

**PROPOSED ADDITIONS AND ALTERATIONS WORKS FOR OFFICE OF FOOTBALL ASSOCIATION OF SINGAPORE @ 100 TYRWHITT ROAD, JALAN BESAR STADIUM, SINGAPORE 207542**

**TECHNICAL SPECIFICATION OF MECHANICAL & ELECTRICAL WORKS**

**4.0 ELECTRICAL**

**1. General**

The electrical installation work shall conform strictly to the latest edition of Singapore Standard CP5 and comply with the latest requirements of Energy Market Authority. Electrical accessories shall be of the highest quality consistent with the required safety and comply with all the relevant standards. Type test certification by recognized testing authority is required.

All temporary electrical installations on site shall comply with latest edition of Standard CP 88: Code of Practice for Temporary Electrical Installations for Construction Singapore and Building Sites.

The tenderer shall engage an **EMA Licensed Electrical Worker** to supervise, test & commission of the entire electrical installation work base on the following categories:

<b>Electrical Workers</b>	<b>Supply capacity of Installation</b>	<b>Voltage</b>
<b>Electrician</b>	Not exceeding 45 KVA	Not exceeding 650 volts
<b>Electrical Technician</b>	<u>Design</u> Not exceeding 150 KVA <u>Install</u> Not exceeding 500 KVA	Not exceeding 650 volts
<b>Electrical Engineer</b>	No limit	No limit

**2. Testing for Electrical Installation work**

The tenderer shall make provision for the testing of the electrical supply by his EMA Licensed Electrical Worker of the entire installation and hand over to the Singapore Polytechnic switching Engineer and to apply to the Power Supply Ltd for testing, if necessary, on completion of the works. The tenderer shall also be responsible to arrange and pay all necessary tests as required by

Power Supply Ltd for turning on the electricity supply including payment of endorsement fee to the Building's Licensed Electrical Worker, and also arrange for opening of an account if necessary.

**3. Shop Drawing, As-Build Drawings and Operation and Maintenance Manuals**

The tenderer shall submit all shop drawings, as-build drawing, catalogues, operation and maintenance manuals of all equipment / items to SO for approval before commencing of any installation work.

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**4. Moulded Case Circuit Breakers (MCCB)**

- a. Moulded case circuit breakers shall be of the quick-make type to SS398, IEC 60947, having inverse time tripping with thermal magnetic trip mechanism. The tripping shall be three poles simultaneously whether fault or fault occurs in one phase, two phases or three phases.
- b. When used in switchboards immediately after the transformers, they shall have a symmetrical short circuit rating of not less than 45 KA at 415V for duration of three seconds.

When used in sub-switchboard to receive sub-mains or distribution boards received from sub-mains or sub-switchboard, they shall have symmetrical short circuit rating of not less than 22 KA at 415V.

- c. When used in distribution boards for protecting outgoing sub-circuits, they shall have a symmetrical short circuit rating of not less than 10 KA at 415V.
- d. When used in distribution boards/fuse boards for protecting final sub-circuits, they shall have a symmetrical short circuit rating of not less than 2 KA at 230/415V.

**5. Current Transformers and Trip Relays**

- a. Current transformers shall be of appropriate rating, 15 VA output, class C accuracy for operating the ammeter and trip relays.
- b. Overload relays shall be of the inverse time lag type adjustable between 75% and 200%.
- c. Earth Leakage Relays shall be of the instantaneous type with adjustable current setting 100mA, 200mA, 500mA, 1A and 2A and be suitable for use in conjunction with adjustable time lag relay.

**6. GI Conduit**

- a. Conduit shall be heavy gauged, welded galvanized steel and to comply with BS 4568, Part I or IEC 61386-2-1. Conduit boxes shall be of malleable iron or pressed and welded galvanized and welded steel to the same specification as the conduits.
- b. The minimum conduit size shall be 19 mm diameter. The contractor shall ensure that the number of wires pulled through a conduit shall be as such that a space factor of 40% is not exceeded.
- c. The number of joints shall be kept to a minimum. These joints shall be made with 50 mm long screwed couplings allowing the conduit to enter 25 mm at each end.

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- d. Inspection elbows and tees shall be provided at all sharp bends and tees unless the conduit is run in accordance with IEE Regulations. Outlet boxes shall be provided where necessary for drawing-in purpose when long conduit runs are unavoidable. All free ends of conduit shall be fitted with approved brass bushes.

Cables and wires shall be draw-in only after the conduit system has been completely erected.

- e. The used of the conduit system itself as a sole means of earth-continuity conductor is prohibited. A separate earth-continuity conductor shall be provided inside the conduit.
- f. Single conduit run shall be fixed by means of approved full saddle. It shall be positioned at not more than 100 mm from either side of a fitting or accessory and at the intervals of not more than 1.2 meter elsewhere.

In the case of several conduits run in parallel on the surface of walls and ceilings, metal brackets with multi-ways saddles fixed with metal cleats shall be used.

- g. Only approved screws, bolts or other metal fixing devices shall be used to secure the conduits. Wooden plugs will not be permitted. Holes shall be formed with electric or pneumatic drills wherever possible.
- h. GI conduit is inserted into concrete or chased into walls if the cement plastering is less than a thickness of 50 mm. It shall be secured by means of full saddles or pipe hooks prior to concreting or plastering.
- i. Conduit terminated at switches, switchboards, fused boards, etc is to be properly fixed with coupler and male brass bushes.
- j. Where required the conduit system shall be painted with glossy orange and grey colour enamel paints for control and power cables respectively.

**7. Trunking**

- a. Trucking shall be made of heavy zinc coated mild steel finished in glossy orange and battleship grey for control and power wire respectively with removable steel cover plates and be supported with strong fixing brackets at not more than 1.5 meter intervals horizontally. For vertical run, all trucking shall be securely fastened to walls by means of fixed brackets, rawl plugs and round head brass screws. Copper tapes of sizes not less than 13 mm X 3 mm shall be fitted on the outer side of the trucking to provide efficient earth continuity throughout the entire installation. The sizes of trucking provided shall be such that a space factor of 45 % is not exceeded.
- b. The cables running inside the trucking shall be suitably mounted by means of retaining clips. In vertical runs, support pins with insulating cleat in addition to the retailing clips shall support cables.

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**8. Cable Trays**

- a. Cable trays shall be fabricated or perforated with hot dipped galvanised mild steel and finished in glossy grey enamel paints for power cables and wires respectively.
- b. Cables trays shall be of sufficient width to take all cables saddled in one layer and be supported with "L" shaped brackets at maximum 1.5 meter intervals horizontally or with steel channel brackets across the back of the trays at 1.0 meter.
- c. Cables trays shall be manufactured in accordance with the following gauges: -

Up to 150 mm width	20 gauge
200 mm to 300 mm width	18 gauge
400 mm to 600 mm width	16 gauge
Over 600 mm width	14 gauge

**9. Methods of Cabling and Wiring**

- a. All electrical cabling and wiring shall be carried out in steel conduits, in metal trucking, on cable trays or in RC trenches or ducts.
- b. Cabling and wiring shall be run only in the directions parallel or perpendicular to the walls. On the walls they shall run from the ceiling down vertically only.
- c. Wiring shall be carried out upon the "looping in" principle with all the joints being made at the switches, outlets, distribution boards and equipment only. No joint shall be made on joint box nor will any through joint be allowed.
- d. All wires shall be colour coded as follows: -

Live	-	Brown, Black and Grey
Neutral	-	Blue
Earth	-	Greenish with Yellow

**10. Earthing**

- a. All metal parts of the electrical system liable to become alive in the event of insulation being defective shall be effectively earthed by means of an earth-continuity conductor of sufficient size. The sizes of earth-continuity conductor and method of earthing for various conditions shall in accordance of IEE regulations.
- b. Where connection is made at switchgear, lighting fittings, etc, the earth-continuity conductor shall terminate in a soldered cable socket/lug.

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**11. Distribution Boards**

- a. Distribution boards shall be of totally enclosed floor standing or wall mounted type complete with all switchgear, equipment, apparatus, instruments and accessories as indicated in the tender drawings and/or specified in this section.

Cable boxes and glands for incoming and outgoing cables where required shall also be supplied.

- b. Distribution boards of floor standing cubical type shall be provided with minimum 50 mm high detachable steel base frame equipped with foundation bolts for securing onto concrete plinths.
- c. All distribution boards shall be provided with ventilation louvres at the bottom and top of their side panels for heat dissipation and power ventilation.

The ventilation louvres shall be covered by wire mesh to prevent the ingress of insects into the distribution boards.

- d. All metal parts of the switchboards and distribution boards shall be degreased and rust inhibited before sprayed with two coats of grey colour of semi-glossy synthetic enamel paints.
- e. All metals parts of the distribution boards liable to become electrically alive in the event of insulation being defective shall be effectively earthed.
- f. All doors and removable panels shall be separately bent to earth. Distribution boards of metal-clad type shall be insulated for 500 volts and manufactured of 16 gauge sheet steel, pressed and rolled to shape having all joints neatly welded and finished flush with the adjacent surfaces.
- g. The front doors of the distribution boards shall be hinged with concealed hinges and seated on rubber gaskets cemented to the door frames and be provided with philips head pattern, nickel or chrome-plate fixing screws.
- h. Distribution boards with plug-in miniature circuit breakers, earth-leakage circuit breakers and isolators type shall have pressed metal-clad or all insulated housings and hinged covers similar to MK Sentry, Legrand, BBC, MEM or GE.
- i. Distribution boards shall be fully wired internally and the wires shall be neatly run, tapped and colour coded.
- j. Each distribution board shall be provided with a layout and single-line drawing giving details of the circuits connected. This drawing is to be housed in plastic bag fixed onto the inner surface of the front door of the distribution board.
- k. Distribution board serving lighting, air conditioning unit and power final sub-circuit shall be of plug-in miniature circuit breakers type. It shall be of load centre type having individual source to lighting, air conditioning unit and power switch socket outlet.

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**12. Busbars and Busbar Connections**

- a. Busbar and busbar connections in and distribution boards shall comply with BS 159. Generally they shall be of hard drawn high conductivity copper. The cross-section area of which shall be 650 mm<sup>2</sup> per 1000 A. They shall be rigidly supported so as to withstand the mechanical and thermal stresses resulting from a maximum of 31 MVA fault condition to which they may be subjected.
- b. Busbars shall be painted or sleeved with PVC covers to indicate the phases in accordance with table B.4 of the IEE regulations. Each bar shall be provided for termination of earthing of all equipment and the sheaths of all cables.
- c. Full size neutral bars shall be provided for all distribution boards and shall have adequate numbers of terminals for cable terminations to suit the installation.

**13. Cable and Wire Terminations**

- a. All cables and wires shall be terminated inside the distribution boards with approved cable lugs or connectors. Separate lugs or connectors shall be used for each individual wire and each core of the cables.
- b. All small wire for control circuits shall be colour coded and shall have numbered ferrules at both ends. The ferrules shall be of white insulating material with characters marked shall be in black. Additional red ferrules marked "Trip" or "T" shall be fitted to the wires interconnecting the relay trip contacts and the shunt release.

**14. Labels**

- a. Extensive labelling and marking shall be used internally and externally in each distribution boards. External labelling shall be engraved on black plastic plates with white letters.
- b. Each switchgear, equipment, apparatus, instrument and accessory shall be labelled to indicate its rating, function, designation, number and/or code letter of the equipment.
- c. All internal cables and wires shall be colour coded and marked with numbered ferrules.
- d. The terminal strips shall be numbered and scheduled so as to identify the circuits without difficulty. The same numbers and reference letters identifying circuits and components of the equipment shall be shown on the wiring diagram, which is to be supplied by the contractor upon the completion of the installation.
- e. Warning signs marked "415V DANGER" with standard design and colour shall be suitably painted or printed on the removable side and back/front panels of the switchboards and distribution boards.

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**15. Cables and Wires**

- a. The type and sizes of cables and wires used shall be strictly as indicate in the tender drawings.

All cables and wires supplied shall be to BS with copper conductors unless otherwise specified.

The minimum wire size to be used for control wiring either single or multi-core shall be of 1.0 mm<sup>2</sup>.

The minimum wire size to be used for lighting wiring either single or multi-core shall be of 1.5 mm<sup>2</sup>.

The minimum wire size to be used for power cabling either single or multi-core shall be of 10 mm<sup>2</sup>.

- b. Cables and wires run in steel conduit or trucking for general power lighting shall be of PVC insulated and rated at 600 volts unless otherwise specified.

Cable and wires run on cable tray shall be of PVC/PVC insulated and rated at 600 volts.

- c. PVC insulated or PVC insulated and sheathed cables shall be of armoured manufacture of 600/1000 volts grade as applicable and conforming to BS 6231 type B, 6346, 6004 and subsequent amendments whichever is applicable and Singapore Standard 50-1971.

- d. The cables shall be delivered to site in the makers standard packing with scale and labels intact, except that cables larger than 4 mm may be delivered in required lengths. Only cables with the maker's identification clearly visible shall be used.

**16. Lighting Fitting**

- a. All lighting fittings supplied shall be adequately rigid and shall have no distortion during and after the installation.

They shall be supplied complete with lamps or tubes, starting gears, driver, control gear where applicable and mounting brackets.

- b. A brass screw with lock nut welded or screwed onto the metal frame of the lighting fitting shall be provided for each fitting to receive the connection of earth wire.

- c. A sample of each type of lighting fitting shall be submitted for approval before manufacture or placing order with the supplier.

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**17. Method of Installation**

- a. In areas where there is without false ceiling, lighting fittings shall be surface mounted by means of "C" brackets or bases. Suspension stainless steel threaded rods of 10 mm diameter of appropriate length, width of 350 mm or more of 6 mm thick powder coated (white) stainless steel plate where required shall be supplied and installed by the contractor. The suspension stainless steel threaded rods shall be installed between the "C" bracket and the polished stainless steel plate. The upper portion of the rods are secured to "C" bracket with washes and nuts where the lower portion of the rods are secured to powder coated steel plate with stainless steel counter sunk alan key bolt. The powder coated stainless plate will act as a base for mounting lighting fitting.

Lighting fittings mounted directly onto surface conduit wiring shall be mounted on conduit junction or end boxes.

- b. In areas where there is suspended false ceiling, lighting fittings shall be suspended with chains or alternatively suspension rods may be used. The suspended ceiling panel framework or suspension devices for the ceiling grids shall not be used as supports for the lighting fitting.
- b. The anchorage points for lighting fitting brackets; bases suspension chains or rods shall be formed by means of ram set. Bawl plugs will not be accepted.

**18. Fluorescent Lighting**

- a. The metal housing of the fluorescent fittings supplied be pressed or rolled from sheet steel of not less than 20 SWG to form a rigid and robust body as a basis for the complete unit.

All metal work of the fittings shall be thoroughly degreased and cleaned before the application of the anti-corrosion treatment. Two finishing coats of white enamel paint shall be applied evenly with each coat of paint to be properly stoved.

- b. The associated components such as ballasts, capacitors, etc shall be mounted on a removable wiring tray or alternatively fixed directly onto the fitting covered by a removable cover for ease of maintenance.
- c. Ballast used if not otherwise specified shall be of air-cooled, low loss, switch start type to SS 24 : 1987 (SS 490 : 2000) and SS 380 : Parts 1 & 2 : 1966, bearing SPRING "Safety Mark" label or certificates.

The watt loss to the ballast shall not be more than 10 watts per 40 watts tube. The power factor of the ballast shall in no case be less than 0.5 lagging.

Electronic ballast shall be of fully electronic high-frequency control system for fluorescent lamps with maximum light comfort. The dimmable control system shall be capable of dimming the fluorescent lamp gradually from 100% to 10% luminous flux. The high frequency manual control unit, signal amplifier, light

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sensor, signal converter and conventional dimmer shall be used to produce individual lighting control installation for modular system.

- d. Capacitors complying with BS 4017:1973 shall provide for all fittings to correct the power factor of each fitting to not less than 0.85 lagging.

Capacitors connected in series to the ballast shall be rated at 440 volts. Capacitors connected in parallel to the ballast shall be rated at 240 volts. They shall be mounted at least 150 mm away from any ballast.

- e. Resettable starters for the lamps shall be suitable for connecting to 220-250 volts source and be equipped with radio interference suppression capacitors.
- f. Lamp holders shall be of approved manufacture non-inflammable and non-conductive type. The lamp holders shall be so fixed that they are adjustable to accommodate slight variation in tube length.
- g. All fluorescent lamps supplied shall conform to BS or CEI standard and shall be of the "Cool white" colour if not otherwise specified.
- h. Plastic diffusers / mirror louvres used shall be made of good quality materials. They shall be of adequate thickness and strength to prevent sagging under normal operating conditions. The lighting louvres used in computer environment shall be constructed in such a way that the fluorescent tubes can be concealed properly. The image of fluorescent tube shall not be seen on the computer monitor screen at a view distance of 45 centimetres and a viewing angle of 20 degree (from eye level to the top and centre of the monitor).
- i. Universal mount fluorescent lighting fitting shall be suitable to mount onto ceiling or base and as well as recess or conceal mount in ceiling with conceal or expose grid. The luminaire body shall be of white colour, powder-coated sheet-steel, refined to particularly elegant concave design. With flush end caps, inclined by 30 degree and perfectly adapted to luminaire profile. The lamp of the lighting fitting shall be of T-5 high output lamp of either 14W, 28W or 35W having a diameter of 16 mm. It shall be operated with high frequency electronic ballast having a characteristic to maintain its luminance level of not less than 90 percent throughout the working life span of the fluorescent tube.

**19. Incandescent Fittings**

- a. Incandescent fittings shall be supplied complete with 240 volts GSL lamps or bulbs with appropriate wattage ratings and standard holders of screw or bayonet type to BS 98 or BS 52 respectively.
- b. Incandescent fittings of recessed type shall be equipped with adjustable sliding lips for mounting onto ceiling of various types of and thickness. These sliding lips shall be adjustable and be able to be tightened from below of the fittings without having to disturb or remove the ceiling panels.
- c. Reflectors where specified shall be of one piece pressed mirror optic type.

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**20. Lighting Switches**

- a. All lighting switches supplied shall be of PVC or metal-clad for conceal and surface mounting. They shall be fixed at a height of 1.40 metres above the floor level.

In damp situations and wherever they are exposed to the weather, the switches shall be of the iron die-cast, galvanized or PVC, surface mounting weatherproof type, IP 55.

Where light switch is to be installed near water tap source, it shall be installed at an acceptable distance of at least 0.8 meter away from the tap water source. Light switch installed below any water tap source or within 0.8 meter zone shall be of weather proof type.

Where light switch is to be installed at an area below a semi-enclosure such as balcony, awning, roof, etc, it shall be of weather proof type if the position of installation is at any position - "below 45 degree", an angle formed between the horizontal plan of the semi-enclosure and the position of installation.

- b. Wherever the number of switches at one location exceeds one, multi-gang switches shall be used.
- c. Unless otherwise specified, all lighting switches shall be single-pole quick-make and slow-break type housed in metal or PVC boxes with knock-outs and be rated at the circuit full-load current for non-inductive circuit and at twice the circuit full-load current for inductive circuit.

**21. Time Switch**

Time switch used for controlling lighting shall be fully electronic with digital display, rated at 16A, 230 volts ac. It shall have the features of programming the time switch to switch on and off the lighting at specify day and time and a reserved capacity to hold schedule program in the event of power failure. The magnetic contactor should be used to incorporate the lighting control in control circuitry.

**22. Socket Outlet**

- a. All socket outlets and plugs provided for this project shall comply with SS 472 (for round pins) and SS 145 (for rectangular pins) flush for recess mounting and metal-clad for surface mounting.

In damp situations and wherever they are exposed to the weather the switched socket outlets shall be of the iron die-cast, galvanized, surface mounting weatherproof type.

Where switched socket outlet is to be installed near water tap source, it shall be installed at an acceptable distance of at least 0.8 meter away from the tap water source. Switched socket outlet installed below any water tap source or within 0.8 meter zone shall be of weather proof type.

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Where switched socket outlet is to be installed at an area below a semi-enclosure such as balcony, awning, roof, etc, it shall be of weather proof type if the position of installation is at any position - "below 45 degree", an angle formed between the horizontal plan of the semi-enclosure and the position of installation.

- b. No more than one phase of supply shall be brought into a twin socket outlet.
- c. All socket outlets shall be installed at a height of 1400 mm from the floor level or otherwise specified in the tender drawing.

Socket outlet mounted within 150 mm from the floor shall be so mounted that the plug can be withdrawn in a horizontal plane. Socket outlets fixed on floor shall be so arranged that no duct or water can accumulate therein.

- d. Socket outlet installed at a height above 2.0 m from floor level shall be provided with separate switches of the same current rating as the socket outlets at accessible positions.

**23. Exit Light and Emergency Light**

- a. Exit light shall be pendant mounting, slim type, complies with latest edition of SS CP 19, The Installation and Maintenance of Emergency Lighting and Power Systems in Buildings.
- b. Internally illuminated Exit signs shall be of a type which will comply with the following requirements:

Exit signs with a white legend and green background:

- i) The luminance of the background in the area within 25 mm of the legend shall not be less  $8 \text{ cd/m}^2$ ;
- ii) The ratio of the luminance of the legend to that of the adjacent background shall be not less than 4:1.
- iii) The variation in luminance within the legend and within the background shall be not less than 5:11.

Exit signs with a green legend and a white opaque background:

- i) The luminance of the legend shall lie within the range  $2 \text{ cd/m}^2$  to  $25 \text{ cd/m}^2$ ;
- ii) The variation in luminance within the legend shall not be not more than 5:1.

The luminance shall be measured within +/- 5 degrees from the normal to the plane containing the legend with a meter which will provide a circular measurement field having a diameter of between 75 percent and 85 percent of the letter stroke thickness of the legend.

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The green legend and a white opaque background are only recommended where an exit sign is normally viewed under dimmed lighting condition, eg in theatres, auditoriums and the like.

- c. Externally illuminated Exit signs. An illuminance of not less than 50 lux shall be provided on the face of externally exit signs and the variation in illuminance shall not exceed 3:1.  
The position of the luminaire(s) relative to the sign shall be such as to cause no reduction in the contrast of the sign (due to reflection of the luminaire in the face of the sign) when viewed from within the required range of directions.

Any light source provided specifically for the purpose of lighting the sign shall be screened from the view of persons moving through the exit.

- d. Exit light shall be position between 2 meters to 2.5 meters above finished floor level. If this is not possible, the relevant authority shall be consulted.
- e. Exit signs shall bear the legend "EXIT" only, together with a directional arrow where required. For viewing distances of up to 24 meter, the sign shall conform to CP 19, SS 4.3.4, Figure 1. Where viewing distances in excess of 24 meter are encountered, the size of the exit sign and directional arrow (Where incorporated) shall be increased by the factor  $d/24$ , where  $d$  is the viewing distance in meters.

The legend of signs, and directional arrows where incorporated shall be white and the background ISO safety green. However, where the exit signs are normally viewed under dimmed lighting conditions the legend of the exit signs and directional arrows (if any) may be green and the background white opaque.

- f. Internally illuminated Exit light shall be the maintained type comprising one no of 8 W fluorescent tube normally operated on 230 volts, single phase, 50 Hertz electricity supply and an inverter for operation on DC battery bank in the event of power failure. The inverter shall be compact and silent in operation.

The battery pack shall consist of sealed Ni-Cal rechargeable batteries with sufficient capacity to operate the 8 W tube or LED light continuously for a minimum period of 2 hours.

The charger shall be transistorised and fully automatic with self cut-off when the batteries are fully charged and with trickle charge facilities, and shall operate on 230 volts, single phase 50 Hertz supply.

All components shall be compact and neatly laid-out and housed inside the exit light as an integral unit.

- g. The identification of emergency luminaire symbol shall be black on white background as conform to CP 19:1991. The symbol shall be display on or adjacent to each emergency luminaire. The symbol shall not be fixed to the diffuser of an emergency luminaire or to removable ceiling tile. The symbol shall not be less than 10 mm in diameter and shall be so located as to be readily visible from floor level.

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- h. The maximum delay between the failure of the electrical supply to normal lighting and the energisation of the emergency lighting system shall meet the relevant requirements of the Fire Precaution for Buildings. The battery operated emergency lighting system shall be capable of continuous operation for the rated period of minimum one hour, or longer. At the end of which the battery shall provide not less than 85 percent of its normal voltage with the normal load connected at the normal ambient temperature of the battery location. After the battery has been so discharged, and following a recharged of not more than 16 hours, it should again be capable of supporting the specified duration period.

**25. Maintenance Of Servicing**

1. The 12 months warranty period shall commence after the successful handover of the entire electrical installation to owner.
2. It is the responsibility of the electrical contractor to maintain the electrical system in the first class running condition.
3. During the warranty period, the electrical contractor shall carry out (12) free servicings to the system at approximately monthly intervals in accordance with the maintenance responsibilities outlined hereinafter. Allowance shall be made in the quotation for any cost incurred by complying with this requirement.
4. The electrical contractor shall prepare a detail inspection and service report form showing the functions to be carried out and the intervals between each function to enable records of servicing to be maintained. The functions shall include all the maintenance responsibilities outlined hereinafter for each specific system plus any other special maintenance requirements recommended by the manufacturers of equipment. The inspection and service report shall be duly signed by the user department and shall be submitted to the owner within the first week of every month.
5. Routine maintenance and servicing to the electrical installation is to be carried out during normal working hours unless it is otherwise specified elsewhere in this specification.
6. During the warranty period, the electrical contractor shall attend to any complaint calls promptly at no expense to the owner.
7. Where it is required for electrical system operating in 24 hours basis, the electrical contractor shall ensure that his workshop can provide 24 hours service for the attendance of any complaint calls after normal work hours.
8. After the attendance of complain calls and completion or repair work, a copy of the fault report or service sheet duly signed by the Onwer.
9. The electrical contractor shall be responsible for the conduct and behaviour of his workmen. Upon arrival at the user department for servicing of repair works, the workmen are requested to inform the officer-in-charge in the department the purpose of their visit. The electrical contractor shall ensure that minimal inconvenience is caused to the user department...

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10. Final payment of retention monies to the electrical contractor will be certified only after evidence of regular and satisfactory maintenance during the warranty period has been shown.
11. The electrical contractor shall state clearly in his quotation, the maintenance and servicing charge per annum after the warranty and free maintenance period. This price shall stay firm for at least 12 calendar months after the aforesaid period and shall be based on the maintenance responsibilities herein stated below.
12. The electrical contractor shall be responsible for all damages caused to the installation of the user department's property through the act of negligence of their workmen except where it can be proven that it is no fault of theirs.