

"Supply and install the required electrical and mechanical works and procure the medical equipment CT-SCAN, X-ray, and MRI"

Technical SPECIFICATIONS FOR ELECTROMECHNAICAL SERVICES

Preamble

1. It is the contractor responsibility to submit method statement for the supply, delivery, installation and commissioning process for each and every item in the BOQ, including but not limited to medical equipment (MRI, CT scanner, X ray..etc), electromechanical equipment (AC, fans, ..etc) and services such as ducts, cable trays, lighting fixtures, air terminals, ..etc.
2. The method statement shall clearly indicate the safe delivery and installation procedure for each single element in the project, taking into consideration the fact that the project is an existing building and in operation.
3. The contractor shall allow for any civil works which deemed necessary for equipment installation and access activities, as well as MEP services installation, these works might include dismantling doors, expanding existing door openings (if needed), creating temporary access, demolishing and building walls partitions preparing the required foundations, floor tiling ,installation of any required cladding ,insulation, openings, doors and windows .eventually, it is the contractor responsibility to fix all temporary works and put the building in its original conditions and i operational manner including painting any structural element affected by the work, as per UNOPS engineer and beneficiary representative instructions and approval.
4. Prior installing MEP services above the existing false ceiling, it is the contractor responsibility to carefully dismantle / replacing the existing false ceiling, route the new MEP services, reinstall the false ceiling replace any damaged part (tile, stud, ..etc), and put the system in its original shape according to UNOPS engineer and beneficiary representative instructional and approval.
5. It is the contractor responsibility to arrange the work schedule with the building operator during the day working hours, in order to have no conflict with building occupants during the construction stage.
6. It is the contractor responsibility to arrange with the building operator the procedure of connecting electrical power to the existing main board, without affecting the function of the building, this might require affording temporary electrical generator to avoid power supply interruption during the functional working hours.
7. It is the contractor responsibility to supply and install the medical equipment complete with their required civil and MEP systems as per manufacturer's instruction such as Cryogen vent, MRI cooling system, electrical control boards and wiring...etc to ensure safe and accurate

functioning of the equipment as per manufacturer catalogues. Such services shall be submitted in the material submission stage for engineer's review and approval prior installation.

8. The contractor is responsible to prepare and submit a complete set of detailed MEP workshop drawings including coordination drawings between all disciplines to UNOPS engineer for approval prior to commencing any work.

9. The contractor must maintain the integrity of the existing fire alarm system, while adding new system components to the existing fire alarm system.

10. The contractor is responsible to reflect actual selected MEP and medical equipment to workshop drawings in terms of specific requirement and load capacity needed for each equipment based on approved material submittal for each equipment and manufacturer instruction manual.

11. Segregation between low current cables and power cables must be maintained during installation works.

Mechanical Specifications

1. AIR DUCTS:

1.1 DUCT MATERIALS

- A. Furnish materials in accordance with the applicable authority standards.
- B. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60/G90 zinc coating of in conformance with ASTM A90/A90M.
- C. Steel Ducts: ASTM A1008/A1008M/ASTM A1011/A1011M/ASTM A568/A568M.
- D. Aluminum Ducts: ASTM B209M ; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.
- E. Stainless Steel Ducts: ASTM A167, Type 304/316 as applicable.
- F. Fasteners: Rivets, bolts, or sheet metal screws.
- G. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

1.2 DUCTWORK FABRICATION

- A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints.
- F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

2. EXHAUST FANS

- A. Furnish materials in accordance with the applicable authority standards.
- B. Product Description: V-belt drive with galvanized steel housing lined with 13 mm acoustic glass fiber insulation, removable side panel for access, inlet and outlet duct collar, gravity backdraft damper in discharge, horizontal hanging brackets.
- C. Fan Wheel: Double width-double inlet backward inclined/forward curved (as indicated on drawings) centrifugal type.

- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- E. Motor and Drive Mounting: Within air stream.
- F. Motor: Open drip proof/Totally enclosed fan cooled/Two speed, Explosion proof type mounted on vibration isolators. NEMA MG1.
- G. Bearings: ABMA 9 life at 200,000 hours.
- H. Accessories:
 - 1. Belt guard.
 - 2. Disconnect Switch: NEMA 250 Type 1, lockable enclosure.
 - 3. Slide out filter box with throwaway type filter.
- I. Performance: as indicated on drawings.
- J. Electrical Characteristics and Components: as indicated on drawings.

3. DX SPLIT SYSTEM AIR CONDITIONING UNITS

General Inverter Units should all be Heat Pumps Class A for cooling and heating operations, Single phase (230V ~ 50Hz).

The Units should all be factory-assembled and tested, consists of indoor and outdoor units, each one complete piece, air cooled outdoor unit, designed for roof, slab or floor mounting, Contained with in the unit enclosure shall be all factory wiring, piping, Consisting of DC compressors, DC fan motor, condensers, evaporator fans, holding charge of R410 Refrigerant and temperature control, filters and special features required prior to field start up.

Outdoor unit cabinet shall be constructed of galvanized steel; compressor compartment shall be isolated to assure quiet operation.

Condenser fans shall be direct drive Propeller type, and motors shall be totally enclosed.

Compressor shall be Hermetic type, 4 Pole, DC Rotary Inverter motor for all units except the unit with cooling capacity 5 KW which is Scroll DC inverter motor.

Condenser coil shall be constructed of aluminum fins mechanically bonded to internally enhance seamless copper tubes.

OUTDOOR UNITS:

The outdoor unit should be air cooled split system .Outdoor section shall be suitable for on the ground/roof top installation.

Units shall consist of Hermetic type, 4 Pole, high efficiency DC Inverter Rotary compressor and a high efficiency DC scroll compressor for the unit with cooling capacity 5KW.

All Units shall consist of air cooled coil, propeller type condenser fan, DC Inverter control box, DC inverter motor and holding refrigerant charge R410A.

The outdoor heat exchanger should be of aluminum fins mechanically bonded to internally enhance seamless copper tubes.

The Outdoor unit's weight should not exceed 61 Kg.

The outdoor fan should be driven by DC Inverter motor.

INDOOR UNITS:

Unit shall be direct-expansion complete with coil, Heat Pump, Cross Flow fan, DC motor, piping connectors, electrical controls, and a holding charge of R410A refrigerant.

Unit should have a Cross Flow fan for uniform distribution.

Coil shall be copper tube with aluminum fins and galvanized steel tube sheets.

Motors shall be DC Inverter with multi speed, permanently lubricated with inherent overload protection.

The weight of the indoor units should not exceed 14 Kg.

CONTROLLERS:

- a. Operation is controlled by a wireless remote controller.
- b. Indoor temperature can be detected accurately by the inclusion of a thermo sensor in the body of the wireless remote controller.
 - 1) The controller must have a simple operation with Built-In Daily Timer possible to set ON/OFF timer once within a 24 hour period.
 - 2) The controller must have a simple and sophisticated operations with a choice of 4 daily timers (On/Off/Program/Sleep)
 - 3) The controller must have the ability to control up to 16 Indoor units.
 - 4) The controller must have a sleep timer function that automatically corrects the set temperature to prevent excessive heating or cooling during sleep hours.

ACCESSORIES:

The outdoor units shall be provided with the following features:

Service charging valves.

Pre-charged outdoor unit with Freon.

Expansion device, Muffler & two strainers.

Thermostat with Multi-speed switch wall mounted type.

SAFETY:

The Indoor Units must have a Circuit protection – Current Fuse (PCB)-and a fan motor thermal protection.

The Indoor Units must have a terminal Protection – Current (Thermal) Fuse.

The Outdoor units must have a Circuit Protection – Current fuse- near the terminals and main PCB, Fan motor protection by a thermal protection program, high pressure protection by a pressure switch for units above 5.3KW and compressor thermal protection.

4. ROOFTOP AIR CONDITIONING UNITS

- A. Furnish materials in accordance with the applicable authority standards.
- B. Product Description: Self-contained, packaged, factory assembled and wired, consisting of roof curb, cabinet, supply fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, , air filters, mixed air casing, controls, and accessories.
- C. Configuration: As indicated on Drawings.
- D. Roof Mounting Curb: 350 mm high, galvanized steel, channel frame with gaskets, nailer strips. Full perimeter type for mounting under entire unit.

- E. Cabinet:
 - 1. Designed for outdoor installation with weatherproof construction.
 - 2. Panels: Constructed of galvanized steel with baked enamel finish meeting salt spray test in accordance with ASTM B117. Furnish access doors or removable access panels.
 - 3. Insulation: Factory applied to exposed vertical and horizontal panels. 50 mm thick aluminum foil faced glass fiber with edges protected from erosion.
- F. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley high efficiency motor. Motor permanently lubricated with built-in thermal overload protection.
- G. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Galvanized drain pan with piping connection. Factory leak tested under water. Furnish coil with corrosion resistant coating capable of withstanding salt spray test of 1000 hours in accordance with ASTM B117.
- H. Compressor:
 - 1. Hermetically sealed, resiliently mounted with positive lubrication, and internal motor overload protection. Furnish internal vibration isolators/external vibration isolators, and short cycle protection.
 - 2. Semi hermetic (screw) for large capacities, where efficiency of hermetic compressors are not suitable according to ARI rating standards.
- I. Refrigeration circuit: Furnish the following for each circuit, fixed orifice control, expansion device, thermal expansion valve, filter-drier, suction, discharge, and liquid line service valves with gauge ports, and high and low pressure safety controls. Dehydrate and factory charge each circuit with oil and refrigerant.
- J. Condenser:
 - 1. Coil: Copper tube aluminum fin coil assembly with subcooling rows and coil guard. Factory leak tested under water. Furnish coil with corrosion resistant coating capable of withstanding salt spray test of 1000 hours in accordance with ASTM B117.
 - 2. Condenser Fan: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Motor permanently lubricated with built-in thermal overload protection. Furnish high efficiency fan motors.
- C. Electric Heating Coil (supplementary to heat pump for winter application):
 - 1. Finned tube heating elements easily accessible with automatic reset thermal cut-out, built-in magnetic contactors, galvanized steel frame, control circuit transformer and fuse, airflow proving device, pilot duty toggle switch, load fuses. Number of stages as indicated on Drawings.
 - 2. Controls: Start supply fan before electric elements are energized and continue operating until air temperature reaches minimum setting, with switch for continuous fan operation.
- D. Air Filters: 50 mm thick glass fiber disposable media in metal frames. 25 to 30 percent efficiency based on ASHRAE 52.1.
- E. Mixed Air Casing:
 - 1. Outside Air Damper Leakage: Maximum 0.13 L/s per square meter at 250 Pa pressure differential.

2. Economizer: Factory installed fully modulating motorized outside air and return air dampers controlled by enthalpy controller with minimum position setting. Furnish rain hood with screen.

F. Controls:

1. Furnish control to provide low ambient cooling to -5 degrees C.
2. Furnish low limit thermostat in supply air to close outside air damper and stop supply fan.
3. Furnish terminal strip on unit for connection of operating controls to remote panel.
4. Thermostat: Remote space thermostat with 2 stage heating and 2 stage cooling with automatic changeover. Furnish system selector switch heat-off-cool and fan control switch auto-on.
5. Status Panel: Furnish remote panel containing the following status indications:
 - a. Cooling mode
 - b. Heating mode
 - c. Compressor 1
 - d. Compressor 2
 - e. Heating failure
 - f. Dirty filters
6. Furnish interface to Building Automation & Control System specified in Section 255000.

G. Accessories:

1. Convenience Outlet: Factory installed, 230 volt, 15 amp, GFCI type, internally mounted.
2. Roof Curb Adaptor Package: Furnish duct support hardware to adapt unit to existing roof curb.
3. Factory installed ultraviolet C light located downstream of cooling coil.

H. Capacity: As indicated on drawings.

ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: In accordance with Section 26 05 03 and as indicated on drawings.

B. Disconnect Switch: Factory mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.

5. DX DUCTED SPLIT SYSTEM AIR CONDITIONERS

A. Direct Expansion (DX) split system air conditioning units shall be installed as indicated on the drawings and shall be complete with all required refrigerant piping, temperature controls and all other necessary ancillary items.

B. The ducted split units consist of an indoor unit and an outdoor unit.

C. Outdoor unit casing shall be made of heavy gauge galvanized steel with appropriate painting finish for the maximum weatherproof protection.

D.The compressor shall be low noise, hermetically sealed, high efficiency, and refrigerant gas cooled motor. Compressor motor shall be 2 pole, permanent split capacitor type protected against both thermal and electrical overload.

E.Condenser coil shall be made of seamless copper tubes with aluminum fins.

F.Condenser fan shall be axial type mounted directly on the motor shaft and shall be selected for optimum efficiency and maximum sound power reduction, fan blades shall be made of coated steel for maximum corrosion resistance. Fan shall be statically and dynamically balanced before installation.

G.Indoor unit shall be ceiling model type designed to be concealed in ceiling space with ducted supply and free or ducted return air as shown on the drawings.

H.Indoor unit coils (evaporator coils) shall be made of seamless copper tubes with aluminum fins.

I.Indoor unit fan shall be double inlet, double width centrifugal forward curved and belt driven fan. Fan motor shall be totally enclosed fan cooled type placed on a floating base.

J.Filters placed inside the indoor unit shall be washable type easily accessible and shall cover the full unit area of re-circulated air. Air filters shall be flat with a 25 mm minimum thickness and shall be constructed of aluminum. Filter shall have a minimum efficiency of 80% when tested in accordance with BS 2831 Test Dust No. 3.

K.The coil and fan sections in the indoor unit shall be internally lined with at least 25mm fiberglass insulation.

L.Indoor unit shall be provided with a drain pan insulated on the underside and sides.

M.The units shall deliver the design cooling capacity at the external ambient specified. The units shall be suitable for continuous operation with external ambient temperature at 38°C.

N.Controls shall be factory wired and completely enclosed within the unit. All operating controls shall be located in a single area. Adjustable thermostats shall automatically cycle the compressor to maintain space conditions and the sensing element shall extend across the complete face of the cooling coil.

O.Condensate removal shall be by means of gravity drainage.

P.Gas line insulation shall be carried out using 19 mm thickness of cell, foamed plastic, tubular pipe insulation. Tape all joints to form a good vapor seal, then wrap with glass cloth and paint with two coats of approved vapor seal.

Q.The control panel shall have at least the following functions:

1. On/Off/Heat/Cool Control
2. Low/High heating and cooling control
3. Adjustable Thermostat
4. Air discharge direction control On/Off

FLOOR, WALL AND CEILING MOUNTED DX SPLIT SYSTEM AIR CONDITIONERS

Direct Expansion (DX) split system air conditioning units shall be installed as indicated on the drawings and shall be complete with all required refrigerant piping, temperature controls and all other necessary ancillary items.

The units shall deliver the design cooling capacity at the external ambient specified. The units shall be suitable for continuous operation with external ambient temperature at 38°C.

Controls shall be factory wired and completely enclosed within the unit. All operating controls shall be located in a single area. Adjustable thermostats shall automatically cycle the compressor to maintain space conditions and the sensing element shall extend across the complete face of the cooling coil.

Condensate removal shall be by means of gravity drainage.

Unit electrical power shall be 380 volts 3 phase 50 hertz. The unit shall be capable of operating within line voltage limits of +3% to -4.6%.

Evaporator and condenser coils shall be of copper tube construction with Aluminum fins and additional anti corrosion coating suitable for salty spray atmosphere.

Compressor motor shall be 2 pole, permanent split capacitor type protected against both thermal and electrical overload.

Filters shall be washable type easily accessible and shall cover the full unit area of recirculated air. Air filters may be nylon fiber, glass fiber cellular plastics material and shall have a minimum efficiency of 80% when tested in accordance with BS 2831 Test Dust No. 3.

Refrigerant stop valves which incorporate a spindle gland shall be serviceable with the valves "in situ".

Gas line insulation shall be carried out using 19 mm thickness of a cell, foamed plastic, tubular pipe insulation. Tape all joints to form a good vapor seal, then wrap with glass cloth and paint with two coats of approved vapor seal.

The evaporator/fan coil section shall be ceiling, wall or floor standing and complete with concealed control panel and finishes as indicated on the drawings.

The control panel shall have at least the following functions:

1. On/Off/Heat/Cool Control
2. Low/High heating and cooling control
3. Adjustable Thermostat
4. Air discharge direction control On/Off

Electrical Specifications

General Conditions & Requirements:

Introduction:

The following general conditions and requirements particularly related to the electrical engineering aspects of the contract.

They shall be read and interpreted in conjunction with all other sections of the specifications, the drawing schedules and all other documents forming parts of the tender package.

Coordination:

The contractor shall be responsible for all aspects of coordination necessary to ensure that the works are properly installed in accordance with the contract drawings and specifications. This shall include the interrelationship between mechanical and electrical services, the building foundations, finishes and all specialist equipment contained therein, whether supplied under this contract or not.

Coordination shall cover the programming and physical requirements of all works. The disposition of services shall be such that necessary segregation is maintained and that the completed installation affords ready access at a later date for the replacement, maintenance and extension thereof.

Equipment:

All equipment, devices and installations to be installed under this contract shall be manufactured by a worldwide well known manufacturers, and the quality of the product shall be of an approved standard.

The contractor must give full details of the manufacturer, and the manufacturers must have local representation in the country capable of supplying spare parts, and giving technical support throughout the working lives of the equipment.

The Contractor shall name each material or equipment he propose to supply for the purpose of this project, supported by all details and technical data. The Engineer reserves the right to reject any equipment.

Shop Drawings:

Important:- The contractor shall prepare ceiling coordination drawings to show the false ceiling with lighting fixtures, loud speakers, smoke detectors, grills and diffusers and access panels this coordination drawings must be submitted and approved before submitting the electrical or mechanical shop drawings.

The Contractor shall prepare shop drawings for the installation. These shall be based upon the actual equipment to be installed, selected for use by the Contractor according to manufacturer's subsequently approved by the Engineer. The Contractor shall make such adjustments to the design as are necessary to accommodate the technical and physical requirements of the selected equipment in the preparation of shop drawings.

Such adjustments shall at all items ensure that the final performance of the completed installations is achieved as intended.

Shop drawings shall be checked and coordinated with the work of all trades involved before submission for the approval of the Engineer and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings submitted without this stamp of approval may be returned to the Contractor for submission.

Drawings shall be initially submitted in the form of a reproducible print by process approved by the Engineer and accompanied by a letter of transmittal.

After return of the Engineer-approved reproducible, the Contractor will furnish the number of additional prints specified by the Engineer.

The Contractor shall submit all drawings sufficiently in advance of construction requirements to permit not less than ten working days for checking and appropriate action.

The approval of drawings will be general, but approval shall not be construed as permitting any departure from the contract requirements, nor relieving the Contractor of the responsibility for any errors, including details, dimensions, materials, etc.

Record Drawings and Materials:

Within thirty days of issue of the certificate of completion, the Contractor shall provide 3 sets of operating and maintenance instructions to be checked and approved by the Engineer. Temporary manuals and record drawings shall be made available at least one month before to enable the employer's staff to familiarize themselves with the installation.

The drawings shall comprise general arrangement drawings of all installations; detail drawings of plant rooms and similar areas; single line diagrams of all services; line diagrams of control systems; and electrical circuit diagrams.

The drawings shall indicate the color coding, labeling and identification of all the services, and shall give full working details of size, load, duty and capacity of each item of plant. The line diagrams shall indicate the type, location and function of each component and, together with the interconnecting wiring the terminal connection reference numbers or letter on the actual equipment.

The Drawings shall:

- a. Indicate sizes and positions of all plant, equipment, conduits, trunking, under-floor ducting, cable tray and cables together with all inspection points and cable joints.
- b. Indicate the circuit reference for all equipment and each outlet shown.

All references shall agree with the charts and labels in distribution boards fixed to the switch gear.

- c. Show the disposition and depth of all cables, whether buried direct in ground, drawing through ducts/manholes. The positions of cables, etc.. Shall be physically measured from permanent buildings, boundaries or other prominent features.

All changes of cable direction shall be shown.

- d. Show the position and nature of all earth electrodes installed and the range of connection copper tapes.

In addition to the record drawings, the Contractor shall obtain and provide two sets of the manufacturer's detailed drawing of all items of plant, suitably titled and with drawing reference numbers added.

The record drawings shall be specially prepared and shall not be modified working drawings. The preparation of these drawings shall proceed during the installation of the contract works, as each section is completed. To ensure that this requirement is met, the Engineer shall be allowed to inspect the drawings on request.

The operating and maintenance instructions shall be prepared as soon as the working drawings are in hand and shall take the form of a manual in which is described the layout and function of the systems, schedules of components comprising each and every item of equipment including manufacturer's name, reference and serial number and operating maintenance instruction based on the manufacturer's standard instruction simplified where necessary.

An overall maintenance schedule shall be prepared by the Contractor on a system basis, listing out in simple terms the plant, nature of attention and intervals due. This shall be cross-referenced with manufacturer's standard instructions.

The Contractor shall include for the preparation and supply of four copies of the manuals and drawings after all details have been approved by the Engineer. Also the supply of the two sets of reproducible, one set to be handed to the employer and one set to be kept with the Engineer.

Services for Testing:

All fuel, oil, gas, water and electricity for the purposes of testing and commissioning shall be provided by the Contractor up to the date of the issue of the certificate of temporary acceptance. This shall include the initial charging of all systems and equipment with water, oil and refrigerants, etc..

Tools:

On completion of the works, the Contractor shall supply the specialist tools and key, etc.. for the routine maintenance of major items of plant as recommended by the manufacturers.

Training of Building Technical Staff:

The Contractor shall provide training for the employees of the employer.

Such training shall cover all aspects of using, running, commissioning and maintenance of all Engineering services. The Contractor shall include in his price for all engineering services. The contractor shall include in his price for carrying out this training.

General Specifications:

Introduction:

This general specifications indicates the minimum standard of works, workmanship and materials necessary for the execution of the contract to the approval of the Engineer and the true intent of this specification and associated drawings.

Materials:

Important:- The contractor shall prepare the material submittals for the engineer review and approval. The items unit prices cover the preparation of the material submittal in 4 copies + CDs The engineer has the right to asked for alternative submittal for any item without clarification of the reasons.

All materials shall be as shown on the relevant drawings. The tender shall be based on materials as specified but where the Contractor, whose tender is accepted, desires to use materials differing from those described, he shall obtain the approval of the Engineer.

The Engineer reserves the right to inspects materials on site at reasonable times and to reject any materials not complying with this specifications, the cost of inspection, visits etc.. shall be covered by the Contractor.

The cost of dismantling and re-erection of installation occasioned by the removal of rejected materials shall be borne by the Contractor.

Nameplates:

All plant and equipment supplied under this contract shall, where appropriate, bear nameplates giving maker's name, date of manufacture, shop number (if any), size and type together with particulars which will aid identification for the future ordering of spare parts.

Electrical Panel Boards:

General:

The manufacturer of the electrical panel boards must be reputable, well established manufacturer with at least 10 years' experience in the manufacture of electrical panel boards of similar size and power as the panel boards required for this project. The Contractor must obtain the client's approval for the order of the electrical panel boards.

The manufacturer of the electrical panel boards should be capable of providing engineering and technical support services such as consulting and maintenance for the panel boards he had manufactured.

The electrical panel boards manufacturing plant must have a quality assurance department which relies on written procedures and regulations, in accordance with the directives of the local standards. The manufacturer would have to present a document confirming this upon the client's demand.

The manufacturer of the electrical panel boards must submit with his bid a document listing the knowledge and technology according to which the panel boards are manufactured, as well as documents which confirm that the electrical panel board chassis in accordance with the recommendations of its manufacturers.

The bid will apply to the contents of these specifications, and must take into account the manufacturing, operation and testing of the panel board at the manufacturer's plant, as well as its packing and transportation to the site, preparations for panel board storage for a period of time in excess of one year, including wrapping with polyethylene sheets if so required by the client, and its installation at the site such a time as determined by the supervisor, including connection of all circuits supplied by the panel board in question.

The manufacturer of the electrical panel boards will supply, at his own expense, all the testing equipment required in order to test the panel boards in accordance with the client's requirements.

The contractor will bear full and exclusive responsibility for the quality of planning and manufacturing of the electrical panel boards, and the client's approval wouldn't exempt him from this responsibility.

All electrical panel boards must be manufactured and tested in accordance with B.S , IEC, or DIN. standards.

Main Electrical Panel Boards & Secondary Electrical Panel Boards-Structural Requirements:

The electrical panel board will consist of a cabinet made up of galvanized, 2mm thick metal sheets, with all equipment items installed behind removal panels (dead front panel). Any changes in the switchboard structure or layout must be authorized in advance by the supervisor, or in accordance with the bill of quantities. Structural requirements are also specified in the plans/drawings for each panel board.

The electrical panel board must be constructed/ manufactured according to a modular method, including modular assembly hardware to enable the future addition of cabinets and equipment without difficulty. This modular manufacturing method must agree with the recommendations of the manufacturer of the electrical equipment regarding the necessary clearance between adjacent accessories and the switchboard chassis.

When determining the panel board dimensions, the manufacturer must take into consideration some extra space for additional equipment (25% spare space minimum), or as specified in the drawings.

Switchboard construction must permit convenient access to all panel boards equipment items as well as to instruments, etc., for such purposes as maintenance & service, repairs, etc. All panel boards must have internal panels unless otherwise specified in the bill of quantities or plans. All switchboard accessories must carry sign/indications in accordance with the panel board manufacturing plans.

Painting of electrical panel boards will be carried out in accordance with the general specifications for paint works. The top coat must be applied electrically and oven-baked. Color shade should be cream, and the minimum thickness of all paint layers must be 90 microns.

Electrical panel board structure must include panels to cover input and output pipes/conduit.

All panel boards must include proper floor-attachment facilities, and terminal panels in the top section and bottom section, in accordance with the location of the cable output.

Electrical Panel Boards Manufacturing Plans:

The drawings of the panel board plans submitted to the Contractor are principle drawings only. The Contractor (manufacturer) of the electrical switchboards must prepare detailed, manufacturing plans for all panel boards, in accordance with the aforementioned drawings, the type of panel board in question and its construction method, as listed in these specifications. These manufacturing plans must include the following:

A single-line electrical schematic of the electrical panel boards, including identifying data from the various equipment items.

A diagram of the panel board with its doors/ panels closed, and in a separate diagram, an outline of the panel board without its doors/ panels .

Structural cross-sections of the panel board from all sides, including detailed description of its structural elements (e.g. metal profile type and thickness, method of connection between the sheet-metal covers and the profiles, welding method, etc..).

A diagram of the routing of the main and secondary bus-bars, main bus-bar junctions, and the reinforcing hardware for the main and secondary bus-bars.

An accurate, detailed diagram, including dimensions, of the installation and locations of all equipment items on the panel board.

A full list of accessories, including: the name of the manufacturer and his representative in the country, part numbers of all equipment items plus their technical characteristics (e.g. breaking capacity, rated current, physical dimensions, rated voltage/ frequency, and insulation voltages).

Whenever possible, the manufacturer should accompany the plans with original catalogues and technical information as issued by the original manufacturer of the equipment, for all equipment types and items he intends to use.

Detailed cross-sections of the bus-bars, the type of insulators on which they are installed, and the clearances between them (the manufacturer should accompany the plans with catalogues of the insulators). The technical data for the cross-sections of the bus-bars and insulators will be determined by the manufacturer in accordance with the following criteria:

1- Tables of bus-bar cross-section and arrangement as function of operating current and environment temperature. The tables must be obtained from the manufacturer of the accessories installed in the panel board, or according to DIN 43671.

2- Tables or calculations of the clearances between the insulators holding the bus-bars as a function of the short-circuit current. Note that the rupturing capacity for the bus bars of the main panel boards shall be 60KA on 415V according to BS.

Panel board impermeability data according to the IP classification, in accordance with the requirements contained in the specifications, plans or bill of quantities.

The plans must include the manufacturer's specifications for the painting process of the panel board chassis, including step-by-step instructions for preparing the panel board prior to actual painting.

Approval of the Manufacturing Plans:

The plans specified in paragraph 3 above must be submitted by the Contractor for reviewing and approval by the planner. Only after the plans have been approved and all modifications and updates (if such had been required) have been introduced may the contractor begin the actual manufacturing of the panel boards. Any plans submitted for authorization with any of the details listed in paragraph 3 above missing will be returned to the contractor without having been reviewed or authorized, and the contractor will be held responsible for any delays in the work process.

Bus-Bars:

. The panel boards will contain bus-bars for phases R,S,T , neutral and ground, leaded without paint and covered by PVC shrink in the same phase color. These bus-bars shall be made of copper, and their cross-section must be compatible, thermally and mechanically, with the short-circuit currents specified in the plans, and in any case not less than 60 KA, on 415 V. for 1 section.

b. In cases of main MCCB breaker from the top or bottom sections of the switchboard, neutral and ground bus-bars will be installed at the top section or the bottom section of the switchboard (in the same side of main MCC breaker).

c. Multi-layer plastic signs carrying the appropriate written identification will be installed over the bus-bars.

Ground & Neutral Bus-bars and Terminal Panels:

Each electrical panel board will include a grounding bus-bar which would provide grounding connections for the various circuits, as well as terminals for the grounding lead which supplies the panel boards or grounds it to metal fixture.

Ditto for the neutral bus-bar and terminals.

The panel board is also include a "terminal and connection box/panel", which should enable convenient access to the terminals, and a profile for cable attachment. With each cable, conductor or wire connected to the terminals, some excess must be provided by forming a length of the cable or wire into a loop.

Grounding:

a. Grounding of the panel board chassis will be effected by welding a galvanized stud inside the panel board, to which a grounding lead from the grounding bus-bar of the panel board, will be connected by means of a cable shoes.

b. Galvanic continuity must be ensured for all parts of the panel boards. In panel board with doors a grounding bridge must be established between the panel board chassis and the doors by means of a flexible grounding lead and cable shoes.

c. In panel boards consisting of integrated modules, a grounding stud will be connected to each module separately, in order to obtain a galvanic continuity between all modules.

Accessories:**Specifications of 400V, 3-pole MCCB:**

Continuous current rating, 400V(AC) , 50Hz, 3-pole moulded case circuit breaker according to IEC 60947-2 edition 2.1 (1998-03) of 65KA rated short-circuit breaking capacities for the main MCCB (i.e. rated ultimate short-circuit breaking capacity I_{cu} = rated service short-circuit breaking capacity $I_{cs} \geq 65KA$) at the nominal voltage (400 VAC). The circuit breaker shall be

operated by toggle type handle and shall have a quick make, quick break, over center tripping handle, so that the contacts can not be held closed against short circuit currents. The tripping of the circuit breaker due to overload or short current shall be clearly indicated by the handle. The handle shall be marked on the cover of circuit breaker. All poles of the circuit breaker shall be constructed to ensure simultaneous open, close and trip operations.

(the contractor shall study the project from local electricity company and Generator supply to the last SMDB and submit the calculations shows the short circuit breaking capacity for each circuit breaker in MDBs and SMDBs and this calculations must be approved by the engineer)

The circuit breaker shall be contained with a common moulded case of high mechanical strength and dust proof.

The circuit breaker shall be designed and manufactured to carry its continuous current rating in ambient temperature of 45 degrees centigrade without exceeding the allowable temperature rise on its terminals.

a. Functionally-equivalent accessories in all panel boards must be of the same make. Installation of functionally-equivalent accessories of different makes will not be allowed.

b. Rotary switches shall be of the on-load disconnection type, with a zero position. Rotary switches must conform to IEC regarding their breaking capacity.

c. All indication lamps will be of the incandescent long life type, 230 volt, E-14 type base and resistor.

d. Air circuit breakers shall be adjustable, motorized, with the following protections:

-Instantaneous short circuit.

-Thermal over load with time delay.

-Under & over voltage protection with time delay.

-Earth fault protection with T-delay.

Circuit breaker must contain accessories as test position carriage switch, push bottom locking device, open position key lock, data transmission connection for program protection management & analyses.

g. Earth-leakage relays must conform to IEC, or BS.

h. Contactors must conform to IEC OR BS.

i. Built-in measuring instruments (gauges) for the ampere (three readings, and voltage six readings) for the main and submain panel boards shall be 72x72 mm.

All built-in measuring instruments (gauges) must be screened against electromagnetic induction, with an accuracy rate of 1.5%, and protected against short-circuit in the measured line.

j. Terminals will be made of a thermoplastic material, with a screw and pressure clamp, of the type suitable for installation characteristics.

k. When selecting the equipment and the method for installing it on the panel boards, the contractor must take into consideration an operating temperature of 40 degrees centigrade

l. Steel cable glands shall be used for panels cable entries.

m. All bus-bars shall be lead coated.

Terminals:

All connections between the various accessories of the panel board and the installation must be arranged by means of terminal lugs, with indication tags and numerated bus-bars for the neutral and ground.

Signing:

a. The contractor must arrange for the proper signing of all circuits, and match all signs with the installation in its complete state. Multi-layer plastic signs will be attached to the front of the switchboard and inside it by means of screws and in such a manner as to ensure the unequivocal identification of all components even when the protective covers have been removed. The signs will be installed after the panel board has been painted for the second time.

b. Color shades for panel board signing will be as follows:

1- Main cable input-white over a red background.

2- Outputs & accessories-white over a black background.

In addition to the aforementioned color shades, signs in different color combinations will also be prepared in order to distinguish specific areas of the panel board. These color combinations will be co-ordinate with the manufacturer of the electrical panel boards before any of the circuits and accessories have been sign-posted.

c. At the top part of the panel boards, a sign will be installed which would indicate the panel board name (designation), number and supply source.

Another sign will be installed on the side of the panel boards, which would contain the name, address and telephone number of the panel boards manufacturer.

Panel Board Schematics:

Each panel board will contain a pouch with a drawing, which is to include an electrical schematic and the panel board structural plan.

Proper Location:

The contractor must check the locations where the panel boards are to be installed. He must also ensure that the panel boards are compatible with the locations where they are to be installed.

Installations in the Building:**Piping/Cable Conduits:**

PVC and UPVC pipes/cable conduit shall be manufactured in accordance with the latest issue of local standard. All piping/cable conduit for the electrical and communication installation shall be of the heavy, bendable, self-extinguishing type.

In any event, all piping/cable conduit installations must be co-ordinate with the installation of the air-conditioning piping and ductwork, work pipes, sewage pipes, etc.

All steel conduits shall be of the heavy gauge screwed welded steel type.

All steel conduit accessories shall be of the malleable iron. Each length of conduit shall bear the manufacturer's name of trade mark and all conduit and accessories shall comply in all respects with zinc, or aluminum based alloy finish conduits or accessories be permitted.

All steel conduit boxes shall to BESA gauge and shall be malleable iron with malleable cast covers fixed with bases screws. Elbows and tees, inspection or solid types shall not normally be allowed, but where conditions warrant the use of these fittings the Contractor shall apply to the Engineer for permission to use them.

All conduits shall be of sufficient size to permit the easy withdrawal and replacement of cables at a later date, no conduit smaller than 20mm shall be used.

Cable Tray:

Cable tray is made of galvanized steel sheets 2mm thick, punched before galvanizing with rectangular holes. A tray cover made of same sheets but without holes fixed properly on tray top side by pressing (without screws). Tray is made of equal units which can be jointed together easily. Length of one piece of tray (2-3 mt).

Tray is fixed on walls by steel angles with roll plugs and able to carry the cable trays plus all cables as drawings, spacing between supports shall be calculated to carry a load 80 Kg/mt of cable tray. All trays fittings are included in tray unit price.

Unit price shall include the tray, the tray cover, steel angles with roll plugs.

Electrical Wires/Cables-General:

As specified in drawings and B.O.Q

Wiring by Means of Cables Drawn into Conduit or Cable Tray:

shall be complete and inspected by the Engineer. Any conduit rejected by the Engineer shall be changed at the Contractor's own expense to the Engineer's satisfaction.

In the event of any protective insulation being damaged whilst cables are being drawn into conduit, the whole of the particular length concerned must be replaced by contractor at his own expense.

Conductors smaller than 1.5 mm² shall not be used. All wiring of multi point sub-circuit shall be carried out in the "Loop-in System" and no joints or connectors, other than those required for the connection of special fittings and other that may be particularly mentioned in the scheme shall be allowed. On all A.C. supplies care must be taken to ensure that both feed and return are contained in the same conduit and that every single pole switch and circuit breakers must be

Cable Terminations:

Unless otherwise specified, all cable terminations shall be in suitable sealing boxes and comply with the proceeding clause where applicable.

Conductor Terminations:

All conductor ends terminating on bolted terminals shall terminate in hydraulically crimped lugs which shall be attached in the manner recommended by the manufacturer. The manufacturer's design shall be used.

Conductor Identification:

The cores of insulated cables shall be identified throughout their length by color in accordance with the I.E.E. regulations.

The cores of armored cables may be identified by means of numbers in accordance with B.S.5467. The numbers 1,2 and 3 shall signify live conductors and the number 0 the neutral conductor.

The cores of flexible cords shall be colored throughout as applicable as follows:

Red for phase or outgoing conductor.

Black for neutral or return conductor.

Green/Yellow for earthed conductor.

Identification of switch boards bus bars and/or connections to individual phases or poles shall be coloring in accordance with the I.E.E. regulations.

On A.C. system, the phase sequence shall be maintained throughout the installation and all phase connections shall be in the order Red, Yellow, Blue from the top to the bottom and/or left to right.

Neutral connections, links and/or bus bars shall always be located above, below or to the side of the phase connections, links or bus bars. The particular phase connected to fuse banks and bus bars shall be clearly indicated by marking with the appropriate color.

Cables forming special circuits, such as extra low voltage circuits for bells and fire alarm etc., shall be distinctively colored or marked, but the colors shall be different from any of those specified for other purposes in the I.E.E. regulations.

Earthing and Earth Bonding:

Earthing and earth bonding shall be carried out strictly in accordance with the requirements of the local electricity supply authority, the I.E.E. regulations and B.S.C.P. 1013.

Where an armored cable enters any piece of apparatus it shall be connected to the housing i.e., by means of an approved type armor clamp and gland capable of effecting a good electrical bond between both the armoring and metal sheath of the cable and apparatus. The clamps shall grip the armoring firmly to the gland or casting so that no undue stress is caused by any ground movement. The gland shall be brass or gunmetal and be capable of being jointed to the sheath of the cable by a "Plumbed Joints" or a lead cone compressed type fixing onto the sheath of the cable.

Lighting Switches and Double Pole Switches:

Lighting switches shall be of the types and sizes specified on drawings and as follows:

-Lighting switches and double pole switches shall be of moulded type.

- All lighting switches and double pole switches shall be tough, impact resistant construction together with innovative design and high performance and safety.

-Where several switches on different phases occur at one position each switch shall be provided

with an internal warning plate indicating the maximum voltage present and suitable phase barriers.

The arrangement of switches in ganged boxes shall be similar in plant to the lighting points which they control. Switches not so arranged shall be engraved to indicate the circuits controlled.

Power Outlet Sockets :

General service power outlet sockets shall be of types and ratings as specified in drawings, bell of quantities.

- All outlet sockets 3-pin, switched, and fitted with shutters to prevent danger to personnel. They shall comply with B.S.1363. Special care shall be taken to ensure the correct polarity of the phase terminals and that socket outlets connected to different phases are spaced at least 2.0m apart.

-Power outlet sockets shall be of moulded range .

- All outlet power sockets shall be tough, impact resistant construction together with innovative design and high performance and safety.

TV Outlet Sockets:

- TV outlet sockets shall be single gang, coaxial TV socket outlet.

- All TV and satellite outlet sockets shall be tough, impact resistant construction together with innovative design and high performance and safety.

Luminaries:

The Interior lighting points will comprise the following as a minimum.

- A. Embedded, ceiling mounted lighting points shall be used.
- B. Lighting installations will be of PVC embedded conduits.
- C. PVC conduits will be of heavy gauge type and with size not less than 20mm.
- D. The maximum number of PVC wires inside the PVC conduits will be such that a free space of 40% of the PVC size will be provided.
- E. High class 2.5 mm² stranded copper, PVC insulated, 450/750 Volts wires will be used for lighting circuits (P+ N+E).
- F. Separate protective device (breaker) will be used for each circuit.
- G. Each lighting circuit comprises number of lighting points based upon the rating of the protection miniature circuit breaker (MCB).
- H. Galvanized steel conduits will be used in exposed installation.
- I. rupturing capacity
- J. It is strictly forbidden to feed lighting circuits from a socket outlet circuit, and visa versa.
- K. Draw boxes and covers, lighting fixtures, distribution boards etc. and anything else is needed to be fixed on the walls or the ceiling will be fixed by plastic sphenoid and zinc plated self tapping hardened steel (zsh) screws. The use of wooden sphenoid or wired is strictly forbidden.

LED Lamps:

- LED lamps shall fulfill the following requirements :
 1. CRI greater than 80% .
 2. Lumens/W to be selected by luminaire unit .
 3. Lamps life hour time to be (50,000 h@L80) .
 4. Pure UGR less than 19 .
 5. Power factor greater than 0.95 .
 6. Color tolerance: less than 3 mac adam steps .
 7. Color temp not less than 2500K .
 8. Complete warranty : 5 years .

-Emergency Exit signs

- The module shall be a 3 hours, maintained type, sealed with rechargeable Nickel - Cadmium battery ,Charger/inverter unit shall have red LED charger monitor.
- Directional arrows on Exit lights shall be as shown on drawings and in accordance with local Civil Defense Department requirements.

Mains Voltage	- 230V +6% or -10%
Mains Frequency	- 50Hz
Power consumption	- 7.5W/9VA
Insulation Class	- 1
Battery	- 9.66V/4Ah
Re-charge Period	- 24 hr.
Approvals	- BSI/IEC 598-2-22
Lamps	-LED lamps 7W .

Mounting and Fixings:

Fixing to block work shall be made in the building blocks and not in the bond. If it is not possible to make all the fixings in the block work then the requirement shall be positioned to enable the upper fixings to be made in the block work.

Wood screws shall be sheradized and greased before use. Machine thread screws shall be solid brass and greased before use.

Heavy equipment shall not be fixed by plugs or shot fixings without the written approval of the Engineer. Approved purpose made clamp brackets, rag bolts or patent fixing bolts shall normally be used. Exterior fixing shall b galvanized or similarly protected.

The supply and fixing of all supports, brackets, clamps and spacer and any other steel works which may be required for the proper and effective fixing of any equipment shall be deemed to be included.

The drilling, welding to, or cutting of, steel works (structural or otherwise) shall be avoided. If such drilling, welding or cutting appears essential, the Contractor must first obtain the approval of the Engineer, before such work is undertaken.

Painting:

The contractor shall include for painting of equipment supplied by him under this contract. This shall include all bare metals and painted equipment whose finish is damaged or scratched. All rust must be completely removed and a suitable rust inhibiting primer applied prior to application of the final finish shall be similar to the original manufacturers, or in the case of site

Site Testing, Commissioning, Client Instruction and Handover Of Engineering Services:

01. The Contractor shall test, regulate, commission and test to work all installations and instruct the users representative in the correct methods of options, regulation and maintenance procedures.

The Contractor shall supervise all testing etc..., and provide labor, tools, scaffolding, test equipment, fuel, water, electricity and all other items needed to complete the installation including testing and commissioning.

Notice prior to testing:

The contractor shall give the Engineer seven days written notice of his intention to carry out a test and shall have carried out all necessary adjustment prior to commencing the test.

Witnessing of procedures:

The testing and commissioning procedures will be witnessed by the Engineer/Employers representative and record documents shall be provided for signature of the witnessing Engineer. Dates for these tests shall be included on the programs document and any dates that the Contractor wishes to revise shall be agreed with the witnessing Engineer not less than seven days prior to the programmed date.

Submittals:

Four (No.4) copies of all testing and commissioning documentation shall be submitted in bound covers indicated as follows:

a. Certificates:

1. Equipment test certificates.
2. System (s) test certificates.

b. Data sheets and record manuals.

1. Data sheets of test equipment to be used.
2. Full commissioning and testing data presented on approved record forms for all systems and equipment.

c. Drawings.

1. Equipment detail drawings for equipment.
2. Circuit diagrams for each system with design and actual flow rates and other pertinent data shown.

d. Record forms:

1. Specimen copies of all commissioning record forms shall be submitted for approval of their use on this project.
2. Forms shall be size A4 paper for loose leaf binding, with blanks for listing of the required test ratings and for certification of report.

Instrument:

A.1. All necessary instruments for commissioning and testing as defined in the CIBS codes and this specification, shall be included.

A.2. All instruments shall have been calibrated within a period of six months and carry a certificate of calibration to that effect. The instruments shall be selected to provide an accuracy compatible with the readings to be taken and tolerances specified.

A.3. The accuracy of the instruments shall be demonstrated to the authorized representative and the use thereof shall be subject to his approval.

B. Test instruments shall be available for use to obtain the readings and recorded data required, and shall include but not limited to the following:

1. Temperature and humidity:

a. Electronic thermometers.

2. Rotational speeds:

a. Direct read out electronic digital tachometer.

b. Revolution counter and stop watch.

3. Sound Levels:

a. Sound spectrum analyzer.

4. Electrical:

a. Ammeters.

b. Voltmeters.

c. Multi-meters.

5. Vibration:

a. Accelerometer.

Commissioning:

When testing has been completed satisfactorily commissioning procedures and setting to work shall commence.

a. Setting to work.

b. Balancing and Regulating to meet design parameters.

c. Check that the values obtained compare satisfactory with the design values.

d. Make final adjustment before demonstrating to the owner that the systems operate correctly and that integration of each installation into the whole building installation has been achieved and that all systems operate efficiently and satisfactorily.

Seasonal testing and commissioning:

It may be possible due to seasonal variations in temperature, humidity and occupational demands to test all systems under appropriate test conditions. Outstanding procedure arising from these shall be recorded and a date agreed during the subsequent period of 12 months when such procedures shall be carried out.

Performance tests:

a. Carry out and supervise the operation of the commissioned insulations for such a period as necessary to satisfactory evaluate and demonstrate to the authorized representative, the

performance of the installations by use of measuring and recording instruments that the installations function correctly and maintain the required conditions within the specified limits.

b. Provide artificial loads as required for the purpose of simulating internal and external loads.

C. During the trial period, plant and building conditions shall be checked and monitored, all necessary adjustment made and recorded on final report sheets.

During the trial period, provide training to the clients nominated staff in the operation of the plant.

No test trial shall be carried out while conditions are abnormal.

Provide the Engineer with 14 days clear notice of proposed commencement date of performance tests.

Test results:

The results of all test carried out shall be recorded and where appropriate the signature of the engineer included. Test result sheets should indicate the date of the test, the name of the test engineer and witnessing offer and details of the test including:

Type of test.

System under test.

Area or section being tested.

Results obtained.

Comments.

Duplicate copies of all test results sheets shall be sent to the engineer/employers representative within seven days of the test date and copies shall be included in the final handover documentation.

10. Equipment cards:

temperatures, pressures, amperes, voltage, power consumption flow rates, resistances, etc. Check out cards shall be standard 12.5 mm x 20 mm stiff index cards enclosed in a clear film card folder, securely attached to equipment, or wall in immediate area.

Telephone System:

Telephone boxes:

It shall be made of galvanized steel, 2mm thick, epoxy painted with gray color, surface mounted with suitable knockouts, it shall have a lockable door, telephone terminal connectors shall be fixed in rows inside the box, capacity as shown in drawings and BOQ.

Telephone points comprises:

a. 25mm diameter rigid and heavy gauge conduits, with PVC socket box 7x7 cm, PVC conduit fittings, pull boxes as needed. Note that more than one cable can pass through one conduit Ø 25mm(see drawings).

b. Two pair telephone cable (Ø0.6mm), telephone point starts from floor telephone box up to the telephone socket without connection, even in draw boxes.

Telephone outlet socket (RJ11), one or two gang as shown on drawings and mentioned in B.O.Q.

- All telephone socket outlets shall be tough, impact resistant construction together with

innovative design and high performance and safety.

- Telephone outlet sockets shall be of moulded type.

Data points comprises:

a. 25mm diameter rigid and heavy gauge conduits, with PVC socket box 7x7 cm, PVC conduit fittings, pull boxes as needed. Note that more than one cable can pass through one conduit Ø 25mm(see drawings).

b. four pair UTP CAT 6 data cable. Data point starts from floor data box up to the data socket without cut/joints, even in draw boxes.

c. Data outlet socket (RJ45), one or two gang as shown on drawings and mentioned in B.O.Q.

d. All data socket outlets shall be tough, impact resistant construction together with innovative design and high performance and safety.

e. Data outlet sockets shall be of moulded type.

Special Specifications:

Introduction:

This particular specification shall be read in conjunction with the drawings, schedules and all other Documents forming part of the tender documents.

Lighting Fixtures:

Description of the work:

The work required in this section includes the supply of the fixture, installation, connections, testing, commissioning, and setting to work of the complete and fully operational general lighting installations.

Luminaries location and types are shown on drawings and as described in luminary schedule.

Lighting circuits shall be wired from related panel boards as shown on drawings.

All light fixtures shall comply with provisions of the codes, specifications and standards outlined in this section, except as otherwise specified or shown, and comply with local building code requirements if more stringent than before mentioned.

The following documents shall be submitted for approval to the supervisor Engineer:

- a. Photometric data with shop drawings for all types of lighting fixtures.
- b. Ballast schedule with lighting fixture shop drawing indicating manufacturer and type of ballast with the suitable recommended capacitor to raise the power factor to at least 0.9.
- c. Sample shall be submitted for final approval.

1. Fixture body:

It shall be made of 0.7mm Zinc coated steel sheet folded (except for operation theater all fixture body must be made of 0.7mm Stainless steel sheets and shall be IP-65), finishing with powder coated film of white color (unless mentioned else). The shallow depth of fixture body facilitates installation directly into situations, in case of restricted ceiling void would otherwise present problems, fixture shallow depth shall be in accordance.

The power factor shall be corrected to at least 0.9, via a dry film capacitor. The switch gear shall be pre-wired to a three way plug and socket which allows for looped 2.5mm² wires.

2. Lamps:

- a. LED light lamps shall be 230 v with lamp socket E27.
- b. Other types of Lamps as specified in luminaire specifications.
- c. Other types of Lamps as specified in luminaire specifications.

Emergency Backup Light Kit (Battery):

1-Tubular Lead acid or gel type VRLA battery should conform to latest BIS standards. A copy of the test certificate for the battery (including its make, country of origin and model number) used in the system should be provided to the test center.

2-At least 75 % of the rated capacity of the battery should be between fully charged & load cut-off conditions

3-The battery will have a minimum rating of 24V, 40Ah (at C/10) discharge rate.

Socket Outlet Types: -

1- One gang (3-pin) 13 A, switched socket outlet.

a- One gang (3-pin), switched socket outlet without pilot light.(normal source)

Normally all receptacles shall be three pin with Bakelite cover plate, or as indicated on drawings or bills of quantities, fixed to rigid PVC black box 7x7 cm. Depth of box shall depend on the

drawings. When ever receptacle or socket outlet is mentioned in the BOQ. It means the receptacle and the plug as one item, together with feeding point.

b- One gang (3-pin), switched socket outlet with pilot light.(emergency source).

c. - One gang (3-pin), switched socket outlet with out pilot lamp with engraved UPS in red. (UPS source).

It shall be as mentioned before but with pilot red light.

2-Two gang. (3-pin), 13A switched socket outlet:-

a- Two gang (3-pin), switched socket outlet without pilot light. .(normal source)

Plate cover and socket box shall be as specified before.

b - Two gang (3-pin), switched socket outlet with pilot light. .(emergency source).

It shall be as mentioned before but with pilot red light.

c - Two gang (3-pin), switched socket outlet with out pilot lamp with engraved UPS in red. (UPS source).

It shall be as mentioned before but with pilot red light.

3- 20A. Two pole & earth receptacles, with pilot light.

1- Plate cover and socket box shall be as specified before. Rating of contacts 20A.

2- Ditto but with 6mt. Flex outlet cable cord. Cover shall have a circular knock out with rubber sealing ring for the outgoing feeding cable to the load.

4- Water proof receptacle.

It shall be seal splash proof, switched and with pilot light. The dust and water proofing shall be IP54 when plug is inserted in receptacle. Receptacle shall be semi-flush with wall

5- Water tight Plug, Socket, and Connector (Industrial type), IP67:

1- 2P+E.

2- 3P+N+E.

6- (3-pole Isolators).

It shall be of high rupturing capacity 20KA. On 415v. According to BS. degree of weather protection (IP 65).

Power feeding circuits

7-Feeding Circuit for AC units.

a-For Indoor installations:-

Feeding point comprises the followings:-

1-PVC conduits, conduits accessories, boxes.

2-PVC insulated copper wires or cables as per drawings, from related consumer panel board.

3-PVC conduits from AHU. Or FCU. To Thermostat(for control wires).

b- For outdoor installations (eg. On roof top):-

Feeding point comprises the followings:-

1-PVC conduits, conduits accessories, boxes.

2-Cable tray with cover.

3- PVC insulated copper cables as per drawings, from related consumer panel board or MCC.

4- PVC conduits from AHU. Or FCU. To Thermostat (for control wires).

8-Feeding Circuit for BHUs,

Feeding point comprises the followings:-

1-PVC conduits, conduits accessories, boxes.

2-PVC insulated copper wires or cables as per drawings, from related consumer panel board.

9-Feeding Circuit water tap outlets.

1-PVC conduits, conduits accessories, boxes.

2- PVC insulated copper wires or cables as per drawings, from related lighting point to tap transformer and tap.

10-Feeding Circuit for Exhaust or Supply fans.

a-For Wall mounted fans:-

Feeding point comprises the followings:-

1- PVC conduits, conduits accessories, boxes.

2- PVC insulated copper wires or cables as per drawings, from nearby lighting point.

3- Isolating switch.

4- Temper box.

b- For outdoor installations (eg. On roof top) mounted on duct:-

Feeding point comprises the followings:-

1- PVC conduits, conduits accessories, boxes.

2-Cable tray with cover.

3- PVC insulated copper cables as per drawings, from related consumer panel board or MCC.

4- PVC control wires or cables.

Fire Alarm System:

General Description

The Contractor shall supply, install, test and commission a fire alarm system (analogue addressable) comprising of a main fire alarm control panel, detectors, alarms, wiring ... etc.

The fire alarm equipment and installation shall comply with the following Standards: -

CDD Civil Defiance Department

NFPA

System of Operation

Operation of an analogue addressable detector or break glass call point shall signal to the main panel to indicate the loop, detector, etc. in which the signal was originated, an LED display shall be provided in the main panel.

Upon receipt of an alarm signal, the sounders through the system shall sound for 5 seconds in the loop zone where the call originated shall sound continuously. In other loops the processor shall be programmable so that for each alarm signal the sounder shall remain silent (after the first 5 second pulse) or shall sound intermittently one second on five seconds off. The alarm

alarm it should go general.

Provision shall be made at the main panel to silence the alarms but the visual indication shall remain until the system is reset. A further call shall not be inhibited whilst the sounders have been silenced.

Provision shall also be provided at the main panel to operate the alarm sounders in any loop to indicate that the area should be evacuated.

Operation of an analogue addressable detector in a lift motor room shall provide a signal to the particular lift or lifts associated with the motor room and dispatch the car to the ground floor.

The repeater panels (if applicable) shall incorporate a LED display and shall indicate for each loop on the system the name of the loop where an alarm call has originated.

Alarm calls shall be relayed to the Local Civil Defense Department by an auto dial machine with recorded message via a dedicated telephone line.

System of Wiring

Fire alarm wiring shall be completely segregated from any other system.

All cables associated with the fire alarm installation shall be fire resistant copper cables with a red PVC oversheath. Joints in cables shall be made only at accessories unless otherwise agreed with the Engineer when the joint box shall be detailed on record drawings.

All wiring shall be fire resistant and comply with NFPA. Sensing loops wires shall not be less than 1.5mm² and 2.5mm² for alarm loops.

Equipment shall all be connected on a two wire fully maintained closed circuit. Fire alarm cables shall be installed in galvanized steel conduits concealed in the building fabric except in plant rooms and service where a surface installation shall be provided.

Main Control Panel (MFACP)

The main control panel shall be an analogue addressable type panel.

The panel shall be flush mounted in a polycarbonate or sheet metallic box with epoxy powder finish. The panel shall comply with EMC requirements (electromagnetic compatibility).

Digital codes shall be incorporated to allow on site reprogramming and isolation of inputs and outputs. All programming shall be possible on site.

The panel shall be complete with a battery and charger unit. SLA free maintenance for 48 hour in normal operation and 1 hour in general alarm.

The panel and associated equipment shall have capacity for all alarm and fault signals required in the Contract and shall be capable of future upgrading to serve a 15% extension of the project.

MFACP shall contain a microprocessor-based central processing unit (CPU). It shall communicate with & control the following types of equipment used to make up the system: intelligent detectors, addressable modules, transponders, local & remote operator terminals, printers, annunciators, alarm system, and other system controlled devices.

MFACP shall perform the following functions: -

Supervise and monitor all intelligent/addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.

Supervise all initiating signalling and notification circuits throughout the facility by way of connection to transponders.

Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.

terminal, panel display, and annunciators.

Operation:

MFACP shall include a full featured operator interface control and annunciation panel, which shall include a liquid crystal display (LCD), individual, color coded system status LEDs, and an alpha-numeric keypad for field programming.

All programming or editing of the existing programming in the system shall be achieved without special equipment or interrupting the alarm monitoring functions of the fire alarm control panel.

The system shall include alarm annunciating system utilizing distributed sounders such that loss of operation by the MFACP will not result in the loss of alarm signal throughout the project.

MFACP shall be capable of providing the following features:-

Block acknowledge for trouble conditions

Rate charger control

Control by-time (delay, pulse, time of day, etc.)

Automatic Day/Night sensitivity adjust (high/low)

Device blink control (turn of detector LED strobe)

Environmental drift compensation (selectable ON or OFF)

Smoke detector pre-alarm indication at control panel.

Smoke detector sensitivity test

System status reports

Alarm verification, by device, with tally

Multiple printer interface

Multiple CRT display interface

Non-fire alarm module reporting

Automatic detector test

Programmable trouble reminder

Upload/download system database to PC computer

Smoke detector maintenance alert

Security monitor point

Alpha-numeric pager interface

On-line or off-line programming

Central Processing Unit (CPU)

MFACP shall include a central processing unit. The CPU shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the CPU.

The CPU shall contain and execute all control-by-event interlock for specific local and network action to be taken if an alarm condition is detected by the system. Control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

The central processing unit shall also provide a real-time clock for time annotation of all system displays. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

Break Glass Contacts

Break-glass contacts unit shall be analogue addressable type and shall be flush mounted. It shall have a plastic coated glass cover, which can be broken without the use of a hammer and incorporate a key operated test facility.

Fire Alarm Detectors

All detectors shall be of analogue addressable type suitable for mounting to a common back base and connected to a two wire circuit.

Heat detectors shall generally be designed to operation on "rate of rise" and a fixed temperature 57°C. Where heat detectors are installed in kitchens, plant spaces etc., where rapid temperature changes may occur they shall be fixed temperature type set for 85°C. Rate-of rise shall operate between temperature rise 8.25°C to 13.5°C.

Smoke detectors shall be photo-optical type. They shall incorporate green LED's to indicate that the unit is operational. Smoke and heat detectors shall incorporate red LED's to indicate when the unit is in "alarm" state.

Where detectors are located in inaccessible positions, a remote indicator light shall be provided to illuminate when the unit is in an alarm condition. This shall be engraved (Fire detector in.).

All programming and setting should be done from the FACP or the base of detector.

All fire alarm detectors shall have built in short circuit isolator.

All required interface modules shall be provided for mech. Duct smoke detectors, transfer, tc.

Alarm Unit

a. Sounders/flasher

Alarm sounders/flasher shall be connected through an analogue addressable modular and mounted directly over a flush conduit box at 500 mm. below ceiling level and clearly labeled "Fire Alarm".

Sounders shall be the electronic type with an output of approximately 103 dBA with a distinctive tone. Sounders for installation outdoors shall be weatherproof. Sounders shall have different selectable tones.

Operating and Maintenance Manuals

Upon practical completion of the Works, the Contractor shall furnish to the Employer Four copies of a Maintenance Manual relating to equipment and plant forming the Works.

The Manual shall be loose-leaf type International A4 size with stiff covers. It may be in several volumes and must be subdivided into sections, each section covering one engineering service

system. It shall have ready means of reference and a detailed index.

The manual shall contain full operating and maintenance instructions for each item of equipment, plant and apparatus set out in a form dealing systematically with each system. It shall include as may be applicable to the Works the following and any other items listed in the text of the Specification herein after:

- a. System description.
- b. Switch operation.
- c. Procedure for Fault Finding.
- d. Emergency Procedures.
- e. Maintenance and Servicing Periods and Procedures.
- f. Schematic and Wiring Diagrams of Apparatus.
- g. Record Drawings, true to scale, reduced to International A-4 size.
- h. List of Primary and Secondary Spares.

The manual is to be specially prepared for the Works, and Manufacturers' standard descriptive literature and plant operating instruction cards will not be accepted for inclusion unless exceptionally approved by the Engineer.

The Contractor shall, however, affix such cards, if suitable, adjacent to plant and apparatus. One spare set of all such cards shall be furnished to the Employer.

Operation, spare-parts, general instructions and safety instructions etc. manuals as well as all technical catalogues, wiring diagrams, drawings and sketches etc. to be submitted by the contractor to the Engineer for approval.

Testing and commissioning

The contractor shall perform all tests required by international standards, the local regulations and manufacturer's recommendations.

Test on insulation and continuity as mentioned in the above rules and regulations shall be carried out by the Contractor on the completed installation, as well as all running tests for insulation.

The expenses for the above tests shall be included in the tender.

All tests must be carried out in the presence of the Engineer or such other person appointed for this purpose, but the Contractor alone will be responsible to the authorities as to the installations' compliance with rules and regulations.

The Contractor shall provide precise instruments and all labor for testing. Test results shall be submitted to the Engineer within 14 days of the test, and the Contractor shall issue the Certificate upon completion, as required under the above referred regulations.

Any defects, faults or omissions of the installations made apparent by such test shall be corrected by the Contractor at his own expense.

Power supplies needed for all tests shall be provided by the Contractor.

Test certificate including factory test procedure for all equipment shall be submitted to the Engineer afterwards.

Partial and spot tests on Site shall be carried out during the execution of the Works according to the Engineer's recommendations. In addition the contractor shall perform his own partial and final tests.

Final tests should be carried out in the presence of the Engineer, upon the completion of the

works. The Contractor must submit to the Engineer a detailed test procedure and time schedule for the test.

The contractor shall provided and establish a regular testing method and procedure. The contractor shall provide training for employees of the client, which shall cover all aspects of the system including but not limited to using, running, commissioning, and maintenance. etc.

Uninterruptible Power Supply (UPS)

PRODUCTS

ON-LINE UNINTERRUPTIBLE POWER SUPPLY

- A. Product Description: On Line Uninterruptible Power Supply with reverse transfer.
- B. System Ratings and Operating Characteristics:
 1. System Continuous Rating: As indicated in BOQ and drawings, such rating shall be considered as a full load for 30 minutes over entire battery voltage range at specified power factor. Maintain output voltage within specified limits at load from full load to no-load.
 2. The UPS input power shall be as follow:
 - a-Voltage: 230/400V, A.C., 3 phase, 4 wire □ 10%
 - b- Frequency: 50 Hz. □ 4%
 - c. Maximum short circuit current: 25KA.
 3. The UPS out put power characteristics shall be as follows :
 - a. Voltage : 400V, A.C. 3 phase, 4 wire (□ 1% for balanced loads)
 - b. Frequency : 50 Hz. □ 0.5% synchronized to by-pass line.
 - c. Voltage adjustment : 0.05% maximum.
 - d. Harmonic voltage : 5% RMS maximum
 - e. RMS current into fault : 150% of rated full load minimum.
 - f. Sustained short circuit time : 1 second minimum
 - g. rating : as indicated on drawings and B.O.Q for 30 minutes full load.
 4. The UPS unit shall be suitable for continuous operation at 10-40□C ambient temperature.
 5. The UPS system shall be guaranteed against faulty and improper materials and workmanship for a period of two years from date of final

acceptance except that the batteries shall be guaranteed for ten years to deliver minimum 80% of its rated capacity.

6. The UPS system shall be inspected and tested to demonstrate achievement of system objectives.

Main UPS Cubicle

The UPS system cubicle shall consist of but not be limited to the following major components :

1. Rectifier/battery charger: The rectifier/charger shall be totally solid state, complete with isolation transformer, rectifier bridge and D.C. filter to deliver regulated and filtered D.C. power to a static frequency inverter, and to the batteries.
2. Static inverter : The silicon solid state static inverter shall be capable of accepting the output of the rectifier/charger or emergency battery and providing an A.C. output.
3. Maintenance by-pass system, to permit direct connection of the critical load to the incoming power line, by passing and isolating the entire UPS and its static by-pass transfer system. The maintenance by-pass and isolation breakers shall be both electrically and mechanically interlocked to prevent interruption of service to the critical load due to improper operation.
4. Instruments : The following switchboard type instruments shall be provided, including current transformers as required:
 - a. D.C. voltmeter and ammeter for measuring D.C. bus volts and battery charge/discharge current.
 - b. A.C. voltmeter and ammeter with switch for measuring input and output phase voltages, line to line, line to neutral and current in each of the input and output phases.
 - c. Frequency meter to measure UPS input and output frequency.
5. Alarm indicators : A visual and audible alarm shall be provided for any fault which occurs in UPS.
6. Controls : The following controls shall be provided in the UPS system:
 - a. Primary Input circuit breaker.
 - b. Reserve circuit breaker.
 - c. Battery input circuit breaker.
 - d. Inverter operate switch.
 - e. Static switch transfer test pushbutton.

f. Indicator test/reset switch.

C. Design:

1. Designed for capacity expansion by addition of parallel modules in field with minimum downtime.
2. Rectifier/Charger Capacity: Sufficient to supply full load to inverter while recharging fully-discharged battery to 95 percent of full capacity in four hours or less; and within input current limits specified.
3. Furnish means for on-line testing of UPS, including test points to allow adjusting and servicing. Furnish means for testing static switch while load is bypassed to utility.
4. Mean Time Between Failures: 60,000hours, minimum.
5. Cooling: forced air cooled unit and ambient temperature of 25 degrees C or lower.
6. Operate battery floating, isolated from UPS AC input and AC output. Furnish battery resistance grounded through 5,000 - 10,000 ohms for purpose of ground fault sensing.
7. Do not use continuous moving parts or electron tubes. Accomplish power switching using semiconductor devices.
8. Construct equipment so each power component capable of replacement without soldering iron or special tools.
9. Use front-panel removable plug-in control modules.

D. Controls:

1. AC input circuit breaker.
2. "Inverter operate" switch to initiate inverter operation.
3. "Inverter standby" switch to cause inverter to cease operation
4. "Static switch transfer" switch to permit manual actuation of static transfer switch.
5. "Static switch lock-out" switch to inhibit automatic retransfer of load to inverter.
6. Battery charge timer.
7. "Indicator test" switch.
8. Static switch preferred input circuit breaker
9. Static switch output circuit breaker
10. Static switch bypass circuit breaker.
11. Controls for maintenance bypass switch.

E. Indicators:

1. "Inverter synchronized to utility."
2. "Load connected to utility."
3. "Static transfer switch inhibited."
4. "High/low DC voltage."
5. "Over temperature."
6. "Inverter output overload."

F. Meters: Use 1percent accuracy meters to indicate the following:

1. Rectifier/charger DC voltage and current.
2. Utility, inverter output, and load AC voltage.
3. Load AC current.
4. Inverter output and utility frequency.
5. UPS output watts.

G. Wall-mounted Alarm Panel: Flush mounted annunciator panel with the following monitoring and alarm functions:

1. "Utility power available."
2. "Utility bypass power available."

3. "Inverter output available."
4. "Inverter synchronized to utility."
5. "Load connected to inverter output."
6. "Load connected to utility bypass power (alarm)."
7. "Static transfer switch inhibited (alarm)."
8. "High/low DC voltage (alarm)."
9. "Over temperature (alarm)."
10. "Inverter output overload (alarm)."
11. Audible alarm (sounds when any of above alarm conditions occur).
12. Alarm/indicator "silence/test" switch.

H. Fabrication:

1. Electroplate brackets and securing hardware with corrosion resistant material. Secure bolts, studs and nuts with lock washers.
 2. Identify internal wiring at each end of conductor. Furnish cabinet grounding lug.
3. Conversion Equipment Enclosure: NEMA 250, Type 1 enclosure allowing access from front for servicing adjustments and connections. Access through hinged door equipped with tumbler lock and latch handle. Equip cabinet for fork truck lifting.
4. Equip air inlet with permanent type filters and pressurize cabinet, or use gaskets around door and panel openings to prevent entry of dirt.
5. Cabinet finish: Primed and painted inside and outside with suitable semi-gloss enamel.

BATTERY

- A. Storage Battery: Lead acid heavy duty industrial battery, designed for auxiliary power service. Furnish battery with impact resistant plastic case. Furnish cells with explosion proof vents, clear containers, and ample space for plate growth without stressing container and cover.
- B. Ampere-Hour Rating: Sized in accordance with IEC-285 or BS6260.
- C. Battery Racks: Maximum of three tier, entirely steel construction, with plastic insulating rails at points of contact with battery case. Paint racks with acid resistant paint.