



sport, arts, culture & recreation

Department of
Sport, Arts, Culture and Recreation
FREE STATE PROVINCE

SMITHFIELD MULTI-PURPOSE INDOOR SPORT CENTRE

ELECTRICAL ENGINEERING DRAWINGS & SPECIFICATION



TENDER DOCUMENT

FREE STATE PROVINCE



public works & infrastructure

Department of
Public Works & Infrastructure
FREE STATE PROVINCE

DEPARTMENT OF PUBLIC WORKS & INFRASTRUCTURE

SPECIFICATION

FOR

ELECTRICAL INSTALLATION

AT

SMITHFIELD INDOOR SPORT CENTRE

CONSISTING OF:

PART	:	ELECTRICAL WORK	PG
1:		Electrical Installation	1-34
2:		Intercom & Voice Evacuation & Fire Detection	35-115

See separate documents for:

Building work

QUANTITY SURVEYOR

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JUNE 2022

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INDEX

PAGE NO.

SPECIFICATION FOR ELECTRICAL WORK	4
PART 1 - GENERAL.....	5
PART 2: INSTALLATION DETAILS.....	13
PART 3: QUALITY SPECIFICATION FOR MATERIALS AND EQUIPMENT OF ELECTRICAL INSTALLATIONS	28
PART 4: BILLS OF QUANTITIES	31
PART 5: ELECTRICAL WORK MATERIAL SCHEDULE.....	32
PART 6: DRAWINGS	34

PART B: ELECTRICAL WORK

NOTICE TO TENDERERS

1. The tenderer for the principal contract shall submit additional information regarding the installer of the Electrical Installation together with the returnable enclosed with the tender enquiry documents
2. The Contractor, on acceptance of his tender for the principal contract shall submit within the period stated, the information indicated on the forms following immediately after the Summary of the Bills Of Quantities for this installation.

SPECIFICATION FOR ELECTRICAL WORK

PART 1 - GENERAL

CONTENTS

1	TESTS	5
2	MAINTENANCE OF INSTALLATIONS	5
3	REGULATIONS	5
4	NOTICES AND FEES	5
5	SCHEDULE OF FITTINGS	5
6	QUALITY OF MATERIALS.....	5
7	CONDUIT AND ACCESSORIES	5
8	CONDUIT IN ROOF SPACES	6
9	SURFACE MOUNTED CONDUIT.....	7
10	CONDUIT IN CONCRETE SLABS.....	7
11	FLEXIBLE CONNECTIONS FOR CONNECTING UP OF STOVES, MACHINES, ETC.....	8
12	WIRING:	8
13	SWITCHES AND SOCKET OUTLETS	8
14	SWITCHGEAR	8
15	SWITCHBOARDS	9
16	WORKMANSHIP AND STAFF.....	9
17	CERTIFICATE OF COMPLIANCE	9
18	EARTHING OF INSTALLATION	9
19	MOUNTING AND POSITIONING OF LUMINAIRES	11

PART 1 - GENERAL

1 TESTS

After completion of the works and before practical completion is achieved, a full test will be carried out on the installation for a period of sufficient duration to determine the satisfactory working thereof. During this period the installations will be inspected and the Contractor shall make good, to the satisfaction of the Principle Agent/Electrical Engineer or the employer, any defects which may arise.

The Contractor shall provide all instruments and equipment required for testing and any water, power and fuel required for the commissioning and testing of the installations at completion.

2 MAINTENANCE OF INSTALLATIONS

With effect from the date of the Practical completion Certificate the Contractor shall at his own expense undertake the regular servicing of the installation during the maintenance period and shall make all adjustments necessary for the correct operation thereof.

If during the said period the installations is not in working order for any reason for which the Contractor is responsible, or if the installations develops defects, he shall immediately upon being notified thereof take steps to remedy the defects and make any necessary adjustments.

Should such stoppages however be so frequent as to become troublesome, or should the installations otherwise prove unsatisfactory during the said period the Contractor shall, if called upon by the Principle Agent/Electrical Engineer or the Employer, at his own expense replace the whole of the installations or such parts thereof as the Principal Agent/Electrical Engineer or the Employer may deem necessary with apparatus specified by the Principal Agent/Electrical Engineer or the Employer.

3 REGULATIONS

The installation shall be erected and tested in accordance with the Acts and Regulations as indicated in the scope of works

4 NOTICES AND FEES

The Contractor shall give all notices required by and pay all necessary fees, including any inspection fees, which may be due to the local Supply Authority.

On production of the official account, only the net amount of the fee charged by the Supply Authority for connection of the installation to the supply mains, will be refunded to the Contractor by the Employer.

5 SCHEDULE OF FITTINGS

In all instances where schedule of light, socket outlet and power points are attached to or included on the drawings, these schedules are to be regarded as forming part of the specification.

6 QUALITY OF MATERIALS

Only materials of first class quality shall be used and all materials shall be subject to the approval of the Employer. Departmental specifications for various materials to be used on this Contract are attached to and form part of this specification.

Wherever applicable the material is to comply with the relevant South African Bureau of Standards, specifications, or to IEC Specifications, where no SANS Specifications exist.

Materials wherever possible, must be of South African manufacture.

7 CONDUIT AND ACCESSORIES

The type of conduit and accessories required for the service, i.e. whether the conduit and accessories shall be of the screwed type, plain-end type or of the non-metallic type and whether metallic conduit shall be black enamelled or galvanised, is specified in Part 2 of this specification.

Unless other methods of installation are specified for certain circuits, the installation shall be in conduit throughout. No open wiring in roof spaces or elsewhere will be permitted.

The conduit and conduit accessories shall comply fully with the applicable SANS specifications as set out below and the conduit shall bear the mark of approval of the South African Bureau of Standards.

- a) Screwed metallic conduit and accessories: SANS 61386-1 and 21.
- b) Plain-end metallic conduit and accessories: SANS 61386-1 and 21.
- c) Non-metallic conduit and accessories: SANS 61386-1 and 21.

All conduit fittings except couplings, shall be of the inspection type. Where cast metal conduit accessories are used, these shall be of malleable iron. Zinc base fittings will not be allowed.

Bushes used for metallic conduit shall be brass and shall be provided in addition to locknuts at all points where the conduit terminates at switchboards, switch-boxes, draw-boxes, etc.

Draw-boxes are to be provided in accordance with the "Wiring Code" and wherever necessary to facilitate easy wiring.

For light and socket outlet circuits, the conduit used shall have an external diameter of 20mm. In all other instances the sizes of conduit shall be in accordance with the "Wiring Code" for the specified number and size of conductors, unless otherwise directed in part 2 of this specification or indicated on the drawings.

Only one manufactured type of conduit and conduit accessories will be permitted throughout the installation.

Running joints in screwed conduit are to be avoided as far as possible and all conduit systems shall be set or bent to the required angles. The use of normal bends must be kept to a minimum with exception of larger diameter conduits where the use of such bends is essential.

All metallic conduit shall be manufactured of mild steel with a minimum thickness of 1,2mm for plain-end conduit and 1,6mm in respect of screwed conduit.

Under no circumstances will conduit having a wall thickness of less than 1,6mm be allowed in screed laid on top of concrete slabs.

Bending and setting of conduit must be done with special bending apparatus manufactured for the purpose and which are obtainable from the manufacturers of the conduit systems. Damage to conduit resulting from the use of incorrect bending apparatus or methods applied must on indication by the Department's inspectorate staff, be completely removed and rectified and any wiring already drawn into such damaged conduits must be completely renewed at the Contractor's expense.

Conduit and conduit accessories used for flame-proof or explosion proof installations and for the suspension of luminaires as well as all load bearing conduit shall in all instances be of the metallic screwed type.

All conduit and accessories used in areas within 50 km of the coast shall be galvanised to SANS 32 and SANS 121.

Tenderers must ensure that general approval of the proposed conduit system to be used is obtained from the local electricity supply authority prior to the submission of their tender. Under no circumstances will consideration be given by the Department to any claim submitted by the Contractor, which may result from a lack of knowledge in regard to the supply authority's requirements.

8 CONDUIT IN ROOF SPACES

Conduit in roof spaces shall be installed parallel or at right angles to the roof members and shall be secured at intervals not exceeding 1,5m by means of saddles screwed to the roof timbers.

Nail or crampets will not be allowed.

Where non-metallic conduit has been specified for a particular service, the conduit shall be supported and fixed with saddles with a maximum spacing of 450 mm. The Contractor shall supply and install all additional supporting timbers in the roof space as required.

Under flat roofs, in false ceilings or where there is less than 0,9m of clearance, or should the ceilings be insulated with glass wool or other insulating material, the conduit shall be installed in such a manner as to allow for all wiring to be executed from below the ceilings.

Conduit runs from distribution boards shall, where possible terminate in fabricated sheet steel draw-boxes installed directly above or in close proximity to the boards.

9 SURFACE MOUNTED CONDUIT

Wherever possible, the conduit installation is to be concealed in the building work; however, where unavoidable or otherwise specified under Part 2 of the specification, conduit installed on the surface must be plumbed or levelled and only straight lengths shall be used.

The use of inspection bends is to be avoided and instead the conduit shall be set uniformly and inspection coupling used where necessary.

No threads will be permitted to show when the conduit installation is complete, except where running couplings have been employed.

Running couplings are only to be used where unavoidable, and shall be fitted with a sliced couplings as a lock nut.

Conduit is to be run on approved spaced saddles rigidly secured to the walls.

Alternatively, fittings, tees, boxes, couplings etc., are to be cut into the surface to allow the conduit to fit flush against the surface. Conduit is to be bedded into any wall irregularities to avoid gaps between the surface and the conduit.

Crossing of conduits is to be avoided, however, should it be necessary purpose-made metal boxes are to be provided at the junction. The finish of the boxes and positioning shall be in keeping with the general layout.

Where several conduits are installed side by side, they shall be evenly spaced and grouped under one purpose-made saddle.

Distribution boards, draw-boxes, industrial switches and socket outlets etc., shall be neatly recessed into the surface to avoid double sets.

In situations where there are no ceilings the conduits are to be run along the wall plates and the beams.

Painting of surface conduit shall match the colour of the adjacent wall finishes.

Only approved plugging materials such as aluminium inserts, fibre plugs, plastic plugs, etc., and round-head screws shall be used for fixing saddles, switches, socket outlets, etc., to walls, wood plugs and the plugging in joints in brick walls are not acceptable.

10 CONDUIT IN CONCRETE SLABS

In order not to delay building operations the Contractor must ensure that all conduits and other electrical equipment which are to be cast in the concrete columns and slabs are installed in good time.

The Contractor shall have a representative in attendance at all times when the casting of concrete takes place.

Draw-boxes, expansion joint boxes and round conduit boxes are to be provided where necessary. Sharp bends of any nature will not be allowed in concrete slabs.

Draw and/or inspection boxes shall be grouped under one common cover plate, and must preferable be installed in passages or male toilets.

All boxes, etc., are to be securely fixed to the shuttering to prevent displacement when concrete is cast. The conduit shall be supported and secured at regular intervals and installed as close as possible to the neutral axis of concrete slabs and/or beams.

Before any concrete slabs are cast, all conduit droppers to switchboards shall be neatly spaced and rigidly fixed.

11 FLEXIBLE CONNECTIONS FOR CONNECTING UP OF STOVES, MACHINES, ETC.

Flexible tubing connections shall be of galvanised steel construction, and in damp situations of the plastic sheathed galvanised steel type. Other types may only be used subject to the prior approval of the Department's site electrical representative.

Connectors for coupling onto the flexible tubing shall be of the gland or screw-in types, manufactured of either brass or cadmium or zinc plated mild steel, and the connectors after having been fixed onto the tubing, shall be durable and mechanically sound.

Aluminium and zinc alloy connectors will not be acceptable.

12 WIRING:

Except where otherwise specified in Part 2 of this specification, wiring shall be carried out in conduit throughout. Only one circuit per conduit will be permitted.

No wiring shall be drawn into conduit until the conduit installation has been completed and all conduit ends provided with bushes. All conduits to be clear of moisture and debris before wiring is commenced.

Unless otherwise specified in Part 2 of this specification or indicated on the service drawings, the wiring of the installation shall be carried out in accordance with the "Wiring Code". Further to the requirements concerning the installation of earth conductors to certain light points as set out in the "Wiring Code", it is a specific requirement of this document that where plain-end metallic conduit or non-metallic conduit has been used, earth conductors must be provided and drawn into the conduit with the main conductors to all points, including all luminaires and switches throughout the installation.

Wiring for lighting circuits is to be carried out with 2,5mm² conductors and a 2,5mm²-earth conductor. For socket outlet circuits the wiring shall comprise 4mm² conductors and a 2,5mm²-earth conductor. In certain instances, as will be directed in Part 2 of this specification, the sizes of the aforementioned conductors may be increased for specified circuits. Sizes of conductors to be drawn into conduit in all other instances, such as feeders to distribution boards, power points etc., shall be as specified elsewhere in this specification or indicated on the drawings. Sizes of conductors not specified must be determined in accordance with the "Wiring Code".

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

The wiring shall be done in PVC insulated 600/1000 V grade cable to SANS 1507.

Where cable ends connect onto switches, luminaires etc., the end strands must be neatly and tightly twisted together and firmly secured. Cutting away of wire strands of any cable will not be allowed.

13 SWITCHES AND SOCKET OUTLETS

All switches and switch-socket outlet combination units shall conform to the Department Quality Specifications, which form part of this specification.

No other than 16 A 3 pin sockets are to be used, unless other special purpose types are distinctly specified or shown on the drawings.

All light switches shall be installed at 1,4m above finished floor level and all socket outlets as directed in the Schedule of Fittings which forms part of this specification or alternatively the height of socket outlets may be indicated on the drawings.

14 SWITCHGEAR

Switchgear, which includes circuit breakers, iron-clad switches, interlocked switch-socket outlet units, contactors, time switches, etc., is to be in accordance with the Departmental Quality Specifications which form part of this specification and shall be equal and similar in quality to such brands as may be specified.

For uniform appearance of switchboards, only one approved make of each of the different classes of switchgear mentioned in the Quality Specifications shall be used throughout the installations.

15 SWITCHBOARDS

All boards shall be in accordance with the types as specified, be constructed according to the detail or type drawings and must be approved by the Employer before installation.

In all instances where provision is to be made on boards for the supply authority's main switch and/or metering equipment the contractor must ensure that all requirements of the authorities concerned in this respect are met.

Any construction or standard type aboard proposed, as an alternative to that specified must have the prior approval of the Employer.

All busbars, wiring, terminals, etc., are to be adequately insulated and all wiring is to enter the switchgear from the back of the board. The switchgear shall be mounted within the boards to give a flush front panel. Cable and boxes and other ancillary equipment must be provided where required.

Clearly engraved labels are to be mounted on or below every switch. The working of the labels in English, is to be according to the lay-out drawings or as directed by the Electrical Engineer and must be confirmed on site. Flush mounted boards to be installed with the top of the board 2,0m above the finished floor level.

16 WORKMANSHIP AND STAFF

Except in the case of electrical installations supplied by a single-phase electricity supply at the point of supply, an accredited person shall exercise general control over all electrical installation work being carried out.

The workmanship shall be of the highest grade and to the satisfaction of the Employer.

All inferior work shall, on indication by the Employer's inspecting officers, immediately be removed and rectified by and at the expense of the Contractor.

17 VERIFICATION AND CERTIFICATION OF ELECTRICAL INSTALLATION (CERTIFICATE OF COMPLIANCE AND TEST REPORT

On completion of the service, a certificate of compliance must be issued to the Principal Agent/Electrical Engineer or Employer in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) in the format as set out in SANS 10142-1 & 2.

18 EARTHING OF INSTALLATION

18.1 MAIN EARTHING

The type of main earthing must be as required by the supply authority if other than the Employer, and in any event as directed by the Principal Agent/Electrical Engineer, who may require additional earthing to meet test standards.

Where required an earth mat shall be provided, the minimum size, unless otherwise specified, being 1,0m x 1,0m and consisting of 4mm diameter hard-drawn bare copper wires at 250mm centres, brazed at all intersections.

Alternatively or additionally earth rods or trench earths may be required as specified or directed by the Electrical Engineer.

Installations shall be effectively earthed in accordance with the "Wiring Code" and to the requirements of the supply authority. All earth conductors shall be stranded copper with or without green PVC installation.

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 1,60 mm solid copper strapping or 16 mm² 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 20 mm 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 pipework with brass nuts and bolts and against walls with brass screws at 150-mm centres. In all cases where metal water pipes, down pipes, flues, etc., are positioned within 1,6m of switchboards an earth connection consisting of copper strapping shall be installed between the pipework 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.

18.2 ROOFS, GUTTERS AND DOWN PIPES

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

18.3 SUB-DISTRIBUTION BOARDS

A separate earth connection shall be supplied between the earth busbar in each sub-distribution board and the earth busbar in the Main Switchboard. These connections shall consist of a 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 utilised where specified or approved.

18.4 SUB-CIRCUITS

The earth conductors of fall sub-circuits shall be connected to the earth busbar in the supply board in accordance with SANS 10142.

18.5 RING MAINS

Common earth conductors may be used where various circuits are installed in the same wire way in accordance with SANS 10142. In such instances the sizes of earth conductors shall be equivalent to that of the largest current carrying conductor installed in the wire way, alternatively the size of the conductor shall be as directed by the Engineer. Earth conductors for individual circuits branching from the ring main shall be connected to the common earth conductor with T-ferrules or soldered. The common earth shall not be broken.

18.6 NON-METALLIC CONDUIT

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, luminaires, etc. The securing of earth conductors by means of self-threading screws will not be permitted.

18.7 FLEXIBLE CONDUIT

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.

18.8 CONNECTION

Under no circumstances shall any connection points, bolts, screws, etc., used for earthing be utilised for any other purpose. It will be the responsibility of the Contractor to supply and fit earth terminals or clamps on equipment and materials that must be earthed where these are not provided.

Unless earth conductors are connected to proper terminals, the end shall be tinned and lugged.

19 MOUNTING AND POSITIONING OF LUMINAIRES

The Contractor is to note that in the case of board and acoustic tile ceilings, i.e. as opposed to concrete slabs, close co-operation with the building contractor is necessary to ensure that as far as possible the luminaires are symmetrically positioned with regard to the ceiling pattern.

The layout of the luminaires as indicated on the drawings must be adhered to as far as possible and must be confirmed with the Department's representative.

Fluorescent luminaires installed against concrete ceilings shall be screwed to the outlet boxes and in addition 2 x 6mm expansion or other approved type fixing bolts are to be provided. The bolts are to be $\frac{3}{4}$ of the length of the luminaires apart.

Fluorescent luminaires to be mounted on board ceilings shall be secured by means of two 40mm x No. 10 round head screws and washers. The luminaires shall also be bonded to the circuit conduit by means of locknuts and brass bushes. The fixing screws are to be placed $\frac{3}{4}$ of the length of the fitting apart.

Earth conductors must be drawn in with the circuit wiring and connected to the earthing terminal of all fluorescent luminaires as well as other luminaires exposed to the weather in accordance with the "Wiring Code".

Incandescent luminaires are to be screwed directly to outlet boxes in concrete slabs. Against board ceilings the luminaires shall be secured to the bracing or joists by means of two 40mm x No. 8 round head screws.

PART 2: INSTALLATION DETAILS

CONTENTS

1	CABLE SLEEVE PIPES	13
2	NOTICES	13
3	ELECTRICAL EQUIPMENT	13
4	DRAWINGS	13
5	BALANCING OF LOAD	13
6	SERVICE CONDITIONS	13
7	SWITCHES AND SOCKET OUTLETS	13
8	LIGHT FITTINGS AND LAMPS	13
9	EARTHING AND BONDING	13
10	MAINTENANCE OF ELECTRICAL SUPPLY	13
11	EXTENT OF WORK	13
12	SUPPLY AND CONNECTION	14
13	CONDUIT AND WIRING	14
14	POWER POINTS	15
15	CABLES	16
16	DISTRIBUTION BOARDS	19
17	SUBSTATION	20
18	SCHEDULE OF LIGHT FITINGS	20
19	SCHEDULE OF POWER POINTS	24
20	SCHEDULE OF CABLES, CONDUIT AND WIRING	25
21	SCHEDULE OF DISTRIBUTION BOARDS	25
22	SUMMARY OF SWITCHGEAR AND CIRCUITS	25
23	SCHEDULE OF LIGHTS, SOCKET OUTLETS AND SPECIAL POWER POINTS	25
24	LIGHTNING PROTECTION	26

PART 2: INSTALLATION DETAILS

1 CABLE SLEEVE PIPES

Where cables cross under roadways, other services and where cables enter buildings, the cables shall be installed in earthenware or high-density polyethylene pipes.

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.

2 NOTICES

The Contractor shall issue all notices and make the necessary arrangements with Supply Authorities, the Postmaster-General, and S.A. Transport Services, Provincial or National Road Authorities and other authorities as may be required with respect to the installation.

3 ELECTRICAL EQUIPMENT

All equipment and fittings supplied must be in accordance with the attached quality specification (Part 3 of this document), suitable for the relevant supply voltage, and frequency and must be approved by the Employers Electrical Engineer.

4 DRAWINGS

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 built in.

5 BALANCING OF LOAD

The Contractor is required to balance the load as equally as possible over the multiphase supply.

6 SERVICE CONDITIONS

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

7 SWITCHES AND SOCKET OUTLETS

The installation of switches and socket outlets must conform to clause 13 of Part 1 of this specification.

8 LIGHT FITTINGS AND LAMPS

The installation and mounting of luminaires must conform to clause 19 of Part 1 of this specification.

All fittings to be supplied by the Contractor shall have the approval of the Employer.

The light fittings must be of the type specified in the Schedule of Light Fittings.

9 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 as described in clause 18 of Part 1 of this specification and to the satisfaction of the Employer/s Electrical Engineer.

10 MAINTENANCE 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 and the Client and the Employer's Electrical Engineer.

11 EXTENT OF WORK

The work covered by this contract comprises the complete electrical installation, in working order, as shown on the drawings and as per this specification, including the supply and installation of all fittings and also the installation of such equipment supplied by the Employer.

12 SUPPLY AND CONNECTION

The Supply Authority is Mangaung Local Municipality. A Provincial Sum of R 350 000.00 must be allowed in the Bill of Quantities.

The supply will be 11000/420 Volt, 50Hz at the Centlec Municipal connection side.

The Contractor will be also be responsible for the supply and installation of the LV cable from the Centlec point to the DK.A. Arrangement in good time must be made with the Municipality for the connection from the Municipal Point.

The Contractor will be responsible for the supply and installation of all the relevant cables as listed in the Schedule of Cables and measured in the Bills of Quantities

The Electrical Contractor will be also be responsible for the supply and installation of the LV cable from the Centlec point to the DK.A. Arrangement in good time must be made with the Municipality for the connection from the Municipal Point.

Arrangement in good time must be made with Centlec for a Temporary Builders Connection. The Electrical Contractor must also apply for a Temporary Builders Connection and pay the costs involved.

SUBSTATION

Not applicable to the tender document

Standby Plant

Not applicable to the tender document

13 CONDUIT AND WIRING

Conduit and conduit accessories shall be black enameled/galvanized screwed conduit or black enameled/galvanized plain end conduit in accordance with SANS 61386.

All conduits, regardless of the system employed, shall be installed strictly as described in the applicable paragraphs of clauses 4 to 8 of Part 1 of the specification. Wiring of the installation shall be carried out as directed in clause 9 part 1 of this specification.

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.

13.1 Telephone Installation

The Contractor shall allow for the complete installation of all conduits, outlet boxes, the communication service provider Distribution boards, sleeve pipes, etc., required for the telephone system as shown on the drawings.

The sizes of all telephone conduits are indicated on the drawings and must be installed in the floor slab. Galvanized steel draw-wires shall be installed in all conduits.

End boxes must consist of a 50mm x 100 mm x 100mm outlet box fitted with suitable blank cover plates, flush mounted 0,4m above floor level.

The communication service provider Distribution Board must consist of a 150mm x 600mm x 600mm metal box and hinged door with a 20mm thick wooden backboard. The board must be flush mounted, 1,37m above the floor.

13.2 Intercom Installation (NOT APPLICABLE)

The supply and installation of the intercom system is not included in this Contract.

The Contractor shall allow for the complete supply and installation of all conduits and outlet boxes required for the intercom installation as shown on the drawings.

The size of all conduits, boxes and mounting heights of the end boxes are indicated on the drawings. Galvanized steel draw-wires shall be installed in all conduits and the boxes fitted with suitable blank cover plates.

13.3 Power Trunking

The Contractor shall be responsible for the supply and installation of all power trunking complete with corner pieces, end pieces, junction pieces, supply conduits, cover plates and power outlets as specified and indicated on the drawings.

The power trunking must comply with SANS 61084. The Contractor must ensure that the power trunking is installed to satisfaction of the Employer's Electrical Engineer before commencing with the wiring of the power trunking.

14 POWER POINTS

Allow for the installation of power points and equipment as listed in the schedule, indicated on the drawings and described below:

14.1 Water Heaters

The supply, installation and plumbing work shall be the responsibility of the Mechanical Contractor.

The Electrical Contractor must electrically connect all water heaters as specified and listed in the Schedule of Power Points.

The Electrical Contractor must liaise with the Plumbing Contractor with regard to the method of mounting the water heater, water inlet and outlet, drainage valve as well as the electrical connection.

30Amp. 2-pole isolators, as indicated on drawings and Schedule of Power Points, to be used. The isolator shall be suitable for voltages of up to 250V. Isolators to conform fully to SANS 152 as amended. Microgap switches shall be capable of carrying rated current continuously and making and breaking of rated current. Connection will be by means of 2 x 6mm sq insulated conductors and 4mm sq BCEW from the indicated circuit to a 30Amp 2P Isolator.

30Amp. 3-pole isolators, as indicated on drawings and Schedule of Power Points, to be used. The isolator shall be suitable for voltages of up to 250V. Isolators to conform fully to SANS 152 as amended. Microgap switches shall be capable of carrying rated current continuously and making and breaking of rated current. Connection will be by means of 4 x 6mm sq insulated conductors and 4mm sq BCEW from the indicated circuit to a 30Amp 3P Isolator

60Amp. 3-pole isolators, as indicated on drawings and Schedule of Power Points, to be used. The isolator shall be suitable for voltages of up to 250V. Isolators to conform fully to SANS 152 as amended. Microgap switches shall be capable of carrying rated current continuously and making and breaking of rated current. Connection will be by means of 4 x 10mm sq insulated conductors and 6mm sq BCEW from the indicated circuit to a 60Amp 3P Isolator

14.2 Extractor Fans (Bathrooms)

The fans will be supplied and installed by the Mechanical Contractor. All fans will be connected by the Electrical Contractor. Extraction fan connections will be by means of 20mm conduit from the indicated extractor fan circuit to a 100 x 100mm flush mounted outlet box 300mm under the ceiling or at 2400mm where there is no ceiling.

30Amp. 2-pole isolators, as indicated on drawings and Schedule of Power Points, to be used. The isolator shall be suitable for voltages of up to 250V. Isolators to conform fully to SANS 152 as amended. Microgap switches shall be capable of carrying rated current continuously and making and breaking of rated current

Connection will 3 x 4mm sq insulated conductors to end in a 30Amp, 2-P isolator with red indication light on the switched cover plate. Install a 20mm ø conduit from the isolator to the fan and connect with same wiring as being fed.

14.3 Extractor Fans (Canopy)

The fans will be supplied and installed by the Mechanical Contractor. All fans will be connected by the Electrical Contractor. Extraction fan connections will be by means of 25mm conduit from the indicated extractor fan circuit to a 100 x 100mm flush mounted outlet box at the extractor fan motor.

Extraction fans will be by means of new 25mm conduit from the indicated circuit to a 30Amp 3P Isolator mounted inside a weatherproof 100 x 100mm outlet box within arm's reach of fan and to be connected to a 30A 3P DOL starter at 1400mm AFFL specified and indicated on the drawings.

Extraction fans connection will be by means of new 4 x 6mm sq insulated conductors and 4mm sq BCEW from the indicated circuit to a 30Amp 3P Isolator and to the 30A 3P DOL starter.

14.4 Air Conditioners

The supply, installation and plumbing work shall be the responsibility of the a/c contractor.

The electrical contractor must electrically connect all air conditioners as specified and listed

A 30Amp two-pole isolators, as indicated on the drawings and Schedule of Power Points, to be used. Triple pole isolator shall be rated 660V while two pole shall be suitable for voltages up to 250V. All isolators shall conform fully to SANS 152 as amended. Microgap switches shall be capable of carrying rated current continuously, making, and breaking of rated current.

Connection will be by means of 2 x 4mm sq insulated conductors and 2.5mm sq BCEW from the indicated circuit to a 30Amp 2P Isolator.

A 30Amp three pole isolators, as indicated on the drawings and Schedule of Power Points, to be used. Triple pole isolator shall be rated 660V while two pole shall be suitable for voltages up to 250V. All isolators shall conform fully to SANS 152 as amended. Microgap switches shall be capable of carrying rated current continuously, making, and breaking of rated current.

Connection will be by means of 4 x 6mm sq insulated conductors and 4mm sq BCEW from the indicated circuit to a 30Amp 3P Isolator.

14.4 Compressor (Comp)

Compressor will be by means of new 25mm conduit from the indicated circuit to a 20Amp 3P Isolator mounted inside a weatherproof 100 x 100mm outlet box within arm's reach of compressor as indicated on the drawings.

Compressor connection will be by means of new 4 x 6mm sq insulated conductors and 4mm sq BCEW from the indicated circuit to a 20Amp 3P Weatherproof Isolator

15 CABLES

The Contractor shall supply and completely install all distribution cables as indicated on the drawings, and listed in the Schedule of Cables.

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 0,9m 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 clean and the bottom and sites 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 the cables shall be laid on a 75mm thick bed of earth and be covered with a 150-mm layer of earth before the trench is filled in.

All joints in underground cables and terminations shall be made either by means of compound filled boxes according to the best established practice by competent cable jointers using first class materials or by means of approved epoxy-resin pressure type jointing kits. Epoxy-resin joints must be made entirely in accordance with the manufacturer's instructions and with materials stipulated in such instructions. Low tension PVCA cables are to be made off with sealing glands and materials designed for this purpose which must be of an approved make. Where cables are cut and not immediately made off, the ends are to be sealed without delay.

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.

15.1 LAYING, JOINTING AND MAKING OFF OF ELECTRICAL CABLES

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

1. 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 back-filled 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 joiner.
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:
 - 5.1 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,

- 5.2 That the joint pit is dry and that all loose stones and material are removed,
- 5.3 That the walls and banks of the joint pit are reasonable firm and free from loose material which can fall into the pit,
- 5.4 That the necessary coffer-dams or retaining walls are made to stop the flow of water into the joint pit,
- 5.5 That the joint pit is provided with suitable groundsheets so that the jointing work is carried out in clean conditions,
- 5.6 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,
- 5.7 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,
- 5.8 That the cables and other materials are dry, undamaged and in all respects are suitable for the joint work or making off,
- 5.9 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)

Flow temperatures of cable oil and compound must be determined with suitable thermometers. Cable oil and compound must not be heated to exceed the temperatures given on the containers and precaution must be taken to ensure that the tin is not overheated in one position. The whole mass must be evenly and proportionally heated.

(Temperatures of solder and plumbers metal may be tested with brown paper (testing time: 3 seconds). The paper must colour slightly - not black or burnt).

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 $130 \pm 5^{\circ}\text{C}$.

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.

7. If the cable contains moisture or is found to be otherwise unsuitable for jointing or making of 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. The jointer must ensure that the material and his tools are dry at all times, reasonably clean and absolutely free from soil.
11. Relating to the jointing of the cable the following requirements apply:
 - 11.1 All jointing must be carried out in accordance with recognized and tried techniques and comply strictly with the instructions given by the supplier of the jointing kit.
 - 11.2 The cables must be twisted by hand so that the cores can be joined according to the core numbers. If necessary the cable is to be exposed for a short distance to accomplish this. Under no circumstances may the cores in a joint be crossed so as to enable cores to be joined according to the core numbers. If it is not possible to twist the cables so that the preceding requirements can be met, then cores are to be joined in the normal way without any consideration of the core numbers.
 - 11.3 Normally the cables will have profile conductors. The conductors shall be pinched with gas pliers to form a circular section, bound with binding wire so that they do not spread, and then tinned before jointing.
 - 11.4 Jointing ferrules, the length of which are at least 6 times the diameter of the conductors, must be slid over the conductor ends to be joined and pinched tightly. Then they are soldered by means of

the ladle process whilst being pinched further closed.

Use resin only as a flux. The slot opening in the ferrule must be completely filled, including all depressions.

Remove all superfluous metal with a cloth dipped in tallow. Work during the soldering process must be from top to bottom. Rub the ferrule smooth and clean with aluminium oxide tape after it has cooled down to ensure that there are not any sharp points or edges.

NB: The spaces between the conductor strands must be completely filled by soldering process and must be carried out quick enough to prevent the paper insulation from burning or drying out unnecessarily.

11.5 After the ferrules have been rubbed smooth and clean, they and the exposed cores must be treated with hot cable oil (110°C) to remove all dust and moisture. These parts are to be thoroughly basted with the oil.

11.6 The joiner must take care that his hands are dry and clean before the joint is insulated. Also the insulating tape which is to be used must first be immersed in warm cable oil (110°C) for a sufficient period to ensure that no moisture is present.

11.7 After the individual cores have been installed 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.

11.8 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.

11.9 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.

11.10 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.

12. As far as cable end boxes are concerned the requirements as set out above are valid where applicable.

16. DISTRIBUTION BOARDS

In addition to clause 14 and clause 15 of Part 1 of this specification the following shall also be applicable to switchboards required for this service.

The Contractor shall supply and install the distribution boards as indicated on the drawings and listed in the distribution Board Schedule. All distribution boards shall comply with the quality specification in Part 3 of this specification, and be approved by the Employer's Electrical Engineer.

The following types of distribution boards are required for the service:

BOARD	TYPE	PANEL	FAULT LEVEL	LOAD kVA
DK A	Floor standing mounted, with lockable doors	Normal	15kA	138.40
DK B	Floor standing mounted, with lockable doors	Normal	15kA	138.40
DB. M	Floor standing mounted, with lockable doors	Normal	15	138.40
		Local	6	55
DB. A	Semi-recessed mounted, with lockable doors	Normal	6	55
DB. B	Semi-recessed mounted, with lockable doors	Normal	6	55
DB. GK	Semi recessed mounted, with lockable doors	Normal	6	6.6
DB. GH	Semi recessed mounted, with lockable doors	Normal	6	6.6

The latest Departmental Quality Specification Section for Distribution Boards must be adhere to by Part 3 of the specification.

17. MINIATURE SUBSTATION AND NETWORK

Not applicable to the tender document

18. SCHEDULE OF LIGHT FITTINGS

The light fittings and accessories are to be according to the quality specifications in Part 3 and shall be approved by the Employer.

TYPE	DESCRIPTION	PICTURE	AREA
A	SURFACE LEDVANCE LED PANEL LUMINAIRE - 1200 MM X 600 MM NOMINAL WATTAGE: 60W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG. TO BARE SABS APPROVED MARK.		Staircase area
A1	SURFACE LEDVANCE LED PANEL LUMINAIRE - 600 MM X 600 MM NOMINAL WATTAGE: 32W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG. TO BARE SABS APPROVED MARK.		Staircase area
B1	RECESSED LEDVANCE LED PANEL LUMINAIRE - 1200 MM X 600 MM NOMINAL WATTAGE: 60W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG. TO BARE SABS APPROVED MARK.		Office areas
B2	RECESSED LEDVANCE LED PANEL LUMINAIRE - 1200 MM X 600 MM NOMINAL WATTAGE: 60W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG. TO BARE SABS APPROVED MARK. WITH ONE HOUR BATTERY BACKUP		Office areas
B3	RECESSED LEDVANCE LED PANEL LUMINAIRE - 600 MM X 600 MM NOMINAL WATTAGE: 32W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG. TO BARE SABS APPROVED MARK.		Office areas

B4	RECESSED LEDVANCE LED PANEL LUMINAIRE - 600 MM X 600 MM NOMINAL WATTAGE: 32W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG. TO BARE SABS APPROVED MARK. WITH ONE HOUR BATTERY BACKUP		Office areas
C1	CEILING MOUNTED DOWNLIGHT EQUAL OR OTHER APPROVED LEDVANCE 230V 6W LED CAB SAT-CHROME, 3m CABTYRE AND 5A PLUG. 6W LED OSRAMS LAMPS 3000K WARM WHITE AND FLUSH MOUNTED.		BATHROOM
C2	CEILING MOUNTED DOWNLIGHT EQUAL OR OTHER APPROVED LEDVANCE 230V 12W LED CAB WHITE, 3m CABTYRE AND 5A PLUG. 12W LED LAMPS 4000K COOL WHITE AND FLUSH MOUNTED. INCLUDED WITH 1HOUR BATTERY BACKUP		BATHROOM
E	SURFACE OPEN CHANNEL LEDVANCE EQUAL OR OTHER APPROVED 2x1,5m HL2/N224-LED-4000K LED LUMINAIRE WITH INCLUDED WITH 2x24W 4000K OSRAM LED LAMPS. MANUFACTURED FROM COLD ROLLED 0.8mm STEEL HOT DIP ZINC PHOSPHATED AND FINISHED IN A BAKED, HIGH GLOSS, WHITE EPOXY POLYESTER POWDER COAT. ROTO-LOCK AS STANDARD		STORE ROOM
E1	SURFACE OPEN CHANNEL LEDVANCE EQUAL OR OTHER APPROVED 1x1,5m HL1/N124-LED-4000K LED LUMINAIRE WITH INCLUDED WITH 1x24W 4000K OSRAM LED LAMP. MANUFACTURED FROM COLD ROLLED 0.8mm STEEL HOT DIP ZINC PHOSPHATED AND FINISHED IN A BAKED, HIGH GLOSS, WHITE EPOXY POLYESTER POWDER COAT. ROTO-LOCK AS STANDARD		STORE ROOM
F	SURFACE MOUNTED BEKA BULK BULKHEAD WITH 18W LED COMPLETE WITH LED. THE BULKHEAD SHALL BE RECTANGULAR, AT LEAST 324*155MM AND SUITABLE TO OPERATE 18W LED LAMPS. THE LUMINAIRE SHALL BE MADE OF HIGH-PRESSURE DIE-CAST ALUMINIUM LM 6 BASE AND INJECTION MOULDED, NON-DISCOLOURING, CLEAR DIFFUSER, FIXED WITH 4 X STAINLESS STEEL ALLEN HEAD SCREWS. THE TONGUE AND GROOVE SYSTEM WITH SILICON SPONGE GASKET SHALL SECURE THE IP RATING. THE IP RATING SHALL BE AT LEAST IP-65, TO PREVENT ANY INGRESS OF DUST AND WATER. THE BULKHEAD SHALL BE SUPPLIED WITH RETROFIT LED LAMPS FOR FUTURE REPLACEMENTS, THE LUMINAIRE SHALL BE COMPENSATED TO A POWER FACTOR OF 0.98, TO REDUCE THE RUNNING CURRENT. THE LUMINAIRE SHALL BEAR THE SANS 60598-1 SAFETY MARK. EQUAL AND OR OTHER APPROVED TO BEKA		Carports

G	WALL MOUNTED BEKA NOVA 32W LED BULKHEAD WITH SANS MARK OF APPROVAL INCLUDED WITH A LAMP. THE BULKHEAD SHALL BE RECTANGULAR, AT LEAST 420*320MM AND SUITABLE TO OPERATE CFL LAMPS. THE LUMINAIRE SHALL BE MADE OF HIGH-PRESSURE DIE-CAST ALUMINIUM LM 6 BASE AND TRIM RING FIXED WITH 4 X STAINLESS STEEL ALLEN HEAD SCREWS AND AN INJECTION MOULDED, NON-DISCOLOURING, CLEAR DIFFUSER, TONGUE AND GROOVE SYSTEM WITH SILICON SPONGE GASKET AND A HIGH PURITY SINGLE PIECE DIE FORMED REFLECTOR WITH A MOUNTING HEIGHT RATIO OF 8:1. THE IP RATING SHALL BE AT LEAST IP-66, TO PREVENT ANY INGRESS OF DUST. THE LUMINAIRE SHALL BE COMPENSATED TO A POWER FACTOR OF 0.9, TO REDUCE THE RUNNING CURRENT. THE IGNITOR SHALL BE OF THE SUPERPOSED PULSE TYPE AND SABS APPROVED. THE LUMINAIRE SHALL BEAR THE SANS 60598-1 SAFETY MARK. EQUAL OR OTHER APPROVED		OUTSIDE LIGHT
J1	POST TOP BEKA ZELLE 55W LED LUMINAIRE DESIGNED FOR GENERAL AREA LIGHTING FOR MINIMAL AND MODERN LOOKING SURROUNDINGS. THE LUMINAIRE CONSISTS OF A HIGH-PRESSURE POWDER-COATED DIE-CAST ALUMINUM BASE AND GEAR PLATE, A TOP COVER MADE OF ASA AND A HIGH-IMPACT POLYCARBONATE PROTECTOR. THE DESIGN CAN OPERATE LEDS OF UP TO 55W. THE CABLE ENTRY GROMMET CAN ACCOMMODATE. WEATHER-, HAILPROOF, CORROSION PROOF AND VANDAL RESISTANT. MANUFACTURED FROM ACRYLONITRILE STYRENE ACRYLATE AND FIRMLY SECURED WITH STAINLESS STEEL SCREWS TO THE HIGH-IMPACT ACRYLIC PROTECTOR. THE COLOUR IS MOULDED INTO THE ASA MATERIAL TO ENSURE COLOUR CONSISTENCY OVER THE LIFETIME OF THE PRODUCT. A SILICON SPONGE GASKET FIXED INTO A GROOVE TO SEAL THE TOP COVER AGAINST THE PROTECTOR TO IP66. THE SPIGOT BASE MANUFACTURED FROM HIGH-PRESSURE DIE-CAST ALUMINIUM, POWDER COATED FOR ADDED PROTECTION IN THE COLOUR SPECIFIED. THE LUMINAIRE SECURED TO THE POLE BY THREE M8 STAINLESS STEEL GRUB SCREWS. THE HIGH-IMPACT NON-DISCOLOURING ACRYLIC PROTECTOR WITH ROUGHENED SURFACE TO REDUCE THE DIRECT GLARE COMPONENT. A SILICON SPONGE GASKET FIXED INTO A GROOVE TO SEAL THE PROTECTOR TO THE SPIGOT BASE TO IP66. ALL SCREWS, BOLTS AND METAL PARTS ARE STAINLESS STEEL OR NON-CORROSIVE MATERIAL. MAINS CONNECTIONS BY MEANS OF A SUITABLE SCREW TERMINAL BLOCK WITH A WIRE CLAMPING CONTACT. THE LUMINAIRE POWER FACTOR CORRECTED TO A MINIMUM OF 0.9. THE IP66 SPIGOT BASE WITH COOLING FINS OPTIMIZES THE THERMAL OPERATING ENVIRONMENT AROUND THE LEDS ENABLING THE LONG USEFUL LIFETIME (60 000HRS, L80).		AREA LIGHTS

J2	THE LUMINAIRE MUST BE MOUNTED ONTO A 5.0m MOUNTING HEIGHT GLASS FIBRE REINFORCED POLYESTER BLACK POLE UTILISING THE GLASS FILAMENT WINDING PROCESS. THE POLE SURFACE SHALL BE FINISHED IN A GEL COAT THAT COMPLIES WITH THE SABS 141. THE POLE MUST BE SUPPLIED WITH A BASEPLATE, GLANDPLATE, 1 X 5A 5KA SCHNEIDER DOUBLE POLE CIRCUIT BREAKERS SPIGOT AND A HEAVY-DUTY ACCESS DOOR.		AREA LIGHTS
K	BEKA ECOBAY SHALL BE ABLE TO OPERATE THE LED LIGHT SOURCES OF UP TO 203W IN AN AMBIENT TEMPERATURE. THE LUMINAIRE SHALL BE MADE OF HIGH-PRESSURE DIE- CAST ALUMINIUM. THE IP RATING SHALL AT LEAST BE IP-66 TO PREVENT ANY INGRESS. THE PROTECTOR SHALL BE POLYCARBONATE OPAQUE, WITH HIGH IMPACT POLYCARBONATE (IK 10). THE LUMINAIRE SHALL BE COMPENSATED TO A POWER FACTOR OF 0.95. THE LUMINAIRE SHALL BEAR THE SANS 60598 SAFETY MARK. EQUAL AND OR OTHER APPROVED TO BEKA.		SPORT ROOM
K1	THE BEKA SURFACE MOUNTED LEDBAY-MIDI CONSISTS OF A GLASS FILLED NYLON GEAR COMPARTMENT AND A DIE-CAST ALUMINIUM (EN 1706 AC-44300) OPTICAL HOUSING, ENCLOSED BY A GLASS PROTECTOR (IK 07) OR OPTIONAL POLYCARBONATE PROTECTOR (IK 10). THE LUMINAIRE IS SUSPENDED BY MEANS OF AN EYEBOLT OR ANTI-ROTATION FIXATION. THE LUMINAIRE BEARS THE SANS 60598 SAFETY MARK. THE ELECTRONIC POWER SUPPLY IS SUITABLE FOR OPERATION WITH A 198-264V 50HZ SINGLE PHASE SYSTEM. THE POWER FACTOR IS RATED AT ≥ 0.95 . THE LIFETIME OF THE CONTROL GEAR MATCHES THAT OF THE LEDS AND IT CAN HANDLE SURGES OF UP TO 10KV. ADDITIONAL SURGE PROTECTION UP TO 20KV CAN BE SELECTED. ELECTRONIC TEMPERATURE MONITORING PREVENTS OVERHEATING OF LEDS AND POWER SUPPLY (THERMIX®). THIS ENABLES OPERATIONS IN VERY HIGH AMBIENT TEMPERATURES WITHOUT COMPROMISING LIFETIME. THE LEDBAY RANGE IS DESIGNED FOR LED LIGHT SOURCES BETWEEN 132W. WITH A ONE HOUR BATTERY BACKUP		SPORT ROOM
L	LED BEACON LUMINAIRE WITH RED DIFFUSER, NOMINAL VOLTAGE: 220-240 V , IP 20 ,TYPE OF MOUNTING TYPE: SURFACE		Storage room
X	CEILING MOUNTED EMERGENCY EXIT SIGN COMPLETE WITH BEKA LED MAINTAIN DOUBLE SIDED. INCLUDED WITH 1HOUR BATTERY BACKUP		PASSAGE

18.1 STRAIGHT POLES SPECIFICATIONS

18.1.1 CONSTRUCTION

Poles shall be of tubular design with a constant rate of taper of 1:100, Straight SPBR-8 (planted). Poles shall be of all welded construction. Buttwelds are only permitted with the use of internal reinforcing sleeves. The steel used in the manufacture of the poles shall be Iscor steel to the SANS Spec 1431 Grade 300WA with minimum yield strength of 300MPa. Test and analyses certificates must be provided on request. No steel sections shall be less than 3mm-wall thickness. All welding shall be carried out by coded welders only. Proof that all welders have been tested shall be provided on request. A loose base plate, 300x300x4mm, shall be provided to be attached to the lower end of the pole by means of two stainless steel M8 hook bolts.

18.1.2 DIMENSIONS

The poles shall be 10m long suitable for planting in the ground, giving a mounting height of 8m. An access opening, not smaller than 230 x 90 shall be provided 600mm above ground level and shall be complete with cover, secured by two 5 sided stainless steel Allen screws and galvanised mounting/ gland plate. Two cable entries shall be provided 300mm below ground level at 90° displacement from the access opening.

18.1.3 CORROSION PROTECTION

All parts of the pole and associated parts shall be hot dip galvanised to SANS specification and inspection certificates shall be provided on request. All bolts and nuts shall be stainless steel. No welding, drilling, punching, bending or removal of burrs shall be carried out after galvanising. The bottom 2.3m of poles shall be covered with bitumen epoxy paint for extra protection.

19. SCHEDULE OF POWER POINTS

Socket outlets to be installed shall be 16A switched socket outlets with the following colour coding. Socket outlets shall be wall mounted and power skirting mounted as indicated on the drawings.

TYPE	POWER	APPLICATION	COVER COLOUR	SWITCH COLOUR	EARTH PIN
A	NORMAL	NORMAL	WHITE	WHITE	ROUND
B	NORMAL	DEDICATED	WHITE	WHITE	FLAT
C	EMERGENCY	NORMAL	WHITE	RED	ROUND
D	EMERGENCY	DEDICATED	RED	RED	FLAT
E	UPS	NORMAL	WHITE	BLUE	ROUND
F	UPS	DEDICATED	BLUE	BLUE	FLAT

Light switches shall be of different configurations as below table and shall be of the 16A white steel cover type:

Single lever one way
Two lever one way
Three lever one way
Single lever two way
Two lever two way
Three lever two way
Weather proof rotary type for cells and outdoor applications

5A round socket outlets shall be utilized for lighting installations. 5A round socket outlets shall be mounted on power ducting and 50mm dia round outlet boxes.

Motion sensors shall be installed so to switch light fittings and shall work in correspondence with light switches so that motion sensor can be switched off by the light switches. The motion sensors shall be of the BEG Luxomat occupancy sensor 2channel 10meter ranges indoor flush ceiling mount.type PD3N-2C-FC TYPE

Photovoltaic day/night switches shall be of the 16A type mounted within a weatherproof box with clear front lid.

20. SCHEDULE OF CABLES, CONDUIT AND WIRING

AS PER DRAWINGS PART 6

21. SCHEDULE OF DISTRIBUTION BOARDS

The front panels of normal supply, standby power and no-break supply sections shall be painted in distinctive colours as follows:

Normal supply : Light Orange, colour B26 of SANS 1091.
Standby power : Signal Red, colour A11 of SANS 1091.
No-break supply: Dark Violet, colour F06 or Olive Green,
Colour H05 of SANS 1091.

Indicated is the probable fault level rating (kA) of the busbars. Refer to the Summary of Switchgear and Circuits for the minimum fault level rating of specified equipment.

BOARD	TYPE	PANEL	FAULT LEVEL	LOAD kVA
DK A	Floor standing mounted, with lockable doors	Normal	15kA	138.40
DK B	Floor standing mounted, with lockable doors	Normal	15kA	138.40
DB. M	Floor standing mounted, with lockable doors	Normal	15	138.40
		Local	6	55
DB. A	Semi-recessed mounted, with lockable doors	Normal	6	55
DB. B	Semi-recessed mounted, with lockable doors	Normal	6	55
DB. GK	Semi recessed mounted, with lockable doors	Normal	6	6.6
DB. GH	Semi recessed mounted, with lockable doors	Normal	6	6.6

22. SUMMARY OF SWITCHGEAR AND CIRCUITS

NOTE: ALL CIRCUIT BREAKERS MUST BE OF THE MAGNETIC HYDRAULIC TYPE AND NO THERMAL CIRCUIT BREAKERS WILL BE ALLOWED. ALL THE CIRCUIT BREAKERS MUST BE OF THE SAME TYPE OF RANGE. ALL CIRCUIT BREAKERS MUST BE MANUFACTURE AND ASSEMBLE AT SOUTH AFRICA, NO IMPORTS WILL BE ALLOWED.

AS PER DRAWINGS PART 6

23. SCHEDULE OF LIGHTS, SOCKET OUTLETS AND SPECIAL POWER POINTS

AS PER DRAWINGS PART 6

24. LIGHTNING PROTECTION

24.1.1 The Electrical Contractor must allow for a qualified and accredited subcontractor, which is a member of the Earthing and Lightning Protection Association (ELPA) to conduct a ground survey test and install a lightning protection system for the building in accordance with the latest revision to the *SANS Code of Practice 03 and 03A* and must comply with performance requirements laid down therein.

24.1.2 The lightning protection system shall consist of earth rods around the building as indicated on the drawings.

24.2 Earth Electrode Rods

24.2.1 Earth electrode rods shall be of the stainless steel type with copper coating (minimum thickness of 0.25mm) with a 16mm diameter. The tops of the rods shall be no less than 600mm below final ground level with the rod installed vertically.

24.3 Inter Connections

24.3.1 The earth electrode rods shall be bonded to the down conductors by means of exothermic welding.

24.4 Down Conductors

24.4.1 Down conductors shall be installed in 20mm surface mounted galvanised conduits at the cable ends of the buildings as shown. Down conductors shall consist of 50mm sq Green PVC insulated copper conductors and 8mm diameter aluminium conductor.

25.4.2 Down conductors shall terminate at test points 1400mm above final ground or paving level at a bolted connection. Conduits shall be fixed to the walls by means of raised galvanised saddles.

24.5 Roof Conductors

24.5.1 A 50mm sq aluminium conductor shall be installed along all ridges of roofs terminating at ends with conductors running downwards over surface of roof and the eaves. Lift shaft to have a conductor installed in the form of a closed loop upon their upper surface. In all cases where metallic gutters have been installed along eaves of a pitched roof, these must be bonded to the air terminal system.

The roof conductor shall be mounted on raised aluminium saddles. The down conductors shall be bonded to the roof conductor by means of bolted connection.

24.6 Appointment of Specialist Earthing and Lightning Protection Association (ELPA)

24.6.1 The Contractor shall make allowance for earth resistance tests to be carried out by a Specialist Contractor in lightning and earthing protection. The recommended earthing and lightning protection design shall be submitted to the Engineer, complete with all calculations and supportive documentation.

24.6.2 The procedure to be adopted shall be strictly as follows:

24.6.2.1 Carry out on site earth resistivity tests as many are required to obtain a representative reading.

24.6.2.2 Present the results of tests together with detailed recommendations on the required system in accordance to SANS 03 to **BVi Electrical Department** for approval. This documentation shall include for detailed drawings, graphs, calculations, system description, lengths of conductors and earth spikes.

24.6.2.3 On approval by **BVi Electrical Department**, installation is to proceed as recommended.

24.6.2.4 All exothermic welds, conductors, etc. shall be inspected by the Engineer prior to any backfilling taking place.

24.6.2.5 The system shall be tested in order to verify that the recommendation and installation are satisfactory.

24.6.2.6 Submission of *SANS Certificate of Completion* on the completion of the installation.

24.6.2.7 PARTICULARS OF EARTHING AND LIGHTNING PROTECTION ASSOCIATION (ELPA) CONTRACTOR

(To be completed by tenderers and submitted together with the tender form).

TENDER NO: _____ REFERENCE: _____

SERVICE: _____

NAME OF ELPA CONTRACTOR: _____

ADDRESS _____

EARTHING AND LIGHTNING PROTECTION ASSOCIATION REGISTRATION NUMBER:

DATE

SIGNATURE OF ELPA TENDERER

NOT INCLUDED IN THIS DOCUMENT

**THIS ENTIRE SPECIFICATION AND BILLS OF QUANTITIES SHALL BE
READ IN CONJUNCTION WITH THE ELECTRICAL GENERAL
TECHNICAL SPECIFICATION AND QUALITY SPECIFICATION OF THE
DEPARTMENT OF PUBLIC WORKS, WHICH IS AVAILABLE ON
REQUEST.**

ADDITIONAL REQUIREMENTS OR SPECIFICATIONS NOT COVERED IN QUALITY SPECIFICATIONS ABOVE

LED LIGHTS

All Light fittings installed for this project is to be of the LED type, unless otherwise stated.

The following international standard specifications and South-African Bureau of Standards shall apply to the LED luminaire specification:

SANS 475	Luminaires for interior lighting, street lighting and floodlighting – Performance and requirements
SANS 10114-1	Interior lighting part 1: Artificial lighting of interiors
SANS 10114-2	Interior lighting part 2: Emergency lighting
SANS 60598-1	Luminaires part 1: General requirements and tests
SANS 60598-2.1	Luminaires part 2: Particular requirements section 1 – Fixed general purpose luminaires.
SANS 60598-2.2	Luminaires part 2: Particular requirements section 2 – Recessed luminaires.
SANS 60598-2.3	Luminaires part 2: Particular requirements section 3 – Luminaires for road and street lighting.
SANS 60598-2.5	Luminaires part 2: Particular requirements section 5 – Flood lighting.
SANS 61347-1 to 13	Lamp control gear
SANS 62031	LED modules for general lighting – Safety specifications
SANS 62384	DC or AC supplied electronic control gear for LED modules – Performance requirements.
SANS 62560	Self-ballasted LED lamps for general lighting services with supply voltages > 50V – Safety specification.
SANS 62612	Self-ballasted LED lamps for general lighting services with supply voltages > 50V – Performance requirements
EN 55015	Limits and methods of measurement of radio disturbance of electrical lighting or equipment.
EN 61000-3.2	Electromagnetic compatibility (EMC) limits for harmonic current emissions.
EN 61000-3.3	Electromagnetic compatibility (EMC) limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.
EN 61547	Equipment for general lighting purposes: EMC immunity requirements.
IEC-EN 62471	Photo biological safety of lamps and lamp systems for LEDs
IES LM-79-08	Approved method: Electrical and photometric measurement of solid-state lighting products.
IES LM-80	Approved method: Measuring lumen maintenance of LED light sources.

General requirements:

The luminaire shall be suitable for operation with mid-power LEDs.

The luminaire shall be suitable for operation on a 230V single phase 50Hz mains supply.

Power factor capacitors shall be supplied to correct the power factor to at least 0.95 or higher.

The luminaire shall be marked with identification labels stating the brand name and model and shall bear the SANS approval mark.

The driver shall comply with IEC 61347-1 and IEC 61347-2B as applicable and shall be suitable for operation on 230V $\pm 10\%$, 50Hz single phase system and it must be insured that harmonics filter is provided as per SANS 61000-3-2. The drivers and LED circuitry shall be protected against lighting and power surges. Suitable surge arrestors with a 10kA rating shall be provided for indoor installations and 20kA for outdoor installations.

Colour rendering (Ra) shall be not less than 80 and lumen depreciation of not more than 30% L70 at 50 000 hours @ T_q 25°C. Colour temperature of the LED lamp shall be 4000K, unless otherwise stated.

Thermal requirements:

The luminaire must be able to withstand an ambient temperature of 35°C. Storage temperature of this luminaire should be able to handle $-40^\circ\text{C} < T < 60^\circ\text{C}$.

To this end internal electrical and mechanical components shall not be allowed to exceed their maximum temperature ratings of 75°C. Test reports from an independent authorised testing facility proving this requirement shall be made available on request.

Noise requirements:

The noise level emitted from the luminaire shall be kept as low as possible. Drivers/electronic components shall therefore fully comply with the latest edition of SANS 55015.

= END OF SPECIFICATION =

PART 4: BILLS OF QUANTITIES

Electrical, mechanical and/or any other engineering work must be measured by the quantity surveyor and must be prepared in accordance with the latest edition of the Standard System of Measuring Building Work.

No additional provision for Preliminaries may be included in the engineering sections of the bills of quantities.

Bills of Quantities are included in part C2.2 of the tender document.

PART 5: ELECTRICAL WORK MATERIAL SCHEDULE

The Contractor shall complete the following schedules and submit them to the Electrical Engineer within 21 days of the date of the acceptance of the tender.

The schedules will be scrutinised by the Electrical Engineer and should any material offered not comply with the requirements contained in the specification, the Contractor will be required to supply material in accordance with the contract at no additional cost.

NB: Only one manufacturer's name to be inserted for each item.

Item	Material	Make or trade name	Country of origin
1.	Miniature substation		
2.	Distribution boards		
3.	Circuit breakers 1P, 2P, 3P		
4.	On load isolators without trips		
5.	Contactors 1P, 2P, 3P		
6.	Earth leakage relays 1 & 3 phase		
7.	H.R.C. fuse switches		
8.	Kilowatt hour meter		
9.	Current transformers		
10.	Voltmeter		
11.	Maximum demand ammeter		
12.	Daylight sensitive switch		
13.	Time switch		
14.	Conduit		
15.	Conduit boxes		
16.	Power skirting		
17.	Surface switches		
18.	Watertight switches		
19.	16A flush socket outlets		
20.	16A surface socket outlets		
21.	16A watertight socket outlets		
22.	Luminaries		
23.	Type A		
24.	Type A1		
25.	Type B1		
26.	Type B2		
27.	Type B3		
28.	Type B4		
29.	Type C1		
30.	Type C2		
31.	Type E		
32.	Type E1		
33.	Type F		
34.	Type G		
35.	Type J1		
36.	Type J2		
37.	Type K		
38.	Type K1		
39.	Type L		
40.	Type X		
41.	4 plate stove		
42.	Convection heater		
43.	Fan heater		
44.	PVCA cable		
47.	Cable trays		
46.			
47.			

PARTICULARS OF ELECTRICAL CONTRACTOR

The electrical contractor to complete the info below and attach the certified documentation (ECB & ECA & DOL) to the electrical tender document. If the info is not complete and certified documentation not attach to the electrical tender, the tenderer to be disqualified and marked as non-responsive to the tender.

TENDER NO: _____ REFERENCE: _____

SERVICE: _____

NAME OF THE ELECTRICAL CONTRACTOR THREE PHASE REGISTER: _____

ADDRESS _____

CONTACT NUMBER: _____

ELECTRICAL CONTRACTOR'S REGISTRATION NUMBER AT THE ELECTRICAL CONTRACTING BOARD OF SOUTH AFRICA.

ECB NUMBER: _____

ELECTRICAL CONTRACTOR'S REGISTRATION NUMBER AT THE ELECTRICAL CONTRACTORS ASSOCIATION OF SOUTH AFRICA

ECA NUMBER: _____

ELECTRICAL CONTRACTOR'S REGISTRATION NUMBER AT THE DEPARTMENT OF LABOUR:

DOL NUMBER _____

THE QUALIFIED THREE PHASE ELECTRICIAN IS REQUIRED TO SUBMIT THE FOLLOWING COMPREHENSIVE INFO:

- Original tax clearance certificate
- VAT registration certificate
- Workmen's Compensation registration certificate (or proof of payment of contribution in terms of the COID Act no. 130 of 1993)
- Company / cc / Trust / Partnership registration certificate
- Certified copy of identity document staff on the project
- Certified academic and certified electrical certificate of the staff on the project.

DATE

SIGNATURE OF TENDERER

PART 6:

DRW NO	SHORT DESCRIPTION
34581-310-01-A	Electrical Installation: Site Layout
34581-311-02-A	Electrical Installation: Lighting Layout
34581-311-03-A	Electrical Installation: Power Point Layout
34581-311-04-A	Electrical Installation: Fire Detection Layout
34581-311-05-A	Electrical Installation: Gatehouse: Lighting, Power Point, Layout
34581-311-06-A	Electrical Installation: Housekeeper Layout
34581-312-07-A	Electrical Installation: Schematic Layout



**public works &
infrastructure**

Department of
Public Works & Infrastructure
FREE STATE PROVINCE

DEPARTMENT OF PUBLIC WORKS & INFRASTRUCTURE

SPECIFICATION

FOR

**INTERCOM & VOICE EVACUATION &
FIRE DETECTION INSTALLATION**

AT

SMITHFIELD INDOOR SPORT CENTRE

CONSISTING OF:

SECTION	:	ELECTRICAL WORK	PG
2.		Intercom & Voice Evacuation & Fire Detection	35-115

See separate documents for:

Building work

QUANTITY SURVEYOR

Quantum
Contact: Siyasanga Mlandu
53 Parfitt Avenue
BLOEMFONTEIN
9301

Tel. No. (083) 371-0527

ELECTRICAL ENGINEER

BVi Consulting Engineers
Contact: Johan Boshoff
P.O. Box 12441
BRANDHOF
9324

Tel. No. (051) 447-2137

JULY 2022

SMITHFIELD INDOOR SPORT CENTRE

INTERCOM & VOICE EVACUATION & FIRE DETECTION INSTALLATION

PART 1 : GENERAL SPECIFICATION

INDEX

<u>Item</u>	<u>Description</u>	
1.	General Information	38
2.	Standardisation	38
3.	Compliance with Regulations.....	39
4.	Standards	39
5.	Standards and Samples.....	41
6.	Identification of Sub-sections and Components.....	41
7.	Availability of Components.....	41
8.	Radio and TV Interference	41
9.	Delivery.....	42
10.	Methods of Fixing	42
11.	Protective Painting.....	43
12.	Wiring.....	49
13.	Constructing of Free Standing Equipment Racks/Control Boards.....	50
14.	Earthing	54
15.	Cables.....	54
16.	Installation of Conduit System	55

<u>Item</u>	<u>Description</u>	<u>Page</u>
17.	Electrical Equipment and Components, Electronic Circuits.....	58
18.	Testing of System and Training	59
19.	Drawings	60
20.	Variations to the Contract	62
21.	Manuals and Literature	62
22.	Tests and Reports	63
23.	Warranty	63
24.	Guarantee of Installation	63
25.	Contractor's Liability in Respect of Defects	63
26.	Maintenance	63
27.	Trouble Calls	65
28.	Materials and Packing	66
29.	Compliance with Regulations	66
30.	Certificate of Compliance for Electrical Installation	67
31.	Electronic Equipment	68
32.	Special Equipment	69
33.	Electromagnetic Compatibility	69
34.	Making Good	69
35.	Manuals	69
36.	Workmanship	69
37.	Trade Names	69
38.	Completion of Contract	69

SMITHFIELD INDOOR SPORT CENTRE

INTERCOM & VOICE EVACUATION & FIRE DETECTION INSTALLATION

PART 1 : GENERAL SPECIFICATION

1. GENERAL INFORMATION

This specification covers the general requirements regarding the material, equipment, installation, testing and commissioning of the installation.

The general specification shall be read in conjunction with the requirements for tendering, conditions of contract and the technical requirements in the project specification.

Should any differences or contradictions exist between the general specification and the project specification, then the latter shall take preference.

The technical, construction and performance requirements contained in this general specification must be regarded as being of minimum required standards and therefore full compliance is a necessity.

These specifications are not exhaustive and full compliance with these requirements does not release the Contractor from his contractual undertaking to provide an installation that complies in all aspects with the operational requirements specified.

The installation shall include all necessary items, whether specified in detail or not, and shall be carried out in the best possible way to ensure a complete high quality installation to the approval of the Engineer.

On being requested to do so by the Engineer, the Contractor shall supply a certificate of compliance issued by a recognised Research Laboratory, or the South African Bureau of Standards, for material or equipment used.

Should any material and apparatus used comply with or be in accordance with the standard of any other recognised standards institution, this must be clearly stated at the time of the tender.

2. STANDARDISATION

Individual components or apparatus shall be of the same make, type or series for each item used throughout the installation.

Standardisation and mutual interchangeability of parts and components is essential and must be considered in the contractor's approach to the interpretation of the specification.

The aim must be to standardise component types, series and makes, thus reducing the number of items to be held as spare parts.

Equipment shall be readily available and imported equipment shall be available in South Africa on a well established agency basis prove of which shall be submitted with the tender.

Preference to locally manufactured equipment shall be given.

Manufacture of sub-units or sub-assemblies shall be "jig built" to ensure uniformity.

3. **COMPLIANCE WITH REGULATIONS**

The installation shall be erected and commissioned in compliance with the regulations and the conditions as set out in the conditions (terms) of contract which include the following in particular:

- (a) The Occupational Health and Safety Act of 1993, as amended, which include the code of practice for the wiring of premises: SABS 0142-1 of 2001, as amended, in terms of regulation C175 of the aforementioned act.
- (b) The regulations of the local Municipality.
- (c) The regulations of the local Supply Authority.
- (d) The regulations of the local Fire Brigade.
- (e) The regulations of Telkom SA Inc.
- (f) The regulations of the Post Office.
- (g) The regulations of any Government Department or public service company, where applicable.
- (h) Government Notices.
- (i) Radio Act No. 3 of 1952.

It must clearly be understood that where there are differences in standards in the requirements as set out above, the higher standard and stricter requirements shall apply.

In the instance of direct discrepancies, the requirements as stipulated in the specification must be given first priority, and thereafter the requirements as decided by the Engineer.

Should any requirements, by-law or regulations which contradicts the requirements of this specification, apply or become applicable during erection of the installation, the contractor shall immediately inform the Engineer of such a contradiction.

Under no circumstances shall the contractor carry out any variations to the installation in terms of such contradictions without obtaining the written permission to do so from the Engineer.

4.

STANDARDS

All materials and apparatus used shall comply in respect of quality, manufacture, test and performance with the relevant current specification of the following standards institutes:

- (a) The South African Bureau of Standards (SABS).
- (b) The Fire Offices Committee of the United Kingdom (FOC).
- (c) The Underwriter's Laboratories. (UL)

Should material and apparatus used comply with or be in accordance with the standard of any other recognised standards institution, this must be clearly stated in the schedules at the end of this specification.

Imported materials must comply with the requirements of the appropriate SABS or BS specification although these materials need not necessarily bear the SABS mark.

All material shall be suitable for the conditions on site. These conditions shall include weather conditions, altitude, 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 contractor shall at his own cost provide suitable protection until these unfavourable site conditions cease to exist.

5.

STANDARDS AND SAMPLES

Equipment, materials and apparatus used in the installation shall be of best commercial quality with a high reliability and shall be selected for ease of maintenance.

Throughout these documents, the words - "Approved", "Approval", "Suitable", "Equal", "Necessary" and "Required", wherever they may occur, shall respectively have the special meaning "Approved/approval in writing by the Engineer" and "suitable/equal/necessary/required in the opinion of the Engineer", and all materials or equipment so described shall be submitted to the Engineer for his approval.

Samples of all items of equipment used and the relevant SABS or BS test reports or certificates shall be submitted to the Engineer on his request before installation is commenced.

All such samples may be retained until completion of the contract. All such samples shall have securely attached thereto labels designating the contract by name and number (if any), the name of the contractor, and any further relevant information.

6. **IDENTIFICATION OF SUBSECTIONS AND COMPONENTS**

Equipment should be delivered to site in the largest subassemblies which are practical.

Components, equipment and subassemblies shall be assembled in the workshop, after manufacture.

Individual units shall be clearly marked by employing an identification code in such a manner that re-assembly, erection and installation on site could be done in the shortest time and with the minimum adjustment on site.

Where practical completed electronic and other control units shall be assembled in the workshop for preliminary tests, this shall be done to check whether the equipment complies with predetermined set values and shall produce certain predetermined set results.

The Engineer may upon request of the contractor visit existing installations or prototype assemblies in the factory to determine whether such units and workmanship are of the required standard for this installation.

7. **AVAILABILITY OF COMPONENTS**

All components used in the system shall be readily available in the Republic of South Africa. A list of suppliers shall be compiled and submitted with the tender.

8. **RADIO AND TV INTERFERENCE**

The Contractor must allow for the interference suppression components where required to ensure that the installation shall not cause interference to radio, television and paging systems.

All necessary steps are to be taken to ensure compliance with the Telkom Regulations.

9. **DELIVERY**

The Contractor must satisfy himself that the delivery date for all items of equipment put forward by him will allow the complete installation to be installed energized and capable of operation in time to allow full commissioning and testing prior to contract completion.

It will be the Contractor's responsibility to place orders timeously so as to meet the programme. No substitution to the tendered items will be allowed due to the Contractor not having placed orders timeously.

10. **METHODS OF FIXING**

The size of bolts and screws shall be the largest permitted by diameter of the hole in the apparatus concerned and are to be of adequate length. When fixing

any item of equipment, all bolt or screw holes provided therein shall be used and the fixing in each hole is to be secure.

10.1 **LIGHT WEIGHT EQUIPMENT**

All light weight fixing to brick or concrete shall be made with steel screws and "Fischer" or other approved plugs. Plugs made of wood shall not be allowed. Holes of the requisite size for the plug which shall suit the screw used, are to be neatly drilled in the concrete or brickwork (not in the joints between bricks) to a depth excluding plaster or soft wall finish, equal to at least the length of the plug to be used. The plug length shall be such that when the screw is in place all the threaded length is in the plug. Fixing to timber shall be made with greased brass wood screws. For fixing to hollow tiles, etc., screw anchor type fixing shall be used, fitted as above as far as possible.

Fixing to soft or hard fibre boards, etc., which are inaccessible to the back shall be made with sheradised self-tapping screws of appropriate size or with springs or gravity toggles.

10.2 **HEAVY EQUIPMENT**

All heavy weight fixing to brick or concrete shall be by means of mild steel bolts of appropriate size of the grouted bolt type or by one of the various types of suitable expanding bolt fixings. After erection of equipment all exposed metalwork or fixing shall be treated with two coats of paint to match the finish of the equipment.

11. **PROTECTIVE PAINTING**

The paintwork of all equipment and plant which is damaged during the course of erection and prior to acceptance by the Engineer, must be satisfactorily made good by the Contractor at his own expense.

12. **WIRING**

Unless otherwise specifically stated or arranged between the contractors, all conduit, trunking, ducting, sleeves for cables, wire ways etc., shall be supplied and installed by others. However the onus is on the Contractor to ensure that these installations conform in all respects to this specification and to his requirements.

12.1 **GENERAL WIRING**

All cabling shall be looped from point to point. There shall be no joints in cabling or wiring. Not more than three conductors shall be looped together in any one terminal. Where multiway terminations are necessary, these may only be made off in suitable junction boxes, appropriately labelled.

There shall be no cutting away or nicking of wire strands.

The junction of main cables and branch cables shall be made with suitable junction blocks to facilitate the isolation of various sections in the event of fault location.

Ends should all be plier twisted and firmly terminated in approved junction blocks, which shall be fitted with built in cable protectors.

12.2

EQUIPMENT WIRING

Equipment shall be wired in PVC insulated annealed copper wire.

The internal wiring of equipment shall be neatly done. All soldered connections shall be neatly and carefully made. All cable runs shall be neatly laced and tied to suitable supports. The capacity, type, and insulation of each conductor shall be adequate for its function and excessive compressive stress shall be avoided in looms.

Cable entries shall be provided, and so designed that no damage to the cable can result during normal use.

High quality heat resistant cables must be used to minimize damage to adjacent wiring in the event of electrical faults causing high currents and heating of the faulty circuits.

All terminations are to be via numbered terminals, and all wires are to be numbered at both ends to correspond with the wiring diagrams. Should any particular wiring Colour Code be adopted, this is to be kept standard throughout the installation.

All soldered joints are to be fixed so that there is no strain on the joints.

12.3

SIGNAL WIRING

Wiring of the various parts of the systems carrying a.c. or d.c. signals shall be by means of multicore, stranded cabling comprising PVC insulated annealed copper wires combined as coded twisted pairs and sheathed with extruded PVC.

The cable shall be such that cross-talk isolation between wires at audio frequency shall be less than 50dB and the insulation shall be rated at 300V.

In general, all low voltage signal cables shall be spaced at least 150mm from supply mains cables.

Wiring at V.H.F. & U.H.F. frequencies shall be in black U.V. resistant co-axial cable, of the low loss type, 6dB per 100m loss or less and of an impedance, to match the equipment.

12.4 IDENTIFICATION OF WIRING

All wiring is to be uniquely identified by means of numbered ferrules in the case of single core wiring or by means of numbered cores or a strictly adhered to colour coding system in the case of colour coded multicore wiring. Where colour coding is used the International accepted code of Blue, Orange, Green, Brown, Slate shall be strictly adhere to and the same colour shall be used throughout for a specific circuit.

12.5 WIRING TERMINALS

All wires shall be clearly identified by using plastic label tags.

Cable ends shall be terminated in approved terminal blocks as supplied by MS², Klippon, Wago or other approved type, "cheese blocks" are not acceptable. Terminals shall be easily accessible, clearly labelled, well supported and easy to wire using a spring mechanism to grip the wire. Tenderers must take note that it is a special request that all PLC and I/O's, loudspeaker lines to outside building installations, shall be wired to **fused** terminals or where this requirement is not feasible surge arrestors shall be fitted so as to provide adequate and efficient lightning protection.

Identification shall be such that any circuit can be clearly identified and traced from the wiring diagrams. These wiring diagrams shall clearly show all terminals, draw boxes, joints, points of termination etc. and shall be such that a circuit can easily be traced from point to point throughout the system.

13. **CONSTRUCTING OF FREE STANDING EQUIPMENT RACKS/CONTROL BOARDS**

13.1 FRAMEWORK

Free standing equipment racks/control boards shall be manufactured from angled, channel or folded steel metal sections and metal framework with a solid U-channel base frame, sufficiently braced to support all equipment and span floor and access holes.

Separate sections of the framework shall be bolted together with rubber packing installed between joints to provide a finished appearance.

Depending upon the number and size of components, a common front panel may be installed over one or more groups of equipment.

13.2 GROUPING OF SWITCHGEAR AND CONTROL EQUIPMENT

Switchgear and control equipment shall be logically arranged and grouped.

13.3 INTERNAL WIRING

13.3.1 Type of conductors

Standard 600V grade PVC insulated stranded annealed copper conductors manufactured to SABS 150 shall be employed for the internal wiring of control boards.

Except in cases where cables are specified, all wiring shall be done with PVC-insulated, single core stranded copper conductors and bare stranded or green and yellow PVC-insulated copper conductors for earth continuity in compliance with SABS 150.

The PVC-insulated copper conductors shall be compounded and stabilized to comply with SABS 175.

If the internal ambient temperature is likely to exceed 60°C, SABS approved stranded 600V grade asbestos or silicone rubber insulated stranded copper conductors shall be used.

The wiring of low voltage systems and circuits (less than 50 V) may be done by means of multi-core single conductor PVC-insulated and PVC shrouded cables.

13.3.2 Wiring

Wiring shall be arranged in horizontal and vertical rows and may be -

- (a) bunched and strapped using "HELLERMANN" or similar strapping and studs which are fixed to tubular harness supports.
- (b) bunched and flat mounted using PVC covered steel tape fixed directly to the chassis .
- (c) open cleat wired in a "WIRAC" or similar cleat bunch.
- (d) installed according to the "SIEMENS X" or similar wiring system, or
- (e) may be installed in "EGADUCT" or similar PVC wiring channels

Bunched conductors shall be neatly formed to present a uniform appearance without twisting or crossing the conductors.

Conductors leaving harnesses shall be so arranged that they are adjacent to the chassis.

These conductors shall first be led in the same direction as the conductors in the harness and shall then be bent over the top of the harness and progress to its final destination.

Bunched conductors may not be grouped into smaller bunches within the large harness.

13.3.3 **Wiring across hinged panels**

Conductors to hinged panels and doors shall be secured on both the door and the frame and shall be looped between the two points.

The loop shall be arranged to produce a twisting motion when the door is opened or closed.

A flexible protection sleeve shall be installed over the conductors.

13.3.4 **Flat multiple cables**

The wiring in the desk section of desk type consoles shall, where possible, be by means of flat multiple PVC-insulated cables.

These cables shall serve as connections between equipment mounted on hinged panels, the electronic racks and the terminals.

Flat multicore PVC-insulated conductors shall be installed between equipment mounted on hinged panels and equipment mounted within these consoles and the terminals in the consoles.

Flat multicore flexible PVC-insulated conductors shall be neatly arranged and clamped at both ends to prevent strain on the individual conductors connected to the terminals.

Where necessary the flexible cables shall be fitted with socket connectors to allow for the withdrawal of racks from the control consoles.

13.3.5 **Current Rating Conductors**

The current rating of conductors for the internal wiring shall be sufficient to carry the maximum continuous current that can occur in the circuit.

This value shall be determined from the circuit breaker or fuse protection of the circuit.

Conductors ratings for PVC-insulated, single core conductors are specified in the table below for maximum internal ambient temperatures of 35°C.

Nominal cross-section (mm ²)	CONDUCTOR CURRENT RATING (A)				
	Number of conductors bunched together				
	1	2-3	4-5	6-9	10 & more
1,5	13	12	10	9	8
2,5	17	16	14	12	10
4	22	20	18	16	13

13.3.6 **Wiring Channels**

Where wiring channels are used, they shall be installed horizontally and vertically.

UNDER NO CIRCUMSTANCES MAY POWER AND CONTROL CIRCUIT WIRING BE INSTALLED IN THE SAME WIRING CHANNEL.

Channels containing control circuit wiring shall not be more than 60 % full.

Channels in which power circuits are installed shall not be more than 40 % full.

13.3.7 **Terminal Strips**

All external wiring such as power, control interlocking, alarm, measuring and DC circuits shall terminate on numbered terminal strips of the "KLIPPON" or other approved manufacture.

The correct terminal size as recommended by the manufacturer for each conductor to be connected, shall be used throughout.

Terminals for power wiring shall be separated from other terminals.

Terminals for internal wiring shall not be interposed with terminals for external circuits.

Spring-loaded snap or pin type terminals attached to glass fibre or artificial resin reinforced isolator boards may only be used for electronic control circuits where the current rating does not exceed 0,1 A.

13.3.8 **Termination of Conductors**

All conductors terminating on meters, fuse holders and other equipment with screwed-on terminals, shall be fitted with lugs.

The lugs shall be soldered or crimped to the end of the conductor.

The insulation of conductors shall only be removed over the portion of the conductors that enter the terminals of equipment and strands may not be cut from the end of the conductor.

Conductor terminals connected to "KLIPPON", or other approved type terminals need not be soldered or ferruled. When more than one conductor enters a terminal, the strands shall be securely twisted together.

Connections to circuit breakers, isolators or contactors shall be installed by one of the following methods:

- (a) a ferrule of the correct size.
- (b) soldering the end of the conductor, or

- (c) winding one conductor strand around the end to totally cover the end.

External cable connections shall be secured by cable glands fixed to gland plates installed within the rack/consoles.

13.3.9 **Identification of Conductors**

Under no circumstances may PVC adhesive tape be used for the bunching of conductors or for the colour identification of conductors.

The colour of the insulation material of conductors for all 220 V circuits shall correspond to the colour of the supply phase for the circuit and the colour of the insulation material of all neutral conductors for 220 V circuits shall be black.

All other conductors, supplying control circuits, etc., shall be coded in colours other than those specified above and a colour code shall be devised for the installation of the other conductors that will enable positive identification on the wiring diagrams.

13.4 **BUSBARS**

Unless specified to the contrary, busbars shall be manufactured of solid drawn high conductivity copper with a rectangular cross-section in accordance with SABS 784 as amended and BS 159 where applicable.

Busbars shall be supplied for the following applications:

- (a) Distribution of supply voltage.
- (b) Connection bars for parallel cubes.
- (c) Connection bars for neutral conductors.
- (d) Earth busbars.

The maximum allowable temperature of busbars (including joints) carrying full load current in an ambient temperature as specified shall not exceed 80°C.

13.5 **MOUNTING OF EQUIPMENT**

13.5.1 **Access**

All equipment, busbars and wiring shall be completely accessible when the front and/or back panels are removed.

13.5.2 **Space Requirements**

In designing control boards or racks, the following requirements shall strictly be adhered to:

- (a) A minimum of 75 mm between any piece of equipment and the frame or internal partitioning. This minimum space is required above, below and on the sides of the equipment.

- (b) A minimum of 75 mm between horizontal rows of equipment. The maximum outside dimensions of equipment shall be considered.

13.5.3 **Instrumentation**

All metering instruments shall be mounted flush in the front panel unless otherwise specified.

In certain instances it may be required that instruments be mounted flush in the door. In these instances the back of the metres shall be covered by removable covers of isolating material fixed to the door to protect the terminals of instruments and to prevent accidental contact.

13.5.4 **Fuses**

Fuses for instrumentation shall be mounted in an easily accessible position with a label clearly indicating the fuse rating.

Fuse holders shall be mounted semi-recessed in the front panel so that fuses can readily be changed without removing the front panel.

13.6 **FINISH**

13.6.1 **Paint Finish**

Metal components of the framework, panels and chassis shall be finished with a high quality paint applied according to the best available method.

Baked enamel, electro statically applied powder coating or similar proven methods shall be used.

Care shall be taken to ensure that all edges and corners are properly covered.

13.6.2 **Baked Enamel Finish**

Prior to painting, all metal parts shall be thoroughly cleaned of rust, mill-scale, grease and foreign matter to a continuous metallic finish.

Sand or shot blasting, or acid picking and washing may be employed for this purpose.

Immediately after cleaning, all surfaces shall be covered by an electrolytically applied rust inhibiting tough, unbroken metal phosphate film and then thoroughly dried.

Within forty eight (48) hours after phosphating, a passivating layer consisting of a high quality zinc chromate primer shall be applied, followed by two coats of high quality baked enamel to SABS 783.

The minimum paint thickness after baking shall be 0,06 mm in diameter.

The paint shall have a minimum shock resistance of 25 kg/cm on 1 mm mild steel and a scratch resistance of 2 000 grams.

13.6.3 **Powder Coated Finish**

Prior to painting, all metal parts shall be thoroughly cleaned of rust, mill-scale, grease and foreign matter to a continuous metallic finish.

Sand or shot blasting, or acid picking and washing may be employed.

The metal parts shall be pre-heated and then covered by a micro-structured paint powder applied electrostatically.

The paint shall be baked on and shall harden within 10 minutes at a temperature of 190°C.

The minimum paint thickness after baking shall be 0,05 mm.

The paint shall have a minimum shock resistance of 25 kg/cm on 1 mm mild steel plate and a scratch resistance of 2 000 grams.

13.6.4 **Colour**

The colour used shall correspond to the colour specified in the project specification.

If no colour is specified the colour shall be dark grey, code G12 of SABS 1091 on the outside and white on the inside or a light grey code G80 or G54 of SABS 1091 inside and outside.

Should metal hinged panels be used, these shall be finished in a lighter grey colour paint than the surrounding framework unless otherwise specified in the project specification.

Should stainless steel type panels be specified, these shall be brushed in 150 grit the grain orientated parallel to the side of the console.

Should aluminium type panels be specified, these shall be of the anodized satin finished type.

13.7 **IDENTIFICATION LABELS**

13.7.1 **Material**

Identification labels shall be installed for all control equipment.

The labels shall be in one official language - English.

Engraved plastic or "IVORENE" type labels shall be installed.

The labels shall bear white lettering on a black background or vice versa.

13.7.2 **Method of Labelling**

Boards shall be supplied with the following labels:

Number and allocation of board -

Example: DB.S-G1

These labels shall be fixed to the outside of the board in a prominent position.

The lettering shall be a minimum of 10 mm high.

In each control board an identification label shall be installed on the front panel stating which equipment or group of control equipment is housed in that particular section or subsection of the board -

Example: POWER SUPPLY 24 V DC

Individual control components such as push buttons, switches, relays, contactors, etc., shall each have an identification label corresponding to the identification letter and/or code number shown on the schematic diagrams.

The function of the equipment and circuits shall be clearly identified.

Flush mounted equipment within doors or front panels shall be identified with labels fixed to doors or front panels respectively.

The labels for all equipment, installed behind panels shall be fixed to the chassis close to the equipment.

13.7.3 **Fixing of Labels**

Engraved labels shall be secured by means of brass nuts and bolts or slotted label holders.

A sufficient number of bolts shall be installed to prevent labels from warping.

Self-tapping screws will not be allowed.

14. **EARTHING**

The installation shall be earthed properly in accordance with the latest edition of SABS 0142-1, and the bye-laws of the local authority.

All earth conductors shall be bare stranded copper conductors or stranded conductors with green and yellow PVC-insulation, unless specified otherwise in the project specification.

EARTH CONNECTION

A separate earth connection shall be supplied between the earth busbar in each rack/control board and the earth busbar in the main electrical board. These connection shall consist of bare, stranded copper conductors supplied along the same routes as the interconnecting supply cables or wiring.

The size of the incoming earth wire shall be in relation to the main incoming power supply conductors complying with the requirements of SABS 0142-1.

Under no circumstances shall general connection points, bolts, screws, etc., be utilized for earthing purposes but it will be the responsibility of the contractor to provide separate earth terminals or clamps.

All earth connections shall be tin-plated and fixed with approved ferrules. The entire connection shall then be soldered.

The earth conductors of all sub-circuits shall be connected to the earth busbar of the supply board.

The ends of all metal channels and cable trays containing cables and conductors under load shall be earthed to the nearest control board with copper strapping or 2.5 mm² stranded conductors.

Adjoining rack sections shall be connected at joints with copper strapping or 2,5 mm² conductors, unless the method of joining the racks is sufficient for earth continuity.

All metal conduits shall, where installed by the contractor, terminate on the rack/boards or junction boxes.

Where this cannot be done the conduit end shall be earthed separately with a stranded conductor.

An earth conductor shall be installed in all types of flexible conduit.

The earth conductor shall be connected securely to the metal parts at both ends.

In order to avoid formation of earth loop currents in electronic circuits, printed circuit layouts must be designed such that a common earthing track or point is established.

Where digital integrated circuits are used, decoupling of the supply line (VCC) to earth must be done with suitable decoupling capacitors at regular intervals to avoid fluctuation of potentials during switching.

Feedback loops in earth potential tracks and stray capacitance between pointed tracks must be avoided in radio frequency (RF) in the VHF or UHF spectrum.

Common earthing bars or points should be utilized where banks of electronic equipment are connected to function on common banks.

These points could either be at "absolute" earth potential i.e. returning to the earth of the input power circuits or may be at "floating" earth potential i.e. an earth potential insulated (by making use of an insulating transformer from the supply earth potential).

The resistance between the earth electrode and earth on electronic equipment shall be less than 2 ohms.

Any conducting material that has been anodized, e.g. aluminium, may not be used as an earth busbar unless special precautions have been taken to ensure that the anodizing material has been removed where the earthing connections are made.

Connections to electronic equipment must be made using cadmium plated lugs, bolts and nuts fixed to properly cleaned and prepared surfaces on the electronic sub-racks or trays.

From the sub-rack earthing point to all the individual earthing points of the electronic equipment, separate copper conductors must be installed for each electronic rack.

The conductor size shall be determined according to SABS 0142, must be sufficient for that particular rack and must be soldered to the terminal(s) of the edge connector(s) on that rack.

All connections between racks or sub-racks for the conveying of signals in the VHF, UHF or microwave frequency range shall be made using co-axial cable with matching impedance.

Terminations of co-axial cable shall be in proper connectors (plugs and sockets) of the BNC or RG8U or equivalent type depending on the particular application.

15. **CABLES**

Cables shall generally be of the PVC-insulated type, individual cores of multicore cables being identified by means of distinctive colouring of the PVC-insulated material of the individual cores.

All cables shall be supplied and installed WITHOUT JOINTS unless written approval has been obtained from the Engineer.

15.1 **VOLTAGE RATINGS**

All cables shall be suitable for the voltage to be applied between the conductors and between the conductor and earth.

All cables to be used in systems with a system voltage between 50 Volt and 500 Volt, shall have a volt rating of 600/1 000 Volt.

15.2 **TERMINATION OF PVC-INSULATED, ARMoured CABLES**

All ends of PVC SWA PVC cables shall be terminated with approved glands ensuring a watertight connection between the sheath, gland and equipment.

In cases where copper earth conductors are joined to the armouring, special glands complying to SABS 150-1970, shall be used.

The glands to be used shall be constructed so that the armouring of the cable is clamped between two bevelled cores with a screw-clamp.

The cable gland shall be screwed to the gland plate or equipment and fixed with a locknut.

A neoprene or PVC shroud shall be used to seal the gland and sheath watertight.

Cable cores shall be connected to equipment with suitable lugs.

Exposed armouring shall be covered with bitumen-base paint.

15.3 CABLES IN FALSE FLOOR AREAS

Cables shall preferably be installed in the false floor space below equipment racks, control boards or control consoles if so provided.

Cables shall be installed in groups parallel and adjacent to each other in straight line and/or in groups at 90° to each other.

Generally the cables shall be installed directly on the concrete floor and groups shall be bound together by means of steel straps approximately 12 mm wide.

Groups of cables crossing each other at 90° shall be approximately 50 mm apart vertically.

For this purpose, the contractor shall supply and install "O-LINE" or similar type cable trays manufactured and bent in the shape of a bridge spanning the lower group of cables.

The two cable tray approach section of the bridge shall be inclined at an angle of 30° to the horizontal.

Cable tray bridge sections shall be bolted to the concrete floor at both ends by means of 12 mm diameter "RAWL" or similar bolts and nuts.

15.4 CABLES FIXED TO WALLS AND VERTICAL DUCTS

Cables to be installed and fixed to walls and in vertical ducts, shall be clamped to galvanised "O-LINE" or similar type channels fixed to the wall face.

The "O-LINE" channels shall be installed at vertical distances not exceeding 600 mm and shall be secured to the walls by means of "RAWL"-bolts or by means of a self-drilling anchoring system.

Cables shall be arranged parallel and adjacent to each other and each cable shall be supported and fixed to the "O-LINE" or similar type clamps.

The size of the clamp (and the corresponding catalogue number) shall be determined from the diameter of the cables.

All cables larger than 35 mm² 4-core shall be clamped to the "O-LINE" or similar channel by means of J type cleats.

Cables installed on horizontal distribution sections other than in false floor areas shall be installed on cable trays.

Cables for the installation of other services including communication systems and other low voltage systems (less than 50 V), shall be separated from power cables.

In vertical building ducts, a physical barrier shall be provided between power cables and cables for low voltage systems.

Where armoured cables are used for low voltage services, they shall be installed in separate cable trays or shall otherwise be at least 1 metre away from power cables.

Where unarmoured cables are used for these other services, they shall be installed in separate conduits or metal channels.

15.5 IDENTIFICATION OF CABLES

All cables shall be identified at both ends and at all joints and as otherwise specified according to a code or number system.

These numbers shall appear on the drawings to be submitted when the installation has been completed.

Cables shall be marked with non-deteriorating bands with raised or punched numbers.

The marking may be done by means of lettering punched into aluminium foil.

The foil shall be wrapped around each respective cable and bound with aluminium tape.

The cables shall be marked as follows:

- (a) At both terminations.
- (b) At T-sections or four-way joints of cable trays and/or metal channels.
- (c) At entries to vertical ducts should cables extend up and down at the particular point of entry, the cables shall be marked directly above and below such a point of entry.

16. **INSTALLATION OF CONDUIT SYSTEM**

16.1 **GENERAL**

In general the conduit for interconnecting wiring to various types of outlets for electronic installations, shall be installed by OTHERS unless specified to the contrary in the project specification.

The conduit installed by OTHERS shall be provided with draw-wires only.

All wiring in the conduit shall be done by the contractor.

Generally all interconnections between boards, consoles, sockets and power distribution equipment shall be done by means of PVC-insulated cables.

All conduit and conduit fittings installed surface mounted in ducts, false ceiling voids, in false floor areas or surface against walls, shall be of the steel GALVANISED type.

Conduit and fittings shall in general comply to the requirements of SABS 162, as amended.

16.2 **OUTLETS**

All accessories such as detector outlets, break glass units, microphone input points etc., shall be accurately positioned.

It is the responsibility of the contractor to ensure that all accessories are installed level and square at the correct height from the floor, ceiling or roof level as specified.

It shall be the responsibility of the contractor to determine the correct final floor, ceiling and roof levels.

16.3 **DRAW BOXES**

Draw boxes shall not be installed in positions where they will be inaccessible after completion of the installation.

All installed draw boxes shall be pointed out to the Engineer and the positions of all draw boxes shall be indicated on the "as installed" drawings.

16.4 **WALL OUTLETS**

Where more than one outlet is connected to the same circuit, the conduit shall be looped from one outlet box to the following on the same circuit.

Where a metal channel is used, the conduit may be installed from the channel directly to the outlet box on condition that the conductors can be looped from one outlet to the next without making any joints in the wires.

16.5 CEILING OUTLETS

Where the conduit end is used to support detectors, sirens loudspeakers, etc., a ball-and-socket type lid shall be fitted to the ceiling outlet box in all cases where the conduit from the concrete or ceiling is longer than 500 mm.

In all other cases, a dome lid may be used.

Where equipment is specified as ceiling mounted it shall be fixed directly to the draw box, this shall be done by a minimum of two screws screwed to the box or alternatively by screws fixed directly to the concrete ceiling.

16.6 FLUSH MOUNTED OUTLET BOXES

The edges of flush mounted outlet boxes shall not be deeper than 10 mm from the final surface.

Where this is not the case, an extension box which ends flush with the surface, shall be screwed to the outlet box.

This method shall be used in partitions and cladded surfaces.

16.7 EXCESS HOLES

All excess holes in draw, distribution boxes, control boards, cable ducts or trunking, power skirting, etc., shall be securely blanked off to render the installation vermin proof.

Brass stopping plugs shall be used in conduit accessories.

All conductors shall be installed in conduits, cable channels (trunking) or power skirting and shall under no circumstances be exposed to the atmosphere. Cable channels and power skirting shall be of metal construction unless specifically approved otherwise.

16.8 SEQUENCE OF THE WORK

Wiring shall only be carried out after the conduit installation and plaster have been completed, but before painting has commenced.

No conductors shall be installed before the conduits have been cleaned of all debris and moisture.

16.9 CIRCUITS

Conductors that are connected to different control boards, shall not be installed in the same conduit.

In the case of power distribution, the wiring of one circuit only will be allowed in 20 mm diameter conduit with the exception of the wiring between control boards and fabricated sheet metal boxes close to control boards. In this case more than one circuit will be allowed.

16.10 **LOOPING**

All wiring shall be carried out according to the loop-in-system. If a conductor joint is found necessary in an isolated case, jointing will only be accepted in cable channels or draw boxes and not in conduits.

Conductor jointing shall be executed by approved ferruling properly covered with heat shrink.

16.11 **NUMBER OF CONDUCTORS**

The number of conductors that may be drawn through a conduit, shall comply with the requirements of SABS 0142-1.

16.12 **DRAWING IN OF CONDUCTORS**

When conductors are drawn through conduit, care shall be taken that they are not kinked or twisted.

Care shall also be taken that the conductors do not come into contact with materials or surfaces that may damage or otherwise adversely affect the durability of the conductor.

17. **ELECTRICAL EQUIPMENT AND COMPONENTS, ELECTRONIC COMPONENTS AND CIRCUITS**

17.1 **GENERAL**

Electronic components such as I.C's shall be of a type and model obtainable in the RSA and not specifically designed for the equipment in which it is used.

The contractor shall clearly indicate to the Engineer which of the equipment offered does not comply with this requirement before approval shall be granted.

17.2 **RELAYS**

The coil, contacts and operating mechanism of all relays shall be contained in a transparent, dust proof enclosure of plastic or other suitable synthetic material.

Relays shall be supplied with plug-in bases of "bakelite" or other insulating material.

Bases shall be fixed to the equipment rack, control board or console frame in a fashion to facilitate removal or insertion of the relay and enclosure.

Relays bases shall be fitted with wire-spring type retaining clips to ensure positive relay contact even when the relay is subjected to severe vibrations.

Relay contact ratings shall be sufficient for the current drawn over the contacts taking the impedance of the load into account.

17.3 **PUSH BUTTONS**

Impulse type push buttons shall be of robust construction and shall be suitably rated for the switching duty and for the control functions specified.

The push buttons shall be suitable for flush mounting in control boards, consoles or in outlet boxes in walls.

Push buttons shall be fitted with screw-on-retaining rings.

RED push buttons shall generally be used for tripping, stopping or switching of functions and GREEN push buttons for starting or switching on functions.

Push buttons installed in walls or on other non-metallic surfaces, shall be mounted in purpose-made flush or surface mounted boxes equipped with a mounting plate with slotted holes and a suitable cover plate.

Self-locking type push buttons shall be similar in construction to impulse type push buttons. When such a push button is depressed a second time, it shall cancel the original switching state.

Illuminated push buttons, key-operated push buttons, buttons plates, legend plates etc., shall be supplied as specified. Economy resistors shall be provided with illuminated push buttons.

Push buttons shall comply with the requirements of the relevant clauses of BS 3955, part 1 or VDE 0660.

Generally switching functions of push buttons shall be indicated by means of symbols or figures engraved on the moulded shroud. This shall be the preferred method of identifying the function of push buttons.

17.4 **INDICATING LIGHTS**

Indicating lights to be installed on equipment racks, control boards and consoles shall be similar in construction to the shroud of push buttons, and shall illuminate internally when indicating a switching state.

The colour of the shroud shall be green and red respectively for indicating an "ON" and "OFF" switching state or any other colour specified for a particular control function indication.

17.5 **PROTENTIOMETER TYPE CONTROLLER**

Controllers shall be of the quadrant type with linear movement.

Each controller shall be fitted with a scale marked as specified with unit divisions indicated numerically.

The quadrant controller shall rotate about a swivel operating through an arc of approximately 90° with the "OFF" position at the bottom end nearest to the operator and the maximum at the top.

18. **TESTING OF SYSTEM AND TRAINING**

18.1 **FACTORY ACCEPTANCE**

A Factory Acceptance Test of the various components of the systems shall be provided on request.

18.2 **COMMISSIONING**

After installation and run-up, a commissioning and hand- over procedure shall be followed by the contractor to demonstrate proper operation of the system, in accordance with this specification.

18.3 **TRAINING**

18.3.1 The Contractor shall be required to train technical personnel in the proper operation and maintenance of the system. A total of 4 people will be nominated for this purpose. Training shall be done on site. Tenderers shall indicate the time allowed for this purpose, but the minimum period acceptable will be 1 day.

18.3.2 It is the intention to obtain a very thorough understanding of the system. To this end, training shall be done in three ways:

18.3.2.1 **Formal hands-on training** sessions of the operating personnel in system operation, covering all software and hardware operational aspects.

18.3.2.2 **During the installation phase,** a person will be designated to be closely involved with the installation and commissioning process. The intention is not to interfere with the Contractors' installation team, but to observe in order to obtain the maximum possible information regarding the installation.

18.3.2.3 **Software instruction**

During these sessions the operators will be familiarized with the software regarding the generation of reports by the system, set-up of analogue limits, modification of displays, configuration, as well as other operational requirements, of the software.

19. **DRAWINGS**

The specification drawings are in diagrammatic form and are not manufacturing drawings and the dimensions given are only sufficient for tendering purposes or

to enable the Contractor to complete his working drawings. Due allowance must be made in the tender for such items not shown or detailed on the drawings, but which are nevertheless necessary for the proper execution of the works and operation of the system.

The Contractor shall submit for approval:

(a) Builder's Work Drawings

Builder's work drawings shall include positions, sizes and masses of major pieces of equipment, as well as all other building requirements such as shelves, cupboards, etc., necessary for the successful installation of equipment and operation of the system.

(b) Electrical Drawings, such as:

General arrangement drawings of the equipment in the relevant area.

Line Diagrams of each part of the system.

Interconnection Diagrams.

Cable and Equipment Schedules.

All cable routes shall be shown on the site plan drawings.

Two prints of manufacture/erection drawings for approval.

The Engineer requires two (2) weeks from the date of receipt to check drawings submitted. Drawings shall be submitted in sufficient time to permit the Contractor to meet his fabrication programme, since no claim for extension of the contract will be considered should drawings not be submitted timeously.

It is the Contractor's responsibility to ensure that all drawings conform to the specification and to correct any errors, omissions or deviations. If manufacture drawings differ from the specification, the Contractor shall make specific mention of each deviation in a letter accompanying the submission, giving the reasons for the deviations, and any cost implications, if any.

Should the drawing indicate work which **does** deviate from the specification and is not pointed out, the Consulting Engineer reserves the right to amend such workshop drawings at any stage when the deviation is discovered **i.e.** even after installation, at the Contractor's expense.

Where it is necessary to consider the building and electrical details of the project when compiling workshop drawings, the Contractor must refer to the detailed Architectural drawings produced by the Architect and the drawings of the electrical details produced by the Consulting Electrical Engineer. Both these sets of drawings are in the possession of the Client.

The accuracy and practicability of all shop dimensions necessary for the manufacture and installation of the equipment remains the responsibility of the

Contractor. Approval of submitted information shall not be construed as a complete check and shall not relieve the Contractor of his responsibilities as defined elsewhere.

20. **VARIATIONS TO THE CONTRACT**

The Contractor shall, upon a written request from the Engineer, price the variation intended to his works within seven (7) days of such request.

Failing to submit prices to such variations within the stipulated period, may result in them being priced by the Engineer and issued officially as variation orders.

The Contractor shall rate on his priced variations the extra time required to carry out the work intended. Should the Contractor fail to inform the Engineer of extra time required it shall be assumed that such work will be carried out within the contract period and no later claim for extension of time will be considered.

The Contractor shall perform no work that involves a cost implication or a variation in price to the original contract amount unless the Contractor is in possession of:

- (a) an approved variation order.
- (b) a letter of definite instruction from the Consulting Engineer advising him to proceed without the approved variation order.

21. **MANUALS AND LITERATURE**

At the stage of performance testing, the Contractor shall submit to the Consulting Engineer, three (3) copies of maintenance and operating instructions each containing the following:

- (a) A full set of electrical drawings of the final installation.
- (b) A full set of control drawings of the final installation.
- (c) Literature on all equipment installed, including wiring diagrams, recommended spare part lists together with the model number, etc. and the name and address of the supplier.
- (d) Test certificates for fire detection installations.
- (e) All workshop drawings of the system as installed.
- (f) Trouble-shooting check list.
- (g) All wiring diagrams.

Wiring diagrams are to be correct in every respect and checked before being submitted. All the above relevant information shall be properly filed and indexed in appropriate files.

22. **TESTS AND REPORTS**

22.1 **GENERAL**

Where practical according to the discretion of the Engineer, complete electronic and other control units shall be assembled in the workshop for preliminary tests.

This shall be done to check whether the equipment complies with predetermined set values and shall produce certain predetermined set results. It is in the interest of the contractor to notify the Engineer when the installation reaches various stages of completion in order that he may inspect the installation and point out any discrepancies. These inspections shall be considered informal and under no circumstances will they in any part or in whole invalidate the requirements of the specification. Any costs incurred in correcting discrepancies shall be to the contractors account.

22.2 **PRE-FINAL INSPECTION**

A pre-final inspection of the installation shall be made at the contractors request at least seven days prior to the official testing and acceptance of the installation once the installation is, in the contractor's opinion, complete and ready to operate. After this pre-final inspection the installation must be set into trail operation. The installation shall only be deemed ready for official acceptance subject to its having maintained the specified performance without any failure for a period of seven consecutive days. Upon completion of the installation and the trail run, the contractor must conduct tests and submit the results to the Engineer for evaluation before requesting the Engineer to take first delivery of the entire, or any part, of the installation. The Department shall be informed 7 days in advance prior to the actual tests being done.

22.3 **FINAL ACCEPTANCE**

On the day of the first delivery inspection, the contractor shall be ready and fully equipped to repeat the tests in the presence of the Engineer. The system will be considered for accepted only after satisfactory tests of the entire system has been accomplished by a representative of the contractor in the presence of the Engineer. The contractor shall provide on-site services of an authorized technical representative of the manufacturer/s, to supervise all connections and fully test all devices and components of the complete installation as installed. The Engineer shall witness all tests conducted by the contractor or the manufacturer/s in accordance with the final acceptance test plan. Properly calibrated standard test equipment shall be utilized to complete tests that shall confirm the compliance of the complete system with the requirements of the specification.

23. **WARRANTY**

All equipment and wiring supplied and installed under this specification shall be warranted from inherent mechanical or electrical defects for a period of 12 (twelve) months.

24. **GUARANTEE OF INSTALLATION**

The contractor shall guarantee that the entire system complies with the major applicable codes and standards, as well as with the specified and implied qualities and that the operation of the system shall be proper and faultless.

The contractor shall guarantee all system components in hardware and software and the whole of the installation against any defect of materials or workmanship for a period of 12 months (one year) after acceptance of the installation.

During the stated period of guarantee the contractor shall replace free of charge all components failing or malfunctioning. However, system components damaged or stolen on site prior or after installation by negligence of the Department shall be exempted from this guarantee.

25. **CONTRACTOR'S LIABILITY IN RESPECT OF DEFECTS**

Any defects or faults which may appear within 12 months from the date of completion of the installation due to materials or workmanship not being in accordance with the specification shall be made good by the contractor within such period as may be determined by the Engineer.

Should the contractor fail to rectify the defects or faults within the predetermined period, the Department shall be entitled to rectify such defects or faults or to arrange for the rectification thereof and to recover from the contractor any damages and costs as a result of the contractor's failure to comply with these terms.

26. **MAINTENANCE**

The contractor will be required to maintain the complete system in good working order for a period of twelve months after the installation has been taken over. **The contractor shall supply free maintenance during the one year guarantee period inclusive of spares and labour.** The maintenance shall include standard maintenance during normal working hours (08:00-17:00) at three months intervals and a 24-hour service on request.

After the lapse of this twelve months period, the contractor may be required to enter into a prolonged maintenance agreement in the form of a maintenance contract on a continued basis for a one calendar year. The agreement will initially be for one calendar year, and may subsequently be renewed for yearly periods.

The contractor shall prepare and submit a pro-forma maintenance and service contract. The contract shall be a formal service agreement signed by an authorised employee and shall include the monthly cost of the services to be provided and to what extent the price quoted will be subject to variation.

The service contract shall include the following minimum provisions:

- (a) To provide regular scheduled preventive maintenance and service of at least one man-day per three months period, i.e. at least four man-days per year, by trained service representatives of the contractor or suppliers.
- (b) At each visit which shall be arranged in advance with the Department, a record of all maintenance carried out shall be kept. The time and date of visits shall be entered in a log book, kept by the Department.
- (c) To check the mechanical soundness of all parts.
- (d) To replace all defective parts.
- (e) To clean all equipment.
- (f) To carry out thorough system check with the use of all the testing equipment and instruments required. A detailed report comparing the system performance at the time of testing and at the time of handing over shall be prepared and handed to the Department along with comments.
- (g) To comment on improved system reliability and system design changes as it becomes available from the manufacturers, enabling the Department to keep up with the latest trends.

Entering into a prolonged maintenance and service contract shall in no way invalidate the one year guarantee and maintenance as stated above.

The contractor must state the details in the schedules of this specification for the cost of the year maintenance, the prolonged maintenance over the year period and over five years after the prolonged maintenance period has expired.

The contractor shall keep adequate stocks of spares for the equipment offered, for a minimum period of ten (10) years and the submission of a tender will imply that the contractor guarantees adequate stock for the minimum period.

27. **TROUBLE CALLS**

The contractor shall respond on site within four (4) hours after notification of trouble calls. The corrective action or maintenance shall occur during normal working hours.

The technical staff and spares shall be locally available or else in Bloemfontein.

28. **MATERIALS AND PACKING**

The successful contractor is urged to order materials as early as possible as he will be held responsible for any delay in the delivery thereof. The contractor

shall be responsible for packing all materials and goods in a manner that will ensure that no damage thereto occurs in transit.

29. **COMPLIANCE WITH REGULATIONS**

The entire installation shall comply fully with the applicable regulations valid in the RSA and described in this specification. In addition the contractor shall issue all notices and pay all the required fees in respect of the installation to the local authorities and shall exempt the Department from all losses, cost or expenditure which may arise as a result of the contractor's negligence to comply with the requirements of the regulations of this specification.

30. **CERTIFICATE OF COMPLIANCE FOR ELECTRICAL INSTALLATION**

On completion of the electrical parts of the installation, the contractor must issue a certificate of compliance to the Department as described in the Machinery and Occupational Safety Act, Act No. 6 of 1983 of the RSA (as amended).

31. **ELECTRONIC EQUIPMENT**

All equipment must be protected from damage or faulty operation resulting from external factors such as static electricity, induced voltages, magnetic forces, radio waves, lightning, etc. in accordance with SABS requirements (Note must be taken in particular of SABS 03 and 03 A with regard to lightning protection). All electronic equipment inputs from power points, telephone wires, antenna feeder cables and data or signal lines, must be issued with in-line protection. The products of manufacturers that carry the SABS mark of that have CSIR approval, must be used (Examples hereof are ZAPTRAP, CLEARLINE, COPA AND IRENCO).

Equipment sensitive to interferences and spikes in electrical power, variance in the voltage and frequency as normally occurs and is inevitable in the electricity distribution network and the municipal supply to the building, must be equipped with the necessary stabilisers, over and under voltage protection equipment, suppressers, etc. Equipment must be manufactured and installed (inter alia be provided with suppressers), so that it shall not cause any interference in respect of other equipment, or have an effect on the working thereof. Fully installed equipment/systems must meet SABS requirements in so far as interference is concerned that may arise as a result of this equipment (Static electricity, induced voltages, magnetic forces, radio waves and sound levels are included herein). The contractor must submit full explanations of his methods in order to comply with all the aforementioned. The onus is on the contractor to provide proof after installation that the applicable standard or specified values have been complied with and any adjustments/additional equipment shall be for his own account.

32. **SPECIAL EQUIPMENT**

Any special instruments, equipment, software, components or terminations that may be required during calibration, initiation or programming/reprogramming, must be provided to as part of the contract.

33. **ELECTROMAGNETIC COMPATIBILITY**

As the buildings will house a conglomeration of equipment together with radio frequency equipment, the contractor must design electromagnetic compatibility into the system and ensure that the one system shall not affect the other adversely when operating, e.g. when a hand-held two-way radio is used it should not interfere in any way with the rest of the equipment.

34. **MAKING GOOD**

The contractor shall be responsible for making good of all damages, disturbances to the building installations, finished surfaces and other services or trades, which he or his employees may have caused. The contractor will be responsible for keeping the areas where installation work is performed tidy. The contractor shall remove from the site all rubble and litter resulting from the installation of the system.

35. **MANUALS**

Deviations or alternatives under this heading may be offered after consent has been given by the Engineer. Each type of equipment/system must be issued with three full sets of manuals in English.

Each set must contain the following sections and information:

- (a) The equipment and function must be identified.
- (b) The working thereof must be described in full.
- (c) The prescribed and acceptable conditions of usage.
- (d) All applications and procedures must be set out in full.
- (e) The function and operation of all controls, indicators and adjustable components must be described.
- (f) Components with factory codes, or marked in any other way unclear or in a manner not well known, must be given with generally available equivalents.
- (g) Complete electric circuit diagrams, functional diagrams and explanations of components as well as programming of components must be provided.
- (h) Any special installation/mounting or initiation procedures must be explained.

An abridged version of the abovementioned, or stated otherwise, a "Quick reference guide" hereof, aimed at the end-user, must be provided in a durable plastic cover along with every system/item of equipment.

Comprehensive fault detection procedures and diagrams must be provided on both use and maintenance levels.

This information must enable any suitably qualified technician to undertake urgent repairs and/or maintenance of the equipment.

36. **WORKMANSHIP**

The contract shall be executed with the best workmanship in a workmanlike manner to the satisfaction of the Engineer. Should any material or workmanship not be to the satisfaction of the Engineer, it shall be rectified at the cost of the contractor and all rejected material shall be removed from site. The contractor shall be responsible for the correct and complete erection of the installation. Inspection by the Engineer shall not release the contractor from this responsibility.

Before the installation is handed over, the contractor shall ensure that all paint surfaces are clean and undamaged. Final coats of paint may be applied on site immediately prior to completion.

37. **TRADE NAMES**

Tenderers are asked to take note that where trade names and reference to catalogues appear in this specification, this is for the purpose of determining a standard for the materials needed. If approved material is used other than that tendered on, price adjustments shall be made and amendment instructions be issued so as to confirm such adjustments.

38. **COMPLETION OF CONTRACT**

The contract will only be considered complete when all the conditions and requirements stipulated in this document and the following have been carried out:

- (a) The work completed to the satisfaction of the Engineer, the Architect and the Employer.
- (b) The system commissioned and functioning as intended by this document.
- (c) All operating and maintenance manuals, as specified, have been submitted and approved.
- (d) All commissioning results have been submitted, checked and approved by the Engineer.

Only when the above requirements have been fulfilled will the issuing of a completion and acceptance certificate be considered.

Should the Contractor, in the opinion of the Engineer, unnecessarily delay the completion of the works, the Employer reserves the right to make use of the works beneficially without any recourse from the Contractor. Such action will in no way implement the commencement or alter in any way the guarantee period.

SMITHFIELD INDOOR SPORT CENTRE

INTERCOM & VOICE EVACUATION & FIRE DETECTION INSTALLATION

PART 2 : PROJECT SPECIFICATION

This part of the specification forms part of and is to be read in conjunction with Part 1 (General) of this specification and relevant drawings. Part 2 of the specification takes preference over Part 1 of this document.

CONTENTS

<u>Item</u>	<u>Description</u>	
1.	General	72
2.	Scope of Work	72
3.	Extent of Work	72
4.	Electrical Work	73
5.	General Requirements	73
6.	Working Drawings and Technical Information	75
7.	Environmental Conditions	76
8.	Supply Voltage	77
9.	Site Amenities	77
10.	Quality Control of Material	78
11.	Workmanship	78
12.	Competency of Workmen	78

<u>Item</u>	<u>Description</u>	<u>Page</u>
13.	Training of Operators	81
14.	Training of Technical Personnel	81
15.	Requirements of the Fire Detection System	81
16.	System Alarm Detection	96
17.	System Trouble Detection.....	96
18.	Control Switch Operation	96
19.	Testing and Commissioning.....	96
20.	Voice Evacuation System	98
21.	Maintenance	98
23.	Literature Required	98
23.	Wire Ways	98
24.	Intercom & Voice Evacuation System.....	100

SMITHFIELD INDOOR SPORT CENTRE

INTERCOM & VOICE EVACUATION & FIRE DETECTION INSTALLATION

PART 2 : PROJECT SPECIFICATION

1. GENERAL

This part of the specification, called the project specification, covers the detail requirements regarding material, equipment, installation, testing and commissioning of the complete installation and shall be read in conjunction with the conditions of contract, general specification, schedules and the bills of quantities.

The complete installation shall comply with the requirements of this specification. Should any differences or contradictions exist between other parts of this specification and the project specification, then the latter shall take preference.

2. SCOPE OF WORK

The scope of work includes the supply, delivery, installation, testing, commissioning and handing over in good working order of an Intercom & Voice Evacuation & Fire Detection installation with associated peripherals at the **SMITHFIELD INDOOR SPORT CENTRE**. The designer and installer must be register by PRIVATE SECURITY INDUSTRY REGULATION ACT (PSIRA) and The South African Qualification & Certification for the Committee for the Fire Industry (SAQCC).

3. EXTENT OF WORK

The extent of the work includes the supply and installation of all equipment, peripherals, software and sundries necessary for the proper completion of the installation, although not specifically mentioned or specified, encompassing:

- (a) The supply and installation of all cabling, wiring, connectors, distribution frames, mounting brackets, etc. and all the equipment required by the contractor to install a complete and neat workable installation, excluding all conduiting, distribution boards and sleeves indicated as electrical work (See Clause 4).
- (b) The supply and installation of all material and equipment that are not specifically stated in this specification, but which are nonetheless necessary to execute the contract in accordance with the requirements of this specification, regulations, statutes and codes of practice which are applicable to the installation.

- (c) The supply and installation of a central fire detection control panel (addressable analogue type) connected to the relevant break glass units, optical smoke detectors, isolators, etc., in ceiling mounted outlet box, mounted over the flush wall mounted terminal box (supplied by others). A display unit as part of the central detection panel that can display the number, room description of each detector or break glass unit.
- (d) The supply and installation of a 600 x 600 mm (minimum) mimic panel flush mounted against the wall as part of the control panel indicating all the zones per floor with high intensity leds.
- (e) The supply and installation of a 1000 x 1000 mm mimic chart or charts flush mounted against the wall, indicating the number, room description, etc. of each detector or break glass unit at the control fire detection panel.
- (f) The supply and installation of a fire resistant 2 - core transmission medium connected to the detectors or break glass units, enabling the pre-fire alarm and buzzer signal.
- (g) The supply and installation of a 2-core transmission medium connected to the air conditioning units, enabling the cut-off of air conditioning units and extraction fans.
- (h) The supply and installation of optical smoke detectors, break glass unit, buzzers, and sirens, as indicated on the drawings. No conduit will be installed in the ceiling void and detectors shall be mounted on 65mm ø steel outlet boxes. The wiring should be glanded to the outlet boxes and open wiring shall be fixed to the roof structure. No wiring laying in the ceiling will be allowed. Wiring shall be installed in conduit in areas with concrete ceilings.
- (i) The supply and installation of a printer on the fire detection control panel.
- (j) The supply, installation and cabling of the future UPS power supply to all the equipment supplied under this contract.
- (k) The testing, commissioning and handing over of all the systems that form part of the contract.

4. **ELECTRICAL WORK (Done by Others)**

The following electrical work will be provided by others.

- (a) Break glass unit outlet
 - 100 x 50 x 50mm flush outlet box with 20mm ø steel conduit and draw wire linking to ceiling void.

(b) Main Panel

- 150 x 150 x 50mm flush outlet box with 6 x 32mm ø steel conduit and draw wire linking to ceiling void.
- 1 x 20A double pole flush mount isolator with cover plate and cord grid adjacent to main panel. Emergency power if available (Final position to be coordinated on site).

(c) Public Address System

- 150 x 150 x 50mm flush outlet box with 3 x 32mm ø steel conduit and draw wire linking to ceiling void.
- 2 x 16A switched socket outlet adjacent to public address panel. Emergency power if available (Final position to be coordinated on site).
- 3 x 32 mm ø steel conduit and draw wires linking between ceiling void of ground floor and ceiling void of first floor in position of the public address system control panel.

- (d) 1 x 50mm ø PVC conduit and draw wires linking between 150 x 150mm central fire detection control panel outlet box and 150 x 150mm central fire detection control panel outlet box at the office block reception of the Hospital.

5. **GENERAL REQUIREMENTS**

Tenderers shall supply full detail of the equipment offered at tender stage and shall make full allowance for the design, supply, wiring, installation and commissioning of the total system. Approval of equipment shall only be considered after samples have been approved and/or a working installation inspected. The cost of this inspection shall be for the contractors account.

All the control equipment for the Fire Detection systems shall be installed where indicated on the drawings with alarms where indicated.

For calculating of his tender price the tenderer must take the following into consideration:

- (a) It is essential that a layout showing the equipment positions and any changes that the contractor requires, shall be submitted for approval within two weeks after the tender has been awarded so as to ensure that the electrical work, provided by others, is to the Contractor's specification. Changes at a later stage required by the Contractor, due to bad planning at this point in time, shall be for his own account.

- (b) During the time of installation there will be a number of other contractors and workers on site and tenderers must make ample allowance for co-ordination with others.
- (c) The Contractor have to co-ordinate his program with the building program and will ensure that under no circumstances any delays are caused due to his interfering with the building program or for that matter with any other contractor on site.
- (d) Although the electrical works will be provided by the Electrical Contractor to the Building Contractor, the onus is on this Contractor to ensure that the conduit is installed to the specific requirements, regarding position of outlets and size of conduits, sleeves, distribution boxes, etc. However the quality of the conduit installation will be determined by the Engineer. Any instructions that the Contractor wishes to issue to the Electrical Contractor doing the electrical works shall be timeously requested from the Engineer to be issued to the Electrical Contractor via the Main Contractor.

Supply and install the complete fire detection system to comply with the current applicable provisions of the following standards:

- (a) Local electric codes
- (b) National fire protection standards:
 - NFPA 71 : Central station signalling systems - protected premises unit
 - NFPA 72A : Local protective signalling systems
 - NFPA 72D : Proprietary protective signalling systems - protected premises unit
 - NFPA 72E : Automatic fire detectors
- (c) Local and state building codes
- (d) All requirements of the local authorities having jurisdiction
- (e) The system and all components shall be listed by Underwriters Laboratories Inc for use in fire protective signalling systems under the following standards as applicable:
 - UL 864 : Control units for fire protective signalling systems
 - UL 268 : Smoke detectors for fire protective signalling systems
 - UL 268A : Smoke detectors for duct applications

UL 217	Smoke detectors, single and multiple stations
UL 521	Heat detectors for fire protective signalling systems
UL 228	Door closer-holders for fire protective signalling systems
UL 464	Audible signalling appliances
UL 1638	Visual signalling appliances
UL 38	Manually actuated signalling boxes
UL 346	Water flow indicators for fire protective signalling systems
UL 1481	Power supplies for fire protective signalling systems.

6. **WORKING DRAWINGS AND TECHNICAL INFORMATION**

6.1 **GENERAL**

Only the main equipment and devices have been shown on the drawings and specific wiring or cabling between equipment has not been shown.

It shall be the responsibility of the contractor to ensure that the method of installing wiring or cabling, and the wiring used, between the equipment shall optimize the use of such equipment and that the optimum parameters specified can be obtained.

6.2 **SUBMITTALS DURING TENDER PERIOD**

All tenderers shall submit the following information with their tenders:

- (a) Outline drawings showing the dimensions (size) and configurations of all equipment in the spaces allocated to these equipment.
- (b) Any information that may have a direct effect on the architectural or structural features of the building, which features may upon the proposal of the contractor be subject to modification.
- (c) Certification of ISO compliance for the equipment and cabling that will be used during the execution of the contract.
- (d) Brochures and specifications of all equipment offered for the execution of the contract.
- (e) Brochures and specifications of all software offered for the execution of the contract.

- (f) Full details regarding the proposed training to be given on the hardware, software and the operation and maintenance of the systems.
- (g) A letter of compliance also indicating which of the items offered does not comply with this specification and what the differences are and the implications thereof.

6.3 SUBMITTALS DURING CONTRACT PERIOD

The contractor shall submit complete documentation showing the type, size, rate, style, catalogue number, manufacturer's names, photos, and/or catalogue data sheets for all items offered enabling the Engineer to ensure compliance of the equipment with this specification.

This information shall be submitted to the Engineer within fourteen (14) calendar days after award of this contract and shall be subject to his approval.

Equipment must not be ordered without this approval.

Furthermore the contractor shall submit for approval the complete layout of the entire system, showing wiring and all equipment.

All equipment proposed as equal to that specified herein, shall conform to the standards herein.

For equipment other than specified, the contractor shall supply proof that such substitute equipment does in fact equal or exceed the features, functions, performance and quality of the specified equipment. However the Engineer shall have the final decision of acceptance and his decision shall be final.

6.4 SUBMITTALS ON COMPLETION OF THE INSTALLATION

Detail "as-built" transparent drawings and DXF computer format of each part of the complete installation shall be submitted to the Engineer on completion of the installation.

Such detail drawings shall include complete and fully dimensional drawings of the equipment, full schematic diagrams of all circuits, terminal numbers, resistance values, capacities of all equipment, supply voltages, component characteristics and values, block diagrams and line diagrams, etc.

Three user manuals as specified in this specification, bound in hard cover ring binders, shall be submitted to the Engineer on completion of the installation.

6.5 **APPROVAL OF DRAWINGS**

The approval of drawings shall not relieve the contractor of his responsibility to supply the installation according to the requirements of this specification or to obtain the highest quality of craftsmanship possible.

7. **ENVIRONMENTAL CONDITIONS**

The installation shall operate satisfactorily in the following environmental conditions:

Average monthly maximum temperature	:	30°C
(Summer condition)	:	32°C
Average monthly minimum temperature	:	-4°C
(Winter condition)	:	
Absolute minimum temperature	:	-15°C
Absolute maximum temperature	:	42°C
Altitude above sea level	:	1350m

(The aforementioned figures are the prevailing outside weather conditions)

8. **SUPPLY VOLTAGE**

The low voltage power distribution system will be a 400/230 Volt $\pm$ 10%, 3-phase, 4 wire, 50 Hz AC supply.

All the equipment offered shall be able to function at this voltage and at this tolerance.

All the equipment associated with the system shall be able to operate from the low voltage power distribution system for twenty-four hours per day without overheating or degradation.

9. **SITE AMENITIES**

Tenderers should liaise with the building contractor, regarding site accommodation and storage facilities and should allow for all cost in this tender, including the storage and safe keeping of materials, as well as assurance against loss or damage.

10. **PROJECT MANAGEMENT**

The contractor shall provide adequate project management during the installation, implementation and training period.

The project management shall at least include:

- (a) The provision of a full time project manager for the management of employees during the complete installation, implementation and training period.
- (b) The provision of a full time competent project foreman, agent or charge-hand appointed to superintend operations on site.
- (c) Supervision over the implementation of the systems.
- (d) Daily on site support until the system is operating effectively.
- (e) Weekly progress reports including reports on items and incidents that may affect the implementation of the systems.
- (f) Arrangements for and the training of the Administration's staff.

11. **QUALITY CONTROL OF MATERIAL**

All materials shall be the best of their respective kinds described in the specification and shall in every way be suitable for the purpose for which they are intended to be used.

All materials and equipment supplied shall fully comply to the requirements laid down in this specification and the latest editions of the relevant SABS, BS, IEEE, CCITT, EIA, ISO and DIN specifications or as otherwise specified.

Any item not complying with the following shall be substituted with an approved new component at no cost to the Client, the acceptance or rejection of such work being determined by the Client's representative.

The contractor shall maintain adequate and effective quality control standards while manufacturing or installing of the specified equipment.

The Client's representative shall have the prerogative of inspecting the equipment in the contractor's factory or on site, or to call for manufacturer's test certificates of such equipment at any reasonable time. The Client's representative shall ensure accuracy of dimensions, completeness, configuration, quality of workmanship, correct identification, proper use of and type of materials, equipment used and finishes to equipment.

Samples of all equipment must be submitted for approval before installation is commenced.

Such approval shall not relieve the contractor of his responsibility for design, detail and dimension and shall in no way exonerate him from his liability to carry out the work in accordance with the terms of the contract and specification.

All such samples may be retained until completion of the contract. All such samples must have labels securely attached thereto designating the contract by name and number, the name of the contractor and any further relevant information.

12. **WORKMANSHIP**

The contractor shall only employ competent Engineers, Technicians and Artisans to erect the installation on site.

The contract shall be executed with the best workmanship in a workmanlike manner to the satisfaction of the Client's representative.

The contractor must maintain a high quality of workmanship and the Engineer shall be in full control to determine whether the installation or individual portions thereof are acceptable or not.

The contractor shall be informed in writing should the equipment or workmanship not be to the satisfaction of the Engineer and thus not acceptable. In such a case the contractor shall replace the equipment and/or perform the remedial work immediately at the cost of the contractor. All rejected material shall be removed from site.

The Engineer may upon request of the contractor visit existing installations or prototype assemblies in the factory to determine that the workmanship is of the required standard.

If required the contractor shall provide the Engineer with equipment of facilities to examine all equipment and if necessary test this equipment to preclude malfunctioning of the equipment.

The contractor shall be held liable for all damage to other services and if such damage is not repaired to the satisfaction of the Engineer within a reasonable period the Engineer shall be entitled to appoint another contractor to repair such damage and debit the account of the contractor.

13 **COMPETENCY OF WORKMEN**

The Client reserves the right to call upon the contractor to remove any workman or representative who, in their opinion, is incompetent or whose presence would have a deleterious effect on the progress of the works.

14 **TRAINING OF OPERATORS**

A suitable qualified person, preferably one who has been involved with a similar installation or the installation on site and who is conversant with the English language shall train and instruct operators employed by the Client in operating the installation.

Such a person shall be available to instruct and train the persons involved by means of lectures and practical instructions on site for a period of one day minimum, commencing two days before the commissioning and handing over of the installation.

The contractor shall supply full details of the proposed training to be given on all hardware and software as specified in this specification detailed as follows in the bills of quantities:

- Cost per person
- Duration of the course
- Course outline

The training cost shall cover training for four persons on the premises of the Client.

The contractor shall supply additional software support on any problems and questions asked by the trained personnel during the one year guarantee period.

15. **TRAINING OF TECHNICAL PERSONNEL**

A suitable qualified person, preferably one who has been involved with a similar installation or the installation on site and who is conversant with the English language shall train and instruct technical personnel employed by the Client in maintaining the functionality of the installation at the end of the guarantee period.

Such a person shall be available to instruct and train the persons involved by means of lectures and practical instructions on site with regards to operation, routine maintenance and inspection of the installation for a period of one day minimum, commencing two days before the commissioning and handing over of the installation.

Irrespective of the above, the contractor shall perform revision training of the technical personnel six months after acceptance of the installation and the first training session. The contractor shall determine whether the personnel are familiar with and adequately trained to utilize the installation fully and submit a report after this revision training to the Client's representative.

The contractor shall supply full details of the proposed technical training to be given on all hardware detailed as follows in the bills of quantities:

- Cost per person
- Duration of the course
- Course outline

The training cost shall cover training of four persons on the premises of the Client.

The technical and operational manuals to be supplied by the contractor must be explained fully to the personnel.

The contractor shall supply any additional technical support training during the one year guarantee period, the cost of which shall be allowed for in the tender price.

16. REQUIREMENTS OF THE FIRE DETECTION SYSTEM

16.1 GENERAL INFORMATION

This part of the specification is for the supply, delivery, installation, testing and commissioning of a Fire Detection System and must be read in conjunction with the General Specification. Where it deviates from any of the specifications listed or accepted as general practice those deviations must be brought to the Engineer's attention at tender stage.

16.2 EQUIPMENT MANUFACTURERS

All references to manufacturers, supplies, model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.

Equivalent equipment from other manufacturers or suppliers may be submitted for that specified providing the submittals are of the same or higher quality, standards and performance and conforms to this specification.

16.3 EQUIPMENT AND MATERIAL REQUIREMENTS

All equipment and material shall be new and unused.

All equipment and material shall be designed for continuous duty without undue heating or degradation of function or performance.

All equipment, materials, accessories, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for their intended use and shall be provided by a single manufacturer or, if provided by different manufacturers, recognised as compatible by both manufacturers (written proof/statement shall be provided by the manufacturers).

16.4 TERMINOLOGY

The functions of the equipment or components of the equipment shall be indicated by means of identification labels.

Identification shall preferably be in the form of universally accepted symbols.

The terminology shall be in the English language.

The contractor shall submit a complete schedule of symbols and/or terms of the identification of equipment to the Client's representative for approval before any labels are engraved and installed.

16.5 ENGRAVING OF LOOSE EQUIPMENT

All loose equipment and tools supplied under this specification shall be indelibly engraved in a suitable position with the words SMITHFIELD INDOOR SPORT CENTRE.

16.6 BASIC SYSTEM

The system shall be a commonly known "addressable system" Type L1 for protection of life, i.e. with addressable detectors and break glass units.

Wiring shall be in such a way that all zones and 2 x spare zones can be established as indicated on the drawings.

16.7 SYSTEM REQUIREMENTS

The following are the basic system requirements, which requirements are the minimum and not exhaustive.

- (a) The system needs to function properly, so that a fire in any place in the building can be detected before it gets out of hand and before extensive damage is caused.
- (b) Detectors shall be optimally spaced and break glass units positioned at exit doors, while bells shall be spaced for total coverage.
- (c) The system shall be designed in such a way that it is simple to operate and that no adjustments shall be required after installation.
- (d) The equipment shall preferably be manufactured in the RSA and equivalent all replacement equipment shall also be available in the RSA.
- (e) Equipment shall have been installed in the RSA in a similar installation as the one specified and shall have operated reliably and satisfactory for at least one year.
- (f) All components for the system offered and installed shall be available for a period of at least 10 years from the date of the contract. A certificate of guarantee to this effect shall be submitted by the supplier of such components.
- (g) Detectors mounted in hidden areas, or areas which may be kept locked for specific reasons, shall each be provided with a permanently marked remote indicator LED light mounted in a conspicuous position on the

wall/ceiling outside the area and close to the point of entry into such areas.

- (h) If the system offered is software driven then the software program shall be burnt into EPROM, after all parties agreed that the system is operating in a satisfactory manner. Backups of software shall be supplied to the Client for future use.
- (i) Devices shall be grouped into zones as indicated on the drawings and each loop shall be wired separately. A wiring fault in one loop shall thus not disable any other loop or device throughout the building.
- (j) Spare capacity of 20% shall be allowed for in the design of the control panels, loops, zones, etc.
- (k) The control panel shall have facilities to accommodate a further two detector circuits (zones), additional to the required number of zones, without having to be replaced or to add additional cabinets (extensions) to the control panel.

16.8 EQUIPMENT SPECIFICATION

16.8.1 Detectors

Detectors shall be designed for mounting on a standard C-type round electrical outlet box having 50mm hole centres. In the case of ceilings the base of the detector shall be mounted flush with the ceiling. Detector heads shall be a bayonet or screw fit into the base to facilitate their easy replacement and repeated insertion and removal of the head shall not damage the base. Bases for all types shall be interchangeable.

Detectors shall operate satisfactorily on a nominal 24 V DC non-polarized 2 wire system within a voltage range of 20 to 27 V. Automatic 24 hour sensitivity adjustment shall be software controlled from the panel. Reverse polarity or faulty circuit wiring shall not cause damage to the detector head or base.

All units shall be suitable to operate reliably under all conditions normally excepted in the positions where they are installed.

Detectors shall be as supplied by "ZITTON" or other approved make, fitted with red LED status indicator.

Extended status indication is required where indicated on the drawings.

This extension will consist of a red LED mounted on a 65mm round cover plate, properly labelled, i.e. "Matron's Office".

The base shall be provided with wire terminals for wire sizes up to 1,5mm², which terminals shall be of the screw and clamp plate type to hold a lug firmly

pressed against its contact surface. Spring-loaded push-in contacts will not be acceptable.

The removal of a detector from the base shall not affect the operation of other detectors on the line.

The control panel shall indicate when a detector head has been removed and also the address where it has been removed. Likewise it shall indicate when the wrong type of head is inserted in a base, as well as its address.

The detector shall be suitable to operate on a wire system carrying both power and signals for the operation of each and every detector in the system.

The detector shall be able to receive, and decode signals transmitted to it by the control panel. Upon receipt of a signal directed at its particular address, the detector shall transmit data back to the control panel for processing and storage thereof by the control panel. Such data transmitted shall represent the analogue values present in the electronic circuits of the detector head/base combination at that point in time.

The detector when addressed by the control panel shall transmit data to enable the control panel to deduct the following basic information:

- (a) The type of head generating the data (i.e. optical, heat, etc.)
- (b) The address of the detector.
- (c) The reference limits of calibration of the detector.
- (d) The percent visible or invisible combustion particles per meter present in the detected chambers at that point in time, or the temperature measured at the detector.

16.8.2

Break Glass Units

These units shall be as manufactured by KAC Alarm Company (Ltd) Model KR1/SR/C supplied by Messrs "Fire Fight" of Cape Town or Messrs "CDP" of Johannesburg or other approved type and shall be in accordance with BS 5839-2, except that it shall be resettable.

Address cards which will make communication with the control panel shall be fitted.

These units shall have normal open contacts rated at 5 A which shall make contact when the glass front breaks.

Units shall be red in colour, clearly marked "FIRE/BRAND" with all other instructions normally required.

Mounting shall be surface over a 100 x 50 x 50mm box where indicated on the drawings. Wiring shall be to screw and clamp plate type terminals.

Two (2) spare glasses and testing keys must be provided.

16.8.3

Control Unit

The control panel shall be supplied and installed (by the contractor) at the reception of the office block. The position will be indicated on site.

The control panel shall house all control units and the mimic and shall be manufactured by extruded aluminium, giving 20 % spare space for expansion.

The contractor must liaise with the supplier of the equipment console to ensure a matchable, neat and proper control panel and console.

The system shall be functional for 24 hours of the day and be operated automatically.

All controls and lamps shall be accessible on the units' front panel/s. All loose interface equipment, power supplier, etc. shall be neatly installed in the control panel or equipment rack.

Matching blank panels shall be fitted into the spare section of the console to accomplish the requirements stated in this specification.

Plugs and sockets shall be fitted to the rear of the equipment to allow the equipment to be unplugged for maintenance purposes.

Sufficient cable and connecting wire slack shall be allowed for to enable the withdrawal of equipment on site for adjustments without the need to unplug.

This unit shall conform with BS 5839 Part 4 or EN 54-2 and shall be approved by Telkom in the RSA. It shall make provision for at least the following functions:

The control panel shall continuously monitor a number of parameters of the field devices, makes decisions and takes actions based on the information received.

Sensing devices shall not switch into an alarm state. All decisions shall be taken by the control panel only.

To enable the system to be tailored to suit the protected building and to permit future changes, the alarm management shall be configurable from the control panel via a keypad. This configuration shall be maintained under power failure conditions in non-volatile memory.

The front panel of the control panel shall comprise a keyboard, alpha numeric display, text and indicator LED, etc. The occurrence and location of an event shall be displayed on the screen.

Outputs for communication with devices such as remote text display units, graphic display units, computers, printers and intelligent mimic panels shall be provided where necessary.

The control panel shall be supplied complete with printout facilities. Connections (a printer port and 24 Vdc power connector) for a portable printer shall be required.

The control panel shall further have the facilities to execute the following functions, via potential free 2A rated contacts:

- Transmission of a general fire alarm to the main central fire detection control panel at the main entrance of the Hospital.
- Monitored switching off of air conditioning equipment in case of a general fire alarm.
- Monitored alarm outputs, e.g. voice evacuation system.

The control unit shall be of a high degree of engineering design and of high level of workmanship. The design shall be modular so as to ensure rapid fault finding and replacement of faulty circuit boards or components.

Monitoring of detector circuits shall be such that the following conditions shall be detected and displayed as a "FAULT" condition on the control panel:

- (a) Open circuit line
- (b) Short circuit line

The system shall operate in the "Fail Safe" mode, that is, the presence and functional condition of each and every detector head and signal line shall be proven by a small current flowing continuously through a monitoring circuit.

A bleeper shall be provided on the control panel with the facility to be switched off.

A "Fault Alarm" shall operate this local buzzer only and shall not be extended to the alarm bells.

Consecutive alarms shall be stored by the control panel in chronological order and shall have the ability to determine the priority order of alarms by means of repetitive receipt of data from detectors.

A "Fire Alarm" shall operate a local buzzer only and shall not extend to the main alarms in the passages. These alarms shall be activated by a special fool proof switch only after confirmation of a fire condition by the appropriate personnel.

The control panel shall be able to function as a stand-alone unit, together with its own power supplies and shall not be dependant on external control equipment, such as computers, for functioning.

Provision in the form of suitable terminals, connectors, or ports, shall be made on the control panel for the connection of peripheral equipment, such as computers, printers and interface equipment, to ensure that the accumulation of data generated by detectors and the control panel, to be used for future reference, or for the relaying thereof to remote monitor or control equipment.

The transmission of all data shall be via a two-wire system, which shall carry both the supply voltage and the data.

The type of wire or cable used shall be suitable for the speed of data transmission so that signals can be carried over without loss of information or corrupted data. Wiring shall meet the requirements of the detection system manufacturer, which requirements shall be published in a formal wiring specification.

The control panel shall be fully programmable through the keypad on the front of the panel, and through an RS 232 port by using a separate computer.

It shall be possible to make back-ups of the programmed data onto separate magnetic media by means of an external computer linked to an RS 232 port on the control panel.

Communications with other equipment, such as computers, shall be achieved through RS 232 ports using a fully documented public domain protocol. The protocol documentation shall also be included in the Maintenance Manual so that it will be possible for another party to communicate with the control panel without the approval of the control panel manufacturer.

All communications with other equipment shall be bi-directional, and at least the functions and displays available on the front of the control panel shall be possible through the communications port. Programming of the control panel by means of other equipment is not required (except as described earlier).

The control panel shall be equipped with a alpha numeric display capable of displaying at least 80 characters.

A message of at least 40 characters long per device shall be programmable and displayable on the display.

The display of the following reports/information shall be possible:

- Device information
- List of the devices isolated
- List of devices that need maintenance
- List of the most recent events
- I/O mapping
- Device messages

Each sensing device shall be numbered individually and uniquely to correspond with its address on the control panel.

If a detector head is moved from its base to another base, the address of such a detector shall remain at its original location indicated on the control panel, i.e. the base shall be addressed and not the head.

The address of each device shall be manually set to the desired value.

Addressable devices shall be polled by the control panel and the equipment condition and analogue status shall be read and stored in the control panel.

The varying status of each device shall be assessed by software algorithms and the control panel shall indicate the following conditions:

(i) Analogue Detectors

Detector removed
Incorrect type of Detector
Detector failed
Detector contaminated
Pre-alarm
Fire Alarm
Detector healthy

(ii) Interface to Contracts

Fire Alarm
Interface removed
Interface faulty
Contact wiring open circuit
Contact wiring short circuit
Contacts normal

A printer shall be provided.

The printer shall provide a hard copy of the following:

- Alarms
- Faults
- Maintenance date
- Control panel operations
- Outputs Operated
- Configuration report
- Status report

The printer shall print out the following information for each alarm or signal:

- Type of alarm or fault
- Device type
- Device number
- Zone number
- User message
- Day
- Date
- Time

It shall be possible to set the printer to print out alarms, faults, control panel operations, and outputs operated, either individually or in any combination.

Control panels shall utilize electronic devices specially designed for minimum power usage in both battery and main power supply modes.

Battery charging equipment mounted in the control panel, or elsewhere shall be mounted in such a way that 220 V terminals and wiring and other mains voltages are shielded against accidental contact. All shields shall be marked 220 V.

No 220 V terminals shall be placed directly next to other terminals containing wiring at other voltages.

The power pack of the control panel shall be able to accept an incoming $230 \pm 10\%$ Volt single phase supply and shall be equipped with transformers, rectifiers, inverters, condensers and integrated circuits for the supply of stabilised power to the control panel equipment and detector circuits. The power supply unit shall be equipped with over voltage protection and spike arrestors to prevent damage to the equipment by lightning or other spikes, or damage due to over voltages.

The battery charger shall be able to deliver the full charging current to discharged batteries, and thereafter the charger shall automatically vary the charging current to the batteries as may be required by battery voltage conditions. Batteries shall not be subjected to overcharging. The battery charger shall be protected against reverse polarity and short circuits on the DC supply side.

The power pack of the control panel shall regulate the supply voltage to detectors so that detectors or bases are operated in their nominal supply voltage range.

Upon loss of mains power, the power supply unit shall automatically revert to battery power, where after the system shall remain fully operational for a period of 24 hours of which at least 1 hour is at the total alarm status. The unit shall automatically revert back to mains power upon mains power restoration and manual resetting of the unit shall not be necessary.

The power supply shall be equipped with the following indications on the front of the unit:

- (a) "Mains On" : green LED
- (b) "Charger Fault" : amber LED

Batteries shall be mounted in a separate ventilated padlockable cubicle in such a way that contamination of other equipment cannot take place by utilizing a special plastic container to contain any possible spillage. Any supply fault, charging fault or low battery voltage shall be transmitted to the control panel so that an alarm can be generated. No fuses or switches shall be accessible on the front of the power supply unit without opening the door. Batteries shall be of the sealed lead acid type and the sizes of the batteries to be used shall be indicated on a label in the battery cubicle. Batteries shall be charged to 85% of their capacity within 24 hours.

Wiring terminals shall be clearly marked with a label strip for identification so as to simplify installation and connection of wires on site, during installation. All outgoing and incoming terminals and all other equipment in the control panel, shall be suitable labelled to simplify maintenance and installation and all panel mounted equipment shall likewise be labelled. Outgoing and incoming power and field wiring shall be individually and correspondingly, numbered at each point of termination.

The control panel shall have knock-outs in the bottom plate thereof to terminate conduiting for all power cabling and knock-outs in the top plate thereof, to terminate conduiting for signal and other electronic cabling or wiring. Holes drilled on site for this purpose will not be acceptable.

All identification labels, as well as wire terminal numbers shall be clearly shown on all wiring diagrams in the maintenance manual.

It shall be possible to silence the audible alarms without influencing the visual alarms or alarm transmissions to the Fire Brigade (Main fire detection panel at the main entrance of the Hospital).

Two (2) spare fuses shall be provided.

16.8.4 **Electronic Dialling Device**

The unit shall be surface mounted next to the fire detection control panel.

This two-in-one alarm control unit shall be as supplied by "SESCO" cat. no. 4195 or similar and must consist of the following features and benefits:

- (a) High quality keypad control unit.
- (b) Lightning protected.
- (c) Selectable entry/exit time delay or instant arming.

- (d) Four (4) N/O or N/C zones and a N/O or N/C panic zone.
- (e) Panic, burglary and power trouble facilities to report to one or more of eight pre-select telephone numbers.
- (f) High quality, solid state devices to ensure voice clarity.
- (g) Instant programming via unit's own keypad.
- (h) 100% reliability.
- (i) Adjustable siren output time from 30 seconds to $\pm$ five minutes.
- (j) DTMF or pulse dialling with selectable "dial-tone detect".
- (k) Test facility.
- (l) Selectable siren or telephone activation.
- (m) Selectable siren or buzzer annunciation.
- (n) Play-back facility to listen to recorded messages.
- (o) 4K7 end-of-line resistors on key switch, panic and burglary zones.
- (p) 2K2 end-of-line resistors on the light trigger zone.

In the case of an alarm (fire, power failure or panic) this unit shall automatically, by using the telephone line dial up to eight pre-select telephone numbers, (e.g. Fire Brigade, Police, etc.) informing the dialled occupant of the relevant situation.

(The contractor shall be responsible to tender on a device that is approved and acceptable by the local Fire Brigade).

Inputs to this device shall be :

- (a) Fire alarm from the fire alarm control panel.

16.9

WIRING

The Contractor must take note that it is a specific requirement that only fire proof multicore stranded wires and cables shall be used where wiring is done outside of steel conduit.

All wires and circuits shall be clearly identified by either using colour coded cable or plastic label tags.

Wiring shall be arranged in a return loop (ring), in such a manner that, in the event of an open circuit or a short occurring on the line, the control panel communicates with the detectors from both sides of the loop.

The arrangement shall be such that during an open or short circuit no more than 50% of any zone shall be deactivated. To enable this, line isolators shall be provided on the line on each side of each zone.

Cable ends shall be terminated in approved terminal blocks as supplied by MS², Klippon, Waco or other approved type, **"Cheese blocks" are not acceptable.** In the distribution board the Contractor shall use terminal blocks that are specially designed for this function and in which the terminals are easily accessible, clearly labelled, well supported and easy to wire, using a spring mechanism to grip the wire.

The wires of each circuit shall be strapped together and clearly labelled in all wire ways.

Where coloured wires are used, the wiring shall be done in such a way that the same colour is used throughout for a specific circuit.

Identification shall be such that any circuit can be clearly identified and traced from the line diagrams.

The Contractor shall determine the various wire sizes to ensure that the voltage drop in any circuit shall not exceed 2 V under alarm conditions. This requirements also include the alarm circuits.

Cables shall be terminated on each detector base or break glass unit. The wiring shall be arranged in the "loop" method and no "T-offs" or joints shall be permitted.

All draw boxes shall be clearly indicated on the "As Built" drawings.

The insulation resistance of all circuits must be tested individually with a suitable insulation tester at 50 V and shall not be less than 1 Megohm with detector heads plugged in.

16.10 **INSTALLATION**

16.10.1 **Control panel**

Mechanical design

The control panel shall be housed in a cabinet designed for mounting directly to a vertical surface. The back box and door shall be constructed with provisions for electrical conduit connections. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

The control unit shall be modular in structure for ease of installation, maintenance and future expansion.

System Capacity

The control panel shall provide and be capable of expansion to the following capacities:

Addressable loops	2
Devices per loop	100
Addressable devices per loop	100
Total addressable devices or control modules.....	200

The control panel shall be wall-mounted at the main entrance where indicated on site. Cabling between the control panel and auxiliary equipment shall be neat and tidy in conduit channels supplied by others.

The printer shall be mounted on a shelf below the control panel or form part of the unit.

The contractor shall provide a neat floor plan/block plan drawing (1000 x 1000mm) of the total building showing the position of each device with the address and zone. This information shall correspond with the display on the control panel as well as the printout. This drawing, when approved, shall be framed and mounted next to the control panel at a position indicated on site.

The contractor shall furthermore provide a neat floor plan/block plan drawing (1000 x 1000mm) of each block and floor showing the position of each device with the address and zone as per the relevant floor. This drawing, when approved, shall be framed and mounted on the relevant floor at a position indicated on the drawings.

16.10.2 **Detectors**

Detectors shall be ceiling mounted and break glass units at 1500mm above finished floor level, over the outlet provided under the electrical contract. The onus is on the contractor to contact the engineer for a ruling whenever there is any uncertainty regarding the position of installation of any piece of equipment. Failure to comply to this specification might require later movement of such equipment at the contractor's expense.

16.10.3 **Cables and Wiring**

Installation shall be in strict compliance with the manufacturer's recommendations. The manufacturer must be consulted for all wiring diagrams, schematics, sizes, outlets, etc before installing the equipment and wiring.

All equipment shall be held firmly in place. Fastening and supports shall be adequate to support the loads with a safety factor of five.

The fire alarm control panel shall be connected to a separate dedicated uninterrupted power supply branch circuit of maximum 20 amperes. (Supplied by others)

This circuit shall be labelled as "Fire Alarm" and supplied by others as a dedicated plug or single phase outlet at the entrance foyer.

All wiring shall be completely supervised. In the event of a primary failure, disconnected standby battery, disarrangement of any components, or any open circuits in the system, an audible and visual trouble signal will be activated until the system is restored to normal.

Zones shall be clearly indicated on the fire alarm control and mimic panel. The names and the position of the zones shall be co-ordinated with the engineer and client and shall meet with their approval.

Air conditioning system(s) shall be indicated on a separate zone.

Open cable shall be allowed above ceilings, in attic's and in other areas allowing surface wiring.

Cable shall be the type "listed for the use" as specified under NEC article 760-30 (bell wire, intercom or telephone wire are not approved).

Enclosed cable installed in 20 mm diameter conduit shall be of 0,5 to 1 mm screened (shield) "Belden" or equivalent type.

Open cable installed on the surface in open roof (void) spaces shall be of 0,5 to 1 mm "Perilli" or "Alpha Pyron" special fire cable.

All cable shall be installed as per NEC article 760.

Leave 150 mm wire tails at each device box and 1 m wire tails at the fire alarm control panel.

Cable for the initiating devices (manual stations, heat detectors, smoke detectors, etc) shall be looped. Cable shall be installed from the monitor module to the first device, then to each succeeding device within each address line and back to the monitor module.

Cable shield continuity must be maintained and connected to earth ground only at the control panel. Intelligent detector wiring must not be routed power wiring, 240 V AC power wiring or other high current circuits.

Cable for the control of the air conditioning units must be installed in the ceiling and cable duct installed.

The air conditioning units of the entire complex must be shut down should a fire alarm occur. The fire alarm sub-contractor shall allow in his tender for one control cable and the control panels as indicated on the drawings. The control

wiring from the air conditioning control panel to the air conditioning unit shall be done by others.

The system shall be wired such that the air conditioning system shall shut-down after detection of a fire by a detector.

Steel conduit (20 mm diameter) shall be installed by others for wiring to the break glass unit as indicated on the electrical drawings.

No conduits shall be installed for the wiring to the fire detection detectors. All wiring shall be installed above the ceiling and shall be surface mounted open wiring.

The surface fire cable shall be held in place at the device by means of two special cable glands fixed to a 65 mm diameter drawbox.

The surface wiring/cable shall be held in place at the device box, by means of gripper glands. The cable must be stapled or strapped per NEC or at 1 m maximum spacing.

Cables must be separated, minimum 50 mm from any open conductors of light, power and shall not be placed in any outlet or draw box or containing these conductors, as per NEC article 760-29.

All splices or connections shall be made within approved junction boxes and with approved fittings. Boxes shall be red and/or labelled "Fire Alarm System" or other approved markings.

16.10.4 **Detection Lines**

Detection lines may have a capacity of detectors or devices as decided upon by the manufacturer, but this capacity shall not exceed 100 devices per line.

These detectors/elements shall be freely distributable over any one of the individual alarm zones.

Zones must be clearly defined and quick and precise identification of a fire must be possible.

Each line shall be capable of all the self monitoring functions.

The control unit with its mimic panel shall be utilised to indicate the exact position of triggered detectors/elements in any line.

A triggered detector/element shall not cause any other detectors on the line to seize monitoring.

The Central Control Unit shall be capable of switching off air conditioning units in the case of a fire alarm.

In the specific zone where a fire has been detected it shall be possible to control the equipment.

Any detector when triggered, shall be capable of causing specific control functions.

Any individual zone or detector in an alarm line shall be capable of being isolated without affecting the operation of the remaining zones or detectors in the line and without raising the fire alarm. However, during this condition an isolation indication per zone, shall be displayed on the Control Unit.

17. **SYSTEM ALARM DETECTION**

When a fire alarm condition is detected by one of the system initiating devices, the following functions shall immediately occur:

- (a) The system alarm LED shall flash.
- (b) A local sounding device in the panel shall be activated.
- (c) Local sounding devices on the floor that a fire the condition was detected shall activate a prepare to evacuate sound.
- (d) The 80-character LCD display shall indicate all pertinent information associated with the alarm and it's location.
- (e) The LED mimic panel shall indicate the zone and level which is activated.
- (f) All automatic programs assigned to the alarm point shall be executed and the associated indicating devices and relays activated.
- (g) Local trained personnel will investigate the possible fire condition and communicate with the fire officer, at the panel via the intercom system. On confirmation of a fire condition, the alarm must be activated by hand and sounding devices on the floor and the bells on ground floor activated.

18. **SYSTEM TROUBLE DETECTION**

When a trouble condition is detected by one of the system initiating devices, the following functions shall immediately occur:

- (a) The system alarm LED shall flash
- (b) A local sounding device in the panel shall be activated.
- (c) The 80-character LCD display shall indicate all pertinent information associated with the trouble condition and it's location. However, unacknowledged alarm messages shall have priority over trouble

messages and if such an alarm must also be displayed, the trouble message shall not be displayed on the LCD.

19. **CONTROL SWITCH OPERATION**

19.1 **ACKNOWLEDGE SWITCH**

Activation of the control panel acknowledge switch in response to a single new trouble or alarm condition the system alarm or trouble LED's from flashing to steady-on. If additional new alarm or trouble conditions exist in the system, activation of this switch shall advance the display to the next alarm or trouble condition that exists, and shall not silence the local audible device or change the LED's to steady until all new conditions have been so acknowledged. New alarm conditions shall always be displayed before new trouble conditions. Occurrence of a new alarm or trouble condition shall cause the panel to "resound" and the sequences described above shall repeat.

19.2 **SIGNAL SILENCE SWITCH**

Activation of the signal silence switch shall cause all appropriate indicating appliances and relays to return to the normal condition after an alarm condition. The selection of indicating circuits and relays silenced by this switch shall be fully programmable and changeable in the field.

19.3 **SYSTEM RESET SWITCH**

Activation of the system reset switch shall cause all electronically-latched initiating devices or zones, as well as all associated output devices and circuits, to return to the normal state. If alarm conditions exist in the system after the system reset switch activation, the system shall then resound the alarm.

19.4 **SYSTEM TEST SWITCH**

Activation of the system test switch shall initiate an automatic test of all intelligent detectors in the system. Such test shall activate the electronics in each intelligent device, simulating an alarm condition. A report summarising the results of this test shall be displayed automatically on the front panel.

19.5 **LAMP TEST**

Activation of the lamp test switch shall turn on all LED indicators, LCD display and local sounder and then return to the previous condition.

19.6 **AUTOMATIC DETECTOR TEST**

The system shall include a special automatic detector test which permits a serviceman to test all intelligent detectors from the main control panel.

19.7 **WATCH-DOG TIMERS TEST**

The system shall include independent "Watch-Dog" timers to detect and report failure of any microprocessor circuit, memory, or software.

19.8 **PROGRAMMING**

The system shall be programmable, configurable and expandable in the field without the need for special tools or PROM programmers and shall not require replacement of memory IC's. All programming may be accomplished through the standard control panel keyboard. All programs shall be stored in non-volatile memory.

The programming function shall be entered with a special password that may be selected when the system is installed. The password may be changed in the field to a new value at any time by entering the old password and requesting a password change.

20. **TESTING AND COMMISSIONING**

The Contractor shall test each and every detector and break glass unit in the system and only after he is satisfied that the system is in a hundred percent working condition shall the Engineer be notified that the system is ready for hand over.

The Contractor shall provide all the latest equipment used in the testing of ionisation and heat detectors.

21. **MAINTENANCE**

Tenderers must note full particulars of the year free maintenance as specified in the general specification Part 1.

Each tenderer shall give full particulars of the maintenance, spare parts and service facilities which are available either locally or in the RSA.

The tenderer shall list the centres where maintenance facilities can be readily provided and shall state if repairs under guarantee or maintenance agreement can be undertaken at these centres. Local Companies or subsidiaries thereof, other than the main supplier who only offers replacement of malfunctioning printed circuit boards, etc. cannot be considered to be maintenance centres under this clause.

When replacing faulty cards, the new cards, when inserted, must automatically initialise themselves.

22. **LITERATURE REQUIRED**

The installation shall not be handed over if any of the following are outstanding:

- (a) An instruction card at the control panel indicating in English the procedure to be followed in the event of an ALARM.
- (b) Operating, maintenance and fault-finding instructions in triplicate.
- (c) Schematics and wiring diagrams in triplicate.
- (d) "As Built" drawings.

23. **WIRE WAYS**

Conduit, sleeves and draw boxes shall be provided by others; however, it is the responsibility of the contractor to ensure that this installation is to his requirements. He will thus submit a conduit layout within two weeks after the tender has been awarded and shall be responsible, during the construction stage, to ensure that the conduit system is installed to his requirements regarding positions and height of outlet boxes. No claims shall be entertained at a later stage due to the wire ways not complying to the contractors needs.

To ensure that this requirement is met it is essential that the contractor closely liaises with the Electrical contractor to the Main Contractor.

It is also a requirement that tenderers should indicate at tender stage whether they are satisfied with the basic layout as per the drawings.

24. **INTERCOM AND VOICE EVACUATION SYSTEM**

GENERAL INFORMATION

This part of the specification is for the supply, delivery, installation, testing and commissioning of an Intercom and Voice Evacuation System and must be read in conjunction with the General Specification. Where it deviates from any of the specifications listed or accepted as general practice, those deviations must be brought to the Engineer's attention at tender stage. Tenderers must take note of the following:

- (a) Control shall be from as indicated on the drawing.
- (b) No wiring shall be surface except where agreed upon with the engineer. All conduit shall be provided by the electrical contractor.
- (c) Distribution boxes shall be provided by others if and where required.
- (d) The central terminal board, power supply, remote microphone, system management amplifier and voice announcement board for the functioning of the

system as specified shall be supplied and installed by the contractor at indicated on the drawings.

- (e) The electronic equipment shall be installed in one free standing equipment rack. All this equipment shall be suitable for rack mounting with front access to the necessary controls.
- (f) The amplifier unit/s shall be manufactured in such a way to enable installation thereof in a standard 483 mm rack manufactured of extruded aluminium.
- (g) The console shall be properly ventilated and shall be dust, vermin and tamper proof.

BASIC SYSTEM

The Intercom and Voice Evacuation System shall basically consist of the following:

- {a} PA amplifiers fully equipped with evacuation signal generator, microphone pre-amp, volume control, etc. powerful enough to drive the loudspeakers that are offered to the required sound level with the building filled to capacity with a background noise of at least 70 dbA.
- {b} Wall and ceiling mounted loudspeakers.
- {c} A desk mounted high quality microphone.
- {d} Input/output selection controls for selection of:
 - {i} Inputs such as Microphone/Evacuation signal/CD, tape deck and radio for background music.
 - {ii} Outputs to each zone individually or any configuration of zones, as well as an "all call" function.

SYSTEM REQUIREMENTS

The following are the basic system requirements, which requirements are the minimum and not exhaustive.

- {a} The system needs to function properly so that the evacuation signal can be heard clearly at any place in the building 10 dB above an ambient noise of 70 dbA.
- {b} Speakers shall be spaced so that speech is clearly audible along the escape routes above a background noise of 70 dbA.
- {c} The system shall be designed in such a way that it is simple to operate and that volume adjustments should not be critical to prevent feedback and should not require adjustment after installation.

- {d} The frequency response of the system shall be between 170 Hz and 15 kHz with no more than 3 dB fluctuation at the output power specified with 400 Hz as reference.
- {e} At full power and at a rating 3 dB lower, the harmonic distortion shall not exceed 1% with 1 kHz as reference.
- {f} The hum and noise level shall not be audible at any output and shall not exceed minus 60 dB at the output power specified.
- {g} The working potential of all cables and conductors on the output circuits of amplifiers shall be 100 V rms balanced to earth for full modulation.
- {h} All microphone cables and conductors on the input circuits of amplifiers shall be of the double conductor double screened type and shall be balanced to earth and of an impedance that matches the equipment.
- {i} The brightness of all indication lamps shall be such that they are clearly visible under normal ambient lighting conditions. The voltage at the terminals of each lamp shall not exceed the rated voltage of the lamp under working conditions.
- {j} The equipment shall comply with the relevant requirements of SABS SV 106 but need not bear the SABS mark.

EQUIPMENT SPECIFICATION

General

This specification is for the major items of equipment incorporated in the system as applicable and should be read in conjunction with the general specification.

Amplifier

The amplifier/s shall be power amplifiers as supplied by "TOA" type VM2240 or other approved type and/or supplier.

These units shall be in accordance with the following minimum general requirements:

- {i} Rack - mountable.
- {ii} 240 W RMS output power at 100 V into a 42 ohm load
- {iii} **(Note: not music power)**
- {iv} Freq. Response: 40Hz - 16 kHz $\pm$ 2 dB at 20% and 80% of rated output.
- {v} Distortion : Less than 1% at rated output at 1,000 Hz.

{vi} S/N Ratio : 80 dB

{vii} Output to be short circuit protected.

The amplifier/s shall be capable of delivering an output power of 40% higher than the power required to drive all loudspeakers, as specified.

Provision shall be made to adjust this value to an optimum level to suit the environmental conditions on site.

The output circuitry shall not be damaged, if the load is changed between open and short circuit or if one of the conductors of the wiring system is connected to earth.

The hum and noise level at the output power specified shall not be audible and shall not exceed -75 dB.

It is the sole responsibility of the Tenderer to ensure that the number of amplifiers offered are correctly sized for their specific application.

Switching Module

This shall be a rack mountable unit equipped with all the required switching circuitry, or may form part of the amplifier/s. Basic requirements are as follow:

{i} Input : 3 Inputs ie Microphone, Siren module, background music (Radio/Tape Deck/CD/MP3, Etc)

{ii} Output : 5 Zones, individually or in any combination and also all call selection.

{iii} Selection : Controlled from the desk mounted remote microphone unit.

The power loss through this switching panel shall be less than 1 dB and shall be accomplished by utilising solid state driven relays.

The CD, tape deck or radio set shall be supplied by others.

Control Unit

This item is for a desk mounted control unit located at the microphone from where all the control functions shall be selected.

The control box shall be neat in appearance and constructed to blend in with the rest of the PA equipment.

Before any construction commences, the contractor shall submit neatly, professionally prepared layout drawings and wiring diagrams for approval.

The control unit shall be equipped with:

- {i} On/off key-switch with "power on" light.
- {ii} Input selector switch for Microphone, Siren and background music positions.
- {iii} All call and zone selection push buttons for 10 zones.

Switching from one position to the other shall not be heard over the loudspeakers.

The cable for the control wiring from this unit to the equipment rack shall terminate in a screw-on multi plug on either end and shall have at least 500 mm slack. Only a coded, stranded, multi-core cable shall be allowed.

Microphone

The microphone shall be the remote desk type dynamic microphone designed for the pre-amp and system to which it will be connected. The microphone provided shall be ideally suitable for this specific application and shall ensure clear and distortion free speech and shall have a unidirectional polar pattern so as to ensure minimum interference from outside noise.

The microphone shall not introduce more than 0,4% additional acoustical distortion into the system.

A normal speech level of 80 dB (refer to a sound pressure of 1 micro-bar) at a distance of 0,5m from the microphone shall cause the amplifier to deliver a voltage of 100 V rms to the output system.

Loudspeakers

As it is the sole responsibility of the Tenderer to provide systems ideally suitable for these applications the following requirements regarding the loudspeakers shall not be regarded as exhaustive, but as minimum requirements only. However, any deviations from these requirements shall be clearly indicated at tender stage.

The speakers shall be small, dust proof, indoor type loudspeakers as supplied by TOA or other approved supplier/type, flush mounted in suspended ceilings (200 mm max deep).

The speakers shall be mounted at positions as indicated by the contractor so as to ensure good sound quality and uniform sound distribution.

To determine the optimum speaker positions Tenderers are allowed to take scale measurements from the attached drawings. However, should there be any uncertainty, the engineer shall be contacted at tender stage.

The loudspeakers shall be capable of producing a SPL of 90 dB at 1m.

HORN SPEAKERS SHALL NOT BE ALLOWED.

Speakers shall have a frequency response of not worse than 160 - 10,000 Hz.

A 100 volt line shall be used throughout and each speaker shall be equipped with a high quality transformer and shall be adjusted to provide the required SPL for the position where the loudspeaker is installed.

Evacuation Signal Generator

This signal generator shall produce the standard 2-tone "whoop and wail" evacuation signal. The evacuation tone shall only be heard once the power to the control base is turned on and the siren position selected.

WIRING

Wiring of the speakers shall be in a loop system to ensure that a break in the line shall not have an affect on any loudspeaker i.e. the circuit shall be fed from both ends.

Cabling to the loudspeakers shall be with stranded, high quality, two core PVC cable with positive polarity indication markings. Wires shall not be soldered onto loudspeaker terminals but shall be made off by crimping wiring terminals onto the wire which shall then terminate onto the loudspeaker terminals.

No T-offs shall be allowed and only approved connector blocks may be used, which connector block shall be neatly installed in the conduit outlet box behind the speaker.

Cables shall be adequately sized to ensure a volt drop of less than 5% at full power ie not less than 95 V at any speaker terminal at 1 000 Hz.

INSTALLATION

The equipment shall be placed on shelves provided for it, by others, at the main maternity nurses station, where indicated on site. Cabling between the control base, microphone and amplifiers shall be neat and tidy. Slack shall be allowed for to enable equipment to be withdrawn out of their positions for maintenance purposes.

TESTING AND COMMISSIONING

After installation, the total system shall be tested in the presence of the Engineer. The contractor shall supply all test equipment as requested by the Engineer for these tests.

The test shall consist of at least the following:

Syllable articulation test: This test shall be conducted to determine the degree of understanding and shall consist of a syllable articulation test in which 100 syllables shall be pronounced at random and the number of correctly heard syllables, in various positions along the escaping routes, shall be recorded. A percentage syllable articulation of less than 70% at 30%, 60% and 100% volume shall not be accepted.

Siren test: This test shall be conducted at the same volume settings as for the speech test and the siren should be heard clearly throughout the building with special attention given to isolated places, such as toilets, archives , store rooms, etc.

SMITHFIELD INDOOR SPORT CENTRE

INTERCOM & VOICE EVACUATION & FIRE DETECTION INSTALLATION

PART 3 : SCHEDULES

1. **GENERAL**

This section of the specification forms part of, and must be read in conjunction with, Parts 1 and 2 as well as the drawings.

2. **SCHEDULE OF DRAWINGS**

The following drawings where the complete installation is shown form part of the specification and is to be read in conjunction therewith:

Drawing No.	Description
34581-311-04-A	Electrical Installation: Fire Detection Layout

The layout of the installation according to the specified equipment which is to be installed is shown on the above drawing/s on a scale of 1:100.

3. **SCHEDULE OF ADDITIONAL LABOUR (Rand/hour)**

These tariffs shall be used for the recharging of labour costs not included in other tariffs. P & G amounts are excluded. These tariffs will be subject to negotiation by the Engineer or his representative during the installation phase.

	Supervisor (R)	Foreman (R)	Artisan (R)	Registered Apprentice (R)	Labourer (R)
Normal Time					
Weekly Overtime					
Sunday Time					
Public Holiday					

4. **SCHEDULE OF ADDITIONAL TRANSPORT (Travelling Costs)**

Should the contractor be successful in tendering, the following costs per kilometre shall pertain to the cost of all additional travelling.

Vehicle Gross Mass	Cost per Kilometre	
	Tarred Surface Road	Gravel Surface Road
CAR	R .. /km	R /km
1000 Kg	R /km	R /km
3000 Kg	R /km	R /km

5. **SCHEDULE OF PROFIT FOR MATERIAL FOR VARIATIONS**

The following profit percentage is applicable to all materials not included in other tariffs; P & G items excluded, and will be subject to negotiation by the Engineer or his representative during the installation phase.

If the Contractor is successful with the tender the following percentage profit shall be applicable on the cost of all materials specified for variation order purposes for which unit prices have not been included in this tender document.

The stated percentage profit is not fixed and the Engineer may negotiate for a lower percentage during variation.

The Engineer shall be at liberty to call for adjustment of individual prices, as considered necessary, on the basis of the average ruling prices as determined by the Engineer for similar work in the industry, in the area in which the work is being carried out.

Variations	Percentage Profit
Additions	%

6. **SCHEDULE OF ADDITIONAL INFORMATION ON TENDERER**

6.1 **SHOULD THE TENDERER BE A COMPANY**

Directorship of Company submitting tender

Name of Director	Date of Appointment

Shareholding of Company submitting tender

(State the shareholders of the Company)

Name of Shareholders

State all other Companies in which shares are held

Name of Company

6.2 **SHOULD THE TENDERER BE A CLOSED CORPORATION**

Should the tenderer be a closed corporation, state members' names, date of appointment and percentage share in the closed corporation.

Name of Member	Date of Appointment	% Share in CC

6.3 SHOULD THE TENDERER BE IN PARTNERSHIP

Should the Tenderer be in partnership, state the names of the partners, their date of entry to the partnership and each partner's share of profits/losses:

Name of Partner	Date of Entry	% Share of Profit/Loss

6.4 SHOULD THE TENDERER BE AN INDIVIDUAL

Full Name and Surname	I.D. Number	PSIRA Number

6.5 PRIVATE SECURITY INDUSTRY REGULATION ACT (PSIRA)

Full Name and Surname	I.D. Number	PSIRA Number

6.6 THE SOUTH AFRICAN QUALIFICATION & CERTIFICATION FOR THE COMMITTEE FOR THE FIRE INDUSTRY (SAQCC) LEVEL 1

Full Name and Surname	I.D. Number	SAQCC Number

THE SOUTH AFRICAN QUALIFICATION & CERTIFICATION FOR THE COMMITTEE FOR THE FIRE INDUSTRY (SAQCC). LEVEL 2

Full Name and Surname	I.D. Number	SAQCC Number

THE SOUTH AFRICAN QUALIFICATION & CERTIFICATION FOR THE COMMITTEE FOR THE FIRE INDUSTRY (SAQCC). LEVEL 3

Full Name and Surname	I.D. Number	SAQCC Number

THE SOUTH AFRICAN QUALIFICATION & CERTIFICATION FOR THE COMMITTEE FOR THE FIRE INDUSTRY (SAQCC). LEVEL 4

Full Name and Surname	I.D. Number	SAQCC Number

THE SOUTH AFRICAN QUALIFICATION & CERTIFICATION FOR THE COMMITTEE FOR THE FIRE INDUSTRY (SAQCC). LEVEL 5

Full Name and Surname	I.D. Number	SAQCC Number

7. SCHEDULE OF AUTHORISED SIGNATORIES

Signatories for Companies, closed corporations or partnerships must confirm authorization thereto by means of a certified copy of the relevant directive, appended to this form.

"By a directive decision on20
at
is Mr

whose signature appears in the space underneath is authorized to sign all documents in connection

with tender no..... on behalf of
(capital letters, print)

Signature	In Capacity as	Date
1.		
2.		
3.		
4.		

Signature	Witnesses
1.	(Capital Letters, Print)
2.	

8. **SCHEDULE OF EQUIPMENT**

Should the Contractor be successful in tendering, the following material/equipment will be used.

The Contractor shall submit full details regarding the information required when submitting the tender.

This includes equipment that was not specified in this document, but may form part of the installation.

Failure to include full details regarding the information required might invalidate the tender.

Description	Manufacturer or Trade Name
1. Fire Detection Control Panel	
2. Ionization Smoke Detector	
3. Heat Detector	
4. Break Glass Unit	
5. Bells	
6. Sirens	
7. Automatic Telephone Caller (Dialling Device)	

Description	Manufacturer or Trade Name
8. Schematic Block Diagram	
9. Printer	
10. Buzzers	
11. Fire Resistant Cable	
12. Internal & General Wiring	

9. **SCHEDULE OF WORK COMPLETED BY TENDERER (Previous Contracts)**

The Tenderer must, in the space below, supply a list of at least four customer/s contracts of a similar/comparable nature (reference sites) that was completed or where similar systems have been installed during the last three to five years.

Arrangements will be made with the Contractor during the evaluation period, to visit at least one of the sites, where a successful installation of a similar/comparable nature has been made.

Projects Completed				
Client Name and Tel. No.	Consulting Engineers Name and Tel. No.	Type of Work (Contract)	Value of Work	Year of Completion

Projects Currently under Construction				
Client Name and Tel. No.	Consulting Engineer Name and Tel. No.	Type of Work (Contract)	Value of Work	Year of Completion

10. **SCHEDULE OF SUB-CONTRACTORS**

The Contractor shall state in the schedule below the names of all sub-contractors he wishes to employ for the works and shall define their duties and outline their experience.

Acceptance of this tender should not be seen as acceptance of all or any of the sub-contractors. If any of the sub-contractors is not approved after acceptance of the tender it will not invalid the tender and the tender tariff for the various items will stay final and binding, even should the engineer approve a sub-contractor this was not mentioned in the tender document.

Name of Sub-Contractor	Proposed Duties	Experience

11. **SCHEDULE OF PROPOSED PERSONNEL AND LABOUR**

Tenderers must here under indicate the personnel and labour that will be utilized with the completion of the contract

Personnel and Labour	Number
(a) Technical Personnel	
(b) Clerical Personnel	
(c) Artisan	
(d) Skilled Labour	
(e) Un-skilled Labour	
TOTAL PERSONNEL AND LABOUR	

SIGNATURE OF TENDERER:

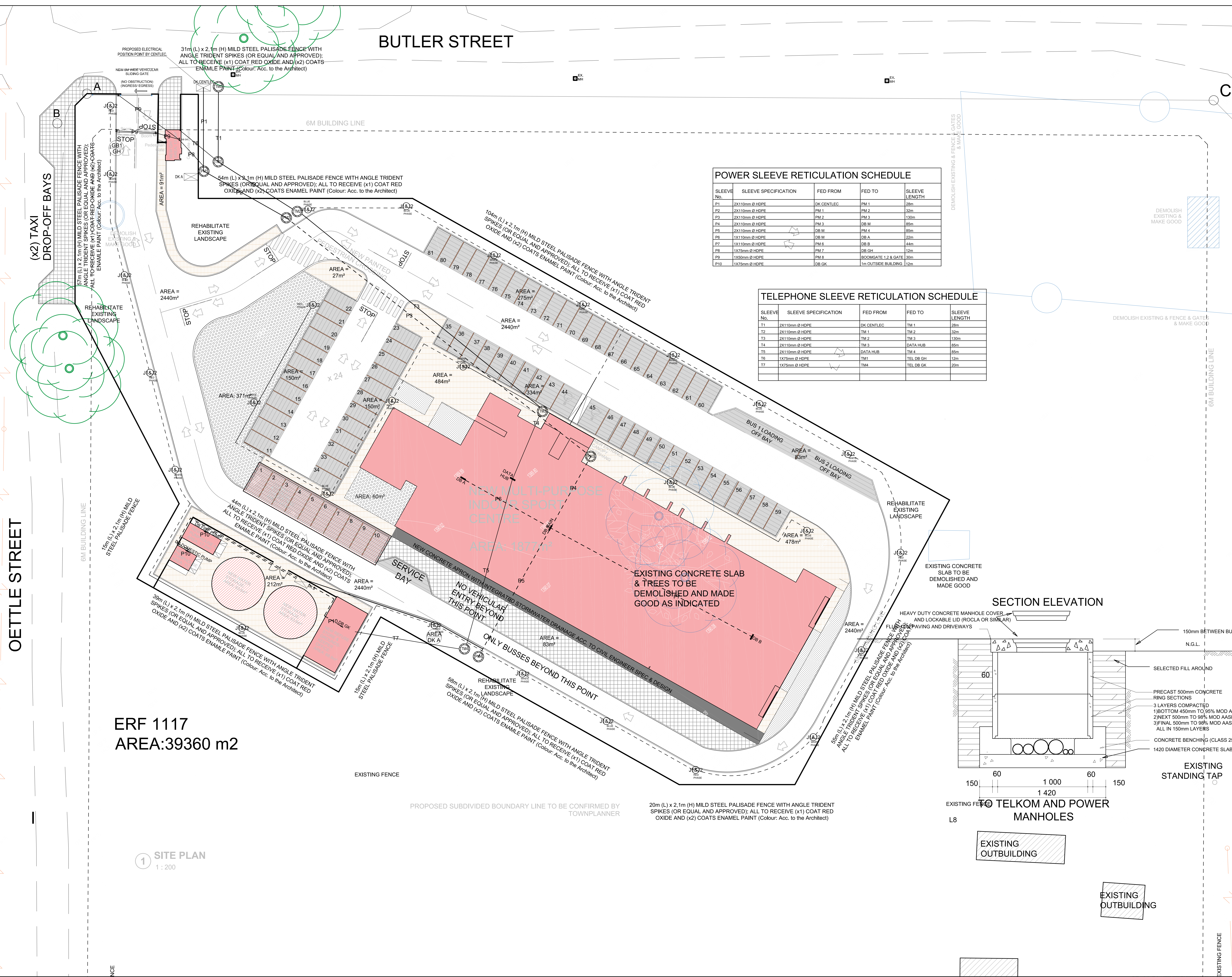
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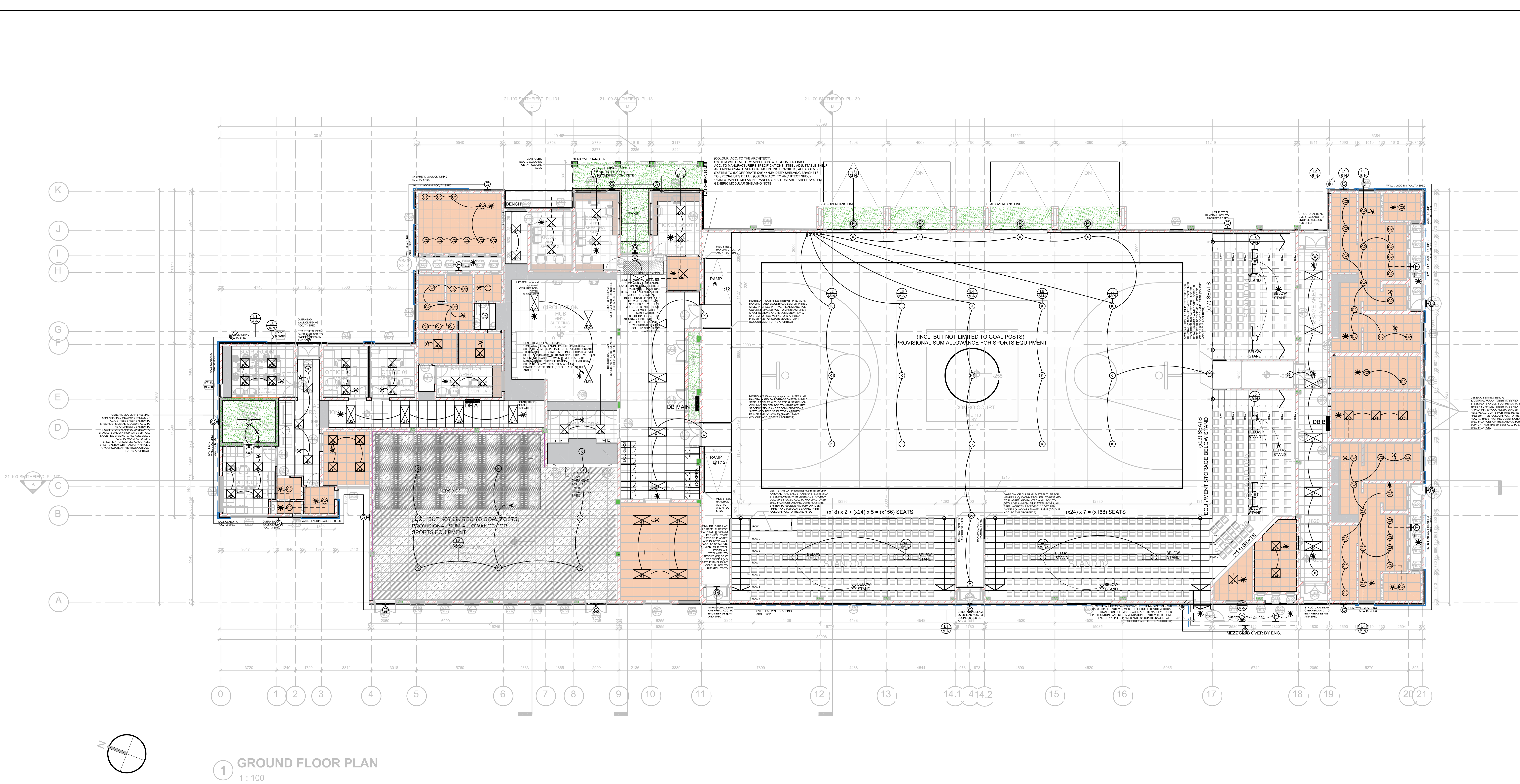
NAME OF (SIGNATURE) TENDERER:

ADDRESS OF TENDERER:

TELEPHONE NO.:

FAX NO.:

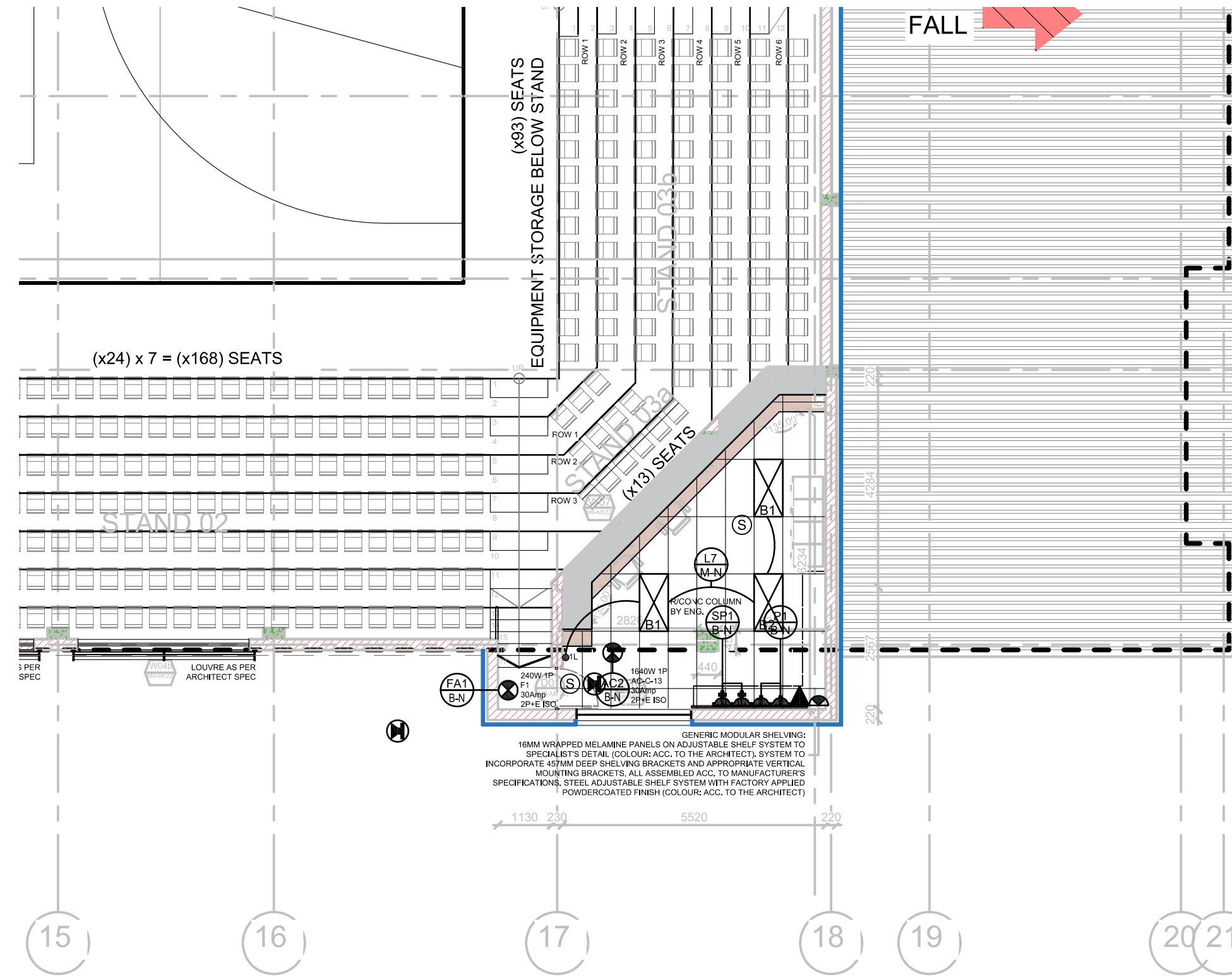




1 GROUND FLOOR PLAN
1:100

DESCRIPTION OF LIGHTS

- (A)** SURFACE LED PANEL LUMINAIRE - 1200 MM X 600 MM NOMINAL WATTAGE: 60W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG, TO BARE SABS APPROVED MARK.
- (A1)** SURFACE LED PANEL LUMINAIRE - 600 MM X 600 MM NOMINAL WATTAGE: 32W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG, TO BARE SABS APPROVED MARK.
- (B1)** RECESSED LED PANEL LUMINAIRE - 1200 MM X 600 MM NOMINAL WATTAGE: 60W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG, TO BARE SABS APPROVED MARK.
- (B2)** RECESSED LED PANEL LUMINAIRE - 1200 MM X 600 MM NOMINAL WATTAGE: 60W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG, TO BARE SABS APPROVED MARK.
- (B1)** RECESSED LED PANEL LUMINAIRE - 600 MM X 600 MM NOMINAL WATTAGE: 32W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG, TO BARE SABS APPROVED MARK.
- (B2)** RECESSED LED PANEL LUMINAIRE - 600 MM X 600 MM NOMINAL WATTAGE: 32W, NOMINAL VOLTAGE: 220-240 V, 0.9PF, COLOR TEMPERATURE: 4000 K, LUMINOUS FLUX: 3000 LM, LUMINOUS EFFICACY: 95 LM/W, CRI 80, BEAM ANGLE 120, L70 LIFESPAN 50000 H, TYPE OF MOUNTING: RECESSED, IP 22, ALUMINIUM HOUSING, WHITE HOUSING, INCLUDING 3 METER 3 CORE CABTYRE CABLE ATTACHED TO 3 PIN PLUG, TO BARE SABS APPROVED MARK.
- (C)** CEILING MOUNTED DOWNLIGHT EQUAL OR OTHER APPROVED LEADADVANCE SY121-230V-6W-LED-CAB-SAT-CHROME, 3m CABTYRE AND 5A PLUG, 6W LED OSRAMS LAMPS 3000K WARM WHITE AND FLUSH MOUNTED.
- (C2)** CEILING MOUNTED DOWNLIGHT EQUAL OR OTHER APPROVED LEADADVANCE DL703-230V-12W-LED-CAB-WHITE, 3m CABTYRE AND 5A PLUG, 12W LED LAMPS 4000K COOL WHITE AND FLUSH MOUNTED, INCLUDED WITH HOUR BATTERY BACKUP.
- (E)** SURFACE OPEN CHANNEL LEADADVANCE EQUAL OR OTHER APPROVED 2x1.5m HL/N224-LED-4000K LED LUMINAIRE WITH INCLUDED WITH 120W 400K OSRAM LED LAMPS, MANUFACTURED FROM COLD ROLLED 0.8mm STEEL HOT DIP ZINC PHOSPHATED AND FINISHED IN A BAKED, HIGH GLOSS, WHITE EPOXY POLYESTER POWDER COAT, ROT-LOCK AS STANDARD.
- (E1)** SURFACE OPEN CHANNEL LEADADVANCE EQUAL OR OTHER APPROVED 1x1.5m HL/N124-LED-4000K LED LUMINAIRE WITH INCLUDED WITH 120W 400K OSRAM LED LAMP, MANUFACTURED FROM COLD ROLLED 0.8mm STEEL HOT DIP ZINC PHOSPHATED AND FINISHED IN A BAKED, HIGH GLOSS, WHITE EPOXY POLYESTER POWDER COAT, ROT-LOCK AS STANDARD.
- (F)** SURFACE MOUNTED BEKA BULK HEAD WITH 18W LED COMPLETE WITH A LED, THE BULKHEAD SHALL BE RECTANGULAR, AT LEAST 32x155MM AND SUITABLE TO OPERATE 18W LED LAMPS, THE LUMINAIRE SHALL BE MADE OF HIGH-PRESSURE DIE-CAST ALUMINIUM LM 6 BASE AND INJECTION MOULDED NON-DISCOLOURING, CLEAR DIFFUSER, FIXED WITH 4 X STAINLESS STEEL ALLEN HEAD SCREWS, THE TONGUE AND GROOVE SYSTEM WITH SILICON SPONGE GASKET SHALL SECURE THE IP RATING, THE IP RATING SHALL BE AT LEAST IP-66, TO PREVENT ANY INGRESS OF DUST AND WATER, THE BULKHEAD SHALL BE SUPPLIED WITH RETROFIT LED LAMPS FOR FUTURE REPLACEMENTS, THE LUMINAIRE SHALL BE COMPENSATED TO A POWER FACTOR OF 0.96, TO REDUCE THE RUNNING CURRENT, THE LUMINAIRE SHALL BEAR THE SANS 60598-1 SAFETY MARK, EQUAL AND OR OTHER APPROVED TO BEKA.
- (L)** LED BEACON LUMINAIRE WITH RED DIFFUSER, NOMINAL VOLTAGE: 220-240 V, IP 20, TYPE OF MOUNTING TYPE: SURFACE.
- (X)** CEILING MOUNTED EMERGENCY EXT SIGN COMPLETE WITH BEKA LED MAINTAIN DOUBLE SIDED, INCLUDED WITH HOUR BATTERY BACKUP.



1 MEZ FLOOR PLAN
1:100

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CLIENT FILE NUMBER

REFERENCE DRAWINGS

APPROVED BY COUNCIL / CLIENT

CITY ENGINEER / CLIENT REG. NO. DATE

AMENDMENTS CODE

A.B.C./ : BEFORE TENDER
D : : TENDER DRAWING
1,2,3,4 : : AFTER TENDER
Z : : AS BUILT

A : BY CLIENT
B : BY ARCHITECT
C : BY MECHANICAL OR ELECTRICAL
D : BY BVI
E : BY OTHER

DATE INITIAL FILE CODE REVISION DESCRIPTION

14/07/2022 J.B. A.D. ISSUE FOR PRELIMINARY STAGE

PROVIDE OFFICE

Province: Free State
City: Bloemfontein
Region: Free State
District: Butha Buthe
Municipality: Butha Buthe
Ward: 10
Electoral District: Ficksburg

CLIENT

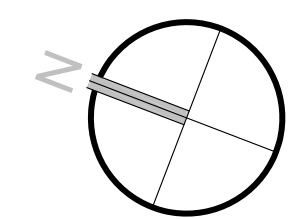
SMITHFIELD: MULTI-PURPOSE INDOOR SPORT CENTRE

ELECTRICAL INSTALLATION: LIGHTS LAYOUT ERF 1117

APPROVED BY BVI

J. Boshoff 2007/70032 6 Nov 2020
ENGINEER/TECHNOLOGIST REG. NO. DATE
SCALE 1:250 DRAWN A. BOOSEN
DESIGNED P. HARMSE CHECKED J. BOSHOFF
PLAN NUMBER REVISION NO. DATE SAVED
34584E-311-02 A 4 Jul 2022

Smithfield Indoor Sport Centre Palm Design





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NOTES / LEGEND

CLIENT FILE NUMBER

REFERENCE DRAWINGS

NUMBER	REVISION	DRAWING DESCRIPTION

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CITY ENGINEER / CLIENT REG. NO. DATE

AMENDMENTS CODE	
A.B.C. / : BEFORE TENDER	/A: BY CLIENT
0 / : TENDER DRAWING	/B: BY ARCHITECT
1,2,3... / : AFTER TENDER	/C: BY MECHANICAL OR ELECTRICAL
Z / : AS BUILT	/D: BY BM
	/E: BY OTHER ()

DATE	INITIAL	No./CODE	REVISION DESCRIPTION

04/07/2022 J.B. A/D ISSUE FOR PRELIMINARY STAGE

PROVINCE	OFFICE	E-MAIL
Gauteng	Pretoria	(012) 349-0099 ptat@bvi.co.za
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	Worcester	(053) 353-2499 wst@bvi.co.za
	Upington	(053) 320-6660 upg@bvi.co.za
Northern Cape	Springsbok	(021) 719-3614 spg@bvi.co.za
KwaZulu Natal	Durban	(031) 268-8302 dnr@bvi.co.za
	Empangeni	(035) 794-1780 emp@bvi.co.za
Eastern Cape	Port Elizabeth	(041) 374-5453 peb@bvi.co.za
	Gratask	(048) 881-3344 grt@bvi.co.za
Western Cape	Cape Town	(021) 419-3505 cpt@bvi.co.za

bvi
CONSULTING ENGINEERS
Civil, Structural & Electrical Engineers, Environmental & Project Management
Registration no. 1998/001/05/07

FREE STATE

CLIENT



DIREKTEUR GENERAAL:
DIRECTOR GENERAL:
MORENA MOHOLO KAKARETSO:
Ernest Mohlahlo

DIE HOOF OPENBARE WERKE EN INFRASTRUKTUUR:
THE HEAD PUBLIC WORKS AND INFRASTRUCTURE:
HLOHO SECHABA MESEBETISING LE DISEBEDISUWA:
Gadja Brown

PROJECT
**SMITHFIELD: MULTI-PURPOSE
INDOOR
SPORT CENTRE**

DRAWING TITLE

**ELECTRICAL
GATE HOUSE LAYOUT
ERF 1117**

APPROVED BY BVI

J. Boshoff 200770032 6 Nov 2020

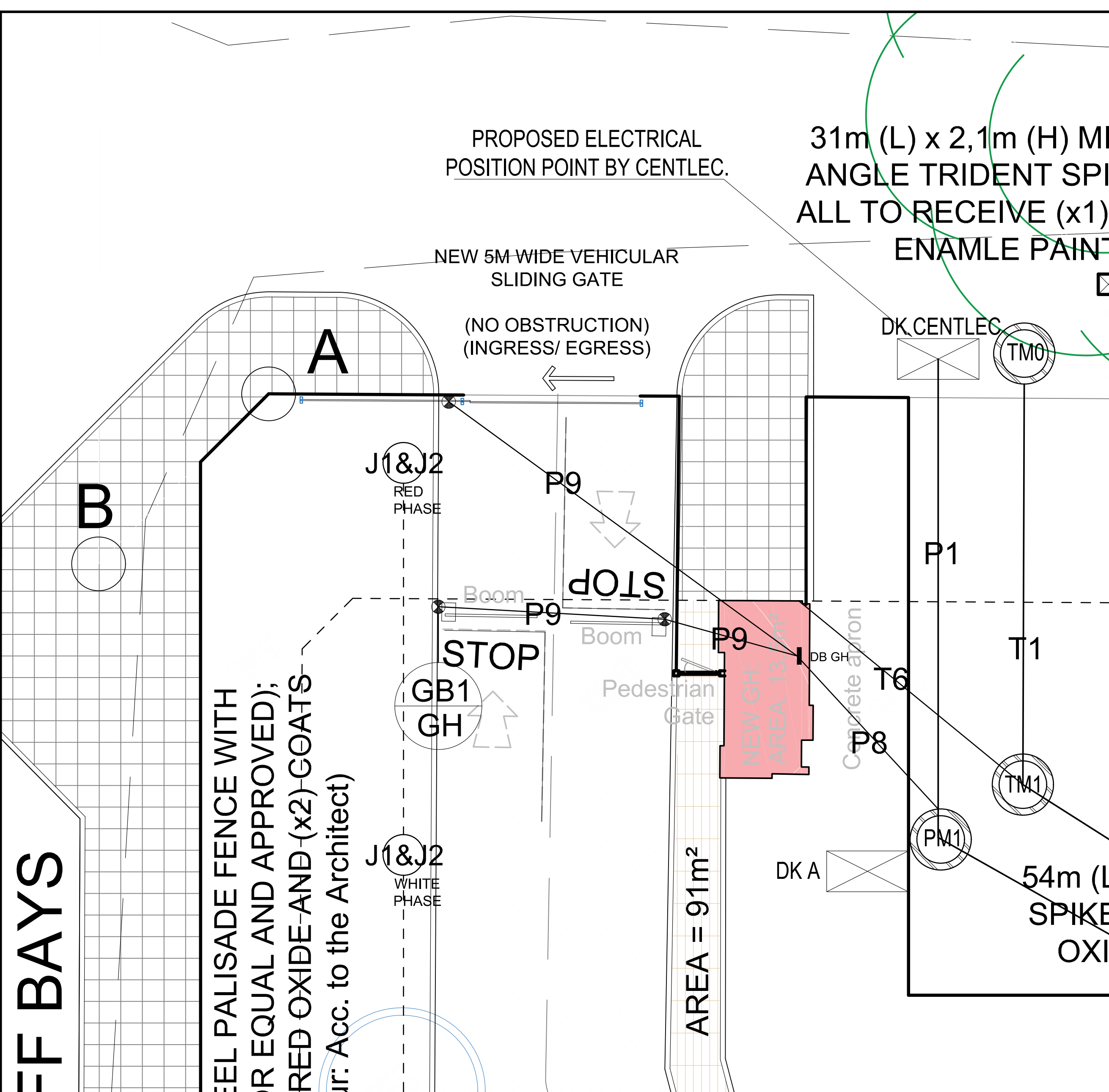
ENGINEER/TECHNOLOGIST REG. NO. DATE

SCALE AS SHOWN DRAWN A BOOYSEN

DESIGNED P HARMSE CHECKED J BOSHOF

PLAN NUMBER REVISION NO. DATE SAVED

34584E--311-05- A 4 Jul 2022



FF BAYS

FEEL PALISADE FENCE WITH
R EQUAL AND APPROVED);
RED OXIDE-AND (x2)-COATS
ur: Acc. to the Architect

PROPOSED ELECTRICAL
POSITION POINT BY CENTLEC.

NEW 5M-WIDE VEHICULAR
SLIDING GATE

(NO OBSTRUCTION)
(INGRESS/ EGRESS)

31m (L) x 2,1m (H) MILL
ANGLE TRIDENT SPIKE
ALL TO RECEIVE (x1)
ENAMEL PAINT

54m (L)
SPIKE
OXID.

AREA = 91m²

STOP

STOP

STOP

STOP

STOP

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STOP

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STOP

STOP

GUARDHOUSE
PORCELAIN TILE
9.4m²
+0.085

GUARDHOUSE
FLOOR PLAN

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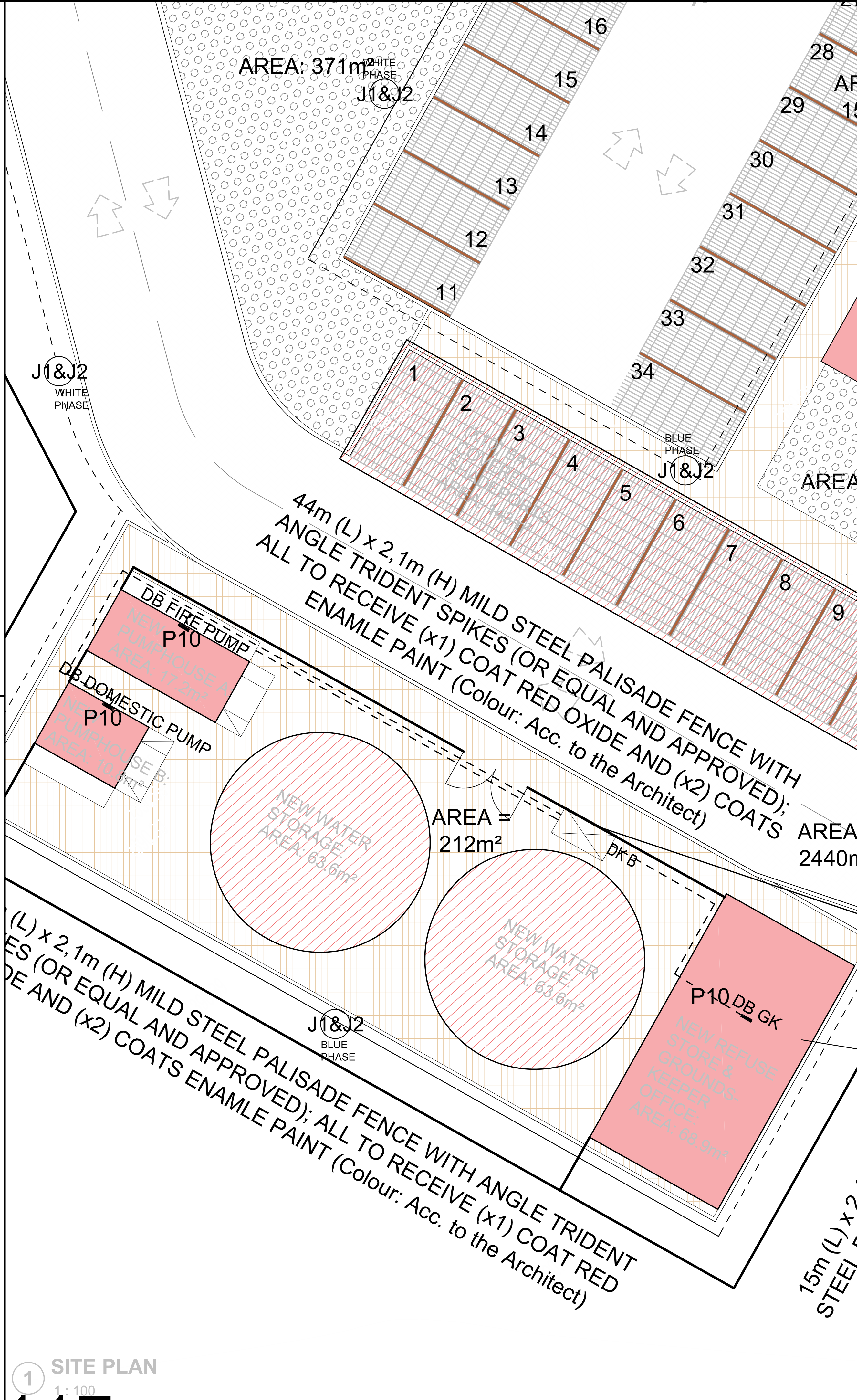
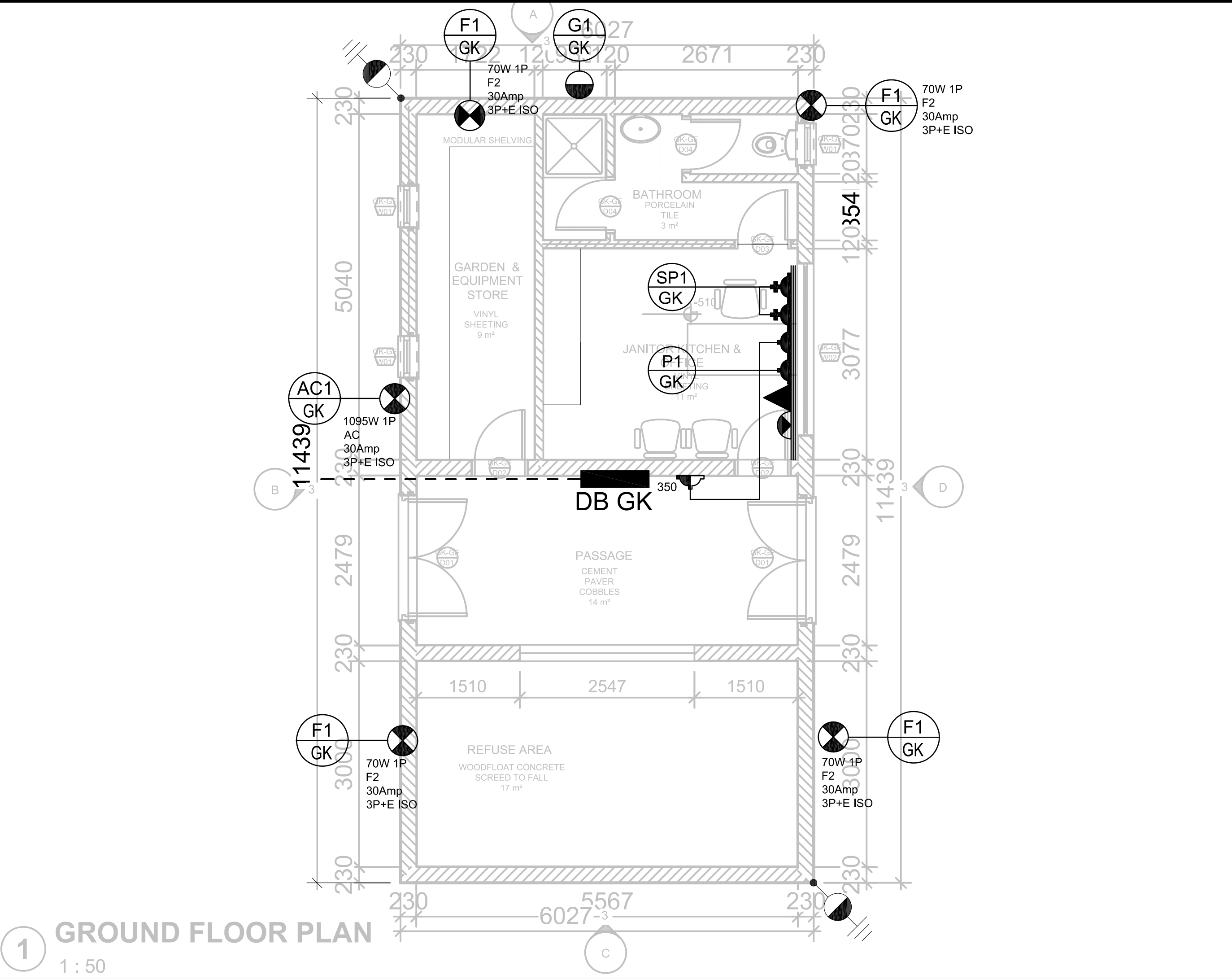
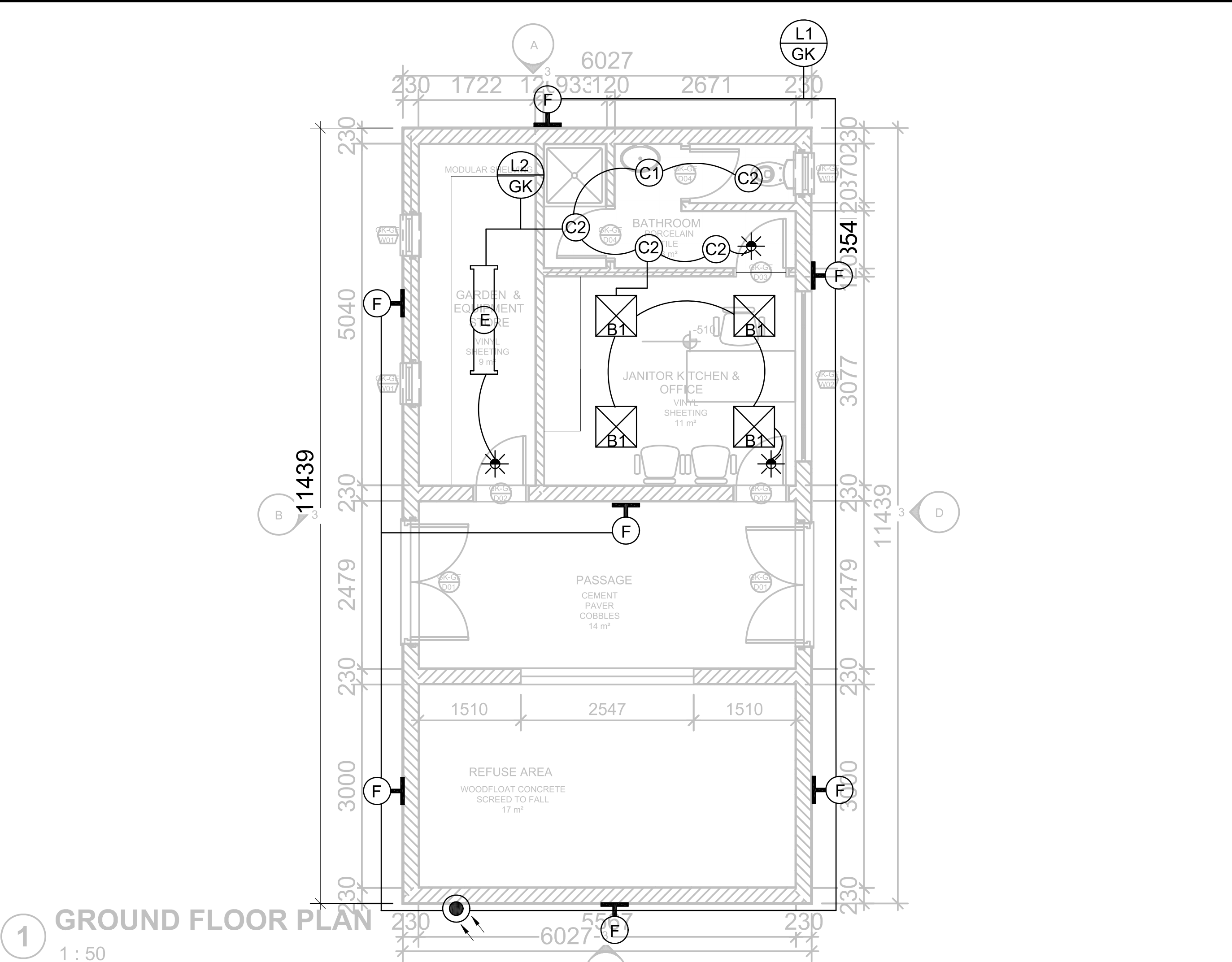
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04/07/2022	J.B	A/D ISSUE FOR PRELIMINARY STAGE	
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PROJECT			
SMITHFIELD: MULTI-PURPOSE INDOOR SPORT CENTRE			
DRAWING TITLE			
ELECTRICAL GROUND KEEPER LAYOUT ERF 1117			
APPROVED BY BVI			
J. Boshoff		200770032 6 Nov 2020	
ENGINEER/TECHNOLOGIST		REG. NO. DATE	
SCALE	AS SHOWN	DRAWN A BOOYSEN	
DESIGNED	P HARMSE	CHECKED J BOSHOFF	
PLAN NUMBER	REVISION NO.	DATE SAVED	
34584E-311-06-	A	4 Jul 2022	

