surface of the oil is an indication that moisture is present in the impregnated insulation and the amount of the froth gives an indication of the moisture present.
- 18.7 If the cable contains moisture or is found to be otherwise unsuitable for jointing or making off the inspector is to be notified immediately and he will issue the necessary instruction to cope with the situation.
- 18.8 The joint or making off of paper insulated cables must not be commenced during rainy weather.
- 18.9 Once a joint is in progress the jointer must proceed with the joint until it is complete and before he leaves the site.
- 18.10 After the individual cores have been insulated they must be well basted with hot cable oil and again after the applicable separator and/or belt insulation tape is applied before the lead joint sleeve is placed in position.
- 18.11 The lead joint sleeve must be thoroughly cleaned and prepared before it is placed on the cable and must be kept clean during the whole jointing process. Seal the filling apertures of the sleeve with tape until the sleeve is ready for compound filling.
- 18.12 The plumbing joints employed to solder the joint sleeve to the cable sheath, must be cooled off with tallow and the joint sleeve is to be filled with compound while it is still warm. Top up continuously until the joint is completely filled to compensate for the compound shrinkage.
- 18.13 The outer joint box must be clean and free from corrosion. After it has been placed in position it must be slightly heated before being filled with compound. Top up until completely full.

- 18.14 As far as cable end boxes are concerned the requirements as set out above are valid where applicable.

PS 19 DISTRIBUTION BOARDS, CIRCUIT BREAKERS, SOCKET OUTLETS AND SWITCHES

19.1 DISTRIBUTION BOARDS

The electrical contractor shall supply and install the distribution boards as indicated on the drawings. All distribution boards shall comply with the quality specification and be approved by the Engineer or by the Client's representative.

All DB's as well as both ends of cables will be marked with engraving on aluminium plate.

All distribution boards shall be manufactured according to the detail specifications and drawings and shall be inspected and **approved** by the Engineer before installation.

The Engineer shall first approve any other type of distribution board, which may be submitted as an alternative.

All bus bars and lugs shall be insulated, and wiring shall enter the switch gear from the back of the distribution board.

All circuit breakers will be the quality of **SCHNEIDER** or better.

Quality Specification and Manufacturers:

All switchgear and equipment shall comply with the specification in the document.

Wiring:

The manufacturers shall internally wire all distribution boards. Wiring between switchgear and busbars shall be done by means of PVC insulated stranded copper conductors, fixed to the busbars with copper lugs, and brass bolts.

Only color-coded wiring shall be accepted, e.g.: Red, yellow, and blue for phases, and black for neutral.

Wiring coloured by means of PVC insulated tape shall not be accepted.

Wiring shall be neatly strapped in a vertical and horizontal manner. All instrument and control wiring shall be 2.5mm² PVC insulated copper conductors and shall be numbered for ease of tracing circuits.

Colour:

The colour of all distribution boards shall be light stone and all painting shall be done in accordance with the standard paint specifications in part 3 of this specification.

Doors:

Where specified, doors shall be of the removable type.

19.2 CIRCUIT BREAKERS & ISOLATORS

All circuit breakers will be similar to SCHNEIDER or better and all circuit breakers will be of the Hydraulic Magnetic type.

19.3 SOCKET OUTLETS

All socket outlets will have metal plate covers and will be pop-riveted in place of installing 2 x screws.

19.4 SWITCHES

WATERTIGHT SWITCHES

GENERAL DESCRIPTION

Watertight switches and socket outlets will be a single unit with a cover only protecting the socket outlet itself. It will be double weather protected.

RATINGS

Electrical : 16A, 230V, 1 Phase
Weather : IP 66

Separate Compartments:

Where distribution boards have separate compartments, they shall be separated by means of a metal dividing section, and be equipped with individual removable circuit breaker covers.

Legend Cards:

Legend cards covered by removable glass or 1.6mm transparent acrylic plastic shall be fitted to the inside of the door of the distribution board and circuits shall be noted on this legend card. Legend cards shall be as follow, *for example*:

Main -	Main Isolator Switch OR Local Isolator Switch (As case may be).
L1 -	Lights; Bedroom 1, Bedroom 2 & Kitchen.
P1 -	Plugs; Bedroom 1, Bedroom 2 & Kitchen.
ELU1 -	Earth leakage unit for plug circuits 1, 2 & 3.

PS 20 BILLS OF MATERIALS

20.1 This Bill of Quantities forms part of, and must be read in conjunction with the specification.

20.2 No alteration, erasure or addition is to be made in the text of the Bill of Quantities. Should any alteration, erasure or addition be made it will not be recognized but the original wording of the Bill of Quantities will be adhered to.

20.3 The Client will check the completed Bill of Quantities and reserves the right to adjust any individual price and to rectify any discrepancy whilst the total tender price as quoted remains unaltered.

20.4 The quantities given in the Bill for cable, cable markers, earth wire laid with cable, overhead conductors, overhead earth wire and excavations cannot be regarded as exact and are subject to measurement on site after completion of the service and adjustments will be made according to the unit rates given in the Bill.

In the event of discrepancies between the drawings, specifications and Bill of Quantities the Engineer shall decide whether the work as executed shall be re-measured on site.

NOTE:

Checking of Cable and Overhead Conductor Lengths

Notwithstanding the fact that the lengths of cables and overhead conductors as given in the Bills of Quantities have been measured from scaled drawings, the contractor shall check such lengths on site before ordering the cable as he will not be paid for excess cable after the completion of the service. Any allowance for off-cuts shall be made in the unit rates. The final measurements shall be based on the nett route length of the cables and overhead lines concerned.

20.5 Where alternative prices for gear of different manufacture are quoted the lowest alternative price for gear to specification must be quoted against the relevant item in the Bill of quantities. The remaining alternative prices must be furnished separately.

20.6 The unit prices quoted in the Bill of Quantities must include for such small Installation materials as are required for the complete installation in accordance with the specification.

PS 21 GENERATOR SERVICE

1. The following activities shall be INCLUDED as part of the generator service:
 - 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.

2. 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).

3. 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

4. Alternator shall be checked for accumulation of dust on the regulator and for any loose components.

5. Test run shall be undertaken, if possible on load, and volt, ampere and frequency readings recorded.

6. Alternator shall be cleaned and switched back into 'auto' mode.

7. Complete Standby Generator log sheets

8. Record running hours, diesel consumption etc in the following prescribed format (example):

	Previous Measurement	This Measurement	Consumption	Average per day
Date:	01-Apr-24	03-May-24	Total	32 days
Diesel Supplied:			2077	liters
Running Hours:			(hours)	(hrs/day)
Generator (hrs)	2535.6	2927.6	392.0	12.3
Average Diesel consumption			5.3	ltrs/hr

TECHNICAL SPECIFICATION

HC LOW VOLTAGE RETICULATION

CONTENTS

HC 01	SCOPE
HC 02	STANDARD SPECIFICATIONS, REGULATIONS, CODES AND ADDITIONAL SPECIFICATIONS
HC 03	TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK
HC 04	RE-COMMISSIONING OF INSTALLATION
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HC 06	INSTALLATION MAINTENANCE
HC 07	LOW VOLTAGE DISTRIBUTION BOARDS: TECHNICAL DETAILS
HC 08	LOW VOLTAGE DISTRIBUTION KIOSKS: TECHNICAL DETAILS
HC 09	LOW VOLTAGE OVERHEAD DISTRIBUTION SYSTEM: TECHNICAL DETAILS

HC 01 SCOPE

HC 01.01 This specification comprises all aspects regarding the repair and maintenance of low voltage systems. Low voltage comprises:

- ◆ low voltage distribution boards
- ◆ low voltage kiosks
- ◆ low voltage overhead distribution system

HC 01.02 This specification shall form an integral part of the repair and maintenance contract document and shall be read in conjunction with Part C, the Additional Specification included with this document.

HC 02 STANDARD SPECIFICATIONS, REGULATIONS AND CODES

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

HC 02.02 SANS Specifications

- ◆ SANS 10142-1
- ◆ SANS 10142-2
- ◆ SANS 141
- ◆ SANS 1091
- ◆ SANS 121
- ◆ SANS 1195
- ◆ SANS 784

HC 03 TEST AND INSPECTION FOLLOWING COMPLETION OF REPAIR WORK

HC 03.01 It is the responsibility of the Contractor to provide all labour, accessories and properly calibrated and certified measuring instruments necessary to record the following parameters :

- ▶ Phase voltages and current
- ▶ Earthing resistance testing

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

HC 04 RE-COMMISSIONING OF INSTALLATION

On completion of the repair work, the low voltage reticulation shall be put into operation.

HC 05 REPAIR WORK TO LOW VOLTAGE RETICULATION

The distribution boards, kiosks and overhead reticulation system shall be repaired as measured in the bills of quantities, during the first period of the repair and maintenance contract.

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

The Contractor shall record the repair actions in tabular format before the maintenance phase commences.

Repair work shall be executed within the approved period for repairs. This period shall be agreed at the start of the contract period.

New equipment and material shall be supplied with a written guarantee confirming a defects liability period of 12 months from date of hand-over. These guarantees shall be furnished in favour of the User Client.

HC 06 LOW VOLTAGE RETICULATION MAINTENANCE

HC 06.01 The various low voltage systems shall be maintained following the initial repair work. The maintenance contract shall run for the balance of the 36 month contract period.

HC 07 LOW VOLTAGE DISTRIBUTION BOARDS : TECHNICAL DETAILS

HC 07.01 Installation description

This section describes the electrical distribution network that will be repaired and maintained in terms of the contract.

Substations

The low voltage supply is distributed from the low voltage room in substation.

This room contains floor standing low voltage panels that are installed over cable trenches. The enclosures contain low voltage circuit breakers and instrumentation equipment.

HC 07.02 Scope of repair work

HC 07.02.01 General repair work

- ☐ Service low voltage distribution boards: clean, secure circuit breakers, secure terminations, label circuit breakers and cables.
- ☐ Move circuit breakers: Loosen circuit breakers move and secure in new position.

- ☐ Install circuit breaker.
- ☐ Re-paint front cover of emergency section.
- ☐ Disconnect and remove redundant switchgear.
- ☐ Replace circuit breakers.
- ☐ Disconnect and remove redundant street and security lighting control panel.
- ☐ Disconnect and remove redundant cables.
- ☐ Replacement of undersized jumper cables.
- ☐ Installation of trench covers.

HC 07.03

Repair work: measurement and payment

<u>Item</u>	<u>Unit</u>
(a) Service low voltage distribution boards	No
The unit of measure shall be the number of low voltage boards serviced.	
The tendered rate shall include full compensation for the opening and cleaning of low voltage board, vermin protection, secure MCBs and terminations, fitting of engraved labels and blank covers.	
<u>Item</u>	<u>Unit</u>
(b) Test ammeter and CT functionality.	No.
The unit of measure shall be the number of ammeters and CT's tested.	
The tendered rate shall include full compensation for the removal, testing and replacement of meters.	
<u>Item</u>	<u>Unit</u>
(c) Re-paint cover on panel	No.
The unit of measure shall be the number of front covers of panels re-painted.	
The tendered rate shall include full compensation for the removal, de-rusting and degreasing of panel and re-painting, fitting of engraved labels and re-installation of the cover with dimensions as specified in the Bill of Quantities.	
<u>Item</u>	<u>Unit</u>
(d) Remove 5kA MCB's on incoming section of Main Substation low voltage distribution board.	item
The unit of measure shall be the sum for removal of the circuit breakers as specified.	
The tendered rate shall include full compensation for the removal of the existing 5kA MCB's on the incoming section of the main board.	

<u>Item</u>	<u>Unit</u>
(e) Removal of Fuchsware MCB's on Main Substation Low Voltage distribution board (local section).	item
The unit of measure shall be a sum for the removal of the circuit breakers as specified.	
The tendered rate shall include full compensation for the removal of the existing MCB's and supply and installation of new MCB's as specified and connection.	
<u>Item</u>	<u>Unit</u>
(f) Removal of redundant switchgear on Main Substation low voltage distribution board	item
The unit of measure shall be a sum for removal of the equipment.	
The tendered rate shall include full compensation for disconnection and removal of redundant equipment and jumpers.	
<u>Item</u>	<u>Unit</u>
(g) Removal of redundant security and perimeter light control panel in Main Substation	No.
The unit of measure shall be the number of panels removed.	
The tendered rate shall include full compensation for locating and disconnection of all cables to this panel including removal of the panel from the substation.	
<u>Item</u>	<u>Unit</u>
(h) Remove redundant cable	No
The unit of measure shall be the number of cables removed.	
The tendered rate shall include full compensation for the complete removal of the cable from site.	
<u>Item</u>	<u>Unit</u>
(i) Supply and install power outlets.	No
The unit of measure shall be the number of power sockets installed.	
The tendered rate shall include full compensation for the removal, supply and installation of single power outlets.	
<u>Item</u>	<u>Unit</u>
(j) Supply and install light switch.	No.
The unit of measure shall be the number of light switches installed.	
The tendered rate shall include full compensation for the removal supply and installation of a 1 way 1 lever light switch.	

<u>Item</u>	<u>Unit</u>
(k) Label cables	No.
The unit of measure shall be the number of labels installed.	
The tendered rate shall include full compensation for the installation of cable markers on both ends of all cables with a minimum font height of 18mm. The marking system used should be of type Graftoplast or equal.	
<u>Item</u>	<u>Unit</u>
(l) Install trench covers	No.
The unit of measure shall be the number of covers installed.	
The tendered rate shall include full compensation for the supply and installation of cable trench covers in sizes as specified.	
<u>Item</u>	<u>Unit</u>
(m) Supply and Install circuit breakers	No.
The unit of measure shall be the number of circuit breakers installed.	
The tendered rate shall include full compensation for the supply and installation and connection of circuit breakers as specified.	

HC 08 DISTRIBUTION AND METERING KIOSKS : TECHNICAL DETAILS

HC 08.01 Installation description

This section describes the electrical distribution and metering kiosks that will be repaired and maintained in terms of this contract.

This part of the distribution network consists of freestanding low voltage outdoor kiosks. The kiosks contain circuit breakers, switching and instrumentation equipment.

HC 08.02 Scope of repair work

- 1) Open distribution kiosk, check locks, door hinges, clean inside, provide rodent protection, secure circuit breaker and terminations: label all kiosks, label circuit breakers, label cables and provide warning notices.
- 2) Measure earth resistance.
- 3) Touch up kiosks: Remove all rust with an anti-corrosion agent and repaint kiosks.
- 4) Replace handles and padlocks on distribution kiosks.
- 5) Remove and re-mount contactors
- 6) Replace door hinges and latches
- 7) Replace panel catches
- 8) Repair burnt connections

HC 08.03

Repair work : measurement and payments.

<u>Item</u>	<u>Unit</u>

(a) Service distribution kiosk	No

The unit of measurement shall be the number of distribution kiosks serviced.

The tendered rate shall include full compensation for the servicing of the distribution kiosk, vermin protection, cleaning of circuit breakers, general cleaning of the kiosk, earth testing, securing of MCB and terminations. The contractor shall submit a report on the general condition of the kiosk (damage, rust etc.)

<u>Item</u>	<u>Unit</u>

(b) Remove rust and paint kiosks	No

The unit of measurement shall be the total number of kiosks painted.

The tendered rate shall include full compensation for the removal of rust with a anti corrosion agent and the repainting of the whole kiosk.

<u>Item</u>	<u>Unit</u>

(c) Label kiosks	No.

The unit of measure shall be the total number of kiosks labelled.

The tendered rate shall include full compensation for the labelling of kiosks circuit breakers, cable and the warning notification to be installed.

<u>Item</u>	<u>Unit</u>

(d) Supply and install padlocks	No.

The unit of measurement shall be the number of padlocks installed.

The tendered rate shall include full compensation for the ordering, supply, engraving and installation of the padlocks, locking devices and seals.

Lock shall be "keyed alike".

<u>Item</u>	<u>Unit</u>

(e) Replace distribution meter and stubby kiosks.	No.

The unit of measurement shall be the number of distribution kiosks replaced.

The tendered rates shall include full compensation for the removal, the ordering, supply and installation of the new meter boxes and stubbies.

<u>Item</u>	<u>Unit</u>

(f) Replace door hinges on meter and distribution kiosks.	No.

The tendered rate shall include full compensation for the removal of damaged hinges, the supply, delivery and installation of new hinges.

<u>Item</u>	<u>Unit</u>

(g) 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.

<u>Item</u>	<u>Unit</u>

(h) Supply and install low voltage PVC/SWA/PVC Cu cable and bare copper earth wire.	No.

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

The tendered rate shall include the ordering and delivery to site of the cable. (Excavations measured somewhere else.)

<u>Item</u>	<u>Unit</u>

(i) Termination of low voltage PVC/SWA/PVC Cu cables.	No.

The unit of measurement shall be the total number of terminations removed and new terminations made. The tendered rate shall include full compensation for the supply and installation of cable glands and lugs.

<u>Item</u>	<u>Unit</u>

(j) Jointing of low voltage PVC/SWA/PVC Cu cable.	No.

The unit of measurement shall be the total number of joints made.

The tendered rate shall include full compensation for the supply and installation of all material needed to complete the joints.

<u>Item</u>	<u>Unit</u>

(k) Excavations for cable trenches and meter boxes.	m ³

The unit of measurement shall be the total volume excavated and backfilled in dimensions as specified by the engineer.

<u>Item</u>	<u>Unit</u>

(l) Supply and installation bare copper earth conductor.	meter

The unit of measure shall be the total length of cable supplied and installed. The tendered rate shall include the ordering and delivery to site of the cable (Excavations measured somewhere else).

<u>Item</u>	<u>Unit</u>

(m) Termination of bare copper earth conductor.	No.

The unit of measure shall be the total number of terminations removed and new terminations made.

The tendered rate shall include full compensation for the supply and installation of cable glands and lugs.

<u>Item</u>	<u>Unit</u>

(n) Re-wiring of kiosk.	No

The unit of measure shall be number of kiosks re-wired.

The tendered rate shall include full compensation for removal of the existing wiring, re-wiring, labelling and commissioning of the kiosk.

<u>Item</u>	<u>Unit</u>

(o) Reposition contactors on kiosk.	No

The unit of measure shall be number of contactors repositioned.

The tendered rate shall include full compensation for removal of the existing wiring, removal of contactors, mounting in new positions re-wiring, labelling and commissioning of the kiosk.

<u>Item</u>	<u>Unit</u>

(p) Supply and install front covers.	No

The unit of measure shall be number of covers supplied and installed.

The tendered rate shall include full compensation for measuring, manufacturing painting and installation of front covers.

HC 09	LOW VOLTAGE OVERHEAD DISTRIBUTION SYSTEM : TECHNICAL DETAILS

HC 09.01	<u>Installation description</u>

This section describes the low voltage overhead distribution system that will be repaired and maintained in terms of this contract.

This part of the distribution network consists of wooden poles, bare low voltage overhead conductors in a horizontal system configuration with cable connections to houses.

HC 09.02	<u>Scope of repair work</u>

- (a) Visual inspection of overhead conductors, insulators, securing of terminations and connections, adjustment to stay assemblies to re-tension conductors, labelling of cables and provision of warning notices.

- (b) Measure earth resistance.

- (c) Clearing of all vegetation within 1m distance from conductors.

- (d) Replacement of rusted distribution boards

HC 09.03	<u>Repair work : measurement and payments.</u>

<u>Item</u>	<u>Unit</u>

(a) Service overhead distribution system	meter

The unit of measurement shall be the linear length of three phase overhead distribution system network serviced.

The tendered rate shall include full compensation for visual inspection of conductors and insulators, clearing of vegetation, securing of connections and terminations. The contractor shall submit a report on the general condition of the overhead reticulation system.

<u>Item</u>	<u>Unit</u>
(b) Replace damaged insulators.	No.
The unit of measurement shall be the total number of insulators replaced.	
The tendered rate shall include full compensation for isolation of the overhead reticulation system, temporary suspension of conductors if required, removal of damaged insulators, provision and installation of new insulators and securing of conductors.	
<u>Item</u>	<u>Unit</u>
(c) Re-tensioning of overhead conductors	No.
The unit of measure shall be the total number of stays adjusted.	
The tendered rate shall include full compensation for isolation of overhead conductors, attachment of wire tensioning equipment to stays and adjustment of stay wires.	
<u>Item</u>	<u>Unit</u>
(d) Replacement of wooden pole	No.
The unit of measurement shall be the number of poles replaced.	
The tendered rate shall include full compensation for isolation of overhead conductors, temporary suspension and disconnection of conductors and suspension assemblies, excavation, removal of existing pole, provision and plant of new pole, backfilling and compaction, re-installation of suspension assemblies and connection of conductors and re-tensioning of conductors if required.	
<u>Item</u>	<u>Unit</u>
(e) Replacement of overhead house connection	No.
The unit of measurement shall be the number of house connections replaced.	
The tendered rate shall include full compensation for isolation of overhead conductors, disconnection and removal of existing overhead house connection, excavation for new cable connection, supply and installation of 16 mm ² 3 core Cu cable including all connections to existing meter and overhead supply line and backfilling of trench.	
<u>Item</u>	<u>Unit</u>
(f) Replacement of existing distribution boards	No.
The unit of measurement shall be the number of distribution boards replaced.	
The tendered rate shall include full compensation for disconnection of existing cabling, removal of old distribution board, supply and installation of new board as per specification excluding equipment.	
<u>Item</u>	<u>Unit</u>
(g) Supply and install low voltage circuit breakers	No.

HC.10

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

The tendered rate shall include full compensation for supply of new circuit breaker with rating as specified, installation of breaker in distribution board and connection of breaker.

TECHNICAL SPECIFICATION

HE EXTERIOR LIGHTING SYSTEMS

CONTENTS

HE 01	SCOPE
HE 02	STANDARD SPECIFICATIONS, REGULATIONS, CODES AND ADDITIONAL SPECIFICATIONS
HE 03	REPAIR WORK TO EXTERIOR LIGHTING INSTALLATIONS AND KIOSKS
HE 04	AREA LIGHTING: TECHNICAL DETAILS
HE 05	SECURITY FENCE LIGHTING: TECHNICAL DETAILS
HE 06	STREET LIGHTING: TECHNICAL DETAILS

HE 01 SCOPE

HE 01.01 This specification comprises all aspects regarding the repair and maintenance of external lighting systems. External lighting comprises:

- i) Area lighting
- ii) Security lighting along perimeter fences
- iii) Street lighting

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 Regulations
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-reinforced polyester (GRP) poles
02.02.07	SANS 1250	Capacitors, ballasts & lamps
02.02.08	SANS 1279	Floodlight luminaires
02.02.09	SANS 1777	Photoelectric control units for lighting (PECUs)
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 03 REPAIR WORK TO EXTERIOR LIGHTING INSTALLATIONS

HE 03.01 The various lighting systems shall be repaired as part of installation H during the first phase of the repair and maintenance contract

HE 03.02 The scope of the repair work shall include, but shall not be limited to the activities listed below.

HE 03.03 The Contractor shall record the repair actions in tabular format before the Contractor's responsibility for maintenance commences.

HE 03.04 Repair work shall be executed within the approved period for repairs.

HE 03.05 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 03.06 The following measurement and payment items shall apply for repair work

<u>Item</u>	<u>Unit</u>
HE 03.06(a) <u>Excavate in all materials for trenches, backfill, compact and dispose of surplus material</u>	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.

<u>Item</u>	<u>Unit</u>
HE 03.06(b) <u>Extra over item HE 09.06(a) for excavating in hard material</u>	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.

<u>Item</u>	<u>Unit</u>
HE 03.06(c) <u>Extra over item 3.10.1.1 for excavating by hand in all materials</u>	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.	

<u>Item</u>	<u>Unit</u>
HE 03.06(d) <u>Extra over item HD09.06(a) for using backfill material obtained from sources provided by the Contractor</u>	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.	

<u>Item</u>	<u>Unit</u>
HE 03.06(e) <u>Supply and Install Cable Sleeves</u>	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.	
<u>Item</u>	<u>Unit</u>
HE 03.06(f) <u>Supply and Install Plastic Warning Tape</u>	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.

<u>Item</u>	<u>Unit</u>
HE 03.06(g) <u>Supply and delivery of low-voltage cable</u>	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.	

<u>Item</u>	<u>Unit</u>
HE 03.06(h) <u>Lay LV-cable</u>	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.	

<u>Item</u>	<u>Unit</u>
HE 03.06 (i) <u>Termination of LV-cables</u>	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.	

<u>Item</u>	<u>Unit</u>
HE 03.06(j) <u>Supply bare copper earth conductor</u>	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.	

<u>Item</u>	<u>Unit</u>
HE 03.06(k) <u>Installation of bare copper earth conductor</u>	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.	

<u>Item</u>	<u>Unit</u>
HE 03.06(l) <u>Terminate and connect bare copper earth conductor</u>	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.

<u>Item</u>	<u>Unit</u>
HE 03.06(m) <u>Jointing of low-voltage cable</u>	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.

<u>Item</u>	<u>Unit</u>
HE 03.06(n) <u>Re-lamp luminaire</u>	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.

<u>Item</u>	<u>Unit</u>
HE 03.06(o) <u>Supply and installation of internal luminaire components</u>	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.

<u>Item</u>	<u>Unit</u>
HE 03.06(p) <u>Internal wiring of luminaire</u>	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 separately.

<u>Item</u>	<u>Unit</u>
HE 03.06(q) <u>Supply and install circuit breakers</u>	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.

<u>Item</u>	<u>Unit</u>
HE 03.06(r) <u>Supply and install isolators</u>	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.

<u>Item</u>	<u>Unit</u>
HE 03.06(s) <u>Supply and install contactors</u>	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.	
<u>Item</u>	<u>Unit</u>
HE 03.06(t) <u>Supply and install of low tension fuses</u>	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.	
<u>Item</u>	<u>Unit</u>
HE 03.06(u) <u>Supply and install National photocell (plug-in type)</u>	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.	
<u>Item</u>	<u>Unit</u>
HE 03.06(v) <u>Supply and install Heinemann QAT-R-Clip in timer</u>	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	
<u>Item</u>	<u>Unit</u>
HE 03.06(w) <u>Supply and install 0-30A HRC fuses</u>	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.	
<u>Item</u>	<u>Unit</u>
HE 03.06(x) <u>Supply and install end connectors and insulating sleeves</u>	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.	

	<u>Item</u>	<u>Unit</u>
HE 03.06 (y)	<u>Replace pole</u>	
	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	
	<u>Item</u>	<u>Unit</u>
HE 03.06 (z)	<u>Replace Luminaire diffuser</u>	
	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.	
	<u>Item</u>	<u>Unit</u>
HE 03.06 (aa)	<u>Replace pole mounted brackets</u>	
	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.	
	<u>Item</u>	<u>Unit</u>
HE 03.06 (ab)	<u>Replace pole cover.</u>	
	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.	
	<u>Item</u>	<u>Unit</u>
HE 03.06(ac)	<u>Junction boxes including pole mount brackets.</u>	No.
	The unit of measure shall be the number of junction boxes supplied and installed.	
	The tendered rate shall include full compensation for the supply and installation of junction boxes brackets and strapping. The junction box must be fitted with a neutral bar earth bar, din terminal rails and CBI circuit breaker clips to accommodate the maximum number of terminals and circuit breakers.	

	<u>Item</u>	<u>Unit</u>
HE 03.06(ad)	<u>Remove rust and paint kiosks</u>	
	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.	
	<u>Item</u>	<u>Unit</u>
HE 03.06(ae)	<u>Label kiosks</u>	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.	
	<u>Item</u>	<u>Unit</u>
HE 03.06(af)	<u>Supply and install padlocks</u>	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".	
	<u>Item</u>	<u>Unit</u>
HE 03.06(ag)	<u>Replace distribution meter kiosks.</u>	No.
	The unit of measurement shall be the number of distribution kiosks replaced.	
	The tendered rates shall include full compensation for the removal, the ordering, supply and installation of the new 6/4 way meter boxes complete with watt hour meters, circuit breakers, gland plate, labelling and concrete foot strip as specified. The distribution kiosks shall be similar or equal to Eprotech or Aluex.	

Consumer distribution kiosks

(a) General

The kiosks shall be of adequate size to accommodate the number of outgoing consumer circuits specified.

The kiosks shall have two sections, namely:

- (i) one section containing all incoming and outgoing switchgear and cables, and
- (ii) one section containing the consumer meters and circuit breakers.

(b) Fabrication

The kiosks shall be fabricated from 3CR12 stainless steel of minimum thickness 2,5 mm and shall be mounted on a channel iron steel base.

A metal framework, 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 rainwater and dust out of the kiosk.

The kiosk shall have a pitched roof that slopes downwards at the front and at the back with an overhang of at least 75 mm all round.

The kiosks shall be fitted with a door in the front and at the back of the kiosk. The maximum width per door shall be 600 mm. The doors shall provide free access to the equipment and shall provide a full view of all meters. The doors shall have well returning edges to fit into the channel of the door entry surrounds. Each door shall have three robust solid brass hinges each of length at least 100 mm. The hinges shall be completely concealed. Doors shall be fitted with lever locks equal or similar to the "Barker & Nelson" type. The locking mechanism shall facilitate three point latching at the top, side and bottom of the doors. In the case of double doors, the first door shall be locked with two slides on the inside onto the kiosk shell. The second door shall close over a lip on the first one. Nylon door restraints shall be provided. The fixing points of the restraints at the door and the canopy shall be reinforced. The doors shall be earthed bonded to the frame by means of a copper braided strap, tooth washers, bolts and nuts.

Ventilation louvers with approximate size 225 x 150 mm shall be provided on both sides of the kiosk. Each ventilation louver shall be covered on the inside with perforated plates with 2,5 mm² 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 framework, 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 than 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 of the "Klippon SAK" or equivalent 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 de-rusted and degreased and shall be prepared for painting in accordance with SANS 10066.

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.

(I) 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

<u>Item</u>	<u>Unit</u>
HE 03.06(ah) <u>Replace door hinges on meter and distribution kiosks.</u>	No.

The tendered rate shall include full compensation for the removal of damaged hinges, the supply, delivery and installation of new hinges.

<u>Item</u>	<u>Unit</u>
HE 038.06(ai) <u>Supply and install handles.</u> (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 04 AREA LIGHTING : TECHNICAL DETAILS

HE 04.01 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 and creosote poles of various lengths. Area lights are controlled by means of photocells and manual on/off switches.

HE 04.02 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 luminaires 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 04.03 Repair work: Measurement and payment

<u>Item</u>		<u>Unit</u>

(a)	<u>Relamp luminaire</u>	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.

<u>Item</u>		<u>Unit</u>

(b)	<u>Service luminaire</u>	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.

<u>Item</u>		<u>Unit</u>

(c)	<u>Service light distribution kiosk or DB</u>	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.)

<u>Item</u>		<u>Unit</u>

(d)	<u>Supply and install padlocks</u>	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".

<u>Item</u>		<u>Unit</u>

(e)	<u>Service area light pole</u>	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

<u>Item</u>		<u>Unit</u>

(f)	<u>Replace luminaire</u>	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.

<u>Item</u>	<u>Unit</u>
(g) <u>Replace pole</u>	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

HE 05 SECURITY FENCE LIGHTING: TECHNICAL DETAILS

HE 05.01 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 05.02 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 termite 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 05.03 Repair work: Measurement and payment

<u>Item</u>	<u>Unit</u>
(a) <u>Service security light pole</u>	No

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

The tendered rate shall include full compensation for the opening of pole box, visual inspections, corrosion protection, straightening of poles if necessary, treating of wooden poles with creosote and securing circuit breakers and terminations.

The contractor shall give a general report on the condition of the pole and equipment. The report should indicate if poles are rotten (wood poles), bent (steel poles), broken (wood, steel, concrete or fiberglass poles) or if the pole should be painted (steel). Strap all cable to pole.

<u>Item</u>	<u>Unit</u>
(b) <u>Re-lamp luminaire</u>	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.

<u>Item</u>	<u>Unit</u>
(c) <u>Service distribution kiosk</u>	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.)

<u>Item</u>	<u>Unit</u>
(d) <u>Replace luminaires</u>	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 Lascon L14ST 400W HPS Floodlight

<u>Item</u>	<u>Unit</u>
(e) <u>Service luminaire</u>	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 06 STREETLIGHTING: TECHNICAL DETAILS**HE 06.01 Installation description**

This section describes the electrical distribution network that will be repaired and maintained in terms of this contract.

Luminaires are suspended on creosote and fibreglass poles of various lengths. Street lights are controlled by means of photocells and manual on/off switches.

HE 06.02 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 06.03 Repair work: Measurement and payment

<u>Item</u>	<u>Unit</u>
(a) <u>Service streetlight pole</u>	No
The unit of measurement shall be the number of security light poles opened and serviced.	
The tendered rate shall include full compensation for the opening of pole cover, visual inspections, straightening of poles if necessary and securing circuit breakers and terminations.	
The contractor shall give a general report on the condition of the pole and equipment. The report should indicate if poles are rotten (wood poles), bent (steel poles), broken (wood, steel, concrete or fibreglass poles) or if the pole should be painted (steel). Strap all cable to pole.	

<u>Item</u>	<u>Unit</u>
(b) <u>Re-lamp luminaire</u>	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.	

<u>Item</u>	<u>Unit</u>
(c) <u>Service street Luminaire</u>	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	

<u>Item</u>	<u>Unit</u>

- (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.

<u>Item</u>	<u>Unit</u>

- (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.

<u>Item</u>	<u>Unit</u>

- (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.

<u>Item</u>	<u>Unit</u>

- (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 air duct and cable clamps on to the overhead line.

TECHNICAL SPECIFICATION

JC CONVENTIONAL FIRE FIGHTING EQUIPMENT

CONTENTS

JC 01	SCOPE
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JC 01 SCOPE

This specification covers the general repair and maintenance of the conventional firefighting equipment installations, which include the following:

- (a) Fire hydrants
- (b) Fire hose reels
- (c) Fire extinguishers.

The Ports of Entry consists of various facilities, as listed in additional specification **SS: Site Specific Inventory**, which forms part of this contract for fire fighting equipment.

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;	- Fire extinguishers- Assessment of fire rating
ICS 13.220.10	
CKS 532;	- Fire extinguishers, foams
ICS 13.220.10	
SANS 10105-1;	- The classification, use and control of firefighting.
ICS 13.220.10	equipment Part 1: Portable fire extinguishers
SANS 1322;	- Portable, non-refillable fire extinguishers (general purpose
ICS 13.220.10	type
SANS 1567;	- Fire extinguishers, portable, rechargeable, carbon dioxide
ICS 13.220.10	
SANS 1573;	- Portable rechargeable fire extinguishers – CO2 type
ICS 13.220.10	extinguishers
SANS 1475-1;	- Portable rechargeable fire extinguishers
ICS 13.220.10	
SANS 810;	- Portable rechargeable fire extinguishers – dry powder type
ICS 13.220.10	extinguishers
SANS 1522;	- Fire extinguishers, powders
ICS 13.220.10	

SANS 1571; ICS 13.220.10	- Transportable rechargeable fire extinguishers
SANS 889; ICS 13.220.10	- Portable, rechargeable fire extinguishers – water type extinguishers
SANS 10105-1; ICS 13.220.10	- Portable rechargeable fire extinguishers
SANS 1322; ICS 13.220.10, 23.020.30	- Portable, non- refillable fire extinguishers (general type purpose)
SANS 543; ICS 13.220.10	- Fire hose reels (with hose)
SANS 10105-2; ICS 13.220.10	- Fire hose reels
SANS 1128-2; ICS 13.220.10, 23.040.60	- Hose couplings, connectors and branch pipe and nozzle connections
SANS 1128-1; ICS 13.220.10, 23.060.99	- Components of underground and above-ground hydrant system
SANS 810; ICS 13.220.10	- Portable rechargeable fire extinguishers – dry powder type extinguishers
SANS 1475-1; ICS 13.220.10	- Portable rechargeable fire extinguishers
SANS 889; ICS 13.220.10	- Portable, rechargeable fire extinguishers – water type extinguishers
SANS 543; ICS 13.220.10	- Fire hose reels (with hose)
SANS 10105-2; ICS 13.220.10	- Fire hose reels
SANS 1475-2; ICS 13.220.10	- Fire hose reels
SANS 1456-5; ICS 13.220.10	- Oil-resistant and chemical-resistant fire hose
SANS 1456-2; ICS 13.220.10	- Percolating fire hose
SANS 1456-1; ICS 13.220.10	- General requirements and methods of test
SANS 1456-4; ICS 13.220.10	- Coated non-percolating fire hoses.
SANS 1456-3; ICS 13.220.10	- Uncoated non-percolating fire hoses
SANS 1128-2; ICS 13.220.10, 23.040.60	- Hose couplings, connectors and branch pipe and nozzle connections
SANS 1128-1; ICS 13.220.10, 23.060.99	- Components of underground and above-ground hydrant systems
SANS 1056-1; ICS 23.060.20	- Heavy duty valves (not fire-safe)
SANS 10400	- Application of the NBR

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 03 TRAINING OF OPERATORS FOR THE OPERATION OF THE INSTALLATION AND EQUIPMENT

The end user shall be trained, by the supplier of the firefighting equipment, to operate the individual firefighting equipment.

Firefighting training shall be done by a national accredited training institute (Fire Protection Association of South Africa).

JC 04 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. 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) 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 05 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 firefighting equipment shall be categorised under the following headings:

- (a) Fire hydrants
- (b) Fire hose reels
- (c) Fire extinguishers.

JC 05.02 REPAIR WORK OF EXISTING EQUIPMENT

The Contractor shall at the start of the repair and maintenance contract inspect, record and report on all the existing firefighting 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 time of 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 05.03 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 hand 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 of fire cupboard doors and locks.
- (i) Replacement of fire damaged, missing or shortfall fire signage to equipment.
- (j) Hydrants shall be labelled with identifying tags and details recorded.

JC 05.04

FIRE HOSE REELS

Repair work to the fire hose reel systems is detailed in the Particular Specification and shall include but not 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 05.05

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) CO₂ 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 CO₂ 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 06 MEASUREMENT AND PAYMENT

JC.01 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.

JC.02 SERVICING AND CLEANING OF FIRE HYDRANTS Unit: number

The tendered rate shall include full compensation for the servicing 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 stem 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.

JC.03 SERVICING AND CLEANING FIRE OF HOSE REELS Unit: number

The tendered rate shall include full compensation for the servicing 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 valves, 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.

JC.04 SERVICING, CLEANING AND RECHARGING OF FIRE EXTINGUISHERS Unit: number

The tendered rate shall include full compensation for the servicing 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, and the recharging of CO₂ extinguisher to capacity, servicing, resealing of CO₂ discharge mechanism, checking, servicing and repairing of activation mechanisms,

replacement of DCP 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.

JC.05

**COMPILATION OF FIRE PLAN FOR EACH OF THE
SERVICE BUILDINGS**.....

Unit: site

Provision of a "Fire Plan". The Contractor shall provide a Fire Plan (Emergency Evacuation Plan) indicating positions, and keeping up to date any changes of the equipment position, status and operation.

The unit of measurement shall be for each site (all service buildings) for which the fire plans were developed, printed and laminated. The tendered rate shall include full compensation for all drawings, printing, duplicating and laminating.

JC.06

FIRE FIGHTING TRAINING.....

Unit: number

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 national accredited training institute (Fire Protection Association of South Africa).

The unit of measurement shall be the number of training sessions conducted for a maximum of 20 attendees including all training material, transport and training-aids required.

MANANGA LAND PORT OF ENTRY: 36 MONTHS INFRASTRUCTURE MAINTENANCE AND REPAIRS OF BUILDING, CIVIL, MECHANICAL, ELECTRICAL AND INSTALLATIONS (APPOINTMENT OF A CONTRACTOR), BRAY, MAKGOBISTAD AND SKILPADSHEL LAND PORTS OF ENTRY LAND PORT OF ENTRY: 36 MONTHS INFRASTRUCTURE MAINTENANCE AND REPAIRS OF BUILDINGS, CIVIL, MECHANICAL, ELECTRICAL AND INSTALLATIONS (APPOINTMENT OF CONTRACTOR)

PART C3.3:

ADDITIONAL SPECIFICATIONS

PORTION 3: ADDITIONAL SPECIFICATIONS

ADDITIONAL SPECIFICATION

SA MAINTENANCE AND SERVICING

CONTENTS

SA 01	SCOPE
SA 02	MAINTENANCE APPROACH
SA 03	MAINTENANCE REQUIREMENTS
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SA 08	MANDATORY PERIODICAL SERVICES
SA 09	FREQUENT SERVICING OF INSTALLATIONS
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SA 01 SCOPE

Maintenance and Servicing of the specified systems, services and/or parts of buildings and infrastructure shall all be referred to as "Maintenance and Servicing of an Installation". Maintenance and statutory periodical servicing of all installations shall ensure reliable functioning and optimum service life thereof.

Monthly maintenance and servicing responsibilities for each installation, including all units and components as specified, shall commence with access to the site. Maintenance of an installation shall be performed in accordance with the Technical 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 as well as servicing of various installations is provided for in the Schedules of Quantities by means of monthly payment items and scheduled servicing items.

This Additional Specification covers maintenance and servicing requirements, development of a maintenance control plan (MCP), site maintenance administration, logging water- and electricity consumptions, maintenance performance measurement, as well as the items for measurement of the Contractor's service level and resulting payment.

SA 02 MAINTENANCE AND SERVICING APPROACH

The Contractor is expected to be represented on **site full time**. Contractor must allow for the appointment of a qualified project manager to be available on site on a full time basis for the duration of the contract.

SA 02.01

ROUTINE PREVENTATIVE MAINTENANCE VISITS

When submitting the maintenance control plan (MCP), the Contractor shall schedule “routine preventative maintenance visits” to the site. A “routine preventative maintenance visit” shall be scheduled for the intervals as indicated in the table below. The duration of a “routine preventative maintenance visit” will depend on the time required to complete all routine preventative maintenance, corrective maintenance as well as breakdowns logged during the course of the month as specified. However, a “routine preventative maintenance visit” may never be less than the minimum period specified in the table below. The Engineer will carry out a site inspection on any arbitrary day and measure the quality of maintenance and servicing. The Engineer will also inspect correction/repair of breakdowns that were logged with the Contractor during the course of the month.

INSTALLATION	FREQUENCY OF ROUTINE MAINTENANCE VISIT	MINIMUM DURATION OF ROUTINE MAINTENANCE VISIT
MANANGA LAND PORT OF ENTRY	5 days a week	8 hours

The Contractor should indicate to the Engineer within 21 days after the site handover the days of the week which he would visit the site for his scheduled routine maintenance visits including the various resources allocated for the different preventative maintenance actions, site keeping and cleaning services to be performed. Qualified electrician and plumber should be available for the above mentioned dates.

SA 02.02

EMERGENCY BREAKDOWN VISIT

Whenever an emergency breakdown is logged with the Contractor, an “emergency breakdown repair visit” shall be carried out by the Contractor to attend to the repair of the emergency breakdown within **12 hours** after it was logged with the Contractor.

Remuneration for the material and labour required to attend to repair of the emergency breakdown shall be deemed included in the payment item for maintenance of an installation based on a point system and measured monthly. Payment for the “emergency breakdown repair visit” will be measured separately in the schedule of quantities to cover the cost of the call-out, in terms of travel and accommodation cost, including travel time and any other cost associated with the call-out. No payment for the “emergency breakdown repair visit” shall be done if the call-out coincides with any of the monthly scheduled maintenance visits as listed in SA 02.01.

The Contractor will only be remunerated for *emergency breakdown repair visits* upon instruction of the Engineer or his representative.

Typical examples of “emergency repair breakdown visits” would be:

- A Breakdown of any standby power generator that prevents the standby power generator from operating at its capacity and meeting the demand.
- A Breakdown of any water supply pump or any other component of the water supply or bulk water installation that affects the water supply to such an extent that it cannot meet the demand
- A Breakdown of the water reticulation network or sewer reticulation network that affects water supply or sewer removal to such an extent that the service is disrupted to any site.

- A Breakdown of site electrical or building electrical that disrupts power supply to a building (including residential unit)
- A Breakdown of a geyser that prevents it from supplying hot water as per specification
- Any other Breakdown that can be regarded as having the potential to cause damage to equipment or property and is included in the scope of work to be maintained and serviced by the Contractor, as per specifications. The Engineer or his representative will be responsible for categorising a breakdown as an emergency.

SA 03 MAINTENANCE REQUIREMENTS

SA 03.01 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall maintain and service the installations for the 36-month Contract period.

Maintenance implies and shall include monthly routine preventative maintenance, corrective maintenance, as well as breakdown maintenance on all components of the specified installations.

The maintenance control plan (MCP) will be developed by the Contractor at the start of the contract, to schedule the frequency of routine inspections and format of reports. The Contractor shall carry out inspections on the equipment as detailed in the Specifications and the maintenance control plan. Each inspection, test or breakdown shall be recorded in an approved format and listed in a monthly report (part of the maintenance control plan).

The Contractor shall ensure through training that the operating and maintenance personnel are conversant with the instructions and procedures for operating and maintaining the various installations.

The specifications, maintenance control plan, and (where applicable) the Operating and Maintenance Manuals, shall be used as a basis for routine preventative maintenance.

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 06.02 at the Contractor's cost, *except* in the event of replacement being labelled as exceeding liability as specified in of the Project Specific Conditions of Contract, in which case the Department of Public Works will bear part of the costs or in the event of a damaged breakdown.

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 monthly report.

SA 03.02 CONDITIONS FOR EXCEEDING THE CONTRACTOR'S LIABILITY DUE TO DAMAGE BREAKDOWNS

In the event of damage caused to the installation or any part thereof, the repair and/or replacing of necessary parts of the damaged installation shall be performed by the Contractor. Damage shall be defined for the purpose of this clause as being any damage caused on purpose or through negligence by the User Client's employees, suppliers, subcontractors, etc for any reason whatsoever. For the purpose of this clause, damage and vandalism shall have the same meaning. Where repair work is necessitated as a result of damage caused by User Clients or their associates, the Contractor will be requested to:

- (a) perform work, using tendered rates for the supply, delivery and installation of material forming part of the corrective maintenance schedule, within the

maximum down-time allowed for damage, where the Engineer rules that the damage has been caused maliciously;

- (b) submit one (1) quotation for repair and/or replacement of the damaged unit, where tendered rates are not available and where the Engineer rules that the damage has been caused maliciously;
- (c) perform the work on receipt of an order from the Engineer, within the time offered as part of the quotation, and
- (d) notify the Engineer well in advance of completion of the repair work in order to enable inspection.

No additional call-out cost, travelling or accommodation shall be paid to the contractor, and CPA shall be applicable to repair rates. Even though preventative maintenance of *building structural* is not included in the monthly maintenance points, instruction can be given to the contractor to repair building structural elements damaged under this item. The contractor shall be expected to do the repair work during his routine maintenance inspection, and billed corrective maintenance items shall be used to pay for the cost thereof. The responsibility of determining whether damage to the installation was caused maliciously by people other than the Contractor shall rest with the Engineer or his representative. Damage caused by the employees, suppliers, subcontractors, etc of the Contractor, shall be repaired by the Contractor at his own cost.

SA 03.03

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** or 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 of 7,5% or shall be taken equal to the contractor's average mark-up for related tendered items and shall be applicable to the total cost (VAT excluded) of repair work by outside companies;
 - (f) 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 Engineer. 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 03.04

COMPONENTS INCLUDED IN MAINTENANCE AND SERVICING SCOPE

The following main sections with its subsections as set out in the Specifications where applicable will each be deemed "an installation". Maintenance and servicing, as specified, will be applicable to the Buildings (Wet Services and Building Electrical), Roads, Stormwater, Water distribution, Sewer Networks, Standby Power generation, External Lighting, Water Purification Works, Wastewater Treatment Works, HVAC Installations and Fire fighting equipment at the following Ports of Entry:

■ MANANGA LAND PORT OF ENTRY

Note that Building structural and building related installations are excluded from the maintenance portion of the contract, *however, ad-hoc repair work of damaged items can be instructed for by the Engineer and are to be performed during the contractor's routine preventative maintenance visit at rates as scheduled in the corrective maintenance section of the bills of quantities (CPA applicable) – No additional fixed or time related Preliminary and General Charges will be applicable to such repair work.* Furthermore, breakdowns can be logged for items requiring attention, which will also be attended to by the contractor.

In general, additional corrective maintenance work may be instructed for by the Engineer or his representative and are to be performed during the contractor's routine preventative maintenance visit *at rates as scheduled in the corrective maintenance*

section of the bills of quantities (CPA applicable) – No *additional* fixed or time related Preliminary and General Charges will be applicable to such work.

The Engineer may at any time inspect any part of the entire installation. During Maintenance and Servicing work, the Engineer shall at his discretion order special tests to be carried out on installations to verify the satisfactory functional condition of the installation.

SA 03.05 COMMENCEMENT OF MAINTENANCE PERIOD

Maintenance responsibilities for an installation shall include maintenance of all individual units, equipment or components shall commence immediately at the start of the Contract.

SA 03.06 PREVENTATIVE MAINTENANCE: DEFINITION

This entails the rendering of services and servicing of equipment according to a predetermined maintenance control plan to:

- (a) replace and service components of equipment, units or parts thereof for each installation at prescheduled moments regardless of condition;
- (b) readjust, reset, clean, corrosion protect all components of equipment, units or parts thereof for each installation, and
- (c) all implied actions to maintain installations in a perfect functional condition.

Routine preventative maintenance shall be aimed at minimisation of breakdowns.

SA 03.07 CORRECTIVE MAINTENANCE: DEFINITION

This entails regular observation of the equipment, identifying pending breakdowns, maladjustment or anomalies of equipment, units or parts of installations and subsequent action to restore installations to the perfect functional condition as specified.

SA 03.08 BREAKDOWN MAINTENANCE: DEFINITION

This entails repair and/or replacement of defective equipment, units or parts of installations following a breakdown that leaves the installation inoperable or unsafe, and subsequent action to restore installations to the perfect functional condition as specified, within the maximum down-time allowed.

SA 03.09 SERVICING

This entails mandatory periodical services included for payment in the bills of quantities which shall be measured separately for payment, and performed on the intervals as instructed for by the Engineer.

SA 03.10 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 monthly reports shall be filed, together with information regarding repairs exceeding the Contractor's liability, as set out in SA 03.02 and SA 03.03.

Site maintenance records shall be submitted at each monthly meeting.

SA 03.11 SUPPLY OF LABOUR, EQUIPMENT AND MATERIAL

SA 03.11.01 Labour

Competent personnel that have been trained by the Contractor shall execute all maintenance and servicing work.

SA 03.11.02 Equipment

All tools and equipment required for maintenance and servicing work shall be supplied by the Contractor at his cost.

SA 03.11.03 Material

All material, spare parts, components, equipment and appurtenances necessary for the complete maintenance and servicing of each installation shall be supplied and installed by the Contractor at his cost, to a maximum value per part/subassembly as specified in the Project Specific Conditions of Contract for exceeding Contractor's Liability.

SA 04 MAINTENANCE CONTROL

SA 04.01 SCOPE

Maintenance quality control shall be the responsibility of the Contractor. The Contractor shall introduce a **maintenance control plan** to ensure that preventative, corrective and breakdown maintenance, site keeping and cleaning and servicing are performed as described in the Specifications.

SA 04.02 MAINTENANCE CONTROL PLAN

The maintenance control plan 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.

The maintenance control plan shall at least contain the following:

- (a) A summary of the maintenance and servicing work to be carried out under the contract.
- (b) Details of how the Contractor intends to carry out the various types of maintenance and servicing work especially breakdown maintenance should breakdowns occur.
- (c) Programme of preventative maintenance actions, site keeping and cleaning operations on a daily basis.
- (d) Resources allocated for the various actions as per item (c) above (incorporating possible staff shortages during public holidays and festive periods.
- (e) Details of how the call centre operates, as specified below as well as statistics of breakdowns, leakages, blockages, etc. available from the call centre for the

installation shall be taken into account in compiling the contents of the maintenance control plan.

- (f) A list of organisations and persons directly involved with the Contract or those whose requirements have to be taken into account during the 36-month 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.
- (g) Reports to be submitted after every routine inspection (all reports, checklist, breakdowns records, score card results, consumption sheets, etc. for each system of an installation shall be kept on the site in a hard cover file)
- (h) Procedures to address complaints and logged breakdowns;
- (i) Updated key plan with numbers and locations of manholes, fire fighting equipment, etc.
- (j) Monthly reports, summarising all inspections, together with inspection data such as nature of test, names of persons carrying out tests and inspection results. Detail of services, corrective maintenance actions and replacements, together with testing of equipment shall also be reflected in this report.

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.

The maintenance control plan shall be upgraded when its contents are no longer representative of the actual conditions.

SA 05 COMMUNICATION

The maintenance control plan (Clause SA 04) 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 line, fax line and a cellular telephone connection to ensure that he can be reached at any time (24 hours per day, 365 days a year).
- (b) The Contractor shall primarily be responsible for determining the items requiring preventative, corrective, breakdown maintenance and servicing and shall communicate this information directly to his maintenance workforce.
- (c) Should the Engineer suspect that preventative, corrective or breakdown maintenance or servicing 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 06.02.
- (e) All complaints of the User Client shall be reported to the Engineer via the call centre, as set out in the maintenance control plan, and the Engineer shall issue instructions to the Contractor. After the Contractor has attended to the complaint, he will notify the Engineer or his representative in writing (faxed BS3 form), and the Engineer will provide feedback to the call centre.

The call centre logs the details of the Engineer's call and provides feedback to the complainant.

SA 06 PERFORMANCE MEASUREMENT

The Contractor's performance shall be measured against the following parameters:

SA 06.01 SPECIAL TESTING OF AN INSTALLATION

The Engineer may at any time inspect any part of the entire installation. During Maintenance and Servicing work, the Engineer shall at his discretion order special tests to be carried out on installations to verify the satisfactory functional condition of the installation.

The Contractor shall provide all equipment, tools and instruments required for testing.

SA 06.02 MAXIMUM MAINTENANCE DOWN-TIME

After a complaint has been logged and forwarded to the Contractor, the Contractor shall be expected to minimise the maintenance down-time until the system component is fully operational to the satisfaction of the Engineer. Should the Contractor not respond within the maximum down-time, the Engineer may arrange, at the cost of the Contractor, for the necessary repair work to be done by others.

Should the actual down-time exceed the maximum down-time the Contractor shall be liable to a payment reduction for the difference between actual down-time and maximum down-time. This is reflected in the table below:

REQUIRED MAINTENANCE	MAXIMUM DOWN-TIME ALLOWED	PAYMENT REDUCTION IF EXCEEDED
Emergency Breakdown	12 Hours	R 150/hour
Ordinary Breakdown	4 Days	R 200/day
Malicious damage	7 Days	R 200/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.

"Emergency breakdown" shall imply any breakdown repair work required to rectify a component or unit of the installation as specified under SA.

Emergency breakdowns shall be repaired within 12 hours after it was logged with the Contractor. The Contractor will be remunerated for the call-out by means of a re-measurable payment item as measured in the schedule of quantities ***only if the breakdown does not coincide with a scheduled routine maintenance visit.*** Material and labour cost is deemed to be included in the payment item for "maintenance of an installation" that is based on a point system and measured monthly.

"Ordinary breakdown" shall imply all breakdown repair work required other than emergency breakdowns. Ordinary breakdowns shall be repaired during the following "routine preventative maintenance site visit". Ordinary breakdowns will be logged with the Contractor on a continuous basis, and it will be the responsibility of the Contractor to attend to these breakdowns with the following "routine preventative maintenance site visit", and report back to the Engineer as soon as the breakdowns have been attended to.

SA 06.03 PERFORMANCE-BASED PAYMENT

Remuneration for all *time-related* preliminary and general charges shall be measured for payment in the bills of quantity on a monthly basis.

SA 06.03.01 Score-card

The Engineer shall inspect each installation monthly on any arbitrary day of the month or with the maintenance control meeting (held quarterly). The Engineer shall use a score-card to measure the quality of routine preventative and corrective maintenance 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. The Contractor shall always have the opportunity to score the maximum points, provided that his routine preventative and corrective maintenance work comply with the Specifications. Statutory periodical services as measured in the bills of quantity shall not form part of the score-card payment items (and shall be paid for separately).

SA 06.03.02 Performance indicators

Performance indicators shall be selected to measure the Contractor's service level of routine 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.

The Contractor shall aim to perform satisfactorily on at least ten performance indicators. The Contractor shall have knowledge of all ten selected performance indicators. All indicators shall be selected from the scope of his normal routine preventative and corrective maintenance work and shall be based on the maintenance control plan, specifications and operating and maintenance manuals. The work shall either be satisfactory, or unsatisfactory, and the Contractor shall score 1 or zero 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. Should the contractor not select five performance indicators, the Engineer shall reserve the right to provide the Contractor's five performance indicators.

SA 06.03.03 Satisfactory performance

The Engineer or his representative shall inspect the site on any 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 routine 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 07 **PREVENTATIVE MAINTENANCE ACTIONS**

The preventative maintenance actions for the various installations for preventative maintenance are described in this section. Remuneration for maintenance of the infrastructure shall be deemed included in the tendered monthly payment for the respective installations

The said maintenance and servicing 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.

The maintenance and servicing 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 forming part of the Maintenance Control Plan.

The Port of Entry consists of various facilities, as listed in additional specification SS: Site Specific Inventory. The preventative actions required are divided into maintenance installations and grouped as follow:

1. Plumbing and Drainage

- SA 07.01 – Plumbing and Drainage Installations

2. Electrical Installations

- SA 07.02 – Electrical Installations

3. Fencing, Refuse Removal and Pest Control

- SA 07.03 – Fencing
- SA 07.04 – Refuse removal and Pest Control

4. Cleaning and Site Keeping

- SA 07.05 – Cleaning and Site Keeping

5. External Water and Sewer Networks

- SA 07.06 – Water Distribution Networks
- SA 07.07 – Water Reservoirs and Pressed Steel Tanks
- SA 07.08 – Borehole Pump Systems
- SA 07.09 – Water Pump Systems
- SA 07.10 – Sewerage Networks
- SA 07.11 – Wastewater Pump Systems

6. Roads and Stormwater Drainage

- SA 07.12 – Roads
- SA 07.13 – Stormwater Drainage

7. External Lighting and Standby Power

- SA 07.14 – External Lighting
- SA 07.15 – Low Voltage Distribution Network
- SA 07.16 – Standby Power Systems

8. Heating, Ventilation and Air-Conditioning Systems

- SA 07.17 – Heating, Ventilation and Air-Conditioning Systems

9. Fire Fighting Equipment

- SA 07.18 – Fire Fighting Equipment

SA 07.01

PLUMBING AND DRAINAGE INSTALLATIONS

RAINWATER DISPOSAL SYSTEM

NO	PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Clean out and clear all rainwater gutters and full bores	Bi-monthly
2	Clean out and clear all catch pits, channel drains and floor outlets	Bi-monthly
3	Clean and unblock all drain pipes	Bi-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	Four-monthly
7	Check and inspect manhole covers and frames for damages or missing	Monthly

SOIL AND WASTEWATER DRAINAGE SYSTEM

NO	PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Check, inspect and clean out all gullies	Monthly
2	Replace broken or missing gully gratings	Monthly
3	Check, inspect, repair or replace all manhole covers and frames	Bi-monthly
4	Check, inspect and repair manhole benching	Four-monthly
5	Check, inspect, repair or replace all inspection eyes, end caps and cleaning eye covers	Monthly
6	Check, inspect, repair or replace all bracketing systems	Four-monthly
7	Check, inspect, report and unblock any blockage that occurs	Monthly
8	Check, inspect, service, repair/replace all vacuum and two-way vents	Four-monthly

DOMESTIC WATER DISTRIBUTION AND RETICULATION SYSTEMS

NO	PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Check, inspect, report and repair leaks	Monthly
2	Replace all valve gaskets, gland packings and seals	Annually
3	Check, inspect, service, repair and readjust all pressure-reducing valves	Annually
4	Check, inspect and test operation of all valves on site	Four-monthly
5	Clean out all strainers	Monthly
6	Check, inspect, service test and repair/replace all safety and expansion release valves	Six-monthly
7	Check, inspect, repair or replace all bracketing systems	Four-monthly
8	Check, inspect, service, repair/replace all air release valves and vacuum breakers	Four-monthly

9	Check, service, repair or replace all ball float valves	Four-monthly
10	Check, inspect, test, service, repair all geyser installations	Four-monthly
11	Check, inspect, test, service and repair all non-return valves	Four-monthly

SANITARY AND BRASSWARE EQUIPMENT

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

FIRE WATER PIPED RETICULATION NETWORKS

NO	PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Report any failures/breakage of fire fighting equipment to the Engineer	Monthly
2	Replace all valve gaskets, gland packings and seals	Annually
3	Check, inspect, service, repair/replace all non-return valves and backflow preventers	Four-monthly
4	Check, inspect, report and repair all leaks	Monthly
5	Inspect, service, readjust and calibrate all pressure gauges	Four-monthly
6	Paintwork repairs to piping, fittings and equipment	Annually
7	Check, inspect, repair or replace all bracketing systems	Four-monthly

SA 07.02 ELECTRICAL INSTALLATIONS

SA 07.02.01 Monthly maintenance

Check operation of protective and monitoring devices.

Verify operation of switching elements and meters.

Check lamp operation

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

Inspect and repair the following:

- any visible damage to the installation
- setting of protective and monitoring devices

Ensure upkeep of the labelling of the distribution board, equipment, cabling and wiring

Ensure presence of labelling on face plates or bodies of light switches, socket outlets and isolators.

SA 07.02.02 Annual maintenance

Service all luminaires, distribution boards, socket outlets, isolators, light switches, etc.

Witnessed testing of all earth leakage protection units on all socket outlet units.

Visually inspect the following and repair if required:

- Connection of cables and conductors including earthing and bonding.
- Presence of appropriate devices for isolation and switching.
- Correct connection of socket outlets, light switches, isolators, lamp holders, etc.

SA 07.03 FENCING

Maintenance shall include replacing of components, fixing defects, tightening, redressing or any other actions or rectifying measures necessary for complete operation of the fencing installation. This shall include keeping the installation free of litter and any growth or any other element interfering with the function or integrity of the system, 0,5m wide on each side of the fence.

SA 07.03.01 Monthly maintenance

- Clearing the fence route.
- Inspect and repair any visible damages to the installation.
- Corrosion protection on fencing, gates and tubular posts.
- Inspect fence for tightness to straining wire and redress of repair of repair of necessary.
- Inspect tension of straining wires and repair if necessary.

SA 07.04 REFUSE REMOVAL AND PEST CONTROL

The whole of the site within the perimeter fences of the Ports of Entry (as reflected in Specification SS: Site Specific Information) shall be kept free of litter, rubble and other solid waste. Litter and rubble (solid waste) shall be collected, stored by the Contractor and removed from the site as frequently as necessary

Removal of household solid waste to the municipal dump site will still be carried out by the Contractor. The cleanliness of the site will be the sole responsibility of the Contractor.

Garden refuse may be amongst the litter and rubble to be collected and disposed off by the Contractor.

The tendered monthly payment for maintenance and site keeping shall be deemed to include to *continuously* collecting litter and rubble across the entire site, placing it in a central solid waste container (skip) and removing it off-site to a formal solid waste facility.

NO	ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Cleaning out of all waste bins in public areas	Daily
2	Cleaning out of all waste bins at residential units	Weekly
3	Collect litter, rubble and other waste across the entire site within the perimeter fences of the Port of Entry and place in central solid waste container (skip)	Continuously
4	Re-fill all rodent bait stations	Monthly
5	Internal pest, termite and rodent control	Monthly
6	External pest, termite and rodent control	Monthly

SA 07.05 CLEANING AND SITE KEEPING

The contractor shall further be responsible for maintaining the grass cutting equipment in a perfect working condition.

SA 07.05.01 Site Keeping

Site Keeping activities will include providing all equipment necessary for site keeping, such as lawn movers, brush-cutters, rakes, shovels, etc. and shall be deemed included in the monthly maintenance cost for Site keeping and Cleaning.

NO	ACTION	FREQUENCY
1	Cleaning out of <i>and supply</i> of black waste bin bags to all waste bins in public areas	Daily
2	Cleaning out of all waste bins in residential areas	Weekly
3	Emptying the solid waste skip and removal of waste off-site to approved dumping site	At least Monthly (when required)
4	Watering of plants, shrubs, grass and trees (<i>only</i> if water is readily available and instructed for by Engineer)	Daily

5	Removal of weeds	Weekly
6	Clearing of weeds and grass along the edges of paved areas.	Weekly
7	Cutting of grass. Lawns: <i>No grass to exceed the length of 40mm.</i> Open areas: <i>No grass to exceed the length of 100mm.</i>	At least Monthly (when required)
8	Trimming of dense shrubs	2 Monthly
9	Removal of undesirable shrubs	Quarterly
10	Trimming of trees where branches cause obstruction	Quarterly
11	Collecting of litter and foreign objects	Continuous

SA 07.05.02 Cleaning tasks for Offices, Ablutions and Support Facilities

The Contractor shall be responsible for cleaning ablution facilities as frequently as necessary to maintain them in a clean and healthy condition. The actions outlined below serve only as a benchmark for the cleaning and maintaining of the facilities.

Cleaning activities will include providing all cleaning agents and equipment necessary for cleaning. Consumables such as toilet paper, sanitizers, batteries for sanitizers, bin liners for she-bins, paper towels and hand-wash soap will be replaced by the Contractor as and when necessary and shall be deemed included in the monthly maintenance cost for Site keeping and Cleaning. It can be assumed that toilet paper will be consumed at 3 rolls per toilet per day (single ply), and hand washing soap at 2 litres per soap dispenser per month.

CLEANING TASKS FOR OFFICE AND SUPPORT FACILITIES

	ACTION	FREQUENCY
1	Disinfect and cleaning of floors in public passage areas and open plan offices	Daily (before the opening of the port of entry)
2	Disinfect and cleaning of counter tops and under counter shelves	Daily (before the opening of the port of entry)
3	Emptying of waste baskets in offices and service buildings	Daily
4	Disinfect and cleaning of office floors / Vacuum of carpets	Weekly
5	Washing of windows and dusting of window sills and ledges	Weekly
6	Clean and polish all fittings	Weekly
7	Washing of walls	Monthly
8	Dusting of interior of the building to remove dust and spider webs	Monthly

CLEANING TASKS FOR ABLUTION FACILITIES

	ACTION	FREQUENCY
1	Disinfecting, cleaning and ensuring that the ablution facilities are in a pristine sanitary condition at all times	Continuous 7 days a week
2	Disinfect, washing and cleaning of floors	Continuous 7 days a week
3	Empty and clean all waste receptacles	Continuous Daily
4	Clean and sanitise all bowls, basins and urinals	Continuous Daily
5	Clean, sanitise and polish all fittings and mirrors	Continuous Daily
6	Sanitising and cleaning out of the bins	Continuous Daily
7	Washing of windows and dusting of window sills, ledges, pipes and fittings	Weekly
8	Disinfecting and washing of walls	Weekly
9	Dusting of interior of the building to remove dust and spider webs	Weekly

SA 07.06

WATER DISTRIBUTION NETWORKS

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Water Audit	Monthly
2	Clean out all strainers	Monthly
3	Check, inspect, repair or replace all bracketing systems	Four-monthly
4	Paint repairs to piping, fittings and equipment	Annually

CLEANING OF EXISTING PIPELINES

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Remove silt, debris and loose lime deposits from within pipelines where required by scouring	Annually
2	Do general cleaning in areas where leakage has occurred	Six-monthly

FITTINGS AND STRUCTURES

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	Four-monthly

	release valves and vacuum breakers	
6	Check, service, repair or replace all ball float valves	Six-monthly
7	Clean out structures of debris	Four-monthly
8	Check, inspect, test, service and repair/replace all non-return valves	Four-monthly

FIRE WATER PIPED RETICULATION STRUCTURES

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Report any failures/breakage of fire fighting equipment to the Engineer	Monthly
2	Replace all valve gaskets, gland packings and seals	Annually
3	Clean out water storage tanks and reseal/repair if necessary	Annually
4	Check, inspect, service, repair/replace all non-return valves and backflow presenters	Four-monthly
5	Check, inspect, report and repair all leaks/replace rotten pipes where required	Monthly
6	Inspect, service, readjust and calibrate all pressure gauges	Four-monthly
7	Paint repairs to piping, fittings and equipment	Annually
8	Check, inspect, repair or replace all bracketing systems	Four-monthly

SA 07.07

WATER RESERVOIRS AND PRESSED STEEL TANKS

NO	ROUTINE PREVENTATIVE MAINTENANCE OF PRESSED STEEL TANKS AND ANCILLARIES	MAINTENANCE FREQUENCY
1	Check for and repair all leaks. Repair leaks.	Monthly
2	Corrosion protection.	Annually
3	Clean and sterilise pressed steel tank.	Annually

SA 07.08

BOREHOLE PUMP SYSTEMS

All borehole pumping equipment and systems shall be serviced and maintained to keep it in perfect functional condition.

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

SA 07.09 WATER PUMP SYSTEMS

Maintenance shall include all repairs, replacing of components or materials, routine setting or any other actions necessary to ensure a perfect functional condition.

NO	ROUTINE PREVENTATIVE MAINTENANCE OF CLEAR-WATER PUMP SYSTEMS	MAINTENANCE FREQUENCY
1	Check, service, repair and clean all pumps	Six-monthly
2	Corrosion protect pumps, motors and surface piping	As required
3	Check, inspect, report and repair all leaks	Monthly
4	Check and lubricate moving parts	Four-monthly

SA 07.10 SEWERAGE NETWORKS**SA 07.10.01 Sewerage Network System**

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Check, inspect, repair or replace all manhole covers and frames and builder's work to manholes	Four-monthly
2	Check, inspect and repair manhole benching.	Four-monthly
3	Check, inspect, repair or replace all inspection eye, end caps and cleaning eye covers	Four-monthly
4	Check, inspect, report and unblock any blockage that occurs	Monthly
5	Systematically mechanical cleaning of all sewer manholes and unblocking of all sewer lines	Monthly
6	Check, inspect, repair/replace sewer pipes where necessary to maintain good working condition at all times	Four-monthly

SA 07.10.02 Sewerage Retention Dams (Maturation Ponds)**DAILY**

- Rake the bar screen at inlet works (if installed).
- Test outflow water quality

MONTHLY

- Cut grass and remove weeds within fence
- Remove foreign objects from dams
- Cut grass and remove weeds from dam edges

SA 07.11 WASTEWATER PUMP SYSTEMS

NO	ROUTINE PREVENTATIVE MAINTENANCE OF WASTEWATER PUMP SYSTEMS	MAINTENANCE FREQUENCY
1	Check and clean all pumps	Monthly
2	Corrosion protect pumps, motors and surface piping	Annually
3	Check, inspect, report and repair all leaks	Monthly
4	Check and lubricate moving parts	Four-monthly

SA 07.12 ROADS

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

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Check, inspect, repair all surface failures	Two-monthly
2	Check, inspect, repair all pavement failures	Six-monthly
3	Inspect and repair gravel shoulders	Six-monthly
4	Check, inspect, repair road signs	Six-monthly
5	Check, inspect, repair, repaint, replace road markings	Annually
6	Remove loose material from the surface of parking areas by means of mechanical brooming	Monthly

SA 07.13 STORMWATER DRAINAGE

All components of the stormwater drainage infrastructure, including surface as well as underground components, shall be maintained during the 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.

NO	ROUTINE PREVENTATIVE MAINTENANCE ITEM DESCRIPTION	MAINTENANCE FREQUENCY
1	Check, inspect, repair or replace all manhole or inlet covers, grids and frames and builder's work to manholes.	Four-monthly
2	Check, inspect and repair manhole and inlet benching.	Four-monthly
3	Check, inspect, report and unblock any blockage that occurs.	Monthly
4	Clean all vegetation and debris accumulated in inlets and stormwater pipes / culverts.	Monthly

SA 07.14 EXTERNAL LIGHTING SYSTEMS

Maintenance shall include all repairs, replacing of components or materials, routine setting or any other actions necessary to ensure a perfect functional condition. The following shall be used as guidelines to ensure effective maintenance:

SA 07.14.01 Area LightingMonthly Maintenance

- Verify operation of switching element
- Check lamps
- Check mast door for weatherproof seal
- Check earth connection at footing, record value

Annual Maintenance

- Service all luminaires
- Measure earth resistance of electrode
- Measure earth resistance of trench earth
- Record values in record book

SA 07.14.02 Security LightingMonthly Maintenance

- Verify operation of switching element.
- Check lamps.
- Check that all pole covers are secure.
- Visually check distribution kiosk.

Annual Maintenance

- Measure phase voltages and line currents in distribution kiosk or local distribution board.
- Do vermin protection.
- Service all luminaires.
- Paint timber poles with creosote.

SA 07.14.03 Street LightingMonthly Maintenance

- Verify operation of switching element.
- Check lamps.
- Check that all pole covers are secure.
- Visually check distribution kiosk.

Annual Maintenance

- Measure phase voltages and line currents in distribution kiosk.
- Do vermin protection.
- Service all luminaries and distribution kiosks.
- Paint timber poles with creosote.

SA 07.15 LOW VOLTAGE RETICULATION**SA 07.15.01 Monthly maintenance**

- Verify operation of volt and ammeters.
- Check that access covers are secure.
- Visually check distribution board.
- Check all connections.
- Check operation of switching timers.
- Inspect and secure access doors and covers.
- Inspect distribution kiosks.
- Inspect overhead conductors, insulators and poles.
- Monthly electricity meter readings

SA 07.15.02 Annual maintenance

- Service all low voltage boards.
- Measure phase voltages and line currents in low voltage distribution board.
- Record values in record book and Maintenance Control Plan.
- Service all distribution and metering kiosks
- Service overhead distribution system.

SA 07.16 STANDBY POWER SYSTEMS**SA 07.16.01 Monthly maintenance**

1. 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.
2. 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).
3. 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
 4. Alternator shall be checked for accumulation of dust on the regulator and for any loose components.
 5. Test run shall be undertaken, if possible on load, and volt, ampere and frequency readings recorded.
 6. Alternator shall be cleaned and switched back into 'auto' mode.
 7. Complete Standby Generator monthly log sheets
 8. Record running hours, diesel consumption etc in the following prescribed format:

	Previous Measurement	This Measurement	Consumption	Average per day
Date:	01-Apr-24	03-May-24	Total	32 days
Diesel Tank Meter Reading (litres)	26542.2	30546.2	(liters) 4004.0	(ltrs/day) 125.1
<u>Running Hours:</u>			(hours)	(hrs/day)
Generator 1 (hrs)	1245.6	1604.2	358.6	11.2
Generator 2 (hrs)	2535.6	2927.6	392.0	12.3
Total Generator Hours (hrs)			750.6	
Average Diesel consumption			5.3	ltrs/hr

SA 07.16.02 Annual maintenance

The following activities shall be executed in addition to the monthly maintenance work after every twelve months.

1. Drain an oil sample and submit for analysis to establish need for an oil change. Fix test report in Record book.
2. Record output parameters while on load.
3. Record running hours.
4. Replace oil and fuel filters (if not replaced during 1 year as part of 200hrs service)
5. The cooling system shall be drained, flushed and refilled with water and prescribed water conditioner.

SA 07.17 HEATING, VENTILATION AND AIR-CONDITIONING SYSTEMS**SA 07.17.01 Monthly maintenance**

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 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 cooling and heating cycle

SA 07.17.02 Bi-Annual maintenance (6-monthly)

REFERENCE NUMBER	ACTION
S-1	Clean filters, replace if required
S-2	Inspect air intake and discharge for blockages
S-3	Check all refrigerant, drainage pipes for damages and leaks
S-4	Check sight-glass: clear or flash gas
S-5	Carry out visual inspection of condenser coil for blockages and correct operation of fans
S-6	Carry out visual inspection of evaporator coil for blockages and correct operation of supply fan
S-7	Check enclosure for damages
S-8	Check electric motor running temperatures
S-9	Check electric connections for tightness
S-10	Test thermostat and control operation
S-11	Clean condensate tray and test drainage for proper operation
S-12	Check filter/dryer
S-13	Check superheat and functioning of expansion valve
S-14	Check operation of HP and LP switch
S-15	Check operation of controllers
S-16	De-rust, neutralize and touch up paint work
S-17	Check cooling and heating cycle
S-18	Clean evaporator and condenser coil chemically
S-19	Clean all filter frames and seals
S-20	Check fan motor and compressor current
S-21	Check and test overload settings
S-22	Lubricate all bearings

SA 07.18 FIRE FIGHTING EQUIPMENT

The routine preventative 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.

SA 07.18.01 Fire Hydrants: Monthly Maintenance

- Check hydrant valve seal.
- Check right hand wheel for tightness.
- Check valve stem and or top for damage.
- Check valve stem seal and readjust.
- Check operation of quick couplers.
- Check operation (opening and closing movement of valve).
- Check water pressure and flow.
- Check stand pipe for rigidness and leaks.
- Log maintenance schedule.
- Report defects for processing and repair.

SA 07.18.02 Fire Hose Reels: Monthly Maintenance

- Check drain seal.
- Roll down hose and check for cracks or perishing.
- Check operation of PWD type nozzle.
- Check operation of drain.
- Check operation of fire hose reel valve.
- Lubricate moving parts of drum.
- Check pressure and flow of fire hose reel.
- Check piping for leaks and damages.
- Log maintenance schedules.
- Report defects for processing and repair.

SA 07.18.03 Fire Extinguishers: Monthly Maintenance

- Check charge of the extinguisher.
- Check the condition of the discharge.
- Check the mechanism condition of the discharge hose.
- Update the log entry on the extinguisher.
- Log maintenance schedule.
- Report defects for processing and repair.
- DCP extinguishers: Check charge and replace powder at prescribed intervals.
- CO₂ extinguisher: Check charge.

SA 07.18.04 Lister Engine: Monthly Maintenance

- Visual inspected and report on complete diesel engine as per manufacturers specifications.
- Check and log batteries
- Check oil level
- Check radiator water level
- Test engine for 30 minutes

- Check and log fuel, oil pressure and hest gauge reading
- Check and log rev counter reading
- Check and log hour meter reading
- Listen for unusual noises and vibrations

SA 07.18.05 Lister Engine: Annual Maintenance

- Visual inspected and report on complete diesel engine as per manufactures specifications.
- Check and log batteries
- Check oil level
- Check radiator water level
- Test engine for 30 minutes
- Check and log fuel, oil pressure and hest gauge reading
- Check and log rev counter reading
- Check and log hour meter reading
- Replace oil and oil filter
- Replace diesel filter
- Replace air filter
- Drain flush and refill the cooling system
- Listen for unusual noises and vibration
- Check the radiator fins and radiator fan blades for damage
- Replace the fan drive belt
- Check all external nuts, bolts and unions for tightness.
- Check hose conditions and connections

SA 07.18.06 Centrifugal Pump

Monthly maintenance responsibilities:

- Visually inspect and report on complete suction pump
- Check and inspect for leaks
- Listen for unusual noises and vibrations

Bi-Annual and Annual maintenance responsibilities:

- Check alignment of pump every 6 months or 1000 hours which ever comes first
- Change the oil every 5000 hours or 12 months which ever comes first
- On grease type bearings, grease the bearings every 2000 hours
- The bearings should be removed, serviced or replaced every 10000 hours or 2 years which ever comes first
- Sealed for life bearings require no maintenance. They should be checked every 6 months for sign of rough or noisy running.

SA 07.18.07 Jockey Pump

Monthly maintenance responsibilities:

- Visually inspect and report on complete pump and motor
- Test pump for 30 minutes
- Check manual start
- Check auto start
- Listen for unusual noises and vibration
- Keep the machine clean and ensure free ventilation air-flow
- Check the condition of connections and mounting and assembly bolts
- Inspect bearings for lubrication

SA 07.18.08 Motor Control Centre

Monthly maintenance responsibilities:

- Visually inspect and report on Motor Control Centre
- Check if all the lights on the panel are working
- Check operation of panel
- Check siren and beacon light
- Check charging rate of batteries
- Check panel batteries
- Check connections in panel

SA 08 MANDATORY PERIODICAL SERVICES

The following mandatory periodical services shall be measured for payment separately and does not form part of the remuneration for monthly preventative maintenance items.

SA 08.01 Log all water meter readings and calculate losses on a monthly basis and report in the following format:

	Previous Measurement	This Measurement	Consumption	Average per day (kl)
Date:	01-Apr-24	03-May-24	Total	32 days
WATER SUPPLY: (kl)			(kl)	(kl/day)
Main Supply (Input)	278540.6	279235.5	694.9	21.716
Admin	15642.0	15690.0	48.0	1.500
Cell Block	15674.0	15721.5	47.5	1.484
House A1	18569.5	18610.8	41.3	1.291
House A2	32598.0	32650.5	52.5	1.641
House B1	13359.4	13396.0	36.6	1.144
House B2	89562.5	89620.7	58.2	1.819
House B3	98685.3	98721.1	35.8	1.119
Ablution A	85684.0	85723.2	39.2	1.225
Ablution B	53265.5	53397.6	132.1	4.128
Building A	25689.2	25790.2	101.0	3.156
Building B	26858.8	26952.1	93.3	2.916
Total consumption (Output)			685.5	21.422
Loss (Input - Output)			9.4	0.294
POTABLE WATER SUPPLY:				
Water supply within standards	Yes/ ~~No~~	Yes/ ~~No~~		
Water test report attached	Yes/ ~~No~~	Yes/ ~~No~~		

SA 08.02

Sample potable water supply and chemical analyses to be provided by an authorised company on a monthly basis. The water report should be provided in the following format, **in accordance with SANS 241-1 : 2015**

SANS 241-1 : 2015 - Edition 2

DRINKING WATER

	<u>Risk</u>	<u>STANDARD LIMITS</u>
Physical and Aesthetic Determinands		
Colour (mg/l as Pt-Co)	Aesthetic	≤15
Conductivity (at 25 °C)	Aesthetic	≤170
Total Dissolved Solids (mg/l)	Aesthetic	≤1200
Turbidity (NTU)	Operational ^a	≤1
	Aesthetic	≤5
pH (at 25 °C) ^b	Operational	≥5 to ≤9.7
Chemical Determinands – Macro Determinands		
Free Chlorine (mg/l as Cl ₂) ^d	Chronic Health	≤5
Monochloramine (mg/l) ^{cd}	Chronic Health	≤3
Nitrate (mg/l as N) ^{ef}	Acute Health	≤11
Nitrite (mg/l as N) ^{efg}	Acute Health	≤0.9
Combined Nitrate plus Nitrite (mg/l) ^{efg}	Acute Health	≤1
Sulphate (mg/l as SO ₄ ²⁻)	Acute Health	≤500
	Aesthetic	≤250
Fluoride (mg/l as F ⁻)	Chronic Health	≤1.5
Ammonia (mg/l as N)	Aesthetic	≤1.5
Chloride (mg/l as Cl ⁻)	Aesthetic	≤300
Sodium (mg/l as Na)	Aesthetic	≤200
Zinc (mg/l as Zn)	Aesthetic	≤5
Chemical Determinands – Micro Determinands		
Antimony (µg/l as Sb)	Chronic Health	≤20
Arsenic (µg/l as As)	Chronic Health	≤10
Barium (µg/l as Ba)	Chronic Health	≤700
Boron (µg/l as B)	Chronic Health	≤2400
Cadmium (µg/l as Cd)	Chronic Health	≤3
Total Chromium (µg/l as Cr)	Chronic Health	≤50
Copper (µg/l as Cu)	Chronic Health	≤2000
Cyanide (recoverable) (µg/l as CN ⁻)	Acute Health	≤200
Iron (µg/l as Fe)	Chronic Health	≤2000
	Aesthetic	≤300
Lead (µg/l as Pb)	Chronic Health	≤10

SA 08.03 Log all electricity meter readings on a monthly basis and report in the following format:

	Previous Measurement	This Measurement	Consumption	Average per day (kl)
Date:	01-Apr-24	03-May-24	Total	32 days
ELECTRICITY: (kWh)			(kWh)	(kWh/day)
Main Supply	124899.0	145865.9	20966.9	655.2
Admin	1356.0	1523.3	167.3	5.2
Cell Block	3596.5	3658.2	61.7	1.9
House A1	8976.0	9256.3	280.3	8.8
House A2	9686.0	9785.2	99.2	3.1
House B1	9565.0	10152.3	587.3	18.4
House B2	3594.0	4512.3	918.3	28.7
House B3	3594.0	4689.2	1095.2	34.2
Ablution A	3598.0	4154.8	556.8	17.4
Ablution B	5975.0	8754.3	2779.3	86.9
Building A	5698.0	8520.0	2822.0	88.2
Building B	5689.0	8654.2	2965.2	92.7

- SA08.04 Cleaning and sterilization of water storage reservoir/tank to be performed annually.
- SA08.05 Blade all gravel roads and parking areas every six months
- SA08.06 Remove and empty waste from skip to external waste disposal site on a weekly basis.
- SA08.07 De-sludge and cleaning of septic tanks as and when required and instructed for by the Engineer.
- SA08.08 Service submersible pumps for borehole installations annually
- SA08.09 Service sewage pumps for wastewater installations annually
- SA08.10 Supply of Chemicals for dosing equipment at the Water Treatment plant as required
- SA08.11 Sample wastewater effluent and chemical analyses to be provided by an authorised company on a monthly basis.
- SA08.12 Statutory annual servicing of fire extinguishers.
- SA08.13 Statutory annual servicing of fire hose reels.
- SA08.14 Statutory annual servicing of fire hydrants.
- SA08.15 Annual Pest control (internal and external)

SA 09 FREQUENT SERVICING OF INSTALLATIONS**SA 09.01 Wastewater Treatment Works**

General frequent servicing of the wastewater treatment works shall be done in accordance with this specification.

SA 09.01.01 General

The general frequent servicing work to be performed and executed shall include, but shall not be limited to the items listed in the table below.

Item	Description	Frequency
01	General housekeeping: Keep site in neat and acceptable condition.	Daily
02	Control access to the site.	Daily
03	Maintain safety conditions on site.	Daily
04	Log and report spills, pollution events, power failures, extraordinary process phenomena, etc. Check auto-reset of power to mechanical equipment.	Event
05	Develop a feel for effective treatment by means of visual indicators of good/bad plant performance: Colour, odour, foam, algae growth, aerator spray patterns, effluent clarity, bubbles, floating material, solids accumulation, flow patterns, turbulence, touch.	Daily
06	Record operating hours and kW-hours of all mechanical equipment.	Daily
07	Check operation of all valves and sluices.	Monthly

SA 09.01.02 Specific Processes and Units

The specific frequent servicing work to be performed and executed shall include, but shall not be limited to the items listed in the table below.

Item	Operation of Specific Processes and Units	Frequency
01	Septic tanks and French drains	
	01 Check and log scum, water and sludge depths in tank.	6 Months
	02 Empty tank at specified frequencies (max. 3 years) or when full.	3 Years
	03 Inspect French drain for accumulation of water or for seepage to surface. If positive, repair drain.	3 Months
	04 Clean connecting pipes and accessories and remove tree and grass roots from pipes.	3 Months
02	Inlet works	
	01 Hand-raked screens: Remove screenings (rags, plastics, etc), ensuring that only degradable material is passed on to subsequent process units. (Last removal after evening peak flow)	2 hours during day
	02 Wash screenings and grit, and return degradable material to treatment train.	Hourly
	03 Dispose of screenings and grit by on-site burial.	Daily
03	Oxidation/maturation ponds	
	01 Remove floating material from trap at inlet to pond and dispose of by off-site removal.	Daily
	02 Remove tree and grass roots from verges of ponds.	Monthly
	03 Check leak detection facilities (if provided) for signs of leakage.	Monthly
	04 Ensure that surface growths are not accumulated in ponds.	Monthly

04	Aeration facilities		
	01	Check whether all aerators are operating.	Daily
	02	Check spray pattern of aerators and degree of turbulence in reactor.	Daily
	03	Check whether waste and return flow pumps are operating.	Daily
	04	Measure and record dissolved oxygen levels in reactor (average values and variations).	Daily
	05	Check dissolved oxygen levels for sudden drops (organic shock load), sudden increases (acute toxicity) or slow increase (chronic toxicity).	Daily
05	Re-circulation facilities		
	01	Check whether pumps are operating.	Daily
	02	Check return flow rates.	Monthly
06	Settling tanks		
	01	Scour settling tank and check for clumps of floating sludge.	Daily
	02	Remove scum and clean overflow weirs.	Daily
	03	Clean submerged portion of settling tank walls by pushing settled sludge on inclined surfaces down to the apex of the cone.	Monthly
07	Sludge drying beds		
	01	Apply sludge to drying beds in depths to suit climatic conditions, and remove when adequately dried.	Daily
	02	Keep sludge beds free of weed growth.	Daily
	03	Replenish filter media when required.	Event
08	Sludge disposal facilities		
	01	Remove tree and grass roots from verges of sludge lagoon.	Monthly
	02	Check leak detection facilities (if provided) for signs of leakage from lagoon.	Monthly
	03	Maintain hygienic conditions at sludge handling facilities.	Daily
09	Pump stations		
	01	Check operation and correct switching of pumps.	Daily
	02	Clean pump sumps.	Weekly
10	Bio filters		
	01	Check operation of dosing siphons and snifter pipes.	Daily
	02	Check operation of flow distribution pipes.	Daily
	03	Flush flow distribution pipes.	Weekly
	04	Check spread of flow and clean distribution nozzles/holes.	Weekly
	05	Evaluate, by means of measurement and calculation, flushing rates, frequency and duration.	6 Months
	06	Inspect health of biological growth on filter media.	Weekly
	07	Check occurrence of blockages, ponding and nuisance conditions on filter media.	Monthly
	08	Check operation of dosing and re-circulation pumps.	Daily
11	Chemical phosphate removal		
	01	Check operation of dosing equipment.	Daily
	02	Select chemicals and dosing rates by means of beaker tests. Ensure correct calculation of dosage concentration and dosing rates.	6 Months
	03	Check, by means of measurement and calculation, the accuracy of dosing rates and their control proportional to flow rate.	6 Months
	04	Manage provision, storage and control of chemicals.	Daily
	05	Ensure continuous dosing – avoid pulsing of dosing stream.	Daily
12	Disinfection		
	01	Check operation of chlorination facilities.	Daily
	02	Clean chlorine contact tank.	4 Months
	03	Ensure chlorine-dosing proportional to flow rate.	Weekly

13	Effluent disposal facilities		
	01	Oxidation ponds: Manage irrigation of effluent as means of disposal.	Daily
	02	Ensure erosion free discharge to receiving water body.	Monthly
14	Power supply		
	01	Check operation of stand-by generator where applicable.	Monthly

SA 09.01.03 **Monitoring and Reporting**

The contractor shall keep a written record of all measurements taken and analyses done for process control and for reporting to relevant authorities in terms of legal or project requirements.

A logbook shall be kept for daily recording of failures, malfunctions, spills, pollution events, power failures and detail of measures taken.

SA 09.02 **Water Treatment Works**

General operation of the water treatment works shall be done in accordance with this specification, with Additional Specification SF: General Operations.

SA 09.02.01 **Daily Actions**

- Check that the raw water valve is open
- Check that the chemical dosing pumps are working correctly
- Check dosing rates
- Check all valve positions
- Check that all feed pumps are running without vibration
- Check control panel for any alarm
- Make-up chemicals if required
- Check pressure gauges for normal reading
- Check pH- & Chlorine readings, and record
- Record flow-meter readings

SA 09.02.02 **Weekly Actions**

- Perform all daily checks as stated above.
- Clean out the strainer in chlorine feed-line
- Clean out plant room
- Check chemical stock (re-order if additional chemicals are needed)
- Check pump rotation and action accordingly

SA 09.02.03 **Monthly Actions**

- Perform all daily checks as stated above.
- Perform all weekly checks as stated above.
- Clean dosing system
- Check sand filter media
- Shut-down plant for at least 4 hours and de-sludge clarifiers manually (for at least 30 seconds each)
- Check corrosion, record and take corrective action

SA 09.02.04 Yearly Actions

- Perform all daily checks as stated above.
- Perform all weekly checks as stated above.
- Perform all monthly checks as stated above
- Check sand filter media levels and top-up hydro anthracite if needed
- Check all electrical connections for tightness and corrosion on all terminals
- Replace dosing pump diaphragms

SA 10 MEASUREMENT AND PAYMENT**SA.01 Maintenance of an installation Unit: point**

The unit of measurement shall be a point. Each month shall represent a maximum of ten points and a minimum of zero points, depending on the performance and quality of maintenance. Ten points per month at the tendered rate shall include full compensation for the complete monthly maintenance of an entire installation and all appurtenant works deemed to form part thereof, as defined in the relevant Specifications.

Ten points per month at the tendered rate 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.
3. Call-Out cost for emergency breakdown visit (if applicable - measured separately)
4. *Statutory Periodical Services as described and listed in paragraph SA 08 of this specification.*

Different installations shall be listed in the Bill of Quantities, in accordance with the definition of each installation.

Although ten points per month shall include full compensation for routine preventative, corrective and breakdown maintenance, the Contractor might fail to achieve all points applicable in the event of unsatisfactory performance, in which case he shall still perform all maintenance requirements according to specification, but at his own cost where a reduction in points awarded is insufficient to cover his cost.

SA.02 Payment reduction due to exceeding of maximum allowable down-time during emergency breakdown Unit: hours

The unit of measurement shall be the number of hours, *in excess of 12 hours*, during which a component of an installation was in a dysfunctional condition that required emergency repairs.

The negative fixed rate shall include full compensation for the User Client's loss in productivity and, multiplied by the number of hours measured, shall be deducted from the certified amount due to the Contractor.

SA.03 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 4 days*, during which a component of an installation was in a dysfunctional condition that required ordinary repairs.

The negative fixed rate shall include full compensation for the User Client's loss in productivity and, multiplied by the number of days measured, shall be deducted from the certified amount due to the Contractor.

SA.04 Payment reduction due to exceeding of maximum allowable down-time during 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.

SA.05 Call-Out for repair of Emergency Breakdown Unit: No

The Unit of measurement shall be number. The Contractor will be remunerated for the number of call-out trips to the site, in order to attend to the repair of an *emergency breakdown* logged with him by the Engineer. The tendered rate shall provide full compensation for all travel, accommodation and travel-time cost to and from the site. Remuneration for material and labour cost is deemed to be included under the "maintenance of an installation" payment item in the schedule of quantities, based on the points system and measured monthly.

SA.06 Maintenance Control Plan Unit: site

The Unit of measurement shall be site for which a Maintenance Control Plan has been developed and approved as described in SA 04.02.

SA.07 Site Maintenance Record Keeping Unit: month

The Unit of measurement shall be month for each site for which the Maintenance Control Plan has been updated with all site maintenance record keeping, reports, checklists, schedules and forms as described in SA 03.10.

SA.08 Update Existing and Supply Complete Key Plan..... Unit: site

The unit of measurement shall be for each complete colour set (**three** colour A0-size copies) of the key plan(s) as well as 'dxf' or 'dwg' electronic format on CD. The existing key-plans shall be provided to the contractor in electronic format (similar to the key-plans contained in this document).

The tendered rate 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, stormwater inlets and pipes, fences, paving, transmission lines, transformers, sewerage lines, water distribution networks, pump stations, fire fighting equipment, street lighting and air-conditioning etc. For sewerage reticulation, water reticulation and stormwater drainage systems the pipe sizes and types, 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 or DWG). Drawings shall be drawn to scale.

SA.08.01 TITLE BLOCK

The standard drawing sheet layout and title block of the Department of Public Works must be used.

Complete all the relevant fields in the title block with reference to the name of the Port of Entry in the appropriate block. The words KEY PLAN should form part of the drawing title.

Drawing Number

The drawing number should consist of a three-part identifier:

- Port of entry designator: WCS 056395
- Drawing number: Numbering will start at 1
- Revision number: Will start at 01

Typical example: WCS 056395/1 Rev 01

Overlay Sheets/Layering Scheme

The overlay sheet designator identifies the type of drawing (example: overlay for water reticulation) and can be added to the drawing number:

- C: Existing structures, facilities, roads, paving, fencing, etc
- CR: Stormwater drainage system
- CE: Electrical power and equipment
- CF: Fire fighting equipment
- CS: Sewer network
- CT: Telephone lines
- CW: Water reticulation system

Typical example for the numbering of an overlay sheet:
WCS 056395/1**CW** Rev 01

SA.08.02 DRAFTING CONVENTIONS

The Key Plan should be created following engineering conventions and standards in order to represent a clear drawing simplifying the huge amount of visual information.

Paper Prints

Preference is given to size A1 plans, but for reporting size A3 will be used and the information should still be legible in this format.

Scale

The Key Plan must be drawn according to scale and the following scales can be used:

- 1:200 or 1:500 or 1:1000

Plan Orientation

The Port of Entry should be rotated on the plan so that the north point arrow are pointing in the direction of either the upper left or upper right quadrants of the plan. The north point arrow to be placed in the top right hand corner of the drawing space.

Contours

Contours should not be printed on the final Key Plan.

Line Weight

Line weight/width is extremely important and features such as the services should be drawn with lines that are more prominent. The following line weights (mm) can be used:

1. 0.10	5. 0.35
2. 0.15	6. 0.50
3. 0.25	7. 0.70
4. 0.30	8. 1.00

Line Type/Style

The following typical standard line types that can be used:

TYPICAL LINE TYPES	
LINE DESCRIPTION	LINE APPEARANCE
1. Centre Line	
2. Solid/Continuous line	
3. Short broken line	
4. Long broken line	
5. Break line	
6. Hatch lines 45°	

Hatching

Hatching are angled line patterns to indicate the position of permanent structures. The spacing between lines should be consistent at 45° to the structure. Park Homes must be shown on the plan, but without hatching.

Surfaced Areas

Surfaced roads should be indicated by two solid lines as well as paved areas.

Two long broken lines should be used to indicate gravel roads.

Non Standard Line Types

The following lines could be used for the various services, but must be identified in the Legend as a non standard line type:

NON STANDARD LINES (OPTIONAL)

LINE DESCRIPTION	LINE APPEARANCE
1. Electrical power line	——— E ——— E ———
2. Electrical power cable	——— C ——— C ———
3. Stormwater pipe	——— R ——— R ———
4. Sewerage pipe	——— S ——— S ———
5. Telephone line	——— T ——— T ———
6. Water pipe	——— W ——— W ———
7. Fence line and gate	1.8 m ——— x ——— x ——— 

Lettering and Font Styles

Use the standard font style and font size for engineering drawings and do not use stylized fonts.

Create all text in upper case letters, except for certain unit designations such as km, m, mm, kVA, etc.

Key Layout

When the Port of Entry is too large for one sheet, divide the plan into logical sections. Add a key layout in the title block showing how the various sheets should be joined together to obtain a layout of the entire site. This key layout should form part of each sheet.

Facilities

The name of the facility should be written inside or adjacent to the facility. If the space is limited, a reference number of the facility, which refers to a description of the facility, is inserted in a table format in or close to the title block.

Fences and gates

Show the position of the security fence and all other fences as well as gates. Include the height of all fences.

Destinations

The destination to the nearest town with a pointing arrow should appear on all incoming and outgoing roads.

SA.08.03 SERVICES

The position of the services is extremely important and should be indicated by lines that are more prominent/thicker. The description of the line types for the various services must be given in the Legend.

The following services, where applicable, must be shown on the Key Plan for future reference:

Water Reticulation System

Show the position of the water reticulation system and include the following:

- Pipe lines, pipe sizes, type of pipes, valves, meters, boreholes and tanks (include capacities). Show the direction of flow.

Sewerage Network

Show the layout of the sewerage network and include the following:

- Pipe lines, pipe sizes, type of pipes, manholes, rodding eyes, septic tanks (include capacities), french drains (include volumes). Show the invert levels of all manholes as well as the position and level of the bench mark.

Electrical Power

Indicate the position of electrical power lines, cables, substations, kiosks, flood lights along the perimeter as well as street lights and area lighting.

Air-conditioning units should be numbered and listed in table format including the type and size.

Give the source(s) of electrical power.

Telephone Lines

Show the position of overhead telephone lines.

Stormwater System

Show the layout of the stormwater system, culverts and sizes as well as inlet and outlet structures. Give the invert levels of all structures as well as the position and level of the bench mark.

Fire Fighting Equipment

Include the pump installation, tank and capacity, fire hydrants, valves, meters, fire extinguishers and fire hose reels.

Fire extinguishers should be numbered and listed in table format including the type and size.

SA.08.04 ELECTRONIC FORMAT

A complete set of electronic files shall be placed on CD(s) in a Data Exchange Format (DXF) or DWG format.

Affix a stick-on label to the CD with the following information:

- Department of Public Works and logo
- Name of Port of Entry
- WCS number
- Description: KEY PLAN
- Drawing number(s)
- Date issued
- Electronic format: DXF or DWG

Also refer to the table below: **Site Key Plan: Drawing Specifications** for detail regarding required services, formats and settings.

SA.09 Contingency allowance for Operational Damages..... Unit: PC Sum

The contractor shall be required to repair/replace all defects/damages logged at the National Call Centre as 'MALICIOUS DAMAGE' as defined in section SA 06.02 (based on ruling by Engineer), **and** instructed for by the Engineer, for which payment shall be made under this item after approval of quotation by the Engineer, prior to any work being done. The PC Sum amount shall be for direct costs only based on approved documentation provided to the Engineer. All profits, attendance, travelling, labour, mark-up, accommodation and time-cost should be added as the percentage charge required by the Contractor on sub-item provided for in the bills of quantities.

DEPARTMENT OF PUBLIC WORKS AND INFRASTRUCTURE
PREVENTATIVE MAINTENANCE SCORE-CARD



CONTRACT NUMBER: WCS

CONTRACT:

CONTRACTOR:

ENGINEER: Ukhukhula Holdings (Pty) Ltd

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

- 1.1
1.2
1.3
1.4
1.5

0	1

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 PREVENTATIVE 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 routine preventative and corrective maintenance that will be based on the Maintenance Control Plan, the specifications 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 routine preventative and corrective maintenance.

Breakdown maintenance is excluded from the score-card's scope of measurement. 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.

Site Key Plan: Drawing Specifications

Layer Specifications					
No	Layers Name	Line type	Pen	Hatching	Description
1	Paved Roads	1	1	None	All edges of paved section and top and bottom of kerbs, top and middle of side drains
2	Gravel Roads	2	1	None	All edges of gravel road, top and middle of side drains
3	Storm Water System	2	2	None	All storm water pipes, kerb inlets, surface inlets, pipe culvers and manholes
4	Sewer Pipe Lines	6	6	None	All sewer pipe lines with Ø of pipe indicated on each section between manholes
5	Sewer manholes	1	6	None	All manholes to be indicated with manhole no, top of manhole and invert level.
6	Water	11	11	None	All water pipe lines with Ø of pipe line indicated on line and boreholes
7	Electrical cables	9	14	None	All electrical cables with size of cable indicated on cable
8	Electrical Lights	1	14	None	All perimeter, street lights and area lighting
9	Telephone Lines	1	9	None	All overhead telephone lines
10	Fire Fighting Extinguishers	5	1	Pen 7, line type 1 at 90° angle	All fire extinguishers indicated with 0,5m radius circle with hatching, and numbered according to numbering on site
11	Fire Fighting Hose Reels	5	1	Pen 7, line type 1 at 90° angle	All fire hose reels indicated with rectangle of 0.5m x 0.75m with hatching, and numbered according to numbering on site
12	Fire Fighting Fire Hydrant	5	1	Pen 7, line type 1 at 90° angle	All fire hydrants indicated with a circle of 0.5m with hatching, and numbered according to numbering on site
13	Fire Fighting Fire Hydrant Hose Box	5	1	Pen 7, line type 1 at 90° angle	All fire hydrant hose boxes indicated with a rectangle of 0.75 x 1.5m
14	Buildings	2	1	Pen 13, line type 1 at 45° angle	All buildings, sewerage works, and water works, containers, search canopies and parkhomes, and water tanks
15	Fencing 1.2m high	18	7	None	All fencing and gate of 1,2m in height
16	Fencing 1,8m high	20	7	None	All fencing and gate of 1,8m in height
17	Fencing 3.0m high	24	7	None	All fencing and gate of 1,8m in height
18	Contours 1m	1	13	None	Contours in 1m intervals
19	Contours 5m	1	7	None	Contours in 5m intervals, with height indicated on contours at the end of the lines
20	Cadastral	1	3	None	Cadastral boundaries indicated on drawings with property name and number indicated
21	Banks Top	1	13	None	All top of banks
22	Banks Hatching	1	13	Standard bank hatch or lines	All bank hatching
23	Banks Bottom	5	13	None	All bottom of banks
24	Co-ordinate Grid	1	13	None	Grid to be in 50m intervals, full grid
Text Specifications					
	Text type	Pen	Font	Text Height	Description
1	All normal text	1	Arial	3mm	
2	Table heading	5	Arial	5mm	
3	Table contents	1	Arial	3mm	
4	Co-ordinate Grid text	5	Arial	5mm	Grid co-ordinates to be on the edge of the drawing, within the title block frame
Table Specifications					
	List of Tables	Table Line Type	Table Pen		Description
1	Buildings	1	2		All Building numbers with building type/name indicated in table
2	Fire Fighting Equipment	1	2		All Fire fighting equipment numbered, with type indicated in table
3	Air-Conditioners	1	2		All Air conditioners, in which building, make, and size indicated in table
4	Legend	1	2		Legend indicating Sewer, Water, Electrical Cables, Fencing, Fire Fighting Equipment
General					
1	Place frame around drawing area, no title block				
2	Indicate Scale on drawing				
3	Drawing to fit on A0 sheet.				
4	Drawing Space to be 800mm x 1050mm on 1:1 Scale				
5	Drawing to be in landscape orientation				
6	Tables to be placed in drawing space				
7	North indicator to be placed in top right hand corner of drawing space				
8	No blocks or patterns must be used, if drawing is generated by AutoCAD				
9	If AutoCAD is used to generate drawings, drawing must be done in layout mode and not model space				
10	Direction and name of nearest town should be indicated on drawings				Text 5mm high
11	Scale bar to be placed on bottom right hand corner				
12	Scale Should be one of the following - 1:100, 1:200, 1:500, 1:1000				
13	Key to layout of sheets to be placed in title block				

Ablution: Daily Checklist Sheet per Month

Port of Entry:

Month:

Ablution description:

Inspected by:

	ITEM	TASK	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
			Time																															
Sanitary	1	Floors clean																																
	2	Walls & windows clean																																
	3	Toilets clean																																
	4	Toilet seats clean																																
	5	Urinal clean																																
	6	Taps clean																																
	7	Wash hand basins clean																																
	8	Wall mounted bins cleaned of paper																																
	9	Sanitary She bins (in female toilets) clean																																
Consumables	10	Sufficient Toilet paper																																
	11	Sufficient Air fresheners																																
	12	Sufficient Soap in dispensers																																
Building components	13	Doors in working order																																
	14	Door handles operational																																
	15	Indicator bolts working																																
	16	Hand dryer unit working																																
	17	Lights in working condition																																
	18	Mirrors and other fittings in good order																																
	19	Toilet cistern flushing mechanisms operational																																
	20	Urinal flushmasters fully operational																																
	21	Taps not leaking																																
	22	Toilet Seats OK																																

Breakdowns logged with Call Centre:

1

Date reported:

2

Date reported:

3

Date reported:

4

Date reported:

5

Date reported:

Time reported:

Time reported:

Time reported:

Time reported:

Time reported:

Call Centre Reference Number:

Call Centre Reference Number:

Call Centre Reference Number:

Call Centre Reference Number:

Call Centre Reference Number:

Attended to?

Yes

No

Attended to?

Yes

No

Attended to?

Yes

No

Attended to?

Yes

No

Attended to?

Yes

No

Checked by Port Coordinator:

Engineer:

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 an 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 have 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 Troubleshooting
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/manufacture
- (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 comment. 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 Troubleshooting

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 SITE LAYOUT PLAN Unit : sum

The unit of measurement shall be a sum for each complete colour set (three A0-size copies) of the key plan(s) as well as 'dxf' or 'dwg' electronic format on CD.

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, sewerage lines, water distribution networks, pump stations 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 or DWG).

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;

SC.3

- (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 Contractor shall be required to comply with the Occupational Health and Safety Act 85 of 1993, Construction Regulations 2014 and related regulations.
- (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 from 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;

SC.7

- (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 conducive 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.

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

SF GENERAL OPERATION

CONTENTS

SF 01	SCOPE
SF 02	OPERATION REQUIREMENTS
SF 03	OPERATION CONTROL
SF 04	COMMUNICATION
SF 05	PERFORMANCE MEASUREMENT
SF 06	MEASUREMENT AND PAYMENT

SF 01 SCOPE

Operation of the specified systems, services or equipment shall all be referred to as "Operation of an Installation". Operation of an installation shall ensure effective functioning and optimum operational condition thereof. Monthly operation responsibilities for the required installations including all units and components as specified shall commence with access to the installation.

Operation of an installation shall be performed in accordance with Specifications and the Operating and Maintenance Manuals.

Remuneration for operation is provided for in the Bill of Quantities by means of monthly payment items, depending on the score achieved.

This Additional Specification covers operation requirements, site operation administration, communication operation performance measurement, as well as the items for measurement of the Contractor's service level and resulting payment.

SF 02 OPERATION REQUIREMENTS

SF 02.01 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall operate the complete installation for the 36-month Contract period.

Operation implies and shall include hourly operation, daily operation (night and day), weekly as well as monthly operation on all components of the specified installations, *including* public holidays and non working days.

The Contractor shall operate the equipment as detailed in the specifications and the operation and maintenance manuals. Each operational function, task, test or action shall be recorded in an approved format and listed in a monthly report by the Contractor.

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 for the duration of the 36-month Contract.

The Contractor shall perform all Operational tasks as described in the Operating and Maintenance Manuals.

SF 02.02 COMPONENTS INCLUDED IN OPERATION SCOPE

The main sections of a facility with their subsections are as set out in the Specifications where applicable and in the Bill of Quantities and will each be deemed "an installation". Operation, as specified, will be applicable to all of the installations listed in the schedule of quantities under the "OPERATION OF INSTALLATION" section

SF 02.03 SITE OPERATION RECORD KEEPING

The Contractor shall provide and maintain hard-cover A4 Operation files for each installation that needs to be operated for the duration of the Contract. All schedules, checklists, actions, tasks, reports, hourly, daily and monthly operational records and monthly reports shall be incorporated into the monthly maintenance control plan.

SF 02.04 SUPPLY OF LABOUR, EQUIPMENT AND MATERIAL**SF 02.04.01 Labour (qualified where necessary)**

Competent personnel (qualified where necessary) that have been trained by the Contractor or external training authority shall execute all Operational work.

SF 02.04.02 Equipment

All tools and equipment required for Operation work shall be supplied by the Contractor at his cost (except where otherwise provided).

SF 02.04.03 Material

All material, equipment, testing equipment, protective clothing and appurtenances necessary for the complete operation of each installation shall be supplied and installed by the Contractor at his cost. Remuneration for *maintenance* actions and material shall be measured elsewhere in this document.

The technical specification of each specific installation to be operated, shall indicate whether the contractor should supply other consumables (such as chemicals) as part of his operation requirements.

SF 03 OPERATION CONTROL

Operation quality control shall be the responsibility of the Contractor. The Contractor shall introduce his own quality assurance system to assist him in ensuring that hourly, daily and monthly operational tasks are performed as described in the operating and maintenance manuals and Specifications.

SF 04 COMMUNICATION

The contractor shall include the following operational results in the maintenance control plan on a monthly basis:

- The quality of waste water discharged into the environment and the total recorded weekly (compiled monthly).
- Record keeping of activities as specified shall be up to date on a daily basis and available to the Engineer on inspection.
- The quality of domestic waste water discharged into the environment.
- Details of failures and malfunctions and details of measures taken to avoid environmental pollution.

SF 05 **PERFORMANCE MEASUREMENT**

The Contractor's performance shall be measured against the following parameters:

SF 05.03 **PERFORMANCE-BASED PAYMENT****SF 05.03.01** **Score-card**

The Engineer shall inspect each installation monthly. The Engineer shall use a score-card to measure the quality of operational tasks rendered by the Contractor during the preceding month, on all components that form part of the installation, in accordance with the Operation specifications. The Engineer will record his inspection directly onto the score-card. The score-card shall serve to evaluate ten performance indicators each month in the manner set out below.

The Contractor shall always have the opportunity to score the maximum points, provided that his operation work complies with the Specifications. The Employer shall be protected against a reduced or unsatisfactory operational level.

SF 05.03.02 **Performance indicators**

Performance indicators shall be selected to measure the Contractor's service level of operation.

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 operation quality against the relevant specifications for the ensuing month. All ten (10) performance indicators are known to both the Engineer and the Contractor.

The Contractor shall aim to perform satisfactorily on all ten performance indicators. All indicators shall be selected from the scope of his normal hourly, daily and monthly operation work and shall be based on the operation control plan and operating and maintenance manuals. The work shall either be satisfactory, or unsatisfactory, and the Contractor shall score one (1) or zero (0) respectively per indicator. Performance indicators shall be used to focus on certain key aspects of the work and shall in no way limit the Contractor's responsibility to do all the required work.

SF 05.03.03 **Satisfactory performance**

The Engineer shall inspect the site on an arbitrary day to measure the quality of operation against the ten selected performance indicators. Should the Contractor score the maximum points (10) he shall receive his full operation payment for the installation. Should the quality of operation be unsatisfactory according to the score-card, the Contractor may fail to achieve full payment due to a reduced service level. Each monthly payment for operation shall be subject to evaluation based on the score-card.

SF 06 MEASUREMENT AND PAYMENT

SF.01 OPERATION OF AN INSTALLATION..... Unit: month

The unit of measurement shall be a calendar month and shall include full compensation for all liabilities and obligations described or implied in the Contract document and deemed by the Contractor to be applicable to the operation of an entire installation, and all appurtenant works deemed to form part thereof, as defined in the relevant Specifications.

It shall also include full compensation for complete hourly, daily, weekly and monthly operation as well as all chemicals and testing equipment required to operate the installation in accordance with the Department of Water Affairs specifications.

ADDITIONAL SPECIFICATION

SH HIV/AIDS REQUIREMENTS

CONTENTS

SH 01	SCOPE
SH 02	DEFINITIONS AND ABBREVIATIONS
SH 03	BASIC METHOD REQUIREMENT
SH 04	HIV/AIDS AWARENESS EDUCATION AND TRAINING
SH 05	PROVIDING WORKERS WITH ACCESS TO CONDOMS
SH 06	ENSURING ACCESS TO HIV/AIDS TESTING AND COUNSELLING FACILITIES AND TREATMENT OF SEXUALLY TRANSMITTED INFECTIONS (STI)
SH07	APPOINTMENT OF AN HIV/AIDS AWARENESS CHAMPION
SH08	MONITORING

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 Department of Public Works as a specialist in conducting HIV/AIDS awareness programmes.

Service Provider Workshop Plan: A plan outlining the content, process and schedule of the training and education workshops, presented by a Service Provider which has been approved by the Representative/Agent.

Worker: Person in the employ of the Contractor or under the direction or supervision of the Contractor or any of his Sub-contractors, who is on site for a minimum period of 30 days in 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 Department of Public Works, is to be screened to Workers at workshops. In order to enhance the learning experience, groups of not exceeding 25 people shall attend the interactive sessions of the workshops.

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 Department of Public Works

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 Department of Public Works.

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 SANS 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 Liaising 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						
	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M			
Programme implemented within 14 days of site handover																											
Awareness champion on site																											
HIV/AIDS awareness service provider report																											
Male condom dispenser																											
Sufficient male condoms available																											
Male condom dispenser in a highly trafficked area																											
Female condom dispenser																											
Sufficient female condoms available																											
Female condom dispenser in a highly trafficked area																											
All four types of posters displayed																											
Posters in a good condition																											
Posters in a highly trafficked area																											
Posters displayed on local support services: clinic & VCT centre																											
Support service poster/s in highly trafficked area																											
Support service poster/s in a good condition																											

<i>Please indicate the applicable number for the reporting period</i>							
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							

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 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			
	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M
Content of workshop: (Mark the content included)																												
SLO1																												
SLO2																												
SLO3																												
SLO4																												
SLO5																												
SLO6																												
SLO7																												
HIV/AIDS in construction video																												
Indicate the duration of the workshop in hours																												
Total number of Workers																												
Indicate workshop venue																												

SCHEDULE C

CONTRACTOR HIV/AIDS PROGRAMME REPORT

Project name _____

Project Location _____

Contract value of project (R) _____

Department of Public Works Project Manager _____

HIV/AIDS Programme duration: (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
Reactive TB
Hair loss
Severe tiredness

Coughing or chest pain
Pain when swallowing
Persistent fever
Diarrhoea

Vomiting
Meningitis
Memory loss
Pneumonia

Number of HIV/AIDS-related deaths _____

Contractor

Date

Departmental Project Manager

Date

ADDITIONAL SPECIFICATION

SI OCCUPATIONAL HEALTH AND SAFETY IN CONSTRUCTION PROJECTS. REPAIRS, RENOVATIONS & MAINTENANCE

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SI 01 PREAMBLE

In terms of Construction Regulation 4(1)(a) of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), and 5(1) construction regulation of 2014, the Department of Public Works, as the Client and/or its Agent on its behalf, shall be responsible to prepare Health & Safety Specifications for any intended construction project and provide any Principal Contractor who is making a bid or appointed to perform construction work for the Client and/or its Agent on its behalf with the same.

The Client's further duties are as described in The Act and the Regulations made thereunder. The Principal Contractor shall be responsible for the Health & Safety Policy for the site in terms of Section 7 of the Act and in line with Construction Regulation 5 as well as the Health and Safety Plan for the project.

This 'Health and Safety Specifications' document is governed by the "Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), hereinafter referred to as 'The Act'. Notwithstanding this, cognizance should be taken of the fact that no single Act or its set of Regulations can be read in isolation. Furthermore, although the definition of Health and Safety Specifications stipulates 'a documented specification of all health and safety requirements pertaining to associated works on

a construction site, so as to ensure the health and safety of persons', it is required that the entire scope of the Labour legislation, including the Basic Conditions of Employment Act be considered as part of the legal compliance system. With reference to this specification document this requirement is limited to all health, safety and environmental issues pertaining to the site of the project as referred to here in. Despite the foregoing it is reiterated that environmental management shall receive due attention.

Due to the wide scope and definition of construction work, every construction activity and site will be different, and circumstances and conditions may change even on a daily basis. Therefore, due caution is to be taken by the Principal Contractor when drafting the Health and Safety Plan based on these Health and Safety Specifications. Prior to drafting the Health and Safety Plan, and in consideration of the information contained here-in, the contractor shall set up a Risk Assessment Program to identify and determine the scope and details of any risk associated with any hazard at the construction site, in order to identify the steps needed to be taken to remove, reduce or control such hazard. *This Risk Assessment and the steps identified will be the basis or point of departure for the Health and Safety Plan.* The Health and Safety Plan shall include documented 'Methods of Statement' (see definitions under Construction Regulations) detailing the key activities to be performed in order to reduce as far as practicable, the hazards identified in the Risk Assessment.

The Department of Public Works is tasked to provide accommodation and operational facilities to a very large proportion of the approximate 35 National Departments responsible for the governance of the Department of Public Works. A very large number of State employees and public users of the facilities and the services provided there-in directly interacts with the facilities provided by the well-being, health and safety of a great number of people. This Department thus has directly or indirectly, an impact on the Republic of South Africa as well as the National Parliament.

In this a high premium is to be placed on the health and safety of the most valuable assets of the Department of Public Works. These are its personnel, the personnel of its Clients and the physical assets of which it is the custodian and may also include the public as well. The responsibilities the Department and relevant stakeholders have toward its employees and other people present in the facilities or on the sites are captured further in this specification document. These responsibilities stem from both moral, civil and a variety of legal obligations. The Principal Contractor is to take due cognisance of the above statement.

Every effort has been made to ensure that this specification document is accurate and adequate in all respects. Should it however, contain any errors or omissions they may not be considered as grounds for claims under the contract for additional reimbursement or extension of time, or relieve the Principal Contractor from his responsibilities and accountability in respect of the project to which this specification document pertains. Any such inaccuracies, inconsistencies and/or inadequacies must immediately be brought to the attention of the Agent and/or Client.

SI.02 SCOPE OF HEALTH AND SAFETY SPECIFICATION DOCUMENT

These Specifications should be read in conjunction with the Act, the Construction Regulations and all other Regulations and Safety Standards which were or will be promulgated under the Act or incorporated into the Act and be in force or come into force during the effective duration of the project. The stipulations in this specification, as well as those contained in all other documentation pertaining to the project, including contract documentation and technical specifications shall not be interpreted, in any way whatsoever, to countermand or nullify any stipulation of the Act, Regulations and Safety Standards which are promulgated under, or incorporated into the Act.

SI.03 PURPOSE

The Department is obligated to implement measures to ensure the health and safety of all people and properties affected under its custodianship or contractual commitments, and is further obligated to monitor that these measures are structured and applied according to the requirements of these Health and Safety Specifications.

The purpose of this specification document is to provide the relevant Principal Contractor (and his /her contractor) with any information other than the standard conditions pertaining to construction sites which might affect the health and safety of persons at work and the health and safety of persons in connection with the use of plant and machinery; and to protect persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work during the carrying out of construction work for the Department of Public Works. The Principal Contractor (and his /her contractor) is to be briefed on the significant health and safety aspects of the project and to be provided with information and requirements on inter alia:

- a) Safety considerations affecting the site of the project and its environment;
- b) Health and safety aspects of the associated structures and equipment;
- c) submissions on health and safety matters required from the Principal Contractor (and his /her contractor); and
- d) the Principal Contractor's (and his /her contractor) health & safety plan.

To serve to ensure that the Principal Contractor (and his /her contractor) is fully aware of what is expected from him/her with regard to the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and the Regulations made there-under including the applicable safety standards, and in particular in terms of Section 6,7 and 8 of the construction regulation (2014).

To inform the Principal Contractor that the Occupational Health and Safety Act, 1993 (Act 85 of 1993) in its entirety shall apply to the contract to which this specification document applies. The Construction Regulations promulgated on 07 February 2014.

SI.04 DEFINITIONS

- The most important definitions in the Act and Regulations pertaining to this specification document are hereby extracted.

“Purpose of the Act” – To provide for the health and safety of persons at work and the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety; and to provide for matters connected therewith.

“Health & Safety Specification” – means a document that includes information required under the construction regulation and obtained from the clients & designers during the early planning & design stage for a specific project on a specific site for use by the contractors when preparing their tenders or bids to clients.

“Health & Safety Plan” – means a document which is site specific and includes all identified hazards, safe work procedures to mitigate, reduce & control the hazards identified in a project.;

“Agent” – means any person who acts as a representative for a client;

“Client” – means any person for whom construction work is performed;

“ Construction Health & Safety Agent (SACPCMP)” – The person or entity appointed by the client through the Agent and who has a full authority and obligation to act on the client’s behalf in terms of the construction regulations;

“Construction Work” is defined as any work in connection with –

the erection, maintenance, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure;
the installation, erection, dismantling or maintenance of a fixed plant where such work includes the risk of a person falling;
the construction, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; or
the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work;

“Contractor” – means an employer, as defined in Section 1 of the Act, who performs construction work and includes Principal Contractors;

“Contract Amount” Financial value of the contract at the time of the award of the contract, exclusive of all allowance and any value added tax or sales tax, which the law requires the employer to pay to the contractor.

“Practical Completion Certificates” A certificates issued in terms of a contract by the employer, signifying that the whole of the construction works have reached a state of readiness for occupation or use for the purposes intended, although some minor work may be outstanding.

“Accident” – means unplanned occurrence that happens due to the unsafe condition and may cause injury to a person, damage to the property, material, plant, equipment and the environment;

“Hazard” – means anything including work activities and practices with the potential to cause harm;

“Risk” – means the likelihood that harm will occur and the subsequent consequences.

“Risk assessment” – means a process to determine any risk associated with any hazard at a construction site in order to identify the steps needed to be taken to mitigate, reduce or control such hazards.

Health and Safety File” – means a file, or other record in permanent form, containing the information required a contemplated in the regulations;

SI 05 OCCUPATIONAL HEALTH & SAFETY MANAGEMENT

5.1 Structure and Organization of OH&S Responsibilities

5.1.1. Overall Supervision and Responsibility for OH&S

The Client and/or its Agent on its behalf to ensure that the Principal Contractor, appointed in terms of Construction Regulation 4(1)(c), implements and maintains the agreed and approved H&S Plan. Failure on the part of the Client or Agent to comply with this requirement will not relieve the Principal Contractor from any one or more of his/her duties under the Act and Regulations.

The Chief Executive Officer of the Principal Contractor in terms of Section 16 (1) of the Act to ensure that the Employer (as defined in the Act) complies with the Act. The pro forma Legal

Compliance Audit may be used for this purpose by the Principal Contractor or his/her appointed contractor.

All OH&S Act (85 /1993), Section 16 (2) appointee/s as detailed in his/her/their respective appointment forms to regularly, in writing, report to their principals on matters of health and safety per routine and ad hoc inspections and on any deviations as soon as observed, regardless of whether the observation was made during any routine or ad hoc inspection and to ensure that the reports are made available to the principal Contractor to become part of site records (Health & Safety File).

The Construction Supervisor and Assistant Construction Supervisor/s appointed in terms of Construction Regulation 6 to regularly, in writing, report to their principals on matters of health and safety per routine and ad hoc inspections and on any deviations as soon as observed, regardless of whether the observation was made during any routine or ad hoc inspection and to ensure that the reports are made available to the principal Contractor to become part of site records (Health & Safety File).

All Health and Safety Representatives (SHE-Reps) shall act and report as per Section 18 of the Act.

5.12 Required appointments as per the Construction Regulations:

Item	Regulation	Appointment	Responsible Person
	3.	Application Construction work permit	Client
	5(1)(k)	Principal contractor for each phase or project	Client
	5(6)	Construction Health & Safety Agent	Client
	7.(1)(c)	Contractor	Principal Contractor
	7(3)	Contractor	Contractor
	8(1)	Construction manager	Contractor
	8(2)	Assistance Construction manager	Contractor
	6(1)	Construction supervisor	Contractor
	6(2)	Construction supervisor sub-ordinates	Contractor
	8(5)	Construction Safety Officer	Contractor
	8(8)	Responsible employee	
	9(1)	Person to carry out risk assessment	Contractor
	10(1)	Fall protection planner	Contractor
	12(1)	Temporal work designer	
	12(2)	Supervisor of temporal work operation	
	13(1)	Excavation supervisor	Contractor
	13(2)(k)	Competent person in the use of explosive for excavations	Contractor
	14(11)	Explosives expert	Contractor
	14(1)	Supervisor demolition work	Contractor
	14(2)	Scaffold supervisor	Contractor
	16(1)	Suspended platform supervisor	Contractor
	18(1)a	Rope access	Contractor
	19(8)(a)	Material hoist inspector	Contractor
	20(1)	Bulk mixing plant supervisor	Contractor
	21(2)	Explosive actuated fastening device inspector	Contractor
	21(2)(g)	Explosive actuated fastening device cartridge, nails and studs: issuer & collector	Contractor
	23 (1)	Operator : construction vehicle and mobile plant	Contractor
	28 (a)	Stacking and storage supervisor	Contractor
	29 (h)	Fire equipment inspector	Contractor

5.2 Communication, Participation & Consultation

5.2.1 Occupational Health & Safety matters/issues shall be communicated between the Employer, the Principal Contractor, the other Contractors, the Designer and other concerned parties shall be through the H&S Committee or other means determined by the client.

5.2.2 In addition to the above, communication may be directly to the Client or his appointed Agent, verbally or in writing, as and when the need arises.

5.2.3 Consultation with the workforce on OH&S matters will be through their Supervisors and H&S Representatives ('SHE – Reps')

5.2.4 The Principal Contractor will be responsible for the dissemination of all relevant OH&S information to the other Contractors e.g. design changes agreed with the Client and/or its Agent on its behalf and the Designer, instructions by the Client and/or his/her agent, exchange of information between Contractors, the reporting of hazardous/dangerous conditions/situations etc.

SI 06 INTERPRETATION

The Occupational Health and Safety Act and all its Regulations, with the exception of the Construction Regulations, distinguish between the roles, responsibilities and functions of employers and employees respectively. It views consultants and contractors as employees of the "owner" of a construction or operational project, the "owner" being regarded as the employer.

(The position taken by the Construction Regulations is that the "owner", in terms of its instructions, operates (has to operate) in the role of client as per relevant definition. The contractors working for the "client" are seen to be in two categories, i.e. the Principal Contractor and Contractors.

The Principal Contractor has to take full responsibility for the health and safety on the site of the relevant project / contract. This includes monitoring health and safety conditions and overseeing administrative measures required by the Construction Regulations from all contractors on the project site.

SI 07 RESPONSIBILITIES

7.1 Client

The Client or his appointed Agent on his behalf will appoint each Principal Contractor for this project or phase/section of the project in writing for assuming the role of Principal Contractor as intended by the Construction Regulations.

The Client or his appointed Agent on his behalf shall discuss and negotiate with the Principal Contractor the contents of the health and safety plan of the both Principal Contractor and Contractor for approval.

The Client or his appointed Agent on his behalf will take reasonable steps to ensure that the health and safety plan of both the Principal Contractor and Contractor is implemented and maintained. The steps taken will include periodic audits at intervals of at least once every month.

The Client or his appointed Agent on his behalf, will prevent the Principal Contractor and/or the Contractor from commencing or continuing with construction work should the Principal Contractor and/or the Contractor at any stage in the execution of the works be found to:

- have failed to have complied with any of the administrative measures required by the Construction Regulations in preparation for the construction project or any physical preparations necessary in terms of the Act;
- have failed to implement or maintain their health and safety plan;
- have executed construction work which is not in accordance with their health and safety plan; or
- act in any way which may pose a threat to the health and safety of any person(s) present on the site of the works or in its vicinity, irrespective of him/them being employed or legitimately on the site of the works or in its vicinity.

7.2 Principal Contractor

The Principal Contractor shall accept the appointment under the terms and Conditions of Contract. The Principal Contractor shall sign and agree to those terms and conditions and shall, before commencing work, notify the Department of Labour of the intended construction. Annexure 2 of this construction regulation contains a "Notification of Construction Work" form. The Principal Contractor shall submit the notification in writing prior to commencement of work and inform the Client or his Agent accordingly.

The Principal Contractor shall ensure that he is fully conversant with the requirements of this Specification and all relevant health and safety legislation.

The Principal Contractor will in no manner or means be absolved from the responsibility to comply with all applicable sections of the Act, the Construction Regulations or any Regulations proclaimed under the Act or which may perceivable be applicable to this contract.

The Principal Contractor shall provide and demonstrate to the Client a suitable and sufficiently documented health and safety plan based on this Specification, the Act and the Construction Regulations, which shall be applied from the date of commencement of and for the duration of execution of the works. This plan shall, as appendices, include the health and safety plans of all Sub-contractors for which he has to take responsibility in terms of this contract.

The Principal Contractor shall provide proof of his registration and good standing with the Compensation Fund or with a licensed compensation insurer prior to commencement with the works.

The Potential Principal Contractor shall, in submitting his tender, demonstrate that he has made provision for the cost of compliance with the specified health and safety requirements, the Act and Construction Regulations. (Note: This shall have to be contained in the conditions of tender upon which a tenderer's offer is based.)

The Principal Contractor shall consistently demonstrate his competence and the adequacy of his resources to perform the duties imposed on the Principal Contractor in terms of this Specification, the Act and the Construction Regulations.

The Principal Contractor shall ensure that a copy of his health and safety plan is available on site and is presented upon request to the Client, an Inspector, Employee or Sub-contractor.

The Principal Contractor shall ensure that a health and safety file, which shall include all documentation required in terms of the provisions of this Specification, the Act and the Construction Regulations, is opened and kept on site and made available to the Client or Inspector upon request. Upon completion of the works, the Principal Contractor shall hand over a consolidated health and safety file to the Client.

The Principal Contractor shall, throughout execution of the contract, ensure that all conditions imposed on his Sub-contractors in terms of the Act and the Construction Regulations are complied with as if they were the Principal Contractor.

The Principal Contractor shall from time to time evaluate the relevance of the Health and Safety Plan and revise the same as required, following which revised plan shall be submitted to the Client and/or his/her Agent for approval.

7.3 Contractor

The contractor must demonstrate to the Principal Contractor that he has the necessary competencies and resources to perform the construction work safely.

7.4 Responsibilities of Construction Health & Safety Agent (SACPCMP)

The construction Health & Safety Agent act as a link between the client, Principal Contractor and the project team members with respect to health & Safety, they are required to ensure that the client carry out its H&S responsibilities in terms of legislation as well as to co-ordinate and ensure good H&S practices are maintained throughout the duration of the project. In many cases this role starts from project initiation to project close-out.

- a) H&S competence: In the event that the client is unable to satisfy the requirements of the Construction Regulations for whatever reasons, the construction H&S agent may be appointed to perform these functions on behalf of the client. Given the need to appoint a registered construction H&S agent that is competent and adequately resourced with respect to H&S matters.
- b) H&S goals: It is important that the construction H&S agents demonstrate clearly to clients how they are going to contribute to the achievement of any client H&S goals and objectives. They should also set their own H&S goals.
- c) H&S responsibilities: Prior to accepting the H&S agent appointment from clients, H&S agents need to ensure that they brief clients fully on the client's particular responsibilities in terms of the OH&SA of 1993 and Construction Regulations as amended from time to time. In the absence of acceptance by clients of these responsibilities, H&S agents will not be able to adequately meet their own H&S responsibilities and duties.
- d) H&S information: H&S agents must provide the designer or design team with all H&S information to enable them to conduct a design HIRA to identify the significant hazards that need to be included in the H&S specification. This information may be gathered from multiple sources such as, for example, discussion with the client, previous historical use of the site or facility, previous surveys and investigations and past H&S files.

SI 08 SCOPE OF WORK

These specifications are applicable to the specific scope of work pertaining to the above-mentioned project as detailed in the tender documents, this amongst all includes for example:

- Repair and Maintenance work
- Operation of installations
- Construction, erecting, alteration, renovations, refurbishment, repairs, demolishing or dismantling of building and structures.
- Site clearance
- Site hoarding, demarcation and demolition works
- Excavations, filling, compaction, evening surface
- Piling (by drilling, excavating)
- Temporal works
- Construction, erecting, alteration, renovations, refurbishment, repairs, demolishing or dismantling of any bridge, dam, canal, road, railway, runaway, sewer, or water reticulation system or any civil engineering structure or type of work

SI 09 PREPARING A HEALTH & SAFETY PLAN

The level of detail required for a H&S plan will depend on how complex the workplace is (in particular, the number of contractors at the workplace at any one time) and the risks involved in the work. The plan must be easily accessible in a construction site and it must be clearly understood by management, supervisors & workers on construction site.

The plan must be implemented, maintained and kept up to date during the construction of the project.

The principal contractor should prepare an H&S plan that includes:

- project information;
- client requirements for H&S management on the project;
- Environmental restrictions and existing on-site risks arrangements, imposed by others or developed by the principal contractor, to control significant site H&S risks; H&S file & project H&S review.

The H&S plan should include the following information:

- details of the client, that is the person commissioning the construction work, for example their name, representative and contact details;
- details of the principal contractor;
- details of the construction project, for example address of the workplace, anticipated start and end date and a brief description of the type of construction work that the H&S plan will cover;
- details on how subcontractors will be managed and monitored, including how the principal contractor intends to implement and ensure compliance with the H&S plan such as checking on the performance of subcontractors and how non-compliance will be handled; and details on how the risks associated with falls, falling objects, moving plant, electrical work and all high risk construction work that will take place on a construction project will be managed.

The H&S plan should also include information on:

- the provision and maintenance of a hazardous chemicals register, safety data sheets and hazardous chemicals storage;
- the safe use and storage of plant;
- the development of a construction project traffic management plan;
- obtaining and providing essential services information – electrical, gas, telecom, water and similar services;
- workplace security and public safety; and
- ensuring workers have appropriate licences and training to undertake the construction work.

The H&S plan must contain:

- a general description of the type of work activities involved in the project and not just a description of the facility to be constructed;
- the project program or schedule details, including start and finish dates, showing principal activities;
- details of client, design team, principal contractor, subcontractors, and major suppliers; and
- extent and location of relevant existing records, surveys, site investigation and geotechnical reports, 'as-built' plans, H&S files.

SI 10 HEALTH AND SAFETY FILE

The H&S file is a document prepared by the principal contractor containing important project H&S information for use by the owner of the completed structure after construction has been completed.

The principal contractor is responsible for producing an H&S file. It contains important project H&S information for use by the owner of the completed structure after construction has been completed. It is essential that the process of compiling the file commence as early as possible to ensure sufficient time to gather the required information.

The Principal Contractor must, in terms of Construction Regulation 7(7), keep a Health & Safety File on site at all times that must include all documentation required in terms of the Act and Regulations and must also include a list of all Contractors on site that are accountable to the Principal Contractor and the agreements between the parties and details of work being done. A more detailed list of documents and other legal requirements that must be kept in the Health & Safety File.

The contractor must ensure that the client's format and layout of the H&S file is adhered to. The contractor must identify the responsible person that will prepare the H&S file and who will be responsible for the drafting of as-built drawings. The contractor must establish procedures:

The Health and Safety File will remain the property of the Client and/or its Agent on its behalf throughout the period of the project and shall be consolidated and handed over to the Client and/or its Agent on its behalf at the time of completion of the project.

SI 11 OH&S GOALS AND OBJECTIVES AND ARRANGEMENTS FOR MONITORING AND REVIEWING OH&S PERFORMANCE

The Principal Contractor is required to maintain an acceptable disabling incident frequency rate (DIFR) and report on this to the Client and/or its Agent on its behalf on a monthly basis.

11.1 IDENTIFICATION OF HAZARDS AND DEVELOPMENT OF RISK ASSESSMENTS, STANDARD WORKING PROCEDURES (SWP) AND METHOD STATEMENTS

The Principal Contractor is required to develop Risk Assessments, Standard Working Procedures (SWP) and Method Statements for each activity executed in the contract or project.

The identification of hazards is over and above the hazards identification programme and those hazards identified during the drafting of the Health and Safety Plan.

11.1.1 Monthly Audit by Client and/or its Agent.

The Client and/or its Agent on its behalf will be conducting Periodic Audits at times agreed with the Principal Contractor Audit to comply with Construction Regulation 4(1)(d) to ensure that the principal Contractor has implemented, is adhering to and is maintaining the agreed and approved OH&S Plan.

A representative of the Principal Contractor and the relevant Health and Safety Representative(s) (SHE-Reps) must accompany the Client and/or its Agent on its behalf on all Audits and Inspections and may conduct their own audit/inspection at the same time. Each party will, however, take responsibility for the results of his/her own audit/inspection results. The Client and/or its Agent on its behalf may require to be handed a copy of the minutes of the previous Health and Safety Committee meeting reflecting possible recommendations made by that committee to the Employer for reference purposes.

11.1.2 Health & Safety incident/accident reporting & investigations

The Principal Contractor shall report all incidents where an employee is injured on duty to the extent that he/she:

- dies
- becomes unconscious
- loses a limb or part of a limb
- is injured or becomes ill to such a degree that he/she is likely either to die or to suffer a permanent physical defect or likely to be unable for a period of at least 14 days either to work or continue with the activity for which he/she was usually employed

or where:

- a major incident occurred
- the health or safety of any person was endangered
- where a dangerous substance was spilled
- the uncontrolled release of any substance under pressure took place
- machinery or any part of machinery fractured or failed resulting in flying, falling or uncontrolled moving objects
- Machinery ran out of control, to the Provincial Director of the Department of Labour within seven days and at the same time to the Client and/or its Agent on its behalf.

The Principal Contractor is required to provide the Client and/or its Agent on its behalf with copies of all statutory reports required in terms of the Act and the Regulations.

The Principal Contractor is required to provide the Client and/or its Agent on its behalf with a monthly "SHE Risk Management Report".

The Principal Contractor is required to provide a.s.a.p. the Client and/or its Agent on its behalf with copies of all internal and external accident/incident investigation reports.

The Principal Contractor is responsible to oversee the investigation of all accidents/incidents where employees and non-employees were injured to the extent that he/she/they had to receive first aid or be referred for medical treatment by a doctor, hospital or clinic. (General Administrative Regulation 9)

The results of the investigation to be entered into the Accident/Incident Register listed above. (General Administrative Regulation 9)

The Principal Contractor is responsible for the investigation of all non-injury incidents as described in Section 24 (1) (b) & (c) of the Act and keeping a record of the results of such investigations including the steps taken to prevent similar incidents in future.

The Principal Contractor is responsible for the investigation of all accidents relating to the construction site and keeping a record of the results of such investigations including the steps taken to prevent similar accidents in future.

Notwithstanding the requirements of Section 24 of the Act, ALL incidents shall be investigated and reported on in writing, irrespective of whether such incident gave rise to injury or damage.

Determine the underlying H&S deficiencies and other contributory factors Identification of corrective/preventative actions and continual improvement communicating the outcome/results and documenting the events of the investigation.

Reporting Of Near-Misses

The Department of Public Works views the reporting of near misses as a critical component in creating a positive health and safety awareness culture on site.

The Department of Public Works retains the right to enforce the reporting of near misses within 24 hours of occurrence.

SI 12 REVIEW

The Principal Contractor is to review the Hazard Identification, Risk Assessments and Standard Work Processes at each Production Planning and Progress Report meeting as the construction work develops and progresses and each time changes are made to the designs, plans and construction methods and processes.

The Principal Contractor must provide the Client and/or its Agent on its behalf, other Contractors and all other concerned parties with copies of any changes, alterations or amendments as contemplated in the above paragraph.

12.1 Site Rules and other Restrictions

Site OH&S Rules

The Principal Contractor must develop a set of site-specific OH&S rules that will be applied to regulate the Health and Safety Plan and associated aspects of the construction. When required for a site by law, visitors and non-employees upon entering the site shall be issued with the proper Personal Protective Equipment (PPE) as and when necessary.

Security Arrangements

The Principal Contractor must establish site access rules and implement and maintain these throughout the construction period. Access control must include the rule that non-employees shall at all times be provided with fulltime supervision while on site. The Principal Contractor must develop a set of Security rules and procedures and maintain these throughout the construction period.

If not already tasked to the H&S Officer appointed in terms of Construction Regulation, the Principal Contractor must appoint a competent person who must develop contingency plans for any emergency that may arise on site as indicated by the risk assessments.

12.1.1 Appointment of Health & Safety Representatives

H&S Representatives('SHE – Reps')

Where the Principal Contractor employs more than 20 persons (including the employees of other Contractors (sub-contractors) he has to appoint one H&S Representatives for every 50 employees or part thereof. (Section 17 of the Act and General Administrative Regulation 6. & 7.)

H&S Representatives must be appointed in writing and the designation shall be in accordance with the Collective Agreement as concluded between the parties as is required in terms of General Administration Regulation 6.

Duties and Functions of the H&S Representatives

The Principal Contractor must ensure that the designated H&S Representatives conduct at least a weekly inspection of their respective areas of responsibility using a checklist developed by a Principal Contractor.

The report must be consolidated and submitted to the Health & Safety Committee.
H&S Representatives must form part of the incident/accident investigating team.

12.1.3 Establishment of H&S Committee(s)

The Principal Contractor must establish H&S Committees consisting of designated H&S Representatives together with a number of Employers Representatives appointed as per Section 19(3) that are not allowed to exceed the number of H&S Representatives on the committee.

The persons nominated by the employer on a H&S Committee must be designated in writing for such period as may be determined by him. The H&S Committee shall co-opt advisory (temporary) members and determine the procedures of the meetings including the chairmanship.

The H&S Committee must meet minimum monthly and consider, at least, an agreed Agenda for the first meeting. Thereafter the H&S Committee shall determine its own procedures.

12.1.4 Training & Awareness

The contents and syllabi of all training required by the Act and Regulations including any other related or relevant training as required must be included in the Principal Contractor's Health and Safety Plan and Health and Safety File.

Training & Induction

All employees performing work or task on site that potentially impact on H&S must be competent & have the necessary appropriate education, training & experience.

All the training must be closely aligned with the risk profile of the project; procedures must be put in place to ensure that all workers are aware of the consequences of their work activities & benefits of improved H&S performance.

All employees of the Principal and other Contractors must be in possession of proof of General Induction training

Site Specific Induction Training

All employees of the Principal and other Contractors must be in possession of Site Specific Occupational Health and Safety Induction or other qualifying training.

Other Training

All operators, drivers and users of construction vehicles, mobile plant and other equipment must be in possession of valid proof of training.

SI 13 PROJECT/SITE SPECIFIC REQUIREMENTS

The following is a list of specific activities and considerations that have been identified for the project and site and for which Risk Assessments, Standard Working Procedures (SWP), management and control measures and Method Statements (where necessary) have to be developed by the Principal Contractor:

- Clearing & grubbing the area/site
- Site establishment
- Dealing with existing structures
- Location of existing services
- Boundary & Access control/Public liability exposures
- Protection against heat exhaustion, dehydration, wet & cold conditions
- Dealing with HIV & aids other related diseases
- Use of portable electrical & explosive tools
- Any Excavation work
- Any welding work
- Loading & offloading of trucks
- Driving & operations of Construction vehicles & mobile plant
- Temporal works and
- Construction work as defined in the construction regulation 2014

SI 14 OUTLINED DATA, REFERENCES AND INFORMATION ON CERTAIN AND/OR SPECIFIC OBLIGATORY REQUIREMENTS TO ENSURE COMPLIANCE

Administrative & Legal Requirements

OHS Act Section/ Regulation	Subject	Requirements
Construction. Regulation	Notice of carrying out Construction work	Department of Labour notified Copy of Notice available on Site
General Admin. Regulation 4	Copy of OH&S Act (Act 85 of 1993)	Updated copy of Act & Regulations on site. Readily available for perusal by employees.
COID Act Section 80	Registration with Compensation Insurer.	Written proof of registration/Letter of good standing available on Site
Construction. Regulation 4 & 5(1)	H&S Specification & Programme	H&S Spec received from Client and/or its Agent on its behalf OH&S programme developed & Updated regularly
Section 8(2)(d) Construction. Regulation 7	Hazard Identification & Risk Assessment	Hazard Identification carried out/Recorded Risk Assessment and – Plan drawn up/Updated RA Plan available on Site Employees/Sub-Contractors informed/trained
Section 16(2)	Assigned duties (Managers)	Responsibility of complying with the OH&S Act assigned to other person/s by CEO.
Construction Regulation 6(1)	Designation of Person Responsible on Site	Competent person appointed in writing as Construction Supervisor with job description
Construction Regulation 6(2)	Designation of Assistant for above	Competent person appointed in writing as Assistant Construction Supervisor with job description
Section 17 & 18 General Administrative Regulations 6 & 7	Designation of Health & Safety Representatives	More than 20 employees - one H&S Representative, one additional H&S Rep. for each 50 employees or part thereof. Designation in writing, period and area of responsibility specified in terms of GAR 6 & 7 Meaningful H&S Rep. reports. Reports actioned by Management.
Section 19 & 20 General Administrative Regulations 5	Health & Safety Committee/s	H&S Committee/s established. All H&S Reps shall be members of H&S Committees Additional members are appointed in writing. Meetings held monthly, Minutes kept. Actioned by Management.

Section 37(1) & (2)	Agreement with Mandatories/ (Sub-)Contractors	Written agreement with (Sub-)Contractors List of Subcontractors displayed. Proof of Registration with Compensation Insurer/Letter of Good Standing Construction Supervisor designated Written arrangements re. H&S Reps & H&S Committee Written arrangements re. First Aid
Section 24 & General Admin. Regulation 8 COID Act Sect.38, 39 & 41	Reporting of Incidents (Dept. of Labour)	Incident Reporting Procedure displayed. All incidents in terms of Sect. 24 reported to the Provincial Director, Department of Labour, within 3 days. (Annexure 1)(WCL 1 or 2) and to the Client and/or its Agent on its behalf Cases of Occupational Disease Reported Copies of Reports available on Site Record of First Aid injuries kept
General Admin. Regulation 9	Investigation and Recording of Incidents	All injuries which resulted in the person receiving medical treatment other than first aid, recorded and investigated by investigator designated in writing. Copies of Reports (Annexure 1) available on Site Tabled at H&S Committee meeting Action taken by Site Management.
Construction. Regulation 8	Fall Prevention & Protection	Competent person appointed to draw up the Fall Protection Plan Proof of appointees competence available on Site Risk Assessment carried out for work at heights Fall Protection Plan drawn up/updated Available on Site
Construction. Regulation Driven Machinery Regulations 18 & 19	Cranes & Lifting Machines Equipment	Competent person appointed in writing to inspect Cranes, Lifting Machines & Equipment Written Proof of Competence of above appointee available on Site. Cranes & Lifting tackle identified/numbered Register kept for Lifting Tackle Log Book kept for each individual Crane Inspection: - All cranes - daily by operator Tower Crane/s - after erection/6monthly Other cranes - annually by comp. person - Lifting tackle(slings/ropes/chain slings etc.) - daily or before every new application

General Safety Regulation 8(1)(a)	Designation of Stacking & Storage Supervisor.	Competent Person/s with specific knowledge and experience designated to supervise all Stacking & Storage Written Proof of Competence of above appointee available on Site
Construction. Regulation Environmental Regulation 9	Designation of a Person to Co-ordinate Emergency Planning And Fire Protection	Person/s with specific knowledge and experience designated to co-ordinate emergency contingency planning and execution and fire prevention measures Emergency Evacuation Plan developed: Drilled/Practiced Plan & Records of Drills/Practices available on Site Fire Risk Assessment carried out All Fire Extinguishing Equipment identified and on register . Inspected weekly. Inspection Register kept Serviced annually
General Safety Regulation 3	First Aid	Every workplace provided with sufficient number of First Aid boxes. (Required where 5 persons or more are employed) First Aid freely available Equipment as per the list in the OH&S Act. One qualified First Aider appointed for every 50 employees. (Required where more than 10 persons are employed) List of First Aid Officials and Certificates Name of person/s in charge of First Aid box/es displayed. Location of First Aid box/es clearly indicated. Signs instructing employees to report all Injuries/illness including first aid injuries
General Safety Regulation 2	Personal Safety Equipment (PSE)	PSE Risk Assessment carried out Items of PSE prescribed/use enforced Records of Issue kept Undertaking by Employee to use/wear PSE PSE remain property of Employer, not to be removed from premises GSR 2(4)

General Safety Regulation 9	Inspection & Use of Welding/Flame Cutting Equipment	Competent Person/s with specific knowledge and experience designated to Inspect Electric Arc, Gas Welding and Flame Cutting Equipment Written Proof of Competence of above appointee available on Site All new vessels checked for leaks, leaking vessels NOT taken into stock but returned to supplier immediately Equipment identified/numbered and entered into a register Equipment inspected weekly. Inspection Register kept Separate, purpose made storage available for full and empty vessels
General Safety Regulation 13A	Inspection of Ladders	Competent person appointed in writing to inspect Ladders Ladders inspected at arrival on site and weekly thereafter. Inspections register kept Application of the types of ladders (wooden, aluminium etc.) regulated by training and inspections and noted in register
General Safety regulation 13B	Ramps	Competent person appointed in writing to supervise the erection & inspection of Ramps. Inspection register kept. Daily inspected and noted in register

SI 15 THE PRINCIPAL CONTRACTOR'S GENERAL DUTIES

The Principal Contractor shall at all times ensure his status of an “employer” as referred to in the Act, and will abide by his/her responsibilities, duties and functions as per the requirements of the Act and Regulations with specific reference to Section 8 of the Act.

The Principal Contractor shall keep, and on demand make available, a copy of the Act on site at all times and in addition to that he/she will introduce and maintain a file titled “Health and Safety File”, or other record in permanent form, which shall contain all relevant aspects and information as contemplated in the Construction Regulations. He/she will make this file available to the client or his representative whenever necessary or on request to an interested party.

The project under control of the Principal Contractor shall be subject to periodic health and safety audits that will be conducted by the client at intervals agreed upon between the Principal Contractor and the client, provided such intervals will not exceed periods of one month.

The Principal Contractor is to ensure that he/she and all persons under his control on the construction site shall adhere to the above specifications.

The Principal Contractor should note that he/she shall be held liable for any anomalies including costs and resulting deficiencies due to delays caused by non-conformance and/or non-compliance to the above Health and Safety Specifications and the Health and Safety Plan based on these specifications.

SI 16 THE PRINCIPAL CONTRACTOR'S SPECIFIC DUTIES

The Principal Contractor's specific duties in terms of these specifications are detailed in the Construction Regulations as published under government notice 07 August 2014, stipulated in Section 7.

SI 17 THE PRINCIPAL CONTRACTOR'S SPECIFIC RESPONSIBILITIES WITH REGARD TO HAZARDOUS ACTIVITIES

The following examples of activities are identifiable as hazardous in terms of the Construction Regulations. The contractor shall execute the activities in accordance with the following Construction Regulations and other applicable regulations of the Act:

- Fall protection
- Structures
- Excavation work
- Demolition work
- Scaffolding
- Construction vehicles & mobile plant
- Water environments
- Housekeeping on construction sites
- Fire precautions on construction sites

This list must not be taken to be exclusive or exhaustive. All of the above requirements will be read in conjunction with the relevant regulations and health and safety standards as required by the Act. All documents and records required by the Construction Regulations will be kept in the Health and Safety File and will be made available at any time when required by the client or his representative, or on request to an interested party.

SI 18 GENERAL NOTES TO THE PRINCIPAL CONTRACTOR

Legal Framework

Part of legal obligations

The more important Acts and relevant subordinate/secondary legislation as well as other (inter alia Local Government) legislation that also apply to the State as well as to State owned buildings and premises:

- The latest issue of SABS 0142: "Code of Practice for the Wiring of Premises"
- The Local Government Ordinance 1939 (Ordinance 17 of 1939) as amended and the municipal by-laws and any special requirements of the local supply authority
- The Fire Brigade Services Act 1987, Act 99 of 1987 as amended
- The National Building Regulations and Building Standards Act 1977 (Act 103 of 1977) as amended and relevant proclaimed Regulations (SABS 0400)
- The Post Office Act 1958 (Act 44 of 1958) as amended
- The Electricity Act 1984, Act 41 of 1984
- The Regulations of Local Gas Board(s), including Publications of the SABS Standards and Codes of Practice, with specific reference to GNR 17468 dated 4th October 1997
- Legislation pertaining to water usage and the environment
- Legislation governing the use of equipment, which may emit radiation (e.g. X-Rays etc.)
- Common Law

SI 19 HOUSE KEEPING

Good housekeeping will be maintained at all times as per Construction Regulation No. 25. Poor housekeeping contributes to three major problems, namely, costly or increased accidents, fire or fire hazards and reduction in production. Good housekeeping will enhance production time.

In promotion of environmental control all waste, rubble, scrap etc., will be disposed of at a registered dumpsite and records will be maintained. Where it is found to be impractical to use a registered dump site or it is not available, the Principal Contractor will ensure that the matter is brought to record with the client or his representative, after which suitable, acceptable alternatives will be sought and applied.

Dross and refuse from metals, and waste matters or by-products whose nature is such that they are poisonous or capable of fermentation, putrefaction or constituting a nuisance shall be treated or disposed of by methods approved of by an inspector.

NOTE: No employer (Principal Contractor) shall require or permit any person to work at night or after hours unless there is adequate, suitable artificial lighting including support services in respect of Health and Safety.

Facilities

The site establishment plan shall make provision for:

Dining room facilities

The contractor shall make provision for adequate dining room facilities for his employees on site.

Change rooms

The contractor shall make provision for adequate change rooms for his employees on site.

Ablution facilities

The contractor shall make provision for adequate ablution facilities for his employees on site.

These facilities shall be maintained by the contractor.

Smoking Areas

Designated smoking areas shall be established by Department of Public Works.

Drinking Water Facilities

The provision of drinking water facilities shall be negotiated between the Contractor and Department of Public Works.

Equipment Compliance Certificates

Before equipment is brought on site valid certificates of compliance issued by a competent person shall be presented.

The equipment includes but shall not be limited to:

- lifting equipment and lifting tackle
- power driven machinery
- electrical equipment
- testing and monitoring equipment

Barricading

All barricading shall be of the rigid type unless the use of non-rigid barricading has been approved in writing by the Department of Public Works Project Manager. The contractors' barricading standard shall be included in the Health and Safety Plan.

Where more than one contractor is working on a site, the fixed barricading shall be clearly marked with the company's name, site contact person as well as the contact number/s.

Erection of Structures for Logistic Support

Prior to site establishment Department of Public Works shall approve the contractor's site plan. Department of Public Works shall approve all structures erected for logistical support by the contractor. These structures include fences, workshops, tool sheds, offices, ablution facilities, etc.

Salvage Yard Management

Depending on the site-specific arrangements and procedures, Department of Public Works may provide the salvage yard and the resources to manage it.

The salvage yard management shall conform to safety, health and environmental requirements. The contractors are required to move the equipment from the place of work to the salvage yard.

Fall Arrest and Prevention Equipment

Approved fall prevention equipment shall be used at heights of less than 2.0 metres. Above heights of 2.0 metres fall prevention equipment shall include fall arrest equipment. Users of fall arrest equipment shall, amongst other things be trained in what an appropriate load bearing point is for connecting fall prevention equipment. Any deviation from this requirement shall be negotiated and agreed with Department of Public Works in writing.

Hazardous Chemical Substances Waste Removal

Department of Public Works shall provide a facility to collect all hazardous chemical waste material.

The contractor shall provide adequately marked and sealable containers to transport The hazardous chemical waste from the source to the approved Department of Public Works disposal point.

Personal Protective Equipment (PPE)

Personal protective equipment issued shall be specific to the risks associated with the work to be performed and specific to conditions on site and shall comply with South African National Standards (SANS) or similar.

SI 20 LOCKOUT SYSTEMS

A system of control shall be established in order that no unauthorized person can energize a circuit, open a valve, or activate a machine on which people are working or doing maintenance, even if equipment, plant or machinery is out of commission for any period, thus eliminating injuries and damage to people and equipment as far as is reasonably practicable.

Physical/mechanical lockout systems shall be part of the safety system and included in training. Lockouts shall be tagged and the system tested before commencing with any work or repairs.

SI 21 IMPORTANT LISTS AND RECORDS TO BE KEPT

The following are lists of several records that are to be kept in terms of the Construction Regulations. The lists are:

- List of appointments
- List of record keeping responsibilities
- Inspection checklist

Contractor Risk Assessment Process

The risk assessment process shall include:

- an evaluation of the method of the work to be conducted
- the method statement on the procedure to be followed in performing the task shall be developed
- the risk assessment will also include activities like:
 - Transportation of passengers and goods to and from site
 - Site establishment
 - Physical and mental capabilities of employees
 - Others as may be specified.
 - the hazards as listed in the paragraph – Site Specific Health and Safety Hazards
- a review plan for risk assessments shall provide for:
 - the quarterly review of all applicable risk assessments
 - the review of an assessment if there is reason to believe that the previous assessment is no longer valid, or there has been a change in a process, work methods, equipment or procedures and working conditions

Risk assessment/s to be reviewed if the outcome of incident investigations and audits etc. requires such action.

A pre-task risk assessment shall be conducted in writing on every task and be facilitated by the team leader. All risk assessments and pre-task risk assessments shall be filed and be available on site.

Risk Profile

All contractors shall submit a risk profile of the work to be conducted with their Health and Safety Plan.

Risk Based Inspection Program

The inspection programme shall be risk based. The inspection plan shall form part of the Health and Safety Plan.

IMPORTANT CONTACT DETAILS**(FOR HEALTH & SAFETY ASPECTS ONLY)**

The contractor is to add all the important contact information about essentials services, support and assistance.



SERVICE	NUMBER	CONTACT PERSON
Hospital		



Ambulance		



Water		
Electricity		



Police		



Fire Brigade		



Engineer		

ADD OTHER IMPORTANT HEALTH & SAFETY CONTACT DETAILS AS MAY BE FOUND NECESSARY.

SECTION 37(2) AGREEMENTS

CONCLUDED BETWEEN

DEPARTMENT OF PUBLIC WORKS

(Hereinafter referred to as Department of Public Works)

AND

.....
(Name of contractor/supplier/Agent/)

I, ...(name)

representing do hereby acknowledge

that is an employer in his/her own right, with duties as prescribed in the Occupational Health and Safety Act No. 85 of 1993 ("the Act"), as amended, and agree to ensure that all work will be performed and/or machinery or plant used in accordance with the provisions of the Act.

I undertake that [*insert name of contractor/supplier*] shall strictly adhere to, and ensure that his/her employees adhere to, the provisions of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).

I have been provided with SHE specifications for project/service
.....

[*insert brief details of project/service, for example, name, contract/project number*]

.....and will comply with the requirements set out in these.

I accept and agree that the SHE specifications constitute arrangements and procedures between

..... [*Insert name of contractor/supplier/Agent*]
Safety Manager/Safety Officer] and Department of Public Works, which will ensure compliance

by [*Insert name of contractor/supplier*] with the provisions of the Act, as contemplated in section 37(2) of the Act.

This agreement constitutes the sole agreement between the parties, and no variation, modification, or waiver of any of the provisions of this agreement or consent to any departure from these shall, in any manner, be of any force or effect, unless confirmed in writing and signed by both parties, and such variation, modification, waiver, or consent shall be effective only in the specific instance and for the specific purpose and to the extent for which it was made or given.

This agreement is signed on behalf of the parties, each signatory to this warranting that he/she has the requisite authority to do so.

Signed this day of..... at

..... (Place)

(Full name)..... (Signature)..... on

behalf of(Supplier/contractor/Agent)

Contractor Responsible Manager (responsible for signing the Department of Public Works' contract on behalf of the contractor)

Witnesses

.....

.....

Signed this day of

at..... (Place)

(Full name..... (Signature)..... on

Behalf of **Department of Public Works.**

(Contracts and/or Project Manager or Department of Public Works representative)

Witnesses

.....

.....

PROJECT:

(full name AND site address of project)
(and full or proper description of project)

WCS NO:

SUPERVISION BY THE DEPARTMENT OF PUBLIC WORKS:

Mr /Ms/Me - **CONSTRUCTION PROJECT MANAGER**
(add full details of the project manager)

.....

Mr /Ms/Me - **CONSTRUCTION MANAGER**
(add full details)

.....

Mr /Ms/Me - **AGENT:**
(full particulars of agent)

.....

SUPERVISION BY THE PRINCIPAL CONTRACTOR:

PRINCIPAL CONTRACTOR:
(full particulars of principle contractor / contractor)

Mr /Ms/Me - **CONSTRUCTION HEALTH & SAFETY OFFICER**
(add full details and contact of this officer)

.....

Mr /Ms/Me - **CONSTRUCTION HEALTH & SAFETY MANAGER**
(add full details of this officer)

.....

Mr /Ms/Me - **CONSTRUCTION HEALTH & SAFETY AGENT**
(add full details of this officer)

.....

Mr /Ms/Me - **CONSTRUCTION MANAGER**
(add full details of the head of the project)

.....

OHS Act Site Evaluation

Month:		Site:		Contractor:		
Done by:		Total Score %	0.00%			
Score:	N/A = 3	Comply = 3	Comply partly = 1	Non-compliant = 0	Total Points	Total Scored
					318	0

1. Subcontractors & Agreements	0
1.1 Is a signed copy of the Client's appointment on site?	
1.2 Are subcontractors correctly appointed?	
1.3 Do the subcontractors have a safety file on site?	
1.4 Is the 37.2 signed by both parties?	
1.5 Has the appointments and controlling documents been approved by the principal contractor?	
2. Policies and Site Rules	0
2.1 Is the health and safety policy signed and communicated with all employees?	
2.2 Is the HIV/AIDS policy displayed and communicated with all?	
2.3 Are the safe safety rules communicated with all on site?	
3. Department of Labour and Legal Issues	0
3.1 Is proof of notification of construction work on file?	
3.2 Is the letter of good standing on file and current?	
3.3 Is the contractor's Public Indemnity Insurance on file and valid?	
3.4 Is the OHS Act displayed or available?	
3.5 Is the Construction Regulations available?	
4. Safety Plan and Risk Assessments	0
4.1 Is the contractors Health and Safety Plan on file and site specific?	
4.2 Has Risk Assessments been conducted for this project?	
4.3 Has Risk Assessments been communicated with employees?	
4.4 Are daily safety talks conducted?	
5. Emergency Planning & First Aid	0
5.1 Is there a site specific emergency plan?	
5.2 Is there a Regulation 3 first aid kit on site?	
5.3 Is the first aider's name and tel. Nr. available	
5.4 Is the first aider's certificate still valid?	
5.5 Dressing record available?	
5.6 Emergency number displayed	
6. Site Safety Induction and other training	0
6.1 Have all employees received site safety induction training?	
6.2 Have all employees received HIV/AIDS training?	
6.3 Are the supervisor's competency certificates available on site?	
7. Appointments	0
7.1 Has the 16.2 assignment been documented and signed?	
7.2 Supervisor appointment	
7.3 Qualified Supervisor	
7.4 Qualified Safety Officer	
7.5 Safety Representative	
7.6 Qualified Risk Assessor	
7.7 All other appointments as required	
7.8 Organogram displayed?	

8. Registers	0
8.1 DB Box (Nr's and ID)	
8.2 Fire Equipment	
8.3 Ladders	
8.4 Scaffolding	
8.5 Excavation	
8.6 Form & Support work	
8.7 Portable electrical tools	
8.8 Hand tools	
8.9 PPE	
8.10 Cranes, Lifting Machines	
8.11 Lifting tackle and equipment	
8.12 Construction vehicles	
8.13 Hazardous chemicals	
8.14 Compacting machines	
8.15 Concrete mixer	
8.16 Housekeeping	
8.17 Safety Harness	
8.18 Ropes and Slings	
9. Audits and Inspections	0
9.1 Safety Rep inspections	
9.2 Monthly audit reports	
10. Incident Management	0
10.1 Letter of good standing valid?	
10.2 WCL2,WCL3, WCL5 on file	
10.3 Annexure 1 & 2 on file	
10.4 Incident report procedure on file	
10.5 Are all incidents investigated?	
10.6 Have a training session been conducted to address incidents and lessons learnt?	
11. H&S Committee meetings and safety minutes	0
11.1 Safety meetings minuted with rectification plan?	
11.2 Are issues discussed addressed with deadlines?	
11.3 Agendas address site specifics?	
12. Safety Awareness	0
12.1 Toolbox talks done weekly?	
12.2 One-to-one safety talks on file?	
12.3 Posters displayed	

13. Facilities and Hygiene	0
13.1 Showers available?	
13.2 Toilets available?	
13.3 Toilet paper available?	

20. Hazardous Chemicals & Environmental Issues	0
20.1 Is a list available indicating all hazardous substances on site?	
20.2 Are MSDS for each on site?	
20.3 EMP on site?	

13.4 Are facilities clean?	
13.5 Is clean cool drinking water available?	
14. Personal Protective Equipment (PPE)	0
14.1 Have the PPE register been completed?	
14.2 Are all PPE in a good condition?	
14.3 Is PPE available for visitors?	
15. Lifting Machinery and Mobile Equipment	0
15.1 Do all lifting equipments have a load test certificate?	
15.2 Are all lifting equipment numbered and registered?	
15.3 Has a lifting equipment inspector been appointed?	
15.4 Has lifting machinery been equipped with lightning free footplates?	
15.5 Have all operators a certificate of competence?	
15.6 Have all operators done a medical fitness evaluation?	
15.7 Are all machinery free of oil or fuel leaks?	
15.8 Machinery does not generate excessive smoke or noise?	
15.9 Do all vehicles and mobile plant have a fire extinguisher?	
15.10 Is a pre-start checklist available and completed each day?	
16. Hot Work	0
16.1 Are hot work equipment tested and registered?	
16.2 Is a hot work register available?	
16.3 Is a person trained to issue a hot work permit?	
16.4 Are isolation and barricading used during hot work?	
17. Excavation and shoring	0
17.1 Is an excavation inspector appointed?	
17.2 Are excavations inspected before and after work daily?	
17.3 Are excavations barricaded correctly?	
18. Demolition and Explosives	0
18.1 Is a qualified Demolition Supervisor appointed?	
18.2 Is a qualified Blaster appointed?	
18.3 Are safety talks done before demolition work starts?	
18.4 Are explosives handled according to the Explosives Act?	
19. Working on Heights	0
19.1 Are all employees working on heights tested Physically and Psychologically?	
19.2 Has a qualified fall protection plan developer been appointed?	
19.3 Has all applicable employees received training on fall arrest equipment?	
19.4 Are all ladders been registered and in good condition?	
19.5 Are all open areas or holes been barricaded?	

20.4 Waste Management plan on site?	
20.5 Hazardous Waste removal?	
20.6 Environmental talks?	

General Comments

The Principal contractor must within three (3) working days report to the Client's Agent on how he/she will rectify any deviances. Any non-compliance can result in work stopages

Signature and Date

ADDITIONAL SPECIFICATION**SK EMPLOYMENT AND TRAINING OF LABOUR ON EPWP INFRASTRUCTURE PROJECTS****CONTENTS**

SK 01	SCOPE
SK 02	APPLICABLE LABOUR LAWS
SK 03	EXTRACTS FROM MINISTERIAL DETERMINATION REGARDING SPWP
SK 04	EMPLOYER'S RESPONSIBILITIES
SK 05	EMPLOYMENT OF TARGETED LABOUR
SK 06	TRAINING OF WORKERS
SK 07	BENEFICIARY SELECTION CRITERIA
SK 08	CONTRACTUAL OBLIGATIONS IN RELATION TO LABOUR
SK 09	PROVINCIAL RATES OF PAY
SK 10	MEASUREMENT AND PAYMENT
PRO-FORMA EPWP EMPLOYMENT AGREEMENT	

SK 01 INTRODUCTION

This specification contains the standard terms and conditions for workers employed in elementary occupations and trained on a Special Public Works Programme (SPWP). These terms and conditions do NOT apply to persons employed in the supervision and management of a SPWP.

SK 02 APPLICABLE LABOUR LAWS

In line with the Expanded Public Works Programme (EPWP) policies, the Ministerial Determination, Special Public Works Programmes, issued in terms of the Basic Conditions of Employment Act of 1997 by the Minister of labour in government Notice No. R63 of 25 January 2002, of which extracts have been reproduced below in clauses SK 03 shall apply to works described in the scope of work and which are undertaken by unskilled or semi-skilled workers.

The Code of Good Practice for Employment and Conditions of Work for Special Public Works Programmes, issued in terms of the Basic Conditions of Employment Act of 1997 by the Minister of Labour in Government Notice No. R64 of 25 January 2002

shall apply to works described in the scope of work and which unskilled or semi-skilled workers undertake.

SK 03 EXTRACTS FROM MINISTERIAL DETERMINATION REGARDING SPWP

SK 03.01 DEFINITIONS

In this specification –

- (a) “department” means any department of the State, implementing agent or contractor;
- (b) “employer” means any department that hires workers to work in elementary occupations on a SPWP;
- (c) “worker” means any person working in an elementary occupation on a SPWP;
- (d) “elementary occupation” means any occupation involving unskilled or semi-skilled work;
- (e) “management” means any person employed by a department or implementing agency to administer or execute a SPWP;
- (f) “task” means a fixed quantity of work;
- (g) “task-based work” means work in which a worker is paid a fixed rate for performing a task;
- (h) “task-rated worker” means a worker paid on the basis of the number of tasks completed;
- (i) “time-rated worker” means a worker paid on the basis of the length of time worked
- (j) “Service Provider” means the consultant appointed by Department to coordinate and arrange the employment and training of labour on EPWP infrastructure projects.

SK 03.02 TERMS OF WORK

- (a) Workers on a SPWP are employed on a temporary basis.
- (b) A worker may NOT be employed for longer than 24 months in any five-year cycle on a SPWP.

- (c) Employment on a SPWP does not qualify as employment and a worker so employed does not have to register as a contributor for the purposes of the Unemployment Insurance Act 30 of 1966.

SK 03.03 NORMAL HOURS OF WORK

- (a) An employer may not set tasks or hours of work that require a worker to work—
 - (i) more than forty hours in any week
 - (ii) on more than five days in any week; and
 - (iii) for more than eight hours on any day.
- (b) An employer and a worker may agree that the worker will work four days per week. The worker may then work up to ten hours per day.
- (c) A task-rated worker may not work more than a total of 55 hours in any week to complete the tasks (based on a 40-hour week) allocated to him.

Every work is entitled to a daily rest period of at least eight consecutive hours. The daily rest period is measured from the time the worker ends work on one day until the time the worker starts work on the next day.

SK 03.04 MEAL BREAKS

- (a) A worker may not work for more than five hours without taking a meal break of at least thirty minutes duration.
- (b) An employer and worker may agree on longer meal breaks.
- (c) A worker may not work during a meal break. However, an employer may require a worker to perform duties during a meal break if those duties cannot be left unattended and cannot be performed by another worker. An employer must take reasonable steps to ensure that a worker is relieved of his or her duties during the meal break.
- (d) A worker is not entitled to payment for the period of a meal break. However, a worker who is paid on the basis of time worked must be paid if the worker is required to work or to be available for work during the meal break.

SK 03.05 SPECIAL CONDITIONS FOR SECURITY GUARDS

- (a) A security guard may work up to 55 hours per week and up to eleven hours per day.
- (b) A security guard who works more than ten hours per day must have a meal break of at least one hour duration or two breaks of at least 30 minutes duration each.

SK 03.06 DAILY REST PERIOD

Every worker is entitled to a daily rest period of at least eight consecutive hours. The daily rest period is measured from the time the worker ends work on one day until the time the worker starts work on the next day.

SK 03.07 WEEKLY REST PERIOD

Every worker must have two days off every week. A worker may only work on their day off to perform work which must be done without delay and cannot be performed by workers during their ordinary hours of work ("emergency work").

SK 03.08 WORK ON SUNDAYS AND PUBLIC HOLIDAYS

- (a) A worker may only work on a Sunday or public holiday to perform emergency or security work.
- (b) Work on Sundays is paid at the ordinary rate of pay.
- (c) A task-rated worker who works on a public holiday must be paid –
 - (i) the worker's daily task rate, if the worker works for less than four hours;
 - (ii) double the worker's daily task rate, if the worker works for more than four hours.
- (d) A time-rated worker who works on a public holiday must be paid –
 - (i) the worker's daily rate of pay, if the worker works for less than four hours on the public holiday;
 - (ii) double the worker's daily rate of pay, if the worker works for more than four hours on the public holiday.

SK 03.09 SICK LEAVE

- (a) Only workers who work four or more days per week have the right to claim sick- pay in terms of this clause.
- (b) A worker who is unable to work on account of illness or injury is entitled to claim one day's paid sick leave for every full month that the worker has worked in terms of a contract.
- (c) A worker may accumulate a maximum of twelve days' sick leave in a year.
- (d) Accumulated sick-leave may not be transferred from one contract to another contract.
- (e) An employer must pay a task-rated worker the worker's daily task rate for a day's sick leave.
- (f) An employer must pay a time-rated worker the worker's daily rate of pay for a day's sick leave.
- (g) An employer must pay a worker sick pay on the worker's usual payday.
- (h) Before paying sick-pay, an employer may require a worker to produce a certificate stating that the worker was unable to work on account of sickness or injury if the worker is –
 - (i) absent from work for more than two consecutive days; or
 - (ii) absent from work on more than two occasions in any eight-week period.
- (i) A medical certificate must be issued and signed by a medical practitioner, a qualified nurse or a clinic staff member authorised to issue medical certificates indicating the duration and reason for incapacity.
- (j) A worker is not entitled to paid sick-leave for a work-related injury or occupational disease for which the worker can claim compensation under the Compensation for Occupational Injuries and Diseases Act.

SK 03.10 MATERNITY LEAVE

- (a) A worker may take up to four consecutive months' unpaid maternity leave.
- (b) A worker is not entitled to any payment or employment-related benefits during maternity leave.
- (c) A worker must give her employer reasonable notice of when she will start maternity leave and when she will return to work.
- (d) A worker is not required to take the full period of maternity leave. However, a worker may not work for four weeks before the expected date of birth of her child or for six weeks after the birth of her child, unless a medical practitioner, midwife or qualified nurse certifies that she is fit to do so.
- (e) A worker may begin maternity leave –
 - (i) four weeks before the expected date of birth; or
 - (ii) on an earlier date –
 - (1) if a medical practitioner, midwife or certified nurse certifies that it is necessary for the health of the worker or that of her unborn child; or
 - (2) if agreed to between employer and worker; or
 - (iii) on a later date, if a medical practitioner, midwife or certified nurse has certified that the worker is able to continue to work without endangering her health.
- (f) A worker who has a miscarriage during the third trimester of pregnancy or bears a stillborn child may take maternity leave for up to six weeks after the miscarriage or stillbirth.
- (g) A worker who returns to work after maternity leave, has the right to start a new cycle of twenty-four months employment, unless the SPWP on which she was employed has ended.

SK 03.11 FAMILY RESPONSIBILITY LEAVE

- (a) Workers, who work for at least four days per week, are entitled to three days paid family responsibility leave each year in the following circumstances -
 - (i) when the employee's child is born;
 - (ii) when the employee's child is sick;
 - (iii) in the event of the death of –
 - (1) the employee's spouse or life partner
 - (2) the employee's parent, adoptive parent, grandparent, child, adopted child, grandchild or sibling

SK 03.12 STATEMENT OF CONDITIONS

- (a) An employer must give a worker a statement containing the following details at the start of employment –
 - (i) the employer's name and address and the name of the SPWP;
 - (ii) the tasks or job that the worker is to perform;
 - (iii) the period for which the worker is hired or, if this is not certain, the expected duration of the contract;
 - (iv) the worker's rate of pay and how this is to be calculated;
 - (v) the training that the worker may be entitled to receive during the SPWP.
- (b) An employer must ensure that these terms are explained in a suitable language to any employee who is unable to read the statement.
- (c) An employer must supply each worker with a copy of the relevant conditions of employment contained in this specification.
- (d) An employer must enter into a formal contract of employment with each employee. A copy of a pro-forma is attached at the end of this specification.

SK 03.13 KEEPING RECORDS

- (a) Every employer must keep a written record of at least the following –
 - (i) the worker's name and position;
 - (ii) in the case of a task-rated worker, the number of tasks completed by the worker;

- (iii) in the case of a time-rated worker, the time worked by the worker;
 - (iv) payments made to each worker.
- (b) The employer must keep this record for a period of at least three years after the completion of the SPWP.

SK 03.14 PAYMENT

- (a) A task-rated worker will only be paid for tasks that have been completed.
- (b) An employer must pay a task-rated worker within five weeks of the work being completed and the work having been approved by the manager or the contractor having submitted an invoice to the employer. Payment must be made in cash, by cheque or by direct deposit into a bank account designated by the worker.
- (c) A time-rated worker will be paid at the end of each month and payment must be made in cash, by cheque or by direct deposit into a bank account designated by the worker.
- (d) Payment in cash or by cheque must take place –
- (i) at the workplace or at a place agreed to by at least 75% of the workers; and
 - (ii) during the worker's working hours or within fifteen minutes of the start or finish of work;
- (e) All payments must be enclosed in a sealed envelope which becomes the property of the worker.
- (f) An employer must give a worker the following information in writing –
- (i) the period for which payment is made;
 - (ii) the number of tasks completed or hours worked;
 - (iii) the worker's earnings;
 - (iv) any money deducted from the payment;
 - (v) the actual amount paid to the worker.
- (g) If the worker is paid in cash or by cheque, this information must be recorded on the envelope and the worker must acknowledge receipt of payment by signing for it.

- (h) If a worker's employment is terminated, the employer must pay all monies owing to that worker within one month of the termination of employment.

SK 03.15 DEDUCTIONS

- (a) An employer may not deduct money from a worker's payment unless the deduction is required in terms of a law.
- (b) An employer must deduct and pay to the SA Revenue Services any income tax that the worker is required to pay.
- (c) An employer who deducts money from a worker's pay for payment to another person must pay the money to that person within the time period and other requirements specified in the agreement law, court order or arbitration award concerned.
- (d) An employer may not require or allow a worker to –
 - (i) repay any payment except an overpayment previously made by the employer by mistake;
 - (ii) state that the worker received a greater amount of money than the employer actually paid to the worker; or
 - (iii) pay the employer or any other person for having been employed.

SK 03.16 HEALTH AND SAFETY

- (a) Employers must take all reasonable steps to ensure that the working environment is healthy and safe and that all legal requirements regarding health and safety are strictly adhered to.
- (b) A worker must:
 - (i) work in a way that does not endanger his/her health and safety or that of any other person;
 - (ii) obey any health and safety instruction;
 - (iii) obey all health and safety rules of the SPWP;
 - (iv) use any personal protective equipment or clothing issued by the employer;
 - (v) report any accident, near-miss incident or dangerous behaviour by another person to their employer or manager.

SK 03.17 COMPENSATION FOR INJURIES AND DISEASES

- (a) It is the responsibility of employers to arrange for all persons employed on a SPWP to be covered in terms of the Compensation for Occupational Injuries and Diseases Act, 130 of 1993.
- (b) A worker must report any work-related injury or occupational disease to their employer or manager.
- (c) The employer must report the accident or disease to the Compensation Commissioner.
- (d) An employer must pay a worker who is unable to work because of an injury caused by an accident at work 75% of their earnings for up to three months. The employer will be refunded this amount by the Compensation Commissioner. This does NOT apply to injuries caused by accidents outside the workplace such as road accidents or accidents at home.

SK 03.18 TERMINATION

- (a) The employer may terminate the employment of a worker provided he has a valid reason and after following existing termination procedures.
- (b) A worker will not receive severance pay on termination.
- (c) A worker is not required to give notice to terminate employment. However, a worker who wishes to resign should advise the employer in advance to allow the employer to find a replacement.
- (d) A worker who is absent for more than three consecutive days without informing the employer of an intention to return to work will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.
- (e) A worker who does not attend required training events, without good reason, will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.

SK 03.19 CERTIFICATE OF SERVICE

- (a) On termination of employment, a worker is entitled to a certificate stating –
- (i) the worker's full name;
 - (ii) the name and address of the employer;
 - (iii) the SPWP on which the worker worked;
 - (iv) the work performed by the worker;
 - (v) any training received by the worker as part of the SPWP;
 - (vi) the period for which the worker worked on the SPWP;
 - (vii) any other information agreed on by the employer and worker.

SK 04 EMPLOYER'S RESPONSIBILITIES

The employer shall adhere to the conditions of employment as stipulated in the *Code of Good Practice for Employment and Conditions of Work for Special Public Works Programmes*. Over and above the conditions stipulated above, he shall be responsible to:

- (a) formulate and design a contract between himself/ herself and each of the recruited workers, ensuring that the contract does not contravene any of the Acts stipulated in South African Law, e.g. Basic Conditions of Employment Act, etc. (A copy of a pro-forma contract is attached at the end of this specification);
- (b) screen and select suitable candidates for employment from the priority list of workers provided by the client;
- (c) ensure that the recruited workers are made available to receive basic life skills training which will be conducted and paid for by the Department of Labour;
- (d) ensure that all workers receive instruction on safety on site prior to them commencing with work on site;
- (e) ensure that all workers are covered under workmen's compensation for as long as they are contracted to the contractor. Payment to the Compensation Commissioner shall be the responsibility of the contractor;
- (f) assist in the identification and assessment of potential workers to undergo advanced technical training in respective trades;
- (g) test and implement strict quality control and to ensure that the health and safety regulations are adhered to;

- (h) provide all workers with the necessary protective clothing as required by law for the specific trades that they are involved in.
- (i) provide overall supervision and day-to-day management of workers and/or sub-contractors; and
- (j) ensure that all workers are paid their wages on time through a pre-agreed payment method as stipulated in the contract with the worker.

SK 05 EMPLOYMENT OF TARGETED LABOUR

Employers will be contractually obliged to:

- (a) employ workers from targeted social groups from the priority list provided by the Independent Development Trust (Service Provider);
- (b) facilitate on-the-job training and skills development programmes for the workers;
- (c) achieve the following minimum employment targets:
 - (i) 60% women;
 - (ii) 20% people between the ages of 18 and 35; and
 - (iii) 2% people with disabilities.
- (d) brief workers on the conditions of employment as specified in subclause SK 03.09 above;
- (e) enter into a contract with each worker, which contract will form part of the Employment Agreement;
- (f) allow workers the opportunity to attend life skills training through DOL. This shall be arranged at the beginning of the contract;
- (g) ensure that payments to workers are made as set out in subclauses SK 03.14 and SK 03.15 above.
- (h) keep a copy of personnel files as compiled by Service Provider and as set out in subclause SK 03.13 above.

SK 06 TRAINING OF WORKERS

Three types of training are applicable, namely

- Life skills;
- On the job training
- Skills development programme

Training will be implemented by training instructors accredited by DOL and/or CETA :

- Trainees shall be employed on the projects for an average of 6 months.
- Trainees shall be deployed on projects in the vicinity of their homes. The same arrangements as for workers regarding accommodation, subsistence and travel shall be applicable to trainees.

(a) Life skills training

All workers are entitled to undergo life skills training. Training of this module will be flexible enough to meet the needs of the employer. Training should take place immediately after site hand-over and during the period of site establishment and pre-planning before actual construction starts.

(b) On-the job training

The Employer shall provide workers with on-the-job training to enable them to fulfil their employment requirements. The employer shall also be expected to closely monitor the job performance of workers and shall identify potential trainees for the skills development programme.

(c) Technical skills development programmes

The Employer shall assist in identifying workers for further training. These workers will undergo further technical training to prepare them for opportunities as semi-skilled labourers.

Such training will comprise of an off-site theoretical component and practical training on-site. The contractor will be responsible for on-site practical work under his supervision. Workers who graduate from the first phase of the training programme will be identified and given opportunities to register for skills development programmes with the CETA. These can ultimately result in accredited qualification. The programme will consist of theoretical instruction away from the construction site as well as on-site practical work under the supervision of the employer. Candidates will be entitled to employment to complete all training modules.

SK 07 BENEFICIARY SELECTION CRITERIA

SK 07.01 PREAMBLE

The Code of Good Practise for Employment and Conditions of Work for Special Public Works Programmes encourages:

- optimal use of locally-based labour in a Special Public Works Programme (SPWP);
- a focus on targeted groups namely women, female-headed households, youth, the disabled and households coping with HIV/AIDS; and
- the empowerment of individuals and communities engaged in a SPWP through the provision of training.

SK 07.02 BENEFICIARY SELECTION CRITERIA

- (a) The beneficiaries of the programmes should preferably be non-working individuals from the most vulnerable sections of disadvantaged communities who do not receive any social security pension income.
- (b) In order to spread the benefit as broadly as possible in the community, a maximum of one person per household should be employed, taking local circumstances into account.
- (c) Skilled 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, this should not result in more than 20% of persons working on a programme not being from local communities.
- (d) Programmes should set participation targets for employment with respect to single male- and female-headed households, women, youth, people with disabilities, households coping with HIV/AIDS, people who have never worked, and those in long-term unemployment.
- (e) The proposed targets are:
 - 60% women;
 - 20% youth from 18 to 35 years of age; and
 - 2% disabled.

SK 07.03 RECOMMENDED EXCLUSIONS

- (a) Persons receiving a state pension or assistance from a social security system may not be employed on a SPWP.

- (b) Persons under eighteen years of age may not be employed on a SPWP.

SK 07.04 SELECTION OF WORKERS

- (a) The local community must, through all structures available, be informed of and consulted about the establishment of any SPWP.
- (b) Members of the community who are economically active and who form part of the targeted groups will be given an opportunity to apply for work.
- (c) Preference must be given to the targeted groups in selecting workers.
- (d) The following criteria are to be used to help target the poorest of the poor:
- People who come from households where the head of the household has less than a primary school education;
 - People who come from households that have less than one full time person earning an income;
 - People who come from households where subsistence agriculture is the source of income.

SK 08 CONTRACTUAL OBLIGATIONS IN RELATION TO LABOUR

The workers to be employed in the programme (SPWP) shall be directly contracted to the employer. Over and above the construction and project management responsibilities, the employer will be expected to perform the tasks and responsibilities as set out in clause SK 04 above.

SK 09 PROVINCIAL RATES OF PAY

The current rates of pay for equivalent poverty alleviation projects in the country and listed in the table below, range from R50 (Limpopo) to R75 (Western Cape) per person per day. Based on this data, the national average rate is R56.67 per person per day. It must be understood that this average rate is the minimum remuneration rate payable and employees should add their profit and attendance thereto in the schedule to be priced.

Name of Province	MPUMALANGA
Minimum	R15.16 / hour*

It must be noted that the individual project implementing bodies (or Departments of Public Works) should be allowed to set their daily rates for EPWP workers, taking into account the national average and the minimum rates currently paid by various provincial departments. Most importantly, such rates should be below the market related rates and self-targeting in approach.

SK 10 MEASUREMENT AND PAYMENT

The number of workers specified for this contract that will receive life skills training is 15 and skilled development is 15

SK 10.01 PAYMENT FOR TRAVELLING, ACCOMMODATION AND ADVANCE MEAL ALLOWANCE DURING OFF SITE TRAINING

SK 10.01.01 Life skills training for 10 days

- (a) Travelling (based on km/learner).....Unit: km
- (b) Accommodation... ..Unit: R
- (c) Advance meal allowance (R35 per day per learner).....Unit: R
- (d) Profit and attendance.....Unit: %

SK 10.01.02 Skilled development and technical training for workers for 25 days

- (a) Travelling (based on km/learner) Unit: km
- (b) Accommodation Unit: R
- (c) Advance meal allowance (R35 per day per learner) Unit: R
- (d) Profit and attendance.....Unit: %

The units of measurement for sub items SK 10.01.01 (a) and SK 10.01.02 (a) above shall be the distance travelled in km by the workers trained off site. The tendered rate shall include full compensation to safely transport the workers to and from the training venue/s.

The unit of measurement for sub items SK 10.01.01 (b) and (c) and SK 10.01.02 (b) and (c) above shall be the amounts in Rand expended for accommodation and daily meal allowances for the workers trained off site that must be arranged by the

Contractor. Amounts quoted shall be corrected according to re-measurement based on actual invoices.

The tendered percentages under sub items SK 10.01.01 (d) and SK 10.01.02 (d) will be paid to the contractor on the value of each payment pertaining to the accommodation and advance meal allowances to cover his expenses in this regard.

SK 10.02 ALTERNATIVE WORKERS FOR THE PERIOD OF OFF-SITE TRAINING

SK 10.02.01 Life skills training for 10 days Unit: worker-day

SK 10.02.02 Skilled development and technical training for workers for 25
days..... Unit: worker-day

The units of measurement shall be the number of workers replaced while training multiplied by the number of days absent from the site.

The rates tendered shall include full compensation for additional replacement labour during periods of off-site training.

SK 10.03 LIAISON WITH SERVICE PROVIDER.....Unit: hours

The tendered rate shall include full compensation for the cost of liaising with the Service Provider and Social Facilitators on all issues regarding the works.

SK 10.04 OTHER TRAINING (ARRANGED BY SERVICE PROVIDER)

SK 10.04.01 Life skills training for 10 days Unit: R

SK 10.04.02 Profit and attendance..... Unit: %

SK 10.04.03 Skilled development and technical training for workers for 25
days.....Unit: R

SK 10.04.04 Profit and attendance..... Unit: %

Amounts have been provided in the Schedule of Quantities under sub items SK 10.04.01 and SK 10.04.03 to cover the cost of Life Skills and Skills Development training arranged by the Service Provider. The Engineer will have sole authority to

spend the amounts or part thereof. The tendered percentage under sub items SK 10.04.02 and SK 10.04.04 will be paid to the contractor on the value of each payment pertaining to the training to cover his expenses in this regard.

SK 10.05 PROVISION OF ORANGE OVERALLS TO WORKERS

SK 10.05.01 Supply of orange overalls to workers.....Unit: R

SK 10.05.02 Profit and attendance..... Unit: %

An amount has been provided in the Schedule of Quantities under sub items SK 10.05.01 for the supply of EPWP design overalls, as per the specification provided by the EPWP unit, arranged by the Service Provider. The Engineer will have sole authority to spend the amounts or part thereof. The tendered percentage under sub items SK 10.05.02 will be paid to the contractor on the value of each payment pertaining to the supply of overalls to cover his expenses in this regard.

EPWP EMPLOYMENT AGREEMENT

[Pro-forma]

CONTRACTOR

Name:

Address:

ID:

AND

WORKER

Name:

Address:

ID:

1. I am pleased to confirm that you have been appointed to work on a task-based employment contract within a Special Public Works Programme (SPWP) project. During this contract you will undertake various tasks.
2. This contract must be read in conjunction with the standard terms and conditions of employment applicable to a SPWP, a copy of which is attached.
3. The project where you will be employed is located at
4. The contract will start on
5. You must be aware that this contract is a limited term contract and not a permanent job. The contract may be terminated for one of the following reasons:
 - (a) If the contractor does not get additional contracts from the SPWP.
 - (b) Funding for the programme in your areas comes to an end.
 - (c) You repeatedly do not perform in terms of the tasks set out in your work programme.
 - (d) At practical completion phase of the contract
 - (e) I you breach any of the terms and conditions of this contract.

6. You will be employed as a within the team.

7. While you are working you will report to

8. Payment

- (a) You will be paid a fixed amount of R..... For completing a fixed amount of work.
- (b) The amount of work required for the agreed rate of pay will vary from task to task. You will be informed at the beginning of each task or group of tasks how much work you are expected to complete per day.
- (c) You will only be paid for work completed.
- (d) You will be paid the amount for the number of days quoted in the contract even in you finish the work before the time and after the estimated date of completion.
- (e) The contractor must pay you a production bonus (the extra days if the work is finished early) if you have completed your share of tasks.
- (f) The contractor will be paid within 30 days after the work is completed. You will be paid within 5 days of the contractor being paid.

9. Signatures

Signed on this day of 20.....

Contractor:

Date:

Worker:

Date:

Witness:

Date:

ADDITIONAL SPECIFICATION**SN IMPLEMENTATION OF LABOUR-INTENSIVE INFRASTRUCTURE PROJECTS UNDER THE EXPANDED PUBLIC WORKS PROGRAMME (EPWP)****CONTENTS**

SN 01	SCOPE
SN 02	TERMINOLOGY AND DEFINITIONS
SN 03	APPLICABLE LABOUR LAWS
SN 04	EMPLOYMENT OF UNSKILLED AND SEMI-SKILLED WORKERS IN LABOUR INTENSIVE WORKS
SN 05	TRAINING OF EPWP WORKERS
SN 06	CONTRACTUAL OBLIGATIONS IN RELATION TO LABOUR
SN 07	SETTING OF RATE OF PAY
SN 08	GENERIC LABOUR-INTENSIVE SPECIFICATION

SN 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).

The Contractor shall be required to comply with the Occupational Health and Safety Act 85 of 1993, Construction Regulations 2014 and related regulations. Non-compliance with these regulations, in any way whatsoever, will be adequate reason for suspending the Works.

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

- (d) 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.)
- (e) Public body refers to a department, trading entity, constitutional institution, municipality, public entity or municipal entity
- (f) 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.**

EPWP's 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 be 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;
- Technical Skills training.

Training will be implemented by training instructors accredited by DOL and/or CETA:

- 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) This training should take place as close to the project site as practically possible.
 - (c) 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 the required life skills and technical training.
 - (d) The contractor shall do nothing to dissuade targeted labour from participating in the above-mentioned training programmes.
 - (e) 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.

- (f) 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.

The employer should make provision to appoint temporary staff whilst the EPWP learners are busy with life skills and technical training.

SN 08 GENERIC LABOUR-INTENSIVE SPECIFICATION

The Generic Labour-intensive specification below is the same as ***SANS 1921-5, Construction and management requirement for works contracts- Part 5: Earthworks activities*** which are to be performed by hand and should be included in the scope of works without amendment or modification as set out below.

SN 08.01 Scope

This specification establishes general requirements for activities which are to be executed by hand involving the following:

- a) trenches having a depth of less than 1.5 metres
- b) cleaning of storm water drainage
- c) cleaning of roads and sidewalks
- d) clearing of fence routes
- e) cleaning and site keeping
- f) 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 excavatable material

Hand excavatable 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 10mm and contains no cobbles or isolated boulders, no more than 8 blows of a dynamic cone penetrometer is required to penetrate 100mm;

Note:

- i) A boulder, a cobble and gravel is material with a particle size greater than 200mm, between 60 and 200mm.
- 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 400mm and drives a cone having a maximum diameter of 20mm (cone angle of 60° with respect to the horizontal) into the material being used.

SN 08.04 Trench excavation

All hand excavatable 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 cone penetrometer (DCP) is required to penetrate 100 mm of the backfill, provided that backfill does not comprise more than 10% gravel of size less than 10mm and contains no isolated boulders, or
- c) such that the density of the compacted trench backfill is not less than that of the surrounding undisturbed soil when tested comparatively with a DCP.

SN 08.06 Excavation

All hand excavatable material including topsoil classified as hand excavatable shall be excavated by hand. Harder material may be loosened by mechanical means prior to excavation by hand.

The excavation of any material which presents the possibility of danger or injury to workers shall not be excavated by hand.

SN 08.07 Clearing and grubbing

Grass and small bushes shall be cleared by hand.

SN 08.08 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 undertaken 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 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 150m.

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 320kg. 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 Stormwater

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 320kg).
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 320kg.
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 200m, 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 and technical training are as follow:

- Skills Development Training: **As specified in the Bill of Quantities**
- Technical Training: **As specified in the Bill of Quantities**

SN 10.01 PAYMENT FOR EMPLOYMENT AND TRAINING OF EPWP WORKERS

(TARGET: **AS SPECIFIED IN THE BILL OF QUANTITIES**)

- 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 Profit and attendance for administration of items 1 and 2 above..... Unit: %

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 workplace 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 PENALTY FOR NOT ACHIEVING THE LOCAL LABOUR TARGET (LLT)

Penalty for not achieving the Local Labour Target (LLT) Unit: %

The unit of measurement shall be the percentage (%) difference between the contracted LLT percentage (%) and the actual LLT percentage (%) achieved in the performance of the contract.

SN 10.04 PROVISION OF EPWP DESIGNED SAFETY SHOES, OVERALLS & T-SHIRTS TO WORKERS

- SN 10.04.01 Supply 2 x EPWP designed overalls, a pair of safety shoes a hard hat and 2 x t-Shirts/golf shirts to workers (PC Sum).....Unit : R/ worker

Worker overalls should be orange (top and bottom) as per EPWP specification with the exception of Correctional Services contracts where the workers top would be blue and the bottom orange.

- SN 10.04.02 Profit and attendance.....R0.00.....Unit : %

An amount has been provided in the Schedule of Quantities under sub item SL 10.05.01 for the supply of EPWP designed overalls, as per the specification provided by the EPWP unit, arranged by the Service Provider. The Engineer will have sole authority to spend the amounts or part thereof. The tendered percentage under sub items SL 10.05.02 will be paid to the

SN.10

contractor on the value of each payment pertaining to the supply of overalls to cover his expenses in this regard.

SN 10.5

Tests for medical fitness:

Provision of General Medical Practitioner or clinic to examine EPWP Workers medical fitness before appointment by the contractor and engagement on site experiential training.

SN 10.05.01

Fitness and health examination by a qualified health practitioner 15
workers (YW): R 14,250 – 00... (PC Sum).Unit : R/ YW

ADDITIONAL SPECIFICATION**SS SITE SPECIFIC INVENTORY****CONTENTS**

SS 01	SCOPE
SS 02	SITE LOCALITY INFORMATION
SS 03	DESIGN STANDARDS AND DEFINITIONS
SS 04	SITE INVENTORY
SS 05	LOCATION OF PORTS OF ENTRY
SS 06	SCOPE DEFINITION
SS 07	ADDITIONAL SITE SPECIFIC INFORMATION

SS 01 SCOPE

This Additional Specification (**SS: Site Specific Inventory**) covers the inventory of the Port of Entry included as part of the contract in order to assist the Contractor with the scope of work regarding specific maintenance and servicing requirements, development of a maintenance control plan, site maintenance administration and preventative maintenance performance.

Additional Specification SS: Site Specific Inventory, should be read in conjunction with all other technical, particular and additional specifications applicable to this contract.

The preventative maintenance and periodical mandatory servicing work to be performed and executed shall include, but not be limited to the items listed in this specification.

SS 02 SITE LOCALITY INFORMATION

Due to the size and remote locations of the Port of Entry, the Contractor should also refer to Additional Specification SA: General Maintenance and Servicing regarding the frequency of site visits relating to preventative maintenance.

SS 02.01

MANANGA LAND PORT OF ENTRY

MANANGA LAND PORT OF ENTRY are situated in the MPUMALANGA / SWAZILAND border. The Ports of Entry have ESKOM electricity with a standby generator to support the Administration building and essential security lights. Water is supplied from the three boreholes on site and sewer is pumped to three maturation ponds.

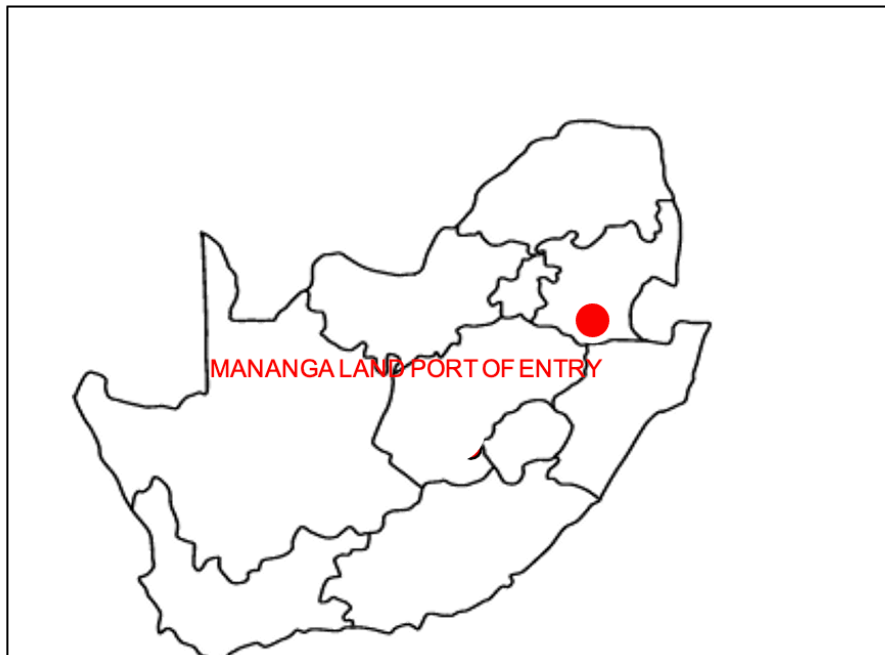


Figure 2.1: MANANGA LAND PORT OF ENTRY Site Layout

The contract at the MANANGA LAND PORT OF ENTRY comprises of maintenance and servicing work as specified in **PG-01.1 (EC) Scope of Works**.

SS 03 DESIGN STANDARDS AND DEFINITIONS

PW371	Department of Public Works Specification: Specification of Materials and Methods to be used
PW347	Department of Public Works Specification: Civil Engineering Manual
SANS (various)	South African Bureau of Standards: National Standards
GCC	General Conditions of Contract for works of civil engineering construction (1 st edition 2004)
Plumbing Fixtures	Plumbing points such as toilets, wash hand basins, showers, sinks, taps, etc.
Electrical Fixtures	Electrical points such as lights, socket outlets, light switches, isolators, etc.
Call Centre	The National RAMP Call Centre
Colours (standardised)	External plastered walls: Barley Internal plastered walls: Tawny-Mink Steelwork: White Ceilings: White Window and door frames: White Roofs: Green

SS 05 LOCATION OF PORTS OF ENTRY

The Ports of Entry included in this contract are located at the positions indicate below:

- MANANGA LAND PORT OF ENTRY are located on the MPUMALANGA / Swaziland border.

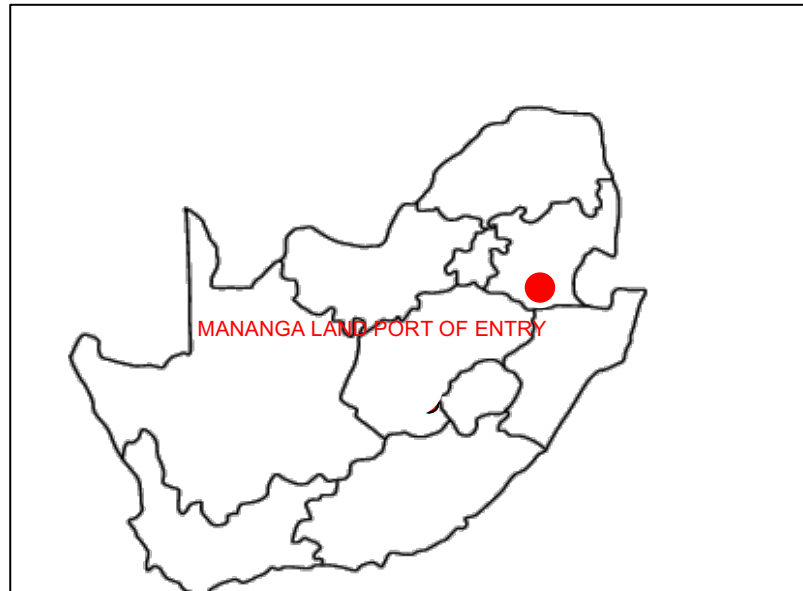


Figure 5.1: Location of Port of Entry

SS 06 SCOPE DEFINITION

The description of the works given above is not necessarily complete and shall not limit the work to be carried out by the Contractor under this contract.

Approximate quantities of each type of work are given in the contract Schedule of Quantities.

SS 07 ADDITIONAL SITE SPECIFIC INFORMATION

Additional site specific information, including asset inventory list, site specific information, bulk water and sewer installations and ablution facilities are attached to this Additional Specification SS: Site Specific Inventory

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

LIST OF DRAWINGS

The following drawings shall be issued during the tender period to form part of tender documentation.
Where applicable, drawings could be re-issued to the Contractor at commencement of the contract.

048176/002/B

048176/004/B

048176/001/B



public works
& infrastructure

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA



HEALTH AND SAFETY SPECIFICATIONS FOR THE INFRASTRUCTURE MAINTENANCE AND REPAIRS OF BUILDINGS, CIVIL, MECHANICAL, ELECTRICAL AND INSTALLATIONS AT MANANGA LAND PORT OF ENTRY

Issued in terms of the Occupational Health and Safety Act,

1993

Construction regulations 2014.

Prepared by 2 BLN Consulting Engineers
Prepared for: Department of Public Works and Infrastructure
Prepared on: 25-04-2024.

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1.0 INTRODUCTION

Occupational Health and Safety Act 85, of 1993 has 18 regulations, most of which are applicable in construction sites. The major regulation that is being implemented in construction projects is Construction Regulations 2014. Construction Regulations 2014 is aimed at ensuring that health and safety issues are properly considered during a project's development.

Construction Regulations 2014 requires that a contractor who intends to carry out construction work to at least 7 days before that work is to be carried out notify the provincial director in writing if the intended construction include the following:

- 1) excavation work.
- 2) work at height where there is a risk of falling.
- 3) demolition of a structure; and
- 4) use of explosives to perform construction work.

Principal contractor must implement Construction Regulations 2014 and address all relevant aspects of health and safety (H&S) compliance in his/her H&S Plan and in his/her implementation thereof.

2.0 SCOPE & APPLICATION OF CONSTRUCTION REGULATIONS 2014

2.1 Legislative Requirements of the Client

Construction Regulations 2014 defines a client as any person for whom construction work is being performed. Section 5 of Construction Regulations 2014; specify that a client has to fulfil duties as follows:

- Prepare a baseline risk assessment for intended work.
- Prepare site specific health and safety specifications for intended work.
- Ensure the health and safety specifications is implemented.
- Ensure principal contractor appointed has the resources to carry out work safely.
- Monitoring of compliance by the principal contractor.

2.2 Legislative Duties of Principal Contractors

Construction Regulations 2014 defines a principal contractor as an employer appointed by a client to perform construction work. Principal contractor is required to prepare and provide the client with a site-specific health and safety (H&S) plan prior to the commencement of the work. Principal contractor has to ensure requirements in table 1 are met.

Table 1: Principal Contractors H&S Requirements

ITEMS	REQUIREMENTS (LEGISLATIVE)
Notification of construction works / Construction work permit	Notification of construction works at the Department of Employment and Labour (DEL, (Construction Regulations 2014-4 (1); / Construction work permit if the intended project is above a certain project value , if the CIDB grading of the contractor is above Grade 7 and if the project is exceeding 12 months in terms of project duration.
Health and safety plan	Prepare and provide a suitable, site specific and sufficiently documented health and safety plan to the client, (Construction Regulations 2014-7(1) (a));
Health and safety file	Provide and maintain a health and safety file to be kept on site throughout the project duration, (Construction Regulations 2014-7(1) (b));
Site audits	Conducts periodic site audits at 30 days interval, (Construction Regulations 2014-7(c) (vii));
Medical certificate of fitness	Ensure all his / her employees have a valid medical certificate of fitness specific to the work to be performed, issued by an occupational health practitioner in the form of annexure 3, (Construction Regulations 2014-7(1) (g));
Health and safety induction training	Ensure no employee is allowed or permitted to enter any site unless that employee or person has undergone health and safety induction training pertaining to the hazards prevalent to the site, (Construction Regulations 2014-7(5));
Contractor appointment	Appoint a contractor in writing in compliance with Occupational Health and Safety Act, 85. 1993, (Construction Regulations 2014-8);
Management and supervision of construction work	Appoint competent persons to ensure management and supervision of construction works, including the duty of ensuring health and safety compliance, (Construction Regulations 2014-8 (1));

Construction health and safety officer (CHSO)	Appoint a full-time construction health and safety officer in writing to assist in the control of health and safety related aspects on the site, (Construction Regulations 2014-8 (5));
Risk assessment	Have risk assessment be performed by a competent person before the commencement of construction works, (Construction Regulations 2014-9 (1));
Fall protection plan	Appoint a competent person in writing to prepare a fall protection plan, (Construction Regulations 2014-10 (1));
Protection of structures	Take all reasonable steps to prevent uncontrolled collapse of any new or existing structures, (Construction Regulations 2014-11 (1) (a));
Excavations	Ensure excavation work is carried out under the supervision of a competent person, (Construction Regulations 2014-13 (1) (a));
Construction vehicle and mobile plant	Ensure acceptable design, construction, maintenance, and use of construction vehicle and mobile plant, (Construction Regulations 2014-23 (1));
Use and temporary storage of flammable liquids	Ensure compliance with the requirements of sections 25 (a-g) under this regulation, in addition to compliance with General Safety Regulations, 2003, (Construction Regulations 2014-25);
Housekeeping and general safeguarding	Ensure that suitable housekeeping is continuously implemented on construction site, in addition to compliance with Environmental Regulations for Workplaces, 1997, (Construction Regulations 2014-27);
Stacking and storage on construction sites	Ensure a competent person is appointed in writing to supervise all stacking and storage on site, and requirements under this regulations, in addition to compliance with General Safety Regulations 2003, (Construction Regulations 2014-28 (a-d));
Fire precautions on construction sites	Ensure that in addition to compliance with Environmental Regulations for Workplaces, 1997, the requirements under Construction Regulations 2014-29 (a-m) are complied with;

Construction employees' facilities	Ensure that in addition to compliance with Facilities Regulations 2004, clean, hygienic and maintained facilities under Construction Regulations 2014-30 (1-2) are complied with.

3.0 PROJECT DETAILS

3.1 Project name:

The infrastructure maintenance and repairs of buildings, civil, mechanical, electrical and installations at Mananga Land Port of Entry.

3.2 Project location:

Komatipoort, under Nkomazi Local Municipality in Mpumalanga Province.

3.3 Project period:

36 Months

3.4 Baseline Scope of works

The following is a brief outline of the scope of works:

- Site establishment
- Building works
- Mechanical
- Electrical
- Installations

3.5 Details of the client and professional team

Client:

Client details	
Company name	Department of Public Works and Infrastructure
Contact person	Ms. Koketso Kgorane
Contact number	012 406 1000
Email	Koketso.kgorane@dpw.gov.za

Principal Agent / Engineer:

Principal agent details	
Company name	2 BLN Engineers
Contact person	Mr. Mothusi Motjale
Contact number	086 177 7719
Email	mothisi@2bln.co.za / admin@2bln.co.za

Health and Safety Consultants:

Health and Safety Agent's details	
Company name	
Contact person	
Contact number	
Email	

4.0 HEALTH AND SAFETY POLICY

The health and safety (H&S) policy statement contains the aims and objectives of a company. Section 7(3) of the Occupational Health and Safety Act provides that employers must prominently display a copy of the health and safety policy signed by the Chief Executive Officer in the workplace where employees normally report for service. In compliance with the Act (OHS), the principal contractor shall display the H&S policy in a common wall at the site office.

Health and safety policy possesses the following characteristics:

- A validity of 12 months;
- Date;
- Name; and
- Signature of the company CEO

5.0 SITE SPECIFIC SAFETY RULES

The client has established the following site safety rules:

- Strict enforcement of discipline in the interests of occupational health and safety.
- All employees must undergo medical surveillance.
- Issue personal protective equipment that shall be worn at all times where necessary.
- No use shall be made of any of the Employer's machinery / plant / equipment / substance / personal protective equipment or any other article without prior arrangement and written approval.
- No alcohol or any other intoxicating substance shall be allowed on the site. Any person suspected of being under the influence of alcohol or any other intoxicating substance shall not be permitted access to or allowed to remain on the site.

6.0 REGISTRATION WITH THE COMPENSATION FUND

Principal contractor must be in possession of proof of registration with the compensation fund, and a valid letter of good standing obtained from the Department of Employment and Labour and an approved insurer must be provided in a site safety file throughout the duration of this project.

7.0 LABOUR NOTIFICATION / CONSTRUCTION WORK PERMIT

Principal contractor must notify the Department of Employment and Labour of this project, and proof of notification shall be kept in the site safety file and or, a construction work permit will be applied by the client's agent and a copy will be kept in the H&S file and site-specific number will be displayed at the site main entrance.

8.0 CONSTRUCTION PHASE HEALTH AND SAFETY PLAN

The principal contractor must prepare a site-specific construction health and safety plan that is suitable, sufficiently documented based on this client's health and safety specifications. The contractor's health safety plan must cover all aspects under the scope of works, that is repairs of buildings encompassing demolitions and alterations, civil works, mechanical works, electrical works and installation works. A construction phase health and safety plan must record the following:

9.0 HEALTH AND SAFETY FILE

Construction Regulations 2014 defines a health and safety file as a file or other record containing the information in writing required by 2014 Construction Regulations. The health and safety file must include the following items:

- 1) a brief description of the work carried out;
- 2) any hazards that have not been eliminated through the design and construction processes, and how they have been addressed (e.g. surveys or other information concerning contaminated land);
- 3) key structural principles (e.g. bracing) and safe working loads for floors and roofs;
- 4) hazardous materials used (e.g. lead paints and special coatings);
- 5) health and safety information about equipment provided for cleaning or maintaining the structure.
- 6) the nature, location and markings of significant services, including underground cables; fire-fighting services etc;

- 7) information and as-built drawings of the building, its plant and equipment (e.g. the means of safe access to and from service voids and fire doors);
- 8) comprehensive and updated list of all the contractors and agreements between them, and the type of work done they carried out for them. The principal contractor must hand over a consolidated health and safety file to the client upon completion of the construction work in which all legal appointments must be cancelled.

Required OHS File Contents (Construction Phase)

Description
Project Organogram
OHS Policy
Contact List including Emergency Numbers
Department of Public Works and Infrastructure Project Scope of Work
Department of Public Works and Infrastructure OHS Specification & Baseline Risk
Health and Safety Plan Approval Memorandum
Workman Compensation COID: Letter of Good Standing
Legal Permits: Notification to Department of Employment and Labour / or Construction Work
37.2: Contractors Written Agreement
Site Entry/ Access Certificate
List of Sub-Contractors
Section 7(1)(c)(v): Agreements between Principal Contractor and Subcontractors
On Site Traffic/Pedestrian Movement Plan (Indicate separation of vehicles/pedestrians). <i>Note: This is not the same document as TMP indicated above.</i>
Certificates of Competencies
Certificates of Medical Fitness(Annexure 3)
Annual Medical Records
Staff List with Copies of valid certified ID/Passport Documents & work permits
Client Induction Registers (OHS/Risk Control)
Contractors Tools and Equipment Inventory
Health and Safety Plans: OHS Management System aligned to the OHS Spec to be implemented on site. Refer to DOEL website for sample of a Health and Safety Plan. Include specific operational requirements as stated below. Emergency Plan, Traffic Management Plans, Excavation Plan, Fall Protection Plan and to be submitted as separate documents.
<i>Public Safety Plan</i>
<i>Excavation Plan</i>
<i>Construction Vehicles/Plant Operations/Movement/Maintenance Plan</i>
<i>Demolition Plan</i>
<i>Blasting Plan</i>
<i>Scaffolding</i>
<i>Bulk mixing Plants</i>
<i>Explosive actuated fastening device</i>
<i>Cranes</i>
<i>Construction Vehicles and Mobile Plant</i>
<i>Electrical Installations</i>
<i>Flammable Liquids</i>
<i>Housekeeping</i>
<i>Stacking and Storage</i>
<i>Fire Precautions</i>
<i>Construction Welfare Facilities</i>

	Appointments
Section 16(1)	Company Chief Executive Officer / Managing Director
Section 16(2)	Assistant to Chief Executive Officer / Managing Director
Section 17	Health and Safety Representative
Section 19	Health and Safety Committee Member(s) and Co-opted Members
GSR 3	First Aider
GSR (2) ER9(1)	Fire Fighter
GSR 5(1)	Confined space Inspector
GAR 9 (2)	Incident/Accident Investigator
DMR18 (11)	Lifting Machinery Operator (Appointment or Permit)
DMR18 (5)	Lifting Machinery Inspector
DMR 18 (10) (e)	Lifting Tackle Inspector
EMR 9	Portable Electrical Equipment Inspector
PER 7	Portable Gas Container Inspector
PER 7 (3) (ii)	Pressure Vessels Inspector
(6) (1)	Lift, escalator or passenger conveyer Inspector
HC1 3 (3)	Hazardous Chemical Agents Co-coordinator
Reg.	Appointment
5(1)(k)	Principal contractor
7(1)(c)(v)	Contractor
8(1)	Construction Manager
8(2)	Assistant Construction Manager
8(7)	Construction supervisor
8(8)	Construction supervisor sub-ordinates
8(5)	Construction Health and Safety Officer
9(1)	Person to carry out risk assessment
10(1)(a)	Fall protection planner
13(1)(a)	Excavation supervisor
13(2)(b)(ii)(bb)	Project Engineer or technologist
14(11)	Explosives expert
16(1)	Scaffold supervisor
17(1)	Suspended platform supervisor
17(8)(c)	Suspended platform expert
23(1)(d)(i)/(k)	Constr. vehicle and mobile plant operator/Inspector.
24(c)(d)	Temporary electrical installations inspector
28 (a)	Stacking and storage supervisor
27 (h)	Fire equipment inspector
Risk Assessments – Baseline and activity based HIRA	
Safe Work Procedures and Method Statements	
Calibration Certificates	
Load Test & Inspection Test Certificates (e.g. Lifting equipment and Tackle)	
	Incident recording Register
	Principal Contractor OHS Induction Register
	First Aid Box Inspection Register
	PPE Issue Register
	Risk Assessment Communications Register
Fall Protection Inspection Register	
Excavation Inspection Register	
Demolition Work Inspection register	
Scaffolding Inspection Register	
Suspended Platforms Inspection register	
Bulk mixing Plants Inspection Register	
Cranes Inspection Register	

Temporary Electrical Installations Inspection Register
Flammable Liquids Inspection register
Hazardous Chemicals Inspection register
Ladder Inspection Register
Compressor register
Electrical Machinery Inspection register
Construction Vehicles and Mobile Plant Inspection Register Plant
Gas Equipment Register
Stacking and Storage Register
Fire Precaution Register
General Housekeeping Register
Incident Management
Emergency Response and evacuation Procedures
Emergency Drill Schedule
Minutes of OHS meeting
OHS Toolbox Talks/DSTI's
Job Observations
Material Safety Data sheets
Training Records
OHS Rep Monthly Inspection Reports
Monthly Inspection /Audit Reports
Non-conformance Reports (Work Stoppages & Penalties /Spot fines)
Client OHS/ EMS Audit and Inspection Reports
Contractor OHS Reports i.e. Contractor weekly report, Monthly Statistics
Site Clearance Certificate
Temporary Site Closure Checklist
Copy of the OSHACT

10.0 MANDATORY AGREEMENT - SECTION 37 (2) O.H.S. ACT

The Department of Public Works and Infrastructure / Agent / Principal Contractor / Sub-contractor shall sign an agreement as per Occupational Health and Safety Act, 85 of 1993, in which all parties exercise their affective duties as employers in their own right and will therefore see that each company or employer will comply with the Occupational Health and Safety Act and the relevant regulations. The client / principal contractor mandatory agreement will be drafted and provided to the principal agent, for the principal contractor to complete and sign. Principal contractor must file a signed copy in the site safety file.

11.0 RISK MANAGEMENT

11.1 Hazard Identification and Risk Assessment

Hazards are defined as a source of danger that could result in a chance event such an accident or incident. A danger itself is a potential exposure or a liability to injury pain or loss. Exposure to hazards may be dangerous but this is dependent upon the amount of risk that accompanies it. Risk is the possibility of loss or injury/illness all the degree of possibility of such laws. Incidents do not occur if a hazard does not exist ,that presents a danger to those working around it. If potential exposure is high, there is a greater risk that an undesired event will occur (Reese, 2017).

The task specific risk assessment to be provided must meet the following requirements/characteristics:

- Be prepared by a person nominated and appointed in writing.
- Risk assessor must be in possession of a valid proof of training in risk assessment.
- Be site / task specific.
- Be aligned to the scope of works.
- Address only the hazards related to the project.
- Be quantitative in nature.
- Provide date.
- Provide name and surname of risk assessor.
- Provide signature of risk assessor.
- Must be accompanied by proof of communication.

11.2 Potential Hazards Identified

11.2.1 Potential safety hazards and risks

Hazards and risks to safety emanating from construction site activities are the following:

- Delivery trucks hitting workers / spectators;
- Delivery trucks colliding with fixed structures;
- Construction vehicles hitting bystanders / pedestrians from lack of concentration;
- Construction vehicles / plant colliding with site workers from accidental man-machine interaction;
- Construction vehicles / plant hitting fixed structures from lack of access space;
- Construction vehicles / plant hitting site workers / the public from driving under the influence;
- Construction vehicles / plant hitting site workers / the public from un-roadworthy vehicles / plant;
- Trip and fall on same level from bad housekeeping;
- Trip and fall on same level from trailing cables;
- Trip and fall into ground level holes from open trenches;
- Accidental fall into ground level holes from open trenches;
- Accidental collapse of superstructures;
- Stepping on sharp objects from bad housekeeping;
- Falling objects hitting people below from unsecure tools / materials;
- People hitting fixed structures from fatigue / lack of concentration;
- Fire and explosion from smoking near ignition sources;
- Fire and explosion from dropping residues of cigarette / zol near ignition sources;

- Fire and explosion from arson;
- Fire and explosion from accidental contact of ignition sources;
- Fighting from horseplay;
- Fighting from petty arguments;
- Sexual abuse;
- Bullying;
- Theft of tools from unsecure storage areas;
- Theft of materials from unsecure storage areas;
- Theft of tools from behavioural problems.

11.2.2 Potential health hazards and risks

Hazards and risks to health emanating from construction site activities are the following:

- Skin irritation from contact with irritant substances;
- Respiratory irritation from inhalation of varying types of dust;
- Respiratory irritation from inhalation of hazardous chemical agents;
- Skin burn from exposure to sunlight;
- Skin irritation from skin contact with concrete;
- Skin burn from excessive exposure to;
- Flu from exposure to viruses circulating during the winter season;
- Common cold from exposure to bacteria circulating during the winter season;
- Bronchitis from exposure to excessive cold;
- Asthma from exposure to contaminated soil;
- Hepatitis from digging up contaminated ground;
- Tuberculosis from inhalation of ambient/cement dust;
- Headache from overwork;
- Fatigue from work pressure / unreasonable timeframes / work hours;
- Eye irritation from contact with excessive dust;
- Heat stroke;
- Arthritis from cold conditions;
- Neck and back pain from prolonged continuous bending;
- Neck and shoulder pain from prolonged continuous overreaching;
- Muscular shoulder pain from backwards repetitive overhead movements;
- Leg and hip pain from descending and ascending work at height equipment;
- Stress from unreasonable workload / work disruptions;
- Hand lacerations from poor handling of sharp tools;
- Hand pain from faulty / defective hand-tools;

- Shoulder and back pain from lifting heavy loads;

11.3 Review of Risk Assessment

The construction health and safety officer shall review the hazard identification, risk assessments and the standard working procedures as planned and presented in the risk review plan. And this shall be informed by progress on site and following any major changes to the scope and construction methods and processes.

The client / client's OHS Agent and all other interested and concerned parties will be provided with copies of any changes, alterations or amendments to the risk assessment. Management of the site shall ensure that follow-up and refresher training is conducted whenever we are required to provide any such training, including when work situation changes. Records of all training will be kept in the safety file for auditing purposes.

11.4 Risk Monitoring

Principal contractor shall establish a monitoring programme, and that will be put it in writing, and it shall be integrated into the entire operation. We commit ourselves in the health and safety of our employees and the public who are likely to be affected in the process of project implementation. Daily site safety inspections and periodic monthly (internal) audits have to be conducted and documented.

Control of hazards is essential to an effective injury and illness plan. Supervisory personnel will be sure to look at safe work practices and ensure that they are being followed, and that unsafe conditions or procedures are identified and corrected. Workplace equipment and personal protective equipment will be issued and maintained in good, safe working condition. Periodic health and safety audits will be conducted to verify compliance with legislation and companies' management system as well as with the client's specification.

12.0 MANAGEMENT AND SUPERVISION OF THE WORK

12.1 Management of health & safety

Annexure-B presents an organogram that can be adopted to provide a project team that is responsible for management of health and safety in this project.

13.0 PROVISION OF EMPLOYEES FACILITIES

13.1 Toilet facilities

Workers will have reasonable access to adequate, clean, hygienic and maintained toilet facilities for each sex and for every 30 workers. The following are also provided to our employees:

- Toilet paper;
- Hand wash facilities;
- An eating area
- Soap; and
- Changing room (***where reasonably practicable***)
- Drinking water.

14.0 MANAGEMENT OF HEALTH AND SAFETY RISKS

Identification and control of risks to health and safety is a continuous activity to be taken into account with other factors when initiating, planning and allocating work activities.

14.1 Control of safety hazards

14.1.1 Excavations

All excavation work must be carried out under the supervision of a competent person who has been appointed in writing. Excavation supervisor is to ensure compliance as per Section 13 of Construction regulations 2014, in addition to taking practicable steps as follows to prevent danger to people and property:

- Ascertain location and nature of services which may be affected by work being carried out;
- prevent material from blocking adjacent access routes.
- prevent a person from being buried or trapped by a fall of material.
- prevent people on site from falling into the excavation providing solid barricades where necessary, or provide safety notices, whichever is reasonably practicable.
- prevent any part of adjacent access routes used by school staff / visitors being overloaded by plant or work equipment.
- inspect excavations before every shift and keep a record.
- communicate safe work procedure to workers;

14.1.2 Work at Height including working at the edge of an excavation.

A competent person must assess work at heights, compile hazard analysis and risk assessment and document such which shall form part of a fall prevention plan before work at heights is undertaken. The fall prevention plan must be suitable and sufficient to prevent falls of persons. Height workers must be in possession of "Medical Certificate of fitness" issued by an Occupational Health Practitioner who is registered with the Health Professions Council of South Africa.

- those with the duty to manage H&S on this construction site must adopt the following hierarchy:
 - Where possible, avoiding work at height.
 - Where work at height cannot be avoided, take measures to prevent falls.
 - Where risk cannot be eliminated, take measures to minimize the distance and consequences of falls.
 - Where work at height is necessary, those have the duty to manage H&S are required to ensure that:
 - Ensure risks are assessed and managed (including the risks of working on or near fragile surfaces and risks from falling objects).
 - People involved in work at height are competent, trained, or supervised if they are being trained.
 - Ensure work at height is properly planned and organized (including planning for emergencies and for rescue).
 - Take account of weather conditions that could endanger H&S (work should be postponed if weather conditions endanger health or safety).
 - Suitable equipment is used, inspected, and properly maintained (giving use of collective protection measures priority over personal protection measures)
1. Use of stepladders and trestles, the following factors must be addressed if scaffolding is to be in use on site:
- Stepladders and trestles may not be used at a workplace above 2m in height unless proper edge protection is provided.
 - Equipment must be checked for any defects or damage by a supervisor before use;
 - Any repairs must be carried out by a competent person;
 - Access ladders should be tied and extend at least 1m above the landing;
 - Access ladders are kept away from overhead cables;
 - Access ladders are used on a secure surface.

14.1.3 Handling and Use of Hazardous Chemical Agents (HCA's)

The principal contractor and other contractors engaged in work involving HCA's shall provide the necessary training and information regarding the use, transport, and storage of HCA's. Principal contractor shall ensure that the use, transport, and storage of HCA's are carried out as prescribed by the HCA's Regulations. Contractor shall ensure that all hazardous chemicals on site have a Safety Data Sheet (MSDS) on site and the users are made aware of the hazards and precautions that need to be taken when using the chemicals. Appointed first aider must be aware of the MSDS and how to treat HCA's incidents appropriately.

14.1.4 Control of Construction Plant / Machinery / Vehicles

The principal contractor must apply reasonable health and safety measures relevant for to ensure compliance as per Section 23 of Construction Regulations 2014. The following factors must be addressed if plant, machinery, and vehicles are to be in use on site:

- Plant, machinery and vehicles are suitable for work intended for;
- Ensure all employees required to operate plant, machinery, vehicles have received appropriate training.
- Ensure all employees required to operate plant, machinery, vehicles have been medically assessed and have valid medical certificate of fitness to operate those plant, machinery, and vehicles.

14.1.5 Use and Temporary Storage of Flammable Liquids on Site

The principal contractor has to ensure compliance with provisions for the use and storage of flammable liquids as per General Safety Regulations 2003, and in addition to Section 25 of Construction Regulations 2014, ensure implementation of measures as follows:

- Effectively ventilate by means of natural or mechanical ventilation, areas where flammable liquids are being used or stored.
- Post suitable and conspicuous nonsmoking notices at the entrance where flammable liquids are being used or stored, so as to prevent persons from smoking.
- Install suitable and adequate firefighting equipment with symbolic signs in locations where flammable liquids are being used or stored.

14.1.6 Fire Precautions on Site

Principal contractor and all contractors must comply with Environmental Regulations for Workplaces, 1987, in addition to Section 29 of Construction Regulations 2014.

14.1.7 Control of Electrical Machinery

The principal contractor must ensure compliance with Electrical Installation Regulations, 2009, Electrical Machinery Regulations, 1988, in addition to compliance with Section 24 of Construction Regulations 2014.

14.1.8 Portable electrical tools and equipment and tools

The contractor shall ensure that use and storage of all explosive powered tools and portable electrical tools are in compliance with relevant legislation. The contractor shall ensure that all electrical tools, electrical distribution boards, extension leads, and plugs are kept in safe working order. Regular inspections and toolbox talks must be conducted to make workers aware of the dangers and control measures to be implemented e.g. personal protection equipment, guards, etc. The contractor shall see that users are properly trained.

14.1.9 Operation of work equipment

Work equipment is dangerous, and therefore demand specific health measures such as the ones as follows will be considered:

- Restriction of operation and use of work equipment to experienced workers only;
- Daily inspections before each use;
- Refueling in the absence of fire/ignition sources;
- Knowledge and identification of safety guards.

Site supervisor will have to see to it that workers who shall operate any work equipment shall be those who have adequate knowledge of methods for competent operation of the handling systems in normal operation, start-up, shutdowns and emergency situations. Persons handling work equipment will be advised of hazards, proper procedures, precautions, health effects and recommendations for emergency treatment.

14.1.10 Manual handling controls

Risk assessment on will be communicated to workers during induction training, this is to make workers aware of measures necessary to prevent harm. Workers can avoid personal harm or suffering by considering steps as follows:

- Breakdown of loads into smaller loads.
- Buddy system.
- Clear obstructions before lifting.
- Safe working procedures.

14.1.11 Pulling and pushing

Risk assessment shall be communicated to workers during induction training; this is to make workers aware of measures necessary to prevent personal harm. Site workers and construction supervisor shall take necessary precautions to avoid risks and consequences associated with pulling and pushing formwork and cabling by considering safety measures as highlighted in the baseline risk assessment.

14.1.12 Driving of work vehicles

Vehicles are dangerous, and therefore demand specific controls such as the ones as follows:

- Restriction of use to authorized workers only;
- Daily inspections before each use;
- Refueling in the absence of fire/ignition sources;
- Maintenance and servicing.

14.1.13 Extreme heat

Workers can combat extreme hot weather conditions by wearing safety clothing and. Regular intake of cold fluids necessary to regain energy will also help workers.

14.1.14 Hand Tools

1. Hand tools (miscellaneous)

Supervisors and workers will be encouraged to consider in securing their own safety while handling and using hand tool, and consider safety measures as follows:

- ☐ Compliance with the company's own health and safety policy and internal procedures.
- ☐ Use the correct tool for the job.
- ☐ Use eye protection where appropriate.
- ☐ Any personal protective equipment necessary to be made available and to be worn correctly.

2. Cutting tools

Cutting tools can cause injury to the operator or other people in an area. Site supervisor will have to manage safe use of cutting tools and ensure measures as follows:

- ☐ Tools are in use only by a person who has received instruction in their safe use;
- ☐ Tools are in use in an area where appropriate warning signs have been displayed and where people are wearing eye and hearing protection;
- ☐ Not use cutting tools if parts are damaged, defective or if they do not have a current inspection record;

- ☐ If necessary run cables at height to keep them dry and prevent them from being damaged;
- ☐ Ensure tools are in good condition;
- ☐ Use hand tools with safety gloves where possible and necessary.

14.1.15 Trailing cables

The project supervisor for the construction stage / electricians must ensure control of trip hazards, by taking consideration of measures as follows:

- ☐ Ensure the work area is regularly inspected and electrical cables are kept clear of access ways / routes;
- ☐ Ensure angle grinder leads / cords are not too long.

14.1.16 Flying / falling objects

Risk assessment will be communicated to site workers, workers have been provided with hard hats and safety shoes. Supervisor will monitor those workers and ensure they wear provided hard hats at all times.

14.1.17 Electrical and Mechanical Installations

Risk assessment will have to be communicated to workers during induction training; this is to make workers aware of measures necessary to prevent personal harm. The project supervisor for the construction stage must coordinate and supervise site deliveries.

All electrical and mechanical installations must comply with the requirements of the Health and Safety Act, the Construction Regulation 2014, other relevant regulations and applicable safety standards and industry best practice. This type of work may be done by specialist contractors, in which case, the requirements of Regulation 7 of the Construction Regulations 2014 must be complied with in respect of appointing such contractors. Relevant safe work procedures and technical method statements must be submitted for approval by the PC.

The work must be conducted by appropriately registered contractors and on completion of such installations, certificates of compliance issued by competent persons will be required.

14.1.18 Reduction of employee & persons exposures

The project supervisor must periodically make the necessary assessment of the hazards and risks which could emanate from this project activities and the appropriate action has to be taken. The assessment will have regard to safe access, noise, lifting, client property and obstruction generated by work site activities, emergency procedures, and disruption of services and requirements for signage.

14.1.19 Electricity / power supply

Essential steps necessary to prevent electrical risks is electrical isolation including measures as follows:

- Identification of cable markers to detect underground cables.
- Switching off power at a supply or distribution box.
- Providing competent supervision.
- Getting appropriate authorisation including Permit to Work.
- Identifying the correct isolations and disconnections required.
- Correct sequence of isolations and disconnections.
- Safety methods for maintaining isolations and disconnections.

14.1.20 Material unloading and loading

Materials that are unloaded or tipped from plant will have to be deposited in planned locations where they will not cause any obstructions or hazards. Site deliveries will have to be planned ahead and supervised by site personnel. Site workers must be discouraged to remain on vehicles that are being loaded / off loaded unless the vehicle is equipped with a reinforced cab or falling object protection system (FOPS). Workers working with plant or vehicles, on site where vehicle movements is expected, will have to be provided with and wear high visibility vests.

14.1.21 Transportation and unloading

Transportation and unloading of the material and equipment at the location must be done in a safe manner so that they are not damaged or misplaced.

14.1.22 Objects or tools lying about

Project site supervisor will have to ensure measures as follows:

- Clear up objects or tools on work areas, and ensure housekeeping is practiced;
- Proper store keeping of tools;
- Regular removal of waste and materials;
- Prevent accumulation of rubbish;
- Cordon off areas where scraps and stored material could present a hazard by use of a danger tape.

14.2 Management of health hazards

Daily exposure to health risks result in irreversible damage that may occur before any symptoms are apparent. A development of a preventive strategy to identify and control risks before people's exposure is essential.

14.2.1 Control of construction dust

It is important that workers are made aware of the risks from dust and how it can harm their health. They must be fully trained and informed on how to use dust control measures that have been put in place, how to maintain equipment, and how to use and look after respiratory protective equipment (RPE). The principal contractor is to consider safe method of working which takes proper account of risks to employees and others who may be affected by exposure to dust, such as visitors and contractors.

Steps as follows may be taken to control exposure to dust:

- Assesses health risks;
- Provide workers with appropriate information and training;
- Using building materials that do not require an excessive amount of preparatory cutting to size;
- Using less-powerful tools, such as a block splitter instead of a higher energy cut-off saw;
- Water suppression;
- Keeping the number of workers near the dust-producing work area to a minimum;
- Using sheeting and temporary screens to enclose the work area;
- Issue suitable and comfortable RPE (Respiratory Protective Equipment) for the work.

14.2.2 Control of noise

Noise Induced Hearing Loss Regulations 2003 Section 10(1) specifies that an employer or self employed person shall ensure that exposure of a person to noise is either prevented or where reasonably practicable, adequately controlled.

- Assess noise levels;
- Reduce risks from noise exposure by
- Provide employees with information and training
- Provide hearing protection as a last resort.

14.2.3 Control vibration

The principal contractor is to ensure measures as follows are implemented:

- Avoid, whenever possible, the need for use of vibration equipment;
- Undertake a risk assessment to include a sound estimate of employees' exposure to vibration;
- Develop a maintenance plan for tools and machinery.

14.2.4 Control of radiation

Principal contractor is to ensure control measures are implemented to reduce exposure of people to ultraviolet radiation:

- Minimize worker exposure to radiation by increasing the distance between a source of radiation and the worker;
- Post warning signs where exposure to radiation is possible;
- Workers exposed to radiation above guidelines should be provided with UV blocking safety goggles, face shields, welding shields and long sleeved clothing.

14.2.5 Control of ergonomic risks in construction

Construction is a physically demanding work environment; site workers are often at risk of long-term injury. Back sprains and strains are the most common disabling injuries, often due to overexertion and bodily motion.

Ergonomic risks experienced in construction sites emanate from exposure to hazards that may include improperly designed tools or work areas and improper lifting or reaching, poor visual conditions, or repeated motions in an awkward position which can result in occupational accidents or illnesses.

Potential ergonomic hazards in this project include the following:

- Manual handling of objects and materials where lifting and carrying is done
- Repetitive motion disorders which are encountered when workers use vibrating tools like chain saws and powered hammers
- Continuous movement of hand and arm in the same motion throughout the work shift
- Repetitive and stressful wrist motion that causes irritation, fluid build up, or thickening of the carpal ligaments in the wrists
- Manual materials handling related to carpentry, bricklaying, roofing, plastering, truck driving
- Awkward work postures in activities of plumbers, electricians, boilermakers, labourers, and insulators
- Elevated posture in activities of plumbers, electricians, boilermakers, labourers, and insulators
- Overexertion
- Rapid twisting and bending of the back
- Whole-body vibration transmitted through the seats in heavy equipment.

The principal contractor must comply with the following in line with Ergonomics Regulations 2019:

- Perform ergonomic risk assessment performed by a competent person before the commencement of any work that may expose employees to ergonomic risks.

The risk assessment must meet the following requirements:

- a) include—
 - i. a complete hazard identification;
 - ii. the identification of all persons who may be affected by the ergonomic risks;
 - iii. how employees may be affected by the ergonomic risks;
 - iv. the analysis and evaluation of the ergonomic risks; and

- v. the prioritization of ergonomic risks.

14.2.6 Control of workplace violence

Principal contractor is to ensure that hazards any unsafe acts and evaluate risks of violence among the people on site. He / she has to ensure safety rules are drafted and communicated to all people on site, including self employed persons and contractors. Written acknowledgement on communication of safety rules has to be maintained.

14.2.7 Control of alcohol and drug abuse

The principal contractor is to ensure no use of alcohol and drugs is allowed on site. No person may be under the influence of alcohol or any other drugs while on the construction site.

14.2.8 Control of concrete works

The principal contractor is to ensure that concrete works to be done all site must be done in a safe way safeguard the health of the employee as well as the protection of the environment. Contractor must ensure that employees have proper and adequate PPE.

Safety Precautions for Working With Concrete

- Wear the Appropriate Personal Protective Equipment (PPE)
- Use the Proper Tools.
- Employ the Proper Techniques (competency).
- Have Washing Stations Available.
- Wear Additional PPE.
- Exercise Caution Around Concrete Buckets and in Mixers. ...
- Communicate Proactively With Your Team.
- Stay Alert and Vigilant

14.2.9 Control of paving works

Principal contractor must ensure that paving works are done under the supervision of the site agent and contractor has to take all considerable safety measure to ensure paving works is done in a safe manner, contractor has to make sure that all hazards associated with paving are identified and measures are adopted to eliminate these hazards. Baseline notable hazards identified include not limited to the following.

- Back injuries from lifting heavier concrete products.
- Back injuries from repetitive motion of paver installation.
- Muscle pulls from digging and lifting.
- Finger abrasion from handling concrete products.
- Skin rashes or burns from job site chemical spills and splashes.
- Eye injuries from saw cutting.

- Lung and respiratory injuries from long term exposure to saw cutting dust and cement dust.
- Heat exhaustion.
- Impact injuries from moving equipment.
- Vibration related injuries from compaction equipment.
- Hearing loss injuries from working with high decibel equipment such as saws and compactors.
- Knee injuries from repetitive kneeling.

14.2.b. OPERATIONAL PHYSICAL CONTROL REQUIREMENTS

a. Notices & Signs

All symbolic safety signage, that the Principal Contractor or his/her sub-contractors are to use/display are to conform the requirements of SANS 1186.

The display of the following signs is mandatory:

- For Contractors with Site Establishment: The Contractor Company sign must be posted at their site offices to reflect the name and contact details of the: Construction Supervisor; Health and Safety Manager/Officer; First Aider; Health and Safety Representative and Evacuation Warden. Sign to also include site-specific number as per the construction work permit where applicable.
- “Radio-Active Material” symbolic signs at radioactive storage areas.
- The location of every first aid box; fire extinguisher and emergency exit is to be clearly indicated by means of a sign.
- At the entrance to premises where machinery is used: Restricted access i.e. “Authorised Person Only” signs on entry.
- When in use, an Explosive Power Tool shall have a sign, warning people of its use.
- The Contractors shall provide the signage where work is conducted and where unauthorised entry is prohibited and/or where alerting and cautioning passers-by to be aware of potential dangers.
- Notices & Signs at entrances / along perimeters indicating “No Unauthorised Entry”.
- Notices & Signs at entrance instructing visitors and non – employees what to do, where to go and where to report on entering the site/yard with directional signs. E.g. Visitors to report to Site Office”
- Notices & Signs posted to warn of overhead work and other hazardous activities. E.g. General Warning Signs.

- All equipment brought onto the construction site, (including motorised equipment, e.g. bobcat) that requires PPE to be worn during operation, must have the relevant PPE mandatory sign/s attached. The type and use of PPE will be placed at all entry points to the construction site.

Note: Signage to be adequate to ensure after hour safety.

b. Fire Safety

Contractors must develop a fire safety plan/procedure for the specific construction site prior to commencing work. The procedure must take into consideration the size of the site, type of work being done (e.g. cutting, welding, grinding, etc.) and amount of combustible materials. All workers entering and working in the construction site need to be trained in fire safety and any duties they are required to perform. Pre-existing fire systems in buildings shall be maintained during construction whenever possible. Any changes must be approved by the Client.

The fire safety plan shall include:

- The designation and organization of site personnel to carry out fire safety duties, including fire watch service if applicable.
- The emergency procedures to be used in the case of fire, including: Sounding the fire alarm, notifying the fire department, instructing site personnel, Fire fighting procedures and integrating with existing emergency procedures.
- The control of fire hazards in and around the building.
- Maintenance of fire fighting facilities.

Cutting, Welding, and Hot Work

Prior to cutting or coring of concrete suspended slabs, cast in place or pre-cast walls, slab on grade the contractor must either X-ray the slab or if X-ray is not feasible provide other approved alternate method for determining live electrical concealed in slab or walls. Signage shall be posted to ensure no one enters the affected area during X-raying.

When welding or cutting work is performed, an adequate number of approved fire extinguishes shall be provided by the contractor. The contractor shall provide a thirty minute fire watch after the operations has ended to ensure that no fire starts. Extraction fans to be provided when welding work is performed.

Fire Guidelines:

- Fire alarm shut downs: Contractors must inform the Client in writing 7 days prior to any part of a fire system being shut down.
- Fire Warning: A suitable means of alerting site personnel to a fire shall be provided, and capable of being heard in all areas of the building.
- Portable Extinguishers: suitable extinguishers must be available in the construction site and in cases of hot work, be readily available at the location.
- Combustible Liquid and Flammable Liquid Storage: storage of combustible and flammable liquid in the construction site is not permitted unless stored in approved flammable cabinets or outdoors away from the buildings.

- Smoking Restrictions: Smoking is not permitted indoors, at entrances to buildings or near air intake systems as per Makhado Local Municipality Smoking Policy and legislation requirements

c. Construction Vehicles and Mobile Plant

- a) The Contractor shall implement a site traffic plan (circular movement) to ensure the safe movement of all

Construction related mobile plant.

- b) Contractors shall implement pedestrian and vehicle routings as part of the site traffic plan to demonstrate the route employees may proceed when coming on or going off shift
- c) All motor vehicles operated by Contractors within the area shall, in all respects, comply with the Road Traffic Ordinance and Road Traffic Act. Designated drivers shall be in possession of a driver's licence, valid for the class of vehicle as well as an operator certificate where applicable. The driver's license shall be kept by the person so authorised and shall produce such card on request.
- d) All drivers of construction vehicles and mobile plant to have medical certificates of fitness. Each Project site will have system/ process to manage vehicle access to site.
- e) The contractor shall attach identification markers on all of his/her vehicles that are permitted to enter the site.
- f) The speed limit within the bounds of the construction site is 30 km/h. (To be completed by the project team). A consolidated traffic plan must be in place where there are many vehicles within a project site.
- g) No drivers or operator may talk on cell phones or two way radios whilst driving, unless a hands free kit is used.
- h) It is the responsibility of the driver to ensure:
 - He/OHS and his/her passengers wear seat belts whilst the vehicle is in motion.
 - Comply with all safety, direction and speed signs.
 - Ensure that vehicle loads are properly secured and loaded onto vehicles.
 - Ensure that vehicles are not overloaded.
- i) All requirements with regard to the transportation of tools/equipment/material and persons on the back of construction vehicles must be adhered to:
 - No Personnel to be transported in the back of construction vehicles with tools.
 - Tools, equipment and material to be secured in order to prevent movement;
 - Fixed and firmly secured seats with seat belts – adequate for the number of passengers being transported;

- The driver and all passengers to be seated with seatbelts fastened whilst the vehicle is in motion.(National Road Traffic Act no 93 of 1996).
- j) The Principal Contractor shall ensure that his employees and those of his subcontractors do not.
- Ride on back of elevators, cranes or other mobile plant equipment.
 - Leave vehicles unattended with the engine running.
 - Park vehicles in unauthorised zones/areas.
- k) Makhado Local Municipality reserves the right to search any vehicle on the premises or when entering or leaving the premises.
- l) The Contractor shall be solely responsible for the safety and security of any of his vehicles (including private vehicles) on the premises.
- m) A current maintenance logbook is required for all cranes and large plant equipment, and shall be available for inspection at any time. The logbook shall be located in the cabin of the crane or plant equipment.
- n) Principal contractor is to ensure that visibility (e.g.: switching on of lights, reflectors, barricades equipped with lights, etc.) is enhanced on all Construction Vehicles and Mobile plants in order to identify the location of the vehicles or plant.
- o) The Contractor must maintain his vehicles in roadworthy condition and a valid license. These vehicles shall be subject to inspection by the Client's representative. Vehicles which are not roadworthy will not be allowed onto the site. If mobile plant equipment is used on the public road, the same requirements as for vehicles apply and should be adhered to.
- p) In the event where the principal Contractor and his sub-contractor do not own the equipment, the principal Contractor is still responsible for ensuring all conditions are complied with by all of his subcontractors or hire companies.
- q) Drivers/operators shall be responsible for the travel-worthiness of all loads conveyed by them. Precautions shall be taken to lash all loads properly. Loads projecting from vehicles shall be securely loaded and in daytime a red flag and during darkness a red light or red reflective material shall be attached to the extreme end of such projecting material.
- r) All servicing and repairs must be carried out by the Contractor in a designated area.
- s) All waste from servicing must be disposed of in accordance with the environmental legislation.
- t) Every mobile machine whose vision is impaired when reversing must have a siren/hooter, which sounds, when the machine is reversing. This includes trucks, cranes, loaders, etc.
- u) Operators have great difficulty in seeing light vehicles behind their machines. Drivers of light vehicles must avoid stopping or parking in the vicinity of machines. At least 30 (thirty) meters must be left clear between such a vehicle and such a machine.
- v) Drip Trays to be placed under the vehicles where are possible leaks to avoid soil and ground pollution.

d. Working near Public Roads

The Principal Contractor, his employees and subcontractors required to work on or nearby roadways must put measures in place to ensure safety of the workers and public (pedestrians, road vehicle users, cyclists etc.). The contractor must ensure the following:

- a) Ensure there is traffic control measures for each expected interaction (Construction works and hazards, Vehicles, both public and construction vehicles, pedestrians and workers) including drawings of the layout of barriers, walkways, signs and general arrangements to warn and guide traffic around, past or through the construction site or temporary hazard. The contractor must ensure that the Traffic Management Plan is approved by the engineers and further implement and monitor the effectiveness of a TMP. The TMP must be reviewed regularly after design/work procedure changes and after each incident/accident/near miss.
- b) Providing separate traffic routes for pedestrians, workers and vehicles, where possible.
- c) Providing separate clearly marked pedestrian/workers walkways that take a direct route.
- d) Creating pedestrian/workers exclusion zones where powered mobile plant is operating.
- e) Creating vehicle exclusion zones for pedestrian/workers-only areas.
- f) Plan storage areas so delivery vehicles do not have to cross the site
- g) Securing areas where vehicles and powered mobile plant operate by installing pedestrian/workers barriers, traffic control barricades, chains, tape or bollards. Ensure a competent person with the necessary training or qualifications directs powered mobile plant when it operates near workers or other plant.
- h) Designating specific parking areas for workers' and visitors' vehicles outside the construction area.
- i) Providing clearly signed and lit crossing points where walkways cross roadways, so drivers and pedestrians can see each other clearly.
- j) Using traffic controllers, mirrors, stop signs or warning devices at site exits to make sure drivers can see or are aware of pedestrians before driving out onto public roads.
- k) Avoiding blocking walkways so pedestrians do not have to step onto the vehicle route and construction area.
- l) Scheduling work so vehicles, powered mobile plant and pedestrians are not in the same area at the same time, where possible. Or schedule for times where the traffic is at the lowest.
- m) Ensure workers and other people are familiar with reversing areas and these areas are clearly marked, and
- n) Ensure plant operators are aware of workers who may be in the vicinity of the swing radius, articulation points and overhead load movement of their vehicle.

e. Personal Protective Equipment

In terms of Section 8 of the OHS Act, the duty of the employer is to take steps to eliminate or mitigate (hierarchy of control measures) any hazard or potential hazard to the safety or health of employees before resorting to PPE.

Principal contractor's employees and his sub-contractor employees at the construction site, including visitors, shall use the following SANS or the relevant internationally recognised authority approved risk based PPE at all times, as a minimum:

- Head protection (Hard hat).
- Steel toe capped safety boots.
- Eye protection.
- Sun Hats
- Ear muffs
- Long sleeved and long pants protective clothing. NB: At least two of each to be issued to each employee.
- High visibility vests.
- Refer to General Safety Regulation 2 of the OHS Act- if there are particular activities/areas/risk assessments that require a specific type of PPE, then that specific PPE requirement must be adhered to (e.g.: for dusty environments – eye goggles; for welding – welding helmet; etc.).

The Contractor shall ensure that his employees understand why the personal protective equipment is necessary and that they use them correctly.

Strict non-compliance measures must be administered to any employee not complying with the use of PPE and shall be removed from the Site.

PPE shall be worn in any designated area requiring such a PPE.

Issue, Replacement and Control of PPE: The Principal contractor must provide a detailed programme on the issuing, maintenance and replacement of PPE for all his employees and subcontractors on site. The Principal contractor is required to keep an updated register of all PPE issued to staff, including that of his sub-contractors

f. Housekeeping

Principal Contractors and Sub-contractors

- The Principal Contractor and his sub-contractor shall maintain a high standard of housekeeping within the site. Ensure prompt disposal of waste materials, scrap and rubbish is essential. Also refer to what the requirements are in the EMP

Scrap/Waste Removal System

- Scrap management as per agreement with Project Manager.
- All items of Scrap/Unusable Off-cuts/Rubble and redundant material removed from working areas on a regular basis.
- Scrap/Waste disposed of in designated containers/areas
- Removal from site/yard on a regular basis.

Stacking & Storage

- Before stacking any material, the Contractor, sub-contractor or their employees must consult the Makhado Local Municipality Project/site Manager for allocation of a stacking area, General Safety Regulations 8 of OHS Act.

– Adequate care must be taken by the Contractor to ensure that storage and stacking is correctly and safely carried out. – Materials/objects shall not be left unsecured in elevated areas –falling objects may cause serious injuries/fatalities – All packaging material including boxes, pallets, crates, etc. to be removed from the work area immediately.
Waste Control/Reclamation – Re-usable off-cuts and other re-usable material removed frequently and kept to a minimum in the work areas. – All re-usable materials neatly stacked/stored in designated areas. (Nails removed/bent over in re-usable timber).
After job completion – On completion of his work, the contractor is responsible for clearing his work area of all materials, scrap, temporary buildings and building bases to the satisfaction of the Client.
Inadequate standard of housekeeping – The Makhado Local Municipality Project/Site Manager has the right to instruct the Principal Contractor and his sub-contractor to cease work until the area has been tidied up and made safe. Neither additional costs nor extension of time to the Contract shall be allowed as a result of such a stoppage. Failure to comply will result in site cleaning by another cleaning contractor company at the cost of the Principal Contractor
Regular safety/housekeeping inspections – The Principal Contractor shall carry out regular safety/housekeeping inspections (at least weekly) to ensure maintenance of satisfactory standards. The Principal Contractor shall document the results of each inspection and shall maintain records for inspection.

g. Permit to Work

If the type of work requires that contractors must be trained, competence assessed and authorized in writing to perform the duties of an authorized or responsible person as contemplated in the applicable Makhado Local Municipality regulations e.g. Hot Work, Radiation, confined space work, excavation, blasting etc.

The PM Project Manager is to provide more details on the permit to work system for the specific work to be conducted by the Principal Contractor.

h. Hazardous Chemicals Agents

The aim of this section is to outline to the Principal Contractors and his sub-contractors how hazardous substances, as defined in the Hazardous Chemical Agents Regulations 2021 (OHS Act), should be managed.

- Prior to any HCA being brought onto the site or produced on the site, the Principal Contractor shall supply the Makhado Local Municipality Project Manager with the following: Safety Data sheets (MSDS) in accordance with the requirements of the OHS Act – Regulations for Hazardous Chemical Agents; Purpose for bringing the hazardous substance onto the site; Proposed arrangements for safe storage; Proposed methods for handling/usage; Proposed method of disposal; and Hazard communication / training plan.
- The information is to be provided at least two (2) working days prior to the expected delivery on site.
- The Makhado Local Municipality Project Manager shall approve the use of any hazardous substance after receiving the above information.
- No HCA are not to be brought onto the site until the Makhado Local Municipality Project Manager approval is received.
- All HCA containers to be clearly labelled. Containers that are not marked will not be allowed. No HCA to be stored in food or drink containers.
- Users of HCA to wear/use the correct PPE as per the HCA safety data sheet.
- Users of HCA to be adequately trained in the HCA that they are handling.
- The Contractors to have and maintain a register with all the HCA that they have on site
- Site Risk Control/OHS Teams must be notified of any HCA, explosive, and radiation sources that may enter the premises.

Flammable and Combustible Liquids

- Proposals to store fuel on site must have written approval from the Makhado Local Municipality Project Manager.
- The volumes of fuel allowed to be stored will depend on site conditions and Statutory Regulations. A maximum storage of 40 litres of fuel is allowed to be stored. Anything greater than 40 litres to be stored in a licensed flammable/combustible liquid store.
- Adequate numbers of dry chemical fire extinguishers shall be provided, installed and maintained.
- Before a machine is refuelled, the motor must be stopped. Refuelling shall take place at designated safe areas and appropriate warning signs installed. Suitable drip trays must be used to prevent spillage at the filling nozzle.
- All fuel storage areas must comply with the following requirements: -
Storage should be well clear of buildings, Storage areas must be kept free from all combustible materials. All danger signs must be prominently displayed, i.e. Flammable Liquid, No Smoking, No Naked flames. Hazchem identification. Adequate fire fighting equipment must be available. Diesel tanks will be installed in a bund area; bund area must be able to contain 110% of tank capacity. Bund area shall be of a concrete or steel construction. Bund area shall have a lockable drain valve. No other material/equipment shall be stored in the bund area. See Construction Regulation 23, of the OHS Act.

Explosives

- Explosives shall not be brought onto the site or be used without the express permission of the relevant Makhado Local Municipality/Representative.

- Explosives or detonators shall not be stored on the site.
- Detonators and other explosives shall never be carried in the same box.
- The provisions of all relevant Acts and Regulations shall be strictly observed.

Compressed Gas Cylinders (General Safety Regulation 9) and SABS 1548

The following requirements apply to all gas cylinders storage:

- Contractors shall establish storage areas as approved by the Makhado Local Municipality Project Manager.
- Storage areas should be well clear of buildings.
- The storage areas shall be fenced, shaded, stable, and solid surfaces.
- For security and ventilation purposes, a wire mesh fence should surround the storage area. Keep the enclosure locked.
- All danger signs must be prominently displayed at storage area; e.g.
- No Smoking and naked flames.
- A protective covering must be provided.
- Adequate ventilation must be provided.
- Storage areas must be kept free from all combustible materials; no other materials must be stored in cylinder enclosure.
- Full cylinders must be kept apart from empty cylinders so that it will not be necessary to open valves to check whether cylinders are empty or full.
- Cylinders must always be chained separately in an upright position and special stands must be used for cylinders.
- Cylinders must be stored in rows with aisle in-between for easy removal in event of fire.
- Mark empty cylinders clearly and move to approved storage areas.
- Adequate fire fighting equipment must be available.
- Cylinders for different gasses must be stored separately.
- Flammable and oxidising gasses must not be stored together; greases and oils must never be allowed to come in contact with oxygen.
- Only flame-proof electrical lighting should be used, if required.
- Cylinders will only be allowed on site in an approved trolley, properly secured and with a chain.
- All gas cylinder torches to have flashback arrestors fitted on both sides.
- Clamps are to be used to separate cables

i. Falling Risk Positions (including falling into an excavations)

Whenever persons are required to work in a fall risk position where there potential exposure to falling either from, off, or into, a fall protection plan (which includes fall prevention) will be compiled, implemented and reviewed and every possible and practicable means shall be adopted to provide such persons with effective training and safeguards.

All persons required to work in fall risk positions shall be declared medically fit.

Working on fall risk positions shall only be carried out under the supervision of a competent person.

Safety belts are not allowed to be used in Makhado Local Municipality. An appropriate full body safety harness will be worn when working at an elevation of 2 (two) meters or more.

Mitigation measures to be put in place:

- All tools in fall risk positions must be attached to lanyards, attached to person or structure or effectively prevented from falling.
- Equipment in fall risk positions must be tied back to the structure.
- Loose items in fall risk positions. E.g. Bolts and nuts to be kept in tins or similar robust containers and not in paper boxes.
- When working at fall risk positions, nets and/or other suitable material should be used catch falling debris and sparks directly below where the task is being performed
- Roof work discontinued when there is bad/hazardous weather
- Fall protection measures (including warning notices) when working close to edges or on fragile roofing material

Fall protection includes: Safety harnesses and double lanyards; approved lifelines; and other approved means.

Fall protection equipment to be implemented where fall prevention is not possible and shall comply with SANS Standards -: SANS 503&508 Series and other recognised international standards.

Scaffolding

- All scaffolding used shall comply with the OHS Act and Regulations as well as SANS 10085.
- Scaffolding erectors to be trained as specified in SANS 10085.
- Scaffolding access ladders shall form part of the scaffold structure and not the ladder register.

Ladders (Portable)

- All ladders used on the site shall be in compliance with the OHS Act and Regulations.
- All Ladders shall have an identification tag, logged in a register, and inspected on a monthly basis and prior to use.
- Damaged ladders shall be marked as “DAMAGED” and removed from the project site.
- Prior to work being performed, a risk assessment must be conducted, and work must be conducted as per General Safety Regulation 6 and 13A and Construction Regulation 10 of the OHS Act.

j. Excavations, Trenches and Floor Openings

- a) Prior to commencing work on any excavation or trench, utility owners shall be contacted and advised of the proposed work and to determine the location of all underground installations, i.e., sewer, telephone, water, fuel, gas, electric, etc. Overhead hazards shall be assessed and dealt with prior to commencement of work. Where details of existing services are not available from the client, the contractor is to make an assessment of the area for such services.
- b) Adequate precautions shall be taken by the Contractor to prevent slumping of excavations, as well as to prevent rocks and loose material falling onto workers.

- c) All excavations done by the Contractor are to be clearly demarcated and barricaded to prevent accidental access.
- d) Only solid barricading will be used at areas where a fall hazard is present. Solid barricading and / or hole covers shall be provided around all holes or openings to prevent any person being injured as a result of a fall. The solid barricading must be visible to prevent persons from coming close to the danger area.
- e) Barricading must be placed as close as possible to the excavation.
- f) If an excavation or trench endangers the stability of buildings or walls, shoring, bracing, or underpinning will be provided. Excavations and trenches that are adjacent to backfilled excavations or trenches, or which are subject to vibrations from railroad traffic, road traffic, blasting in open cast mining or the operation of machinery (e.g., shovels, cranes, trucks), must be secured by a support system, shield system or other protective systems (i.e., Steel pile shoring, bracing).
- g) Where it is impracticable to provide fixed guard railing, effective removable barriers shall be provided at all unguarded openings in guard railing or floors, and shall be maintained in position at all times until the hazard no longer applies.
- h) Warning signs and flashing warning lights at night shall be displayed in suitable positions to warn any persons approaching the area of the location and extent of any excavation.
- i) No material to be within 1m of the excavation edges.
- j) No work shall commence in an excavation unless the excavation has been declared safe by the competent person
- k) Whilst work is being performed in an excavation, there shall be a supervisor, at all times
- l) All excavations must be on register and inspected daily before work commences and after inclement weather by the contractor's appointed competent person, declared safe and his findings noted in the register
- m) Emergency – access ladders – access may not be further than 6 meters from the point where any worker within the excavation is working.

k. Barricading (Guarding of Excavations, Trenches)

Areas where the restriction or prevention of unauthorised persons/members of public/passers-bys is required

- Name and contact detail of person and Contractor Company that is responsible for the barricading shall be posted on the actual barricading.

- *All barricading shall be of the rigid type. Chambers are to be fenced off, on residential and industrial areas; diamond mesh fence of at least 1.5m heights with overhanging orange net will be used on all sides. All openings and edges must be barricaded with solid barricading to withstand an impact of at least 100 kg and adequately maintained. Note: This does not refer to traffic control barricading; different requirements as per approved Traffic Management Plan must be implemented for traffic control.
- Physical barriers to prevent persons falling into openings in floors, staircases, open-sided buildings and any structure in the course of erection, where dangerous openings exist.
- Contractors must pre-plan the delivery of floor grating, stair treads, landings and handrails to ensure safe access and protection for persons working on structures.

I. Blasting

- a) A copy of the written permission from the Chief Inspector of Department of Employment and Labour shall be obtained before use of any explosive material – refer to requirement in Explosives Regulation 13 of the OHS Act.
- b) Requirements for the transporting and storage of explosives to be in accordance to Explosives Regulation 13.4 of the OSH Act and SANS 100228 “Code of Practice for the Identification and Classification of Dangerous Substances and Goods” Published by the South African Bureau of Standards.
- c) Should blasting be necessary during the construction phase, the necessary authorisation must be secured from the relevant authorities. Adjacent land owners must be notified prior to the blasting activities on site.
- d) The Construction operations may necessitate that ground and rock be blasted. Prior to a blast a siren will have to be sounded. Warning flags will have to be displayed at the entrance to the area of the blast and guards will be placed at strategic points.
- e) Should the Contractor be required to carry out blasting operations, he is to fully acquaint himself with, and adhere to the blasting procedures and legislation. Every blast must be cleared with the appropriate Client representative before charges are placed.
- f) Only a licensed operator is allowed to blast.
- g) For all blasting operations, a blasting mat shall be used to cover the blasting area so as to reduce the amount of flying debris. The method statements and blasting pattern must be approved by the appropriate Makhado Local Municipality personnel before and blasting commences. Before any open trench blasting commences, the Contractor shall be in possession of a Blasting Permit (BLP Form) as well as Transport Permit (TTP Form) from the South African Police Service Explosives Section. All tunnel blasting (i.e. Pipe Jacking), shall comply with the Mine Health and Safety Act and the permits shall be issued by the Department of Minerals and Energy.

m. Machinery, Tools and Equipment

The aim of this section is to outline the process used by Makhado Local Municipality project management team to ensure that all equipment brought onto site by the Principal Contractor and their sub-contractors is appropriate to the task being performed and in good condition.

The Contractor shall ensure that all machinery, tools and equipment are identified, safe to be used and is maintained in a good condition.

- a) All machines driven by means of belts, gear wheels, chains and couplings shall be adequately guarded. A machine is guarded when persons cannot gain inadvertent access to the moving parts.
- b) The Principal Contractor shall ensure that all machinery, tools and equipment to be listed on an inventory list and handed to security with a copy kept on site.
- c) All machinery, tools and equipment to be regularly inspected at least monthly or as required by legislation and risk assessments, registers of tools shall be kept in the OHS file. The equipment should be numbered or tagged so that it can be properly monitored and inspected.
- d) All machinery, tools and equipment must have the necessary approved test or calibration documentation where applicable prior to being brought onto the premises and the records shall form part of the OHS plan.
- e) All fuel driven equipment must be inspected by the Makhado Local Municipality OHS Practitioners/Officers prior to mobilizing it onto site.
- f) All fuel driven equipment must be properly maintained in accordance with the manufacturer's recommendations and legal requirements.
- g) The Contractor shall supply, at his cost, all items of plant and equipment necessary to perform the work else otherwise indicated.
- h) The Client reserves the right to inspect items of plant or equipment brought to site by the Contractor for use on this Contract. Should the Client find that any item is inadequate, faulty, unsafe or in any other way unsuitable for the safe and satisfactory execution of the work for which it is intended, the Client shall advise the Principal Contractor in writing and the Principal Contractor shall forthwith remove the item from the site and replace it with a safe and adequate substitute. In such cases, the Principal Contractor shall not be entitled to extra payments or extensions of time in respect of delay caused by the Client's/OHS Representative's instructions.
- i) The Principal Contractor/sub-contractor will ensure that he has all the necessary registers to record all tools and equipment.
- j) All employees shall be competent when operating or using machines and tools i.e. have a valid certificate. And proof of any form of task related training.

n. Machine Guarding

- a) An assessment should be conducted in writing to ensure that all machines and tools are fitted with a guard and the assessment should be kept on the OHS file.
- b) The machine or tool should be guarded to prevent limbs or loose clothing from getting under, into, above or around the dangerous moving parts.
- c) Every shaft, pulley, wheel-gear, sprocket, coupling, clutch, friction drum, spindle end screw, key, bolt on a revolving shaft, driving belt, chain rope or similar object shall be securely fenced or guarded.

- d) Guards should form a permanent part of the machine or tool, easy to remove non corrosive, rigged and as far as reasonable heat resistant.
- e) Machine guards must be painted on the outside in the same colour as the machine or tool.
- f) Inside of guards and moving or rotating parts must be painted orange.
- g) All guards must be inspected by a competent person on a monthly basis as well as by users prior to use. These inspections and proof of corrective action taken must be recorded and kept on site.

Records:

- A register should be used which indicate the name, number of the machine or tool and the number of guards.
- The register should be kept on the safety file.

o. Hand Tools and Pneumatic Tools/Explosive Actuated fastening Tools

- a) All hand tools (hammers, chisels, spanners, etc.) must be recorded on a register and inspected by the supervisor on a monthly basis as well as by users prior to use.
- b) All pneumatic tools (tools driven by gas, usually compressed air) should be numbered, recorded and inspected at least monthly as well as by users prior to use. And the revolutions per minutes measured in accordance with the manufacturer specifications.
- c) Tools with sharp points in toolboxes must be protected with a cover.
- d) All files and similar tools must be fitted with handles.
- e) It is illegal for a pneumatic tool to be operated by using a compressed gas cylinder. Pneumatic equipment shall only draw supply from mobile air compressors or from compressed air lines installed within the premises after gaining permission from the Client Representative.
- f) When using the interlocking type of connection of an airline, connectors shall be secured with wire clips through holes provided to prevent accidental disconnection.
- g) Compressed air shall NOT be used for any purpose other than that for which it is provided. Compressed air should not be used to remove dust from clothing.
- h) Hoses to be orderly routed and elevated if required in order to prevent tripping hazards.

Records:

- Check list for hand tools
- Check list for air tools including records of the measurement of revolutions on grinders
- Gas cylinder trolley checklist
- Register

p. Explosive Actuated fastening Tools

- a) Written permission to use these tools on site must be obtained by the Makhado Local Municipality Project/Site Manager
- b) Only used by trained / authorized and appointed personnel.
- c) Prescribed warning signs placed / displayed where tool is in use.

- d) Work area must be properly isolated/ demarcated during use of tool.
- e) Inspected at least monthly by competent person and results recorded.
- f) Issue and return recorded including cartridges / nails and unused cartridges / nails / empty shells recorded.
- g) Cleaned daily after use.
- h) Users should be issued with suitable protective equipment.
- i) Cartridges and explosive power tools to be stored separately

Records:

- Register for the issue and return of cartridges.

q. Lifting Machines and Lifting Tackle

- a) A risk assessment shall be conducted prior to commencing with the task to identify the risk involved and appropriate mitigation measures must be put in place.
- b) If it is the Principal Contractor's intention is to use lifting machines on site, it should be indicated in the Principal Contractor's OHS plan as well as the inspection so that the Makhado Local Municipality Project/Site Manager can conduct an inspection when equipment is brought onto site. If his/her intention is to use a sub-contractor he must enter the name of the sub-contractor into the notification letter to the Department of Employment and Labour.
- c) All lifting machine operators shall be competent to operate a lifting machine. They must be in possession of a valid permit.
- d) The Principal Contractor should verify if the lifting machines have been examined and a performance test done.
- e) The training should have been done according to the Code of practice by a provider registered by the Department of Employment and Labour.
- f) Before using any lifting machines or tackle the operator should inspect it.
- g) All lifting machines shall be examined be colour-coded and subjected to a performance test by an accredited person/company at intervals not exceeding 12 months.
- h) All lifting tackle should be examined and be colour-coded (colour tagged and not 'painted') by an accredited person/company at intervals not exceeding 3 months.
- i) Refer to the requirements of the Driven Machinery Regulation 18 and Construction Regulation 19 and 22 of the OHS Act.
- j) All lifting tackle should be recorded on a register.
- k) All hooks shall be fitted with a safety latch/catch.
- l) A lock out system should be implemented to ensure that only an operator that is competent can draw lifting machines and fork lifts.
- m) All lifting tackle should be conspicuously and clearly marked with identification particulars and the maximum mass load, which it is designed for.

- n) No person shall be moved or supported by means of a lifting machine unless such a machine is fitted with a cradle approved by an inspector.
- o) A risk assessment should be conducted prior to starting with the task.
- Account should be taken of wind forces.
 - Lifting machines are erected taking into account a safe distance from excavations.
 - When working in close proximity to power lines, the contractor must apply for a permit. Refer to Electrical Machinery Regulation 15 of the OHS Act.
 - Account should be taken of the bearing capacity of the ground.
- p) Principal Contractors and their employees shall keep out from under suspended loads, including excavators, and between a load and a solid object where they might be crushed if the load should swing or fall. They shall not pass or work under the boom or any crane or excavator.
- q) Contractors and their employees shall ensure that crane loads are not carried over the heads of any workmen.
- r) Guide ropes to be used to prevent loads from swinging.
- t) Rigger requirements: Rigger ID document, medicals, induction card, National Rigging Certificate (NRC) Competency certificate which states the tons to be lifted, Trade test certificate in accordance with the standards recognized by the National Apprenticeship Board in terms of Section 7 of the training of Artisans Act, Lifting tackle & equipment certification and Industry ID Skills card

Records:

- Record books and test certificates of lifting machined and tackle should be kept on the safety file.
- A copy of the risk assessment should be kept on the safety file.
- A certificate of approval shall be obtained from the Department of Employment and Labour Inspector.
- Register of all lifting machines and tackle on site (For inspection purposes).
- Training certificates and certificates of fitness for operators of the equipment

r. Pipe Jacking

No person may enter a tunnel, which has a height dimension of less than 800 millimetres.

Pipe Jacking shall be supervised and undertaken only by persons fully conversant with this work. Pipe Jacking to comply with SANS standards (SPEC 1200 LG-1983), Mine Health and Safety Act. 29 of 1996 and Mineral and Petroleum Resources Development Act (Act 28 of 2002).

Adequate ventilation and lighting must be provided to employee working inside the tunnel at all times.

Employees involved in drilling and operation of jackhammers must be provided with ear muffs and shock absorbing gloves

The launch and reception pits should be properly secured from collapsing, and must be inspected daily by a competent person appointed in writing.

The working area must be completely fenced off and the pits must be adequately barricaded.

Where there is presence of groundwater or mud, steel-toed gumboots must be provided.

Employees shall be trained by a competent person on the safe use of the Hydraulic Power pack or winch used to push the pipes.

Hydraulic power packs and winches shall be pressure and load tested and records thereof retained.

Detailed method statements for each area shall be submitted to Makhado Local Municipality prior to the commencement of the work.

A calibrated gas tester/ oxygen measuring meter shall at all times be placed at the working area, and employees will be trained on the use thereof.

An adequate emergency procedure must be submitted to Makhado Local Municipality prior to the commencement of the work.

s. Asbestos Control Management

The Contractor shall inform the PM Project Manager and CHSA if during construction.

work, asbestos, or suspected asbestos containing material is found. Only Asbestos Approved Contractor can work on asbestos containing material. Asbestos monitoring should be carried out in accordance with Asbestos Abatement Regulations 2020 during asbestos work. Monitoring should be performed by and Approved Inspection Authority. Medical surveillance should be carried out on all people working with asbestos. The asbestos area should be demarcated and relevant signs should be posted at all entrances and exits. After the asbestos work is finished, a clearance certificate should be issued by a competent person.

t. Pressure Equipment

- a) The Principal Contractor shall ensure that all vessels under pressure are inspected by an Approved Inspection Authority, and he shall be in possession of the manufacturer's certificate.
- b) All pressure vessels shall be provided with at least one safety valve and such safety valve should be kept locked.
- c) The vessel under pressure should be provided with a manufacturer's plate.
- d) The vessel under pressure should be fitted with a pressure gauge in Pascal and the maximum permissible operation pressure marked with a red line on the dial.

Records:

- Inspection registers for vessels under pressure
- The certificate from the manufacturers
- Registration certificate of an Approved Inspection Authority

15.0 INDUCTION TRAINING

The principal contractor must ensure every site worker is given a suitable site induction. The induction should be site specific and address all potential H&S risks and shall be guided by the

baseline risk assessment (BRA) prepared for this project. Annexure-A provides a standard risk matrix (RM) as a form of guidance.

The following issues should be considered:

- a.** Senior management commitment to health and safety;
- b.** Outline of the project;
- c.** Management of the project;
- d.** First-aid arrangements;
- e.** Accident and incident reporting arrangements;
- f.** Arrangements for briefing workers on an ongoing basis, e.g. toolbox talks;
- g.** Arrangements for consulting the workforce on health and safety matters;
- h.** Individual worker's responsibility for health and safety.

Induction should also be provided to those who do not regularly work on the site, but who visit it on an occasional (e.g. professional team, client). The inductions should be proportionate to the nature of the visit.

16.0 MEDICAL FITNESS EXAMINATION AND TESTING

Ensure all workers on site undergo medical fitness examination and testing by an occupational medical practitioner or an occupational health nurse. Medical certificate of fitness has to be issued in the form of annexure 3 incorporated in Construction Regulation 2014.

17.0 HOUSEKEEPING ON CONSTRUCTION SITE

Project site supervisor will ensure that: - Suitable housekeeping is implemented to prevent possible risks to workers and pedestrians including provision for the:

- Proper storage of material and equipment; and
- Removal of waste and materials at appropriate intervals
- No loose material will be accumulating on site so as to obstruct means of access to and egress from workplaces and passageway.
- Remove all waste regularly to prevent accumulation of rubbish.
- Ensure danger or caution tape where excavations/trenches could present a hazard.

18.0 SAFETY NOTICES AND SIGNS

18.1 Display of safety signs

In compliance with section 2B of the General Safety Regulations, 1986 and section 44 of the Occupational Health and Safety Act, 1993, safety notices and signage/s will be provided and displayed.

18.2 Admittance of persons

In compliance with the General Safety Regulations, 1986, in the interests of health and safety, we shall post up notices to work areas prohibiting the entry of unauthorized persons to work areas. Risks to any person who wishes to enter or remain at such workplace without the permission of the employer shall be controlled.

The following measures will be employed, should we find ourselves in a situation where we have to allow entry of a person to a risky area without choice:

- Cooperate with an instruction from the client;
- Seek guidance to the most relevant person;
- Record the conversation for future reference;
- Pause with a risky activity;
- Safeguard work equipment prior to entry of a person;
- Guide entry of a person to whom site supervisors shall allow entry;

- Guide exit of a person to whom entry to a risky area was allowed.

19.0 MANAGEMENT OF EMERGENCIES ON CONSTRUCTION SITE

19.1 First aid

There shall be provision and access to adequate first aid treatment at the construction. And in compliance with the General Safety Regulations 2003, the following will be provided:

- Nomination and appointment of a trained first aid personnel;
- Communication and sharing of details of first aid personnel; and
- Provision of a regulation 3 first aid kit.

19.2 Emergency Procedures

Emergency and evacuation procedures have been documented and they will be communicated to site workers during induction training. Workers will acquaint themselves with emergency and evacuation procedures available in the safety file.

19.3 Emergency Contact Numbers

An emergency telephone number list must be prominently displayed in a common wall; alternatively the list will be kept in the site safety file. Emergency contact numbers have been provided for the local municipality. Appendix-C provides emergency contact numbers (internal) and external that provides details for all Municipalities where we are operating.

20.0 EMERGENCY PREPAREDNESS AND MANAGEMENT

Possible emergencies that are likely to occur on site such as the following must be identified so that proper procedures and a related plan is prepared and communicated to the site staff

- Delivery vehicle crashing into the premises;
- Chemical spillages;
- Accidental flooding of the work areas;
- Arson;
- Community disruptions;

Suitable and experienced personnel have to be nominated to supervise and coordinate all emergencies. Nominated personnel shall have access to a senior manager.

20.1 Emergency procedures

Health and safety officer must ensure the following measures are put in place:

- There is adequate access for emergency services;
- Suitable arrangements for treating and recovering injured people are set;
- There are arrangements for calling fire and rescue services;
- All workers are familiar with emergency assembly points;
- Emergency contact numbers have been communicated and shared to all workers;
- Everyone one knows what signal will be given for an emergency and knows what to do.

20.2 Assembly and roll call

Workers shall observe client's assembly points which are currently established on the site facilities in the event of evacuation.

21.0 INCIDENT MANAGEMENT

21.1 Incident reporting

Any incident which results in injury to any person or damage to any equipment or property affecting or involving the company and its workers and all accidents in the company premises will be reported to the Construction Manager who will record the incident. On the spot collection of factual information (location, witnesses, measurement, parties involved, police and fire brigade services, hospital, photographs where possible) will be the responsibility of the safety officer and construction supervisor concerned.

Any incident on a construction site will be reported immediately to the relevant person in charge and to the Construction Manager on return to the office.

21.2 Incident investigation

Injuries:

All injuries are reported to the designated first aid officer in the workplace.

First Aid:

Personnel record all injuries on the register of injuries. Where the injury requires medical attention or off site treatment, assistant site manager will complete an incident investigation report.

Copies of incident investigation reports will be provided to the health & safety committee.

Incidents:

For all incidents involving near misses, property/plant damage or injury to the public or environmental damage, health & safety officer will investigate and records the details in an incident investigation report.

Copies of incident investigation reports will be provided to the health & safety committee.

Notifiable Incidents:

Construction manager will report all notifiable incidents to the relevant authority. And when a notifiable incident has occurred, construction manager will consider whether the site needs to be preserved for investigation by the relevant authority.

Record Keeping:

We shall keep records of incidents and injuries in accordance with statutory requirements.

21.3 Accident Reporting

Any incident which results in injury to any person or damage to any equipment or property affecting or involving the company and its staff and all accidents in the company premises have to be reported to the Construction Manager who will record the incident. On the spot collection of factual information (location, witnesses, measurement, parties involved, police and fire brigade services, hospital, photographs where possible) shall be the responsibility of the Safety Officer or Construction Supervisor concerned.

Any accident on a construction site has to be reported immediately to the relevant person in charge and to the Construction Manager on return to the office.

21.4 Occupational Disease / Conditions

Occupational diseases must be reported and recorded as prescribed by the Compensation for Occupational Injuries and Diseases Act.

22.0 MEDICAL CERTIFICATE OF FITNESS

In compliance with section 7 of the Construction Regulations 2014, all site workers will be in possession of valid certificate of medical fitness.

23.0 LEGAL COMPLIANCE AUDITS

In compliance with section 7 of the Construction Regulations 2014, and as prescribed by the client periodic audits will be scheduled and conducted. A schedule will be concluded once the site works starts.

24.0 ENVIRONMENTAL MANAGEMENT

Pressure on natural resources, including land, has continuously increased, as the population increases and likewise, awareness of the need to lessen the negative impacts of development and construction on the environment will continue to increase. Efforts must be made to avoid negative impact on the areas surrounding the project. Waste materials will have to be disposed off at an approved disposal site.

25.0 SAFE WORKING PROCEDURES

A programme of safe work procedures shall be embarked on, starting with those identified during the hazard identification and risk assessment. Where reasonable and practicable steps will be taken to ensure the work, activities are safe. Safe work procedures have been documented.

26.0 PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

Risk assessment informs on the required PPE. All items to be issued will have to be maintained in good working order i.e. serviced and repaired as and when necessary. Items of PPE are to be provided free of charge and for the personal use of site workers. It is expected that items of PPE will be used as prescribed. Workers have to be provided with the necessary training in the use and care of the items.

27.0 PROJECT / SITE SECURITY

27.1 Barricading and maintenance

Adequate and suitable barricading has to be erected and maintained to prevent unauthorized entry as well as to control access onto and from the site. Construction signage will be strategically positioned at the entrance of the site.

27.2 Access control

Control of access to the construction has to be implemented and assistant site manager and supervisor shall advice on the best way to manage the access to and egress from the construction area.

28. NON- CONFORMANCES

The Principal Contractor may be penalized for critical and / or repeat non-conformances with the requirements of this specification, the Principal Contractor's health and safety plan and current health and safety legislation. Penalties shall be in the form of monetary value or workstoppage or both. Penalties of monetary value shall be at the discretion of the CHSA, after consultation with the Client / Consulting Engineer or Architect.

29. PROJECT CLOSE OUT REQUIREMENTS

The documentation submitted and approved following the awarding of the contract will be used to form the H&S file. On completion of the project, a consolidated health and safety file consisting of the following documents but not limited to, shall be submitted to the client appointed CHSA:

- The H&S Plan and the approval by Client.
- PC Appointment Letter.
- Mandatory Agreement with Client.
- Construction Work Permit from DEL.
- Record of Competencies (CVs) and appointments.
- Training Records.
- Method statements.
- Risk assessments.
- Safe work procedures.
- Emergency and Injury Management (Accident Stats and Investigations);
- Medical surveillance records.
- Registers and Checklist.
- Internal H&S Audit Reports
- Contractor H&S Audit Reports.
- Non-Conformance Reports; and
- Any other documents which may be required by the appointed CHSA.

The file must be submitted in an electronic copy stored on a flash drive and must be arranged chronologically in folders and subfolders where necessary.

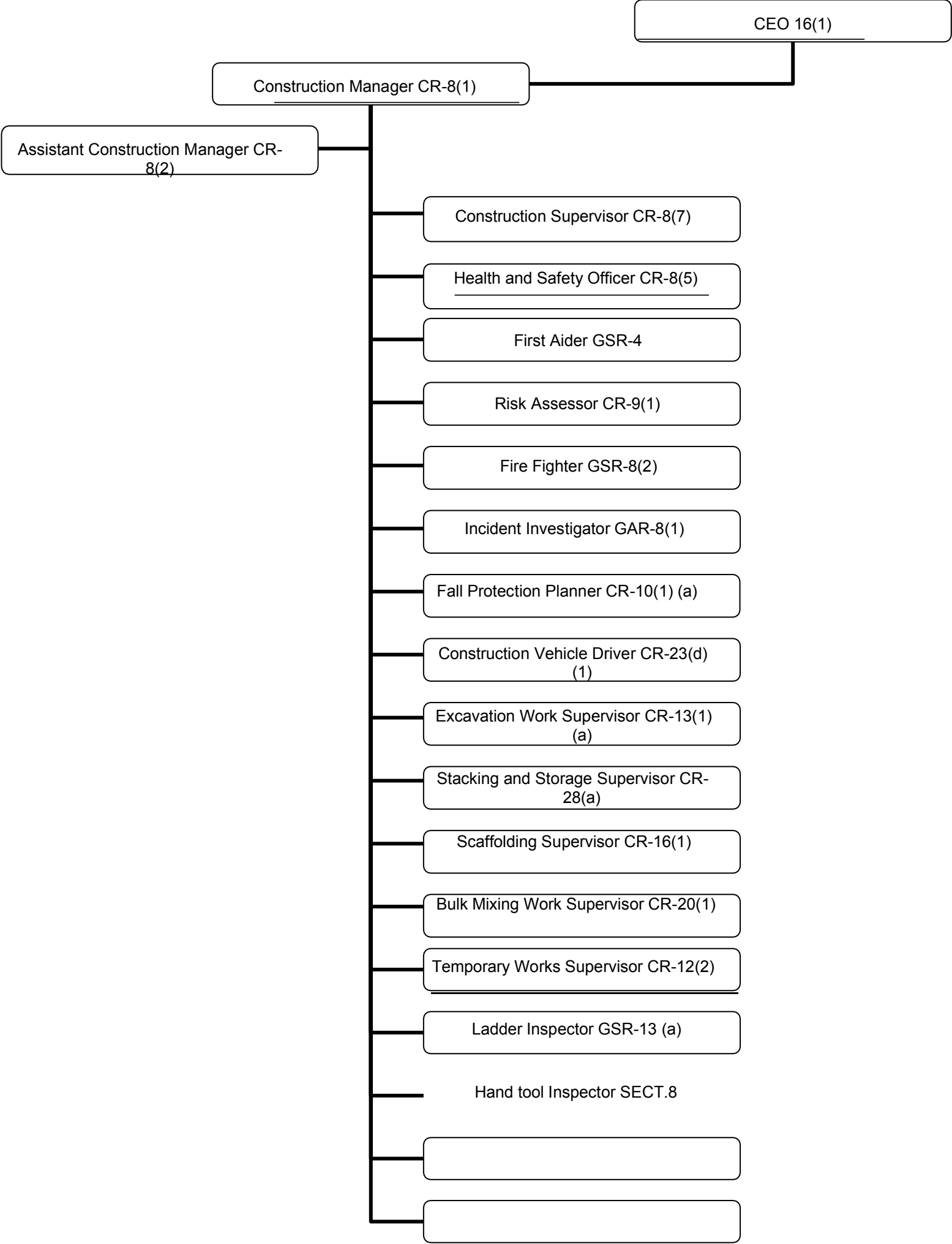
NOTE TO PRINCIPAL CONTRACTORS AND THEIR SUB-CONTRACTORS

The OHS specifications are Department of Public Works and Infrastructure's minimum requirements. The contractor is expected to develop a Health and Safety Plan which meets these requirements contained herein, as well as all the relevant applicable legislation and methods to be used in the execution of the works. Department of Public Works and Infrastructure in no way assumes the Contractors legal responsibilities. The Contractor is and remains accountable for the quality and the execution of his Safety, Health and Environmental programme, and that of any Contractors and Suppliers. This OHS specification reflects minimum requirements and should not be construed as all-encompassing or fixed in terms of this or other amendments made during the project.

ANNEXURE A: RISK MATRIX

Tasks/activities	Hazards identified	Risks	Persons at risk	Likelihood use 5 = Almost Certain 4 = Likely 3 = Possible 2 = Unlikely 1 = Rare	Consequence use 5 = Terminal 4 = Major 3 = Moderate 2 = Minor 1 = Negligible	Likelihood x Consequence	Risk class	Control measures	Responsible person

ANNEXURE B: HEALTH AND SAFETY ORGANOGRAM



ANNEXURE C: EMERGENCY CONTACT NUMBERS

EMERGENCY CONTACT INFORMATION			
Service Centre	Contact	Address / Location	Telephone
Ambulance	-	-	112 Vodacom 112 Cell C 112 Mtn
Police			
Electrical Services			
Water Services			
Primary Medical Facilities			
Disaster			
Poison Information centre	-	-	

Annexure D – Annexure 1

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993

(Regulation 3 (2) of the Construction Regulations, 2014)

APPLICATION FOR A PERMIT TO DO CONSTRUCTION WORK

This application must be submitted with the following documents:

1. Health and Safety Specification.
2. Health and Safety Plan.
3. Baseline Risk Assessment.

Name, postal address and telephone numbers of the client:

Details of the Agent:

1. Title, Surname and Initials:
2. Identity number / Passport number:
3. Registration number with SACPCMP:
4. Office Tel. number and/or Mobile number:
5. Postal address:

Name, postal address and telephone numbers of the appointed principal contractor:

Name, postal address and telephone numbers of designer of the project:

Name, postal address and telephone numbers of the following persons:

1. Construction Manager:
2. Construction Health and Safety Manager:
3. Construction Health and Safety Officer:

Exact physical address of the construction and the site office:

ANNEXURE E – OHS REQUIREMENTS

OCCUPATIONAL HEALTH AND SAFETY ACT OF 1993 AND CONSTRUCTION REGULATIONS 2014 REQUIREMENTS:

- Your attention is drawn to “General Duties of Employers to their Employees” as required by Section 8 of the Act.

You are required to:

- Sign a written “Agreement with Mandatary” as required by Sect 37(1)(2) of the Act before commencing any work on site.
- Ensure that all your employees receive the necessary Induction Training and have proof thereof.
- Note: You must ensure that all employees under your control are informed, instructed, and trained by a competent person regarding any hazard and the related work procedures before any work commences.
- Ensure the provision of Welfare Facilities for your employees as per Construction Regulation 28.
- Provide the Client/Principal Contractor with your SHE Plan and Specifications
- Ensure that Method Statements, Risk Assessments and Safe Work Procedures are done and available.
- Provide the Client/Principal Contractor with written appointment of the person who is going to supervise the Construction Work per Construction Reg. 8
- Provide the Client/Principal Contractor with written designation of your nominated Health and Safety Representative as per Section 17(1).
- Note: Your Health and Safety Representative will be expected to attend the Client/Principal Contractor safety meetings.
- If you employ more than five (5) persons, you are required to provide your own First Aid Box (GSR 3(2)).
- If you employ more than ten (10) persons, you are required to provide your own qualified First Aider as per GSR 3(4) Note: If you have difficulty in complying with items 2.7 and 2.8 above, you may arrange/come to an agreement with the Client/Principal Contractor to make use of his First Aid facilities in case of injury. You will be expected to communicate such an agreement to your employees.
- Asbestos Abatement Regulations
- Hazardous Chemical Agents Regulations
- When using a Materials Hoist, comply with the requirements of Construction Reg. 19.
- When using Lifting Machines and Lifting Tackle, comply with DMR 19
- Note: You may be required to appoint a Banksman to control Lifting/Slinging operations
- When erecting/using Scaffolding comply with the requirements of SANS/0085 “Access Scaffolding”

- When doing Demolition Work, comply with Construction Reg. 14
- When doing blasting to comply with Explosives Regulations Chapter 10
- When doing Excavation Work, comply with Construction Reg. 13
- When doing Electrical Installations, comply with the requirements of Construction Reg. 24 Note: Electrician to provide copy of registration as per Elect. Install. Reg. 9(3)
- When using Construction Vehicles, comply with Construction Reg. 23
- When using/erecting Support/Form Work, comply with Construction Reg. 12
- When working over or in close proximity to Water, comply with Construction Reg. 26
- Ensure that good Housekeeping, Stacking and Storage principles are applied on this project as per Construction Reg. 27 and 28
- Ensure that appropriate measures are taken to avoid the risk of Fire/Explosion and comply with requirements of Construction Reg. 29
- If you are going to work at heights a Fall Protection Plan must be submitted (roof work included) as per requirements of Construction Reg. 8
- When using Explosive Powered Tools, comply with GSR 19
- When Welding, Flame Cutting/Soldering, comply with GSR 9
- When working in Confined Spaces, comply with GSR 5
- You are responsible for providing your own legal safety documents and registers to comply with the Act's requirements a copy of the OHS Act of 1993 and the Construction Regulations ;2003 will be available for perusal in the Principal Contractor's site office.
- You are required to comply with General Safety Regulations 2(1) to (7) and provide your employees with: personal protective equipment which will allow them to carry out their work in a safe manner, e.g. hard hats, safety harnesses, gloves, safe footwear, eye protection, ear protection, waterproof clothing etc.
- Reporting of Incidents of Occupational Diseases shall be done as per General Admin. Regulation 8 (Also see Sect 24 of the Act)
- Compensation for Occupational Injuries and Diseases Act (No 130 of 1993) You are required to provide the Client/Principal Contractor with proof of registration with the Compensation Commissioner/Federated Employer(s) Mutual when signing this agreement. If you are not registered, the Client/Principal Contractor may deduct the necessary amounts from your progress payments and pay it over to the Commissioner to ensure that you are insured. See Section 80 and 89 of the COID Act.



public works
& infrastructure

Department:
Public Works and Infrastructure
REPUBLIC OF SOUTH AFRICA



HEALTH AND SAFETY SPECIFICATIONS FOR THE INFRASTRUCTURE MAINTENANCE AND REPAIRS OF BUILDINGS, CIVIL, MECHANICAL, ELECTRICAL AND INSTALLATIONS AT MANANGA LAND PORT OF ENTRY

Issued in terms of the Occupational Health and Safety Act,

1993

Construction regulations 2014.

Prepared by 2 BLN Consulting Engineers
Prepared for: Department of Public Works and Infrastructure
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1.0 INTRODUCTION

Occupational Health and Safety Act 85, of 1993 has 18 regulations, most of which are applicable in construction sites. The major regulation that is being implemented in construction projects is Construction Regulations 2014. Construction Regulations 2014 is aimed at ensuring that health and safety issues are properly considered during a project's development.

Construction Regulations 2014 requires that a contractor who intends to carry out construction work to at least 7 days before that work is to be carried out notify the provincial director in writing if the intended construction include the following:

- 1) excavation work.
- 2) work at height where there is a risk of falling.
- 3) demolition of a structure; and
- 4) use of explosives to perform construction work.

Principal contractor must implement Construction Regulations 2014 and address all relevant aspects of health and safety (H&S) compliance in his/her H&S Plan and in his/her implementation thereof.

2.0 SCOPE & APPLICATION OF CONSTRUCTION REGULATIONS 2014

2.1 Legislative Requirements of the Client

Construction Regulations 2014 defines a client as any person for whom construction work is being performed. Section 5 of Construction Regulations 2014; specify that a client has to fulfil duties as follows:

- Prepare a baseline risk assessment for intended work.
- Prepare site specific health and safety specifications for intended work.
- Ensure the health and safety specifications is implemented.
- Ensure principal contractor appointed has the resources to carry out work safely.
- Monitoring of compliance by the principal contractor.

2.2 Legislative Duties of Principal Contractors

Construction Regulations 2014 defines a principal contractor as an employer appointed by a client to perform construction work. Principal contractor is required to prepare and provide the client with a site-specific health and safety (H&S) plan prior to the commencement of the work. Principal contractor has to ensure requirements in table 1 are met.

Table 1: Principal Contractors H&S Requirements

ITEMS	REQUIREMENTS (LEGISLATIVE)
Notification of construction works / Construction work permit	Notification of construction works at the Department of Employment and Labour (DEL, (Construction Regulations 2014-4 (1); / Construction work permit if the intended project is above a certain project value , if the CIDB grading of the contractor is above Grade 7 and if the project is exceeding 12 months in terms of project duration.
Health and safety plan	Prepare and provide a suitable, site specific and sufficiently documented health and safety plan to the client, (Construction Regulations 2014-7(1) (a));
Health and safety file	Provide and maintain a health and safety file to be kept on site throughout the project duration, (Construction Regulations 2014-7(1) (b));
Site audits	Conducts periodic site audits at 30 days interval, (Construction Regulations 2014-7(c) (vii));
Medical certificate of fitness	Ensure all his / her employees have a valid medical certificate of fitness specific to the work to be performed, issued by an occupational health practitioner in the form of annexure 3, (Construction Regulations 2014-7(1) (g));
Health and safety induction training	Ensure no employee is allowed or permitted to enter any site unless that employee or person has undergone health and safety induction training pertaining to the hazards prevalent to the site, (Construction Regulations 2014-7(5));
Contractor appointment	Appoint a contractor in writing in compliance with Occupational Health and Safety Act, 85. 1993, (Construction Regulations 2014-8);
Management and supervision of construction work	Appoint competent persons to ensure management and supervision of construction works, including the duty of ensuring health and safety compliance, (Construction Regulations 2014-8 (1));

Construction health and safety officer (CHSO)	Appoint a full-time construction health and safety officer in writing to assist in the control of health and safety related aspects on the site, (Construction Regulations 2014-8 (5));
Risk assessment	Have risk assessment be performed by a competent person before the commencement of construction works, (Construction Regulations 2014-9 (1));
Fall protection plan	Appoint a competent person in writing to prepare a fall protection plan, (Construction Regulations 2014-10 (1));
Protection of structures	Take all reasonable steps to prevent uncontrolled collapse of any new or existing structures, (Construction Regulations 2014-11 (1) (a));
Excavations	Ensure excavation work is carried out under the supervision of a competent person, (Construction Regulations 2014-13 (1) (a));
Construction vehicle and mobile plant	Ensure acceptable design, construction, maintenance, and use of construction vehicle and mobile plant, (Construction Regulations 2014-23 (1));
Use and temporary storage of flammable liquids	Ensure compliance with the requirements of sections 25 (a-g) under this regulation, in addition to compliance with General Safety Regulations, 2003, (Construction Regulations 2014-25);
Housekeeping and general safeguarding	Ensure that suitable housekeeping is continuously implemented on construction site, in addition to compliance with Environmental Regulations for Workplaces, 1997, (Construction Regulations 2014-27);
Stacking and storage on construction sites	Ensure a competent person is appointed in writing to supervise all stacking and storage on site, and requirements under this regulations, in addition to compliance with General Safety Regulations 2003, (Construction Regulations 2014-28 (a-d));
Fire precautions on construction sites	Ensure that in addition to compliance with Environmental Regulations for Workplaces, 1997, the requirements under Construction Regulations 2014-29 (a-m) are complied with;

Construction employees' facilities	Ensure that in addition to compliance with Facilities Regulations 2004, clean, hygienic and maintained facilities under Construction Regulations 2014-30 (1-2) are complied with.

3.0 PROJECT DETAILS

3.1 Project name:

The infrastructure maintenance and repairs of buildings, civil, mechanical, electrical and installations at Mananga Land Port of Entry.

3.2 Project location:

Komatipoort, under Nkomazi Local Municipality in Mpumalanga Province.

3.3 Project period:

36 Months

3.4 Baseline Scope of works

The following is a brief outline of the scope of works:

- Site establishment
- Building works
- Mechanical
- Electrical
- Installations

3.5 Details of the client and professional team

Client:

Client details	
Company name	Department of Public Works and Infrastructure
Contact person	Ms. Koketso Kgorane
Contact number	012 406 1000
Email	Koketso.kgorane@dpw.gov.za

Principal Agent / Engineer:

Principal agent details	
Company name	2 BLN Engineers
Contact person	Mr. Mothusi Motjale
Contact number	086 177 7719
Email	mothisi@2bln.co.za / admin@2bln.co.za

Health and Safety Consultants:

Health and Safety Agent's details	
Company name	
Contact person	
Contact number	
Email	

4.0 HEALTH AND SAFETY POLICY

The health and safety (H&S) policy statement contains the aims and objectives of a company. Section 7(3) of the Occupational Health and Safety Act provides that employers must prominently display a copy of the health and safety policy signed by the Chief Executive Officer in the workplace where employees normally report for service. In compliance with the Act (OHS), the principal contractor shall display the H&S policy in a common wall at the site office.

Health and safety policy possesses the following characteristics:

- A validity of 12 months;
- Date;
- Name; and
- Signature of the company CEO

5.0 SITE SPECIFIC SAFETY RULES

The client has established the following site safety rules:

- Strict enforcement of discipline in the interests of occupational health and safety.
- All employees must undergo medical surveillance.
- Issue personal protective equipment that shall be worn at all times where necessary.
- No use shall be made of any of the Employer's machinery / plant / equipment / substance / personal protective equipment or any other article without prior arrangement and written approval.
- No alcohol or any other intoxicating substance shall be allowed on the site. Any person suspected of being under the influence of alcohol or any other intoxicating substance shall not be permitted access to or allowed to remain on the site.

6.0 REGISTRATION WITH THE COMPENSATION FUND

Principal contractor must be in possession of proof of registration with the compensation fund, and a valid letter of good standing obtained from the Department of Employment and Labour and an approved insurer must be provided in a site safety file throughout the duration of this project.

7.0 LABOUR NOTIFICATION / CONSTRUCTION WORK PERMIT

Principal contractor must notify the Department of Employment and Labour of this project, and proof of notification shall be kept in the site safety file and or, a construction work permit will be applied by the client's agent and a copy will be kept in the H&S file and site-specific number will be displayed at the site main entrance.

8.0 CONSTRUCTION PHASE HEALTH AND SAFETY PLAN

The principal contractor must prepare a site-specific construction health and safety plan that is suitable, sufficiently documented based on this client's health and safety specifications. The contractor's health safety plan must cover all aspects under the scope of works, that is repairs of buildings encompassing demolitions and alterations, civil works, mechanical works, electrical works and installation works. A construction phase health and safety plan must record the following:

9.0 HEALTH AND SAFETY FILE

Construction Regulations 2014 defines a health and safety file as a file or other record containing the information in writing required by 2014 Construction Regulations. The health and safety file must include the following items:

- 1) a brief description of the work carried out;
- 2) any hazards that have not been eliminated through the design and construction processes, and how they have been addressed (e.g. surveys or other information concerning contaminated land);
- 3) key structural principles (e.g. bracing) and safe working loads for floors and roofs;
- 4) hazardous materials used (e.g. lead paints and special coatings);
- 5) health and safety information about equipment provided for cleaning or maintaining the structure.
- 6) the nature, location and markings of significant services, including underground cables; fire-fighting services etc;

- 7) information and as-built drawings of the building, its plant and equipment (e.g. the means of safe access to and from service voids and fire doors);
- 8) comprehensive and updated list of all the contractors and agreements between them, and the type of work done they carried out for them. The principal contractor must hand over a consolidated health and safety file to the client upon completion of the construction work in which all legal appointments must be cancelled.

Required OHS File Contents (Construction Phase)

Description
Project Organogram
OHS Policy
Contact List including Emergency Numbers
Department of Public Works and Infrastructure Project Scope of Work
Department of Public Works and Infrastructure OHS Specification & Baseline Risk
Health and Safety Plan Approval Memorandum
Workman Compensation COID: Letter of Good Standing
Legal Permits: Notification to Department of Employment and Labour / or Construction Work
37.2: Contractors Written Agreement
Site Entry/ Access Certificate
List of Sub-Contractors
Section 7(1)(c)(v): Agreements between Principal Contractor and Subcontractors
On Site Traffic/Pedestrian Movement Plan (Indicate separation of vehicles/pedestrians). <i>Note: This is not the same document as TMP indicated above.</i>
Certificates of Competencies
Certificates of Medical Fitness(Annexure 3)
Annual Medical Records
Staff List with Copies of valid certified ID/Passport Documents & work permits
Client Induction Registers (OHS/Risk Control)
Contractors Tools and Equipment Inventory
Health and Safety Plans: OHS Management System aligned to the OHS Spec to be implemented on site. Refer to DOEL website for sample of a Health and Safety Plan. Include specific operational requirements as stated below. Emergency Plan, Traffic Management Plans, Excavation Plan, Fall Protection Plan and to be submitted as separate documents.
<i>Public Safety Plan</i>
<i>Excavation Plan</i>
<i>Construction Vehicles/Plant Operations/Movement/Maintenance Plan</i>
<i>Demolition Plan</i>
<i>Blasting Plan</i>
<i>Scaffolding</i>
<i>Bulk mixing Plants</i>
<i>Explosive actuated fastening device</i>
<i>Cranes</i>
<i>Construction Vehicles and Mobile Plant</i>
<i>Electrical Installations</i>
<i>Flammable Liquids</i>
<i>Housekeeping</i>
<i>Stacking and Storage</i>
<i>Fire Precautions</i>
<i>Construction Welfare Facilities</i>

	Appointments
Section 16(1)	Company Chief Executive Officer / Managing Director
Section 16(2)	Assistant to Chief Executive Officer / Managing Director
Section 17	Health and Safety Representative
Section 19	Health and Safety Committee Member(s) and Co-opted Members
GSR 3	First Aider
GSR (2) ER9(1)	Fire Fighter
GSR 5(1)	Confined space Inspector
GAR 9 (2)	Incident/Accident Investigator
DMR18 (11)	Lifting Machinery Operator (Appointment or Permit)
DMR18 (5)	Lifting Machinery Inspector
DMR 18 (10) (e)	Lifting Tackle Inspector
EMR 9	Portable Electrical Equipment Inspector
PER 7	Portable Gas Container Inspector
PER 7 (3) (ii)	Pressure Vessels Inspector
(6) (1)	Lift, escalator or passenger conveyer Inspector
HC1 3 (3)	Hazardous Chemical Agents Co-coordinator
Reg.	Appointment
5(1)(k)	Principal contractor
7(1)(c)(v)	Contractor
8(1)	Construction Manager
8(2)	Assistant Construction Manager
8(7)	Construction supervisor
8(8)	Construction supervisor sub-ordinates
8(5)	Construction Health and Safety Officer
9(1)	Person to carry out risk assessment
10(1)(a)	Fall protection planner
13(1)(a)	Excavation supervisor
13(2)(b)(ii)(bb)	Project Engineer or technologist
14(11)	Explosives expert
16(1)	Scaffold supervisor
17(1)	Suspended platform supervisor
17(8)(c)	Suspended platform expert
23(1)(d)(i)/(k)	Constr. vehicle and mobile plant operator/Inspector.
24(c)(d)	Temporary electrical installations inspector
28 (a)	Stacking and storage supervisor
27 (h)	Fire equipment inspector
Risk Assessments – Baseline and activity based HIRA	
Safe Work Procedures and Method Statements	
Calibration Certificates	
Load Test & Inspection Test Certificates (e.g. Lifting equipment and Tackle)	
	Incident recording Register
	Principal Contractor OHS Induction Register
	First Aid Box Inspection Register
	PPE Issue Register
	Risk Assessment Communications Register
Fall Protection Inspection Register	
Excavation Inspection Register	
Demolition Work Inspection register	
Scaffolding Inspection Register	
Suspended Platforms Inspection register	
Bulk mixing Plants Inspection Register	
Cranes Inspection Register	

Temporary Electrical Installations Inspection Register
Flammable Liquids Inspection register
Hazardous Chemicals Inspection register
Ladder Inspection Register
Compressor register
Electrical Machinery Inspection register
Construction Vehicles and Mobile Plant Inspection Register Plant
Gas Equipment Register
Stacking and Storage Register
Fire Precaution Register
General Housekeeping Register
Incident Management
Emergency Response and evacuation Procedures
Emergency Drill Schedule
Minutes of OHS meeting
OHS Toolbox Talks/DSTI's
Job Observations
Material Safety Data sheets
Training Records
OHS Rep Monthly Inspection Reports
Monthly Inspection /Audit Reports
Non-conformance Reports (Work Stoppages & Penalties /Spot fines)
Client OHS/ EMS Audit and Inspection Reports
Contractor OHS Reports i.e. Contractor weekly report, Monthly Statistics
Site Clearance Certificate
Temporary Site Closure Checklist
Copy of the OSHACT

10.0 MANDATORY AGREEMENT - SECTION 37 (2) O.H.S. ACT

The Department of Public Works and Infrastructure / Agent / Principal Contractor / Sub-contractor shall sign an agreement as per Occupational Health and Safety Act, 85 of 1993, in which all parties exercise their affective duties as employers in their own right and will therefore see that each company or employer will comply with the Occupational Health and Safety Act and the relevant regulations. The client / principal contractor mandatory agreement will be drafted and provided to the principal agent, for the principal contractor to complete and sign. Principal contractor must file a signed copy in the site safety file.

11.0 RISK MANAGEMENT

11.1 Hazard Identification and Risk Assessment

Hazards are defined as a source of danger that could result in a chance event such an accident or incident. A danger itself is a potential exposure or a liability to injury pain or loss. Exposure to hazards may be dangerous but this is dependent upon the amount of risk that accompanies it. Risk is the possibility of loss or injury/illness all the degree of possibility of such laws. Incidents do not occur if a hazard does not exist ,that presents a danger to those working around it. If potential exposure is high, there is a greater risk that an undesired event will occur (Reese, 2017).

The task specific risk assessment to be provided must meet the following requirements/characteristics:

- Be prepared by a person nominated and appointed in writing.
- Risk assessor must be in possession of a valid proof of training in risk assessment.
- Be site / task specific.
- Be aligned to the scope of works.
- Address only the hazards related to the project.
- Be quantitative in nature.
- Provide date.
- Provide name and surname of risk assessor.
- Provide signature of risk assessor.
- Must be accompanied by proof of communication.

11.2 Potential Hazards Identified

11.2.1 Potential safety hazards and risks

Hazards and risks to safety emanating from construction site activities are the following:

- Delivery trucks hitting workers / spectators;
- Delivery trucks colliding with fixed structures;
- Construction vehicles hitting bystanders / pedestrians from lack of concentration;
- Construction vehicles / plant colliding with site workers from accidental man-machine interaction;
- Construction vehicles / plant hitting fixed structures from lack of access space;
- Construction vehicles / plant hitting site workers / the public from driving under the influence;
- Construction vehicles / plant hitting site workers / the public from un-roadworthy vehicles / plant;
- Trip and fall on same level from bad housekeeping;
- Trip and fall on same level from trailing cables;
- Trip and fall into ground level holes from open trenches;
- Accidental fall into ground level holes from open trenches;
- Accidental collapse of superstructures;
- Stepping on sharp objects from bad housekeeping;
- Falling objects hitting people below from unsecure tools / materials;
- People hitting fixed structures from fatigue / lack of concentration;
- Fire and explosion from smoking near ignition sources;
- Fire and explosion from dropping residues of cigarette / zol near ignition sources;

- Fire and explosion from arson;
- Fire and explosion from accidental contact of ignition sources;
- Fighting from horseplay;
- Fighting from petty arguments;
- Sexual abuse;
- Bullying;
- Theft of tools from unsecure storage areas;
- Theft of materials from unsecure storage areas;
- Theft of tools from behavioural problems.

11.2.2 Potential health hazards and risks

Hazards and risks to health emanating from construction site activities are the following:

- Skin irritation from contact with irritant substances;
- Respiratory irritation from inhalation of varying types of dust;
- Respiratory irritation from inhalation of hazardous chemical agents;
- Skin burn from exposure to sunlight;
- Skin irritation from skin contact with concrete;
- Skin burn from excessive exposure to;
- Flu from exposure to viruses circulating during the winter season;
- Common cold from exposure to bacteria circulating during the winter season;
- Bronchitis from exposure to excessive cold;
- Asthma from exposure to contaminated soil;
- Hepatitis from digging up contaminated ground;
- Tuberculosis from inhalation of ambient/cement dust;
- Headache from overwork;
- Fatigue from work pressure / unreasonable timeframes / work hours;
- Eye irritation from contact with excessive dust;
- Heat stroke;
- Arthritis from cold conditions;
- Neck and back pain from prolonged continuous bending;
- Neck and shoulder pain from prolonged continuous overreaching;
- Muscular shoulder pain from backwards repetitive overhead movements;
- Leg and hip pain from descending and ascending work at height equipment;
- Stress from unreasonable workload / work disruptions;
- Hand lacerations from poor handling of sharp tools;
- Hand pain from faulty / defective hand-tools;

- Shoulder and back pain from lifting heavy loads;

11.3 Review of Risk Assessment

The construction health and safety officer shall review the hazard identification, risk assessments and the standard working procedures as planned and presented in the risk review plan. And this shall be informed by progress on site and following any major changes to the scope and construction methods and processes.

The client / client's OHS Agent and all other interested and concerned parties will be provided with copies of any changes, alterations or amendments to the risk assessment. Management of the site shall ensure that follow-up and refresher training is conducted whenever we are required to provide any such training, including when work situation changes. Records of all training will be kept in the safety file for auditing purposes.

11.4 Risk Monitoring

Principal contractor shall establish a monitoring programme, and that will be put in writing, and it shall be integrated into the entire operation. We commit ourselves in the health and safety of our employees and the public who are likely to be affected in the process of project implementation. Daily site safety inspections and periodic monthly (internal) audits have to be conducted and documented.

Control of hazards is essential to an effective injury and illness plan. Supervisory personnel will be sure to look at safe work practices and ensure that they are being followed, and that unsafe conditions or procedures are identified and corrected. Workplace equipment and personal protective equipment will be issued and maintained in good, safe working condition. Periodic health and safety audits will be conducted to verify compliance with legislation and companies' management system as well as with the client's specification.

12.0 MANAGEMENT AND SUPERVISION OF THE WORK

12.1 Management of health & safety

Annexure-B presents an organogram that can be adopted to provide a project team that is responsible for management of health and safety in this project.

13.0 PROVISION OF EMPLOYEES FACILITIES

13.1 Toilet facilities

Workers will have reasonable access to adequate, clean, hygienic and maintained toilet facilities for each sex and for every 30 workers. The following are also provided to our employees:

- Toilet paper;
- Hand wash facilities;
- An eating area
- Soap; and
- Changing room (***where reasonably practicable***)
- Drinking water.

14.0 MANAGEMENT OF HEALTH AND SAFETY RISKS

Identification and control of risks to health and safety is a continuous activity to be taken into account with other factors when initiating, planning and allocating work activities.

14.1 Control of safety hazards

14.1.1 Excavations

All excavation work must be carried out under the supervision of a competent person who has been appointed in writing. Excavation supervisor is to ensure compliance as per Section 13 of Construction regulations 2014, in addition to taking practicable steps as follows to prevent danger to people and property:

- Ascertain location and nature of services which may be affected by work being carried out;
- prevent material from blocking adjacent access routes.
- prevent a person from being buried or trapped by a fall of material.
- prevent people on site from falling into the excavation providing solid barricades where necessary, or provide safety notices, whichever is reasonably practicable.
- prevent any part of adjacent access routes used by school staff / visitors being overloaded by plant or work equipment.
- inspect excavations before every shift and keep a record.
- communicate safe work procedure to workers;

14.1.2 Work at Height including working at the edge of an excavation.

A competent person must assess work at heights, compile hazard analysis and risk assessment and document such which shall form part of a fall prevention plan before work at heights is undertaken. The fall prevention plan must be suitable and sufficient to prevent falls of persons. Height workers must be in possession of "Medical Certificate of fitness" issued by an Occupational Health Practitioner who is registered with the Health Professions Council of South Africa.

- those with the duty to manage H&S on this construction site must adopt the following hierarchy:
 - Where possible, avoiding work at height.
 - Where work at height cannot be avoided, take measures to prevent falls.
 - Where risk cannot be eliminated, take measures to minimize the distance and consequences of falls.
 - Where work at height is necessary, those have the duty to manage H&S are required to ensure that:
 - Ensure risks are assessed and managed (including the risks of working on or near fragile surfaces and risks from falling objects).
 - People involved in work at height are competent, trained, or supervised if they are being trained.
 - Ensure work at height is properly planned and organized (including planning for emergencies and for rescue).
 - Take account of weather conditions that could endanger H&S (work should be postponed if weather conditions endanger health or safety).
 - Suitable equipment is used, inspected, and properly maintained (giving use of collective protection measures priority over personal protection measures)
1. Use of stepladders and trestles, the following factors must be addressed if scaffolding is to be in use on site:
- Stepladders and trestles may not be used at a workplace above 2m in height unless proper edge protection is provided.
 - Equipment must be checked for any defects or damage by a supervisor before use;
 - Any repairs must be carried out by a competent person;
 - Access ladders should be tied and extend at least 1m above the landing;
 - Access ladders are kept away from overhead cables;
 - Access ladders are used on a secure surface.

14.1.3 Handling and Use of Hazardous Chemical Agents (HCA's)

The principal contractor and other contractors engaged in work involving HCA's shall provide the necessary training and information regarding the use, transport, and storage of HCA's. Principal contractor shall ensure that the use, transport, and storage of HCA's are carried out as prescribed by the HCA's Regulations. Contractor shall ensure that all hazardous chemicals on site have a Safety Data Sheet (MSDS) on site and the users are made aware of the hazards and precautions that need to be taken when using the chemicals. Appointed first aider must be aware of the MSDS and how to treat HCA's incidents appropriately.

14.1.4 Control of Construction Plant / Machinery / Vehicles

The principal contractor must apply reasonable health and safety measures relevant for to ensure compliance as per Section 23 of Construction Regulations 2014. The following factors must be addressed if plant, machinery, and vehicles are to be in use on site:

- Plant, machinery and vehicles are suitable for work intended for;
- Ensure all employees required to operate plant, machinery, vehicles have received appropriate training.
- Ensure all employees required to operate plant, machinery, vehicles have been medically assessed and have valid medical certificate of fitness to operate those plant, machinery, and vehicles.

14.1.5 Use and Temporary Storage of Flammable Liquids on Site

The principal contractor has to ensure compliance with provisions for the use and storage of flammable liquids as per General Safety Regulations 2003, and in addition to Section 25 of Construction Regulations 2014, ensure implementation of measures as follows:

- Effectively ventilate by means of natural or mechanical ventilation, areas where flammable liquids are being used or stored.
- Post suitable and conspicuous nonsmoking notices at the entrance where flammable liquids are being used or stored, so as to prevent persons from smoking.
- Install suitable and adequate firefighting equipment with symbolic signs in locations where flammable liquids are being used or stored.

14.1.6 Fire Precautions on Site

Principal contractor and all contractors must comply with Environmental Regulations for Workplaces, 1987, in addition to Section 29 of Construction Regulations 2014.

14.1.7 Control of Electrical Machinery

The principal contractor must ensure compliance with Electrical Installation Regulations, 2009, Electrical Machinery Regulations, 1988, in addition to compliance with Section 24 of Construction Regulations 2014.

14.1.8 Portable electrical tools and equipment and tools

The contractor shall ensure that use and storage of all explosive powered tools and portable electrical tools are in compliance with relevant legislation. The contractor shall ensure that all electrical tools, electrical distribution boards, extension leads, and plugs are kept in safe working order. Regular inspections and toolbox talks must be conducted to make workers aware of the dangers and control measures to be implemented e.g. personal protection equipment, guards, etc. The contractor shall see that users are properly trained.

14.1.9 Operation of work equipment

Work equipment is dangerous, and therefore demand specific health measures such as the ones as follows will be considered:

- Restriction of operation and use of work equipment to experienced workers only;
- Daily inspections before each use;
- Refueling in the absence of fire/ignition sources;
- Knowledge and identification of safety guards.

Site supervisor will have to see to it that workers who shall operate any work equipment shall be those who have adequate knowledge of methods for competent operation of the handling systems in normal operation, start-up, shutdowns and emergency situations. Persons handling work equipment will be advised of hazards, proper procedures, precautions, health effects and recommendations for emergency treatment.

14.1.10 Manual handling controls

Risk assessment on will be communicated to workers during induction training, this is to make workers aware of measures necessary to prevent harm. Workers can avoid personal harm or suffering by considering steps as follows:

- Breakdown of loads into smaller loads.
- Buddy system.
- Clear obstructions before lifting.
- Safe working procedures.

14.1.11 Pulling and pushing

Risk assessment shall be communicated to workers during induction training; this is to make workers aware of measures necessary to prevent personal harm. Site workers and construction supervisor shall take necessary precautions to avoid risks and consequences associated with pulling and pushing formwork and cabling by considering safety measures as highlighted in the baseline risk assessment.

14.1.12 Driving of work vehicles

Vehicles are dangerous, and therefore demand specific controls such as the ones as follows:

- Restriction of use to authorized workers only;
- Daily inspections before each use;
- Refueling in the absence of fire/ignition sources;
- Maintenance and servicing.

14.1.13 Extreme heat

Workers can combat extreme hot weather conditions by wearing safety clothing and. Regular intake of cold fluids necessary to regain energy will also help workers.

14.1.14 Hand Tools

1. Hand tools (miscellaneous)

Supervisors and workers will be encouraged to consider in securing their own safety while handling and using hand tool, and consider safety measures as follows:

- ☐ Compliance with the company's own health and safety policy and internal procedures.
- ☐ Use the correct tool for the job.
- ☐ Use eye protection where appropriate.
- ☐ Any personal protective equipment necessary to be made available and to be worn correctly.

2. Cutting tools

Cutting tools can cause injury to the operator or other people in an area. Site supervisor will have to manage safe use of cutting tools and ensure measures as follows:

- ☐ Tools are in use only by a person who has received instruction in their safe use;
- ☐ Tools are in use in an area where appropriate warning signs have been displayed and where people are wearing eye and hearing protection;
- ☐ Not use cutting tools if parts are damaged, defective or if they do not have a current inspection record;

- ☐ If necessary run cables at height to keep them dry and prevent them from being damaged;
- ☐ Ensure tools are in good condition;
- ☐ Use hand tools with safety gloves where possible and necessary.

14.1.15 Trailing cables

The project supervisor for the construction stage / electricians must ensure control of trip hazards, by taking consideration of measures as follows:

- ☐ Ensure the work area is regularly inspected and electrical cables are kept clear of access ways / routes;
- ☐ Ensure angle grinder leads / cords are not too long.

14.1.16 Flying / falling objects

Risk assessment will be communicated to site workers, workers have been provided with hard hats and safety shoes. Supervisor will monitor those workers and ensure they wear provided hard hats at all times.

14.1.17 Electrical and Mechanical Installations

Risk assessment will have to be communicated to workers during induction training; this is to make workers aware of measures necessary to prevent personal harm. The project supervisor for the construction stage must coordinate and supervise site deliveries.

All electrical and mechanical installations must comply with the requirements of the Health and Safety Act, the Construction Regulation 2014, other relevant regulations and applicable safety standards and industry best practice. This type of work may be done by specialist contractors, in which case, the requirements of Regulation 7 of the Construction Regulations 2014 must be complied with in respect of appointing such contractors. Relevant safe work procedures and technical method statements must be submitted for approval by the PC.

The work must be conducted by appropriately registered contractors and on completion of such installations, certificates of compliance issued by competent persons will be required.

14.1.18 Reduction of employee & persons exposures

The project supervisor must periodically make the necessary assessment of the hazards and risks which could emanate from this project activities and the appropriate action has to be taken. The assessment will have regard to safe access, noise, lifting, client property and obstruction generated by work site activities, emergency procedures, and disruption of services and requirements for signage.

14.1.19 Electricity / power supply

Essential steps necessary to prevent electrical risks is electrical isolation including measures as follows:

- Identification of cable markers to detect underground cables.
- Switching off power at a supply or distribution box.
- Providing competent supervision.
- Getting appropriate authorisation including Permit to Work.
- Identifying the correct isolations and disconnections required.
- Correct sequence of isolations and disconnections.
- Safety methods for maintaining isolations and disconnections.

14.1.20 Material unloading and loading

Materials that are unloaded or tipped from plant will have to be deposited in planned locations where they will not cause any obstructions or hazards. Site deliveries will have to be planned ahead and supervised by site personnel. Site workers must be discouraged to remain on vehicles that are being loaded / off loaded unless the vehicle is equipped with a reinforced cab or falling object protection system (FOPS). Workers working with plant or vehicles, on site where vehicle movements is expected, will have to be provided with and wear high visibility vests.

14.1.21 Transportation and unloading

Transportation and unloading of the material and equipment at the location must be done in a safe manner so that they are not damaged or misplaced.

14.1.22 Objects or tools lying about

Project site supervisor will have to ensure measures as follows:

- Clear up objects or tools on work areas, and ensure housekeeping is practiced;
- Proper store keeping of tools;
- Regular removal of waste and materials;
- Prevent accumulation of rubbish;
- Cordon off areas where scraps and stored material could present a hazard by use of a danger tape.

14.2 Management of health hazards

Daily exposure to health risks result in irreversible damage that may occur before any symptoms are apparent. A development of a preventive strategy to identify and control risks before people's exposure is essential.

14.2.1 Control of construction dust

It is important that workers are made aware of the risks from dust and how it can harm their health. They must be fully trained and informed on how to use dust control measures that have been put in place, how to maintain equipment, and how to use and look after respiratory protective equipment (RPE). The principal contractor is to consider safe method of working which takes proper account of risks to employees and others who may be affected by exposure to dust, such as visitors and contractors.

Steps as follows may be taken to control exposure to dust:

- Assesses health risks;
- Provide workers with appropriate information and training;
- Using building materials that do not require an excessive amount of preparatory cutting to size;
- Using less-powerful tools, such as a block splitter instead of a higher energy cut-off saw;
- Water suppression;
- Keeping the number of workers near the dust-producing work area to a minimum;
- Using sheeting and temporary screens to enclose the work area;
- Issue suitable and comfortable RPE (Respiratory Protective Equipment) for the work.

14.2.2 Control of noise

Noise Induced Hearing Loss Regulations 2003 Section 10(1) specifies that an employer or self employed person shall ensure that exposure of a person to noise is either prevented or where reasonably practicable, adequately controlled.

- Assess noise levels;
- Reduce risks from noise exposure by
- Provide employees with information and training
- Provide hearing protection as a last resort.

14.2.3 Control vibration

The principal contractor is to ensure measures as follows are implemented:

- Avoid, whenever possible, the need for use of vibration equipment;
- Undertake a risk assessment to include a sound estimate of employees' exposure to vibration;
- Develop a maintenance plan for tools and machinery.

14.2.4 Control of radiation

Principal contractor is to ensure control measures are implemented to reduce exposure of people to ultraviolet radiation:

- Minimize worker exposure to radiation by increasing the distance between a source of radiation and the worker;
- Post warning signs where exposure to radiation is possible;
- Workers exposed to radiation above guidelines should be provided with UV blocking safety goggles, face shields, welding shields and long sleeved clothing.

14.2.5 Control of ergonomic risks in construction

Construction is a physically demanding work environment; site workers are often at risk of long-term injury. Back sprains and strains are the most common disabling injuries, often due to overexertion and bodily motion.

Ergonomic risks experienced in construction sites emanate from exposure to hazards that may include improperly designed tools or work areas and improper lifting or reaching, poor visual conditions, or repeated motions in an awkward position which can result in occupational accidents or illnesses.

Potential ergonomic hazards in this project include the following:

- Manual handling of objects and materials where lifting and carrying is done
- Repetitive motion disorders which are encountered when workers use vibrating tools like chain saws and powered hammers
- Continuous movement of hand and arm in the same motion throughout the work shift
- Repetitive and stressful wrist motion that causes irritation, fluid build up, or thickening of the carpal ligaments in the wrists
- Manual materials handling related to carpentry, bricklaying, roofing, plastering, truck driving
- Awkward work postures in activities of plumbers, electricians, boilermakers, labourers, and insulators
- Elevated posture in activities of plumbers, electricians, boilermakers, labourers, and insulators
- Overexertion
- Rapid twisting and bending of the back
- Whole-body vibration transmitted through the seats in heavy equipment.

The principal contractor must comply with the following in line with Ergonomics Regulations 2019:

- Perform ergonomic risk assessment performed by a competent person before the commencement of any work that may expose employees to ergonomic risks.

The risk assessment must meet the following requirements:

- a) include—
 - i. a complete hazard identification;
 - ii. the identification of all persons who may be affected by the ergonomic risks;
 - iii. how employees may be affected by the ergonomic risks;
 - iv. the analysis and evaluation of the ergonomic risks; and

- v. the prioritization of ergonomic risks.

14.2.6 Control of workplace violence

Principal contractor is to ensure that hazards any unsafe acts and evaluate risks of violence among the people on site. He / she has to ensure safety rules are drafted and communicated to all people on site, including self employed persons and contractors. Written acknowledgement on communication of safety rules has to be maintained.

14.2.7 Control of alcohol and drug abuse

The principal contractor is to ensure no use of alcohol and drugs is allowed on site. No person may be under the influence of alcohol or any other drugs while on the construction site.

14.2.8 Control of concrete works

The principal contractor is to ensure that concrete works to be done all site must be done in a safe way safeguard the health of the employee as well as the protection of the environment. Contractor must ensure that employees have proper and adequate PPE.

Safety Precautions for Working With Concrete

- Wear the Appropriate Personal Protective Equipment (PPE)
- Use the Proper Tools.
- Employ the Proper Techniques (competency).
- Have Washing Stations Available.
- Wear Additional PPE.
- Exercise Caution Around Concrete Buckets and in Mixers. ...
- Communicate Proactively With Your Team.
- Stay Alert and Vigilant

14.2.9 Control of paving works

Principal contractor must ensure that paving works are done under the supervision of the site agent and contractor has to take all considerable safety measure to ensure paving works is done in a safe manner, contractor has to make sure that all hazards associated with paving are identified and measures are adopted to eliminate these hazards. Baseline notable hazards identified include not limited to the following.

- Back injuries from lifting heavier concrete products.
- Back injuries from repetitive motion of paver installation.
- Muscle pulls from digging and lifting.
- Finger abrasion from handling concrete products.
- Skin rashes or burns from job site chemical spills and splashes.
- Eye injuries from saw cutting.

- Lung and respiratory injuries from long term exposure to saw cutting dust and cement dust.
- Heat exhaustion.
- Impact injuries from moving equipment.
- Vibration related injuries from compaction equipment.
- Hearing loss injuries from working with high decibel equipment such as saws and compactors.
- Knee injuries from repetitive kneeling.

14.2.b. OPERATIONAL PHYSICAL CONTROL REQUIREMENTS

a. Notices & Signs

All symbolic safety signage, that the Principal Contractor or his/her sub-contractors are to use/display are to conform the requirements of SANS 1186.

The display of the following signs is mandatory:

- For Contractors with Site Establishment: The Contractor Company sign must be posted at their site offices to reflect the name and contact details of the: Construction Supervisor; Health and Safety Manager/Officer; First Aider; Health and Safety Representative and Evacuation Warden. Sign to also include site-specific number as per the construction work permit where applicable.
- “Radio-Active Material” symbolic signs at radioactive storage areas.
- The location of every first aid box; fire extinguisher and emergency exit is to be clearly indicated by means of a sign.
- At the entrance to premises where machinery is used: Restricted access i.e. “Authorised Person Only” signs on entry.
- When in use, an Explosive Power Tool shall have a sign, warning people of its use.
- The Contractors shall provide the signage where work is conducted and where unauthorised entry is prohibited and/or where alerting and cautioning passers-by to be aware of potential dangers.
- Notices & Signs at entrances / along perimeters indicating “No Unauthorised Entry”.
- Notices & Signs at entrance instructing visitors and non – employees what to do, where to go and where to report on entering the site/yard with directional signs. E.g. Visitors to report to Site Office”
- Notices & Signs posted to warn of overhead work and other hazardous activities. E.g. General Warning Signs.

- All equipment brought onto the construction site, (including motorised equipment, e.g. bobcat) that requires PPE to be worn during operation, must have the relevant PPE mandatory sign/s attached. The type and use of PPE will be placed at all entry points to the construction site.

Note: Signage to be adequate to ensure after hour safety.

b. Fire Safety

Contractors must develop a fire safety plan/procedure for the specific construction site prior to commencing work. The procedure must take into consideration the size of the site, type of work being done (e.g. cutting, welding, grinding, etc.) and amount of combustible materials. All workers entering and working in the construction site need to be trained in fire safety and any duties they are required to perform. Pre-existing fire systems in buildings shall be maintained during construction whenever possible. Any changes must be approved by the Client.

The fire safety plan shall include:

- The designation and organization of site personnel to carry out fire safety duties, including fire watch service if applicable.
- The emergency procedures to be used in the case of fire, including: Sounding the fire alarm, notifying the fire department, instructing site personnel, Fire fighting procedures and integrating with existing emergency procedures.
- The control of fire hazards in and around the building.
- Maintenance of fire fighting facilities.

Cutting, Welding, and Hot Work

Prior to cutting or coring of concrete suspended slabs, cast in place or pre-cast walls, slab on grade the contractor must either X-ray the slab or if X-ray is not feasible provide other approved alternate method for determining live electrical concealed in slab or walls. Signage shall be posted to ensure no one enters the affected area during X-raying.

When welding or cutting work is performed, an adequate number of approved fire extinguishes shall be provided by the contractor. The contractor shall provide a thirty minute fire watch after the operations has ended to ensure that no fire starts. Extraction fans to be provided when welding work is performed.

Fire Guidelines:

- Fire alarm shut downs: Contractors must inform the Client in writing 7 days prior to any part of a fire system being shut down.
- Fire Warning: A suitable means of alerting site personnel to a fire shall be provided, and capable of being heard in all areas of the building.
- Portable Extinguishers: suitable extinguishers must be available in the construction site and in cases of hot work, be readily available at the location.
- Combustible Liquid and Flammable Liquid Storage: storage of combustible and flammable liquid in the construction site is not permitted unless stored in approved flammable cabinets or outdoors away from the buildings.

- Smoking Restrictions: Smoking is not permitted indoors, at entrances to buildings or near air intake systems as per Makhado Local Municipality Smoking Policy and legislation requirements

c. Construction Vehicles and Mobile Plant

- a) The Contractor shall implement a site traffic plan (circular movement) to ensure the safe movement of all

Construction related mobile plant.

- b) Contractors shall implement pedestrian and vehicle routings as part of the site traffic plan to demonstrate the route employees may proceed when coming on or going off shift
- c) All motor vehicles operated by Contractors within the area shall, in all respects, comply with the Road Traffic Ordinance and Road Traffic Act. Designated drivers shall be in possession of a driver's licence, valid for the class of vehicle as well as an operator certificate where applicable. The driver's license shall be kept by the person so authorised and shall produce such card on request.
- d) All drivers of construction vehicles and mobile plant to have medical certificates of fitness. Each Project site will have system/ process to manage vehicle access to site.
- e) The contractor shall attach identification markers on all of his/her vehicles that are permitted to enter the site.
- f) The speed limit within the bounds of the construction site is 30 km/h. (To be completed by the project team). A consolidated traffic plan must be in place where there are many vehicles within a project site.
- g) No drivers or operator may talk on cell phones or two way radios whilst driving, unless a hands free kit is used.
- h) It is the responsibility of the driver to ensure:
 - He/OHS and his/her passengers wear seat belts whilst the vehicle is in motion.
 - Comply with all safety, direction and speed signs.
 - Ensure that vehicle loads are properly secured and loaded onto vehicles.
 - Ensure that vehicles are not overloaded.
- i) All requirements with regard to the transportation of tools/equipment/material and persons on the back of construction vehicles must be adhered to:
 - No Personnel to be transported in the back of construction vehicles with tools.
 - Tools, equipment and material to be secured in order to prevent movement;
 - Fixed and firmly secured seats with seat belts – adequate for the number of passengers being transported;

- The driver and all passengers to be seated with seatbelts fastened whilst the vehicle is in motion.(National Road Traffic Act no 93 of 1996).
- j) The Principal Contractor shall ensure that his employees and those of his subcontractors do not.
- Ride on back of elevators, cranes or other mobile plant equipment.
 - Leave vehicles unattended with the engine running.
 - Park vehicles in unauthorised zones/areas.
- k) Makhado Local Municipality reserves the right to search any vehicle on the premises or when entering or leaving the premises.
- l) The Contractor shall be solely responsible for the safety and security of any of his vehicles (including private vehicles) on the premises.
- m) A current maintenance logbook is required for all cranes and large plant equipment, and shall be available for inspection at any time. The logbook shall be located in the cabin of the crane or plant equipment.
- n) Principal contractor is to ensure that visibility (e.g.: switching on of lights, reflectors, barricades equipped with lights, etc.) is enhanced on all Construction Vehicles and Mobile plants in order to identify the location of the vehicles or plant.
- o) The Contractor must maintain his vehicles in roadworthy condition and a valid license. These vehicles shall be subject to inspection by the Client's representative. Vehicles which are not roadworthy will not be allowed onto the site. If mobile plant equipment is used on the public road, the same requirements as for vehicles apply and should be adhered to.
- p) In the event where the principal Contractor and his sub-contractor do not own the equipment, the principal Contractor is still responsible for ensuring all conditions are complied with by all of his subcontractors or hire companies.
- q) Drivers/operators shall be responsible for the travel-worthiness of all loads conveyed by them. Precautions shall be taken to lash all loads properly. Loads projecting from vehicles shall be securely loaded and in daytime a red flag and during darkness a red light or red reflective material shall be attached to the extreme end of such projecting material.
- r) All servicing and repairs must be carried out by the Contractor in a designated area.
- s) All waste from servicing must be disposed of in accordance with the environmental legislation.
- t) Every mobile machine whose vision is impaired when reversing must have a siren/hooter, which sounds, when the machine is reversing. This includes trucks, cranes, loaders, etc.
- u) Operators have great difficulty in seeing light vehicles behind their machines. Drivers of light vehicles must avoid stopping or parking in the vicinity of machines. At least 30 (thirty) meters must be left clear between such a vehicle and such a machine.
- v) Drip Trays to be placed under the vehicles where are possible leaks to avoid soil and ground pollution.

d. Working near Public Roads

The Principal Contractor, his employees and subcontractors required to work on or nearby roadways must put measures in place to ensure safety of the workers and public (pedestrians, road vehicle users, cyclists etc.). The contractor must ensure the following:

- a) Ensure there is traffic control measures for each expected interaction (Construction works and hazards, Vehicles, both public and construction vehicles, pedestrians and workers) including drawings of the layout of barriers, walkways, signs and general arrangements to warn and guide traffic around, past or through the construction site or temporary hazard. The contractor must ensure that the Traffic Management Plan is approved by the engineers and further implement and monitor the effectiveness of a TMP. The TMP must be reviewed regularly after design/work procedure changes and after each incident/accident/near miss.
- b) Providing separate traffic routes for pedestrians, workers and vehicles, where possible.
- c) Providing separate clearly marked pedestrian/workers walkways that take a direct route.
- d) Creating pedestrian/workers exclusion zones where powered mobile plant is operating.
- e) Creating vehicle exclusion zones for pedestrian/workers-only areas.
- f) Plan storage areas so delivery vehicles do not have to cross the site
- g) Securing areas where vehicles and powered mobile plant operate by installing pedestrian/workers barriers, traffic control barricades, chains, tape or bollards. Ensure a competent person with the necessary training or qualifications directs powered mobile plant when it operates near workers or other plant.
- h) Designating specific parking areas for workers' and visitors' vehicles outside the construction area.
- i) Providing clearly signed and lit crossing points where walkways cross roadways, so drivers and pedestrians can see each other clearly.
- j) Using traffic controllers, mirrors, stop signs or warning devices at site exits to make sure drivers can see or are aware of pedestrians before driving out onto public roads.
- k) Avoiding blocking walkways so pedestrians do not have to step onto the vehicle route and construction area.
- l) Scheduling work so vehicles, powered mobile plant and pedestrians are not in the same area at the same time, where possible. Or schedule for times where the traffic is at the lowest.
- m) Ensure workers and other people are familiar with reversing areas and these areas are clearly marked, and
- n) Ensure plant operators are aware of workers who may be in the vicinity of the swing radius, articulation points and overhead load movement of their vehicle.

e. Personal Protective Equipment

In terms of Section 8 of the OHS Act, the duty of the employer is to take steps to eliminate or mitigate (hierarchy of control measures) any hazard or potential hazard to the safety or health of employees before resorting to PPE.

Principal contractor's employees and his sub-contractor employees at the construction site, including visitors, shall use the following SANS or the relevant internationally recognised authority approved risk based PPE at all times, as a minimum:

- Head protection (Hard hat).
- Steel toe capped safety boots.
- Eye protection.
- Sun Hats
- Ear muffs
- Long sleeved and long pants protective clothing. NB: At least two of each to be issued to each employee.
- High visibility vests.
- Refer to General Safety Regulation 2 of the OHS Act- if there are particular activities/areas/risk assessments that require a specific type of PPE, then that specific PPE requirement must be adhered to (e.g.: for dusty environments – eye goggles; for welding – welding helmet; etc.).

The Contractor shall ensure that his employees understand why the personal protective equipment is necessary and that they use them correctly.

Strict non-compliance measures must be administered to any employee not complying with the use of PPE and shall be removed from the Site.

PPE shall be worn in any designated area requiring such a PPE.

Issue, Replacement and Control of PPE: The Principal contractor must provide a detailed programme on the issuing, maintenance and replacement of PPE for all his employees and subcontractors on site. The Principal contractor is required to keep an updated register of all PPE issued to staff, including that of his sub-contractors

f. Housekeeping

Principal Contractors and Sub-contractors

- The Principal Contractor and his sub-contractor shall maintain a high standard of housekeeping within the site. Ensure prompt disposal of waste materials, scrap and rubbish is essential. Also refer to what the requirements are in the EMP

Scrap/Waste Removal System

- Scrap management as per agreement with Project Manager.
- All items of Scrap/Unusable Off-cuts/Rubble and redundant material removed from working areas on a regular basis.
- Scrap/Waste disposed of in designated containers/areas
- Removal from site/yard on a regular basis.

Stacking & Storage

- Before stacking any material, the Contractor, sub-contractor or their employees must consult the Makhado Local Municipality Project/site Manager for allocation of a stacking area, General Safety Regulations 8 of OHS Act.

– Adequate care must be taken by the Contractor to ensure that storage and stacking is correctly and safely carried out. – Materials/objects shall not be left unsecured in elevated areas –falling objects may cause serious injuries/fatalities – All packaging material including boxes, pallets, crates, etc. to be removed from the work area immediately.
Waste Control/Reclamation – Re-usable off-cuts and other re-usable material removed frequently and kept to a minimum in the work areas. – All re-usable materials neatly stacked/stored in designated areas. (Nails removed/bent over in re-usable timber).
After job completion – On completion of his work, the contractor is responsible for clearing his work area of all materials, scrap, temporary buildings and building bases to the satisfaction of the Client.
Inadequate standard of housekeeping – The Makhado Local Municipality Project/Site Manager has the right to instruct the Principal Contractor and his sub-contractor to cease work until the area has been tidied up and made safe. Neither additional costs nor extension of time to the Contract shall be allowed as a result of such a stoppage. Failure to comply will result in site cleaning by another cleaning contractor company at the cost of the Principal Contractor
Regular safety/housekeeping inspections – The Principal Contractor shall carry out regular safety/housekeeping inspections (at least weekly) to ensure maintenance of satisfactory standards. The Principal Contractor shall document the results of each inspection and shall maintain records for inspection.

g. Permit to Work

If the type of work requires that contractors must be trained, competence assessed and authorized in writing to perform the duties of an authorized or responsible person as contemplated in the applicable Makhado Local Municipality regulations e.g. Hot Work, Radiation, confined space work, excavation, blasting etc.

The PM Project Manager is to provide more details on the permit to work system for the specific work to be conducted by the Principal Contractor.

h. Hazardous Chemicals Agents

The aim of this section is to outline to the Principal Contractors and his sub-contractors how hazardous substances, as defined in the Hazardous Chemical Agents Regulations 2021 (OHS Act), should be managed.

- Prior to any HCA being brought onto the site or produced on the site, the Principal Contractor shall supply the Makhado Local Municipality Project Manager with the following: Safety Data sheets (MSDS) in accordance with the requirements of the OHS Act – Regulations for Hazardous Chemical Agents; Purpose for bringing the hazardous substance onto the site; Proposed arrangements for safe storage; Proposed methods for handling/usage; Proposed method of disposal; and Hazard communication / training plan.
- The information is to be provided at least two (2) working days prior to the expected delivery on site.
- The Makhado Local Municipality Project Manager shall approve the use of any hazardous substance after receiving the above information.
- No HCA are not to be brought onto the site until the Makhado Local Municipality Project Manager approval is received.
- All HCA containers to be clearly labelled. Containers that are not marked will not be allowed. No HCA to be stored in food or drink containers.
- Users of HCA to wear/use the correct PPE as per the HCA safety data sheet.
- Users of HCA to be adequately trained in the HCA that they are handling.
- The Contractors to have and maintain a register with all the HCA that they have on site
- Site Risk Control/OHS Teams must be notified of any HCA, explosive, and radiation sources that may enter the premises.

Flammable and Combustible Liquids

- Proposals to store fuel on site must have written approval from the Makhado Local Municipality Project Manager.
- The volumes of fuel allowed to be stored will depend on site conditions and Statutory Regulations. A maximum storage of 40 litres of fuel is allowed to be stored. Anything greater than 40 litres to be stored in a licensed flammable/combustible liquid store.
- Adequate numbers of dry chemical fire extinguishers shall be provided, installed and maintained.
- Before a machine is refuelled, the motor must be stopped. Refuelling shall take place at designated safe areas and appropriate warning signs installed. Suitable drip trays must be used to prevent spillage at the filling nozzle.
- All fuel storage areas must comply with the following requirements: -
Storage should be well clear of buildings, Storage areas must be kept free from all combustible materials. All danger signs must be prominently displayed, i.e. Flammable Liquid, No Smoking, No Naked flames. Hazchem identification. Adequate fire fighting equipment must be available. Diesel tanks will be installed in a bund area; bund area must be able to contain 110% of tank capacity. Bund area shall be of a concrete or steel construction. Bund area shall have a lockable drain valve. No other material/equipment shall be stored in the bund area. See Construction Regulation 23, of the OHS Act.

Explosives

- Explosives shall not be brought onto the site or be used without the express permission of the relevant Makhado Local Municipality/Representative.

- Explosives or detonators shall not be stored on the site.
- Detonators and other explosives shall never be carried in the same box.
- The provisions of all relevant Acts and Regulations shall be strictly observed.

Compressed Gas Cylinders (General Safety Regulation 9) and SABS 1548

The following requirements apply to all gas cylinders storage:

- Contractors shall establish storage areas as approved by the Makhado Local Municipality Project Manager.
- Storage areas should be well clear of buildings.
- The storage areas shall be fenced, shaded, stable, and solid surfaces.
- For security and ventilation purposes, a wire mesh fence should surround the storage area. Keep the enclosure locked.
- All danger signs must be prominently displayed at storage area; e.g.
- No Smoking and naked flames.
- A protective covering must be provided.
- Adequate ventilation must be provided.
- Storage areas must be kept free from all combustible materials; no other materials must be stored in cylinder enclosure.
- Full cylinders must be kept apart from empty cylinders so that it will not be necessary to open valves to check whether cylinders are empty or full.
- Cylinders must always be chained separately in an upright position and special stands must be used for cylinders.
- Cylinders must be stored in rows with aisle in-between for easy removal in event of fire.
- Mark empty cylinders clearly and move to approved storage areas.
- Adequate fire fighting equipment must be available.
- Cylinders for different gasses must be stored separately.
- Flammable and oxidising gasses must not be stored together; greases and oils must never be allowed to come in contact with oxygen.
- Only flame-proof electrical lighting should be used, if required.
- Cylinders will only be allowed on site in an approved trolley, properly secured and with a chain.
- All gas cylinder torches to have flashback arrestors fitted on both sides.
- Clamps are to be used to separate cables

i. Falling Risk Positions (including falling into an excavations)

Whenever persons are required to work in a fall risk position where there potential exposure to falling either from, off, or into, a fall protection plan (which includes fall prevention) will be compiled, implemented and reviewed and every possible and practicable means shall be adopted to provide such persons with effective training and safeguards.

All persons required to work in fall risk positions shall be declared medically fit.

Working on fall risk positions shall only be carried out under the supervision of a competent person.

Safety belts are not allowed to be used in Makhado Local Municipality. An appropriate full body safety harness will be worn when working at an elevation of 2 (two) meters or more.

Mitigation measures to be put in place:

- All tools in fall risk positions must be attached to lanyards, attached to person or structure or effectively prevented from falling.
- Equipment in fall risk positions must be tied back to the structure.
- Loose items in fall risk positions. E.g. Bolts and nuts to be kept in tins or similar robust containers and not in paper boxes.
- When working at fall risk positions, nets and/or other suitable material should be used catch falling debris and sparks directly below where the task is being performed
- Roof work discontinued when there is bad/hazardous weather
- Fall protection measures (including warning notices) when working close to edges or on fragile roofing material

Fall protection includes: Safety harnesses and double lanyards; approved lifelines; and other approved means.

Fall protection equipment to be implemented where fall prevention is not possible and shall comply with SANS Standards -: SANS 503&508 Series and other recognised international standards.

Scaffolding

- All scaffolding used shall comply with the OHS Act and Regulations as well as SANS 10085.
- Scaffolding erectors to be trained as specified in SANS 10085.
- Scaffolding access ladders shall form part of the scaffold structure and not the ladder register.

Ladders (Portable)

- All ladders used on the site shall be in compliance with the OHS Act and Regulations.
- All Ladders shall have an identification tag, logged in a register, and inspected on a monthly basis and prior to use.
- Damaged ladders shall be marked as “DAMAGED” and removed from the project site.
- Prior to work being performed, a risk assessment must be conducted, and work must be conducted as per General Safety Regulation 6 and 13A and Construction Regulation 10 of the OHS Act.

j. Excavations, Trenches and Floor Openings

- a) Prior to commencing work on any excavation or trench, utility owners shall be contacted and advised of the proposed work and to determine the location of all underground installations, i.e., sewer, telephone, water, fuel, gas, electric, etc. Overhead hazards shall be assessed and dealt with prior to commencement of work. Where details of existing services are not available from the client, the contractor is to make an assessment of the area for such services.
- b) Adequate precautions shall be taken by the Contractor to prevent slumping of excavations, as well as to prevent rocks and loose material falling onto workers.

- c) All excavations done by the Contractor are to be clearly demarcated and barricaded to prevent accidental access.
- d) Only solid barricading will be used at areas where a fall hazard is present. Solid barricading and / or hole covers shall be provided around all holes or openings to prevent any person being injured as a result of a fall. The solid barricading must be visible to prevent persons from coming close to the danger area.
- e) Barricading must be placed as close as possible to the excavation.
- f) If an excavation or trench endangers the stability of buildings or walls, shoring, bracing, or underpinning will be provided. Excavations and trenches that are adjacent to backfilled excavations or trenches, or which are subject to vibrations from railroad traffic, road traffic, blasting in open cast mining or the operation of machinery (e.g., shovels, cranes, trucks), must be secured by a support system, shield system or other protective systems (i.e., Steel pile shoring, bracing).
- g) Where it is impracticable to provide fixed guard railing, effective removable barriers shall be provided at all unguarded openings in guard railing or floors, and shall be maintained in position at all times until the hazard no longer applies.
- h) Warning signs and flashing warning lights at night shall be displayed in suitable positions to warn any persons approaching the area of the location and extent of any excavation.
- i) No material to be within 1m of the excavation edges.
- j) No work shall commence in an excavation unless the excavation has been declared safe by the competent person
- k) Whilst work is being performed in an excavation, there shall be a supervisor, at all times
- l) All excavations must be on register and inspected daily before work commences and after inclement weather by the contractor's appointed competent person, declared safe and his findings noted in the register
- m) Emergency – access ladders – access may not be further than 6 meters from the point where any worker within the excavation is working.

k. Barricading (Guarding of Excavations, Trenches)

Areas where the restriction or prevention of unauthorised persons/members of public/passers-bys is required

- Name and contact detail of person and Contractor Company that is responsible for the barricading shall be posted on the actual barricading.

- *All barricading shall be of the rigid type. Chambers are to be fenced off, on residential and industrial areas; diamond mesh fence of at least 1.5m heights with overhanging orange net will be used on all sides. All openings and edges must be barricaded with solid barricading to withstand an impact of at least 100 kg and adequately maintained. Note: This does not refer to traffic control barricading; different requirements as per approved Traffic Management Plan must be implemented for traffic control.
- Physical barriers to prevent persons falling into openings in floors, staircases, open-sided buildings and any structure in the course of erection, where dangerous openings exist.
- Contractors must pre-plan the delivery of floor grating, stair treads, landings and handrails to ensure safe access and protection for persons working on structures.

I. Blasting

- a) A copy of the written permission from the Chief Inspector of Department of Employment and Labour shall be obtained before use of any explosive material – refer to requirement in Explosives Regulation 13 of the OHS Act.
- b) Requirements for the transporting and storage of explosives to be in accordance to Explosives Regulation 13.4 of the OSH Act and SANS 100228 “Code of Practice for the Identification and Classification of Dangerous Substances and Goods” Published by the South African Bureau of Standards.
- c) Should blasting be necessary during the construction phase, the necessary authorisation must be secured from the relevant authorities. Adjacent land owners must be notified prior to the blasting activities on site.
- d) The Construction operations may necessitate that ground and rock be blasted. Prior to a blast a siren will have to be sounded. Warning flags will have to be displayed at the entrance to the area of the blast and guards will be placed at strategic points.
- e) Should the Contractor be required to carry out blasting operations, he is to fully acquaint himself with, and adhere to the blasting procedures and legislation. Every blast must be cleared with the appropriate Client representative before charges are placed.
- f) Only a licensed operator is allowed to blast.
- g) For all blasting operations, a blasting mat shall be used to cover the blasting area so as to reduce the amount of flying debris. The method statements and blasting pattern must be approved by the appropriate Makhado Local Municipality personnel before and blasting commences. Before any open trench blasting commences, the Contractor shall be in possession of a Blasting Permit (BLP Form) as well as Transport Permit (TTP Form) from the South African Police Service Explosives Section. All tunnel blasting (i.e. Pipe Jacking), shall comply with the Mine Health and Safety Act and the permits shall be issued by the Department of Minerals and Energy.

m. Machinery, Tools and Equipment

The aim of this section is to outline the process used by Makhado Local Municipality project management team to ensure that all equipment brought onto site by the Principal Contractor and their sub-contractors is appropriate to the task being performed and in good condition.

The Contractor shall ensure that all machinery, tools and equipment are identified, safe to be used and is maintained in a good condition.

- a) All machines driven by means of belts, gear wheels, chains and couplings shall be adequately guarded. A machine is guarded when persons cannot gain inadvertent access to the moving parts.
- b) The Principal Contractor shall ensure that all machinery, tools and equipment to be listed on an inventory list and handed to security with a copy kept on site.
- c) All machinery, tools and equipment to be regularly inspected at least monthly or as required by legislation and risk assessments, registers of tools shall be kept in the OHS file. The equipment should be numbered or tagged so that it can be properly monitored and inspected.
- d) All machinery, tools and equipment must have the necessary approved test or calibration documentation where applicable prior to being brought onto the premises and the records shall form part of the OHS plan.
- e) All fuel driven equipment must be inspected by the Makhado Local Municipality OHS Practitioners/Officers prior to mobilizing it onto site.
- f) All fuel driven equipment must be properly maintained in accordance with the manufacturer's recommendations and legal requirements.
- g) The Contractor shall supply, at his cost, all items of plant and equipment necessary to perform the work else otherwise indicated.
- h) The Client reserves the right to inspect items of plant or equipment brought to site by the Contractor for use on this Contract. Should the Client find that any item is inadequate, faulty, unsafe or in any other way unsuitable for the safe and satisfactory execution of the work for which it is intended, the Client shall advise the Principal Contractor in writing and the Principal Contractor shall forthwith remove the item from the site and replace it with a safe and adequate substitute. In such cases, the Principal Contractor shall not be entitled to extra payments or extensions of time in respect of delay caused by the Client's/OHS Representative's instructions.
- i) The Principal Contractor/sub-contractor will ensure that he has all the necessary registers to record all tools and equipment.
- j) All employees shall be competent when operating or using machines and tools i.e. have a valid certificate. And proof of any form of task related training.

n. Machine Guarding

- a) An assessment should be conducted in writing to ensure that all machines and tools are fitted with a guard and the assessment should be kept on the OHS file.
- b) The machine or tool should be guarded to prevent limbs or loose clothing from getting under, into, above or around the dangerous moving parts.
- c) Every shaft, pulley, wheel-gear, sprocket, coupling, clutch, friction drum, spindle end screw, key, bolt on a revolving shaft, driving belt, chain rope or similar object shall be securely fenced or guarded.

- d) Guards should form a permanent part of the machine or tool, easy to remove non corrosive, rigged and as far as reasonable heat resistant.
- e) Machine guards must be painted on the outside in the same colour as the machine or tool.
- f) Inside of guards and moving or rotating parts must be painted orange.
- g) All guards must be inspected by a competent person on a monthly basis as well as by users prior to use. These inspections and proof of corrective action taken must be recorded and kept on site.

Records:

- A register should be used which indicate the name, number of the machine or tool and the number of guards.
- The register should be kept on the safety file.

o. Hand Tools and Pneumatic Tools/Explosive Actuated fastening Tools

- a) All hand tools (hammers, chisels, spanners, etc.) must be recorded on a register and inspected by the supervisor on a monthly basis as well as by users prior to use.
- b) All pneumatic tools (tools driven by gas, usually compressed air) should be numbered, recorded and inspected at least monthly as well as by users prior to use. And the revolutions per minutes measured in accordance with the manufacturer specifications.
- c) Tools with sharp points in toolboxes must be protected with a cover.
- d) All files and similar tools must be fitted with handles.
- e) It is illegal for a pneumatic tool to be operated by using a compressed gas cylinder. Pneumatic equipment shall only draw supply from mobile air compressors or from compressed air lines installed within the premises after gaining permission from the Client Representative.
- f) When using the interlocking type of connection of an airline, connectors shall be secured with wire clips through holes provided to prevent accidental disconnection.
- g) Compressed air shall NOT be used for any purpose other than that for which it is provided. Compressed air should not be used to remove dust from clothing.
- h) Hoses to be orderly routed and elevated if required in order to prevent tripping hazards.

Records:

- Check list for hand tools
- Check list for air tools including records of the measurement of revolutions on grinders
- Gas cylinder trolley checklist
- Register

p. Explosive Actuated fastening Tools

- a) Written permission to use these tools on site must be obtained by the Makhado Local Municipality Project/Site Manager
- b) Only used by trained / authorized and appointed personnel.
- c) Prescribed warning signs placed / displayed where tool is in use.

- d) Work area must be properly isolated/ demarcated during use of tool.
- e) Inspected at least monthly by competent person and results recorded.
- f) Issue and return recorded including cartridges / nails and unused cartridges / nails / empty shells recorded.
- g) Cleaned daily after use.
- h) Users should be issued with suitable protective equipment.
- i) Cartridges and explosive power tools to be stored separately

Records:

- Register for the issue and return of cartridges.

q. Lifting Machines and Lifting Tackle

- a) A risk assessment shall be conducted prior to commencing with the task to identify the risk involved and appropriate mitigation measures must be put in place.
- b) If it is the Principal Contractor's intention is to use lifting machines on site, it should be indicated in the Principal Contractor's OHS plan as well as the inspection so that the Makhado Local Municipality Project/Site Manager can conduct an inspection when equipment is brought onto site. If his/her intention is to use a sub-contractor he must enter the name of the sub-contractor into the notification letter to the Department of Employment and Labour.
- c) All lifting machine operators shall be competent to operate a lifting machine. They must be in possession of a valid permit.
- d) The Principal Contractor should verify if the lifting machines have been examined and a performance test done.
- e) The training should have been done according to the Code of practice by a provider registered by the Department of Employment and Labour.
- f) Before using any lifting machines or tackle the operator should inspect it.
- g) All lifting machines shall be examined be colour-coded and subjected to a performance test by an accredited person/company at intervals not exceeding 12 months.
- h) All lifting tackle should be examined and be colour-coded (colour tagged and not 'painted') by an accredited person/company at intervals not exceeding 3 months.
- i) Refer to the requirements of the Driven Machinery Regulation 18 and Construction Regulation 19 and 22 of the OHS Act.
- j) All lifting tackle should be recorded on a register.
- k) All hooks shall be fitted with a safety latch/catch.
- l) A lock out system should be implemented to ensure that only an operator that is competent can draw lifting machines and fork lifts.
- m) All lifting tackle should be conspicuously and clearly marked with identification particulars and the maximum mass load, which it is designed for.

- n) No person shall be moved or supported by means of a lifting machine unless such a machine is fitted with a cradle approved by an inspector.
- o) A risk assessment should be conducted prior to starting with the task.
- Account should be taken of wind forces.
 - Lifting machines are erected taking into account a safe distance from excavations.
 - When working in close proximity to power lines, the contractor must apply for a permit. Refer to Electrical Machinery Regulation 15 of the OHS Act.
 - Account should be taken of the bearing capacity of the ground.
- p) Principal Contractors and their employees shall keep out from under suspended loads, including excavators, and between a load and a solid object where they might be crushed if the load should swing or fall. They shall not pass or work under the boom or any crane or excavator.
- q) Contractors and their employees shall ensure that crane loads are not carried over the heads of any workmen.
- r) Guide ropes to be used to prevent loads from swinging.
- t) Rigger requirements: Rigger ID document, medicals, induction card, National Rigging Certificate (NRC) Competency certificate which states the tons to be lifted, Trade test certificate in accordance with the standards recognized by the National Apprenticeship Board in terms of Section 7 of the training of Artisans Act, Lifting tackle & equipment certification and Industry ID Skills card

Records:

- Record books and test certificates of lifting machined and tackle should be kept on the safety file.
- A copy of the risk assessment should be kept on the safety file.
- A certificate of approval shall be obtained from the Department of Employment and Labour Inspector.
- Register of all lifting machines and tackle on site (For inspection purposes).
- Training certificates and certificates of fitness for operators of the equipment

r. Pipe Jacking

No person may enter a tunnel, which has a height dimension of less than 800 millimetres.

Pipe Jacking shall be supervised and undertaken only by persons fully conversant with this work. Pipe Jacking to comply with SANS standards (SPEC 1200 LG-1983), Mine Health and Safety Act. 29 of 1996 and Mineral and Petroleum Resources Development Act (Act 28 of 2002).

Adequate ventilation and lighting must be provided to employee working inside the tunnel at all times.

Employees involved in drilling and operation of jackhammers must be provided with ear muffs and shock absorbing gloves

The launch and reception pits should be properly secured from collapsing, and must be inspected daily by a competent person appointed in writing.

The working area must be completely fenced off and the pits must be adequately barricaded.

Where there is presence of groundwater or mud, steel-toed gumboots must be provided.

Employees shall be trained by a competent person on the safe use of the Hydraulic Power pack or winch used to push the pipes.

Hydraulic power packs and winches shall be pressure and load tested and records thereof retained.

Detailed method statements for each area shall be submitted to Makhado Local Municipality prior to the commencement of the work.

A calibrated gas tester/ oxygen measuring meter shall at all times be placed at the working area, and employees will be trained on the use thereof.

An adequate emergency procedure must be submitted to Makhado Local Municipality prior to the commencement of the work.

s. Asbestos Control Management

The Contractor shall inform the PM Project Manager and CHSA if during construction.

work, asbestos, or suspected asbestos containing material is found. Only Asbestos Approved Contractor can work on asbestos containing material. Asbestos monitoring should be carried out in accordance with Asbestos Abatement Regulations 2020 during asbestos work. Monitoring should be performed by and Approved Inspection Authority. Medical surveillance should be carried out on all people working with asbestos. The asbestos area should be demarcated and relevant signs should be posted at all entrances and exits. After the asbestos work is finished, a clearance certificate should be issued by a competent person.

t. Pressure Equipment

- a) The Principal Contractor shall ensure that all vessels under pressure are inspected by an Approved Inspection Authority, and he shall be in possession of the manufacturer's certificate.
- b) All pressure vessels shall be provided with at least one safety valve and such safety valve should be kept locked.
- c) The vessel under pressure should be provided with a manufacturer's plate.
- d) The vessel under pressure should be fitted with a pressure gauge in Pascal and the maximum permissible operation pressure marked with a red line on the dial.

Records:

- Inspection registers for vessels under pressure
- The certificate from the manufacturers
- Registration certificate of an Approved Inspection Authority

15.0 INDUCTION TRAINING

The principal contractor must ensure every site worker is given a suitable site induction. The induction should be site specific and address all potential H&S risks and shall be guided by the

baseline risk assessment (BRA) prepared for this project. Annexure-A provides a standard risk matrix (RM) as a form of guidance.

The following issues should be considered:

- a.** Senior management commitment to health and safety;
- b.** Outline of the project;
- c.** Management of the project;
- d.** First-aid arrangements;
- e.** Accident and incident reporting arrangements;
- f.** Arrangements for briefing workers on an ongoing basis, e.g. toolbox talks;
- g.** Arrangements for consulting the workforce on health and safety matters;
- h.** Individual worker's responsibility for health and safety.

Induction should also be provided to those who do not regularly work on the site, but who visit it on an occasional (e.g. professional team, client). The inductions should be proportionate to the nature of the visit.

16.0 MEDICAL FITNESS EXAMINATION AND TESTING

Ensure all workers on site undergo medical fitness examination and testing by an occupational medical practitioner or an occupational health nurse. Medical certificate of fitness has to be issued in the form of annexure 3 incorporated in Construction Regulation 2014.

17.0 HOUSEKEEPING ON CONSTRUCTION SITE

Project site supervisor will ensure that: - Suitable housekeeping is implemented to prevent possible risks to workers and pedestrians including provision for the:

- Proper storage of material and equipment; and
- Removal of waste and materials at appropriate intervals
- No loose material will be accumulating on site so as to obstruct means of access to and egress from workplaces and passageway.
- Remove all waste regularly to prevent accumulation of rubbish.
- Ensure danger or caution tape where excavations/trenches could present a hazard.

18.0 SAFETY NOTICES AND SIGNS

18.1 Display of safety signs

In compliance with section 2B of the General Safety Regulations, 1986 and section 44 of the Occupational Health and Safety Act, 1993, safety notices and signage/s will be provided and displayed.

18.2 Admittance of persons

In compliance with the General Safety Regulations, 1986, in the interests of health and safety, we shall post up notices to work areas prohibiting the entry of unauthorized persons to work areas. Risks to any person who wishes to enter or remain at such workplace without the permission of the employer shall be controlled.

The following measures will be employed, should we find ourselves in a situation where we have to allow entry of a person to a risky area without choice:

- Cooperate with an instruction from the client;
- Seek guidance to the most relevant person;
- Record the conversation for future reference;
- Pause with a risky activity;
- Safeguard work equipment prior to entry of a person;
- Guide entry of a person to whom site supervisors shall allow entry;

- Guide exit of a person to whom entry to a risky area was allowed.

19.0 MANAGEMENT OF EMERGENCIES ON CONSTRUCTION SITE

19.1 First aid

There shall be provision and access to adequate first aid treatment at the construction. And in compliance with the General Safety Regulations 2003, the following will be provided:

- Nomination and appointment of a trained first aid personnel;
- Communication and sharing of details of first aid personnel; and
- Provision of a regulation 3 first aid kit.

19.2 Emergency Procedures

Emergency and evacuation procedures have been documented and they will be communicated to site workers during induction training. Workers will acquaint themselves with emergency and evacuation procedures available in the safety file.

19.3 Emergency Contact Numbers

An emergency telephone number list must be prominently displayed in a common wall; alternatively the list will be kept in the site safety file. Emergency contact numbers have been provided for the local municipality. Appendix-C provides emergency contact numbers (internal) and external that provides details for all Municipalities where we are operating.

20.0 EMERGENCY PREPAREDNESS AND MANAGEMENT

Possible emergencies that are likely to occur on site such as the following must be identified so that proper procedures and a related plan is prepared and communicated to the site staff

- Delivery vehicle crashing into the premises;
- Chemical spillages;
- Accidental flooding of the work areas;
- Arson;
- Community disruptions;

Suitable and experienced personnel have to be nominated to supervise and coordinate all emergencies. Nominated personnel shall have access to a senior manager.

20.1 Emergency procedures

Health and safety officer must ensure the following measures are put in place:

- There is adequate access for emergency services;
- Suitable arrangements for treating and recovering injured people are set;
- There are arrangements for calling fire and rescue services;
- All workers are familiar with emergency assembly points;
- Emergency contact numbers have been communicated and shared to all workers;
- Everyone one knows what signal will be given for an emergency and knows what to do.

20.2 Assembly and roll call

Workers shall observe client's assembly points which are currently established on the site facilities in the event of evacuation.

21.0 INCIDENT MANAGEMENT

21.1 Incident reporting

Any incident which results in injury to any person or damage to any equipment or property affecting or involving the company and its workers and all accidents in the company premises will be reported to the Construction Manager who will record the incident. On the spot collection of factual information (location, witnesses, measurement, parties involved, police and fire brigade services, hospital, photographs where possible) will be the responsibility of the safety officer and construction supervisor concerned.

Any incident on a construction site will be reported immediately to the relevant person in charge and to the Construction Manager on return to the office.

21.2 Incident investigation

Injuries:

All injuries are reported to the designated first aid officer in the workplace.

First Aid:

Personnel record all injuries on the register of injuries. Where the injury requires medical attention or off site treatment, assistant site manager will complete an incident investigation report.

Copies of incident investigation reports will be provided to the health & safety committee.

Incidents:

For all incidents involving near misses, property/plant damage or injury to the public or environmental damage, health & safety officer will investigate and records the details in an incident investigation report.

Copies of incident investigation reports will be provided to the health & safety committee.

Notifiable Incidents:

Construction manager will report all notifiable incidents to the relevant authority. And when a notifiable incident has occurred, construction manager will consider whether the site needs to be preserved for investigation by the relevant authority.

Record Keeping:

We shall keep records of incidents and injuries in accordance with statutory requirements.

21.3 Accident Reporting

Any incident which results in injury to any person or damage to any equipment or property affecting or involving the company and its staff and all accidents in the company premises have to be reported to the Construction Manager who will record the incident. On the spot collection of factual information (location, witnesses, measurement, parties involved, police and fire brigade services, hospital, photographs where possible) shall be the responsibility of the Safety Officer or Construction Supervisor concerned.

Any accident on a construction site has to be reported immediately to the relevant person in charge and to the Construction Manager on return to the office.

21.4 Occupational Disease / Conditions

Occupational diseases must be reported and recorded as prescribed by the Compensation for Occupational Injuries and Diseases Act.

22.0 MEDICAL CERTIFICATE OF FITNESS

In compliance with section 7 of the Construction Regulations 2014, all site workers will be in possession of valid certificate of medical fitness.

23.0 LEGAL COMPLIANCE AUDITS

In compliance with section 7 of the Construction Regulations 2014, and as prescribed by the client periodic audits will be scheduled and conducted. A schedule will be concluded once the site works starts.

24.0 ENVIRONMENTAL MANAGEMENT

Pressure on natural resources, including land, has continuously increased, as the population increases and likewise, awareness of the need to lessen the negative impacts of development and construction on the environment will continue to increase. Efforts must be made to avoid negative impact on the areas surrounding the project. Waste materials will have to be disposed off at an approved disposal site.

25.0 SAFE WORKING PROCEDURES

A programme of safe work procedures shall be embarked on, starting with those identified during the hazard identification and risk assessment. Where reasonable and practicable steps will be taken to ensure the work, activities are safe. Safe work procedures have been documented.

26.0 PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

Risk assessment informs on the required PPE. All items to be issued will have to be maintained in good working order i.e. serviced and repaired as and when necessary. Items of PPE are to be provided free of charge and for the personal use of site workers. It is expected that items of PPE will be used as prescribed. Workers have to be provided with the necessary training in the use and care of the items.

27.0 PROJECT / SITE SECURITY

27.1 Barricading and maintenance

Adequate and suitable barricading has to be erected and maintained to prevent unauthorized entry as well as to control access onto and from the site. Construction signage will be strategically positioned at the entrance of the site.

27.2 Access control

Control of access to the construction has to be implemented and assistant site manager and supervisor shall advice on the best way to manage the access to and egress from the construction area.

28. NON- CONFORMANCES

The Principal Contractor may be penalized for critical and / or repeat non-conformances with the requirements of this specification, the Principal Contractor's health and safety plan and current health and safety legislation. Penalties shall be in the form of monetary value or workstoppage or both. Penalties of monetary value shall be at the discretion of the CHSA, after consultation with the Client / Consulting Engineer or Architect.

29. PROJECT CLOSE OUT REQUIREMENTS

The documentation submitted and approved following the awarding of the contract will be used to form the H&S file. On completion of the project, a consolidated health and safety file consisting of the following documents but not limited to, shall be submitted to the client appointed CHSA:

- The H&S Plan and the approval by Client.
- PC Appointment Letter.
- Mandatory Agreement with Client.
- Construction Work Permit from DEL.
- Record of Competencies (CVs) and appointments.
- Training Records.
- Method statements.
- Risk assessments.
- Safe work procedures.
- Emergency and Injury Management (Accident Stats and Investigations);
- Medical surveillance records.
- Registers and Checklist.
- Internal H&S Audit Reports
- Contractor H&S Audit Reports.
- Non-Conformance Reports; and
- Any other documents which may be required by the appointed CHSA.

The file must be submitted in an electronic copy stored on a flash drive and must be arranged chronologically in folders and subfolders where necessary.

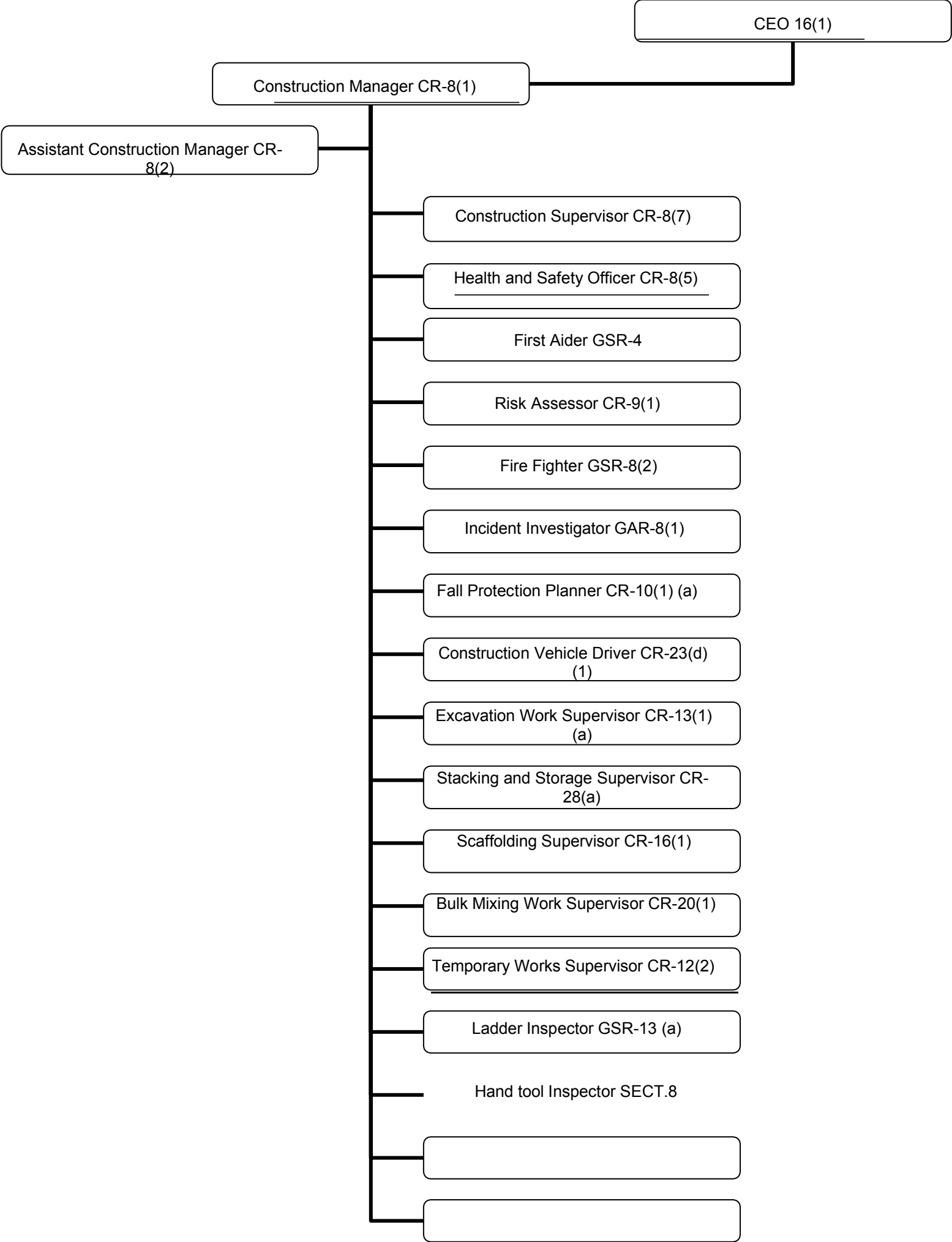
NOTE TO PRINCIPAL CONTRACTORS AND THEIR SUB-CONTRACTORS

The OHS specifications are Department of Public Works and Infrastructure's minimum requirements. The contractor is expected to develop a Health and Safety Plan which meets these requirements contained herein, as well as all the relevant applicable legislation and methods to be used in the execution of the works. Department of Public Works and Infrastructure in no way assumes the Contractors legal responsibilities. The Contractor is and remains accountable for the quality and the execution of his Safety, Health and Environmental programme, and that of any Contractors and Suppliers. This OHS specification reflects minimum requirements and should not be construed as all-encompassing or fixed in terms of this or other amendments made during the project.

ANNEXURE A: RISK MATRIX

Tasks/activities	Hazards identified	Risks	Persons at risk	Likelihood use 5 = Almost Certain 4 = Likely 3 = Possible 2 = Unlikely 1 = Rare	Consequence use 5 = Terminal 4 = Major 3 = Moderate 2 = Minor 1 = Negligible	Likelihood x Consequence	Risk class	Control measures	Responsible person

ANNEXURE B: HEALTH AND SAFETY ORGANOGRAM



ANNEXURE C: EMERGENCY CONTACT NUMBERS

EMERGENCY CONTACT INFORMATION			
Service Centre	Contact	Address / Location	Telephone
Ambulance	-	-	112 Vodacom 112 Cell C 112 Mtn
Police			
Electrical Services			
Water Services			
Primary Medical Facilities			
Disaster			
Poison Information centre	-	-	

Annexure D – Annexure 1

OCCUPATIONAL HEALTH AND SAFETY ACT, 1993

(Regulation 3 (2) of the Construction Regulations, 2014)

APPLICATION FOR A PERMIT TO DO CONSTRUCTION WORK

This application must be submitted with the following documents:

1. Health and Safety Specification.
2. Health and Safety Plan.
3. Baseline Risk Assessment.

Name, postal address and telephone numbers of the client:

Details of the Agent:

1. Title, Surname and Initials:
2. Identity number / Passport number:
3. Registration number with SACPCMP:
4. Office Tel. number and/or Mobile number:
5. Postal address:

Name, postal address and telephone numbers of the appointed principal contractor:

Name, postal address and telephone numbers of designer of the project:

Name, postal address and telephone numbers of the following persons:

1. Construction Manager:
2. Construction Health and Safety Manager:
3. Construction Health and Safety Officer:

Exact physical address of the construction and the site office:

ANNEXURE E – OHS REQUIREMENTS

OCCUPATIONAL HEALTH AND SAFETY ACT OF 1993 AND CONSTRUCTION REGULATIONS 2014 REQUIREMENTS:

- Your attention is drawn to “General Duties of Employers to their Employees” as required by Section 8 of the Act.

You are required to:

- Sign a written “Agreement with Mandatary” as required by Sect 37(1)(2) of the Act before commencing any work on site.
- Ensure that all your employees receive the necessary Induction Training and have proof thereof.
- Note: You must ensure that all employees under your control are informed, instructed, and trained by a competent person regarding any hazard and the related work procedures before any work commences.
- Ensure the provision of Welfare Facilities for your employees as per Construction Regulation 28.
- Provide the Client/Principal Contractor with your SHE Plan and Specifications
- Ensure that Method Statements, Risk Assessments and Safe Work Procedures are done and available.
- Provide the Client/Principal Contractor with written appointment of the person who is going to supervise the Construction Work per Construction Reg. 8
- Provide the Client/Principal Contractor with written designation of your nominated Health and Safety Representative as per Section 17(1).
- Note: Your Health and Safety Representative will be expected to attend the Client/Principal Contractor safety meetings.
- If you employ more than five (5) persons, you are required to provide your own First Aid Box (GSR 3(2)).
- If you employ more than ten (10) persons, you are required to provide your own qualified First Aider as per GSR 3(4) Note: If you have difficulty in complying with items 2.7 and 2.8 above, you may arrange/come to an agreement with the Client/Principal Contractor to make use of his First Aid facilities in case of injury. You will be expected to communicate such an agreement to your employees.
- Asbestos Abatement Regulations
- Hazardous Chemical Agents Regulations
- When using a Materials Hoist, comply with the requirements of Construction Reg. 19.
- When using Lifting Machines and Lifting Tackle, comply with DMR 19
- Note: You may be required to appoint a Banksman to control Lifting/Slinging operations
- When erecting/using Scaffolding comply with the requirements of SANS/0085 “Access Scaffolding”

- When doing Demolition Work, comply with Construction Reg. 14
- When doing blasting to comply with Explosives Regulations Chapter 10
- When doing Excavation Work, comply with Construction Reg. 13
- When doing Electrical Installations, comply with the requirements of Construction Reg. 24 Note: Electrician to provide copy of registration as per Elect. Install. Reg. 9(3)
- When using Construction Vehicles, comply with Construction Reg. 23
- When using/erecting Support/Form Work, comply with Construction Reg. 12
- When working over or in close proximity to Water, comply with Construction Reg. 26
- Ensure that good Housekeeping, Stacking and Storage principles are applied on this project as per Construction Reg. 27 and 28
- Ensure that appropriate measures are taken to avoid the risk of Fire/Explosion and comply with requirements of Construction Reg. 29
- If you are going to work at heights a Fall Protection Plan must be submitted (roof work included) as per requirements of Construction Reg. 8
- When using Explosive Powered Tools, comply with GSR 19
- When Welding, Flame Cutting/Soldering, comply with GSR 9
- When working in Confined Spaces, comply with GSR 5
- You are responsible for providing your own legal safety documents and registers to comply with the Act's requirements a copy of the OHS Act of 1993 and the Construction Regulations ;2003 will be available for perusal in the Principal Contractor's site office.
- You are required to comply with General Safety Regulations 2(1) to (7) and provide your employees with: personal protective equipment which will allow them to carry out their work in a safe manner, e.g. hard hats, safety harnesses, gloves, safe footwear, eye protection, ear protection, waterproof clothing etc.
- Reporting of Incidents of Occupational Diseases shall be done as per General Admin. Regulation 8 (Also see Sect 24 of the Act)
- Compensation for Occupational Injuries and Diseases Act (No 130 of 1993) You are required to provide the Client/Principal Contractor with proof of registration with the Compensation Commissioner/Federated Employer(s) Mutual when signing this agreement. If you are not registered, the Client/Principal Contractor may deduct the necessary amounts from your progress payments and pay it over to the Commissioner to ensure that you are insured. See Section 80 and 89 of the COID Act.

OCCUPATIONAL HEALTH & SAFETY ACT 85 OF 1993

Construction Regulations 2014

MEDICAL CERTIFICATE OF FITNESS

Name of Employee: _____ ID Number _____ Co. Number _____

	* Possible Exposures e.g. Noise, heat, fall risk, confined space, etc.																* Job Specific Requirements Operating mobile crane, digging trenches, erecting formwork and support work, etc.										*Protective Equipment e.g. Dust respirator (light duty), welding gloves, etc.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
*Occupation e.g. General worker, welder, bricklayer, Steel fixer, mobile crane operator, etc.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															

***The Employer to complete the information in the spaces marked with an * before sending the Employee for a medical examination**

Declaration by the Medical Examiner:

I certify that I have, by examination and testing, using the above criteria specified by the employer, satisfied myself that the abovementioned employee is fit to perform the duties as described by the employer in the matrix above.

Occupational Medicine Practitioner / Occupational Health Nursing Practitioner: (Please print name)

Signature _____ Practice Number: _____ Date: _____

Address: _____

THE END

OCCUPATIONAL HEALTH & SAFETY ACT 85 OF 1993

Construction Regulations 2014

MEDICAL CERTIFICATE OF FITNESS

Name of Employee: _____ ID Number _____ Co. Number _____

	* Possible Exposures e.g. Noise, heat, fall risk, confined space, etc.																* Job Specific Requirements Operating mobile crane, digging trenches, erecting formwork and support work, etc.										*Protective Equipment e.g. Dust respirator (light duty), welding gloves, etc.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
*Occupation e.g. General worker, welder, bricklayer, Steel fixer, mobile crane operator, etc.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														

***The Employer to complete the information in the spaces marked with an * before sending the Employee for a medical examination**

Declaration by the Medical Examiner:

I certify that I have, by examination and testing, using the above criteria specified by the employer, satisfied myself that the abovementioned employee is fit to perform the duties as described by the employer in the matrix above.

Occupational Medicine Practitioner / Occupational Health Nursing Practitioner: (Please print name)

Signature _____ Practice Number: _____ Date: _____

Address: _____

THE END