SECTION C (Addendum 1)

SERIES 600: ELECTRICAL INSTALLATION

01. SCOPE OF CONTRACT

The Contract provides for the supply, delivery to site, installation, testing, commissioning, maintenance for a period of twelve months and handing over in good working order of the complete electrical installation as specified or implied herein.

In general, the Contract includes the following:

a. New motor control centres on the plant.

b. Dismantling, removal and handing over to the Council of existing motor control centres.

c. Site lighting system.

d. Flowmeter.

e. Cables associated with the alterations and additions to the plant.

f. Lightning protection system.

02. DRAWINGS

None

03. STANDARDS

All material and equipment supplied and/or installed under this contract shall be new and the best of their respective kinds shall comply with the requirements laid down in the latest editions of the relevant SABS or BS and their amendments (if any) and the requirements of this specification.

In event of items bearing the SABS mark being available in respect of the materials and equipment required, only items bearing this mark will be acceptable.

The workmanship under this contract shall be of a high standard and to the satisfaction of the Engineer.

The work shall be carried out in accordance with the general requirements laid down in this document.

04. TIME FOR COMPLETION AND PENALTIES

Time for completion and rate of progress

The electrical contract must be completed and handed over in accordance with the time schedule for the Civil program.

Should the Engineer at any time be of the opinion that the rate of progress of the works or any part thereof is too slow to ensure the completion of the works according to contract he shall so notify the contractor in writing and the contractor shall thereupon, with the approval of the Engineer, take steps to expedite progress. Failure by the contractor to comply with the Engineer's instructions shall entitle the employer to take the remedies as provided for in the document.

05. PENALTIES

Refer to the relevant clause of this document.

06. RADIO AND TV INTERFERENCES

All equipment installed under this contract shall comply with the Government Notice No. R.2246 and any other applicable rules and regulations in respect of radio and TV interferences. Any equipment found producing interference subsequent to commissioning, shall be suppressed or replaced to the satisfaction of the Engineer without any additional cost.

07. REGULATIONS

The work shall be carried out strictly in accordance with and all material and equipment supplied shall comply with the following laws and regulations where applicable:

a) the latest edition of the "Code of Practice for the Wiring of Premises", SABS 0142, as amended;

b) The Occupational Health and Safety Act No. 85 of 1993;

c) the "Electricity Supply By-Laws and Regulations" of the Supply Authority;

d) the local Fire-Office Regulations;

e) the Post Office Regulations;

f) the Acts and Regulations applicable to the use of explosives; and

g) "The Code of Practice for the Installation and Maintenance of Electrical Equipment used in Explosive Atmospheres" (SABS 086).

The contractor will be responsible for serving all notices and paying all fees due in terms of the above laws and regulations.

08. LOCAL SYSTEM AND OPERATING CONDITIONS

All materials and equipment supplied and/or installed under this contract shall be suitable for satisfactory operation and shall have prescribed characteristics under the following conditions:

HT system conditions: 11 000 Volt, 3-phase, 3-wire 50 Hz, AC system with the star point solidly earthed.

HT system conditions: 400/231 Volt, 3-phase, 4-wire 50 Hz, AC system with a solidly earthed neutral.

Maximum ambient temperature: 40°C

Minimum ambient temperature: -5°C

24 Hour average maximum temperature: 35C

Altitude, a.m.s.l.: 1 080 m

Humidity: Up to saturation point

Atmosphere: Dusty and highly corrosive; organic acids from sewage works.

Solar: Long periods of sunshine giving rise to high temperatures in enclosed outdoor housings; high breakdown incidence due to effect of ultra violet rays of outdoor synthetic materials.

Lightning: A high lightning rate is encountered.

It must be noted that severe voltage surges and/or spikes may be experienced on the electricity supply system due to lightning or switching operations and where necessary the contractor shall provide the necessary protective devices against such surges and spikes for the equipment supplied and installed by him with special reference to electronic devices.

09. SUPPLY OF ELECTRICITY

A 400/231 Volt 3-phase supply is available on site. A 100kVA pole mounted transformer as indicated on the drawings is the existing point of supply to the site.

10. EXISTING UNDERGROUND SERVICES

In event of an accidental interruption of existing services caused by the Contractor or any of his employees, the Contractor shall immediately take the matter in hand and ensure that the service is restored in the shortest possible time.

Any damage to existing services and/or equipment by the Contractor or his employees, shall be repaired or replaced on the Contractor's account.

11. INTERRUPTION OF SUPPLY AND HAMPERING OF ACTIVITIES

The Contractor shall arrange his programme of work and activities in such a way that interruption of supply to the various sections and hampering of activities on site are limited to the absolute minimum.

The Contractor shall collaborate very closely with the official in charge of the purification works and with any other Contractor on site.

In event of an interruption of supply to any item of plant or equipment being unavoidable, the Contractor shall make arrangements for such an interruption with the official in charge, in good time.

In event of an accidental interruption of supply caused by the Contractor or any of his employees the Contractor shall immediately take the matter in hand and ensure that the supply is restored in the shortest possible time. Any damage to existing cables and equipment by the Contractor or his employees shall be repaired or replaced on the Contractor's account.

12. MATERIALS AND EQUIPMENT RECOVERED

All materials and equipment recovered under this Contract remains the property of the Employer and shall, unless expressly otherwise agreed, be handed to the Employer's official in charge at their stores department for storage and safekeeping.

All materials and equipment to be recovered under this Contract shall be handled with care in order to prevent undue damage thereto. The Contractor will be held responsible for and shall make good to the satisfaction of the Engineer any damage to such materials and equipment caused by carelessness and/or negligence on his part of any of his Employees.

Existing underground cables becoming redundant shall only be recovered if practical and then only those sections uncovered by new trenches. All other redundant cables, if any, shall be sealed at both ends and left in the ground.

13. CABLE DUCTS AND WIRING CHANNELS

Where cables cross under existing roads the prescribed cable pipes will have to be provided and installed by the Electrical Contractor.

Where cables cross below other services, the Electrical Contractor must provide and install the necessary pipe ducts.

Wiring channels, where necessary as provided for in Schedule of Prices must be supplied and installed by the Electrical Contractor.

14. GENERAL SPECIFICATION FOR THE EXECUTION OF THE WORK

14.1 MULTICORE CABLES AND EARTHWIRES

Up to 1 kV cables

All multicore cables used on this contract shall comply with the requirements laid down in SABS 1507 - 1990 as amended to date for PVC SWA PVC cables with copper conductors and insulated for 600/1000 volt grade.

Cables for status and analog signals shall consist of the requisite size and number of copper twisted pairs, individually and overall screened, PVC sheathed, steel wire armoured, and PVC covered, complying with the requirements of SABS 1507 where applicable.

Cables and earth wires for a specific application shall be selected strictly in accordance with the requirements laid down in SABS 0142 in respect of current rating and voltage drop. Where practicable the earth continuity conductor shall form an integral part of the cable.

14.2 JOINTING OF CABLES

Joints will only be allowed where more than one full drum length of cable is necessary to complete a specific circuit and must be restricted to the absolute minimum. All joints shall be made to the best practice by competent cable jointers using first class material. The contractor shall maintain the electrical continuity of the armouring in an approved manner at all straight through joints.

a) Low voltage power and control cables

Joints shall only be allowed where more than one drum length of cable is necessary to complete a specific circuit.

The jointing kit shall be equal and similar to Raychem heat-shrinkable joints for cables up to 1kV.

The joints shall be made to the manufacturer's instructions and with materials stipulated in such instructions.

14.3 TERMINATION OF MULTICORE CABLES

Cables are to be terminated with cable glands manufactured of bronze and comprising a barrel with sealing washer and bushnut screwed into one end and a compression nipple with wire clamping ring screwed onto the other end. The opposite end of the compression nipple must have a male electrical thread with locknut. The glands shall be suitably sized for the relevant cables, be of the adjustable type complete with armour clamps and with watertight neoprene shrouds.

Cable terminating glands for outdoor use shall be provided with waterproofing inner seals as well as waterproofing seals on nipples. Cable armouring shall be earthed at each end but may not be used as earth continuity conductor.

14.4 DISTRIBUTION AND MOTOR CONTROL BOARDS

14.4.1. Indoor floor standing distribution and motor control boards

a) Construction

The board shall be designed for front access only unless stated otherwise in the schedules.

The board shall be of the free-standing floor mounted cubicle type with IP 55 insect proofed enclosure, constructed of at least 2 mm mild steel on a rigid channel iron or similar frame, and shall be bolted down in position by means of M16 high tensile stainless-steel bolts grouted into the concrete floor of the pump station building. The bolts shall be inside the board.

The overall height of the board shall not exceed 2,00m and the overall depth shall not be less than 450 mm and shall not exceed 0,6m. The construction of the board shall be such that future extension panels may be fitted on both sides and alterations can be done without major changes to the board. (Modular construction will be preferred.)

The board shall be provided with readily removable covers on the sides and hinged panels on the front.

All removable covers shall be provided with chromium plated handles to facilitate, removal. These covers shall be suitably braced and re-inforced to ensure rigidity.

All hinged panels shall be re-inforced to ensure rigidity and shall be provided with heavy duty rust proof hinges.

These panels shall also be provided with chromium plated knobs or handles.

Each door shall be supplied with completely concealed hinges, each fastened with not less than four (two on each side) brass bolts and nuts. 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.

The doors shall be provided with a locking system suitable for padlocking. The locking system shall consists of a 3-way locking mechanism locking the door at the top, middle and bottom.

All switchgear, instruments and equipment for the control of any specific motor or other electrical device, shall be mounted flush behind a common hinged panel, with only operating handles, push buttons and instrument faces protruding through neatly machine punched holes in the panel.

The board shall be provided with a readily removable, rigidly supported hot dipped galvanised cable end support along the entire length of the board and at least 230 mm above floor level.

Space shall be provided for future switchgear and equipment where specified.

The board shall be suitably sized to accommodate without cramping, all the switchgear and equipment specified.

Screwed-on engraved labels in English shall be provided below all switchgear and equipment on the panels, to facilitate identification.

The board shall be provided with one set of four solid, copper busbars in the top section and extending over the entire length of the board. Provision shall be made at the end of each busbar for future extensions.

Busbars shall comply with the requirements of BSS 1433 and the relevant clauses of BSS 159.

Busbars shall be rigidly supported at suitable intervals to prevent undue damage resulting under short circuit conditions. Ceramic or other approved busbar insulators shall be used. The busbars shall be arranged horizontally with the longer sides of the cross-sections in the vertical plane and one behind the other, in the horizontal plane, at 90 mm centres.

Busbars shall be clearly and indelibly marked Red, White and Blue for the three phases and Black for Neutral.

Connections to busbars shall be effected by means of cable lugs and suitably sized cadmium-plated, high tensile steel bolts and nuts with cadmium-plated cup washers or lock washers.

All screws, studs, bolts, nuts and washers used for these boards shall be Grade 304 Stainless Steel. The use of self-tapping screws will not be permissible. A solid copper earthbar shall be provided inside the board at the back and along the entire length, at a height of approximately 0,6 m above floor level.

The earthbar shall have a cross-section of 150 mm².

a) The earthbars shall be drilled and provided with the required number of 6 mm dia and 10 mm dia cadmiumplated, high tensile steel bolts and nuts, complete with cadmium-plated washers and cup washers or lock washers, for making the earth connections. The earthing positions shall be evenly spaced along the entire length of each busbar.

Paint finishes for electrical materials and equipment

a) The paint finishes for electrical materials and equipment where applicable shall strictly comply with the quality specification, of the corrosion protection specification obtainable from Messrs. Wates, Meiring and Barnard Inc.

Internal wiring

a) The internal wiring of the boards shall consist of coloured PVC-insulated conductors of adequate copper cross-section, which shall be neatly installed horizontally and vertically and bunched where possible by means of perforated plastic tape. (String will not be acceptable). Numbered ferrules of an approved type, shall be provided on each end of each wire, to facilitate the tracing of circuits.

b) Where electronic equipment such as transmitting I/O units are incorporated in a distribution- and motor control board, this equipment shall be installed in a separate and special compartment.

c) Sufficient room shall be provided for the rail mounted terminal strips, equal and similar to Klippon Type SAKR, which will be supplied and installed by the monitor and control system contractor.

The door must be labelled: "ELECTRONIC EQUIPMENT".

Labelling of Switchboards and Motor Control Boards

a) A screwed on engraved label of the black on white "trefolite" type shall be provided below each item of equipment on the front panel of each board as well as on the chassis in close proximity to the relevant equipment to identify such equipment in the English language in 6 mm high lettering.
b) Each board shall further be provided with a screwed on reverse engraved yellow perspex nameplate with black 20 mm high lettering to identify the board in the English language on the outside of the door at the top thereof.

14.4.2 Outdoor distribution- and motor control boards

The outdoor motor control boards shall be of the grade 304 stainless steel cubicle type complying with the specification for indoor boards, but shall be not more than 1 500 mm high.

Where electronic equipment such as transmitting I/O units are incorporated in a distribution- and motor control board, this equipment shall be installed in a separate and special compartment.

Sufficient room shall be provided for the rail mounted terminal strips, equal and similar to Klippon Type SAKR, which will be supplied and installed by the monitor and control system contractor.

This compartment shall consist of a outer and inner shell with at least 10 mm insulation or polystyrene

between the inner and outer shell all round to keep the temperature inside the compartment at least 5 ° C below the temperature surrounding the compartment in summer.

The doors of this compartment must also be of a double wall construction with insulation or polystyrene between the two walls. The door must be labelled:

"Electronic Equipment".

Sufficient provision for breathing and heat dissipation must be made in this compartment.

14.4.3 Control board components

a) Isolators

All isolators shall be of the "Load-breaking" and "fault making" type and shall comply with the requirements of BS 5419-1977 where applicable. Where relevant, isolators shall be provided with auxiliary contacts for signal purposes.

b) Fused switches

All fused switches shall be of the "load-breaking" and "fault-making" type complying with BS-5419 where applicable and fitted with HRC cartridge fused links to BSS-88. Auxiliary contacts shall be provided where relevant for signal purposes.

c) Moulded case circuit breaker

All moulded case circuit breakers shall comply with the requirements of SABS specification No 156-1977 and shall be equal and similar to CBI manufacture.

These circuit breakers shall be fitted with copper terminal collector bars where more than one cable tail has to be terminated on the same terminal.

400 Volt air-break contactors

All contactors shall be of the totally enclosed, three pole, double air break per pole, automatic magnetic type complying with the requirements of IEC 158-1 for Class AC 3 contactors of Intermittent Duty Class 0,3.

All contactors shall be provided with arc extinguisher and readily replaceable silver or silver-alloy contacts rated for at least 2-million "on" and "off" switching operations at rated current.

Each contactor shall be provided with a 230 Volt, 50 Hz closing coil suitable for continuous operation and at least 15 closing operations per hour.

An adequate number of auxiliary contacts shall be fitted.

The contactor may not hum or chatter in service and the contacts may not bounce on closing.

Direct-on-Line starters

These starters shall be of the manually operated (locally and remotely) type and each starter shall be contained in its own separate compartment on the relevant motor control board.

Each of these units shall comprise amongst other the following components:

- Only mains fused switch connected to the busbars of the board and interlocked with the door of the compartment to prevent opening of the door with the switch closed and to prevent closing of the switch with the door open.
- Set of HRC control fused links with carriers and basis;

All necessary relays as required;

- Only mains contactor;
- Set of START and STOP push buttons;
- Only mains operated timing device to limit starts to 15 starts per hour; and
- Only power factor correction capacitor unit for motors of 5 kW and more.

The following protective and indicating devices complete with the necessary suitably rated potential fuses, current transformers, test blocks and auxiliary relays;

- Only motor protection relay;
- Only motor under current relay (Where specified)
- Only instantaneous indicating ammeter for motor current;

Only ammeter selector switch for motors of 5 kW or more;

- Current transformers for motors of 5 kW or more;
- Only running hour meter;
- Only anti-dither circuit;
- Only anti-cycle timer; and
- Only thermistor relay for motors of 22kW or more
- Only blue indicator light to indicate the time delayed starting period
- Only indicator lights as follows:

Red - 'Supply on'; Green - 'Motor Running; and Amber - 'Motor Tripped';

It shall further be possible to trip and lock-out the starter by means of a remote stop button to be provided at the relevant motor.

Provision shall also be made for locking the mains fused switch handle in the OFF position.

d) Current transformers

All current transformers shall be of the air insulated type complying in all respects with the requirements laid down in BS 3938: 1973.

The contractor shall carefully select the ratio, burden and accuracy class to suit its specific application in accordance with the recommendations and requirements of BS 3938.

e) Indicating instruments

All indicating instruments shall comply with the requirements laid down in BS 89: Part I: 1970 for instruments of a 2,5 Accuracy Class. All indicating instruments shall have 96 mm square dials.
The maximum demand ammeters shall be of the 6amp combined maximum demand registering and instantaneous indicating type having MISC movement and thermal demand indication with an integrating time lag of 15 minutes. The ammeter scales shall be direct reading with a full-scale deflection corresponding to 120 % of the rated primary current of the relevant current transformer. Each ammeter shall be clearly and indelibly marked to indicate the colour of the phase to which it is connected.

The ammeters for motor starters shall be 5 amp instantaneous indicating meters with MISC movement and direct reading scales. The meters shall be able to withstand overcurrents resulting under starting conditions and the full load current of the relevant motor shall be clearly marked in red on the face of the meter.

Voltmeters shall be of the direct reading moving iron suppressed zero type.

The power factor meters shall indicate from 0,4 lagging to 0,8 leading.

The running hour meters shall have cyclometer dials indicating up to 5 digits and two decimals.

Instrument selector switch

A four-position rotary type instrument selector switch shall be mounted directly below the relevant instrument in such a way that only the selector knob and indicator plate are on the panel, and the switch itself is behind the panel.

The selector knob shall consist of bakelite, and shall have an arrow engraved on it, indicating the switch position.

The switch shall have a positively driven switching mechanism.

The indicator plate shall consist of bakelite and shall have the positions for the three phases and "OFF", engraved on it in 5 mm high lettering.

f) Power factor correction capacitors for 400 Volt motors

Each of these capacitors shall be of the indoor switchboard mounting 400 Volt 50 cps three phase self-contained type with a dead casing and shall fully comply with the requirements laid down in BS 1650-1971.

Each capacitor unit shall be of carefully selected rating to correct the power factor of its associated motor to 0,95 at full load and should not exceed a value which compensates for 85% of the no-load magnetising current.

The dielectric shall consist of plastic film and low-loss paper situated between aluminium foil and impregnated with a synthetic liquid agent with scavenger additive.

The capacitor losses shall not exceed 1 Watt/kV.Ar.

The capacitor units shall have the following admissible overloads at an ambient temperature of 40 ° C and an altitude 1080 m above sea level

10 % excess volts continuously.

50 % excess current continuously; and

30 % excess kVAr continuously.

Each of these capacitor units shall be provided with discharge resistors and a fuse for each winding element which will disconnect the affected element in event of a dielectric breakdown.

g) Indicator lights

All indicator lights shall be cluster light emitting diodes each consisting of at least a group of six light emitting diodes with lenses of the specified colours.

h) Auxiliary relays shall be adequately rated for their respective duties and shall be silent in operation. All switching relays shall be fitted with robust silver or silver alloy self-cleaning contacts which shall not bounce or chatter on closing and which shall be designed and manufactured to limit arcing, welding and pitting to an absolute minimum.

i) Earthleakage relays for low voltage distribution boards shall comply with the requirements of SABS 767 and shall have a sensitivity of 30 mA.

14.4.4 Information to be submitted with tenders in respect of the 400 Volt distribution boards and motor control boards. The following information shall be submitted with each tender in respect of all boards offered:

a) Full technical details and descriptive literature regarding all equipment and instruments offered;

b) Three paper prints of an outline drawing of each board indicating the main overall dimensions and general lay-out of the boards; and

c) Three paper prints of an outline drawing of the front-end processor cabinet indicating the main overall dimensions, general lay-out and type of material employed on the face of the panel.

14.4.5 Information to be submitted by the successful tenderer in respect of all boards. The successful tenderer shall submit three paper prints of each of the following drawings, in respect of each of the boards to the engineer for approval prior to manufacture:

j) Outline and general arrangement drawings, showing main overall dimensions and construction details;

ii) A wiring diagram; and

iii) A schematic line diagram.

Plastic transparent prints of the following drawings shall be supplied by the successful tenderer in respect of each of the final lay-outs of the boards.

a) Outline and general arrangement drawings of each board;

b) A wiring diagram of each board and mimic panel;

d) A schematic line diagram of each board;

e) A paper print of the schematic line diagram for that specific distribution board, shall be framed and installed behind glass in each of the switch rooms. These drawings shall be furnished on A2 prints; and

f) A paper print of the schematic line diagrams for each LT starter panel shall be installed behind perspex inside the door of each starter panel.

14.4.6 Testing of distribution/motor control boards at the manufacturer's works

Each distribution/motor control board shall be subjected to the following tests in the manufacturer's works after manufacture:

a) A thorough inspection shall be carried out to ensure compliance with the specification and approved drawings and wiring diagrams and to ascertain that all connections are properly made.

b) A high voltage test on all primary connections to check the insulation between phases mutually and between each phase and earth.

c) The polarities and ratios of all potential and current transformer shall be checked.

d) Primary and secondary injection tests shall be carried out on all switching, protection, metering interlocking and indication circuits.

The manufacturer shall submit three copies of test certificates giving details of conditions and results of tests carried out to the Engineer.

14.5 CONCRETE PLINTH FOR STARTER PANELS AND PEDESTALS

The plinth shall be cast 150 mm below as well as 150 mm above the ground level. It shall have neatly bevelled edges and shall be 75 mm wider than the panels all round.

An opening of sufficient width to allow for cable entry, shall be provided under the starter panels.

The grade 304 stainless steel foundation bolts for mounting of the panels shall be cast or grouted into the plinth. The plinth shall be in Class 20/19 concrete and shall be suitably re-inforced if necessary.

It is recommended that the casting of these foundations must be carried out by the Civil Contractor at the cost of the Contractor under this Contract in accordance with his instructions and under his supervision.

14.6 ELECTRONIC LEVEL CONTROL

The micro based electronic controllers which will be mounted in the starter panels shall be easy to calibrate and reliable in service.

The power units for all the pumps in a specific pump station shall be installed in a separate compartment of the starter panel and clearly labelled in accordance with the pumps it controls.

These level controls shall be designed to automatically select the pump sequence to ensure that all the pumps will at random be a duty pump.

Where only two pumps are controlled by a controller and one pump is always a standby pump, the standby pump shall automatically become the next duty pump after each duty cycle, unless one pump is taken down for service. When that occur, the duty pump shall remain on duty until the normal operation is restored.

When a pump selected for duty fails to respond to the start signal from the control, then the next duty pump shall automatically start-up after five minutes.

The level controller must also stop all the pumps, whether on manual or automatic selection, when the pump have reached a predetermined low level.

The transducers shall be designed to operate in air, been capsulated, of rugged construction and impervious to submergence.

The transducers shall, where possible, be installed at a point 500 mm away from a wall or pipe which may cause a false signal and at least 500 mm above maximum water level.

The coaxial cable between the transducer and power unit shall be of sufficient length to avoid any joints in this cable, as no joints will be permissible.

The grade 304 stainless steel mounting brackets must be provided and installed under this contract.

14.7 EMERGENCY STOP PUSH BUTTONS AND WEATHERPROOF ISOLATORS

Each of these units shall consist of a totally enclosed outdoor type heavy duty "push and turn to lock" stop push button station with a cable gland entry at the bottom to accommodate a 3 core 2,5 mm² LT PVC SWA PVC cable.

This push button station and weatherproof isolator shall be mounted on a rigid 1-meter-high grade 304 stainless steel pedestal with 2 mm radius rounded edges, designed to be bolted to a concrete floor. (Refer to the relevant drawing.)

An emergency stop push button station shall be installed where indicated near the coupling between each motor and its associated pump and shall be connected to the relevant starter panel via the specified cable to stop the motor.

The pedestal shall be securely bolted to the floor by means of stainless-steel foundation bolts grouted into the concrete and care shall be taken to ensure that it is installed plumb.

14.8 COVER PLATES

All switch boxes, plug boxes and draw boxes shall be provided with suitable enamelled steel cover plates. Colour to be to the approval of the engineer. All cover plates shall comply with the requirements of SABS 518 and shall be finished in baked enamel.

14.9 CONDUIT AND CONDUIT ACCESSORIES

All conduit and conduit accessories shall comply with the requirements of SABS 1065 Part 1 and 2 and shall bear the SABS mark.

All conduit and conduit accessories shall either be finished in black stove enamel on the inside as well as on the outside, or shall be hot-dip galvanised on the inside as well as on the outside, depending on the circumstances. All conduit fittings shall be of malleable cast iron, zinc base alloy or diecast fittings will not be acceptable.

Only brass bushes and bushnuts will be acceptable.

14.9.1 Standard 100 x 100 x 50 mm and 100 x 50 x 50 mm boxes

These boxes shall be heavy gauge, hot-dip galvanised, pressed steel boxes, complying with SABS 1084 and 1085.

14.9.2 Light switches

All light switches shall comply with the requirements of SABS 163 and shall be suitable for mounting in a standard 100 x 50 x 50 mm box.

The switches shall be equal and similar to Crabtree flush switches

14.9.3 PVC insulated conductors

These conductors shall be of high conductivity, stranded copper with Polyvinyl Chloride insulation of 600/1 000 volt grade, complying with the requirements of SABS 1507 and 1574.

14.9.4 Three phase and multipin plug outlets

Three phase plug outlets shall be of the 63 A, 380V, 5 pin units complete with plug and interlocked isolating switch.

These units shall be equal and similar to the WACO CEE Metal-Clad Industrial Plugs and socket type

The 7 pin plug outlets shall be of the 32 A, 7 pin units complete with plug and interlocked isolating switch.

14.9.5 Light fittings

All light fittings shall be complete with lamps and control equipment as prescribed.

Lamps for fluorescent fittings shall have a colour temperature of 3 000 oK unless otherwise specified.

Although catalogue numbers are used to describe the light fittings, equal and similar fittings will also be accepted.

Fluorescent light fittings shall conform to the requirements of SABS 1119 and SABS 890.

Where light fittings with filament lamps are used, the wiring between the terminal box and the lamp holder shall have heat resisting insulation.

14.10 SITE LIGHT POLES

The site light poles are specified in the detail specification.

14.11 LUMINAIRES

Luminaires are specified in the detail Specification.

14.12 CABLE RACKS

Cable racks shall be of the heavy-duty type, equal and similar to O-Line.

Cable racks shall be manufactured of at least 2,5 mm thick Grade 304 Stainless Steel, the height of the sides shall be 76 mm with the width as indicated on the drawings.

The cable racks shall be secured on suitable lengths which shall be suspended from the roof slab by means of suitable lengths 8 mm dia threaded Grade 304 Stainless Steel rods.

The threaded rods shall be secured to the roofslab with suitable sized Grade 304 Stainless Steel rawl bolts and shall be secured to the channel sections by means of two Stainless Steel nuts and washers.

4.13 LIGHTNING PROTECTION

a) Plant

The lightning protection of the lighting structures, poles and plant of the works, including all the buildings and handrails on the new plant, form part of this contract.

The lightning protection must be a SABS approved scheme and SABS approved drawings of the scheme

must be submitted to the Engineer.

b) Lightning arrestors

Tenderers shall allow in their tender prices for adequate protection of the equipment supplied and installed under this contract against direct as well as induced voltage surges and spikes which may be experienced on the system.

Surge arrestors shall be provided on each phase as well as neutral on the incoming power supply terminals of each board.

Electronic equipment shall be adequately protected on both the incoming and outgoing terminals by means of suitable arrestors compatible with the relevant equipment. Surge protection on all 4-20mA signal cables shall be equal and similar to measurement technology LTD. MTL 375 Lightning protection units and shall be installed on both ends of all 4-20mA signal cables.

Arrestors shall be of DEHN manufacture (as supplied by Pontins Earthing and Lightning Services (Pty.) Ltd.) or equal and similar therein.

All arrestors shall be connected directly to earth along the shortest possible route and only conductors of adequate rating for the discharge currents catered for shall be used for connections to arrestors.

Tenderers shall submit full particulars of the arrestors offered as well as written confirmation that it will provide adequate protection for the relevant equipment against possible voltage surges and spikes on the system.

14.14 EARTH CLAMPS

Earth clamps shall consist of 12 mm x 1,5 mm thick copper strap provided with a 25 mm² x 3 mm dia, brass bolt, nut and washers. The design of the clamp shall be such that it will fit snugly around the conduit without necessitating any extra packing.

14.15 CORROSION PROTECTION SPECIFICATION

Tenderers must obtain the latest edition of the publication "Standardised Corrosion Specification" from Messrs. Wates, Meiring and Barnard Inc. (Tel. 011 3150316). All equipment supplied under this contract must comply with the applicable clauses in the said publication.

14.16 CONCRETE CABLE SLABS

The cable slabs supplied and installed under this Contract shall be formed solidly out of concrete with steel reinforcing and shall have dimensions of 1 000 x 350 x 100 mm. Alternative block sizes will be considered. The following concrete mixture is desired:

1. Portland cement (dry) - 1 part per volume
2. Clean dry river sand - 3 parts per volume
3. Crushed stone (size 10 mm) - 6 parts per volume

14.16 PEDESTAL FOR EMERGENCY STOP STATIONS ONLY

14.17 PEDESTAL FOR OUTDOOR ISOLATORS ONLY

15. GENERAL SPECIFICATION FOR EXECUTION OF THE WORK

15.1 CONDUIT INSTALLATION

The conduit installation shall be carried out on the "loop- in" system and no conduit shall have a diameter of less than 20 mm. All conduit shall be built into walls, concrete ceilings etc, and no conduit will be allowed on the surface.

All conduit ends shall be reamered and all joints securely screwed together. No inspection bends or elbows will be allowed in the installation. Running joints may only be used where unavoidable and shall be provided with lock nuts. All screwed joints shall be thoroughly painted with "Red Lead" in order to prevent corrosion.

No conductor may be drawn into any conduit, unless all foreign materials, moisture and sharp edges have been removed.

In event of a conduit terminating in any sheet metal box, two lock nuts and a brass bush or one lock nut and a bushnut shall be used.

Standard round conduit boxes shall be used for light points and draw boxes. Draw boxes shall be provided with enamelled metal cover plates with brass screws.

Standard 100 x 50 x 50 mm hot dipped galvanised pressed steel boxes shall be used for all switch boxes.

Standard 100 x 100 x 50 mm hot-dipped galvanised pressed steel boxes shall be used for all plug boxes and telephone outlets.

Expansion boxes shall be provided at all expansion joints in the building. Such expansion box shall comprise a flush hot dipped galvanised sheet steel box with blank enamelled steel cover plate secured in position by means of brass screws. The conduit on the one side shall be securely fixed to the box, while the conduit on the other side shall be able to move freely in the box in order to provide for movement of the building. The conduit on the one side shall be bonded to that on the other side inside the box by means of flexible copper connections with clamps, bolts and nuts, in order to ensure earth continuity.

The conduit shall be installed in the concrete ceilings along the shortest possible routes, with the cover plates of draw boxes on the final ceiling surface. Conduit shall be installed as near as possible to the neutral axis of concrete beams, slabs and columns and deep conduit boxes shall be used.

All unwired conduits shall be equipped with Grade 304 Stainless Steel draw wires with at least 200 mm ends on each end of the conduit. The ends of the draw wire shall be neatly coiled in the drawboxes.

15.2 WIRING OF CIRCUITS

The wiring of circuits shall be carried out on the "loop-in" system and no jointing of conductors in conduit runs or cutting away of wire strands will be permissible.

Connectors for use in conduit boxes shall be of the heavy brass terminal type mounted in porcelain insulators.

All plug circuits shall consist of 2 x 4 mm² PVC insulated conductors plus 1 x 2,5 mm² bare copper earth wire in 20 mm dia conduit.

All lighting circuits shall consist of 1,5 mm² PVC insulated conductors in 20 mm conduit. For fluorescent lights an additional 2,5 mm² bare copper earth wire shall be provided and thoroughly bonded to each fitting.

Connections between lampholders of incandescent fittings and the conduit boxes shall consist of asbestos insulated wire or other approved heat resistant conductors.

15.3 INSTALLATION OF MULTICORE CABLES

15.3.1 Cable trenches

The contractor will be responsible for the excavation, bedding, back-filling, consolidating and making good of all cable trenches along the routes indicated on the drawings, with the exception of those sections of the cable routes where it is specifically indicated on the accompanying drawings that open cable ducts will be provided by others. Ducts inside new buildings will be provided by others. The Contractor however will be responsible for the bedding and filling soil in cable ducts. A sealing screed to cover the cable duct shall be provided under this contract and shall be done by an approved sub-contractor to the satisfaction of the engineer.

NOTE: Tenderers shall acquaint themselves fully with the nature and formation of the ground in which the cables are to be laid, before submitting a tender. No subsequent claim for extras due to lack of knowledge in this respect will be entertained by the Council.

Cable trenches for L.T. power and lighting cables shall be deep enough to facilitate the laying of these cables at a depth of 750 mm below final ground level.

Trenches for H.T. power cables shall be deep enough to facilitate the laying of these cables at a depth of 1 m below ground level. The floors of all cable trenches shall be smooth and free from boulders and sharp rock projections.

Plastic danger tape shall be installed in all cable trenches 300 mm above the cables for cable protection during future excavations.

Each cable shall be laid in a bedding of river sand or sifted soil 75 mm over and 75 mm below the cable - clayish soil will not be accepted as bedding.

No cable trench shall be back-filled before the cable(s) in the trench has been inspected and approved by the Engineer.

15.3.2 Underground cable pipes

Cable pipes will be supplied and installed by others unless indicated otherwise on the drawings.

Each cable pipe shall be sealed by the Contractor under this Contract at both ends by means of bitumen impregnated jute bags or similar material, after the cables have been installed.

15.3.3 Installation of concrete slabs

Where electrical cables cross above other services such as water pipes, sewerage pipes, other electrical cables, pilot cables and telephone cables or where danger exists that cables may be damaged due to excavations by other cables shall be protected by means of reinforced concrete slabs. The concrete slabs shall protect the cable for at least 0,5 m in both directions of the crossing.

Where electrical cables cross underneath other services such as water pipes, sewerage pipes, post office cables etc. a concrete slab shall be placed above and axial with the other service and should the free space between the two services be less than 300 mm an additional slab shall be placed axial with the electrical cable between the two services.

Where cables are laid down a grading and a possibility exist that the cables might be washed open due to rain, then cable slabs shall be placed on top of the cables for the entire length of the grading.

The concrete slabs shall be supplied and installed under this Contract.

15.3.4 Crossings with other services

General

Where a cable is laid above another service it shall not be less than 750 mm below ground level, and if this is not possible, the cable shall be laid underneath the other service and shall be protected by means of concrete slabs in the manner prescribed. The deeper or shallower positions of the cable shall only apply for a distance of 1 m on both directions of the crossing.

If not possible to cross underneath the other service, the matter shall be referred to the Engineer for a decision.

Clearances

The following minimum clearances shall be maintained between electrical cables and other services:

	VERTICAL	HORIZONTAL
Post Office cables	0,3 m	0,3 m
Other water pipes	0,3 m	0,3 m
Sewerage pipes	0,3 m	0,8 m
Storm water pipes	0,3 m	0,6 m
Other Electrical cables	150 mm	150 mm

15.3.5 Laying of cables

Cables must be laid without delay

The cables shall be laid with the minimum of delay in order to backfill the trenches as soon as possible.

The Contractor shall, however, not backfill the trench until each length of cable has been tested, inspected and approved by the Engineer.

Only one cable shall be laid at a time and the Contractor shall ensure that cables already laid are not damaged.

Method

All cables shall be handled with the utmost care and shall be laid in accordance with the best methods observed in good modern practice. All cables shall be run out on rollers in order to prevent abrasion and no cable shall be dragged along the ground. No cable shall be bent to a radius of less than 12 times its overall diameter.

Installation of Multicore Cables

a) In concrete ducts

Cables shall be laid neat parallel with each other on the floor of the duct with the maximum spacing.

b) On cable racks

Cable shall be installed neat and parallel with each other with the maximum spacing. On Horizontal sections the cables shall be secured to the cable racks with intervals of not more than 2 m by using flat nylon or equivalent strapping. On vertical sections or where the cable racks are installed at an angle the cables shall be secured to the cable racks with intervals of not less than 500 mm.

Sections of the cable racks shall be electrically connected, and provision shall be made for crimping and expansion of the racks.

c) In Trenches

Two or more L.T cables in the same trench shall be laid in parallel and not less than 75 mm apart, except where otherwise approved.

H.T. cables in the same trench shall be laid parallel and not less than 150 mm apart, except where otherwise approved.

All L.T. power cables shall be laid 750 mm below final ground level and H.T. power cables shall be laid 1 m below final ground level.

The contractor shall provide 3m slack at each end in each run of power cable and its associated earth wire and bury the same in the ground as near to the relevant end as possible. Where the cables and earth wires are to be installed in open ducts outside buildings, the slack shall be coiled in the ducts.

The separation between any signal cable and the nearest parallel power cable shall not be less than 150 mm.

e) Against Walls

Cables and earth wires to be installed on walls, where approved by the Engineer, shall be neatly installed on grade 304 stainless steel cable racks. Cables and earth wires on outside walls shall be installed in a similar manner or in suitably sized 304 stainless steel conduit from 300 mm below up to 2,4 m above final ground level or as required. These conduits shall be secured to the walls by means of grade 304 stainless steel batholders at intervals not exceeding 600 mm.

Saddles shall only be secured by means of round headed Grade 304 Stainless Steel screws and plugs of an approved type. (Wood will not be accepted as plugging material.) Plugs will not be allowed in joints between bricks.

f) On Poles

Cables and earth wires to be installed on poles shall be secured to the poles at intervals not exceeding 600 mm by means of 25 mm x 1,5 mm adjustable Grade 304 Stainless Steel straps. Each cable together with its associated earth wire shall be installed in a suitably sized stainless steel pipe or channel from 300 mm below up to 2,4 m above ground level. This pipe or channel shall be secured to the pole by means of 25 mm x 1,5 mm adjustable stainless-steel straps at intervals not exceeding 600 mm. To avoid metallic action between different materials a Neoprene rubber strip shall be installed between the pole and the strap.

15.4 BACKFILLING OF TRENCHES

Once the cable has been laid, straightened, inspected, approved and covered with the top layer of bedding soil, the trenches shall be backfilled with soil which does not contain more than 40 % rock or shale and will pass through a sieve with 100 mm diameter holes that has been approved by the Engineer.

Back-filling of cable trenches shall be done in layers of 150 mm and shall be compacted and consolidated to 95 % modified AASHTO. Test shall be carried out to ensure the required compaction at the cost of the Contractor.

The closed-up sections of the cable trenches shall be maintained by the Contractor in a proper, safe condition for the duration of the contract. Where the soil in the trenches subsides, it shall be refilled and compacted to the satisfaction of the Engineer.

15.5 JOINTING AND TERMINATING OF CABLES

No joint will be allowed in any run of power cable.

All multicore PVC SWA PVC cables shall be terminated at each end by means of a suitably sized cable gland with armour clamp and Neoprene shroud. The armouring of the cable shall be bonded to earth at each end.

All 11 kV cables shall be terminated in compound filled end boxes.

The termination shall be made to the manufacturer's instructions and with materials stipulated in such instructions.

Where panels are provided with end boxes, these boxes shall be employed to terminate the cable end boxes and shall be filled with the prescribed mass of compound type Henley list No 57040.

The making off of cable ends shall be done strictly in accordance with the manufacturer's instructions as well as the filling of the boxes.

15.6 TESTING OF CABLES

a) Low voltage cables

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

b) 11 kV cables

On each completed section of laid and jointed high-tension cable a high voltage test shall be carried out. The test shall be performed according to SABS 97 of 1991. Alternating or direct current may be used.

15.7 EARTHWIRES

Earth wires shall be installed with L.T. cables as and where indicated on the drawings or specified herein and shall consist of bare hard-drawn copper wire.

These earth wires shall be installed at the same depth as the relevant cables, with at least 75 mm clearance between any earth wire and the nearest cable, unless specifically approved otherwise.

No joint will be allowed in any run of earth wire.

Each earth wire shall be terminated at each end by means of a suitably sized bolted lug either sweated or crimped onto the wire. The lugs shall be bolted onto the relevant earth bars or earthing terminals.

15.8 CABLE MARKERS

Cable markers with lead labels cast into the top of the cable markers shall be supplied and installed along the cable routes under this Contract as follows:

a) Along straight runs of the route, not further than 30 m apart;

b) At turns - one on each side of the turning point, 900 mm from such turning points;

c) At each branch, 3 markers - i.e., one on each side of the branch, 900 mm from the branch.

The cable markers shall be installed deep enough to ensure that the top of the marker will protrude 50 mm above final ground level.

15.9 ROUTE PLANS TO BE SUBMITTED BY THE CONTRACTOR

On completion of the works, but before the certificate of completion will be issued, the contractor shall submit to the Engineer, route plans (polyester prints) indicating in a satisfactory manner:

a) The exact cable routes with reference to fixed points (e.g. buildings);

b) The exact lengths of cable (HT and LT) installed between terminating points and between joints where relevant; and

c) The exact positions of cable joints with reference to fixed points (e.g. buildings).

Prints of the various plans for the marking up of the information required, will be supplied to the contractor on request.

15.10 PLUGGING OF BRICK WALLS AND CONCRETE

Only plugging material of an approved type may be used for fixing to brick walls and concrete, wood will not be acceptable. Plugging in joints of brick walls will not be acceptable. Only round headed brass screws shall be used for fixing.

Steel structures may not be drilled without written approval of the Engineer. Where steel structures may not be drilled, the electrical contractor shall use suitable Grade 304 Stainless Steel clamps for securing the equipment.

15.11 MOUNTING OF LIGHTFITTINGS

All light fittings shall be thoroughly secured, and all special light fittings shall be installed in strict accordance with the manufacturer's instruction.

Light fittings shall be secured to the round draw boxes by means of two brass screws.

Each fluorescent fitting shall be secured on the ceiling by means of at least three screws, evenly spaced along the length of the fitting. On hollow tile construction "butterfly" clips shall be used and on plastered ceilings the fittings shall be supported by suitable wooden struts.

15.12 INSTALLATION OF SITE LIGHTS

The site light installation shall be executed as indicated on the drawings.

Light fittings along a specific route shall be in rotation R-W-B-B-W-R over the three phases.

All poles shall be planted plumb and in line (where applicable). The ground round the pole shall be consolidated with intervals of about 150mm.

15.13 INSTALLATION OF DISTRIBUTION BOARDS AND MOTOR CONTROL BOARDS

Each of the relevant distribution boards and motor control boards shall be securely bolted down on the floor or plinth by means of the requisite number of foundation bolts grouted into the floor in the positions indicated on the drawings.

These positions shall be confirmed with the Engineer on site, prior to installation.

Testing and commissioning of distribution/motor control boards after installation on site

After installation on site but prior to commissioning the following inspections and tests shall be performed on each distribution/motor control board.

a) Check all components to ensure that they are free from dust and protective packing material;

b) Check the operation of all components liable to damage in transit such as meters and protection equipment;

c) The insulation of all primary circuits between phases mutually and between each phase and earth shall be measured;

d) All fused links shall be checked for electrical continuity; and

e) All control supplies shall be checked.

All adjustable protection devices shall then be met, and the boards commissioned all in consultation with and to the instruction of the Engineer.

15.14 INSTALLATION AND ERECTION OF SWITCHGEAR

The switchgear panels shall be properly aligned, erected, plumbed, bolted together and fixed onto the floor.

If the floor is not level, suitable packing shall be used to level the switchboard.

Each individual panel shall be levelled before the panels are bolted together.

The panels shall be assembled and erected strictly in accordance with the manufacturer's instructions, which shall be issued to the Installation Contractor by the manufacturer.

Switchgear trucks shall move freely and shall be properly aligned.

15.15 BALANCING OF LOAD

The contractor shall balance the load as evenly as possible over the three phases on the main board, as well as on all the motor control boards.

15.16 NAME PLATES

Each motor shall be numbered in accordance with the drawings. The numbers shall be rear engraved on Perspex or similar material. The number shall be black, 40 mm high, on a yellow background. The height of the plate shall be 50 mm. The number shall be secured, on top of the pedestal, as prescribed for distribution boards.

All the motors or sets of motors in the pumpstations shall be identified by means of a name plate in accordance with the drawings. These name plates shall be manufactured from 2,5mm aluminium sheet with 50 mm high white characters on a blue background.

All buildings shall be identified by means of a name plate as listed in the Detail Technical Requirements. These name plates shall be manufactured from 2,5mm aluminium sheet with 75 mm high white characters on a blue background.

16. DETAILED TECHNICAL REQUIREMENTS

16.1 NEW HIGH MAST LIGHTING

a) General

One Existing hinged mast complete with the foundation, must be equipped with the prescribed luminaires, distribution board inside the mast and integral lowering mechanism, This must all be supplied and installed under this contract.

A second mast will be supplied by the Council but must be equipped with floodlights and control gear and installed under this contract.

b) Lighting Columns

The columns will have an overall floodlight mounting height of 20 meters. The cross section and wall thickness of the column offered shall be determined by the tenderers on the basis of working loads. However, the manufacturer shall reinforce the column in these sections which are stressed by the frame during raising and lowering to ensure that the metal in these sections shall not crack, tear, stretch or be damaged in any way. The top of the columns shall have suitable mounting brackets to suit the floodlights offered.

A suitably bushed 32mm diameter hole shall be provided at the top of the column in such a manner as to prevent the ingress of rain.

c) Floodlights

8 x 400 W LED floodlight fittings must be provided and installed on both the lighting columns at an angle of 78 degrees.

The floodlights must be equal or similar to the BEKA OMNI Flood floodlights with suitable control gear.

A suitable terminal box shall be mounted on the headframe. Each luminaire shall have a separate connection to the terminal box.

d) Lowering mechanism

The raising and lowering mechanism shall consist of a counterbalance which must be hand operated.

e) Construction

The column shall be continuously tapered and shall be equipped with tamper-proof locking device for the raising and lowering action of the column.

f) Protection and painting

All steel parts of the mast and headframe shall be heavy duty hot-dip galvanised in accordance with the Corrosion Protection Specification.

g) Electrical equipment and mounting plate

Each column shall be equipped with a gland plate with provision for two number 2 PVC SWA PVC cable glands as well as a board wired with 8 x 10A circuit breakers, trailing cable to floodlights. All such equipment shall be labelled in an approved manner.

h) Flexible multicore high mast cables

Each flexible multicore cable shall be 600/1000 V rating 4mm² x suitable number of cores. Each core shall be 50/0,26mm diameter tinned copper wire. Each core shall be rubber insulated and the multicore cables shall be overall sheathed to give a circular form. The final sheath shall be of chloroprene.

The cable shall have numbered cores with one green/yellow earth core. The cable shall be equal to NSHOU available ex GEC or an approved alternative.

The cable shall be provided with an approved tension sock at the point of suspension.

In the event of the luminaire control gear being situated at the bottom of the mast, special cables shall have to be used to allow for the higher voltage. Details of these cables have to be submitted to the Engineer for approval.

i) Access door to electrical equipment

The access door shall be closed fitting, vandal resistant and weatherproof. The door shall be fitted with a heavy-duty locking arrangement suitable for a standard type padlock. Padlocks must be supplied with the mast and can be purchased from the Council.

j) Foundation and bolt-cage

The high mast column shall be provided with a robust integral baseplate for mounting on a concrete foundation and secured by stainless steel HD bolts and nuts. "Disc-Lock" or equivalent self-locking stainless-steel washers must be used to prevent vandals loosening the nuts. These washers will consist of two separately shaped discs that have inclined cams on the one side and a series of ridges on the other. This system must ensure that the loosening torque is 50% higher than the tightening torque.

k) Transport

Special care must be taken in the handling of the galvanised mast during loading and offloading to avoid any damage to galvanised surfaces. During transit, the mast must be supported on wooden blocks and secured in position to avoid surface damage.

l) Guarantee

The manufacturer shall guarantee the column against faulty workmanship, incorrect design and material specification. Should the column be damaged due to any of the above, the manufacturer shall replace the damaged mast and fittings at his own expense. All electrical equipment shall be guaranteed against faulty workmanship for a period of one year as described in the Conditions of Contract.

m) Mast foundations

The contractor shall be responsible for the excavation and casting of the mast foundation which shall be suitable for the particular mast in the prevailing soil conditions.

The contractor shall install the necessary sleeves for the cable feed inside the foundation. The contractor, in conjunction with the mast manufacturer, is responsible for the design of the mast foundations and submission of all calculations and drawings for approval to the Engineer.

Tenderers shall satisfy themselves of the soil conditions on site before the tender is submitted, as no claim will afterwards be entertained due to lack of knowledge in this regard. All mast foundations shall rest on a solid ground base and not in loose ground.

The foundation shall, in the event of being installed close to structures, be off-set to such an extent that the headgear with lamps is at least 750mm away from the structure in lowered position. The final finish

of the mast foundation shall be 400mm above ground level unless stated otherwise.

The high mast foundation shall be designed such that a concrete crushing strength of 25 MPa can be attained after twenty-eight days.

Twenty-four hours before casting the foundations, the contractor shall satisfy himself and the representative that the bolting down assembly is pointed in the correct direction.

The contractor shall ensure that the foundation be kept wet for at least 7 days after casting. The contractor shall by means of test-cubes, tested by an approved authority, satisfy the Engineer that the foundations are of correct strength. Such test cubes shall bear the mast number, the date and the mixture number.

The mast manufacturer shall supply to the electrical contractor, the correct Grade 304 Stainless Steel bolting-down assembly suitable for the type of mast offered and of sufficient strength to comply with the design standard.

n) Installation of masts

The contractor shall allow at least twenty-eight days for the concrete foundation to cure prior to mast installation.

It shall be noted that the masts shall be installed in such a way that the mast is lowered to the high side of the surrounding area unless otherwise approved. Suitable equipment, cranes, nylon sling, etc. shall be used to erect the masts. The base of the mast shall be installed plus minus 75mm above the foundation-top and lock-nuts shall be provided to secure the bolting-down nuts. The opening between the mast-base and foundation shall be filled with a weak cement mix and 4 small weep-holes shall be provided. The cable entry sleeve shall be sealed after cable installation.

o) Earthing

Each mast shall be earthed by means of at least 4 x 1,2m earth spikes. Each spike shall be connected with 70mm² bare copper conductor to the bolting-down assembly inside the concrete foundation. Approved clamps shall be used to ensure positive contact at the connection point between the copper and steel.

The earthing of the electrical installation of the mast is by means of the earthing supplied with the feeder cable. The earth bar in the distribution board shall be connected to the earth stud in the mast.

p) Pole Lightning arrestor

The contractor shall install a pole lightning arrestor on the top of the high mast to protect the luminaires from direct lightning strikes.

A "Copperweld" copper steel bi-metallic rod with a spinule on top shall be used for the pole arrestor. The minimum length of the pole arrestor shall be equal to the radius of the luminaire cluster with the luminaires installed. The diameter of the "Copperweld" rod shall be submitted to the Engineer for his approval.

The pole arrestor shall be attached to the top column of the mast by means of two non-ferrous mechanical clamps and bolts. A 70mm² single core copper earth conductor shall be installed inside the mast. A cable lug shall be crimped on the two ends of the earth conductor for bolting to the earth bar and pole arrestor as appropriate. Any type of brazing will not be permitted.

q) Delivery

Prices quoted shall make provision for supply, delivery and installation of material on site.

16.2 WELDING PLUGS

500V 3-phase 5-pin welding plugs shall be of the type as specified elsewhere. Motor control centres shall be supplied with a welding plug mounted on the outside of the MCC as indicated in the schedules.

16.3 OPEN CHANNEL FLOW METER

The flow meters no. M1 and M2 must be provided and installed under the Electrical Contract and shall be equal and similar to Bestobell type MSP 90-20 microprocessor based ultrasonic open channel flowmeter with temperature compensated transducer.

The transducers shall be installed above the new inlet channel and chlorine channel and shall be supported in position by means of a rigid grade 304 stainless steel bracket properly secured to the channel wall. The flow meter shall be adjusted on site to give the correct rate of flow.

The MSP 90 control units shall be mounted in MCC1 and MCC4 respectively and shall have a separate panel mounted digital rate of flow indicator and totalizer to give the actual rate of flow measured.

16.4 EXISTING OFFICE BUILDING

Supply and signal cables to this building shall be supplied and installed under this contract as listed in the schedules of cables and earth wires.

Tenderers must allow in their prices for disconnecting, dismantling and hand over to the Council of the existing distribution kiosk inside the building.

Tenderers must also allow for the temporary repositioning of the existing distribution kiosk and connection of the kiosk to the new distribution kiosk to maintain the operation of existing equipment during the changeover phase.

16.5 NOTICES AND DANGER PLATES TO BE SUPPLIED AND INSTALLED

The contractor shall supply and install the following notices and danger plates in each of the following locations:

1) Nameplates on all buildings and structures;
1.1) Names of buildings:
1.1.1) Administration building
1.1.2) Oxidation and biofilter pump station
1.1.3) Chlorine dosing building

2) Nameplates at all pumps as well as pump numbers;

3) In each pump station: Notices only;

4) At each plant motor which can start automatically. A warning notice that the machine may start automatically and must be isolated prior to cleaning or maintenance.

16.6 NOTICES

Notices as required by the Occupational Health and Safety Act, shall be installed.

Outdoor notices shall be white letters on blue background (Grade Retroreflective letters and background) and manufactured from 2mm aluminium plate.

Indoor notices shall be of the non-deteriorating plastic type.

16.7 DANGER PLATES

Danger plates in accordance with SABS Specification 1029 Clause 5.2 shall be fitted to the outside of access doors and outdoor cubicles. These plates shall be manufactured from durable non-plastic corrosion resistant material.

16.8 LIGHTNING PROTECTION

Tenderers must allow to supply the complete lightning protection installation. Due allowance must be made to bond all handrails, poles, buildings to proposed protective system.

Notwithstanding any lightning protection installed, additional surge protection shall be supplied and installed under this contract on both cable ends of all 4-20mA signal cables.

The additional surge protection shall be equal and similar to Measurement Technology Ltd., MTL 370 lightning protection units.

Lightning conductors shall not be less than 70mm².

16.9 REDUNDANT CABLES

All redundant cables shall be properly sealed in the ground unless instructed otherwise by the Engineer.

16.10 SCHEDULE OF MULTICORE CABLES AND EARTHWIRES

All cables and wiring are listed on the drawings.

Note:

1. All earth wires shall be bare copper conductors of the specified cross-sectional area and cables shall be of the type as specified elsewhere.

2. The abovementioned schedules of cables and wiring listed on the drawings shall only serve as a guide and the Tenderer must make sure that he allow for all cabling to complete the work in its entirety.

16.11 SCHEDULE OF EQUIPMENT TO BE INSTALLED IN DISTRIBUTION AND MOTOR CONTROL BOARDS.

16.11.1 Distribution board at Office Building

Label: Supply from miniature substation

Type: Floor standing cubicle with front access and without doors

Supply: 150mm² x 4c PVC SWA PVC cable plus 70mm² earth wire

Fault level: 10kA

Equipment will be the following:

QUANTITY	DESCRIPTION OF EQUIPMENT	IDENTIFICATION
1	350 Amp TP isolator equal and similar to CBI K25D type (Door interlocked)	Main
3	2 Amp HRC fused links: plus	Supply voltage

QUANTITY	DESCRIPTION OF EQUIPMENT	IDENTIFICATION
1	Voltmeter selector switch: plus	
1	Voltmeter scaled 0-500V	
3	400/5 Amp current transformers: plus	Load current
3	Maximum demand/direct reading ammeters scaled 0-400 Amps	
1	3 Phase combined Kw-hour and kVA demand meter equal and similar to Sangamo	Energy consumption
4	Lightning arrestors	Protection
4	400 Amp copper busbars: plus	3 Phase + N
1	300 Amp copper busbar	Earth
1	250 Amp TP MCCB equal and similar to CBI	MCC2 Biofilter and oxidation pumpstation
1	60 Amp TP MCCB equal and similar to CBI	MCC1 Inletworks
1	100 Amp TP MCCB equal and similar to CBI	MCC3 Chlorine dosing building
1	30 Amp TP MCCB equal and similar to CBI: plus	High mast HM 1
1	30 Amp TP contractor plus:	
1	5 Amp SP MCCB plus:	
1	SAT-R time switch equal and similar to CBI	
1	60 Amp single pole MCCB equal and similar to CBI	Local DB
ONE	**PANEL COMPRISING THE FOLLOWING:**	
1	10 Amp SP MCCB equal and similar to CBI plus:	
1	Lamp test, test push button plus:	
All	Indicator lights as specified elsewhere for the following remote indications	
	a. Inlet works Green - Screen On Amber - Screen Trip	
	b. Drying beds Sump pump Green - Pump On Amber - Pump Trip	
	c. Biofilter and oxidation pumpstation Green - Pump 1 On Green - Pump 2 On Green - Pump 3 On Green - Pump 4 On Green - Pump 5 On Amber - Pump Trip Red - Dry Sump Flooded (Activate Siren)	

QUANTITY	DESCRIPTION OF EQUIPMENT	IDENTIFICATION
	d. Chlorine dosing pumps — Green - Pump 1 On Green - Pump 2 On Amber - Pump Trip	
	e. Irrigation pump — Green - Pump On Amber - Pump Trip	
	Plus:	
1	230 Volt siren that will be activated in the event of a sump flooding at the biofilter and oxidation pump station	
	Plus:	
1	Reset push button for siren	

16.11.2 Motor control centre at inlet works (MCC1)

Label: Supply from distribution kiosk at office building

Type: Outdoor plinth mounted grade 304 stainless steel cubicle with front and rear access doors

Supply: 10mm² x 4 core PVC/SWA/PVC cable plus 10mm² earth wire

Fault level: 5kA

Equipment will be as following:

QUANTITY	DESCRIPTION OF EQUIPMENT	IDENTIFICATION
1	70 Amp TP door interlocked isolator equal and similar to CBI	Main
4	Lightning arrestors	Supply Protection
4	100 Amp busbars: plus	Phases + N
1	100 Amp earth bar	
3	2 Amp HRC fused links: plus	Supply voltage
1	Voltmeter selector switch: plus	
1	Voltmeter scaled 0-500	
1	40 Amp TP earth leakage relay (CBI) (on outside of motor control centre)	Welding plug
1	10 Amp SP/MCCB (CBI)	Inlet works shelter
1	30 Amp TP/MCCB (CBI)	MCC5
1	30 Amp TP/MCCB (CBI)	Inlet works
1	20 Amp earth leakage relay with 30mA sensitivity: plus	Plug outlet

QUANTITY	DESCRIPTION OF EQUIPMENT	IDENTIFICATION
1	15 Amp three pin flush mounted socket outlet on front panel	
ONE	**PANEL COMPRISING THE FOLLOWING**	
1	10 Amp SP/MCCB (CBI): plus	Flowmeter
1	Bestobell Mobrey MSP 90 type ultrasonic open channel flowmeter control unit with seperate front panel mounted digital rate of flow and totaliser indicators	
All	Surge arrestors for remote sensor unit	Protection
All	Indicator lights as specified elsewhere	
All	Monitoring equipment with interposing relays for all remote indications at the distribution kiosk at the office building	Remote indication
TWO	SPARE PANELS	FUTURE

16.11.3 Motor control centre at biofilter and oxidation pumpstation (MCC2)

Label: Supply from distribution kiosk at office building

Type: Indoor floor standing motor control centre with front access only without doors.

Supply:95mm² x 4 core PVC SWA PVC cable with 70mm² bare copper earth

Fault level:5kA

Equipment will be the following:

QUANTITY	DESCRIPTION OF EQUIPMENT	IDENTIFICATION
1	300 Amp TP door interlocked isolator equal and similar to CBI	Main
4	Lightning arrestors	Supply protection
4	300 Amp copper busbars: plus	3 phase + N
1	200 Amp copper busbar	Earth
3	2 Amp HRC fuse links: plus	Supply voltage
1	Voltmeter selector switch: plus	
1	Voltmeter scaled 0-500V	
1	60 Amp SP/MCCB (CBI)	Local DB
1	40 Amp TP Earth leakage relay (welding plug mounted on side of motor control centre)	Welding plug
1	20 Amp TP/MCCB (CBI)	Isolating switch for sump pump

QUANTITY	DESCRIPTION OF EQUIPMENT	IDENTIFICATION
1	5 Amp SP/MCCB (CBI): plus	Flood Alarm
	Relays for remote indication	
TWO	**PANELS COMPRISING THE FOLLOWING**	
1	10 Amp SP/MCCB (CBI): plus	Level sensor
1	Bestobell - Mobrey MSP 90 type ultrasonic level sensor control unit	
All	Surge arrestors for remote sensor unit	Protection
1	30 Amp TP/MCCB (CBI): plus	High mast HM2
1	30 Amp TP contactor: plus	
1	5 Amp SP/MCCB (CBI): plus	
1	SAT-R time switch equal and similar to CBI	
THREE	**PANELS COMPRISING THE FOLLOWING**	
1	30 kW door interlocked motor protection MCCB equal and similar to CBI: plus	30 kW pump motors
3	80/5 Amp current transformers: plus	
1	Ammeter scaled 0-80 Amps: plus	
1	Ammeter selector switch: plus	
1	Running hour meter: plus	
1	Hand-off-auto selector switch: plus	
1	Set stop/start push buttons: plus	
1	30 kW direct-on-line starter: plus	
1	New-elect 100LA motor protection relay with battery backup: plus	
1	3 phase PF correction condenser with fuse protection: plus	
1	Thermistor relay: plus	
All	Indicator lights as specified elsewhere: plus	
All	Monitoring equipment with interposing relays for all remote indications	
1	10 Amp SP/MCCB (CBI)	Heater
All	Necessary connections for automatic pump control and pump duty rotation by means of level sensing unit	
All	Necessary timers to prevent simultaneous starting of motor after a power failure	
TWO	**PANELS COMPRISING THE FOLLOWING**	18,5kW MOTORS

QUANTITY	DESCRIPTION OF EQUIPMENT	IDENTIFICATION
1	18,5 kW door interlocked motor protection MCCB equal and similar to CBI: plus	
3	50/5 Amp current transformer: plus	
1	Ammeter scaled 0-50 Amp: plus	
1	Ammeter selector switch: plus	
1	Running hour meter: plus	
1	Hand-off-auto selector switch: plus	
1	Set stop/start push buttons: plus	
1	18,5 kW Direct-on-line starter: plus	
1	New-elect 100LA motor protection relay with battery backup: plus	
1	10 Amp SP/MCCB (CBI)	Heater
1	3 phase PF correction condenser with fuse protection: plus	
All	Indicator lights as specified elsewhere: plus	
All	Monitoring equipment with interposing relays for all remote indications	
All	Necessary connections for automatic pump control and pump duty rotation by means of level sensing unit	
All	Necessary timers to prevent simultaneous starting of motors after a power failure	

16.11.4 Motor control centre for irrigation pump

Label: Supply from chlorine dosing MCC3

Type: Grade 304 plinth mounted pedestal type with front access and front door

Supply: 6mm² x 4 core PVC/SWA/PVC cable plus 6mm² earth

Fault level: 5kA

Equipment will be the following

QUANTITY	DESCRIPTION OF EQUIPMENT	IDENTIFICATION
1	50 Amp TP door interlocked MCCB equal and similar to CBI	Main
4	Lighting arrestors	Supply protection
4	50 Amp busbars: plus	3 phase + N
1	50 Amp busbar	Earth
3	2 Amp HRC fuse links: plus	Supply voltage
1	Voltmeter selector switch: plus	
1	Voltmeter scaled 0-500V	
1	40 Amp TP earth leakage relay (welding plug to be mounted on outside of motor control centre)	Welding plug
ONE	**PANEL COMPRISING THE FOLLOWING**	
1	10 Amp SP/MCCB (CBI): plus	
1	Bestobell Mobrey MSP 90 type ultrasonic open channel flowmeter control unit with separate front panel mounted digital rate of flow and totaliser indicators	
All	Surge arrestors for remote sensor unit	
ONE	**PANEL COMPRISING THE FOLLOWING**	
1	7,5kW door interlocked motor protection MCCB (CBI): plus	Irrigation pump
1	20/5 Amp current transformer: plus	
1	Ammeter scaled 0-20 Amp: plus	
1	Running hour meter: plus	
1	Set stop/start push buttons: plus	
1	7,5kW Direct-on-line starter: plus	
1	Omron type low level protection relay: plus	
1	3 Phase power factor correction condenser with fuse protection: plus	
All	Indicator lights as specified elsewhere: plus	
All	Monitoring equipment with interposing relays for all remote indications	

16.11.5 Motor control centre for sump pump at sludge drying beds

Label: Supply from MCC1 at inlet works

Type: Grade 304 plinth mounted pedestal type with front access and front door

Supply: 4mm² x 4 core PVC/SWA/PVC cable plus 4mm² earth

Fault level: 5kA

Equipment will be the following

QUANTITY	DESCRIPTION OF EQUIPMENT	IDENTIFICATION
1	40 Amp TP door interlocked MCCB (CBI)	Main
4	Lightning arrestors	Supply protection
5	50 Amp busbars: plus	Phase + N + E
3	2 Amp HRC fuse links: plus	Supply voltage
1	Voltmeter selector switch: plus	
1	Voltmeter scaled 0-500V	
ONE	**PANEL COMPRISING THE FOLLOWING**	
1	20 Amp TP door interlocked isolator (CBI): plus	Sump pump
1	10/5 Amp current transformer: plus	
1	Ammeter scaled 0-10 Amp: plus	
1	Running hour meter: plus	
1	Hand-off-auto selector switch: plus	
1	Set stop/start push buttons: plus	
1	3kW direct-on line starter: plus	
1	Multitrode type relay for level control: plus	
All	Indicator lights as specified elsewhere: plus	
All	Monitoring equipment with interposing relays for all remote indications: plus	
1	4 pin 63 Amp welding plug and top, mounted on rear side of motor control centre for sump pump connection	

16.12 EXISTING POST TOP SITE LIGHTS

Tenderers shall allow for the removal and handing over of all existing site lights to the official in charge of the Council's store department.

16.13 WELDING PLUGS

The new 500V 3 phase 5-pin welding plugs shall be equal and similar to AMPCO 40 Amp 5 pole welding plugs.

The new 500V 3 phase 4-pin welding plug for the sump motor connection at MCC5 shall be equal and similar to AMPCO 63 Amp 4 pole welding plug.

16.14 OPERATION OF PLANT

16.14.1 Inlet works

The motor control centre and cable connection to screen motor will be supplied and installed by others. The supply from MCC1 to the motor control centre at the screen as well as signal cable shall form part of this contract.

16.14.2 Biofilter and oxidation pump station

The three 30kW pump motors will be automatically controlled by means of the level control unit mounted inside the MCC. Two pumps will always be duty pumps while the third pump will serve as stand by pump.

The level controller will start the first duty pump at a predetermined level and will start the second duty pump at a predetermined higher sump level. Both duty pumps will be stopped at a predetermined low sump level.

The pumps shall be protected against over-heating by means of 145° F thermostats obtainable from the suppliers of Gorman-Rupp Pumps Reference "Therm-O-Disc type 14 TC 1227575" and shall be supplied and installed complete with cable connection to all five pumps under this contract. The overheat protection shall form part of the pump control circuits and an overheat trip and reset facility shall be provided on the relevant motor starter panel.

The two 18,5kW pump motors will be automatically controlled in the same manner as described above. One pump will serve as a duty pump while the other will be a standby pump.

A pump station flooding alarm system shall be supplied and installed under this contract and shall consist of a FLYGHT type level sensor installed at the sump inside the pump station, which shall activate a siren with an audible distance or 500m, mounted against the outside wall of the office building, at occurrence of rising water level inside the pump station.

A surface mounted watertight three phase isolator shall be supplied and installed under this contract to provide a supply of electricity to the sump pump in the pump station basement. The pump will form the subject of another contract but will have to be connected to the isolator by the electrical contractor.

The ultrasonic level sensors shall be supplied and installed under this contract and shall be complete with grade 304 stainless steel mounting brackets to ensure installation to the manufacturer's requirements.

16.14.3 Chlorine dosing building (MCC3)

The motor control centre for the chlorine dosing pumps as well as the cable connections to the dosing pump motors will form the subject of another contract.

Tenderers must allow for the supply and signal cables as well as the cable connections of these cables to this motor control centre.

A flow switch for no flow detection shall be supplied and installed under this contract and shall be equal and similar to bestobell pedal flow switch for a pipeline diameter of 50mm. the flow switch shall be supplied complete with spool piece for easy connection to clean water pipeline. Cable connection to the abovementioned motor control centre shall also form part of this contract.

The flowmeter at the chlorine channel will control the chlorine dosing process. A 4-20mA signal will be

provided under this contract for that purpose. Tenders shall allow for the special type of surge protection specified elsewhere for 4-20mA signals in MCC4 and MCC3 under this contract.

16.14.4 Irrigation pump (MCC4)

This pump will be manually controlled from MCC4.

An emergency stop push button shall be mounted on the outside of the motor control centre.

Grade 304 stainless steel probes shall be installed in the chlorine contact channel for low level cut out purposes.

16.14.5 Sump pump at sludge drying bed (MCC5)

This pump will be automatically controlled by means of a multitrode type of level control unit. The multitrode probe supplied and installed under this contract shall be 1,5m long and shall be secured inside the manhole by means of a grade 304 stainless steel bracket.

16.14.6 Bulk supply of electricity

The existing 100 kVA pole mounted transformer will have to be replaced by a 200 kVA miniature substation that will be supplied and installed on site by the Council.

A provisional sum has been provided in the schedule of prices to refund the Council for the miniature substation and installation cost under this contract.

16.14.7 Office Building

Tenderers must take cognisance of the available space for the new distribution kiosk in the control room.

16.15 MONITORING SYSTEM

Motor status indications as listed in the schedule of equipment for the distribution kiosk at the office building will be required under this contract.

Only a single trip indication for all pumps in a pumpstation or motor control centre shall be available at the control room.

Proper surge protection shall be provided for all these signals.

SERIES 600: ELECTRICAL INSTALLATION

MOTOR CONTROL CENTRES	
Name of manufacturer	.....
Manufacturer of circuit breakers	.....
Manufacturer of contactors	.....
Manufacturer of meters	.....
Manufacturer of current transformers	.....
LEVEL CONTROL	
Manufacturer of ultrasonic type	.....
Manufacturer of probe types:	
Stainless steel	.....
Other	.....
SITE LIGHTING	
High mast manufacturer	.....
Light fittings manufacturer	.....
Flow meters	
Manufacturer	.....

SERIES 600: ELECTRICAL INSTALLATION

SCHEDULE OF PRICES FOR VARIATIONS TO THE ELECTRICAL ENGINEERING WORKS

This schedule must be completed by all tenderers and only provides for amounts to be added to or deducted from the contract amount depending on whether the relevant item is to be supplied and installed as an extra to or has to be omitted from the contract.

All items provided for in this schedule shall comply in all respects with the requirements laid down in the specification and all unit prices shall provide for the complete supply and installation including all the necessary material, accessories, labour and transport.

01. CONDUIT

a) Black enamelled

Supply and installation of welded, black enamelled, screwed conduit per metre length, including waste, couplings and sets.

Conduit size	Cast in concrete	Fixed on surface	Built into brick	Chased into concrete
20 mm.....				
25 mm.....				
32 mm.....				

b) Galvanised

Supply and installation of welded, galvanised, screwed conduit per metre length, including waste, couplings and sets.

Conduit size	Cast in concrete	Fixed on surface	Built into brick	Chased into concrete
20 mm.....				
25 mm.....				
40 mm.....				
50 mm.....				

02. PAIR OF ENDS (CONDUIT)

Terminate one pair of ends, including 2 locknuts and bush at one end and one box, either round or 100 x 100 mm or 100 x 50 mm and locknuts and bush at the other end:

20mm R ..... (Including box)
25mm R ..... (Including box)
32mm R ..... (Bushes and locknuts only)
40mm R ..... (Bushes and locknuts only)
50mm R ..... (Bushes and locknuts only)

03. WIRING

PVC insulated and bare copper conductors in conduit.

Supply and installation of one metre of PVC insulated or bare copper conductor including for wastage. Measurement to be taken from point to point.

Conductor PVC Insulated conductor Bare copper earth wire size (mm²)

1,5.....

2,5.....

4.....

6.....

10.....

16.....

25.....

04. PVC SWA PVC CABLES

Supply and installation of multicore PVC SWA PVC or 11kV cable as specified per metre length, including wastage. Measurements to be taken to include tails. Also, unit price for making off of cable ends complete with glands, lugs and connecting up of cores.

Cable Size(mm²)	No of cores	Laid in ducts	Laid in ground	Cable fixed on Trays	Cable ends complete	Cable joints complete
2,5	3					
2,5	4					
4	4					
1	2pr(tw.scr.)					
1	4pr(tw.scr.)					
1	16pr(tw.scr)					
6	4					
10	4					
16	4					
25	4					
50	4					
70	4					
95	4					
120	4					
150	4					
185	4					
240	4					

05. LIGHTING SWITCHES AND SWITCHED SOCKET OUTLETS

Supply, fitting and connecting of the following complete with box, cover plate and plug top where applicable per unit:

Unit Flush mounted in Surface standard box mounted industrial

5/15 Amp 1 lever 1 way switch .....

5/15 Amp 2 lever 1 way switch .....

5/15 Amp 1 lever 2 way switch .....

15 Amp 3-pin single phase switched socket outlet .....

40 Amp 5-pin 3-phase welding plug complete with isolator and plug top .....

63 Amp 4-pin 3-phase welding plug complete with isolator and plug top .....

06. AIR CIRCUIT BREAKERS (MCCB'S)

Supply, mounting and connecting in a pre-fitted distribution board per unit:

Size

Up to 30 Amp SP (5kA) R .....

Up to 20 Amp TP (5kA) R .....

20 Amp up to 60 Amp TP (5kA) SF3-G3 R .....

50 Amp CBI SH3-G3 R .....

250 Amp Fuchs KD R .....

300 Amp Fuchs KD R .....

30 kW Fuchs FAN R .....

1 SAT-R time switch R .....

20 Amp Heinemann SF12A Earth Leakage Relay R .....

40 Amp three phase earth leakage relay R .....

07. ISOLATORS

Supply, mounting and connecting in a pre-fitted distribution board per unit:

Size

30 Amp TP combination fused switch	R .....
60 Amp TP combination fused switch	R .....
100 Amp TP combination fused switch	R .....
200 Amp TP combination fused switch	R .....
100 Amp TP CBI	R .....
300 Amp TP CBI	R .....

08. MISCELLANEOUS EQUIPMENT

Supply, installation and connecting up of the following:

Type of equipment	
Grade 304 S/S pedestal for lock stop switch	R .....
Lock stop switch with Grade 304 S/S pedestal	R .....
Weatherproof isolator	R .....
Multitrode pump control complete as specified	R .....
Complete 1-4 kW DOL starter + Grade 304 S/S panel (as specified)	R .....
Complete 5-11 kW DOL starter + Grade 304 S/S panel (as specified)	R .....
Telemecanique equipment:	
11kW DOL starter;	R .....
15kW DOL starter;	R .....
18,5 kW DOL starer;	R .....
MSP 90 level controller complete with sensor	R .....
Motor protection relay New Elect 100 LA complete	R .....

09. LIGHT FITTINGS

Supply and installation of the following fittings complete with the prescribed lamps or tubes and the necessary brackets and connectors:

Type of fittings Price/Unit

Excess FLR/CA/400HPS/NB R .....

20m High mast without luminaires R .....

10. DAYWORK AND TRANSPORT

The following rates are for work not covered by any scheduled rates:

Normal time Overtime

Electrician and Labourer R .....R .....

Electrician and apprentice R .....R .....

Non-European Labourer R .....R .....

a) Travelling vehicles not exceeding 1000kg capacity.....km

b) Materials, nett cost plus.....%

c) Excavations

d) In Soft Pickable Soil/m³ R .....

ii) In Soft Rock/m³ R .....

iii) In Hard Rock/m³ R .....

.....
SIGNATURE OF TENDERER

DATE:

NAME AND ADDRESS OF TENDERER:

.....

Tel: .....