



# **GAUTENG PROVINCE**

## **Standard Quality Specification for General Electrical Installations (Schools)**

**MARCH 2013**

GP\_E6\_1\_Standard Quality Specification for General Electrical Installations (Schools)x -1.2-  
Edition – March 2013

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ANNEXURE AC: PERFORMANCE REQUIREMENTS FOR AIR CONDITIONING UNITS

**1.1 ELECTRICAL MATERIALS AND EQUIPMENT**

All material and equipment and component parts thereof are to be in accordance with the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1 and must have the approval of the Employer's Agent.

All material and equipment must be suitable for the power supply system at this site, which is 230/400V 50Hz three phase four wire.

**1.2 CONDUIT AND CONDUIT ACCESSORIES**

The indoor installation may be in black enamelled conduit or PVC conduit. All conduits shall be concealed in the building work where possible. Black enamelled conduit shall be screwed or plain end.

Should for some reason it not be possible to conceal conduit in the building work requiring the conduit to be surface mounted, only steel conduit may be used, secured neatly in vertical and horizontal positions by means of galvanised steel spacer saddles.

Steel conduit exposed to damp or weather conditions shall be galvanised to SANS 121.

Galvanised draw wires must be provided in all conduits provided for other services.

All steel conduit joints in concrete slabs and all running joints must be painted.

No chasing by hammer and chisel will be accepted. Slots for conduits must be cut by using power cutting disk tools where necessary.

Bushes on metal conduit shall be of brass only.

All outlet box cover plates must be metal and steel outlet boxes must be hot-dipped galvanized to SANS 121.

Where cavity walls or face brick walls are encountered deep back-to-back (one end closed) wall boxes must be used.

Blank cover plates on round outlet boxes must be fixed with flat head brass screws and a gasket to seal the box. Blank cover plates on 100 x 100 mm outlet boxes must be fixed with two countersunk chrome screws.

Where outlet boxes or draw boxes are mounted on finished surfaces the electrical contractor shall take care that such outlets are mounted symmetrically. It will not be sufficient to scale the position of any outlet off the drawings. No extra payment will be allowed where the outlets are not mounted symmetrically and have to be changed.

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 Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1.

All PVC conduits shall be installed as per Appendix C of SANS 950 as well as SANS 10142-1.

Non-metallic conduit or conduit boxes shall not support luminaries and other fittings. These fittings shall be secured to the surrounding structure in a way that is acceptable to the Employer's Agent.

Surface mounted conduit shall be supported and fixed with saddles with a maximum spacing of 1,5 m, even in roof spaces. (Refer to SANS 10142-1). The contractor shall supply and install all additional supporting timbers required.

It shall be possible to rewire the completed installation in the future without undue difficulty.

Non-metallic conduit and fittings shall not be used under the following conditions:

- (a) Outside a building (unless protected, or sheltered under eaves).
- (b) For mechanical load bearing.
- (c) Where it may be subjected to temperatures below -10°C or above 70°C for prolonged periods.
- (d) As primary electrical insulation.
- (e) In areas where it may be subject to mechanical damage.
- (f) For applications other than those for which it is designed.

**Painting of Conduits**

Exposed conduit may be painted with normal oil or PVA paints, but care must be taken to ensure that the paint used does not contain any component that will soften or have any other detrimental effect on the materials from which the conduit and fittings are manufactured.

**Connecting of Conduit to Metal Equipment/Components**

When any part of a non-metallic conduit system has to be connected to metal equipment or components (e.g. switchboard, surface socket-outlet or switch box, existing metallic conduit system, etc.) fittings and couplings manufactured specifically for this purpose must be used. Non-metallic conduit must not be threaded to fit metallic connectors.

**Bends**

The technique applied in bending conduit shall result in a smoothly bent conduit without conduit surface ripple, cracking or flattening of the conduit. Suitable bending tools shall be applied to achieve this where manual methods are inadequate. Bends shall comply with SANS 10142-1. Conduits shall be secured immediately following bending.

**Adhesive Joints**

All adhesive joints must be made in a clean dry area. The surfaces of all components to be bonded must be dry and clean. The technique applied in jointing conduit shall ensure that a mechanically sound and watertight joint with an insertion depth equal to half the length of the coupling is achieved, and that no excess jointing adhesive is squeezed into the conduit or accessory.

**NOTE:** Solvent adhesives containing highly volatile liquids and their containers should not be left open.

**Cutting of Conduit**

A fine-tooth hacksaw shall be used to cut conduit to the required length. Each cut end shall be square and free from swarf, burrs and loose material. When determining the length of conduit to be cut, allowance must be made for the length of couplings or accessories attached to the conduit. Incorrect determination will cause bulging of the conduit or insufficient joint length.

**1.3 CONDUIT IN ROOF SPACES**

In roof spaces, the conduit shall be installed in such a manner as to allow for all wiring to be executed from below the ceilings.

Conduit shall be secured at intervals not exceeding 1,5 m by means of saddles fixed to the roof timbers by means of screws or acceptable clout nails.

In the case of repairs and renovations, conduit runs from a distribution board shall, where possible, terminate in fabricated sheet steel draw boxes installed directly above or in close proximity to the boards.

**1.4 WIRING**

Except where otherwise specified in the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1 or indicated on the drawings, 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 must be clear of moisture and debris before wiring them.

Wiring of the installation shall be carried out in accordance with the latest edition of the Wiring Code (SANS 10142). It is a specific requirement of this contract that earth conductors be provided and drawn into the conduit with the main conductors to all points, including all lighting points throughout the installation, irrespective of the type of conduit used.

Wiring for lighting circuits is to be carried out with 2.5 mm<sup>2</sup> conductor and a 2,5 mm<sup>2</sup> earth conductor. For socket outlet circuits the wiring shall comprise 4.0 mm<sup>2</sup> and a 2,5 mm<sup>2</sup> earth conductor. In certain instances, as directed in the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1 or shown on the drawings, the sizes of the aforementioned conductors may have to be changed for specified circuits.

Sizes of conductors to be drawn into conduits 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 in accordance with the Wiring Code.

The stipulations concerning the installation of earth conductors to a certain maximum length for a given size of conductor as set out in the "Wiring Code" are to be strictly applied.

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 300/500V grade cable to SANS 1507.

Where cable ends connect to switches, fittings, 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.

Insulated heat-resistant wiring shall be used to connect totally enclosed luminaires and other fittings where excessive temperatures are likely to occur.

## **1.5 SWITCHES AND SOCKET OUTLETS**

All switches and switch socket outlet combination units shall be of the same manufacture and pattern throughout the installation, and shall comply with the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1 and must be approved by the Employer's Agent.

No other than 16A 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 with the centre line at 1,4 m above finished floor level and all socket outlets with the centre line at 300mm above finished floor level or, where applicable, between a worktop and window sill in such manner that it is either totally within or totally above any tiled area, unless a specific mounting height is indicated on the drawings or specified in the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1

Screws longer than 30mm to affix light switch or switch socket cradles the draw box are not accepted.

## **1.6 SWITCHGEAR**

Switchgear, which includes circuit breakers, metal-clad switches, interlocked switch-plug units, contactors, time switches, etc., is to comply with the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1.

## **1.7 DISTRIBUTION BOARDS**

### **General**

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's Agent 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.

Two spare 25mm dia. and three spare 20mm dia conduits must be supplied from all distribution boards to roof spaces.

Any single line schematic diagram and special construction details issued as part of the contract documentation shall be closely followed in the design of the distribution boards.

Three sets of factory drawings on all distribution boards must be submitted for approval before manufacture of the distribution boards commence.

The Employer's Agent must be notified at least two weeks in advance of the completion of the distribution boards in order that an inspection may be carried out before delivery.

### **Construction**

All distribution boards shall be manufactured and installed to comply with the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1.

Apparatus and requirements by the Supply Authority are not indicated on the distribution board diagrams and schedules. It is expected of the Electrical Contractor to install all such apparatus, accessories and systems as may be required by the Supply Authority, as part of the contract price.

Busbar stubs must be provided where more than one conductor terminates on equipment.

One sample board selected from one of the boards to be supplied under the contract shall be manufactured and presented to the Employer's Agent for approval. Any defects pointed out by the Employer's Agent shall be rectified, whereupon the board shall again be presented for approval.

**Installation**

All distribution boards shall be supplied and installed in the positions shown on the drawings.

All distribution boards must be flush mounted unless otherwise indicated, and are to be installed with the top of the board 2,0 m above the finished floor level.

The distribution boards must be placed in such a way that it can be built into the walls where applicable. Special provision must be made that the distribution board tray is not damaged or distorted while being built in.

Where boards have to be installed in walls of single brick width an expanded mesh shall be affixed to the rear of the board tray to provide support to plaster. All distribution boards must be installed level.

Where a sleeve to provide cable entry into a flush board is required, the distribution board tray shall be set back into the wall to permit the sleeve to terminate below the tray for its full diameter. Face brick facets shall in such instances be used to conceal the sleeve. Slots in the wall with a cover plate will not be permitted unless specifically approved by the Employer's Agent.

Earth conductors must be fastened with screws and/or lugs to earth bars.

Cables must be mounted with compression glands to the distribution board tray. Earth rings and glands must be used to earth cable armouring inside distribution boards

**Labelling**

Circuit breakers that do not feed any load must be marked "SPARE" on the distribution boards.

Labels indicating the source of supply and size of the supply cable must be provided on each distribution board.

Where switchboards are positioned behind doors of the building structure i.e. built-in cupboards, a suitable approved electrical danger sign as well as the applicable distribution board designation label must be supplied and fitted in a suitable position on the outside top section of one of the entrance doors at each such location.

**1.8 EARTHING OF INSTALLATION**

The type of main earth provided must be as required by the Supply Authority, in addition to any requirements indicated by the Employer's Agent, who may require additional earthing to achieve desired results.

Installations shall be effectively earthed in accordance with the Wiring Code. Additional earth rods or trench earths may be required as specified or directed by the Employer's Agent.

All hot and cold water and waste pipes are to be effectively bonded by means of 12,5 mm x 1,6 mm solid or perforated copper tape (not wire), clamped by means of brass bolts and nuts. The tape is to be fixed to walls by means of rounded brass screws at intervals not exceeding 150 mm.

Provision must be made for conduit to be installed in the wall for all earthing requirements. Main earth copper tapes / wires must be installed in these conduits. Where provision was not made as stipulated above, 20 mm diameter galvanised steel conduit must be installed from below ground level to 3 m above ground level. This conduit must be securely fixed to the walls. Corrugated iron roofs and guttering must be effectively earthed with copper tape and brass bolts with nuts at intervals not exceeding 2m. Self-tapping screws are not acceptable as a means of securing earth conductors.

Connection from the main earth bar on the main board must be made at the cold water main, the incoming service earth conductor, if any, and the local earth electrode by means of 12,5 mm x 1,60 mm solid or perforated copper tape or 16 mm<sup>2</sup> stranded (not solid) bare copper wire or such conductor as the Employer's Agent may direct.

**1.9 LIGHTNING PROTECTION**

The buildings shall be protected against lightning by way of 40mm x 4mm aluminium strip secured to the roof tiles along the ridges. Fixing shall be done in such manner that no tile is penetrated or cracked, using M7 concrete anchors at every second tile edge. The aluminium strip shall be installed perfectly straight without weaving or twisting.

At the roof edges the strip shall be bonded to a down conductor consisting of 10mm<sup>2</sup> bare copper earth wire contained in a 20dia PVC conduit, running from a point close to the roof edge to the earth pegs below.

A 100 x 100mm draw box with cover shall be provided 300mm above floor level and another above ceiling level to facilitate installation. Bonding shall be by means of M8 stainless steel bolts washers and nuts.

#### **1.10 LOCATION OF EXTERIOR WALL-MOUNTING EQUIPMENT**

Exterior wall mounted equipment is to be located symmetrically with respect to the surrounding building features.

Daylight switches are to be mounted in locations where it will not sense the light output of a luminaire controlled by it, causing it to cycle. These items shall be mounted with the upper edge in line with the top of adjoining windows.

Wall mounted luminaires at walkways shall be mounted with the upper edge of the luminaire in line with the top of adjacent windows, and symmetrically between windows or between a window and a doorframe.

Type E luminaires shall be mounted with the slanting faces pointing upwards and downwards for maximum light utilisation.

Luminaires on external walls of multi storey buildings must be vertically in line.

The mounting height of type D luminaires shall be as shown on the drawings or if not shown, as indicated by the Employer's Agent on site.

Sirens shall be mounted with the bottom of the impeller in line with the lower edge of the roof overhang and with the impeller facing downwards to guard against dirt and foreign objects obstructing it. The local isolator shall be mounted above it in a weatherproof plastic enclosure with sliding lid.

#### **1.11 BALANCING OF LOAD**

The electrical contractor is required to balance the load as equally as possible over the multi-phase supply.

#### **1.12 CABLES**

##### **General**

The electrical contractor is to supply and install all the low voltage cables specified in this document along the routes shown on the drawings and according to the sizes shown on the single line diagrams and/or as specified.

The cables must comply with the requirements in the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1. Bare hard drawn copper earth continuity conductors are to run with all four core underground cables constituting part of the low voltage distribution system. The earth conductors must be bound to the cables at intervals not exceeding 1 meter with cable ties.

For clean earth connections to computer equipment a green PVC insulated single core cable shall be used, which shall be bonded to the main board earth bar and to the clean earth bar of the computer distribution board, and to no other earthed material.

Conductor insulation which is colour coded by a line only, will not be accepted. The total insulation must have the phase colour.

##### **Installation**

##### a) Testing

All low voltage cables must be tested on site, in the presence of the Employer's Agent. All test results must be submitted to the Employer's Agent.

On each completed section of the laid cable, the insulation resistance shall be tested to approval with an approved Megger type instrument of not less than 1000 V for low voltage cables.

##### b) Depth of Trenches

All low voltage cables must be installed 600mm to the top of the cable, below ground level.

##### c) Marking Tape

Yellow PVC marking tape, 150 mm wide must be supplied and installed 300mm below the final surface and directly above all cables. The wording "Electric Cable" must be on the marking tape.



#### d) Cable Lengths

Tenderers must base their tender price on the preliminary lengths specified in the Bill of Quantities. After installation the exact lengths shall be determined on site. Adjustments to the contract price shall then be calculated using the rates in the Bill of Quantities.

Cables are **not to be ordered** according to lengths measured in the Bill of Quantities. It shall be the responsibility of the electrical contractor to establish the correct lengths of cable required on site including lengths required for termination of cables, before placing an order. The electrical contractor shall not be reimbursed for any surplus cable.

#### **Cable Trenches**

Tenderers must base their rates for cable trenches in soil, soft rock and hard rock on the quantities given in the Bill of Quantities. The actual quantities shall be determined on site. Adjustments to the Contract Price shall be calculated using the rates in the Bills of Quantities, after completion of the installation.

The different classes of materials for excavation are defined as follows:

- SOIL:** Shall mean hand-pickable soil and includes loose gravel, clay, backfilled soil, loose or soft shale, loose laterite and rocks less than 75 mm dia.
- SOFT ROCK:** Shall mean rock that is hand-pickable including hard shale, dense laterite and rocks exceeding 75 mm in dia to 0,03 cubic metres volume.
- HARD ROCK:** Shall mean granite, quartz sandstone, slate and stone of similar hardness as well as rocks exceeding 0,03 cubic metre volume.

No guarantee can be given that explosives will not be necessary for excavations. However, should explosives be necessary and the contractor receive permission to use explosives, the electrical contractor shall remain responsible for all work done with the explosives and shall comply with all conditions, regulations, requirements etc. imposed by the governing bodies.

Should excavations be done in close proximity of existing services extreme care must be exercised. Only labourers with experience of these conditions may be utilised.

The bottom and sides of trenches must be of smooth contour, and shall have no sharp dips or rises that may cause tensile forces in the cable during backfilling.

Backfilling of trenches may commence only after the trenches have been approved and shall be compacted in layers of 150 mm. Sufficient allowance must be made for final settlement. For the first layer of 150 mm, soil sifted to remove all hard objects of 15mm mesh or larger and of which 75 mm must be below and 75 mm must be above the cable must be used. Where no suitable soil is available on site, the contractor shall import fill from elsewhere and make all the necessary arrangements to do so. The cost of soil importation must be included in the appropriate rate for excavations.

The electrical contractor shall be responsible to take the necessary precautions where excavations may be dangerous. Refer to the Occupational Health & Safety Act (Act 85 of 1993), Reg. 11 of the Construction Regulations. The electrical contractor must ensure that all buildings, sewer, etc., are protected against collapsing soil conditions.

The cable trenches shall be excavated to width of 300mm 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.

Payment will be made on the tendered rates based the specified dimensions or the actual dimensions whichever is the lesser. The only exception shall be in cases of additional excavations caused by obstructions such as water pipes, drains, large rocks, etc., in which case the magnitude of the additional excavation must be agreed upon on site by the Employer's Agent.

#### **Joints**

Joints in cable runs shall not be allowed unless specified or authorised in writing by the Employer's Agent. Where cable joints are to be made, a joint hole must be excavated of sufficient size to enable the cable jointer to work efficiently and unimpeded.

Each cable end must be left in a loop of 0,9 m to prevent any tension on the joint.

During backfilling the section supporting the joint must be compacted to the extent that no movement will take place after the trenches have been backfilled.

All joints in LV underground cables and terminations shall be made by means of approved epoxy-resin pressure type jointing kits such as Scotchcast. Epoxy resin joints must be made entirely in accordance with the manufacturer's instructions and with materials stipulated in such instructions. Low voltage PVC cables are to be made off with sealing glands and materials designed for this purpose that must be of an approved make.

Where cables are cut and not immediately made off, the ends are to be sealed without delay.

### **Cable laying**

Cables must be removed from the drums in such a manner that the cable is not subjected to mechanical damage, twisting or tension exceeding that stipulated by the cable manufacturer.

The laying of cables shall not commence until the trenches have been inspected and approved. The cables 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 the approval of the Employer's Agent after drawing in of the cables.

### **Sleeves**

All sleeves indicated on the drawings are to be supplied and installed by the electrical contractor.

Electrical cable sleeves and communication sleeves must be installed at least 600mm apart. All crossings of these sleeves must be at 90° with the communication sleeves on top.

Before backfilling, the ends of all sleeves must be sealed with paper and a weak cement mixture.

### **Cable Markers**

Cable markers must be provided on all cable runs at 50 m intervals on straight runs and at all bends. The position of cable markers must be confirmed on site.

Cable markers must consist of 150mm x 150mm x 300mm high concrete blocks with aluminium or other corrosion proof metal plates marked with arrows to indicate the route.

The cable markers must protrude 25mm above ground level.

One cable marker must be placed at the site boundary where the telephone sleeve enters the site.

## **1.13 STOVES**

Supply, install and commission stoves. The stoves must comply with the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1.

Stoves may only be placed in position after the floor finish is complete and the back wall is tiled.

The electrical connection shall be executed via a round steel conduit extension ring with cover mounted over a round steel flush box located behind the stove at 600mm above the floor. The connection shall consist of a SWA PVC cable connected at both sides using metal glands. The length of the cable shall be such that the stove may be moved away by 500mm for cleaning or servicing/repair.

Flexible conduit **is not acceptable** for stove connections.

## **1.14 INTERCOMMUNICATION INSTALLATION**

Pad lockable flush mounted terminal boxes with an internal size of 400mm high x 300mm wide and 100mm deep with an architrave frame and door must be used for the intercommunication installation. A soft wood backing must be provided in these boxes. A 32mm conduit must be installed between the Main Intercom board and DB-A. A 25mm conduit must be provided between the main intercom board and the main interval sounder board.

Refer to the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1 for general requirements re distribution boards.

100 x 100mm outlet boxes with blank cover plates incorporating a 10mm cord grip hole with grommet must be installed flush in the wall 300mm below the ceiling where outlets are indicated.

25mm dia. steel or PVC conduit is to be used to interconnect intercom outlets.

Draw wires of 1,2mm dia galvanised steel must be installed.

All terminal boxes must be labelled "Intercom" and must be mounted 1800 mm above floor level unless otherwise indicated on the drawings.

32 mm dia PVC sleeves must link terminal boxes on different blocks.

#### 1.15 TELEPHONE INSTALLATION

Lockable, flush mounted terminal boxes with an architrave frame and door must be installed in locations shown on the drawings for the telephone installation. A soft wood backing must be provided in this box.

Refer to the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1 for general requirements re distribution boards.

These terminal boxes shall be identical in size and appearance to the intercom terminal boxes.

Unless specifically otherwise indicated, telephone outlet boxes must be 100 x 100 x 50 mm with blank covers incorporating a slot for accommodation of a standard RJ 11 telephone jack and mounted with the centre line 300mm above floor level.

25mm dia. steel or PVC conduit is to be used to interconnect telephone outlets.

Draw wires of 1,2mm dia galvanised steel must be installed.

All terminal boxes must be labelled "Telephone" and must be mounted 1800 mm above floor level unless otherwise indicated on the drawings.

#### 1.16 INTERVAL SOUNDERS AND PUSH BUTTONS

The interval sounders shall comply with the requirements stipulated in the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1.

Interval sounders are to be controlled by a spring-loaded bell switch rated at 16A 250V AC contained in a 100x50 flush box located at 1,4 m above the floor close to the sounder Distribution Board, which all forms part of this contract.

A two (2) pole 20A isolator must be mounted in a suitable weatherproof box with sliding lid above each sounder. A label with the wording "Danger: Supply from Admin DB-A" must be mounted at each interval sounder isolator.

Connection to the sounder from the isolator shall consist of a 1,0mm<sup>2</sup> 3 core cabtyre cord and compression glands.

Power supply to sounder isolators shall be underground 2,5mm<sup>2</sup> 3 core PVC SWA cable between blocks and 2 x 2,5mm<sup>2</sup> conductors with 2,5mm<sup>2</sup> earth wire within a block.

Cables to sounder isolators shall terminate in a 100x100x50 flush box with blank cover on the interior wall (below the ceiling) behind the isolator location, linking to the isolator with 20mm conduit, so as to obtain a weatherproof connection to the isolator box.

At each sounder location a 32mm conduit shall be installed from the interior draw box to a point 600mm below ground level and clearing the apron around the building.

Pad lockable flush mounted terminal boxes with an internal size of 400mm high x 300mm wide and with an architrave frame and door must be provided as Main Interval Sounder Board. This box must comply with distribution board requirements – see the Standard Quality Specification for Electrical Material and Equipment (Schools) GP/E6/2 Rev 1 for general requirements re distribution boards.

The box must be labelled "Interval Sounder Board" and must be mounted as specified for distribution boards, and must be linked with the internal intercom terminal box by a 25mm dia conduit. A 20mm conduit must be installed between this sounder distribution board and DB-A.

#### 1.17 LUMINAIRES

Supply and install the luminaires schematically indicated on the design drawings. The luminaires must comply with the requirements in the Standard Quality Specification for General Electrical Installations (Schools) GP/E6/2 Rev 1 and the particulars listed hereafter. The required luminaire types are shown on the drawings.

**The Employer's Agent must approve samples of all luminaires prior to any order being placed.**

All luminaires must be complete with lamps and control gear where applicable. In caretaker's residences (where applicable) B.C. lamp holders must be used. Lamp holders for GLS lamps must be porcelain or heavy-duty brass.

- Type A:** 1.5 metre, 2 Lamp fluorescent luminaire complete with 58 Watt lamps as per the Standard Quality Specification for General Electrical Installations (Schools) GP/E6/2 Rev 1
- Type B:** 1.5 metre, 1 Lamp fluorescent luminaire complete with 58 Watt lamp as per the Standard Quality Specification for General Electrical Installations (Schools) GP/E6/2 Rev 1
- Type L:** 1,5 metre, 2 Lamp fluorescent luminaire complete with 58 Watt lamps and low brightness louvers; equipped separately for single lamp control as per the Standard Quality Specification for General Electrical Installations (Schools) GP/E6/2 Rev 1
- Type C:** Round Bulkhead luminaire with unbreakable polycarbonate diffuser complete with 2 x PL-9W lamps as per Standard Quality Specification for General Electrical Installations (Schools) GP/E6/2 Rev 1
- Type M:** Same as Type C but with **red diffuser**.
- Type D:** Functional floodlight with polycarbonate diffuser complete with 125 Watt High Pressure Mercury Vapour lamp as per Standard Quality Specification for General Electrical Installations (Schools) GP/E6/2 Rev 1
- Type E:** Rectangular wall luminaire with high impact acrylic diffuser held in position by a diffuser frame complete with 2 x PL-26W lamps as per Standard Quality Specification for General Electrical Installations (Schools) GP/E6/2 Rev 1
- Type S:** Post top type luminaire with 100Watt High Pressure sodium lamp mounted on a steel pole at 3,0m mounting height on as per the Standard Quality Specification for General Electrical Installations (Schools) GP/E6/2 Rev 1

### 1.18 MOUNTING AND POSITIONING OF LIGHT FITTINGS

The electrical contractor must 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 light fittings are symmetrically positioned with regard to the ceiling pattern.

The layout of the fittings as indicated on the drawings must be adhered to as far as possible, but the exact positions must be confirmed with the Employer's Agent.

Fluorescent fittings 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 fittings apart.

Fluorescent fittings to be mounted on board ceilings shall be secured by means of two 40 mm x No. 10 round head screws and washers and in turn secured to the ceiling brading. The fittings 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. The use of Butterfly clips to secure the light fittings will not be acceptable.

Incandescent fittings are to be screwed directly to outlet boxes in concrete slabs. Against board ceilings, the fittings shall be secured to the brading or joints by means of two 40 mm x No. 8 round head screws and also to the outlet boxes.

### 1.19 DAYLIGHT SWITCHES

The exterior area and walkway lighting must be switched by the photocell daylight switches, either directly or via a contactor in the relevant distribution board where a contactor is called for in the single line diagrams.

3 x 2,5 mm<sup>2</sup> PVC conductors in conduit must link the daylight switch with the relevant distribution board.

The daylight switch must comply with the following: -

- i) Daylight switches of 25A 220-240V rating shall be provided.
- ii) The ON/OFF switching points must be adjustable from 5 to 100 lux.
- iii) It must be weatherproof and must have a built in time delay of approximately 40 seconds.
- iii) Built-in protection against voltage surges must be provided.
- iv) The daylight switch must be mounted in an empty bulkhead type luminaire with IP65 moisture ingress rating and with a clear high impact acrylic diffuser and a LM6 die cast aluminium base with epoxy powder finish. The daylight switch shall be mounted in such manner that the lux switching level adjustment screw can be easily reached for adjustment after installation.
- v) A sample of the proposed daylight switch and light fitting must be submitted to the Employer's Agent for approval.

## **1.20 MANHOLES**

The building contractor will construct all manholes. The electrical contractor shall however co-ordinate the exact location and orientation of all manholes with the building contractor.

## **1.21 SITE RETICULATION**

Refer to the site layout drawings and the single line diagrams for particulars re routes and types/sizes of cables to be installed.

## **1.22 LOW VOLTAGE DISTRIBUTION KIOSKS**

Sheet steel canopies as specified in Electrical Material and Equipment (Schools) GP/E6/2 Rev 1 must be provided for all kiosks, which are to be mounted on suitable concrete plinths.

## **1.23 TESTING AND INSPECTION**

The electrical contractor shall test the entire installation in terms of Regulation 7 of the Electrical Installation Regulations 1992 of the Occupational Health & Safety Act (Act 85 of 1993) and shall issue a Certificate of Compliance on the official form, Annexure 1, obtainable from the Electrical Contracting Board of South Africa. All tests shall be carried out in conjunction with and to the satisfaction of the Supply Authority. The electrical contractor shall make all arrangements for testing and inspection, the costs thereof being included in the Tender Price.

All 230 V socket outlets shall be tested for polarity and the sensitivity of the earth leakage protection equipment shall be tested by means of an approved instrument.

Each length of cable shall be tested for insulation and polarity by means of a 1000 volt Megger designed for that purpose. In the case of underground cables this shall be done before backfilling. In addition, the earth-loop impedance of each main and sub-main feed shall be measured. The earth resistance at each down conductor earth electrode shall be measured. The earth resistance shall be tested by means of an approved instrument.

If there is no power on the day of the test, the electrical contractor shall supply a 3kW, 230 V generating plant for testing purposes.

"DANGER" notices shall be displayed at remote ends of cables under test.

The Employer's Agent reserves the right to witness all tests. The electrical contractor shall advise the Employer's Agent in writing of all results and furnish copies of all certificates.

Load balancing shall be undertaken by the electrical contractor to the satisfaction of the Employer's Agent. Where conductors are altered to achieve satisfactory results they shall be re-laced by the electrical contractor.

The electrical contractor shall provide all the necessary instruments for the proper testing of the complete installation. If there is reason to doubt the accuracy of such instruments, the electrical contractor shall take the necessary action to prove their accuracy.

The electrical contractor shall ensure that the installation is completed in every respect and that there are no major defects prior to notifying the Employer's Agent (in writing) for a first delivery inspection.

The Employer's Agent will accept no defects during the final inspection. Should any defects be

encountered at the final inspection then the Employer's Agent will abandon that inspection and request that the electrical contractor arrange an additional final inspection.

#### **1.24 AIR CONDITIONING INSTALLATION**

For the purposes of this contract any installation shall comprise of the supply, installation, commissioning and testing of split type air conditioning units as required.

All air conditioning units and the installation thereof shall comply with the requirements laid down in the Electrical Material and Equipment (Schools) GP/E6/2 Rev 1.

The specific requirements for this project appear in Annexure AC at the end of this Standard Quality Specification for General Electrical Installations (Schools) GP/E6/1 Rev 1.

#### **1.25 PROTECTIVE CAGE**

A protective cage consisting of a 20x20 cold rolled square tubular frame with an expanded metal mesh infill panel welded to the frame, shall be supplied and installed as part of this contract.

The frame shall have mounting flag pieces of 6mm flat steel with holes suitable for fixing the frame with four M8 galvanised concrete anchor bolts.

The cage shall be sized to cover the entire outdoor unit with at least 100mm free space all around the outline of the air conditioning unit.

The front section of the cage shall be a separate frame that is hinged from the lower section of the cage. It shall open fully by hinging through 180°. It shall be secured in position by padlock.

The entire cage shall be corrosion proofed by sandblasting to bare metal, followed by red lead primer and two coats of SABS quality oil gloss enamel applied with at least 4 hours drying time in between. All painting shall be applied by spray painting. The colour of the final finish is to match the colour of the door frames on site unless advised differently. The contractor is to request confirmation of colour before the final coat is applied.

#### **1.26 SLIDING GATE MOTORS AND CONTROL**

Where specified on the drawings, the supply and installation of automation motors on sliding gates complete with drive rack and micro switch cams welded to the sliding gate frame forms part of this contract.

The motor shall be a 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.

The starting thrust shall be at least 270 Newton, and the rated thrust, 90 Newton.

The mains power input to the controller shall be 230V 50Hz.

Electronic anti-crushing sensing shall be incorporated.

The electronic control system shall permit the gate to open only partly (about 1m) to let pedestrians pass, or fully for vehicles, according to the control signal received from the gate intercom system. The control system shall decelerate the gate at the final closing stage to permit a soft slow-closure without slamming.

Obstruction in the path of a closing gate shall be sensed by way of an infrared beam located at roughly 500mm above the road surface and shall stop the closing movement of the gate instantly.

The gate control shall close the gate automatically after a preset programmable time delay.

The rechargeable battery shall be integrated into the drive housing, and shall be of a type requiring no regular servicing but will provide reliable service for 4-5 years minimum. The rechargeable battery shall be of at least 6,5Ah capacity.

The automatic battery charger shall be incorporated into the motor enclosure and shall be designed to charge the battery with a constant voltage/constant current control system that will ensure optimum life of the battery.

The gate movement shall be controllable by hand-held portable remote controllers fitted with long life batteries.

Only products that enjoy product and service support from many sources in Gauteng and have been in service for over 10 years in South Africa will be considered acceptable.

**1.27 INTERCOM SYSTEM****Outdoor Intercom Stations**

Where intercommunications with the entrance gate are called for, the system shall consist of weatherproof aluminium clad outdoor stations for mounting against a wall or gooseneck faceplate, fitted with one call button. The call button shall have provision for labelling behind a transparent cover. The unit shall be robustly constructed with a high resistance to damage by vandalism.

By depressing the relevant call button, a call is to be registered at the relevant indoor station and clear full duplex bi-directional speech shall be established.

It shall be possible to communicate to the same indoor handset from up to three different outdoor stations.

**Indoor Intercom Stations**

The indoor handset shall be wall mounting and shall have two buttons to open the gate only fractionally or fully.

The handset shall automatically establish the speech channel when it is removed from its cradle.

Communication is only required between the outdoor stations and the indoor handset.

**Central Controller**

The central controller shall incorporate a rechargeable battery that will maintain functionality of the intercom and gate control functions for at least six hours in the event of mains failure.

**Intercom Cabling**

Intercom cabling shall be installed along routes shown in the drawings via sleeves and conduits and intermediate draw boxes.

Cables shall be suitable to perform all functions in satisfactory fashion over the distances involved.

**1.28 INTRUSION DETECTION**

The provision of intrusion detection to the computer rooms ready for connection to a radio alarmed Reaction Service forms part of this contract.

The system to be provided shall comply with the applicable sections of the GP/E6/2 of this document.

Intrusion detectors shall be of the dual technology type, using microwave and infrared sensors, which are to trigger together before an alarm is raised.

A keypad with multiple programmable functions shall be provided for every computer room.

The alarm signal to be relayed to the Reaction Unit Control room shall be a combined signal for all protected rooms.

The intrusion detection system components shall be of a type that enjoys excellent product support in South Africa by more than one firm that has been in operation supporting the product for more than 5 years.

## ANNEXURE AC

### Data for Air Conditioning Units in Computer Rooms (24 work stations)

System Type	Split Type Air Conditioning unit Multi-split not permitted.
Indoor unit types permitted	High Wall Mount or Ceiling Cassette type
Minimum cooling capacity per unit	8,56kW (30 000 BTU/h)
Number of units required	2
Minimum rate of air circulation	21,0 m <sup>3</sup> /min INSIDE, 54 m <sup>3</sup> /min OUTSIDE
Method of mounting: Indoor Units	<u>For Wall Mount Units:</u> On brick wall face using suitable anchors.
Heating method	Reverse Cycle Heat Pump
Power supply	230V+5% -10%, 50Hz, 30A, single phase, from Curve 1 circuit breaker, via isolator at outdoor unit
Permitted max sound level INSIDE/OUTSIDE	44/58 dB
Max piping length between internal fan coil unit and external condensing unit	12m
Moisture Removal	4 ℓ/h
Max height between internal fan coil unit and external condensing unit	8m
Indoor wall mount unit discharge grille adjustment	Manual vertical flaps, auto-swing horizontal flaps



**Data for Air Conditioning Units in Computer Rooms (30 work stations)**

System Type	Split Type Air Conditioning unit Multi-split not permitted.
Indoor unit types permitted	High Wall Mount or Ceiling Cassette type
Minimum cooling capacity per unit	6.7kW (24 000 BTU/h)
Number of units required	3
Minimum rate of air circulation	16,0 m³/min INSIDE, 42 m³/min OUTSIDE
Method of mounting: Indoor Units	<u>For Wall Mount Units:</u> On brick wall face using expanding concrete anchors.
Heating method	Reverse Cycle Heat Pump
Power supply	230V +5% -10%, 50Hz, 30A, single phase, from Curve 1 circuit breaker, via isolator at outdoor unit
Permitted max sound level INSIDE/OUTSIDE	44/58 dB
Max piping length between internal fan coil unit and external condensing unit	12m
Moisture Removal	4 ℓ/h
Max height between internal fan coil unit and external condensing unit	8m
Indoor wall mount unit discharge grille adjustment	Manual vertical flaps, auto-swing horizontal flaps