FIRE PROTECTION SYSTEM

1.1 Hose Reels

1.1.1 Recess Hose reels approved to BS EN 671-1: 1995, or any other equable International Standard, Automatic operation, Right or Left hand take off. Including 30m length of Hose, 19mm diameter hose approved to PR EN 694, or any other equable international standard, and nylon twist operated jet / spray nozzle on mounting plate with integral flexi guide for hose withdrawal device. 03 or 04 fixing holes should be provided in position indicated to suit M8/M10 sized fixing screws or M12 fixing bolts. With ball valve inlet and flexible inlet water pipe.

1.1.2 The overall width of the reel should be no more than 850mm. The overall height of the reel should be less than 850mm including Hose and integral Flexi guide for hose withdrawal guide. The overall depth of the reel should no more than 150mm. Color of the reel should be red, fitted with operating instruction plate.

1.1.3 The Hose Reels and the related equipment's should be approved by the NSS Fire and Rescue Service before Installation. Special permission should be taken for the size of the Hose reels.

The Hose Reels nozzle retainer or hose guide and inlet valve should be fitted at height of about 900mm above floor level.

1.2 Hose Reel Cabinets.

1.2.1 The hose reel should be recess mounting type with or without glass paneled door for use with the above mentioned sized Hose Reels. Hose Reel Cabinet dimension should be no more than 900mm in width, 900mm in height, 300mm in depth (including door).

1.2.2 Color of the cabinet should be Red. Special permission should be taken for other color.

1.2.3 Recessed latch type handle should be installed. Hose reel signage should be in accordance to BS 5499 or any other equable international Standard. Fixing hole should be provided.

1.2.4 The Hose Reel cabinets should be approved by the NSS fire and Rescue Service before Installation.

Water Supply for Hose Reel System.

1.3.1 As a minimum, the water supply to the hose reel should be such that when the two far most reels in the premises are in use simultaneously, each should provide a jet of approximately 6m in length and will deliver not less then 0.5litre/s (30 litre/min).

1.3.1.1 Minimum Quantity of water storage required for hose reel system only.

1.3.1.2 Minimum storage required for the first hose reel; 2275litre.

1.3.1.3 For each additional hose reel; 1137.5litre to a maximum of 9100litre

1.2.5 Tank or inter-connected tanks supplying water for the hose reel should be automatically supplied from the fresh water main(s) controlled by ball valve of a minimum diameter 50mm. Rain water collected from roof can also be stored.

1.2.6 Tanks supplying water for domestic purposes should not be used as suction tanks for hose reel installation unless arrangement have been made these domestic supplies to be drawn off in such a manner that the reserve of water for the hose reel installation is always preserved.

1.2.7 The piping details of the supply o f water for the hose reel system and the water supply system should be approved by the NSS fire and Rescue Service before Installation.

1.2.8 Special permission should be taken if it is different from the above.

1.4 Hose Reel Booster Pump system.

1.4.1 Hose Reel booster pump set, complete with In and Out galvanized steel pipe work with or without expansion vessel.

1.4.1.1 Where the water pressure in the hose reel mains needs to be boosted, the provision of an electrically driven pump is usually a convenient method. A duplicate standby pump should be always provided.

1.4.4.2 Both motors and pump should be sited in fire-protected position and the electrical supply to them should be an Exclusive Circuit with the cables following a route of negligible fire risk or be provided with adequate protection.

1.4.4.3 The booster pumps systems should come into operation automatically on a drop in pressure or a flow of water. Both pumps should be automatically primed at all times.

1.4.4.4 All pumps should also be capable of being started or stopped manually. The standby pumps should be so arranged that it would operate automatically on a failure for any reason of the duty pump.

1.4.2 The Hose Reel Booster Pump set should be approved by the NSS Fire and Rescue Service before installation.

1.4.3 Special permission should be taken if it is different from above.

2.1 Fire Extinguishers.

2.1.1 2Kg Co2 stored pressure Extinguisher approved to BS En 3. Aluminium alloy Body approved to BS5045 Part 3 or any other equable International Standard. Red Body with black band or black colored head cap, swivel Horn, English screen. Fully charged.

2.1.2 The Extinguisher Should be approved by the NSS Fire and Rescue Service before Installation. Special permission should be taken if it is different from above.

2.1.3 9 liter Water Extinguisher (Gal Cartridge Type) approved to BS EN 3 or any other equable International Standard. Red body head cap. English screen, fully charged.

2.1.4 The Fire Extinguisher should be approved by the NSS Fire and Rescue Service before Installation. Special permission should be taken if it is different from the above.

2.1.5 Fire Extinguishers should be located in conspicuous positions on bracket or stands where they will be readily seen by person. The carrying handle of larger heavier extinguishers should be about 01m from the floor level. But smaller Extinguisher should be mounted so as to position the handle 1.5m from the floor level. Extinguisher installing on the cabinet the height should be approved by NSS Fire and Rescue Service.

2.2. Cabinet for the Extinguishers.

2.2.1 Cabinets for the Extinguishers should be of stainless steel with or without glass-fronted doors. Color of the cabinet Red or to suit the requirements of architectural surroundings. Recessed Latch Type handle should be installed.

2.2.1.1 Fire Extinguisher Single Cabinets dimension should be no more than 190mm in width, 640mm in height, 180mm in depth (including door),

2.2.1.2 Fire Extinguisher Double Cabinets dimension should no more than 440mm in width, 640mm in height, 180mm in depth (including door).

2.2.2 The cabinets for the Fire Extinguisher should be approved by the NSS fire Rescue Service before installation. Special permission should be taken if different from above.

3.1 Fire Doors

3.1.1 All fire doors should be opened to the direction of the flow of the people while in emergency.

3.1.2 These doors should be installed with self-closing device including the panic latch. These panic Latch devices should conform to BS 5725 Pt 1 or any other equable international standard.

3.1.3 Fire doors conforming to the method of construction as stipulated below shall be deemed to meet the requirements of the fire-resisting period.

3.1.3.1 Doors frames constructed in accordance with one of the following specification should be deemed to satisfy the requirements for doors having fire resisting period of half-hour (30min).

3.1.3.2 A single door 900 millimeters wide x 2100 millimeters high maximum or double doors1800 millimeters high maximum construction of solid hardwood core of not less than 37 millimeters laminated with adhesives conforming to either BS 745 “Aminal Glues”, or BS 1204, “Synthetic resin adhesives (phenolic and aminoplastic) for wood” Part 1, “Gap-filling adhesives” or BS 1444 “Cold – setting casein glue for wood”, or any other equable International Standard, faced both sides with plywood to a total thickness of not less than 43mm with all edges finished with a solid edge strip full width of the door. The meeting stiles of double doors shall be rabbeted 12mm deep or maybe butted provided the clearance is kept to a minimum.

3.1.3.3 Doors may be double swing provided they are mounted on hydraulic floor springs and clearance at floor not exceeding 4.77mm and frame and meeting stiles not exceeding 3mm;

3.1.3.4 A vision panel should be incorporated provided it does not exceed 0.065 square meter per leaf with no dimension more than 1370mm and should be glazed with 6mm Georgian wired glass in hardwood stops;

3.1.3.5 Doors constructed in accordance with BS459 part 3 : 1951 or any other equable International Standard fire check flush doors and wood and metal frames (half hour type);

3.1.3.6 Timber frames for single swing half hour fire doors of overall width of 60mm including 25mm rabbet and depth to suit door thickness plus 34mm stop;

3.1.3.7 Metal frames half hour fire doors shall be of sheet steel not lighter than 18 gauge of overall width 50mm including 18mm rabbet and depth to suit the door thickness plus 53mm stop;

3.1.3.8 Timber or metal frames for double swing doors should be as specified above with minimum clearances between frame and door;

3.1.3.9 Double doors with rabbeted meeting stiles should be provided with co-coordinating device to ensure that leafs close in the proper sequence;

3.1.3.10 Fire doors may held open provided the hold open device incorporated a heat activated device to release the door. Heat activated devices shall no be permitted on fire doors protection openings to protected corridors or protected staircase.

3.1.4 The Fire doors and its related devise should be approved by NSS fire and rescue Service before Installation.

3.1.5 Special permission should be taken if it is different from above.

4.1 Fire Exit Signs

4.1.1 Photo luminescent Fire exit signs should sign each fire Exit door. The Symbol height should be not more than 100mm.

4.1.2 The fire Exit should be approves by the NSS fire and Rescue Service before Installation.

4.1.3 Special Permission should be taken if it is different from above.

5.1 Fire Detection and Alarm System.

5.1.1 Fire detection and Alarm system should confirm to BS 5839 or any other equable international Standard. Fire Detection and alarm system should be analogue Addressable System with mimic diagram. A system in which signals from each detector and/or call point are individually identified at the control panel. Fire Detection and alarm system should consist of Automatic Detectors, Manual Call Points, Control and indicating equipment, etc. It should also covers System capable of providing signals to initiate, in event of fire, the operation of ancillary services such as fixed fire extinguishing systems and other precautions and actions. Main Fire Control Panel should be located at easy access point.

5.1.1.1 Red Xenon Beacon should be weather resistant IP65 rate Xenon.

5.1.1.2 24 Tone Wall Sounder Compact should confirm BS 5839 Pt. 1 or any other equable international standard.

5.1.1.3 Wiring for detectors should be Fire Resistant Cable.

5.1.1.4 Heat Detectors should comply with BS5445 or any other equable International Standard.

5.1.2 The Fire Detections and Alarm System and all related equipment's should be approved by NSS fire and Rescue Service before Installation including all the relevant equipments.

5.1.3 Wiring details and the positioning of detectors, Call points, etc. for Fire Detection and alarm system should be approved by the NSS Fire and Rescue Service before Installation.

5.1.4 Special permission should be taken if it is different from above.

12 ELECTRICAL INSTALLATIONS

12.1 General

12.1.1 The work shall be carried out strictly in accordance with the standard specifications and shall also conform to the requirements of Electricity Rules in force in ……, …….

12.1.2 All materials to be used in the Electrical Works shall be HAEGER or equivalent and shall bear the certification marks of local authorities. All materials shall be approved by the Consultant before use in the Works.

12.1.3 Earthing shall invariably be done in the presence of the Consultant or his representative.

12.1.4 All the conduits shall be continuously earthed. Check nuts shall be provided at the point where the conduct enters the I.C. box and junction box.

12.1.5 The Contractor shall arrange for the inspection of all Medium Pressure Installation by the Electrical inspector of the local electric supply authority from where the electricity connections has to be obtained, and see that they are passed by him.

12.1.6 The Contractor shall be responsible for all necessary permits, approvals, fees, and deposits etc., required for completing the Electrical works in accordance with the Contract.

12.1.7 Scope of work

12.1.7.1 The work consists of furnishing all tools, plants, labour, materials and equipment and performing the internal electrical Works comprising of:

- Light and power wiring
- Fans and fixtures
- Wires and Cables
- Telephone System
- Sub- Station Equipments:
- Distribution Fuse gear
- Earthing System
- Lightening Protection System
- Fire Alarm System
- Air Conditioning System
- Computer Network Cabling outlet work

12.1.8 Prequalification

12.1.8.1 The Electrification Work shall be carried out only by a licensed contractor authorized to under take such work under the …….

12.1.9 Qualification

12.1.9.1 A licensed Electrical Contractors should have the following qualifications:

- Must have in his employment a competent Electrical Engineer registered with …….
- Must have in its employment an Electrical Consultant having certificate of competency who will exclusively supervise this work.
- Must have necessary tools, plant and instruments.
- Must have adequate experience of similar works.

- If a contractor does not posses the above qualifications he shall be allowed to sublet the Work to a competent Sub-Contractor provided an application for his prequalification is made to the engineer for his approval. Decision of the Engineer in this case shall be binding on the Contractor.

12.1.10 Rules and Regulations

12.1.10.1 The installation in general shall be carried out in conformity with the Electricity Rules, 1937 (UK), and the latest edition of the Regulations for the Electrical Equipment of Buildings issued by the Institution of Electrical Engineers, London (I.E.). However, in case of conflict between these Specifications and the I.E. Regulations, these Specifications shall be followed.

12.1.11 Standards

12.1.11.1 The latest relevant British Specifications, and I.E. recommendations shall be applicable and be followed for the equipment specified herein.

12.1.12 Climatic Conditions

12.1.12.1 All equipment supplied shall withstand, without developing any defect, the following climatic conditions:-

12.1.13 Maximum Ambient Temperature	=	113° F or 45° C
12.1.14 Minimum Ambient Temperature	=	28° F or - 2.2° C
12.1.15 Maximum Humidity	=	98%

12.1.16 Specifications

12.1.16.1 The Contractor shall furnish all material and equipment at site, confirming fully to the specifications given herein and to the accepted standards, the Institution of Electrical Engineers, London, and the ……..

12.1.16.2 It is not the intent of these Specifications to include all details of design and construction of various material and equipment to be supplied under this contract.

12.1.16.3 The Contractor shall supply and install all material and equipment specified herein and also all installation and small material such as nuts, bolts, washers, shims angles, leveling material, insulation, tape, solder, etc. and all such required for complete installation as intended by the Specifications.

12.1.16.4 The contractor shall provide for all the required technical and non-technical personnel, skilled and non-skilled labour, construction equipment, transportation etc., as required for the completion of Work in strict accordance the Technical Specifications laid herein-after.

12.1.16.5 All material and equipment supplied by the Contractor shall be new and in all respects conforming to the high standard of engineering design and workmanship.

12.1.16.6 All material and equipment which have to be supplied and installed by the Contractor shall be passed/approved by the Consultant; even if the same is exactly in accordance with the Bill of Quantities and Drawings.

12.1.17 Submittal

12.1.17.1 The Contractor, after the award of work, shall submit for approval of the Consultant all drawings and cuts of equipment, appliances, fixtures and accessories. Cuts, catalogues and drawings shall be clearly marked to indicate, the items furnished.

12.1.18 Approval of Drawings and Data

12.1.18.1 The Contractor shall provide detailed electrical drawings, wire diagrams, etc. for all electrical switchgear, fuse gear and all other systems etc. for the Consultant to review and approval. Three sets of equipment drawings shall be provided for obtaining approval.

12.1.19 Drawings & Data

12.1.19.1 Three sets of drawings and data (for each equipment) shall be furnished by the Contractor for the Consultant approval before commencement of work. The drawings to be supplied by the Contractor shall be as follows:-

12.1.20 **Electrical Drawings showing**:-

- Single-Line diagram
- Detailed wiring diagram
- All interconnections
- Relays, their locations, and internal wiring diagrams
- Other electrical devices including meters instruments and their wiring diagram

12.1.21 Shop Drawings

12.1.21.1 The design drawings do not show conduit routes and depict only the position of various fixtures and outlets. All the planning for the conduit routes shall be carried out, well in advance of the actual execution of work, by the Contractor to the satisfaction of the Consultant. For this purpose the Contractor shall prepare shop drawings and obtain prior approval of the Consultant. There prints of each shop drawings shall be submitted for obtaining approval.

12.1.21.2 No piece of work shall be allowed to be executed at site without the availability of these approved shop drawings. These shop drawings shall clearly depict the load balancing chart of each Distribution Board.

12.1.21.3 Time required for the preparation and approval of shop drawings shall be considered to have been included in the total time allowed for the completion of the work.

12.1.22 Spare Parts list

12.1.22.1 A list of spare parts required for the one year's operation (each equipment) where deemed necessary together with unit price of each part, shall be supplied by the contractor.

12.1.23 Guarantee

12.1.23.1 The Contractor shall furnish written guarantee in triplicate of the manufacturer for successful performance for each equipment. Such guarantee shall be for replacement which may be found defective in material or workmanship.

12.1.23.2 The guarantee shall cover a minimum period of 12 months effective from the date of completion certificate.

12.1.24 As-Built Drawings

12.1.24.1 The Contractor shall, during the progress of work keep a careful record of all changes and revisions where the actual installation differs from that shown on shop drawings. These changes and revisions shall be accurately carried out on the shop drawings and submitted to the Consultant for approval. After approval these drawings shall become the property of the Owner. These updated and approved

shop drawings depicting clearly all changes and revisions made on site shall be called As-Built Drawings.

12.1.24.2 Reproducible tracings of all these As-Built Drawings shall be handed over to the Consultant. Final payment will be withheld until the receipt of the approved As-Built Drawings.

12.1.25 Test Reports

12.1.25.1 The Contractor shall be responsible for the submitting the test reports/certificates and get the installation inspected passed by the …….

12.2 Conduit and Conduit Accessoires

12.2.1 Conduit Pipe

12.2.1.1 The conduit for the wiring of lights, socket outlets and other systems shall be made of PVC confirming to BSS 3505/1968 Class-D.

The conduit shall have following wall thickness and standard weights:

Pipe Size	Wt/100Rft.	Wall thickness
20mm dia	3.4 Kg	0.04 to 0.05
25mm dia	4.5 Kg	0.045 to 0.055

12.2.1.2 Steel conduit shall conform to BSS 31/latest. The conduit shall be enamelled with good quality non- cracking and non-flaking black paint.

12.2.2 Conduit Accessories

12.2.2.1 The use of factory made round PVC junction boxes shall be used and should have nipples to receive PVC pipe with force fit, shall be used for ceiling outlets. The wall type junction box shall also be PVC.

12.2.2.2 Each junction box shall be provided with one piece cover which shall be fitted on the box with screws.

12.2.2.3 Conduit accessories such as switch boxes, socket outlet boxes, pull boxes and inspection boxes shall be made of PVC having dust tight covers. All boxes shall have required number of conduit entry holes. All the rectangular or square shaped boxes shall have nipples to receive PVC conduit force fit.

12.2.2.4 Manufactured smooth bends shall be used where conduit changes direction. Bending of Conduit by heating or otherwise shall be allowed only at special situations with the permission of the Consultant. Use of sharp 90 degree bends and tees is prohibited.

12.2.2.5 Bends shall have enlarged ends to receive the conduit without any reduction in the internal diameter of the PVC pipe.

12.2.2.6 All accessories e.g. boxes, coupling, bends, solid plugs, bushes, reducers, check nuts etc. shall be equal in quality to the specified conduit.

12.2.2.7 The drawings do not show conduit routes and all the planning for arranging conduit routes shall be carried out by the Contractor to the satisfaction of the Consultant.

12.2.2.8 The entire conduit system shall be essentially completed before the wiring pulling is taken in hand. Each conduit run shall be tested for continuity and obstructions. All obstructions shall be cleared in an approved manner. Water and moisture that

has entered any section of the conduit installation must be dried with suitable swabs to the satisfaction of the Consultant.

12.2.2.9 Adequate expansion joints shall be provided in all conduit runs passing across the expansion joints in the concrete slab of the buildings.

12.2.2.10 All the free ends of conduit shall be solidly plugged till such time as final and proper terminations are made.

12.3 Wires, Cables and Cords

12.3.1 Wires & Cords

12.3.1.1 The wires & cords for the conduit wiring shall be single core, made of stranded copper conductors, PVC insulated, tested to B.S. 6004, 1975. The voltage grade shall be 300/500 volts or 450/750 V unless otherwise specified on Drawings and Bills of Quantities.

12.3.1.2 All the wire and cables shall be of the approved standard of …….

- For light or fan point wiring with 1.5 mm square or as specified in the BOQ.
- For light circuit wiring with 2.5 mm square or as specified in the BOQ.
- For power plug 15A wiring with 4 mm square or as specified in the BOQ.

12.3.2 Installation Instructions

12.3.2.1 All wiring shall be continuous between terminations and use of connectors or joints is not allowed. Spur and tee connections are strictly prohibited.

12.3.2.2 Manufacturers recommended lubricant shall be allowed to facilitate pulling of wires. Use of any kind of oil and soap is prohibited.

12.4 Wiring Accessories

12.4.1 Switches – GEWISS PLAYBUS or equivalent

12.4.1.1 Indoor switches controlling lights and fans shall be single pole, 5A, one or two way, suitable for 250V, 50 Hz. The body of the switches shall be made of moulded plastic, one/two/three/four gang with integral built in moulded plastic face plate.

12.4.1.2 Weatherproof switches shall conform to B.S. standard.

12.4.2 Switch Socket Outlet Units - GEWISS PLAYBUS or equivalent

12.4.2.1 Switch & socket units shall be single, pole, 3 pin rated 5A. 15A or 20A or 250V or 50 Hz. These shall be moulded plastic type with white integral built-in face plate. Each socket shall have its control switch by the side of it on a common face plate. Thus the complete unit specified in BOQ shall be as switch and a socket outlet unit.

12.4.3 Fans

12.4.3.1 All fans shall be capacitor type Deluxe models or equivalent and suitable for operation on 200/220 volts, 50 Hz, A.C Supply. All ceilings fans shall have five speed dimmers. The air displacement shall be adequate to 10,000 c.f.m for 48" (1219 mm) Sweep, and 12,000 c.f.m. for 56" (1423 mm) Sweep at maximum speed. The fan motor shall be capacitor type and bearings shall be groove type to give noiseless and quiet operation. The noise level relative to a frequency of range 1000 Hz should be within the limits of +3 dB.

12.4.4 Dimmer

12.4.4.1 The dimmer shall be recessed type as required and shall be approved by the Consultant.

12.4.5 Fan Hook

12.4.5.1 The fan hook shall be made of 12 dia mild 5/5 steel rod bent to shape of approved design. It should be in the form of a loop about 3-1/4" (87.5 mm) long and about 2" (50 mm) wide. The rod shall be bent to have at least 8" (200 mm) extension on both sides for tying to the reinforcement steel of the slab. All ceiling fan shall be of one make only.

12.4.5.2 The fan hook shall be installed in the RCC slab of the ceiling at the time of pouring concrete.

12.5 Light Fixtures

12.5.1 General

12.5.1.1 The description of light fixtures is given in the Bills of Quantities, and stated on the Drawings, and all relevant material is described in this Section.

12.5.1.2 The determination of quality is based on certified photometric data covering the coefficient of utilization, light distribution curves, construction material, shape, finish, operation, etc.

12.5.1.3 The Contractor shall submit samples of each and every lighting fixture specified for approval of the Consultant.

12.5.1.4 The type of fixtures with manufacturer catalogue reference is given in Bill of Quantities.

12.5.1.5 The lighting fixtures shall be manufactured by ERCO **or equivalent** as approved by Consultant.

12.5.2 Incandescent Light Fixture

12.5.2.1 The glass globes/ shades/ diffusers of the incandescent light fixtures shall be first class quality glass free from any air bubbles or voids. The glass shall generally be of opal white colour unless otherwise specified. The shape of the glass may be spherical, hemispherical, flattened bottom or tablet shaped as required.

12.5.2.2 Surface mounted fixture shall have stove enamelled sheet steel body. It may also be satin brass or aluminium anodised finish as required. The fixing holes shall match the outlet box. Wall bracket light fixtures shall have back plates with matching holes of the outlet box and decorative finish as required.

12.5.2.3 All the lighting fixtures shall be suitable for local climatic conditions.

12.5.3 Fluorescent Light Fixture

12.5.3.1 All the light fixtures shall have lamps and electronic ballasts of the wattage specified. The fluorescent lamp shall be either 2 ft - 18 watts or 4 - 35 watts and the colour shall generally be day light, cool day light in the order of preference or as mentioned specifically.

12.5.3.2 The fluorescent lamps shall be Philips to BSS 1853 but having a minimum useful life of 5000 hours. The new generation of 26mm dia 18 watts and 36 watts energy efficient lamps shall be preferred.

12.5.3.3 The ballast shall be totally enclosed electronic type suitable for operation on 220 V, 50 Hz, single phase supply, a wiring diagram, wattage, voltage and current ratings shall be printed on the body of the ballasts. The power loss shall not more

than 10 watts for 36 watts ballast. The ballast shall be noiseless in operation without any whistling sound.

12.5.3.4 The manufacture shall be called upon to guarantee a trouble free life of 3 years, effective from the date of completion certificate.

12.5.3.5 The starters shall have radio-interference suppressers.

12.5.3.6 The internal wiring of the light fixtures shall be carried out at manufacturer's factory with heat resistance wires of size not less than 1.5 mm square.

12.5.3.7 The louvers of light fixtures shall be made of anodized aluminium and/or moulded plastic. The diffusers shall be made of Acrylic Perspex.

12.5.3.8 All the lighting fixtures shall be suitable for local climatic conditions.

12.5.4 Installation Instructions

12.5.4.1 The light fitting shall be installed according to manufacturer's recommendations or as approved by the Consultant.

12.5.4.2 Flexible connecting wires from outlet box to the fixture shall be provided by the contractor; connector made of porcelain or thermoplastic material shall be provided and installed in the outlet boxes for connecting flexible wires to the point wires.

12.5.4.3 Outlet boxes or any openings in the ceilings and walls shall be covered with appropriately fabricated accessories to provide an architectural entity to conceal them.

12.5.5 Main L.T. Switchboard

12.5.5.1 The L.T. switchboard shall be indoor type, free standing, free supporting, floor mounted, totally enclosed, sheet clad, dust and suitable for operation on 3 phase 4 wire system, 415 v, 50 Hz, AC supply.

12.5.5.2 The board shall be suitable for installation back to the wall and capable of front attendance. The switch board shall be designed to suit service conditions and ensure security and safety during operation, inspection, operation, cleaning and maintenance.

12.5.5.3 The switch board shall be designed and tested to IEC recommendations. Each panel shall withstand strain of 2000 volts insulation level for one minute power frequency test.

12.5.5.4 The L.T. switch board shall consist of the following:

- …… Unit incoming panel
- KWh meters (To be approved and checked by ……)
- Out going distribution feeders

12.5.6 Distribution Feeder Panel

12.5.6.1 Single line diagram of the L.T. switch board shall be approved by the consultant and …….. before placing order for the switch board.

12.5.7 Earthing

12.5.7.1 The switchboard shall be effectively earth by means of a copper strip of 25 mm x 3 mm (1" x 1/8") cross -section bolted to connections near the bottom of the switchboard.

12.5.8 Accessories

12.5.8.1 Designations labels, lifting lugs, foundation bolts, interconnecting nuts blots, and washers, thimbles, lugs, levelling shims cable glands and/or cable end box for all the sizes of incoming and outgoing cable shall be supplied with the switchboard.

12.6 Testing

12.6.1 The following tests shall be conducted on each completed switchboard.

12.6.1.1 Type Tests

- Temperature rise test
- Mechanical endurance test
- Making/Breaking Capacity test
- Routing Test
- High Voltage test
- The Switchboard shall be tested to British/Electricity Council Standard 41-5. Preference shall however, be given to Switchboards fabricated from all components manufactured by only one manufacturer.

Installation Instruction

12.6.2 All labour, equipments, tools and plants required to complete the installation shall be provided by the contractor. The Switchboard shall be fixed firmly on the floor in perfect line, plumb and level position.

12.6.3 All incoming and outgoing cable connections shall be made from the bottom including Earth connections.

12.7 **Distribution Board**

12.7.1 The distribution boards shall be free standing, cubical type or wall mounting type suitable for recessed mounting. Each distribution board (d.b.) shall be tropical in design, fully dust and vermin proof and liquid repellent.

12.8 **Lightning Protection System**

12.8.1 General

12.8.1.1 The Contractor shall be under obligation to supply all labour material, services and skilled supervision necessary. Shop drawing for the lighting system shall be submitted to the Consultant at least 4 weeks before commencing the work.

12.8.2 Workmanship

12.8.2.1 The installation shall be carried out by skilled and competent workmen so as to achieve high class workmanship.

12.9 **Telephone System**

12.9.1 General

12.9.1.1 The design drawings do not show conduit routes and depict only the position of various telephone outlets. All the planning for the conduit routes shall be carries out, well in advance of the actual execution of work, by the Contractor to the satisfaction of the Consultant. For this purpose the Contractor shall prepare shop drawings and obtain prior approval of the Consultant. Three prints of each shop drawings shall be submitted for obtaining approval before commencement of work.

12.9.1.2 No piece of work shall be allowed to be executed at site without the availability of these approved shops drawings. Time required for the preparation and approval of shop drawings shall be considered to have been included in the total time allowed for the completion of the work.

12.9.1.3 The contractor shall furnish and install the type of Telephone outlets approved by ……. All the floor mounted telephone boxes shall be concealed in a PVC box with open able cover for easy access.

12.9.1.4 Both ends of each set of conductors shall be properly identified with durable tags with the same identifications of both ends, at the outlet and the telephone terminal cabinets to facilitate the installations of the telephone instrument in the future and for trouble shouting purposes. Cable used shall be twisted and shielded 3 cables in the office area and the rest as shown in the drawing.

12.10 **Fire Alarm System**

12.10.1 General

12.11 The contractor shall be under obligation to, supply, install, test, commission and maintain for the period specified elsewhere, a fire alarm system as specified in the drawings, for this building.

12.11.1 Specifications

12.11.2 The system shall facilitate the detection of fires occurring in any part of the building by subsequent audible and visual indications. The system shall generally comprise of the following:

- Main Control Panel
- The control panel will be Perspex fronted panel and will display all screened labelling and indications by block LEDs mounted behind the front hinged cover. The control panel shall be mounted in pressed steel housing and provide the following functions and indications.
- Fully monitored two wire circuit for each sensor zone (24V D.C.) as required.
- Fully monitored two wire sounded circuit (24V D.C.) as required.
- Change over relay contacts each rated 5 amps 240V A.C. (Resistive load).
- Full test and isolate functions via a key-board located on the facia of the main termination housing to provide the following:-
- Ability to isolate sensor zones.
- Ability to isolate sounder zones.
- Ability to test automatically zones with an auto reset facility to enable a single person to carry out testing
- Full LED display of all functions comprising of:-
- System on, system fault, processor fault, alarm, zone supply fault, system supply fault, battery fault, charger/mains fault, sounder fault and sensor fault together with a test mode display which provides zone clears , zone open circuit and zone short circuit indication for individual sensor and sounder (bells) lines.
- Sequence of sounder operation- All sounder (bells) and relay out-put sequences shall be completely programmable to enable future changes to be carried out with only soft ware changes.
- The control panel shall provide the following functions and indications:-
- Twin LED display for system on , system fault ,sounder fault, alarm, mains/ charger fault, main processor fault, sensor fault, alarm silenced , battery fault, supply fault and earth fault.
- Also five dedicated control functions on illuminated push buttons which are key - isolated. These shall provide Evacuate, Buzzer Mute, Alarm silence, Lamp test and Reset controls.
- Battery charger - the battery charger shall be an integral part of the main fire alarm control panel cabinet and shall be capable of fully recharging the stand - by batteries after a main's failure within 12 hours. The capacity of the batteries shall be sufficient to supply the standing load for the least 24 hours and the maximum alarm load for one hour. The system shall be suitable for operation on 220v single phase or 415v, 3- phase 50 Hz supply.
- Mimic diagram showing all the floors shall be incorporated in the control panel.
- Sensors and Sounders

12.11.2.1 The main control panel as described in the foregoing shall be capable of working with the following devices having common specification as under:-

(a) Operating voltage	10-30 volts dc (two wire system)
(b) Ambient temperature	10 C to +80 C.
(c) Humidity range	20 to 90 RH

(d) Altitude range Sea level to 6000 meters
(e) Alarm mode Self latching producing a resistance of 680 ohms across the supply line.

12.11.2.2 Photocell (optical) smoke detectors- the units shall operate on light scattering principle. An internal infra-red light source shall be pulsed, with the light beam ranged so as to by-pass a receiving unit. The presence of smoke shall scatter the light beam, causing it to be reflected on to the receiving photocell. An evaluation circuit shall measure the amount of light and shall compare it to a reference. The detector shall trigger in to an alarm state when the amount of smoke exceeds a pre-set level. To ensure against false alarms several pulse readings shall be taken and compared before the detector shall be triggered into alarm. The detectors shall conform to b.s.s. 5446 part -1 and shall have the following specifications:-

(a) Quiescent Current	Less than 100 micro amps at 20 volts.
(b) Alarm Current	Maximum 60 mA
(c) Maximum Coverage	300 cubic meters
(d) Weight	250 grams approx.
(e) Diameter x Height	92 mm x 80 mm

- Manual stations - this unit also named call point shall be break glass type that do not require a hammer. The frangible glass is pressed hand to break the glass which shall activate the alarm. The call point shall conform to B.S. 5839 part-2.
- Alarm bells - the alarm bells shall be centrifugal type and the gong shall be 100 mm diameter or as specified. The unit shall be suitable for an input of 24 v dc. And shall provide a normal output of 94 db at 1 meter.
- Electronic sounders - the unit shall be primarily designed to operate on 24v.d.c. And arranged easily to generate a variety of sound signals: intermittent, continuous or warble tones.

12.12 **Wiring**

12.12.1 The wiring for the fire alarm system shall be carried out in PVC conduit in accordance with instructions contained herein relevant section. 2x2.5 mm square or 4x2.5 mm square PVC heat resistance insulated single core cable 300/500 volts grade shall be pulled in 1" dia PVC conduit laid for the purpose. Any spurs and tee joints in the wiring are strictly prohibited. Instructions contained in section -E.2.2 and 2.3 shall be followed.

12.12.2 Installation

12.12.3 The installation as a whole shall be tested and commissioned, in accordance with manufacturer's instructions, to the entire satisfaction of the Consultant.

12.12.4 Shop Drawings

12.12.5 Shop drawing of the fire alarm system layout shall be submitted to the Consultant for approval.

SIARCH architects & builders

AC Specification & Installation Criteria for Hospitals, Ward Areas and other areas.

1 Installation Criteria

- Installation party should have at least Minimum experience of completing 2 Fresh Air Hospital Air condition Projects in Maldives over the past 5 years.
- Basic AC shop drawing should be provided with the following details
    - AC unit Location and sizes
    - Ducting Sizes and Locations
    - Grill Sizes and Locations
    - Pipeline Location and Sizes
- Upon Completion AC As build drawing should be provided

2 General AC Specification

- The brand of AC Equipment specified or to be proposed should have minimum 2 Fresh air or Hospital Air-condition Projects completed and delivered over the past 5 years in Maldives
- The Brand of AC Equipment specified or to be proposed should demonstrate that it is adequate to cater for highly corrosive environment of Maldives and should have 5 years of past projects completed
- The brand or AC Equipment specified should demonstrate all specs below from manufacturers original catalogue

3 Outdoor Specs

The Outdoor Unit Shall be Factory assembled with Weather Proof casing, constructed from Heavy Gauge Mild Steel Panels and coated with Anti Corrosive Epoxy resin finish. The unit should be completely factory wired and tested and shall be fitted with all necessary controls and switch gear.

- All outdoor units need to be VRV or Central systems which have the capacity to control & operate multiple indoor units
- The Condenser Coil of the Outdoor must be a black fin Condenser with anti-corrosion
- The brand of AC Equipment proposed should have an outdoor or outdoor sets with a maximum Energy Efficiency Ratio of (EER) kw/kw 4.5
- The brand of AC Equipment proposed should have Outdoor Environment sensor for Compressor Control and adjustment
- The Brand of AC Equipment proposed should have an outdoor or outdoor sets of Sound Pressure Level dB (A) below 60
- All Outdoor units shall be with inverter compressors and be able to operate even in the event of failure of one compressor

- All outdoor units need to have aluminium fins with 105+2 µm thickness, with special Anti-corrosive coating of 1.3 ± 0. 35 µm thickness and an outside Hydrophilic layer coating of 0.35 ± 0. 07 µm thickness.
- All outdoor units shall be equipped with high efficiency optimized heat exchangers with variable heat exchanger circuits
- The outdoor units shall be provided with its own microprocessor control panels
- The manufacturer needs to provide a warranty of 18 months replacement for the outdoor units

4 Indoor Specs

The indoor units shall be

4.1 In General:

a. Ceiling Concealed Duct Systems for all General Wards, Operation Theatres & ICU's
b. Ceiling Concealed Fresh Air Systems for all General Wards, Operation Theatres & ICU's
c. Ceiling Cassette System for General Areas, Corridors, Consultation rooms

4.2 Ceiling Concealed Duct System & Fresh Air System

- The address of the indoor unit shall be set automatically in case of individual and group control
- In case of centralized control, it shall be set by liquid crystal remote controller
- The fan shall be a dual suction, aerodynamically designed turbo, multi blade centrifugal type fan which shall be statically & dynamically balanced to ensure low noise and vibration free operation. The fan shall be direct driven, mounted directly on motor shaft having support from the unit housing.
- The cooling coil shall be made out of seamless copper tubes and have continuous aluminum fins. The tubes shall be staggered in the direction of airflow and shall be hydraulically/ mechanically expanded to bond to the fins. Each coil shall be factory tested at 21kg/sqm air pressure under water.
- Each unit shall have a cleanable type filter fixed to an integrally moulded plastic frame. The filter shall be a slide out type and shall be neatly inserted.
- All AC duct systems must have an H14 Hepa filters attached with 99.99% efficiency on Supply & Return Duct as well
- The capacity of Indoor unit have to be calculated as per the volume of the occupied space and should have Air exchange of the Minimum apart from operation theatres
    - 9 – 12 air changes per hour from the AC system
    - 2 -3 air changes per hour of Outside Air (Via Fresh Air System)
- For operation Theatres the Air Exchange Guideline should be
    - 25 air changes per hour from the AC system
    - 5 air changes per hour from Outside Air (Via Fresh Air System)
- Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling .
- Each unit shall be provided with a hand held multi-function remote controller. The controller shall be able to change fan speed and angle of swing, temperature and mode.
- Each Unit shall have service Ball valves for After sale service and future Isolation of FCU

5 Ducting & Ventilation System

- All Conceal Duct Indoor System shall be connected to a Duct Ventilation system which shall be designed to provide the most appropriate air flow for designed Air-condition areas
- The Duct System shall be made with Pre-Insulated Panels with the below specs
    - Panel Thickness: 20 – 30mm
    - Foam Density: 45-48kg/m3
    - Aluminium thickness: 80/80m
    - Alimunium Type: Embossed
    - The Boards should be Anti-Bacterial, Anti Fungus & Fire Restiant
- All supplier & Return Diffusers shall be
    - The Supply and return air diffusers/grills shall be made of extruded aluminum section with flush fixed pattern
    - White Powder Coated RAL9010 or 9016 standard
    - Supply Diffusers shall be with opposed Blade Volume dampers
    - Thickness of frame should not be less than 1.2mm. The core of the diffuser is 0.9mm thick pressed aluminum.
- All ducts shall be installed generally as per the drawings and in strict accordance with approved shop drawings to be prepared by the Contractor.

- The Contractor shall provide and neatly erect all PID Sheet work as may be required to carry out the intent, of these specifications and drawings. The work shall meet with the approval of Owner's site representative in all its parts and details.

- All necessary allowances and provisions shall be made by the Contractor for beams, pipes, or other obstructions in the building, whether or not the same are shown on the drawings. Where necessary to avoid beams or other structural work, plumbing or other pipes, and/ or conduits, the ducts shall be transformed, divided or curved to one side, the required area being maintained, all as per the site requirements.

6 Refrigerant Piping

All refrigerant piping for the air conditioning system shall be constructed from Hard seamless copper up to outer diameter of 41.3 mm and hard drawn copper above outer diameter of41.3 mm. Fittings shall have silver-soldered joints and connections to equipment shall us compression fittings. The refrigerant piping arrangements shall be in accordance with good practice within the air conditioning industry, and shall to include charging connections, suction and liquid line insulation and all other items normally forming part of proper refrigerant circuits.

All joints in copper piping shall be swag joints using low temperature brazing and or silver solder. Before joining any copper pipe or fittings, its interiors shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently, it shall be thoroughly blown out using nitrogen.
After the refrigerant piping installation has been completed, the refrigerant piping system shall be pressure tested using nitrogen at pressure of 580 PSIG. Pressure shall be maintained in the system for 24 hours. The system shall then be evacuated

to minimum vacuum of 700mm hg and held for 24 hours.

The thickness of copper piping shall not be less than mentioned below as per Standard ASTM B280-03:

Pipe Size in mm(OD)	Minimum Wall Thickness in mm
a) 41.3	1.52
b) 38.1	1.52
c) 34.9	1.40
d) 31.8	1.40
e) 28.6	1.27
f) 25.4	1.27
g) 22.2	1.14
h) 19.1	1.07
i) 15.9	1.02
j) 12.7	0.81
k) 9.5	0.81
l) 6.4	0.76

The suction line pipe size and the liquid line pipe size shall be selected according to the manufacturers specified outside diameter. All refrigerant pipes shall be properly supported and anchored to the building structure using steel hangers, anchors, Cable tray, brackets and supports which shall be fixed to the building structure by means of inserts or expansion shields of adequate size and number to support the load imposed thereon.

7 Refrigerant Pipe Insulation

The whole of the liquid and suction refrigerant lines including all fittings, valves etc. shall be insulated with 25mm thick insulation for all copper sizes. Insulation shall be closed cell elastomeric nitrile rubber.

a. Protection of exposedRefrigerant Pipe Insulation

To protect nitrile rubber of exposed piping from degrading due ultra violet rays & atmospheric conditions, it shall be covered polychelid coating with at least two coats of resin and hardener (Make-Polybond /Paramount Polytreat). Fiberglass tape shall be helically wound & painted with two coats of resin with hardener to give smooth & plain finish.

Technical Specifications

Solar Panels

- Panel Wattage: Minimum of 550W or higher
- Panel Type: Monocrystalline
- Minimum Cell Efficiency: At least 22.5%

Grid-Tied Inverter

- Inverter capacity as per the requirements allocated in the island.
- Rated Voltage: 400V
- Frequency: 50Hz
- Communication: Wi-Fi or Ethernet

Material Characteristics and Standards

All materials provided must comply with international standards for photovoltaic systems. The equipment should adhere to the latest editions of the following codes, standards, and regulations (or their equivalents):

1. Maldives Energy Authority Codes and Regulations.
2. IEC 61730; IEC 61730-1:2004 and IEC 61730-2:2004 – Safety qualifications for photovoltaic modules.
3. IEC 61215 and IEC 61646; IEC 61215:1993 and IEC 61215:2005 – Design qualification and type approval for crystalline silicon PV modules.
4. IEC 60364-7-712 – Electrical installations for buildings, focusing on solar PV systems.
5. IEC 61727 – Specifications for utility interaction of PV systems.
6. IEC 61683 – Efficiency measurement procedures for photovoltaic systems.
7. IEC 62446 – Documentation, testing, and inspection requirements for grid-connected PV systems.

Scope of Supply

1. **Documentation post-completion:**
   Upon project completion, the following documents must be provided:

   - **System Information:**

     1. General system details.
     2. Single-line power connection diagram.
     3. Installation layout.
     4. PV module specifications.
     5. Datasheets and manuals for inverters.
     6. Relevant authority-approved documents.

   - **Testing and Commissioning Results:**

     1. Technical screening report.
     2. Inverter protection settings (e.g., voltage and frequency thresholds).
     3. Electrical single-line diagrams.
     4. Inspection reports.
     5. PV array test data.
     6. Certification of verification.

   - **Operation & Maintenance:**

     1. System operation verification procedure.
     2. Troubleshooting guide for system failures.
     3. Shutdown and startup procedures.
     4. Maintenance and cleaning instructions.

Quality Assurance

The contractor must implement a quality system that aligns with current British Standards 5750 Part 1 or comparable international standards.

Major Equipment Requirements

1. **Photovoltaic Modules:**
    - Must meet the latest IEC standards or equivalent BIS standards for PV qualification and safety.
    - Modules must conform to IEC 61215, IEC 61701, and IEC 61730 Part I & II.
    - Monocrystalline modules with aluminum frames and durable face covers.
    - Tested and packaged to withstand shipping without damage.
    - PV modules shall be PID resistant
    - PV modules shall be guarantee 30 years power performance with not more than 1% power degradation in first year and 0.4% annual power attenuation
    - PV modules shall be guarantee 12 years against any kind of production defect.
    - PV module brands must be from reputable and renowned manufacturers.
2. **Grid-Tied Inverter:**
    - High-efficiency inverters (minimum 98%) with a built-in DC isolation switch and surge protection.
    - Capable of remote monitoring via the internet.
    - The inverters shall have an inbuilt DC isolation switch.
    - The inverters shall have surge protection.
    - IP65 rated for outdoor use.
    - Utilizes natural cooling technology.
    - **Accepted Brands:**
        - ABB
        - Huawei
        - Fronius
        - SMA Solar Technology AG
        - Sungrow
    - Warranty: Minimum of 10 years.

3. **Combiner Box:**
    - IP65-rated distribution boards and combiner boxes adhering to IEC 62271.
    - Properly mounted with durable materials resistant to environmental conditions.

4. **Earthing System:**
    - A complete and reliable earthing system designed for the PV installation.

5. **Mounting Structures:**
    - Anodized Aluminum or corrosion-resistant materials.
    - Designed to withstand wind speeds of at least 60 km/h.
    - Guaranteed stability for 12 years in harsh environments.

6. **Cables:**
    - All DC cables must be tinned copper, corrosion-resistant, chemical-resistant, and UV-resistant.
    - All cables should be enclosed in conduits or cable trays.
    - All AC cables must be copper with UV protection.
    - All the cables must be power rated.

Warranty Requirements

- The warranty for key components must meet or exceed the following minimum standards:
    - **PV Modules:** 12 years against defects and 20 years with 91% efficiency with 30 years performance warranty.
    - **Inverters:** 10 years.
    - **Mounting Structures:** 12 years.
- The contractor is responsible for all regulatory and service documentation required for permits, net metering, and grid connection. Relevant signatures from the client will be provided, but the contractor must handle all other formalities.

To meet evaluation standards, the proposal should clearly outline:

- Manufacturer warranties for PV panels and inverters.
- Service warranties for the installed PV system.