



public works

Department:
Public Works
REPUBLIC OF SOUTH AFRICA

SPECIFICATION

FOR THE

ELECTRICAL INSTALLATION

**FOR THE REFURBISHMENT OF EXISTING OFFICE (DEPARTMENT
OF LABOUR), UPINGTON, NORTHERN CAPE**

SPECIFICATION FOR THE ELECTRICAL INSTALLATION
OF THE REFURBISHMENT OF EXISTING OFFICES

AT
DEPARTMENT OF LABOUR, UPINGTON, NORTHERN CAPE ICE

CONSISTING OF:

SECTION C3.....: ELECTRICAL INSTALLATION WORK

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SPECIFICATION FOR ELECTRICAL WORK

PART 1 - GENERAL

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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 Principal 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 develop 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 Principal 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 conduits 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 CONDUITS 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 CONDUITS 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 preferably 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 1,5mm² conductors and a 1,5mm²-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

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.

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.

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.

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.

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.

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.

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.

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

[Omit which is not applicable. Clauses 1 to 10 of Part 2 are standard clauses (which should not be altered) and must be inserted in the document in the order as set out.]

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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 are 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 will be at 400/230 Volt 50Hz.

The Contractor must arrange in good time with the local Municipality for the disconnection and reconnection of supply (if necessary) during construction and will be responsible for any costs associated with this process and the required approvals.

The Contractor will be responsible for the supply and installation of the supply cable from the meter box to the main low-tension distribution board (MDB). The size and length of the cable is listed in the Schedule of Cables and measured in the Bills of Quantities.

Standby Plant

The 100kVA standby plant complete with automatic changeover control panel (Distribution Board – X) be supplied, installed and commissioned by others.

The Contractor will only be responsible for the supply and installation of the cable connections between the Main Distribution Board and the Charge-over Control Panel (Distribution Board - X).

The supply cables are listed in the Schedule of Cables and measured in the Bills of Quantities.

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

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 AIRCON SPLIT UNITS
- 14.2 GEYSER(S)
- 14.3 HAND DRYERS
- 14.4 EXTRACTION FAN(S)
- 14.5 ALARM PANEL
- 14.6 TELEPHONE/PBX PANEL

The Contractor must electrically connect all the equipment listed above as specified and listed in the Schedule of Power Points.

NOTE: The geyser(s) installation must be approved by the Employers Electrical Engineer. Detail with regard to the size and type of geyser to be provided and must be obtained from the Mechanical Engineer.

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 sides free from rocks or stones liable to cause damage to the cable.

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

In the trenches 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 PVC-A 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 jointer.
5. Before the Contractor allows the jointer to commence with the jointing work or making off of the cable (making off is recognized as half a joint) he must take care and ensure:
 - 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 jointer 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:

DB-Main
Sub DB-1

The latest Departmental Quality Specification Section for Distribution Boards must be included in Part 3 of the specification.]

17. SUBSTATION

17.1 GENERAL SUB-STATION WORK

17.2 SUB-STATION EARTHING

17.3 CONTRACTOR'S RESPONSIBILITY

18. SCHEDULE OF LIGHT FITINGS

The Departmental Quality Specification for the relevant luminaires must be included in Part 3 of the specification.

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

Type A: Industrial 40W LED surface mounted channel luminaire with mid-power LED strip complete with diffuser colour 4000K with SANS approved mark.

Type B: Industrial 2 x 40W LED surface mounted channel luminaire with mid-power LED strips complete with diffuser colour 4000K with SANS approved mark.

Type C: Decorative 2 x 40W LED office luminaire with mid-power LED strips and low brightness double parabolic diffuser colour 4000K with SANS approved mark.

Type D: 53W wall/pole/stirrup mounted LED bulkhead luminaire with corrosion resistant aluminium housing and high impact UV resistant polycarbonate protector for LED's, IP66 with optimal photometric performance and flexible combinations of LED arrays, colour 4000K.

19. SCHEDULE OF POWER POINTS

BOARD	POWER POINT	TYPE	SIZE OF CABLES, CONDUIT AND WIRING	LOAD WATTS
DB-Main	PP1	150-liter Geyser	20mm dia. conduit with 2 x 4mm ² conductors and 2,5mm ² earth wire	2500
DB-Main	PP2	AC Split Unit	20mm dia. conduit with 2 x 4mm ² conductors and 2,5mm ² earth wire	2000
DB-Main	PP3	30A hand dryer	20mm dia. conduit with 2 x 4mm ² conductors and 2,5mm ² earth wire	2500
DB-Main	PP4	5A Extraction Fan	20mm dia. conduit with 2 x 4mm ² conductors and 2,5mm ² earth wire	1000
DB-Main/Sub DB1	PP5	Combined 16A 3-pin + 2-pin socket	20mm dia. conduit with 2 x 4mm ² conductors and 2,5mm ² earth wire	300

20. SCHEDULE OF CABLES, CONDUIT AND WIRING

Supply, install and connect the following cable, conduit and wiring:

FROM	TO	SIZE AND TYPE	LOAD (kVA)
Meter box Normal Power	Gen ATS	70mm ² 4-core PVCA cable and 35mm ² earth wire	87,62
Gen ATS	DB-Main	70mm ² 4-core PVCA cable and 35mm ² earth wire	87,62
DB-Main Normal Power	Sub -DB1	25mm ² 4-core PVCA cable and 16mm ² earth wire	36,05

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
DB-Main	Surface, with door	Normal power	20	87,62
		Standby power	n/a	n/a
Sub-DB1	Surface, with door	Normal power	15	36,05

22. SUMMARY OF SWITCHGEAR AND CIRCUITS

The indicated fault current rating (kA) is the minimum value that the switchgear must comply with for connecting to the busbars of the respective panels-distribution boards.

MAIN DISTRIBUTION BOARD : DB-Main

PANEL - 1 : NORMAL POWER

Main switch : 250A three pole 20kA circuit breaker.
 Sub-DB1 : 150A three pole 15kA circuit breaker.

PANEL-2 : NORMAL POWER

Local main switch: 100A three pole isolator
 Lighting circuits 1-5: 5 x 10A one pole 3kA circuit breakers.
 Socket outlets : 3 x 63A two pole 30mA single-phase earth leakage relays, and 10 x 20A
 Single pole 5kA circuit breakers. (Circuits P1 to P10)

Dedicated Power (Circuit DP1-DP3) 20A one pole 5kA circuit breaker.

Isolators (Circuits AC1-AC15, HD1-HD3, G1 and EF1) 20A two pole 6kA circuit breaker.

SUB DISTRIBUTION BOARD : SUB-DB1

PANEL - 1 : NORMAL POWER

Main switch : 150A three pole 15kA circuit breaker.

PANEL-2 : NORMAL POWER

Local main switch: 100A three pole isolator

Lighting circuits 1-5: 5 x 10A one pole 3kA circuit breakers.

Socket outlets : 2 x 63A two pole 30mA single-phase earth leakage relays, and 5 x 20A
Single pole 5kA circuit breakers. (Circuits P1 to P5)

Dedicated Power (Circuit DP1-DP6) 20A one pole 5kA circuit breaker.

Isolators (Circuits AC15-AC26, HD4) 20A two pole 6kA circuit breaker.

[Socket outlets circuits (P) must be controlled by 63A two pole 30mA single phase earth leakage relay and 20A single pole 5kA circuit breakers. With a maximum of 5 circuits (10 plugs) per earth leakage relay.]

PART 3: QUALITY SPECIFICATION FOR MATERIALS AND EQUIPMENT OF ELECTRICAL INSTALLATIONS

"Part 3: Quality specification for materials and equipment" manual of the Department of Public Works is applicable for this Contract and the manual can be obtained from the Department of Public Works.

[ONLY ITEMS OF MATERIAL applicable to the Contract must be included in Part 3]

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<u>CLAUSE</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
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2.3		
2.4		

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. **Note that no LED tubes are allowed to be used.**

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 +/-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 @ Tq 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°C < T < 60°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.	Distribution boards		
2.	Circuit breakers 1P, 2P, 3P		
3.	On load isolators without trips		
4.	Contactors 1P, 2P, 3P		
5.	Earth leakage relays 1 & 3 phase		
6.	H.R.C. fuse switches		
7.	Kilowatt hour meter		
8.	Current transformers		
9.	Voltmeter		
10.	Maximum demand ammeter		
11.	Daylight sensitive switch		
12.	Time switch		
13.	Conduit		
14.	Conduit boxes		
15.	Power skirting		
16.	Surface switches		
17.	Watertight switches		
18.	16A flush socket outlets		
19.	10A surface socket outlets		
20.	16A watertight socket outlets		
21.	Fluorescent luminaires		
22.	Type A		
	Type B		
	Type C		
	Type D		
	Etc.		
23.	Bulkhead fittings: Type F		
24.	Spherical fittings: Type G		
25.	4 plate stoves		
26.	Convection heater		
27.	Fan heater		
28.	Fans		
29.	Clocks		
30.	PVCA cable		
31.	Cable trays		

PARTICULARS OF ELECTRICAL CONTRACTOR

Note to consultants

Please ensure that DPW -22(EC) Particulars of electrical contractor is inserted in main tender document.

PART 6: DRAWINGS

List all drawings

Drawing Description	Drawing Name	Drawing Number	Drawing Size
Main Distribution Board	DB-MAIN	UP-LAB/ELE/DB/01	A1
Sub Distribution Board	Sub-DB1	UP-LAB/ELE/DB/02	A1
MV/LV Schematic Layout	MV/LV Schematic Layout	UP-LAB/ELE/DB/03	A1
Small Power Layout	Small Power Layout	UP-LAB/ELE/P/01	A1
Lighting Layout	Lighting Layout	UP-LAB/ELE/L/01	A1

PROPOSED ALTERATIONS & ADDITIONS FOR DPW LABOUR CENTRE , UPINGTON

ELECTRICAL INSTALLATIONS

Item	Description	Amount
1	SECTION 1 : CABLES & CABLE MANAGEMENT	
2	SECTION 2 : DB's , SOCKETS, SWITCHES & ISOLATORS	
3	SECTION 3 : LUMINAIRES, GENSET, ELECTRONICS & LIGHTNING PROTECTION	
4	SECTION 4 : OTHERS	
TOTAL CARRIED TO FINAL SUMMARY OF BILLS OF QUANTITIES OF BUILDING WORKS		
	15% VAT	
TOTAL		

PROPOSED ALTERATIONS & ADDITIONS FOR DPW LABOUR CENTRE , UPINGTON

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
				R	R
Note	The complete installation must comply with SANS 0142 specifications and the Quality specification in this document. Therefore Tenders are advised to study the specification and drawings before the Bill is to be priced.				
1	CABLES, CONDUCTORS & SLEEVES				
1.1	CABLES Supply and installation of PVC SWA PVC insulated 600/1000V Cu cable and Bare Copper Earth Wire in sleeves and in trenches				
1.1.1	6mm ² 4 core PVC insulated copper cable for guard house & gate motor	m	50		
	Supply and install bare copper earth conductor				
1.1.2	4mm ² bare copper earth cable	m	50		
1.2	CONDUCTORS Supply and install 600/1000Volt PVC insulated stranded copper conductors drawn into conduits ,etc .:				
1.2.1	2,5mm ²	m	1600		
1.2.2	4mm ²	m	1400		
1.2.3	6mm ²	m	300		
	Earth Wire				
1.2.4	2,5mm ²	m	1400		
1.2.5	4mm ²	m	300		
1.3	GLANDS AND SHROUDS				
1.3.1	6mm ² 4 core PVC insulated copper cable	each	10		
1.4	GLANDS AND SHROUDS (Earth bare				
1.4.1	4mm ² bare copper earth cable	each	10		
1.5	CABLE MARKERS & WARNING TAPES				
1.5.1	Cable markers for cable routes indication	each	1		
1.5.2	Cable warning tape	m	30		
1.6	SUPPLY & INSTALL PVC SLEEVES				
1.6.1	110 diameter	m	10		
1.6.2	50 diameter	m	5		
1.7	TRENCHING AND EXCAVATIONS (600mm wide & 500mm deep)				
1.7.1	Soft rock	m ³	15		
1.7.2	Hard rock	m ³	10		
1.7.3	Bedding	m ³	20		
1.7.4	Backfilling	m ³	20		
1.7.5	600mm x 600mm x 1000mm Manhole	each	1		
1.8	ELECTRICAL CABLE MANAGEMENT & TRUNKING				
1.8.1	CONDUITS Supply and install pipes including short lengths jointing, sweeping bends , buses				
1.8.1.1	20mm diameter galvanised steel pipe	m	300		
1.8.1.2	25mm diameter Galvanised steel pipe	m	100		
1.8.1.3	20mm diameter flexible conduit (PVC)	m	700		
1.8.2	Supply and install wall boxes:				
1.8.2.1	100mm x 50mm x 50mm deep (PVC)	each	120		
1.8.2.2	100mm x 100mm x 50mm deep (Galvanized)	each	30		

1.8.2.3	4 Way PVC round boxes	each	120	
1.8.2.4	Supply and install 1,6mm diameter steel galvanised draw wires draw	m	1250	
1.8.3	SKIRTING & TRAYS			
1.8.3.1	Supply and install galvanised steel power skirting (2 compartment) including cutting, ends, covers, elbows, short lengths, screws etc. 2-Compartment with divider	m	100	
1.8.3.2	P9000 galvanized steel trunking	m	240	
AMOUNT CARRIED TO SUMMARY SECTION 1 (CABLES & CABLE MANAGEMENT)				

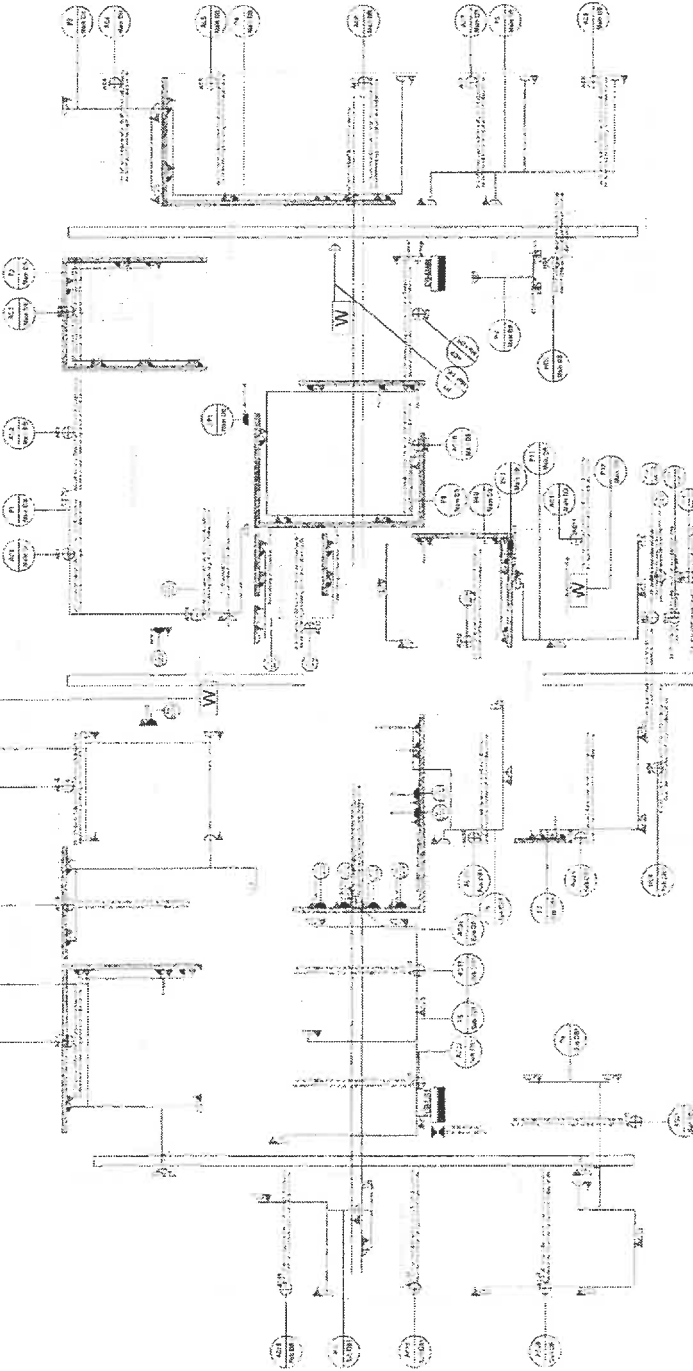
ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
				R	R
2	DISTRIBUTION BOARDS, Refer to drawings UPINGTON /REF/EL/P1/01 as well as design notes included <i>Supply, delivery, storage and submission of workshop drawings for the Flush mounted architrave steel type power distribution boards complete with flush trays,doors,switch gear mounting trays, copper busbars, neutral and earth bars</i>				
2.1	MAIN DB (New DB complete with switchgear)	each	1		
2.2	Sub-DB1 New DB complete with switchgear	each	1		
2.3	DB-GH New DB complete with switchgear	each	1		
3	SOCKETS				
3.1	Supply, install and connect switch sockets in flush mounted boxes, complete with cover plates:				
3.1.1	SANS 164-1 & 2 combined socket (3 pin earthed + 2 pin unearthed)	each	55		
3.1.2	SANS 164-1 & 2 combined socket on power skirting	each	40		
3.1.3	16A single switched double socket	each	5		
3.1.4	16A dedicated (red) 3-pin single switched socket on power skirting	each	15		
3.1.5	Type W : 5 x SANS 164-1 & 2 combined socket (3 pin earthed + 2 pin unearthed) ground mounted	each	4		
3.1.6	5 Amp single unswitched Socket (on 60mm steel round box for light f	each	90		
4	SWITCHES				
4.1	Supply, install and connect switches on flush mounted boxes, complete with cover plates:				
4.1.1	16 Amp 1 -lever / 1-way	each	20		
4.1.2	16 Amp 1 - lever /2-way	each	30		
4.1.3	Day light switch/photocell	each	4		
4.1.4	PIR/Occupancy sensor	each	4		
5	ISOLATORS				
5.1	Double pole 5A isolator for extractor fan	each	3		
5.2	Double pole 30A isolator for hand dryers	each	10		
5.3	Double pole 30A isolator for split units	each	36		
AMOUNT CARRIED TO SUMMARY SECTION 2 (DB's , SOCKETS, SWITCHES & ISOLATORS)					
6	LUMINAIRES				
6.1	Supply, install and connect luminaires complete with lamps, fixings, brass screws washers, etc.: (See designs for luminaire spec and schedule of luminaires spec				
6.1.1	Type LED - 44W LED, 4750Lm , 2.5ft/1170mm ,6500/800, IP20	each	95		

6.1.2	Type B - 2 x 9W LED Round Ceiling/Wall mounted bulkhead , IP65	each	20		
6.1.3	Type B1 - 2 x 18W LED or CFL Wall mounted bulkhead , IP65	each	25		
6.1.4	Type D - 9W LED,120mm recessed downlighter with smooth satin Aluminium reflector , IP20	each	2		
6.1.4	75-100W High Power LED spot light ,motion sensor controlled , IP65	each	2		
7	ELECTRIC GATE MOTOR Supply & install heavy duty 12V or 24V DC motor rated to drive a gate of up to 500kg in mass at a rate of at least 16m/minute . Installation to come with all accessories				
7.1	Heavy duty 12V or 24DC motor to drive 500kg In mass	each	2		
8	GENERATOR SET Supply & install diesel , open installation silent generator				
8.1	100kVA Weather proof silent Genset Installation complete with ATM	each	1		
9	LIGHTNING PROTECTION SYSTEM				
9.1	<i>Repair , make good , test and ensure compliance with a Level 2 lightning protection system to existing LP. This to apply to existing Al and Cu conductors, test joints, steel conduits, earth electrodes etc.</i>				
9.1.1	4mm x 40mm Aluminium Strip along roof edge	m	100		
9.1.2	100 x 100 conduit box	each	22		
9.1.3	50mm ² black pvc insulated stranded galvanized steel cable down conductor	m	48		
9.1.4	70mm ² anti-theft composite stranded earth conductor equivalent to 10mm ² BCEW	m	90		
9.1.5	1200mm long 16mm Ø earth rods	each	22		
9.1.6	20mm galvanized conduits	m	75		
9.1.7	Finial Type Air Terminals	each	8		
9.1.8	Joints for electrical continuity	each	22		
9.1.9	Tests and certifying	each	1		
AMOUNT CARRIED TO SUMMARY SECTION 3 (LUMINAIRES, GENSET, ELECTRONICS & LIGHTNING PROTECTION)					
10	OTHERS				
10.1	Remove all unnecessary conduits , cables , wiring , obsolete electrical equipment & infrastrure eg electric bells , protective cages , satellite dishes etc and make neat accordingly	sum	1		
10.2	Safe removal and disposition of old luminaires & issuance of a crushing certificate	each	1		
10.3	Build a lockable steel palisade fence (4m (L) x 2m (W) x 2m (H) around generator	each	1		
10.4	Testing and Commissioning (CoC) of entire reticulation	sum	1		
AMOUNT CARRIED TO SUMMARY SECTION 4 (OTHERS)					

REVISIONS

NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	01/15/2018
2	REVISED TO SHOW REVISIONS	01/15/2018

PROJECT: [REDACTED]
 CLIENT: [REDACTED]
 DESIGNER: [REDACTED]



LEGEND

SYMBOL	DESCRIPTION
(Symbol)	Power Distribution Panel
(Symbol)	Circuit Breaker
(Symbol)	Outlet
(Symbol)	Fixture
(Symbol)	Wiring Path

OPTIMUM
 ARCHITECTURE & INTERIOR DESIGN

PROFESSIONAL REGISTRATION NO. [REDACTED]
 CHAIRMAN: [REDACTED]
 VICE-CHAIRMAN: [REDACTED]
 SECRETARY: [REDACTED]
 TREASURER: [REDACTED]
 MEMBER: [REDACTED]

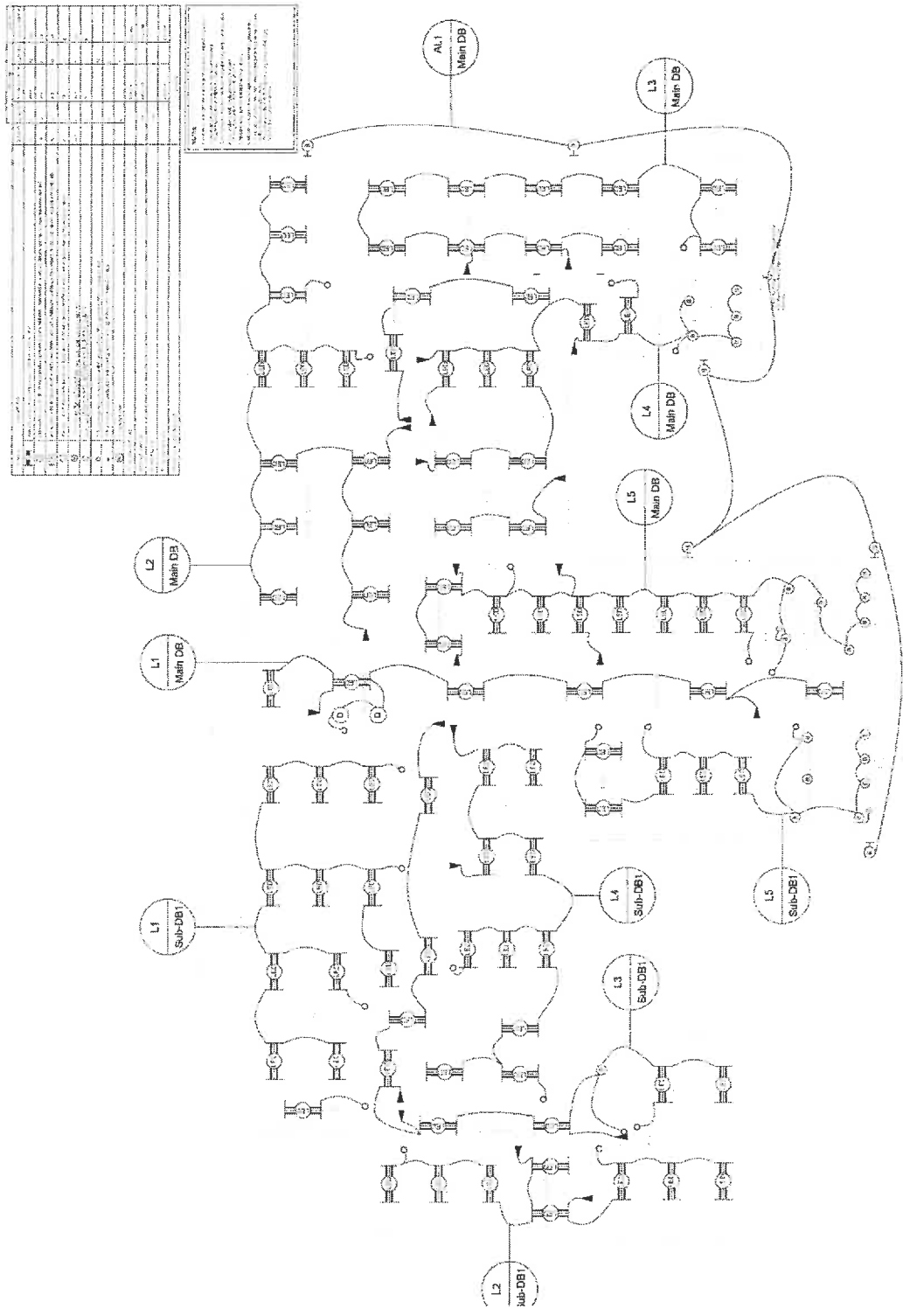
PROJECT: [REDACTED]
 CLIENT: [REDACTED]
 DATE: [REDACTED]

SMALL POWER LAYOUT
 1:100

NO. PROJEKSI	NO. RENCANA	NO. GAMBAR	NO. SKALA	NO. LEMBAR

Nama Proyek : ...
 Nama Gedung : ...
 Lokasi : ...
 Tanggal : ...
 Disetujui : ...
 Dibuat : ...

OETIMAJA
 ENGINEERING & CONSULTING
 Jl. ...
 ...
 ...



LIGHTS LAYOUT

REVISIONS

No.	Description	Date
1	Issue for Review	10/10/2010
2	Issue for Approval	10/10/2010
3	Issue for Construction	10/10/2010

LEGEND

Symbol	Description
(A)	400V 3 PHASE
(B)	230V 1 PHASE
(C)	200V 1 PHASE

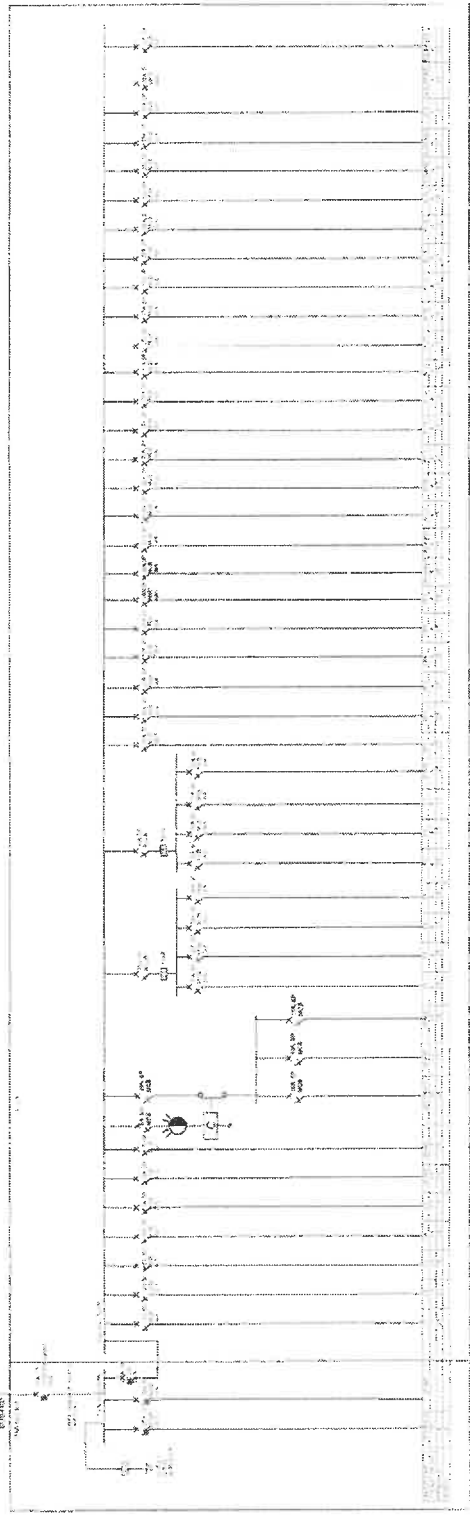
OPTIMAUM CONSULTANTS

100, Jalan Sultan Ismail, 50001 Kuala Lumpur, Malaysia

Phone: +603 2148 8888

Fax: +603 2148 8889

Website: www.optimum.com.my



Equipment Schedule

Code	Description	Quantity	Remarks
1	400V 3 PHASE	1	400V 3 PHASE
2	230V 1 PHASE	1	230V 1 PHASE
3	200V 1 PHASE	1	200V 1 PHASE

SUB-DB LAYOUT

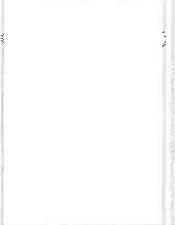
NO.	REVISION
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2.	REVISION
3.	REVISION

DATE	PROJECT
DATE	PROJECT
DATE	PROJECT

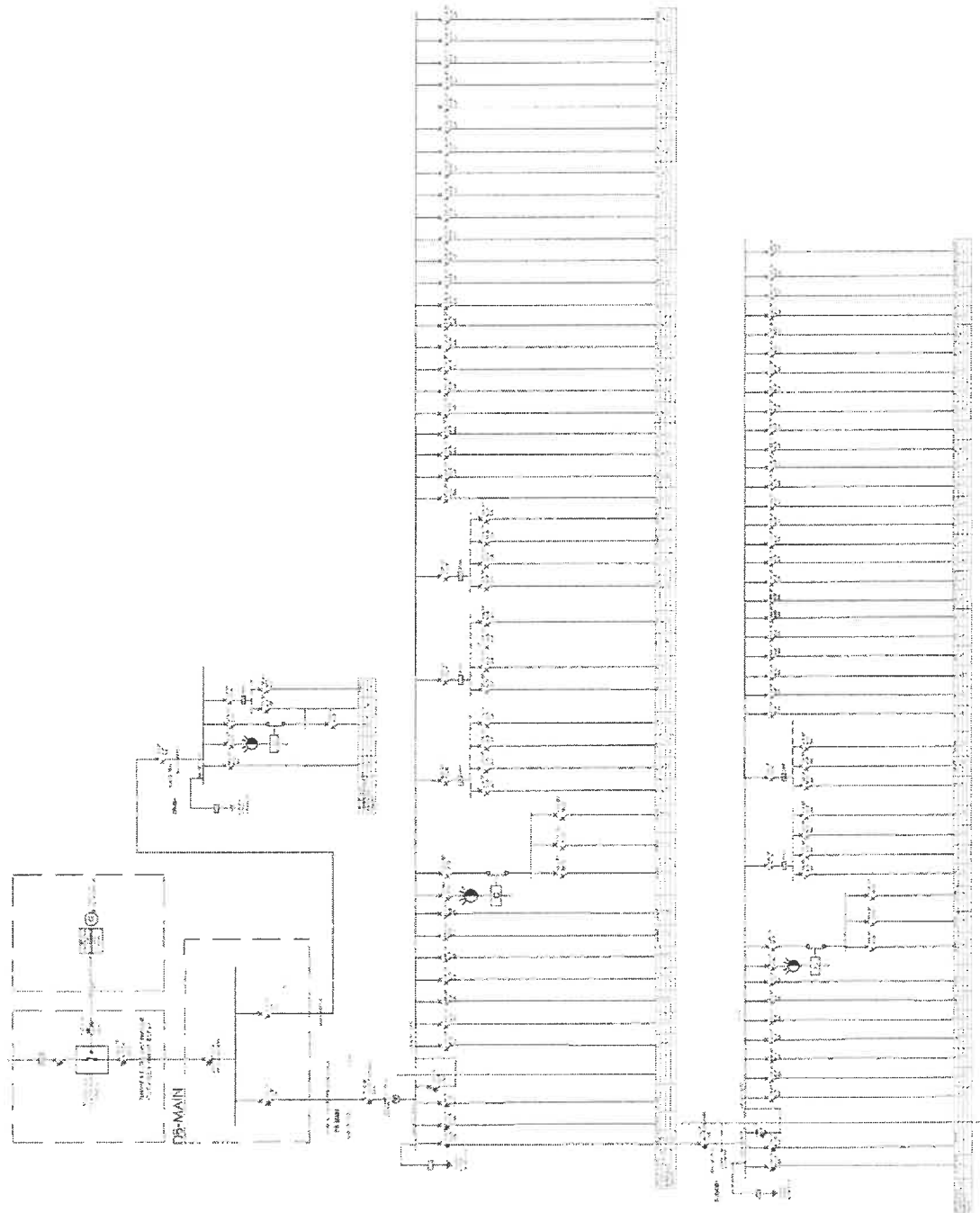
LEGEND

Symbol	Description
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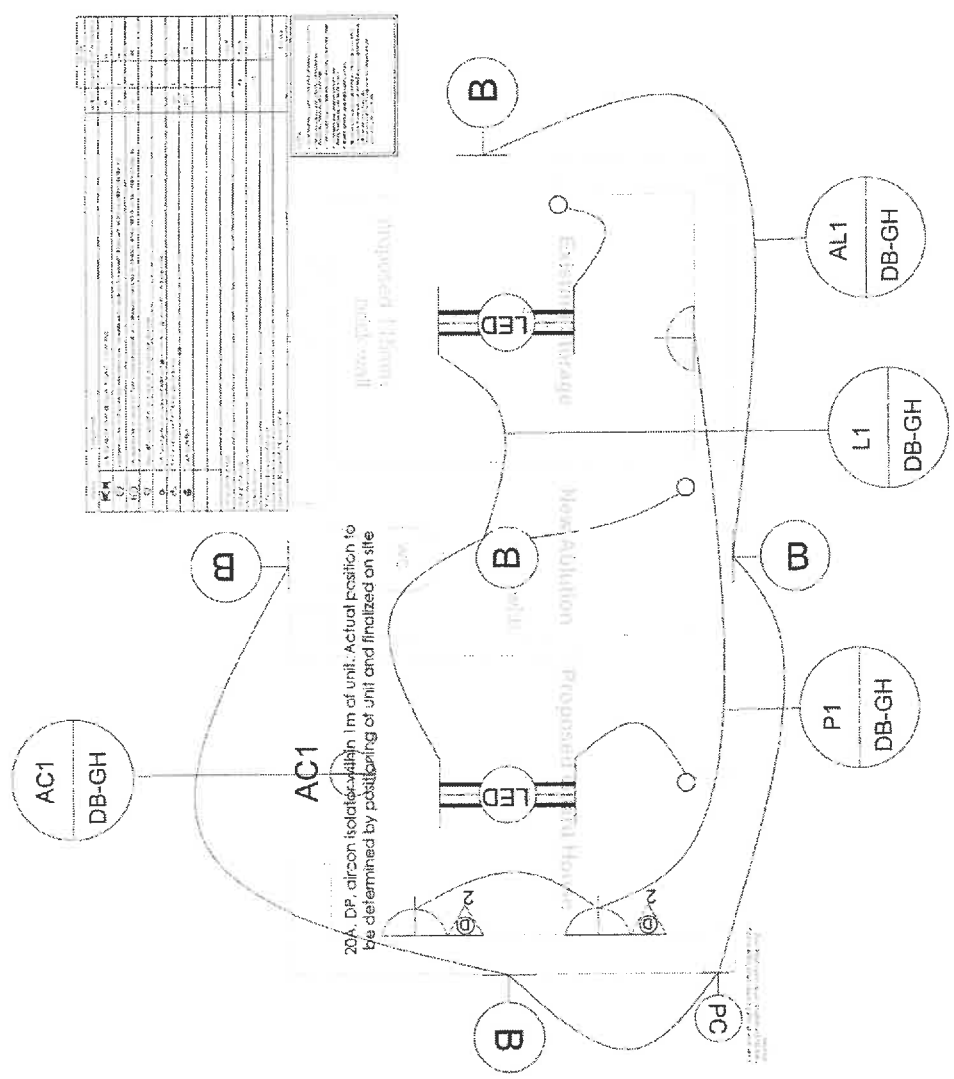
PROJECT: ...
 DRAWING NO.: ...
 DATE: ...



NO.	REVISION
1.	REVISION
2.	REVISION
3.	REVISION



MVLV SCHEMATIC LAYOUT



GUARD HOUSE LIGHTS & SOCKETS LAYOUT

NO. 6152
REV. 01/2017
DATE: 10/2017

PROJECT: ...
SHEET NO. ...

LEGEND

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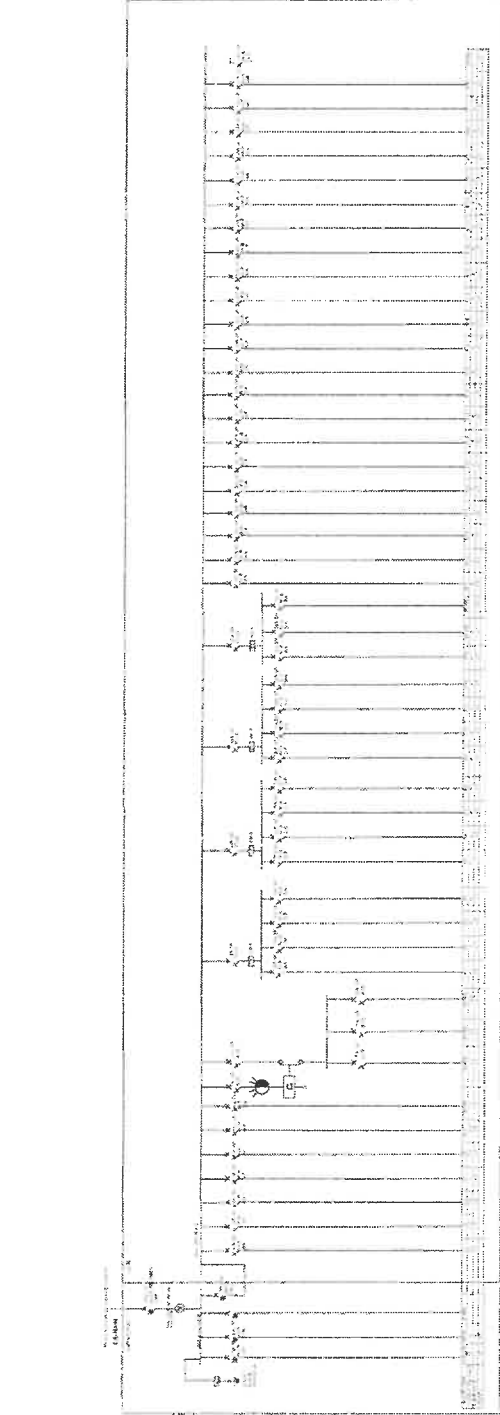
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DB-MAIN LAYOUT

PT. OPTIMUM
SOLUSI TEKNOLOGI

PT. OPTIMUM
SOLUSI TEKNOLOGI
Jl. ...
No. ...
Kota ...

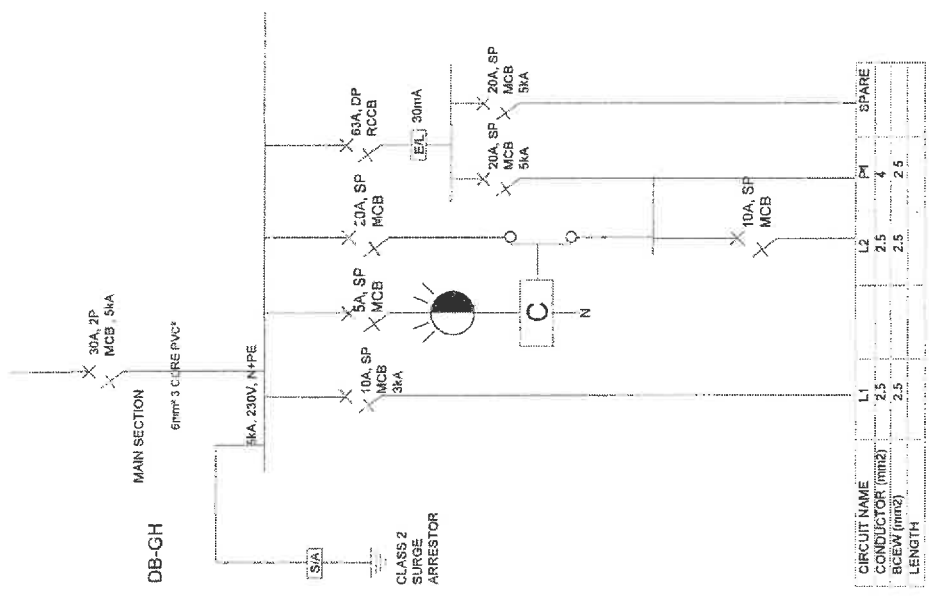
NO. ...
REV. ...
DATE: ...

LEGEND

	MCB
	RCCB
	Light
	Surge Arrester
	Circuit Breaker
	Switch
	Neutral
	Earth

OPTIMUM
 ENGINEERING CONSULTANTS
 10, Jalan Bukit Merah, Singapore 159522
 Tel: 6733 8888, Fax: 6733 8889
 Email: info@optimum-engineering.com.sg
 Website: www.optimum-engineering.com.sg

NO.	DESCRIPTION	QTY	UNIT
1	MCB 30A 2P 5KA	1	EA
2	MCB 10A 1P 3KA	1	EA
3	MCB 5A 1P 3KA	1	EA
4	MCB 20A 1P 5KA	1	EA
5	MCB 10A 1P 5KA	1	EA
6	MCB 20A 1P 5KA	1	EA
7	MCB 20A 1P 5KA	1	EA
8	MCB 10A 1P 5KA	1	EA
9	RCCB 63A 2P	1	EA
10	Light	1	EA
11	Surge Arrester	1	EA
12	Switch	1	EA
13	Neutral	1	EA
14	Earth	1	EA



CIRCUIT NAME	L1	L2	PI	SPARE
CONDUCTOR (mm ²)	2.5	2.5	4	
BCEW (mm ²)	2.5	2.5	2.5	2.5
LENGTH				

DB-GH (GUARD HOUSE) LAYOUT

UPINGTON DEPARTMENT OF LABOUR

Installation : INTERIOR LIGHTING

Project number : GL - 20210525 - UPINGTON DEPARTMENT OF LABOUR

Customer :

Processed by : Sibusiso Mkize

Date : 25.05.2021

Project description:
SUMMARY:

UPINGTON DEPARTMENT OF LABOUR

THE SIMULATIONS ARE DONE ACCORDING TO SANS 10114-1

PLEASE SEE THE COMPLETE REPORT FOR DETAILS.

CAT No.
90 X ALENA LED 44W 1500MM
13 X 9W DISK DOWNLIGHTER

The following values are based on precise calculations performed on calibrated lamps and luminaires, and their configurations, whereby gradual, unavoidable deviations can occur in practice. All guarantee claims are excluded for the specified data.

This exclusion of liability applies irrespective of the legal grounds for both damages and consequential damages suffered by users and third parties.

Object : UPINGTON DEPARTMENT OF LABOUR
Installation : INTERIOR LIGHTING
Project number : GL - 20210525 - UPINGTON DEPARTMENT OF LABOUR
Date : 25.05.2021

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1.2 9W SPL073 (9W SPL073)	
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Object : UPINGTON DEPARTMENT OF LABOUR
Installation : INTERIOR LIGHTING
Project number : GL - 20210525 - UPINGTON DEPARTMENT OF LABOUR
Date : 25.05.2021

1 Luminaire data

1.1 GENLUX LIGHTING, ALENA LED 44W 1500mm 8... (ALENA LED 44W 1...)

1.1.1 Data sheet

Manufacturer: GENLUX LIGHTING

ALENA LED 44W 1500mm 840

ALENA LED 44W 1500mm 840

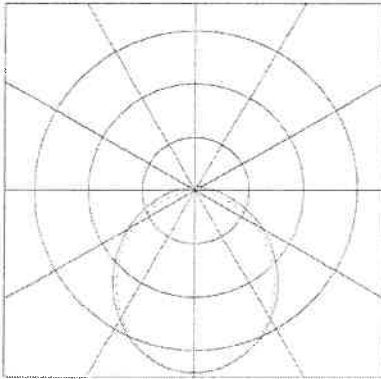
Luminaire data

Luminaire efficiency : 100%
Luminaire efficacy : 107.95 lm/W
Classification : A41 ↓94.0% ↑6.0%
CIE Flux Codes : 47 77 93 94 100
UGR 4H 8H : 21.8 / 20.9
Power : 44 W
Luminous flux : 4750 lm

Equipped with

Quantity : 1
Designation : LEDLine
Colour : 4000
Luminous flux : 4750 lm
Colour reproduction : 85

Dimensions : 1450 mm x 146 mm x 58 mm



Object : UPINGTON DEPARTMENT OF LABOUR
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Date : 25.05.2021

GENLUX LIGHTING
a lighting technology company

1 Luminaire data

1.2 9W SPL073 (9W SPL073)

1.2.1 Data sheet

9W SPL073 9W SPL073

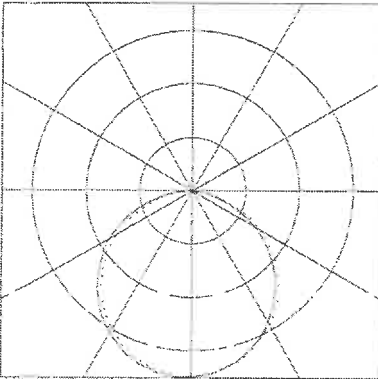
Luminaire data

Luminaire efficiency : 100%
Luminaire efficacy : 91.33 lm/W
Classification : A40 ↓99.4% ↑0.6%
CIE Flux Codes : 47 79 96 99 100
UGR 4H 8H : 25.8 / 28.0
Power : 9.8 W
Luminous flux : 895 lm

Equipped with

Quantity : 1
Designation : 9W
Colour : 4000k
Luminous flux : 895 lm
Colour reproduction : 80

Dimensions : Ø120 mm x 1 mm

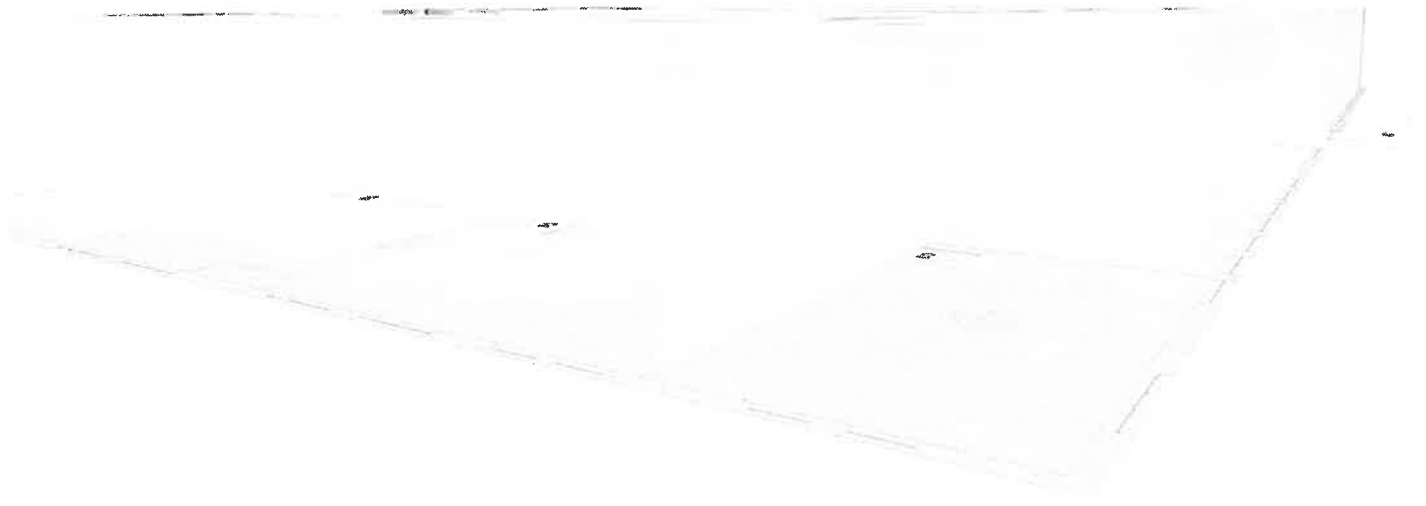




Object : UPINGTON DEPARTMENT OF LABOUR
Installation : INTERIOR LIGHTING
Project number : GL - 20210525 - UPINGTON DEPARTMENT OF LABOUR
Date : 25.05.2021

Description, Floor 1

.1 Floor 3D

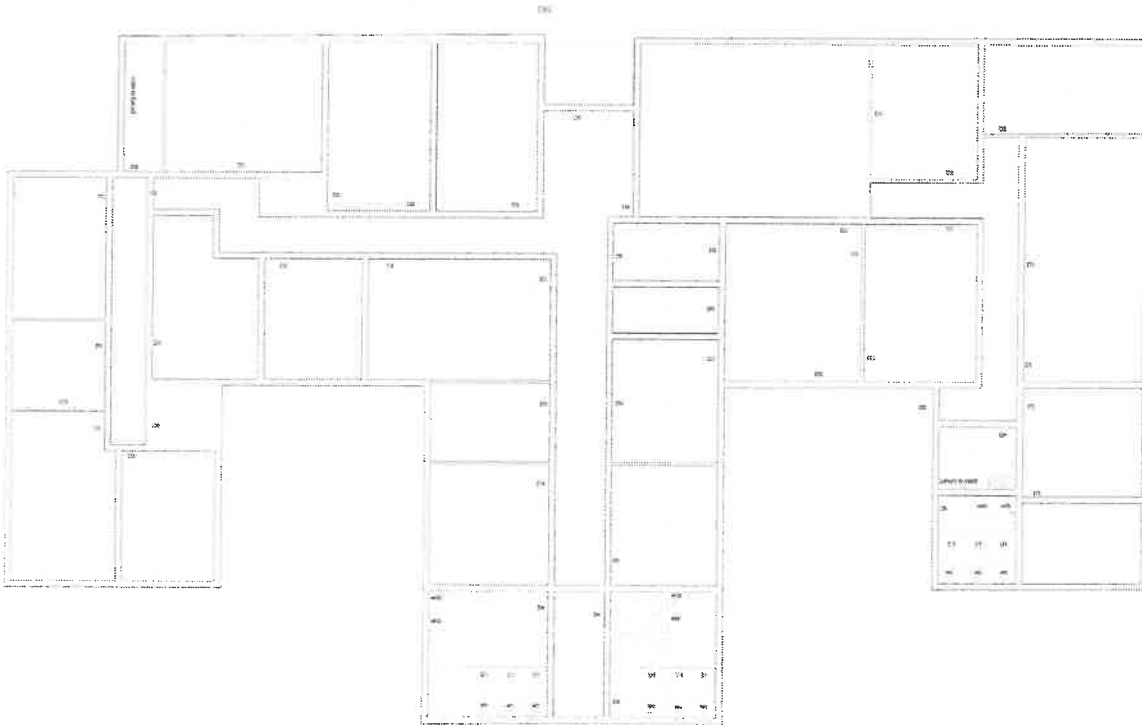




Object : UPINGTON DEPARTMENT OF LABOUR
Installation : INTERIOR LIGHTING
Project number : GL - 20210525 - UPINGTON DEPARTMENT OF LABOUR
Date : 25.05.2021

Description, Floor 1

.2 Floor plan

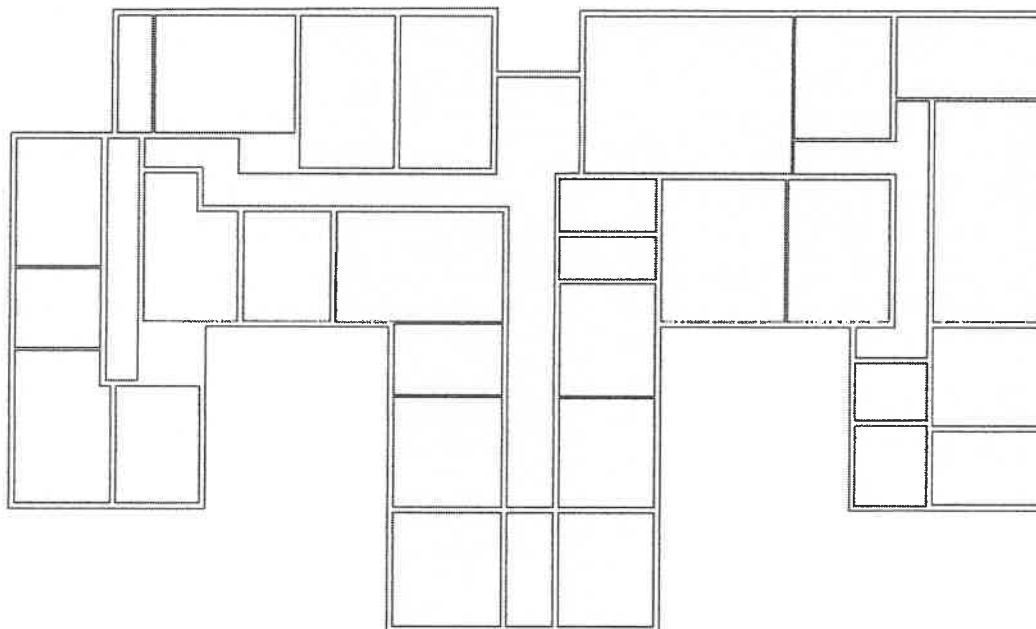




Object : UPINGTON DEPARTMENT OF LABOUR
 Installation : INTERIOR LIGHTING
 Project number : GL - 20210525 - UPINGTON DEPARTMENT OF LABOUR
 Date : 25.05.2021

Summary, Floor 1

.3 Floor overview



Number of rooms : 34
 Total area : 1494 m²
 Number of luminaires : 103
 Total luminous flux of all lamps : 439135 lm
 Total power : 4087.4 W
 Total power per area : 2.74 W/m²

Uncalculated
 Calculated

Parts list

Type No. Make

- GENLUX LIGHTING**
- | | | | |
|---|----|----------------|------------------------------|
| 1 | 90 | Order No. | : ALENA LED 44W 1500mm 840 |
| | | Luminaire name | : ALENA LED 44W 1500mm 840 |
| | | Equipment | : 1 x LEDLine 44 W / 4750 lm |
| | | | |
| 2 | 13 | Order No. | : 9W SPL073 |
| | | Luminaire name | : 9W SPL073 |
| | | Equipment | : 1 x 9W 9.8 W / 895 lm |



Object : UPINGTON DEPARTMENT OF LABOUR
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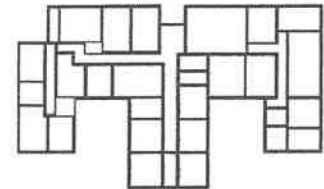
Summary, Floor 1

.3 Floor overview

Rooms

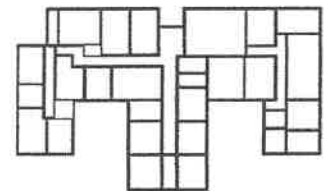
Room 1

Total luminous flux of all lamps ---
 Total power ---
 Total power per area (798 m²) ---
 Em ---
 Emin ---
 Emin/Em (Uo) ---
 UGR ---



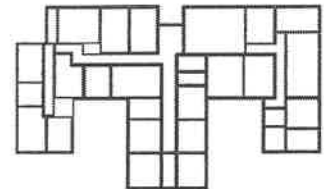
Room 2

3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (24 m²) 5.43 W/m²
 Em 509 lx
 Emin 342 lx
 Emin/Em (Uo) 0.67
 UGR <=19.9



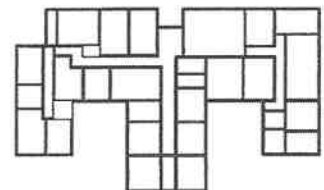
Room 3

2 x Luminaires
 Total luminous flux of all lamps 9500 lm
 Total power 88 W
 Total power per area (17 m²) 5.22 W/m²
 Em 434 lx
 Emin 312 lx
 Emin/Em (Uo) 0.72
 UGR <=19.0



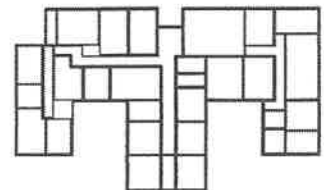
Room 4

2 x Luminaires
 Total luminous flux of all lamps 9500 lm
 Total power 88 W
 Total power per area (12 m²) 7.64 W/m²
 Em 563 lx
 Emin 402 lx
 Emin/Em (Uo) 0.71
 UGR <=17.9



Room 5

3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (19 m²) 7.09 W/m²
 Em 599 lx
 Emin 424 lx
 Emin/Em (Uo) 0.71
 UGR <=19.2



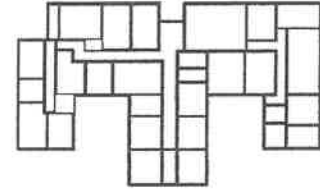


Object : UPINGTON DEPARTMENT OF LABOUR
 Installation : INTERIOR LIGHTING
 Project number : GL - 20210525 - UPINGTON DEPARTMENT OF LABOUR
 Date : 25.05.2021

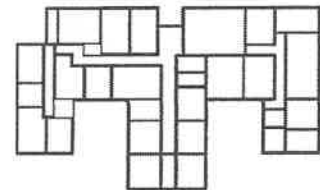
Summary, Floor 1

.3 Floor overview

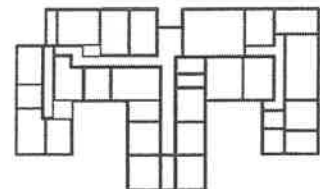
Room 6 3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (21 m²) 6.19 W/m²
 Em 529 lx
 Emin 257 lx
 Emin/Em (Uo) 0.49
 UGR <=19.6



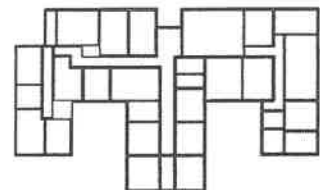
Room 7 4 x Luminaires
 Total luminous flux of all lamps 19000 lm
 Total power 176 W
 Total power per area (28 m²) 6.20 W/m²
 Em 598 lx
 Emin 421 lx
 Emin/Em (Uo) 0.70
 UGR <=20.2



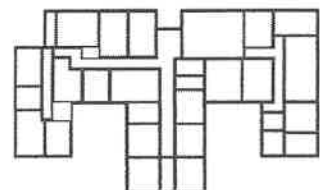
Room 8 3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (24 m²) 5.40 W/m²
 Em 496 lx
 Emin 338 lx
 Emin/Em (Uo) 0.68
 UGR <=19.7



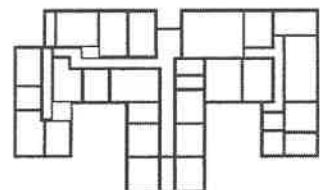
Room 9 3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (24 m²) 5.55 W/m²
 Em 505 lx
 Emin 346 lx
 Emin/Em (Uo) 0.69
 UGR <=19.7



Room 10 2 x Luminaires
 Total luminous flux of all lamps 9500 lm
 Total power 88 W
 Total power per area (16 m²) 5.34 W/m²
 Em 445 lx
 Emin 315 lx
 Emin/Em (Uo) 0.71
 UGR <=18.8



Room 11 4 x Luminaires
 Total luminous flux of all lamps 19000 lm
 Total power 176 W
 Total power per area (31 m²) 5.66 W/m²
 Em 555 lx
 Emin 393 lx
 Emin/Em (Uo) 0.71
 UGR <=20.1



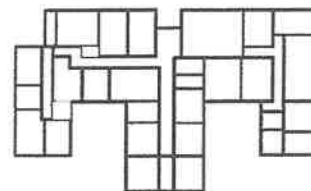


Object : UPINGTON DEPARTMENT OF LABOUR
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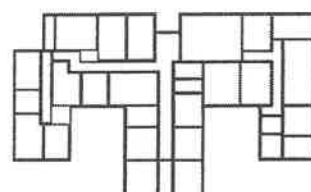
Summary, Floor 1

.3 Floor overview

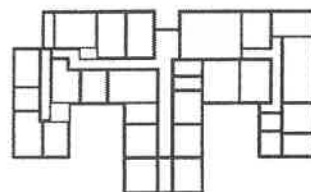
Room 12 2 x Luminaires
 Total luminous flux of all lamps 9500 lm
 Total power 88 W
 Total power per area (13 m²) 6.68 W/m²
 Em 521 lx
 Emin 398 lx
 Emin/Em (Uo) 0.76
 UGR <=18.7



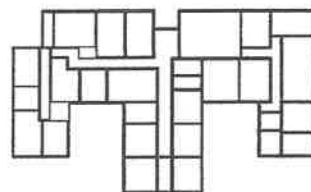
Room 13 3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (20 m²) 6.50 W/m²
 Em 582 lx
 Emin 369 lx
 Emin/Em (Uo) 0.63
 UGR <=19.3



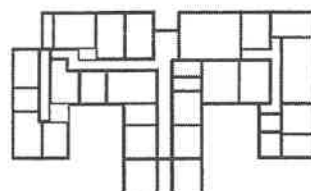
Room 14 6 x Luminaires
 Total luminous flux of all lamps 28500 lm
 Total power 264 W
 Total power per area (56 m²) 4.74 W/m²
 Em 552 lx
 Emin 388 lx
 Emin/Em (Uo) 0.70
 UGR <=21.2



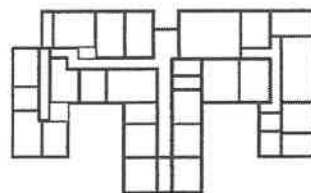
Room 15 4 x Luminaires
 Total luminous flux of all lamps 19000 lm
 Total power 176 W
 Total power per area (22 m²) 8.02 W/m²
 Em 425 lx
 Emin 204 lx
 Emin/Em (Uo) 0.48
 UGR ---



Room 16 4 x Luminaires
 Total luminous flux of all lamps 19000 lm
 Total power 176 W
 Total power per area (30 m²) 5.85 W/m²
 Em 572 lx
 Emin 402 lx
 Emin/Em (Uo) 0.70
 UGR <=20.3



Room 17 3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (25 m²) 5.31 W/m²
 Em 499 lx
 Emin 320 lx
 Emin/Em (Uo) 0.64
 UGR <=19.5

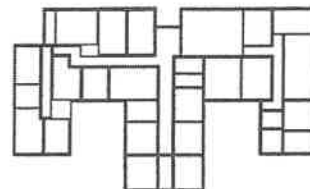


Object : UPINGTON DEPARTMENT OF LABOUR
 Installation : INTERIOR LIGHTING
 Project number : GL - 20210525 - UPINGTON DEPARTMENT OF LABOUR
 Date : 25.05.2021

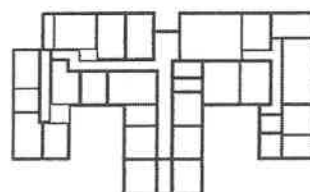
Summary, Floor 1

.3 Floor overview

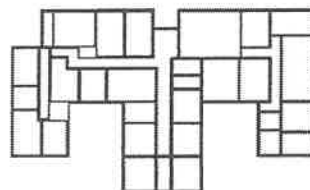
Room 18 3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (20 m²) 6.57 W/m²
 Em 578 lx
 Emin 399 lx
 Emin/Em (Uo) 0.69
 UGR <=19.1



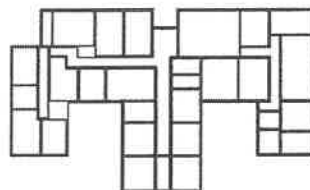
Room 19 3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (20 m²) 6.50 W/m²
 Em 556 lx
 Emin 395 lx
 Emin/Em (Uo) 0.71
 UGR <=19.6



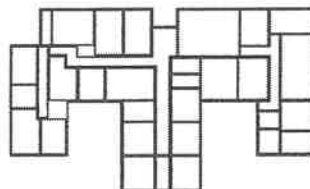
Room 20 6 x Luminaires
 Total luminous flux of all lamps 28500 lm
 Total power 264 W
 Total power per area (41 m²) 6.43 W/m²
 Em 645 lx
 Emin 419 lx
 Emin/Em (Uo) 0.65
 UGR <=20.8



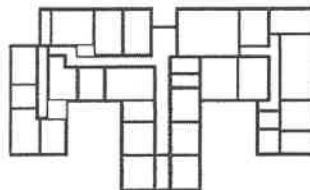
Room 21 3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (18 m²) 7.21 W/m²
 Em 619 lx
 Emin 415 lx
 Emin/Em (Uo) 0.67
 UGR <=18.7



Room 22 2 x Luminaires
 Total luminous flux of all lamps 9500 lm
 Total power 88 W
 Total power per area (14 m²) 6.48 W/m²
 Em 507 lx
 Emin 383 lx
 Emin/Em (Uo) 0.76
 UGR <=18.7



Room 23 1 x Luminaires
 Total luminous flux of all lamps 4750 lm
 Total power 44 W
 Total power per area (7 m²) 6.46 W/m²
 Em 393 lx
 Emin 294 lx
 Emin/Em (Uo) 0.75
 UGR <=17.5



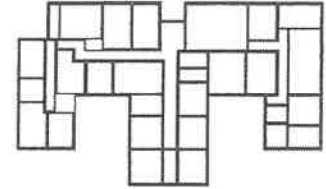


Object : UPINGTON DEPARTMENT OF LABOUR
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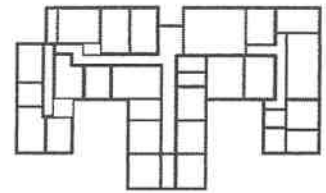
Summary, Floor 1

.3 Floor overview

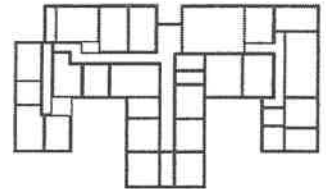
Room 24 1 x Luminaires
 Total luminous flux of all lamps 4750 lm
 Total power 44 W
 Total power per area (9 m²) 5.16 W/m²
 Em 335 lx
 Emin 228 lx
 Emin/Em (Uo) 0.68
 UGR <=18.3



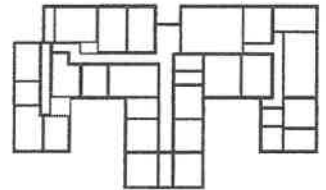
Room 25 1 x Luminaires
 Total luminous flux of all lamps 4750 lm
 Total power 44 W
 Total power per area (7 m²) 6.38 W/m²
 Em 361 lx
 Emin 231 lx
 Emin/Em (Uo) 0.64
 UGR <=18.3



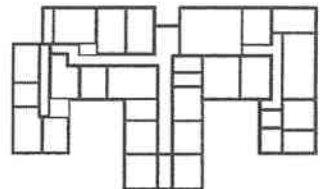
Room 26 3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (18 m²) 7.15 W/m²
 Em 615 lx
 Emin 417 lx
 Emin/Em (Uo) 0.68
 UGR <=18.9



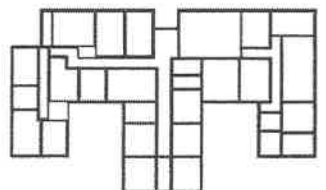
Room 27 3 x Luminaires
 Total luminous flux of all lamps 14250 lm
 Total power 132 W
 Total power per area (18 m²) 7.35 W/m²
 Em 625 lx
 Emin 424 lx
 Emin/Em (Uo) 0.68
 UGR <=18.8



Room 28 6 x Luminaires
 Total luminous flux of all lamps 28500 lm
 Total power 264 W
 Total power per area (62 m²) 4.25 W/m²
 Em 301 lx
 Emin 50 lx
 Emin/Em (Uo) 0.16
 UGR ---



Room 29 2 x Luminaires
 Total luminous flux of all lamps 9500 lm
 Total power 88 W
 Total power per area (13 m²) 6.70 W/m²
 Em 354 lx
 Emin 176 lx
 Emin/Em (Uo) 0.50
 UGR <=20.4



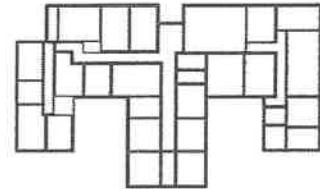


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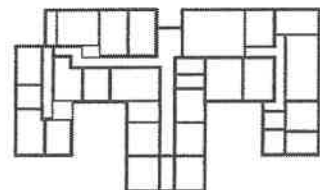
Summary, Floor 1

.3 Floor overview

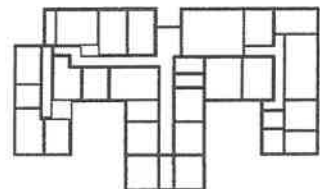
Room 30 1 x Luminaires
 Total luminous flux of all lamps 4750 lm
 Total power 44 W
 Total power per area (9 m²) 4.89 W/m²
 Em 310 lx
 Emin 176 lx
 Emin/Em (Uo) 0.57
 UGR <=19.0



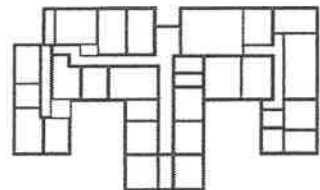
Room 31 4 x Luminaires
 Total luminous flux of all lamps 7435 lm
 Total power 73.4 W
 Total power per area (10 m²) 7.57 W/m²
 Em 211 lx
 Emin 48 lx
 Emin/Em (Uo) 0.23
 UGR ---



Room 32 4 x Luminaires
 Total luminous flux of all lamps 7435 lm
 Total power 73.4 W
 Total power per area (21 m²) 3.48 W/m²
 Em 153 lx
 Emin 0.0 lx
 Emin/Em (Uo) ---
 UGR ---



Room 33 8 x Luminaires
 Total luminous flux of all lamps 11015 lm
 Total power 112.6 W
 Total power per area (19 m²) 6.00 W/m²
 Em 170 lx
 Emin 68 lx
 Emin/Em (Uo) 0.40
 UGR ---



Room 34 1 x Luminaires
 Total luminous flux of all lamps 4750 lm
 Total power 44 W
 Total power per area (7 m²) 6.34 W/m²
 Em 329 lx
 Emin 171 lx
 Emin/Em (Uo) 0.52
 UGR <=19.0

