SUPPLY, INSTALL, TEST, COMMISSION AND HAND OVER OF

ELECTRICAL WORK RELATED TO OFFICES IN ZONE 3 – SHUWAIKH SITE

TECHNICAL SPECIFICATIONS
FOR
ELECTRICAL WORKS

Contents:

SECTION -1
GENERAL CONDITIONS

1. GENERAL:

1.1 Specifications described hereunder are in brief. Therefore, the contractor must take into consideration all the equipment, materials, labor, etc. needed for the complete installation to ensure best workmanship and operating conditions as project requirement, whether detailed in the document and BOQ or not. The contractor must price all the above in the BOQ including any extra work, and if the contractor does not mention the extra work in BOQ, they are obliged to achieve work without any additional charges.

1.2 All electrical works shall conform to the regulations governing electrical installation works issued by MEW latest issue. Contractor to do the electrical work must be at least grade 3 CTC and should submit compliance sheet with the technical and financial offer and must be authorized from KSE.

1.3 Approval of design, material, equipment, systems, layout, etc., does not relieve the contractor from his contractual obligations if later on found that they do not comply with the specification requirements/standards/codes or an error occurred. The Contractor shall then undertake the necessary work to repair the error or replace the materials at his expense without any claims. Contractors may also be asked to attach manufacturer certificates for materials as confirmation for complying with the standards/codes mentioned in this document.

1.4 The tenderers should visit and inspect the site to familiarize themself with the existing dimensions, BOQ, site conditions and **MOI engineer notes/instructions** at tender stage prior to submitting the tender, for no claim for lack of knowledge will be considered after the tender.

1.5 If found any additional either electrical works or materials are required to complete the works satisfactory but not mentioned in the specifications or BOQ, the contractor shall be responsible to supply and execute the additional without any claims. This also takes place during warrantee period.

1.6 Tenderers participated should submit with offers original catalogues giving full details for materials (breakers, sockets, light fittings, data systems, fire alarm systems, etc). Failing to comply with foregoing does mean cancellation of the offer.

1.7 The contractor should adhere to the Materials offered in his tender documents, the contractor is not allowed to change the materials offered and should make sure during tender stage that the materials offered can be obtained within the period of the tender. MOI will not entertain any claims at a later stage.

1.8 The contractor should prepare the necessary **design drawings** for the project facilities and offices including new and **existing** electrical work, architectures and dimensions and submit them to MOI engineer for approval within 2week from the date of handing over the site, No installation works shall be permitted to commence, before approval of the SHOP DRAWINGS by Moi engineer and the electrical sub-contractor. That also include LUX design and calculations (via latest version of DIALUX) before installations of light fittings. And voltage drop calculations (via excel file) for cables. Light fittings work also includes the installation of decorative light strips wherever moi engineer points to.

1.9 The contractor must study the suggested design layout and the number of offices and an overview of the project's furniture and facilities. To then determine, with the MOI engineer approval, the types and quantities of materials to be installed to put the project in most satisfying condition (e.g locations of floor box plug sockets). The design shall be based on the table of requirements as minimum. in accordance of MEW codes. for each respective item.

1.10 Contractor must point out the latest trend in the project systems and subject to MOI engineer approval. All materials should be new, best of their kind and latest technology. Samples of materials must be submitted for approval before supply. MOI has right to instruct the contractor to test and operate the material to be delivered in site before approval.

1.11 All electrical work required as per instructed MOI engineer and related to the HVAC work, fire alarm systems, CCTV, card readers, telephone and data systems should be done by the contractor, the work include supply, install all and maintenance of all materials required to put those systems in perfect working condition. The contractor MUST supply and install conduits related to those systems even if they are going to be done in the future.

1.12 The contractor must ensure that a qualified engineer of the respective field, who is authorized by KSE, supervises all the works. The engineer must be available at site during the ministry working hours and emergency hours as well as during the warrantee period.

1.13 Specifications and BOQ complete each other. The contractor should consider the two as one document. A clause-by-clause statement confirmation shall be submitted along with the offer and it is a must.

1.14 Contractor shall complete all electrical work (and civil work related to electrical work) include any modification which is required on existing DB's and MSBs breakers and busbars, cable trays and their routes. It also includes (if required) supplying, installing, terminating, and connecting new boards, new breakers, new cables and accessories fed from or feeding to them. And the re-distribution of existing loads.

1.15 Contractor must coordinate the work with all other contractors in the site (mechanical contractor, and civil contractor, fire alarm, data systems, etc) and work in parallel with them to deliver the project in most satisfying condition. This also include civil work to improve the overall view of the installations. Civil work includes (but not limited to) painting, decorating, framing, cutting, covering the area surrounding the installations. The contractor must mention the price of the above work in the BOQ as they are responsible for their cost, labor and materials.

1.16 Low voltage systems done by the contractor must be separated from each other's such that a dedicated Telephone system with its own panels, conduits, and accessories are separated from

the Data System's racks and accessories. Similarly with other systems such as fire alarm, CCTV, card readers, etc. However, if directed by MOI engineer, and any of those systems must be connected with the existing MOI systems whether directly or by fiber optics, regardless of the distance, it is the responsibility of the contractor to also design, supply and install the accessories needed with their cost and coordination to link the new systems with the existing systems. This includes the provision of all conduits, switches, racks, and associated accessories and programming needed.

1.17 Telephone system must be able to operate in analogue, digital (isdn) and IP Telephone and also can be linked with MOI existing Telephone system. Data system must contain Cisco switches and SPFs and linked with MOI systems via fiber optics or any other method. The contractor is responsible for the cost, labor and materials of all the work mentioned above.

1.18 The contractor shall ensure cleanliness and safety of the site all through the execution of the project and shall remove all waste materials. No scarp material shall be allowed to accumulate on site, removal of such material shall be carried out at short intervals to avoid mishap, accident or inconvenience to site users. If the contractor fails to clean the site off such waste debris within 48 hours being notified, the Ministry reserves the rights to carry out the necessary cleaning works and charge the contractor without accepting any claims.

1.19 MOI has the right to contact at least 3 different references of a contractor to acquire END USER feedback. Feedback may be for the contactor, their sub-contractors or even the materials submitted in the offer. Feedback will account into the evaluation of bidder offer regardless of pricing. Bidder urged to include in submittal any proof of excellence or good practice from ministries or governmental authorities (MINIMUM 3).

1.20 Workshop and spare parts in store must be equivalent to amount of maintenance work with MOI right to visit bidder premises to verify. All documents to be attached with tender. The Ministry reserves the right to make inspection visits to all company's facilities or the suppliers of the suggested materials.

1.21 If existing nearby MSBs do not have spares or the project's loads are higher than those MSBs ratings, the contractor must design supply install and commission all electrical work to supply the systems from existing LT-panels or any available supply that the MOI engineer points to, regardless of the distance and without any extra cost. The contractor is not allowed to cut power supply in any of the site without the permission of MOI engineer and the arrangement with other departments.

1.21 As Built Drawings:

Upon completion of all works involved the following drawings:

A. Three Copies of the complete works shall be submitted A1 size.

B. "As- Built" drawings AutoCAD and PDF with 2 DVD discs.

1.22 Completion Period:

The successful tenderer shall supply, install, test, commission, and hand over in perfect condition all electrical works involved in this tender in a maximum period of 150 days, from the date of receiving the site. A project Timeline showing all materials and completion of BOQ dates must be submitted by the contractor in the first week of handling the site. The timeline must be subject to MOI engineer modifications and approval. Failing to follow the dates of the timeline is not acceptable. User manuals / instructions manuals to all systems such as fire alarm, data, telephone, etc must be provided after completion. Training to MOI workers must be provided to familiarize themselves with the new installations in normal operations and emergency operations. Also, Labels on cables, DBs, panels and loads must be put to identify them and/or where they are fed from/feeding to.

1.23 Guarantee & Maintenance:

The contractor shall be responsible for guarantee and maintenance of all the installed systems and equipment for 2 years from the date of issuing the final acceptance certificate. The contractor shall be responsible for supplying all the spare parts needed during the maintenance period.

If, during the guarantee and maintenance period, the contractor fails to respond to any

necessary repair calls by MOI within 24 hours after being notified by fax, the ministry reserves the right to execute the repairs under full responsibility from the contractor and charge the contractor the cost of the repairs without accepting any claims from the contractor's side.

SCOPE OF WORKS

The work shall involve but not be limited to the following items, as the successful tenderer shall do all the necessary works to complete the job even if it is not mentioned in the specification or BOQ.

2.1 Preparation of Designs / Shop / as-built drawings for all electrical work systems to meet the documents requirements and submit to MOI Engineer for approval.

2.2 Disconnect, dismantle and transfer to ministry stores, any old, unwanted electrical installations (DBs, cables, wires, conduits, trunky, and switch sockets…….etc.). The dismantling and removal work include areas in ground and first floor electrical rooms where old cables are located.

2.3 Design, supply, install, connect and commission 3 Nos, 10-way TPN RCBO type Distribution boards DBs (2 DB power 1 DB light). The DBs must have 20% spare breakers and must be installed in the first-floor electrical room feeding all the first-floor installations. Fed from existing 400A and/or 300A MSBs in the Ground Floor, this work also includes the supply and install of a newly designed MCCBs inside the existing MSBs and new cabling work.

2.4 Design, Supply, install, and connect all types of Light fixtures and their Wiring accessories for all project site and rooms. The work includes wires, PVC conduits, GI/PVC conduits, boxes, light switches, accessories……etc.). The contractor shall design LUX calculations to then confirm the number of light fittings needed for the project. Samples of light fittings must be installed in the site first and then approved by MOI engineer before the delivery of the rest of the quantity.

2.5 Supply, install, terminate and connect all project's Cables & Wires. The work includes all earthing systems, cable trays and related accessories (cables can be resized to bigger cables regarding voltage drop calculation which should be submitted by electrical contractor). This work also includes redistribution of old cables between MSB1 and MSB2 to the old loads.

2.6 Design, Supply, install, terminate and connect number AS PER DESIGNED twin switch sockets feeding the rooms and partitions' workstations. The contractor is responsible to propose a design, and coordinate with the furniture supplier, to then determine the number and type of plug sockets (e.g wall mounted or floor box) needed and fit them within the furniture. This work should also include sockets for non-workstations (such as kitchen, internet switches, corridors, etc). All this work must include wires, conduits, trunking, skirting system and all accessories required.

2.7 Design and install Telephone system infrastructure on the first floor which includes installing pipe works and wall outlets for future telephone system.

2.8 Design and install Data System infrastructure on the first floor which includes installing pipe works and wall outlets for future data system.

TECHNICAL DATA

SECTION EL-02 / CONDUITS

PART 1 - GENERAL

1.01 GENERAL REFERENCE

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

B. Coordinate the work with all other services affecting the work of this Section.

1.02 DESCRIPTION OF WORK

A. This Section to include all supply, installation and commissioning of all conduit works in accordance with the Specifications.

B. General

1. Light and power circuits, fire alarm, telephone, signal, and other low voltage system wiring and cables feeding equipment and distribution boards shall be drawn in conduits unless otherwise indicated.

2. Conduit system shall generally be concealed and installed as indicated.

3. Normal light power circuits, emergency light and power circuits, fire alarm wiring, telephone wiring, signal wiring and low voltage system wiring shall each be run in separate conduit and wire way.

4. Cables insulated for two different categories of voltage shall be segregated irrespective of service.

5. Conduit and fittings used shall be:

a. Where embedded: heavy gauge rigid PVC.

b. Where surface mounted, exposed conduit; galvanized steel (GI)

c. Where installed for remote indication panels to data center room: galvanized steel (GI).

d. All conduits under raised floor: galvanized steel (GI)

1.04 QUALITY ASSURANCE

A. Applicable Standards referred to in this Section:

1. British Standard Specifications:

a. BS-731: Part 1 Flexible steel conduit and adaptors for the protection of electric cable.

b. BS-4607 : Part 1 Non-metallic conduits and fittings for electrical installations : Rigid PVC conduits and conduit fittings, Metric Units.

c. BS-4568 : Steel Conduits and fittings, metric units.

d. BS-2782 : Method of Testing and Plastics.

1.05 SUBMITTALS

A. Samples

Cut-away samples of all sizes of conduits, conduit boxes and fittings of each type shall be fixed to a board and submitted to the Engineer.

B. Product Data

At the time of submitting samples, submit manufacturer's details, catalogues and copies of test certificates confirming that offered types comply with the Specifications.

C. Shop Drawings

Submit drawings of proposed conduit layout and obtain approval before commencing work.

PART 2 PRODUCTS

1.01 RIGID PVC CONDUIT AND FITTINGS:

A. Physical Properties

1. PVC Conduit shall be high impact, non-hygroscopic, rigid PVC, unthreaded push type. Conduit and conduit fittings shall be in accordance with BS-4607 and CEE Publication 26. This conduit and conduit fittings shall be suitable for installation at temperature - 5°C to +85°C and they shall not soften or suffer any degradation at these temperatures, conduit and conduit fittings shall be self-extinguishing type.

2. All joints shall be made with proper fittings and by using sealing cement (Vinyl Solvent Paint) to ensure a watertight joint. The cement shall be of a type that remains in a sticky condition.

3. Rigid PVC conduits and conduit fittings shall be fully suitable for installation; storage or transport temperatures encountered in Kuwait and at this temperature the material shall not soften or suffer any structural degradation.

4. All PVC conduit and conduit fittings shall be suitably marked and identified by the Manufacturer. Conduits used throughout the Project shall be of one manufacturer. Marking on the Conduit shall include the nominal size. All markings shall be indelible and easy legible.

5. The inside and outside surfaces of conduits shall be smooth and free from burrs, flash and other similar defects.

6. The interior and ends of conduit fittings shall have no sharp edges and surfaces and corners over which the cables are likely to be drawn shall be smooth and well rounded.

7. The conduit entries of fittings shall be so designed that reliable water tight joint can be made between the conduit and fitting. It shall be constructed in such a way that it will be possible to bend the conduit easily with the aid of a simple tool eg. bending spring.

B. Nominal sizes and dimensions

1. Rigid PVC conduits shall be of one of the following nominal sizes 20, 25, 38 and 50mm dia rigid PVC slip type coupler and coupling bends shall be of the same nominal sizes as the conduits and shall fit to the conduits properly.

2. Where size is not indicated, select in accordance with the Regulations and as a function of the number and size of conductors.

C. PVC Conduit Boxes

1. PVC Conduit Boxes shall be used throughout PVC conduit raceway system and shall comply with BS-4607.

2. All boxes shall be provided with tapped brass inserts for fixing the screws.

3. All boxes for switches, sockets, outlets, etc. shall be rigid PVC and their dimensions shall be suitable for fixing the switches, sockets and other accessories.

2.02 RIGID STEEL CONDUIT & FITTINGS

A. Rigid Steel Conduit

1. All metallic conduits shall comply with BS-4568 Part I rigid steel screwed type having an interior and exterior zinc coating of uniform quality and appearance throughout all surfaces.
2. Conduits shall not be less than 20mm diameter size, and shall be complete with all necessary threaded fittings, couplings and connecting devices having galvanized equivalent finish.
3. Conduits and fittings shall be manufactured specially for electric wiring proposed. When manufactured by a continuous weld process, weld heads both inside and outside the tube shall be completely removed prior to galvanizing.
4. All conduits and fitting shall be free from rust or other defects on delivery to the site and shall be properly stored in covered racking so that it is protected from mechanical damage and damage by weather and water whilst stored on the site.
5. All conduits shall be coupled to boxes and trunking wire ways using brass male bushes. All such bushes shall be hexagon headed heavy duty long threaded type.
6. All conduit expansion couplings used shall be fabricated from material equal or equivalent to that of the conduit with which the coupling is to be used, having factory installed packing ring and pressure ring to prevent entrance and moisture. All couplings shall be equipped with earthing ring or earthing conductor.
7. All conduit runs shall be fixed using space bar pattern saddles giving not less than 3mm clearance between the conduit and the surface to which it is fixed. Saddles shall have finish to match the conduit and saddle clips shall be secured to the bar by means of brass screws.

B. Metallic Conduit Boxes

1. Metallic Conduit Boxes shall be used throughout metallic conduit raceway systems, and shall comply with, or be of demonstrated equivalent quality and performance to BS-4568 requirements. All boxes and covers shall be galvanized, zinc plated or equal rustproofed finish equivalent to conduit finish.
2. Circular and/or rectangular boxes shall be used for pull boxes and terminating boxes, according to size and number of conduits connected to box. Boxes shall be either malleable iron or heavy duty steel construction with welded joints and tapped holes to receive metal threaded cover retaining screws. Self-tapping screws will not be permitted.
3. All boxes, other than those to which a fitting or accessory is to be directly mounted shall be fitted with covers screwed to the box by brass screws. Malleable iron covers shall be used with malleable iron boxes and heavy gauge covers shall be used with sheet steel boxes.
4. All cover and accessory fixing provisions shall be so positioned that the fixing screws lie completely clear or cables entering the box. All fixing screws shall be brass.
5. All boxes installed in interior locations, plant rooms, ducts etc., shall be fitted with approved type gaskets to provide a waterproof seal between box and cover or other items fitted to the box.
6. All boxes provided as junction boxes where cable joints are specified or permitted, shall be provided with fixed terminal blocks. Such boxes shall be suitable size to contain the terminal block and sufficient cable to allow neat connections to be made. The terminal blocks shall be fixed to the box by brass screws and shall comprise conductor connectors,

with brass clamping screws enclosed in porcelain or other heat resisting insulation material which will not distort or otherwise have its properties damaged by temperatures below the highest temperature at which the insulation of any cable connected to it is destroyed.

2.03 FLEXIBLE CONDUIT AND CONNECTIONS

A. Flexible Conduit:

1. Flexible conduit shall be to BS-731, Part 1, water tight, PVC sheathed, spiraled metal type. The conduit shall be terminated at boxes and equipment by means of approved compression glands.
2. Flexible conduit shall be of the unpacked type for normal atmospheric conditions and asbestos packed for damp situations. Adaptors shall be of the solid type.
3. Flexible conduit shall be used for the final connection of rigid conduit to the terminal boxes of machines, fitted with a means of drive adjustment and/or where vibrations is likely to occur.

B. Flexible Connections

1. Where connections to electrical machines are to be by multicore cable, the final termination shall be by ring type universal glands and locknuts, and adequate slack cable in the form of a loop or spiral being left to allow for the movement of motors necessitated by belt re-tensioning, vibration, etc.

PART 3 EXECUTIONS

3.01 PREPARATION

Sets and Bends

1. Conduits up to 32mm diameter: form on site with the bending machines using proper formers, guides, springs, etc. taking care not to deform conduit.
2. Conduits over 32mm diameter: using coupling fittings.

3.02 INSTALLATION OF CONDUIT

A. General

1. Run conduit in square, symmetrical lines, parallel to or at right angles to walls and in accordance with the accepted practice.
2. Conduit systems shall be mechanically continuous and watertight after installation. All conduit system shall be arranged wherever possible to be self-draining
3. .Conduit runs between draw-in positions shall not have more than two 90° bends, or the equivalent, length of such runs shall not exceed 10m.
4. Installation shall permit easy drawing in of cables.
5. Keep conduits at least 100mm from pipes and other nonelectrical services.
6. Where conduit runs are to be concealed in the structure or are to pass through floor slabs, the Contractor shall be responsible for making the accurate positions of all chases and holes on site. The Contractor shall provide dimensioned drawings as directed by the Engineer to enable a check to be made of all holes and chases. The Contractor shall arrange the conduit routing to make maximum use of any preformed conduit holes and slots provided in structural beams. Conduit installation on shear walls shall be kept to a minimum. All routing necessary on shear walls shall be agreed with the Engineer before work is put in hand.
7. Install conduits so as not to interfere with ceiling inserts, lights or ventilation outlets.

B. Runs in Reinforced Concrete.

1. Obtain approval for placing steel sleeves before pouring concrete.

2. Run conduits in concrete slabs parallel to main reinforcing steel.

3. Additional openings in finished slabs, where approved, shall be made by drilling, not by breaking.

C. Horizontal or Cross Runs

1. To be avoided in partitions and side walls.

D. Surface mounted conduit (including conduit installed above false ceiling).

1. Fix with distance spacing saddles to allow conduits to be taken directly into accessories without bends or sets.

E. Concealed Conduit

1. Fix securely to prevent movement before casting of concrete and screeds, application of plaster and the like.

2. Spacing of clips shall be not greater than as follows:

Conduit Size Spacing Up to 25mm 600mm

38mm 900mm, 50mm 1000mm

3. Supports for exposed conduit shall be fixed at each side of bends.

F. Expansion Fittings

Fix in conduit wherever it crosses an expansion joint in the structure to which it is fixed.

G. Terminations

1. Make with a flanged coupling, lead washer and hexagonal male brass bush, where conduit runs terminate in cable trunking, distribution boards or any sheet metal structure.

H. Conduit Boxes

1. Fix at all outlet points.

3.03 INSTALLATION OF FLEXIBLE CONDUIT

A. All conduits must be secured to outlet, boxes, junction boxes or cabinets by placing locknuts on outside of box and locknuts and bushings on the inside of box.

B. Conduits connecting recessed fixtures and their adjacent junction boxes must be flexible metallic conduit 20mm minimum size and shall be of sufficient length to permit the dropping of the fixture below the ceiling to gain access to the junction box.

C. Conduit to motors shall be terminated in the conduit fittings on the motors, the final connection being made with liquid tight flexible conduit and suitable liquid tight connectors.

D. A green insulated 4mm² (minimum) tinned copper earth connection shall be made between the solid conduit or cable sheath and the equipment, the copper cable being run inside the flexible conduit. Couplings fitted to removable covers or non-metallic equipment etc. Where changes to flexible conduits occur, a watertight outlet box with threaded entries shall be inserted and the earth connection made to an internal terminal. The cover screws shall not be used for earthing connections.

3.04 SEALING

A. The conduit outlets when installed and before wiring shall be temporarily closed by means of well-fitting wooden plugs, and immediately before cables are drawn in, conduit systems shall be thoroughly swabbed out until they are dry and clean.

3.05 TEST AND INSPECTION

Test shall be performed at the manufacturer's plant in accordance with BS-2782, BS-4607 and BS-4568.

The manufacturer shall submit the test report to the purchaser for approval.

END OF SECTION

3. SECTION EL-03 / TRUNKING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

B. Coordinate the work with all other services affecting the work of this Section.

1.02 DESCRIPTION OF WORK

A. The Contractor shall supply, install and complete trunking as design drawings and specified in this Section.

1.04 REFERENCE STANDARDS

A. BS-729 : Hot dip galvanized coating on iron & steel articles.

B. BS-2989 : Hot dip zinc coated sheet steel coil.

C. BS-3382 : Part 2 - Zinc or steel components.

D. BS-4678 : Part 1 - Steel surface trunking

1.05 SUBMITTALS

A. Samples:

1. Submit samples of trunking, service boxes, junction boxes etc.

B. Product Data:

1. At the time of submitting samples submit manufacturer's details, catalogues etc.

C. Shop Drawings:

1. Submit drawings showing exact route of trunking system and obtain approval before commencing work.

PART 2 PRODUCTS

2.01 UNDER RAISED FLOOR CABLE TRUNKING

A. General:

1. Trunking, associated parts and accessories shall be fabricated from hot dipped galvanized sheet steel not less than 16 SWG.

2. Trunking shall be supplied in 3m lengths each length complete with lid, coupler and coupler screws and shall provide adequate earth continuity throughout the whole trunking run.

3. To be complete with necessary fittings and accessories. All fixing materials shall also be of galvanized sheet steel of 1mm thickness.

4. Trunking shall not be smaller than the minimum size stated on the drawings or specified later and shall be so sized that a space factor of 40% is not exceeded. The Contractor shall check the minimum size of trunking specified is large enough for his requirements without exceeding this space factor.

B. Trunking and Connectors:

1. To be BS-4678 : Part 1, but thickness of metal for body and cover material may exceed those in Table 1.

2. Metal thickness for trunking and connectors exceeding 150x150mm external dimensions shall be to approval and shall not less than that specified in BS-4678 : Part 1 for the largest trunking detailed.

3. Finish

a. For internal use: Class 3 heavy protection internally and externally (e.g galvanized steel to BS-2989 Class 2A or 2Bprotection to BS-4678: Part 1).

b. For external use: Class 3 protection.

4. Lids shall be lipped and fixed at regular intervals not exceeding 2m or straight runs, by quick release cum type fasteners.

5. Metal partitions shall be at least 1mm thick, finished to same standard as trunking. The means of fixing partitions shall prevent them being misplaced and shall not cause long term corrosion or electrolytic action.

6. Connectors shall span the complete internal surface of the trunking. Trunking sections shall have butt joints.

C. Bonding links and fastenings.

1. To satisfy continuity conditions of BS-4678.

2. Shall not cause electrolytic corrosion.

D. Braided Copper Tape

1. To be 15x2mm having a resistance from fixing to fixing equal to or less than the links used in standard trunking joints.

E. Steel Screws and Fasteners

1. To have a zinc coating finish to BS-729 or BS-3382 : Part 2, or equivalent.

2. Fixings used for securing or fitting shall not cause long term corrosion or electrolytic action. Black screws are not acceptable.

3. Brackets: mild steel angle or channel finished to same standard as trunking.

F. Vertical Trunking

1. To have cable support units with insulated pins at not exceeding 3m centers.

G. Horizontal Trunking

1.Sizes exceeding 100x50mm shall have cable separators with insulated pins at not exceeding 2m centers.

PART 3 EXECUTION

3.01 INSTALLATION

1. Trunking

a. Fixing Trunking:

1. Trunking shall be properly aligned, and securely fixed at not exceeding 2m centers on straight runs. At bends, angles and offsets fix with additional fixing at not exceeding 150mm centers on each side of the fitting.

b. Settlement and Expansion Joints.

1. Make a trunking joint where trunking crosses such joints.

2. Make connection through slotted holes allowing a 10mm movement horizontally and vertically.

3. Earth continuity link across joints shall be braided copper tape which is long enough to allow for the maximum movement of trunking. Fold braid ends.

c. Fire Barriers:

1. Install non-combustible, non-metallic fire barriers:

a. Where trunking passes through walls, floors and ceilings;

b. At each floor level when trunking is installed in riser ducts.

d. Connections:

1. Make connections to conduits, multiple boxes, switchgear and distribution boards with flanged units.

e. Cable Retaining Straps

1. Fix at not exceeding 1m centers.

2. Inscreed System

The structural floor slabs on which the underfloor ductings and boxes are to be laid must be reasonably level and smooth. Humps and protruding cement must be hacked to level to ensure the ductings being laid will maintain the minimum screed thicknesss of 25mm over the ducting. For screed thickness less than 25mm over the ducting BRC 0.8mm gauge x 12mm square wire mesh shall be laid over the ducting before screeding to prevent screed cracking. Mark out floor slab where junction and service outlet boxes are to be laid. Ducting shall be laid in straight lines between points of junction boxes and parallel to known base lines on each floor. Changes in direction of ducting shall be made with junction boxes. Use steel fixing clips to secure the ducting on to the floor slab prior to screeding. The intervals between two saddle shall not exceed a maximum of 2 meters.

All joints in ducts and terminations of ducts in junction boxes/vertical access boxes shall be made water-tight with approved type sealing compound and precautions shall be exercised during construction to prevent damage to the duct system and to ensure that the ducts and vertical boxes are free of water, dirt, debris or any other obstruction which may impede and/or damage the cables during pulling-in. Junction and service outlet boxes shall be properly covered with the disposable screeding lids approximately leveled and taped to ensure no cement gets into the boxes during screeding. The frames and traps must be installed after the screeding and while the floor finishing are laid, to ensure the traps and accessories are clean after handover. The traps should now be adjusted to flush with the finished floor. Wires should now be threaded through the ductings and boxes and all accessory plate and accessories must be installed.

3.02 CLEANING AND ADJUSTMENT

1. Make good cutting and damages, remove burrs and rough edges and corrosion and treat with a rust proofing agent, followed by an application of zinc epoxy.

2. Class 2 finishes shall receive a coat of paint to match adjacent surfaces following the zinc epoxy.

3.03 TEST AND INSPECTION

Test shall be performed at the manufacturer's plant in accordance with BS-729, BS-2989, BS-3382 and BS-4678.The manufacture shall submit the test report to the purchaser for approval.

END OF SECTION

SECTION EL-04 / CABLE TRAYS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

B. Coordinate the work with all other services affecting the work of this Section.

1.02 DESCRIPTION OF WORK

A. Provide all labour, materials, equipment, services and accessories necessary to furnish an install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. General provisions for Electrical work - Section EL-01.

B. Conduits - Section EL-02.

C. Wires and Cables - Section EL-05.

1.04 REFERENCE STANDARDS

A. BS-729 hot dip galvanized coating on iron and steel articles.

1.05 QUALITY ASSURANCE

Select the correct grade of cable tray to meet the Specification and site conditions.

1.06 SUBMITTALS

A. Reference Section EL-01.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and products in a manner to prevent damage.

1.08 COORDINATION

The work of this Section shall be completely coordinated with the work of other services.

PART 2 PRODUCTS

2.01 GENERAL

A. The cable tray system shall be of one manufacturer and shall include factory-made trays, tray fittings, connectors and necessary accessories and supports to form a complete cable tray support system.

B. The cable tray system shall include the following factory-made tray elements:

1. Straight cable trays and ladders.
2. Fittings as horizontal and vertical bends of various angles, crosses, trees, wyes, reducers, vertical riser elements.
3. Connectors
4. All necessary fixing accessories

C. Manufacturer's standard accessories shall be used and site fabrication shall only be allowed where special sections are required subject to the approval of the Engineer.

D. Horizontal run of cables laid on cable tray and exposed to direct sunlight on roof shall be provided with fixed asbestos cement covering at higher level to allow for ventilation. Cable tray shall be raised 15cm from finished floor level.

2.02 MATERIALS

A. The whole of the tray work, trays, fittings, and supports shall be of mild steel hot dipped galvanized after manufacture. The thickness of the protective sheath on any element shall not be less than 55 microns.

B. Cable trays shall be constructed from mild steel of minimum thickness of 1.5mm. Trays in excess of 300mm width shall be of minimum thickness of 2mm.

C. Insert elements, bolts, screws, pins, etc., shall be mild steel cadmium plated.

D. Tray work shall have oval perforations. Ladder type trays shall be used where specified or approved by the Engineer.

E. All trays (straight and fittings) to be welded construction and be a heavy duty returned flanged, perforated type, unless specified otherwise.

F. Tray components are to be accurately rolled or formed to close tolerances and all edges rounded. Flanges are to have full around smooth edges.

G. Ladder racks shall be of similar construction. The rungs shall be spaced at maximum 300mm. The system shall allow for installing additional rungs and for resisting rungs.

H. When light-duty trays are permitted, flanges shall be a minimum of 25mm deep. For all other trays, flanges shall be a minimum of 50mm deep, unless otherwise specified.

I. Cable tray width and radius of curved sections shall be selected to suit the number of cables as shown on drawings and to the approval of the Engineer.

3.01 INSTALLATION

A. Drilling, machining or cutting shall not be carried out after application of protective coat, unless previously agreed by the Engineer. If cutting or drilling is necessary, edges shall be cleaned up and painted with zinc based paint before erection.

B. Installation of vertical runs of tray along the line of vertical expansion joints in structure of the building shall not be allowed.

C. Cables shall be fixed to the trays by means of PVC covered saddles or straps secured with brass or cadmium plated bolts, nuts and washers.

3.02 ERECTION

A. Cable trays arranged one above the other shall have spacing in relation to their width not exceeding a ratio of 1:2 with a minimum distance of 150mm.

B. Supports

Install fixings and supports.

a) At 1000mm centers.

b) 150mm from bends, tees, intersections and riser.
c) As close as practicable to joints.

d) Each side of expansion joints.
C. The cable trays, shall be fixed in accordance with site conditions and manufacturer's recommendations.
D. Join cable tray and accessories in accordance with manufacture's recommendations.
E. Avoid mid-span joints
F. The Contractor shall submit, as required all calculations relating to tray work and tray supports demonstrating acceptable mechanical stresses and sag.

3.03 EARTHING

A. Cable trays and accessories shall be electrically and mechanically continuous throughout their length.
B. The entire cable tray system shall be bonded and 12mm x 2.5mm tinned copper or brass links shall be bolted across each joint in the system by means of brass nut and bolts, complete with flat and spring washers.
C. All cable trays shall be provided with earth continuity copper tape along the whole route of cable trays and to be bonded to the main earthing system of the building.

3.04 TEST AND INSPECTION

Test shall be performed at the manufacturer's plant in accordance with BS-729.The manufacturer shall submit the test report to the purchaser for approval.

END OF SECTION

SECTION EL-05 / WIRES & CABLES

PART 1 - GENERAL

1.01 GENERAL REFERENCE

A. The work of this section is integral with the whole of the contract documents and is not intended to be interpreted outside that context.
B. Coordinate the work with all other services affecting the work of this section.

1.02 DESCRIPTION OF WORK

A. This section to include all labours, materials and accessories for the complete performance of all wires and cables system in accordance with the specification.

1.04 APPLICABLE STANDARDS REFERRED IN THIS SECTION

A. Cables and wires shall comply with the following standards as appropriate.
1. BS 6004 IEC 227 : PVC insulated cables (nonarmoured) for Electrical Power and Lighting.
2. BS 6346 : PVC insulated cables for Electrical Supply.
3. BS 6746 : PVC insulation and sheaths
4. BS 5467 IEC 502 : Armored cables with thermosetting insulation.

5. BS 6480, 6007 : Lead Sheathed Cables
6. BS 5468 IEC 502 : Cross linked polyethylene Insulation
7. BS 6500 IEC 227 : Insulated Flexible Cords.
8. BS 6207 IEC 245 : Part-1 Mineral Insulated Cables
9. BS 6360 : Copper Conductors for Cables
10. BS 6234 : Polyethylene Insulation and Sheath for Cables.
11. BS 2897 : Aluminum Strip Armored for Cables
12. BS 1442 : Galvanized Mild Steel wire for Armouring Cables.

B. Cable termination shall comply with the following specifications:

1. BS 4121 : Mechanical cable glands.
2. BS 4579 : Performance of Mechanical and Compression Joints for cables.
3. BS 6081 : Termination of M.I.C.C. Cables.
4. BS 6121 : Mechanical Cable Glands for Elastomer and Plastic Insulated Cables.

1.05 QUALITY ASSURANCE

1. For cables to be Engineered by the Contractor determine the correct size based on current rating and/or voltage drop, as relevant, after taking into consideration.

(a) Type of Cable and Wire
(b) Ambient Conditions
(c) Method of Installation
(d) The disposition of each cable relative to other cables.

2. Calculate voltage drop and current ratings based on information given in MEW regulations or IEE Regulations, whichever is more stringent.
3. All cables and wires shall be suitable for installation and continuous services in the ambient conditions described in section EL-01.
4. Unless otherwise specified, cables and wires of the following specified voltage ratings shall be used as indicated.

a. 600/1000V rated cables: Main and sub-main distribution panels.
b. 450/750V rated cables: Final sub-circuit supplies from lighting, socket outlets…….etc.
c. 250V rated cables : Extra low voltage wiring, communication circuits where the maximum voltage is 50V.
d. All multicore cables shall be 600/1000V rated.

1.06 SUBMITTALS

A. Shop Drawings and Product Data 1. Submit full technical details of each type of cable or wire proposed.

2. Submit copy of test certificates from the manufacturer or an independent testing authority confirming that cables comply with the specifications.
3. Submit exact route of the cable run and relevant sections in the shop drawings.

1.07 PRODUCTS DELIVERY, STORAGE AND HANDLING

A. Reference Section EL-01.

B. Each drum length of cable shall be allotted a distinct and separate reference number. This number shall appear on the test certificates covering the respective length of cable and shall also be clearly marked on the cable drum.

C. The Contractor shall advise the Engineer upon delivery to site of each drum length, quoting the reference number, the test certificates shall be handed to the Engineer for examination and approval.

D. All cables shall be delivered to site with the manufacturer's seals, labels or other proof of origin intact. These labels and seals shall not be removed until the cable is required for use and shall be retained for inspection by the Engineer.

E. The Contractor shall be responsible for the off-loading and handling of the cables on site, and shall ensure that cables are delivered to site on drums and properly protected against mechanical damage. Where lengths are cut from cables, the open cable ends shall be sealed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS FOR ENVIRONMENTAL CONDITIONS

A. The contractor shall be aware of the need to supply and install all wire and cables for this contract which are most suitable for the special environmental conditions prevailing in Kuwait.

B. All conductors shall have good fatigue resistance and not subject to breaks due to nicks or cuts when terminating.

C. All power cables to be laid underground inside the Refinery premises by the Contractor shall be PVC insulated; lead covered, steel wire Armoured, Overall PVC sheathed copper conductor cable.

D. All multi core, electrical control and annunciation cables to be laid underground inside the Refinery premises by the Contractor shall be PVC insulated, lead covered, steel wire Armoured; Overall PVC sheathed copper conductor cable.

2.02 CABLES

A. General

1. Conductors shall be high conductivity copper, to BS 6360 unless otherwise indicate.
2. Copper conductors shall be stranded for Section 4 sq.mm and over.
3. Signal control cables shall have solid conductors.
4. Flexible cords shall have fine stranded conductors.
5. Conductors' sizes shall be metric. Conductors with cross sectional areas smaller than those specified will not be accepted.
6. Insulation for each conductor shall be colour coded or otherwise identified as required by the Regulations. Colour coding shall be maintained throughout the installation.
7. The current carrying capacity of conductors has been determined in accordance with the specified Regulations, the specified type of insulation and the expected conditions of installation.
8. All cables shall be, as far as practicable, of one manufacturer only. All cables shall comply with the relevant IEC/BS.

B. PVC Insulated, Single Wire Armoured and PVC Over sheathed (PVC/SWA/PVC) Cable.

1. Multicore PVC/SWA/PVC cable: 600/1000V grade, to BS 6346.
2. Conductor: Annealed high conductivity copper, stranded, shaped and laid in an approved manner.

3. Armourd: single layer of galvanized steel wires for multicore cables and aluminum wire or tape for single core cables.
4. Insulation: colour coded to BS 6746C.
5. PVC for sheath and insulation : to BS 6746
C. PVC Insulated PVC Sheathed (PVC/PVC) Cable
1. To BS 6346,600/1000V Grade.
2. Conductor: annealed high conductivity copper, stranded, shaped and laid in an approved manner.
3. Insulation: Colour coded to BS 6746C.
4. PVC for sheath and insulation: to BS 6746.
D. PVC Insulated Wires
1. Single core cables shall be to BS 6004, rated 450/750V, with high conductivity copper conductors and PVC compound insulation. Colour coding shall be:
Red : Phase 1
Yellow : Phase 2
Blue : Phase 3
Black : Neutral
Green/Yellow or Green : Earth
2. Wires shall be continuous from outlet to outlet and no splice shall be made except within outlet and junction boxes. A separate neutral wire shall be provided for each circuit wires shall be left sufficiently long enough to permit making final connections.
E. XLPE Cable
1. To BS 5468, 600/1000V grade.
2. Conductors: plain annealed copper to BS 6360.
3. Cables shall comprise plain copper, stranded circular conductors insulated with an adequate thickness of:
a. Low density polythene: melt index 0.3 (polythene), or
b. Extruded cross linked polythene (XLPE); or
c. Extruded ethylene propylene rubber (EPR).
4. Conductors shall be laid up together and warmed circular with suitable performed fillers and warnings, bound with polythene terephthalate (PTP) tape and covered with an extruded PVC sheath minimum 1.4mm thick.
5. Multicore cables shall have steel wire or tape armouring extruded sheath of black PVC, PCP or CSP.
6. Single core cables shall have aluminum wire or tape armouring.
7. Outer sheath or single and multicore shall be at least 2.5mm thick.
8. Design electrical stress at any point in the insulation shall not exceed:
a. For polythene and XLPE: 3 KV per mm.
b. For EPR: 4 KV per mm.
9. Conductor screen: non-metallic comprising either:
a. Semi-conducting tape; or
b. A layer of extruded semi-conducting material.
10. The electro-static screen over insulation shall comprise a nonmetallic layer of semi-conducting material applied over the insulation and in direct contact with it, followed by a

layer of copper tape applied helically over the semi-conducting layer to ensure close contact throughout.

11. Prevent void formation in insulation by:

a. Polythene and XLPE: careful control of its passage through the temperature graded water baths:

b. EPR: careful control of the vulcanizing and cooling processes.

PART 3 – EXECUTION

3.01 INSTALLATION GENERALLY

A. Installation Cables Generally

1. Pull cable into position by hand, where possible using an adequate number of operatives suitably positioned along cable length.

2. Obtain approval of pulling cables by winch or similar appliance.

3. When pulling by winch or the like, fit a suitable tension gauge into the haulage line between winch and cable. Pulling tension shall not exceed the limit recommended by the cable manufacturer.

4. Do not allow cable to twist or rotate about its longitudinal axis.

5. Lay 3-phase groups of single core cables in trefoil formation. If this is not possible obtain instructions.

6. Install cables to allow any one cable to be subsequently removed without disturbing the remainder.

B. Bending Radius

1. Keep as large as possible and do not allow cable to bend to a radius less than that specified in IEE Regulations or relevant BS.

C. Underground Cables

1. Lay in pipe ducts.

2. Obtain approval of trenches before laying cable.

3. Do not lay cables direct into ground if a corrosive agent is present.

4. Run cables at least 30mm clear of other services, whether the later run parallel or transversely to cable trench.

5. Run cables below intersecting piped services, unless the cable would be at a depth exceeding 2m, in which case seek instructions.

6. Cables shall not cross in trenches.

7. Protect cables with a continuous layer interlocking concrete or earthenware covers.

8. Width of covers:

a. For single cables: 100mm (minimum) greater than cable diameter.

b. For multiple cables: 100mm (minimum) greater than cable aggregates of cable diameters.

9. Draw cable into pipe ducts where they:

a. Cross roads and paved areas; except under removable tilling finish

b. Pass through corrosive soils;

c. Enter buildings.

D. Above Ground Cables

1. Protect exposed cables where they are likely to be damaged.

2. Run cables at least 50mm from each other.

3. Run cables at least 150mm from piped services.

E. Jointing

1. Joints in wires and cables shall be avoided wherever possible. Joints in flexible cables and cords are not permitted. Where joints are unavoidable they shall be permanently accessible and made only in junction boxes.
2. Leave at least 150mm of free conductor at each outlet, switch point and pull box for the making up of joints or the connecting of fixtures and devices, except where conductors are intended to loop without joints through lamp holders, socket outlets and the like.
3. Complete joints and termination in the shortest time without interruption.
4. Do not commence jointing and terminations without approval, except where the work is in a dry, weather proof places.
5. Do not make joints in wet or dirty conditions.
6. Make outdoor joints under a suitable tent or shelter.
7. Fill joints with compound filling in stages to allow the material to flow. Do not allow compound to cool to the point where re-heating is necessary.
8. Ensure sealing compounds are pouring at the correct temperature check compound level and top up if necessary, after cooling.
9. Make intermediate joints on plastics and elastomer insulated cables in a joint box. Arrange to have each joint inspected by the Engineer before closing and filling.
10. External joints on MICC cable: fill other box with jointing compound.
11. Joint cable in straight through joints and main cables in tees and other branching joints core to core.

F. Terminations

1. Take cable cores through the termination box directly to equipment terminals, without crosses, unless impracticable and make off with sweated cast brass or hydraulically crimped sockets.
2. Sweet cable core solid 25mm on each side of compound level and over-tape the exposed core insulation with two layers of PVC or other approved tape in appropriate phase colour, half-lapping the tape.
3. Plumb the cable sheath to the brass wiping gland neatly laid back the armourd wires over the gland and fix with an armour clamp effectively bonded to earth.
4. Cut back tape of tape armoured cables neatly below the wiped gland, thoroughly clean, secure with a suitable armour clamp and bond to the body of the terminating box with two soft copper tapes at least 70sq.mm aggregate cross section.
5. Equipment to which cables are connected will have blank, undrilled gland plates. Drill holes necessary for fitting glands.

G. Cable Support

1. Run single core cables used to make up 3 phase circuits in trefoil formation, unless otherwise indicated, and support in cleats.
2. Adjust spacing of cable supports and fixing devices below the specified maximum as necessary to prevent cables sagging and where cables must deviate to pass obstructions.
3. PVC/SWA/PVC cables: run on cable trays as indicated.
4. PVC/PVC cables: run on cable trays as indicated.
5. XLPE cables: run on cable trays as indicated

6. MICC Cables:

a. Run on surface of walls and ceilings. Where embedded, run in as sheet steel trough or conduit.

b. Run cables in square symmetrical lines where single core cables are run in groups, bend the sheaths at maximum 5cm centers.

c. Fix surface run cables with saddles at maximum 300mm centers.

H. Heat Resistant Cables

1. In areas where a constant ambient temperature exceeding 55°C will occur, run all final sub-circuits in heat resistant cable.

2. Make conversion from PVC cable to heat resistant cable with a fixed block connector housed and fixed into a conduit box or equal, except where the conversion of cable types emanate from a switch, ceiling rose or similar fixed connector accessory.

I. Flexible Cables

1. Keep flexible to a minimum

2. Install out of sight.

3. Mechanical retainment shall not depend on electrical connections.

J. Sealing Cables

1. Seal both ends of cables immediately after tests.

2. Seal MICC cables immediately after cutting to prevent hygroscopic action by the dielectric.

3. Seal lead, lead alloy and aluminum sheathed cables with a metal cap plumbed to the sheath.

4. Seal plastic sheathed cables with a plastic cap embracing the wires and outer sheath.

5. Mark cable ends in accordance with the relevant BS.

3.02 INSTALLING CABLE IN CABLE TRAYS

A. Generally

1. Install cables on trays in a single layer, unless otherwise specified.

2. Use purpose made straps or saddles to maintain cables in a neat regular disposition.

3. Secure cables with load bearing cleats securely fixed to the tray, where trays do not directly support the cables.

4. Space cleats saddles and straps at maximum centres recommended in MEW Regulations.

B. Direct Buried System

1. When practical, cable trenches shall run through unpaved areas. Where the cable trench passes beneath paved areas, such as in process paved areas, the paving shall be scored to indicate the trench location.

Markers indicating cable voltage and cable location shall be provided at points in unpaved areas where the trench changes direction and also at 100-foot intervals.

The location of the markers at each point shall be as follows.

Trench Width Marker Location Larger than 4 feet At each edge of trench and between each voltage class

2feet – 4 feet At each edge of trench.

Less than 2 feet At one edge of trench with arrow pointing to opposite edge.

Where markers projecting above grade level obstruct passages, walkways, etc. flush or tapered markers shall be used.
2. Direct buried cable runs shall not be routed
a. Through areas proposed for future development.
b. Adjacent to high-temperature underground piping that would have a deleterious effect on the cable jacketing and insulation materials.
3. In paved area, such as process areas, cables shall be buried. In unpaved areas, such as tank yards, cables shall be directly buried in earth-sidewall cable trenches with protective tiles.
4. Dummy trenches shall be provided for the cable trenches under main pipe racks in process area.
5. A direct buried system in paved area shall be as follows:
a. Cable protective tiles are not required.
b. Two layers or more of cables are acceptable in the process areas
c. Generally, instrument cables shall be laid in multiple tiers 30 inches minimum below grade.
d. The bottom of the trench shall be back filled with a minimum of 6 inch of sand or riddled soil. Also, a minimum of 6 inch of sand or riddled soil filling is required between layers. The rest of the trench shall be filled with sand or riddled soil and then topped with paving.
e. The cable burial depth shall be at least 24 inches from finished grade to the top surface of the largest cable in top layer.
6. A direct buried system in unpaved areas shall be as follows:
a. The cable burial depth shall be at least 30 inches from finished grade to top surface of the largest cable. In the transformer yard however, the cable burial depth may be reduced to 24 inches from the finished grade.
b. Multi layer installation of the cables is not acceptable.
c. The bottom of the trench shall be back filled with a minimum of 6 inches of sand or riddled soil. Each cable layer shall have 6 inches of sand or riddled soil packed over the cables. Concrete tiles with a minimum thickness of 2 inches shall be installed over the top layer of sand or riddled soil to overhang the cables by a minimum of 3 inches and the rest of the trench shall be back-filled with earth.
7. Horizontal spacing between centers of power cables shall be 2(two) inches for cables through 25 sq. mm, 4(four) inches for cables from 34 to 95 sq. mm, 8(eight) inches for cables larger than 95 sq. mm, 12(twelve) inches between low-voltage and high-voltage cables and 8(eight) inches between high high-voltage cables. Control cables shall be laid adjacent to their respective motor feeder or power feeder cables.
8. The following minimum spacing shall be maintained between power cables and analogue signal cables, if parallel runs cannot be avoided.
Power Wiring Minimum Separation
110 V 24 in
240 V 30 in
440 V 36 in
3.3 kV 48 in
11 kV 48 in

Cross overs that bring power and signal cables into close proximity shall be made at right angles.

C. Duct Bank System

1. Non-metallic conduits or PVC conduits shall be used All conduits shall be encased in at least 2 inches of concrete The top of the concrete encasement shall be at least 30 inches below grade

2. Multi cables may be installed in one conduit, provided that the overall current-carrying capacity is observed.

3.03 TESTS AND INSPECTION

Test shall be performed at the manufacturer's plant in accordance with BS- 6004, BS-6346 BS-5468, BS-5467, BS-6746 where applicable for different cables. The manufacturer shall submit the test report to the purchaser for approval.

3.04 The Cables should be Gulf Cable.

END OF SECTION

SECTION EL-06 / BOXES

PART 1 - GENERAL

1.01WORK INCLUDED

A. Wall and Ceiling outlet boxes.

B. Pull and Junction boxes

C. Water proof enclosures

1.03 REFERENCES

A. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

B. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.

C. NEMA 250 - Enclosure for Electrical Equipment (1000 Volts Maximum).

1.04 PROJECT RECORD DOCUMENTS:

A. Submit under provision of Contract.

B. Accurately record actual locations and mounting heights of outlet, pull and junction boxes.

1.05 PROJECT CONDITIONS

A. Verify field measurements are as shown on drawings.

B. Verify locations of boxes and outlets co-ordinated with arch-drawings and the Engineer, prior to rough-in and the Engineer.

C. Boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 PRODUCTS

2.01 OUTLET BOXES

A. Sheet metal outlet boxes: ANSI/NEMAOS 1, galvanized sheet (impeded in concrete areas).

1. Luminaire and Equipment supporting Boxes: Rated for weight of equipment supported include male fixture studs where required.

2. .Concrete ceiling boxes: concrete type.

B. Non-metallic outlet boxes: where there is installations not in concrete but in portion, above false ceiling ...etc.

PART 3 EXECUTION

3.01 INSTALLATIONS

A. Install electrical boxes as shown on Drawings and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

B. Install electrical boxes to maintain headrocine and to present neat mechanical appearance.

C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

D. In accessible ceiling areas: Install outlet and junction boxes no more 150mm from ceiling access panel or from removable recessed luminaire.

E. Install boxes to preserve fire resistance rating of partitions and other elements.

F. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.

G. Use Flush mounting outlet boxes in finished areas.

H. Do not install flush mounting boxes back-to-back in walls, provide minimum 150mm separation. Provide minimum 600mm separation in acoustic rated walls.

I. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

J. Use stamped steel bridges to fasten flush mounting outlet box between studs.

K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

L. Use adjustable steel channel fasteners for hung ceiling outlet box.

M. Do not fasten boxes to ceiling support wires.

N. Support boxes independently of conduit.

O. Use gang box where more than one devices is mounted together. Do not use sectional box on when required.

P. Use gang box with plaster ring for single device outlets and when required.

Q. Use cast outlet box in exterior locations (exposed to the weather) and wet locations.

R. Use custom made GI boxes (as per instructed by MOI engineer) under raised floor in control rooms.

3.02 INTERFACE WITH OTHER PRODUCTS:

A. Co-ordinate installation of outlets box for electrical, telephone, furnished under the Contractor scope of works.

B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening for the access doors.

C. Co-ordinate mounting heights and locations of outlets mounted above or below counters, pantries furniture, benches and back splashes.

D. Position outlet boxes to locate luminaires as shown on approved reflected ceiling plan.

3.03 ADJUSTING

A. Adjust floor box flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closure in unused box opening.

END OF SECTION

SECTION EL-07 / WIRING DEVICES

PART 1 – GENERAL

1.01 GENERAL REFERENCE

A. The work of this section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

B. Coordinate the work with all other services affecting the work of this Section.

1.02 DESCRIPTION OF WORK

A. This Section to include all labour, materials, equipment, appliances and accessories necessary for the complete performance of all switches, socket outlets etc. In accordance with the Specifications.

1.04 APPLICABLE STANDARDS REFERRED IN THIS SECTION

A. BS 5419 : Fuse Switches and Switch Fuses.

B. BS 88 : HRC Fuses

C. BS 4343 : Industrial Plugs, Socket Outlets and Couplers for AC and DC Supplies.

D. BS 1363 : 13 A Plugs, Switched and Un switched Socket Outlets and Boxes.

E. BS 4662 : Boxes for Enclosure of Electrical Accessories.

F. BS 5733 : General Requirements for Electrical Accessories.

G. BS 4177 : Cooker Control Units Rated 30 Amp. and 45 Amp. 240 Volts single Phase Supply.

1.05 SUBMITTALS

Submit shop drawings, equipment list, relevant samples etc., as mentioned under Section EL-01.

PART 2 – PRODUCTS

2.01 GENERAL

A. All individual items of materials shall be of the same make throughout the project unless specifically approved by the Engineer.

2.02 OUTLET BOXES

A. Outlet Boxes

1. Galvanized or sheradized one piece pressed steel, sizes and designs shall suit devices to be fitted.

B. Exterior Mounted Boxes

1. Totally sealed to ensure water tightness.

2.03 SWITCHES

A. Lighting Switches

1. To BS 3676

2. Grid fixing type rated 15 Amps. unless specified otherwise. The grid shall be provided with suitable earthing terminal.

3. Recessed with concealed conduit surface pattern elsewhere.

4. Quick make slow break type.

5. Single pole, double pole, one way or two ways, as indicated.

6. The face plate shall be of matt-chrome.

B. Waterproof Switches

1. To be operated by means of a brass disc.

2. To be watertight and metal clad.

C. Switch Plates

1. Where two or more switches are grouped together and connected to the same phase, multi-gang devices and common plates shall be used.

2. Rectangular, Matt-chrome finished switch plates shall be used in all areas unless specified otherwise. The rocker shall be insulated with ivory finish.

D. Double Pole Switches

1. The double pole switches shall be with indication neon lamps and shall be rated 15 Amps. Or 20 Amps. as specified.

2. The face plate shall be of matt-chrome and shall be engraved 'WATER HEATER', 'WATER COOLER' etc. as require.

2.04 SOCKET OUTLETS

A. General Purpose Socket Outlets

1. To BS 1363

2. 3 rectangular pin (2 P + E) shuttered, with combined switch, rated 13A, 250 V.

B. 15 A Socket Outlet

1. To BS 346.

2. 3 round pin (2 P + E) shuttered switched pattern complete with plug.

C. 1or 2 Gang 13Amp switched socket samild accessory plat

1. 2. Dual earth to BS 7671.

D. Socket Outlet Plates

Matt-chrome finish in all areas unless specified otherwise readily identifiable.

E. Weatherproof Sockets

1. 13 A Sockets: to BS 1363, 3 rectangular pins, switched type.

2. 15 A Socket: to BS 546, 3 round pins, switched type.

3. To be complete with weatherproof plugs.

4. Plugs for 13 Amps. sockets : fused type with single pole cartridge fuse link of same rating as plug.

5. Plugs for 15 A sockets: unfused.
6. Sockets and Plugs :
a. To have minimum IP 44 grade protection;
b. Housing parts : brass or pressure die-cast finished in grey
c. Plugs :
1. Cable grips shall have rubber compression rings;
2. There shall be rubber gaskets between plug and socket to ensure weather tightness.
d. Sockets shall have screw on caps that close tight on socket when plug is not inserted.

2.05 PUSHBUTTONS

A. ON/OFF Pattern Pushbuttons for lighting control :
1. To have shrouded buttons coloured green for "ON", red for "OFF".
B. Operating Mechanism
1. To be contained in the device box.
2. Operating voltage shall be 240 V.
C. Multiple Pushbuttons
1. Where two or more buttons occur in one position they shall be contained in one case and each shall be appropriately labelled to indicate its functions.

2.06 DISCONNECT SWITCHES AND SWITCH FUSES

A. Generally :
1. To be metal clad with front operated handles interlocked with switch fuse case to prevent opening switch in the "ON" position.
B. Fuse Switch and Switch Fuses
1. To BS 5419.
2. Fuses: to BS 88 bolted type, Class Q1, certified for 415 V and AC 33 duty, rated as indicated.
3. Fused switch carriages: with drawable type.
4. Fuse switches: ASTA certified to 50 KA.
C. Disconnect Switches or isolators
1. Same design as switch fuses, with solid copper links in place of fuses.
2. Single pole and neutral, or triple pole and neutral.
3. Ratings, as indicated.

2.07 JUNCTION, PULL AND TERMINAL BOXES

A. The junction box shall be completed with a terminal block suitable for connecting up to 10sq.mm. Copper conductor (phase, neutral and earth) and an all insulated moulded white cover plate with removal covers.
B. The cover plate shall be raised for connecting outgoing cable.

PART - 3 EXECUTION

3.01 INSTALLATION OF OUTLET BOXES

A. Location of Boxes
1. Determine exact location of boxes on site and obtain the Engineer's approval before commencing installation.
2. Make allowance for overhead pipes, ducts, variations in arrangement, thickness of finish, window trim, panelling and other construction when locating boxes.

B. Mounting Heights.

1. Mount boxes as indicated or as approved by the Engineer.
2. Where mounting height is not shown or specified, obtain instructions.
3. Boxes for similar equipment : mount at uniform heights within same or similar areas. C. Fixing :
1. Fix outlet boxes securely.
2. Fix exposed outlet boxes to permanent inserts or lead anchors with machine screws.

3.02 INSTALLATION OF SWITCHES

A. Lighting switches near door.

1. Located at the strike side of the door.
2. Plates shall be installed with all four edges in continuous contact with finished wall.
3. Plates shall be installed with an alignment tolerance of 1.5mm.
4. All switch assembly louver plates shall have their earthing terminal connected to the earth terminal attached to the switch box by an insulated 2.5 sq.mm protective conductor.

3.03 INSTALLATION OF JUNCTION, PULL AND TERMINAL BOXES

A. Generally :

1. Fix junction, pull and terminal boxes where indicated and where required to facilitate pulling of wires and cables and connection of future appliances.
2. Locate boxes as inconspicuously as possible, but accessible after work is completed.

B. Pull Boxes

1. Fix at maximum 10 m. spacing and to limit the number of bends in conduit to not more than two 90 deg. bends.

3.04 TESTING

A. Test all switches, socket outlets etc., for correct polarity and continuity of conductors in the presence of and to the entire satisfaction of the Engineer.

B. Carry out live phase to earth loop impedance tests at all switches and socket outlets with an approved earth loop impedance tester to the entire satisfaction of the Engineer. Ensure that all device plates have satisfactory earth continuity to the protective conductor system.

C. Test all 13 Amp. socket outlets for instantaneous tripping of associated distribution board current operated earth leakage circuit breaker using testing equipment, approved by the Engineer.

END OF SECTION

SECTION EL-08 / ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Nameplates and tape labels.

B. Wire and cable markers.

1.02 SUBMITTALS

A. Submit schedule for nameplates and tape labels.

PART 2 PRODUCTS

2.01 MATERIALS

A. Nameplates: Engraved two-layer laminated plastic, black letters on a white background.
B. Tape Labels: Metal label with type written letters.
C. Wire and Cable Markers: Self-adhesive numbered tape or plastic ring.

2.02 WIRE IDENTIFICATION

A. Provide each cable with rigid non-hygroscopic plastic covered plate fixed with rigid plastic band indicating system and cable number.
B. Provide conductors of control cables with numbered plastic ring.

2.03 EQUIPMENT IDENTIFICATION

A. Provide two-layer plastic labels fixed with rivets or crews.
B. Indicate code of the switchgear, distribution board, control panel, etc.
C. Indicate main switch or circuit-breaker positions (ON-OFF).
D. Indicate purpose and positions of every control equipment (switch etc.)
E. Indicate signal lamp purpose.
F. Provide all equipment inside the switchgear etc., with self-adhesive textile label with type written code of
A. the equipment.
G. Provide all internal wiring with self-adhesive number tape indicating wire destination.
H. Provide all junction or terminal block boxes of cables with code plate indicating the system and the box code.

PART 3 EXECUTION

3.01 INSTALLATION

A. Decrease and clean surfaces to receive nameplate and tape labels.
B. Install nameplates and tape labels parallel to equipment lines.
C. Secure nameplates to equipment fronts using screws, rivets or adhesive as per the engineer's approval. Secure nameplate to inside face of recessed panel board doors in finished locations.

3.02 WIRE IDENTIFICATION:-

A. Provide wire markers on each conductor in panel board gutters, pull boxes, outlet and junction boxes and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on approved schematic and interconnection diagrams, equipment manufacturer's shop drawings.

3.03 NAME PLATE ENGRAVING

A. Provide nameplates to identify all electrical distribution and control equipment and loads served. Letter Height (3mm) for individual switches and loads served, (6mm) for distribution and control equipment identification.
B. Provide nameplates for the following:-
1. Panel boards, motor control centers, identify equipment designation, identify voltage rating and source.
2. Individual circuit breakers, switches, and motor starters, identify circuit and load served including location.

3. Individual circuit breakers, enclosed switches, and motor starters, identify load served.

END OF SECTION

SECTION EL-09 / SWITCH BOARDS

PART 1 - GENERAL

1.01 GENERAL REFERENCE

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

B. Co-ordinate the work with all other services affecting the work of this Section.

1.02 DESCRIPTION OF WORK

A. The Section to include all labour materials and accessories for the complete performance of all Main Low Tension Switchboard, Main Switchboards and Sub-Main Switchboards in accordance with the specifications and approval drawing.

1.04 APPLICABLE STANDARDS REFERRED TO IN THIS SECTION

A. Switchboards and motor control centers shall comply with the following Standards as appropriate:

1. BS 88: Cartridge Fuses
2. BS 142: Electrical Protective Relays
3. BS 159: Bus-bar & Connections
4. BS 162: Electrical Power Switchgear
5. BS 3938, Current Transformers IEC 185
6. BS 4794,Control Devices Pt.2 IEC 337-2
7. BS 37 Pt.1 : Electricity Meters General
8. BS 89, : Direct Acting Indicating Elect. Measuring Instruments IEC 51
9. BS 5685, :Electric Meters IEC 51
10. BS 5420, :Degree of Protection of Enclosures IEC 144
11. BS 4752, :Switchgear and Control-gear IEC 157-1
12. BS 5419, :Air Break Switches
13. BS 5424, :Contactors Pt.1, IEC 158-1 & 1 A
14. BS 5472 : Low Voltage Switchgear and Control- gear
15. BS 6231 : PVC Insulated Cables for Switchgear

1.05 SUBMITTALS

A. Shop Drawings

1. Submit dimensional drawings of all the switchboards, including sections and elevations, showing the following:

a. Arrangement of all Components, Instruments, Indication and dimensions of all bus-bars.

b. Positions and method of fixing cables and boxes.
c. Location of Terminal boards.
d. Single line diagram of the circuits showing the rating of all components, the type and size of the incoming and outgoing feeders.
e. Power and control schematic for incoming and outgoing feeders
f. Wiring diagrams
g. Terminal strip details to facilitate wiring of wires/cables coming from equipment installed elsewhere.
h. Sectional drawings for arrangement of main busbar.
i. Other relevant data.
B. Product Data
1. Full specifications of the enclosure and the components of the switchgear and switchboards with relevant sheets of manufacturer's catalogues.
2. Test certificates of all components and whole assembled MLTB's from an internationally recognized testing authority or from independent testing lab in accordance with IEC 439. All expenses of this work shall be part of electrical Contractor's scope of work.
3. Confirmation that the switchboards complies with the relevant specifications as mentioned in this section.

1.06 QUALITY ASSURANCE

A. The switchgear manufacturer or assembler must have a previous record of satisfactory service in Kuwait for at least 15 years.
B. All main switchboards and motor control centers shall be submitted to testing by an approved laboratory, testing agency witnessed by the Engineer nominated representative, and test certificate issued accordingly prior to delivery to site. The cost of such tests to be included in the tender price. The tests shall be done in accordance with IEC 439/1973 and shall include Mechanical test, voltage test, short circuit test, degree of protection test, creepage distances and clearances in air test and other required test as approved by the Engineer.

PART 2 - PRODUCTS

2.01 MAIN LOW TENSION SWITCHBOARD (M.L.T.B.)

A. General
1. The Main Low Tension Switchboard shall be of Indoor construction, purpose made, floor standing, dead front, totally enclosed, cellular cubicle type, dust protected, vermin proof in double front execution and of clean and modern appearance containing the main components shown on the drawings and/or specified.
2. The switchboard shall be assembled and coordinated by one manufacturer using the same make for each internal switchgear components and shall be constructed in accordance with BS 5486; Part 1 or IEC 439.
3. The switchboard shall be equipped with Air Circuit Breakers, Moulded case circuit breakers, relays, Instruments, Transformers, Ancillary devices necessary for operation protection or measurement purposes and Auto Transfer Switch with Manual by pass arrangement as indicated on the drawings.

4. The Normal Components, Fittings and Accessories required for safe and proper operation of switchgear shall be provided, whether specifically mentioned herein or not.
5. To withstand thermal and mechanical stresses set up by short circuit conditions in accordance with the fault through current of the feeding transformer. In general minimum fault breaking capacity shall be as follows unless otherwise specifically indicated on the drawings.
a. 50 KA R.M.S. for MLTB and MCC if fed directly from transformer.

b. 30 KA R.M.S. for MSB, MCC and SMSB if fed from MLTB.
c. 22 KA R.M.S. for SMSB and MCC if fed from MSB.
The Contractor should calculate required short circuit rating at each point and provide protection accordingly.
6. Irrespective of what has been shown in the attached drawings, minimum 20% spare feeders with compartments fully equipped with components and wired up shall be provided for feeders of each rating.
7. Enclosure protection for the switch board shall be minimum IP 51 as defined in IEC 144 or NEMA-12 without using the floor as part of the enclosure. Barriers shall be provided to segregate the power and control compartment to confine electrical disturbances and faults.
8. Suitable facilities properly interlocked shall be provided for grounding the incoming side of each incoming supply feeder.
9. Lead-in of power source from the transformer secondary shall be made by means of bus-duct or cable as specified in the commodity specification/data sheets/single-line diagrams.
B. Construction
1. Switchboard shall be factory built, totally enclosed, and rear accessible. Size, rating arrangements shall be as indicated on the drawings.
2. The switchboard shall consist of standard cubicles assembled together on continuous base channels to form a rigid in line flush fronted free standing continuous switchboard assembly. Frames are constructed from 2.0 mm thick folded sheet steel screwed on the frames. Hinged doors of 1.5 mm thick sheet steel strengthed wherever necessary. The cubicle shall be sufficiently rigid to withstand all operating forces without deformation or damage.
3. Each cubicle shall be divided into segregated bus-bar section and circuit section. The section shall be further divided into segregated compartments for housing main and emergency circuit
breakers and other devices. Access to internal components of any compartment must be feasible by isolating its particular switch. The hinged door shall be mechanically interlocked with the switch in such a manner that the door can be opened in 'OFF' position.
4. Each panel section shall be provided with space heater with thermostat, HRC Fuse, MCB etc. Supply for the space heater shall be tapped from within the switch board itself.
5. The switchboards shall be totally enclosed, all hinged doors, and covers shall be gasketed to provide protection against dust gaskets for all doors shall be neoprene type.
6. Cabinet shall have adequate means of lifting and shall be capable of being rolled or moved into the installation position and bolted directly to the floor.

7. The switchboards shall be provided with suitable cable glands to suit the type, size and number of cables as indicated on the drawings. The cable glands or bracket where required shall be adequately mounted inside the switchboard. The switchboards shall be provided with the proper cable fixing clamps and terminal lugs for incoming and outgoing cables as well as earth bonding connections.
8. After fabrication, steel work shall be cleaned, zinc sprayed and stove enameled with one prime coat, two under coats and one finishing coat, the surface being rubbed down after each coat.
9. Hinged and draw out type compartment doors, shall be effectively grounded through a flexible connection or wiping contact.

10. Finished colour : Light grey or as approved by the Engineer.

C. Labels

1. All the components in the switchboards shall be identified by means of white labels of an approved design engraved with 5 mm black lettering adequately describing the function of the unit to which it is attached and shall be secured by screws to the outside of each item. Special outlets and equipment shall be fitted with labels in a similar manner. Labels secured by adhesive are not acceptable.
2. All labels shall be engraved in both Arabic and English and shall be approved by the Engineer.

D. Switchboard Wiring

1. Switchboards shall be furnished completely wired including all cleats and terminal blocks.
2. Control and Instrument wiring shall be made with a standard switchboard colour coded cable with fire resistant braid. No cable sizes smaller than 2.5 sq.mm shall be used.
3. The wiring on Instrument panels shall have flexible connections to the terminal blocks.
4. The end of every wire shall be numbered with the number as stated in the control circuit wiring diagram of the manufacturer, also number the terminal blocks.
5. A sufficient number of terminal connections including 15% spare terminals shall be provided for all control and instrument wiring.
6. Each outgoing power and control cable termination shall be contained in an enclosed chamber, suitably identified. Terminals associated with each circuit shall be grouped and shrouded from adjacent circuits to permit disconnection or connection of any circuit without shutting down the switchgear.

E. Bus-bars

1. The bus-bars shall be electro-tinned hard drawn, high conductivity 99.9% purity, suitably sleeved/painted for phase identification to BS 158.
2. All bus-bars shall extend through the length of the board with same cross section throughout unless indicated otherwise. The bus bars shall have a minimum short circuit withstand capacity for 1 second.
3. A Copper Earth Bus-bar suitably sized to withstand the thermal and dynamic stresses of a bolted ground fault equal to the incoming breaker rating for one second shall be provided along the full length of the board.

4. To be adequately supported by flame resistant, non-hygroscopic and non-tracking epoxy cast resin insulators spaced at suitable centers so that the complete assembly can withstand the maximum mechanical stresses to which it may be subjected to under fault conditions.
5. Bus-bars shall be housed in separate adequately ventilated compartment which shall not contain any wiring or apparatus other than that required for connections for bus-bars.
6. Bus bars shall be suitably sized to carry the specified current without exceeding the permissible temperature rise of 50 degree centigrade over the ambient temperature.
7. Contact surfaces at the bolted connection of bus bars shall be silver plated.
8. Bus bars shall be joined by double connection with flexible joints where allowance for thermal expansion is required.
F. Main Air Circuit Breakers
1. To IEC 157-1 or BS 4752 : Part 2, suitable for triple pole service and shall have breaking capacity of 50 KA symmetrical for 1 second at 415 Volts.
2. The Air Circuit Breakers (the conventional type and not moulded case circuit breakers) shall be 600 V, 50 Hz, triple pole with neutral link of ratings as shown on the drawings. They shall be air break, trip free, draw out type with mechanical and electrical ON/OFF and trip indicators.
3. Air circuit breakers shall be electrically operated with spring charging motor. A standby manual operating handle shall be provided for operating the circuit breaker in case of power or motor failure.
4. The air circuit breaker shall be provided with over current, short circuit and earth fault protection having the following characteristics :
a. Adjustable long time delay current setting (5% - 15%) with varied tripping time.
b. Adjustable short time delay current setting (400% - 1000%) with variable tripping time.
c. Instantaneous tripping for heavier over current adjustable from 400% - 1600% of base current.
d. Adjustable earth fault trip current setting (20% - 60%) with variable tripping time.
4. The circuit breaker shall have three positions on the draw out mechanism, namely service position where all main and auxiliary contacts are made, test position where main contacts are open but auxiliary contacts are closed and isolated position where all contacts are open. An indicator shall clearly show these positions and provisions shall be made for locking the breaker in any position.
5. Mechanical Interlocks shall be provided to prevent withdrawing or inserting of the breaker when it is 'ON'. Any attempt to do so shall trip the breaker automatically.
6. Safety shutters shall be provided to automatically cover al bus bars, insulating spouts and isolating contacts whenever circuit breakers are withdrawn.
7. The withdrawable part of the circuit breaker shall be effectively connected to earth through scraping contacts that shall make before and break after the main and auxiliary contacts.
8. The moving contacts comprising the main and arcing contacts shall be of the spring loaded, self-aligning type. The arc contacts shall be arranged to make before and break after the main contacts.
9. ACB shall be included with following components and accessories: a. Auxiliary Contacts.

b. Arc Chutes.
c. Folding Extension Rail.
d. Charging Handle.
e. Open and Close Push Buttons.
f. Over Current Trip Indicator.
g. Keylock on Trip Button.
h. Spring charge Condition Indicator.
i. Breaker Position Indicator.
j. Making Current Release.
k. Automatic Shutters for the B/B Terminal.
l. Carriage for every size of ACB exceeding 25 Kg in weight.
10. The Main Incoming Circuit breakers shall be provided with cable boxes to suit the incoming cables from the transformers which are supplied and installed by the Ministry of Electricity and Water (MEW).
11. The circuit breaker shall be provided with testing facilities to permit testing of the units in the test position with the main circuit open.
12. All breakers of identical current rating shall be fully inter changeable. The current rating of the bus section shall be the same as incoming feeder.
13. The circuit breakers shall include all necessary auxiliary switch contacts, and shall have at least two spare normally open and two spare normally closed auxiliary contacts, wired to accessible terminal blocks.
G. Moulded Case Circuit Breakers (MCCBs)
1. To have a combination of thermal and magnetic tripping giving an inverse time delay protection against sustained overloads and instantaneous tripping under heavy overloads and short circuits.
2. Breakers shall have a quick make, quick break over current switching mechanism that is mechanically trip free from the handle so that contacts cannot be held closed against short circuits and abnormal currents. All MCCB shall be of P2 category according to short circuit performance category.
3. Tripping due to overload or short circuits shall be clearly indicated by the handle assuming a position mid-way between the manual ON and OFF position.
4. Latch surfaces shall be polished.
5. Poles shall be constructed to open, close and trip simultaneously.
6. Ampere ratings shall be clearly visible.
7. Breakers shall be completely enclosed in a moulded case to IEC No. 157 - 1 A, suitable for installation inside switch boards.
8. Non-interchangeable trip breakers shall have the trip unit sealed.
9. Breakers with earth leakage relay protection shall be provided with shunt trips.
10. Frame Sizes :
a. Frame sizes shall be as per manufacturere's standard size and as approved by the Engineer.
11. The magnetic trip shall be adjustable type for rating 200 Amp and above.
H. Earth Leakage Relay.

1. The Relay shall comprise core balance transformer, tripping, mechanism and reset testing buttons.
2. The Relay shall operate within 0.2 sec. when the fault current exceeds specified sensitivity as detailed in the schematic diagram.
3. The Relay shall be connected to the load side and the testing device to be connected to the supply side.
4. The Relay shall withstand available short circuit. In case of using with the MCCB's integrated E/L Relay in MCCB can be accepted.
5. Audible and visual alarm earth leakage relay shall be provided where specified on the drawings.
a. Similar in construction to Earth Leakage Relay except it operates an audible and visual alarm located in the board and remotely positioned in lieu of shunt trip of the breakers.
b. Audible Alarm shall be of sufficient level and may be cancelled by suitable reset button but visual indicator remaining ON until fault is cleared.
I. Instruments
The Measuring Instruments shall include ammeters, voltmeters, KWH meters, selector switches and associated accessories as indicated on the drawings and described herein as follows :
1. Ammeter, Voltmeter, Frequency and Power Factor Meter a. The Ammeter shall be moving iron type, flush pattern with dust and moisture proof enclosure. Anti-glass front, anti-parallax scales and white faces with black numerals and marking shall be used.
b. The dial size shall be 10 x 10 sq.cm.
c. Accuracy shall be one percent of full scale values.
d. Moving elements shall be provided with zero adjustments located at face of dial.
e. The Ammeter shall be capable of withstanding twice the rated current for 10 minutes and overload sustained under fault conditions without damage or loss of accuracy.
f. Voltmeter shall have a measuring range from 0 to 500 V and shall withstand twice the rated full scale voltage for 1.0 minute without damage.
g. Three Nos. Ammeters to read the current of each phase shall be provided as indicated on the drawings.
h. The voltmeter selector switch shall be of the rotary type with cam operated contactor it shall have (7) positions off, R-Y, Y-B, B-R, R-N, Y-N, B-N.
i. Frequency meter, single and poly phase power factor meters with associated current and potential transformers shall be provided as required and specified herein.
j. All instruments shall be semi-flush mounted, taut band switchboard type wide angle with a scale deflection not less than 2400, back connected and with an accuracy of 1.5 percent.
k. The requirements for instruments will be specified in the commodity specification/ single-line diagram/data sheets.
l. Ammeter scale shall be specified in the commodity specification / single-line diagram/data sheets. Ammeter scale shall indicate full load current at approximately 60 percent of scale.
2. Current Transformers & Potential Transformer
a. CTS & PT’s shall be of the bar primary type, air cooled and suitably insulated. The transformers shall be of Class 1.0 accuracy

b. CT & PT shall be rated not less than 15 VA & 50 VA respectively and shall have thermal and mechanical rating at least equal to those of the main breakers.
c. The potential transformers shall be protected with suitably rated cement limiting primary and secondary fuses which shall be readily renewable.
d. The potential transformer shall have draw out type construction.
e. The current transformer shall be suitable for withstanding thermal and dynamic stresses imposed on the electrical system for one(1) second.
3. KWH Meters
a. The KWH meters shall be suitable for operation on 415/240 Volts 3 phases, 4 wires, 50 Hz supply and shall conform to BS 37 Part 1 & 4.
b. The meters shall be absolutely dust-proof and vermin proof, protected from corrosion due to high humidity and compensated against the effect of temperature up to 55 Deg.C.
c. The meters shall maintain their accuracy over many years' service under Kuwait climatic conditions. The counter shall be of the cycle meter type with six figures, the lowest figure being units and not tenth of units. Pointer type counters are not acceptable.
d. The meter cover and cases shall be of metal and not plastic.
e. Meters shall not have less than 5mm diameter terminal holes and shall be operated through current transformers and the counter of the meter should be calibrated to read the primary KWH.
f. All meters shall be handed over to the Ministry of Electricity and Water for calibration prior to final installation and connection.
J. Protective Relays
a. The protective relays shall be semi-flush, draw-out type preferably with built-in test facilities. The test plugs shall be provided for each type of test device.
b. The protective relays without built-in test facilities shall be provided with separate test terminal blocks on the front panel of the switchgears.
c. Each protective relay shall have a flag indication, which can be reset externally.
d. Restricted ground protective relays shall be of the voltage operated (high impedance) type.
e. Master trip relays shall be of the "lockout" hand reset type. A "volt free"SPDT contact wired to the outgoing terminal blocks, shall be provided for remote annunciation of the operation of lockout relay.
K. Auxiliary Switches, Devices, and Wring
f. Each panel shall be equipped with an anti-condensation heater, manual control switch, and a violet pilot lamp. The heater shall be rated for 240 V AC, Single-phase, 50 HZ.
g. Each breaker shall be equipped with the following indication lamps:
ACB Closed: Red
ACB Opened: Green
Trip circuit healthy: White
Fault trip: Amber
h. The indication lamps shall be tungsten filament types with dropper resistance or neon type.
i. Separate circuit breakers (MCB's) shall be provided for control supplies for each unit.

j. Fuses and / or MCB's shall be used for protection, voltage circuits of metering supplies, and auxiliary equipment (space heaters, etc).

k. All auxiliaries wiring shall be PVC insulated stranded copper conductor. The minimum wire size shall be 2.5mm2.

l. The interpanel wiring shall be run in ducts to facilitate safe insertion and removal of individual wires.

m. The auxiliary wiring shall be terminated on the terminal blocks at shipping breaks.

n. All auxiliary wiring shall be ferruled with the wire numbers clearly and durably marked in black.

o. Each terminal shall be suitable to receive the 2x2.5mm2 wires. Ten percent extra terminals shall be provided. Terminals for power cable shall be sized to suit the cable specified in the commodity specification/data sheet/single-line diagram. All bus-bars, cables, and other devices that normally remain energized when the circuit breaker is withdrawn shall be fully shrouded.

2.02 MAIN AND SUB-MAIN SWITCHBOARDS

A. The main and sub-main switchboards shall be of indoor construction, dead front, metal enclosed multi-cubicle type (cellular) form 3B, free standing, two section/panel, 80 cm width min./sec dust and vermin protected, front operated and of clean and modern appearances, dust protected and factory fabricated suitable for operation on 415/240 V, 3 Phase, 4 wire, 50 Hz supply unless shown otherwise.

B. The main and sub-main switchboards shall comprise main incoming MCCB, bus-bars, outgoing MCCB, earth leakage relays, earth bus, etc. with ratings and arrangement as shown on the drawings and all housed in a sheet steel panel fully rustproofed and stove enamelled equipped with a hinged door with approved locking device.

C. The moulded case circuit breakers, earth leakage relays and bus-bars shall be as specified above in this Section.

D. The main and branch busbar insulated by heat shrinkable sleev.

E. The earth bus shall have adequate rating and length for connecting the incoming and outgoing earth wires or tapes.

F. The switch boards shall be complete with all necessary internal wiring and connections.

G. The arrangement of the boards shall be such that the main MCCB and outgoing MCCB can be operated when opening the door but to gain access to the MCCB's cabling and terminations a second cover shall be removed. There shall be ample clearance and ample space available inside the boards for cabling and terminations. Adequate clearance shall be maintained between phases and non-current carrying metal and terminals shall be so located that in the final connected positions there shall be no crowding of wires in close proximity of metal.

H. The boards shall be complete with cable glands for convenient terminations of incoming and outgoing cables. The cable glands shall be so fixed inside theboard that ample clearance exists between various feeders.

I. Voltmeter, Ammeter and selector switch shall be provided as shown on drawings and as required by MPW specification.

2.03 STARTERS

1. Motor starters shall be of electromagnetic, air break type suitable for 3phase, 50 Hz., 415V, A.C. System and in accordance with IEC 947-4.
2. Starters controlling motor less than 11 kW may be of the direct on line type. For motors of 11 kw and higher ratings employ automatic star delta starters. Motor protection against the short-circuit shall be achieved by motor circuit breakers of moulded case type and the combination with control-command devices (breaker + contactor + overload relay) shall be of type 2 coordination as defined by the IEC Standards 947-4-1. The type 2 coordination should be tested in laboratory and the manufacturer should guarantee the same by submitting the type 2 coordination tables. The coordination table shall indicate for each motor rating, the circuit breaker type and set up characteristics, the contactor type and the thermal relay type with its setting range.
3. The specifications mentioned in the MCCB's section is applicable for the breakers used in the motor protection. The moulded case circuit breakers used for motor protection shall be equipped with adjustable magnetic trip unit for short-circuit protection with settings from 6 to 14 times the nominal rating of the device.
4. Starters shall have in addition to the auxiliary contacts required for interlocks, alarms, and controls, two additional sets of normally open and normally closed contacts.
5. The Contactors used for motor protection shall have contactor utilization category AC3 at 415V 50Hz as per IEC 947-4. Tripping class for overload relays used for motor protection shall be one of the tripping class (class 10A, 10, 20, 30) as per IEC 947-4 depending on the motor starting characteristics. In addition, provide single phasing protection. Means should also be inherent in the starter for automatically disconnecting the motor from the electricity supply in the event of interrupted supply or under voltage. Provide earth leakeage protection for all motors.
6. For each starter, the following shall be provided:
a. 1 set of 'ON' and 'OFF' puch buttons for starting and stopping of motor.
b. Red and Green indicating lamps to show status of motor.
c. Suitably scaled ammeter with selector switch for each motor above 25 HP.
7. For each motor circuit, its associated circuit breaker and its starter shall be housed in one cell or unit and interlocked so that cell door cannot be opened and starter unit cannot be withdrawn unless the breaker is in the 'OFF' position.
C. Earth Bus
Copper earth bus of extending throughout the length of the panel shall be provided and fixed to brass nuts brazed to the steel members of the panel.
The earth bus shall be extended at the ends for bonding to the ring earth in the plant.
D. Circuits and Connections
1. All outgoing circuits shall be provided with separate compartment and/or screen so that equipment for any one circuit can be maintained without risk of contact with live connections on any other circuit.
2. For circuits rated up to 63A, feeders shall be connected to terminal blocks located in separate compartments at top or bottom, conveniently arranged to facilitate termination of cables and suitably identified.
3. For feeders, rated more than 63A, copper links shall be suitably extended, rigidly supported and covered with coloured PVC sleeves.

4. All feeders shall be provided with cable lugs and brass cable glands.
5. Removable gland plates shall be provided suitable for the glands required for the specified cables. Where cables are single core, the gland plates shall be of a non-ferrous metal.
6. All small wiring shall be of stranded copper, not less than 2.5mm2 with PVC insulation to BS 6231. Small wiring shall be neatly bunched and cleated in harness form, or shall be enclosed in purpose made plastic trunking or troughing. Wiring cleated to metal surfaces shall be insulated form the metal. Where wiring runs through sheet steel panels, holes shall be grommeted with suitable grommets.
7. Small wiring associated with external circuits shall be connected to terminal strips conveniently arranged.
8. Each connection shall be provided with separate incoming and outgoing terminals with no more wires to be connected to any terminal.
9. All spare contacts shall be wired to terminal strips suitably positioned.
10. Identify all wiring using plastic ferrules at both ends.
E. Motors
1. All mortars shall be suitable for and to have adequate continuous rating for the specified mechanical suity. All motors shall be suitable for the specified voltage and within +/-6%, and frequency within +/-4%.
2. The motors shall be totally enclosed, unless otherwise specified, and fancooled (where applicable). They shall comply fully with the requirements of BS 2613.
3. Motors shall be fully suitable for service in the climatic conditions at the the Site. Main conductor and slot-insulation shall be non-hygroscopic and shall be to Class B insulation level as stipulated in BS 2757
4. Cable boxes shall be provided on all motors to suit the type of cable employed. Terminal boxes shall be generously sized for easy termination of field wiring.
5. All motors to has be a power factor as per the latest MEW regulations.
6. Motors driving air handling units and fan coil units and motors located in other positions, where sound is likely to be transmitted by the air stream or ducting, to be of the quiet running type and so constructed and installed that transmitted or direct noise is reduced to an almost inaudible level.
7. No relaxation of thermal rating of motors will be permitted on the grounds that they are installed within the areas of controlled temperature and below the ambient quoted.
8. Where motors are not readily visible from the control panel position or as shown on the Drawing, provide a lock stop push button adjacent to the motor.
9. Provide starters for each within two meters other than those deriving their source of supply from the motor control center.
10. The starters shall have the same specification as indicated for motor control panel but they shall be housed individually in steel enclosures. Comply with NEMA, NEC or BS Standards. Provide Type I general purpose enclosures with padlock and ears and with frames and supports for mounting on wall, floor or panel as required. Where starter location is not within sight of motor, provide disconnect switch within sight of motor.

2.04 LOCK-STOP BUTTONS PROTECTIVE UNITS

1. The push buttons shall be housed in watertight enclosures of IP 55 minimum. The push button apertures shall be sealed by flexible PVC gaskets.
2. The units shall have a lockable latching device which restricts the starters push buttons return movements so that both contacts of the starters become N/O until the latch is released by the latching key.
3. The units shall be rated for inductive and non-inductive, 250 volt and as required.

2.05 ISOLATORS AND SWITCH FUSES

A. Isolators and switch fuses, where mounted individually shall be of sheet steel construction with doors and front operated handles. They shall be of the quick make, quick break type with removable shields over the fixed contacts, door interlocks and 'ON/OFF' indicators.

B. Isolators and switch fuses shall be single or triple pole with neutral, of ratings as indicated on the Drawings and provided with earth terminals. They shall be in accordance with IEC 408. The switch fuses shall be suitable for H.R.C. type fuses of Class QI to BS 88.

C. Isolators installed outside the building shall be of IP54 construction.

PART 3 EXECUTIONS

3.01 GENERAL

The Contractor shall submit details of proposed equipment and method of installation to the Engineer for approval prior to commencement of installation work.

3.02 EARTH BONDING

A. Each panel section shall be individually bonded to main earth bar located in the L.T. Room.

B. Each panel section shall be cross bonded to adjacent panel section earthing terminal.

C. Size of earth bonding cable shall be 70mm2 copper.

D. All metallic non-current carrying parts which are not inherently bonded together shall be bonded together and connected to the earth bus.

3.03 TESTS AND INSPECTION

Test shall be performed at the manufacturer’s plant in accordance with BS-5486.

The manufacturer shall submit the test reports to the purchaser for approval.

Inspection shall be carried out at the manufacturer’s plant and test witnessed by the Engineer before delivery of equipment to site.

END OF SECTION

SECTION EL-10 / DISTRIBUTION BOARDS

PART 1 - GENERAL

1.01 GENERAL REFERENCE

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

B. Co-ordinate the work with all other services affecting the work of this Section.

1.02 DESCRIPTION OF WORK

A. This Section to include all labour, materials and accessories for the complete performance of all distribution boards in accordance with the Specifications and approval Drawings.

1.04 APPLICABLE STANDARDS REFERRED TO IN THIS SECTION

A. BS 5486 Pt.11: Particular Requirements for HRC.

Pt.12 Fuses, Miniature Circuit Breaker Boards.

B. BS 3871 Pt.1 : Miniature Circuit Breakers

IEC 157-1A

C. BS 4293 : Current Operated Earth Leakage Circuit Breaker

D. BS 6231 : PVC Insulated Cable for Switchgear and Control Gear Wiring.

E. BS 5420,IEC 144: Degree of Protection for Enclosures.

F. IEC 61009-1 / EN 61009-1: Single + neutral 240V RCBO.

1.05 SUBMITTALS

A. Submit fully detailed specifications for the enclosures and components of distribution boards with relevant sheets of manufacturer's catalogues.

B. Submit confirmation that boards offered comply with the relevant specifications, Drawings and Schedule of Points.

2.01 GENERAL

A. Distribution Boards shall be provided to serve lighting, socket outlets and other appliances. Boards shall be arranged in banks of ways as indicated on the schedule of points.

B. Distribution boards shall be flush mounting type unless specifically mentioned otherwise. The boards shall be totally enclosed, dust protected, vermin proof type. Enclosure shall be fabricated from robust galvanized sheet fully rust protected, stove enamelled, of minimum thickness of 1.5mm. The enclosure shall be protected to IP31 for internal use with neoprene gaskets for the doors.

C. The distribution boards shall be provided with fixed cover and a hinged door with padlock which can be opened without any obstruction about 120 Degree and conduit knockouts from the top and bottom. The hinged door with a lock and key shall be integral part of the fixed cover.

D. The cabinet shall be constructed so that it is necessary to open the door to operate Miniature Circuit Breakers or RCBO Access to interior components and internal wiring shall be gained by removing a separate barrier within the enclosure.

E. All distribution boards shall be controlled by an adequately rated ON load isolator or MCCB to interrupt the supply to the entire distribution board.

F. A circuit label shall be provided to indicate the area served by M.C.B. or RCBO.

G. The contractor must be supply 6 Nos. from MCCB, isolator, RCBO, MCB, ELCB / rate, as spare Parts.

2.02 BUS - BARS

A. To be of appropriate current carrying capacity at least equal to the rating of the main incoming isolator.

B. To be of high electrical conductivity copper.

C. Insulated by heat shrinkable sleeve for phase identification.

2.03 MOULDED CIRCUIT NEUTRAL CONNECTOR BLOCK

A. To be of ample size to ensure a separate way is available on the connector block for the neutral conductor of each circuit.

2.04 MINIATURE CIRCUIT BREAKERS (MCB)

A. The M.C.B. shall comply to BS 3871 Part 1 and amendments and shall be of category M6 Type 3.

B. The M.C.B. shall be of the trip free pattern to prevent closing the breaker on a faulty circuit, and shall be engraved to indicate 'ON/OFF' position and rated current.

C. Trip Settings : As indicated on schedule of points.

D. To have a minimum symmetrical RMS interrupting capacity of 10 KA.

E. To have thermal overload trips to operate at 125% rated current and instantaneous magnetic trips to operate at:

a. 500% rated current for single pole breakers.

b. 800% rated current for triple pole breakers.

F. To be arranged so that it is possible to replace three single phase units with one three phase unit.

G. Triple pole miniature circuit breakers shall have inherent characteristics to prevent single phasing and shall be fully suitable for motor duty.

2.05 RESIDUAL CURRENT BREAKER INTEGRATED WITH OVER CURRENT PROTECTION (RCBO/2P/6KA) :

A. RCBO shall comply with IEC 61009-1 and shall be symmetrical rail mounted type available in two, poles version. They shall be trip free type with quick make, quick break mechanism. The rated ultimate breaking capacity (Icu) of the MCB's shall be at least equal to the prospective fault level at the point of the distribution system where they are installed, unless cascaded with an upstream breaker. The minimum rated ultimate breaking capacity (Icu) of the MCB shall be 6 kA if not mentioned on the drawings. MCB can be reverse fed without reduction in performance. Trip setting as indicated on the schedules of points. The MCB shall have thermal overload trip to accept 5% overload and to trip at 30% of rated current as per IEC . The instantaneous magnetic trip shall operate at 5 to 10 times the rated current for 2P breakers. It shall be possible to replace 3 single phase units with one 3 phase unit. The breakers shall be of current limiting type (DIN type) and quick lag type breakers (QL/plug in type) are not allowed. Evidence of the ultimate breaking capacity (Icu) shall be produced by test certificates from one of the internationally recognized High Voltage Laboratories (ASTA, CESI, ESEF/ASEFA, KEMA, PEHLA or SATS).

B. Main Technical Data :

1. Number of poles : 1P+N .

2. Rated Current (A) : 10A, 16A & 20A

3. Rated Residual operating current (in mA) : 30 .

4. Rated Residual Non operating current (in mA) : 30 .

5.Rated voltage (v) : AC 230/240

6.Residual Current off-time : ≤0.1S
7.Short circuit Capacity (Icu) :6000A
8.Endurance : ≥4000
9.Protection degree : IP20

2.05 CURRENT OPERATED EARTH LEAKAGE CIRCUIT BREAKERS (C.O.E/L.C.B)

A. Current operated earth leakage circuit breakers shall provide accident protection by interrupting dangerous contact with voltages which may be present in faulty electrical appliances as a result of frame faults, insufficient insulation or misuse.

B. The E/L.C.B. shall also provide a high degree of protection against earth leakage, fires and electric shock and suitable for short cut circuit at least 10 KA. The breakers shall generally comply with BS 4293, 1983 and the recommended specification CEE 227 of the IEC on Rules for the approval of electrical equipment.

C. The breaker shall consist of a core balance transformer, a tripping coil with contact assembly, main supply contacts, ON/OFF switch, a test button and a trip free mechanism all enclosed in a robust body of all insulated material.

D. Degree of Protection against earth leakage throughout the electrical installation shall be as indicated on the drawings and as follows :

10 mA. trip rating - for underwater lighting.

30 mA. trip rating - for all socket outlets and domestic apparatus.

300mA trip rating - lighting circuits and all other apparatus and equipment's.

E. The breaker protecting lighting and power circuits shall be mounted in the panel board enclosure.

2.06 CONTACTORS

A. Lighting Contactors

1. The lighting contactors shall have minimum making and breaking capacity in accordance with utilization category AC3 and shall be suitable for intermittent duty Class 1.
2. The mechanical rated life of the contactor shall not be less than 3 million operations.
3. The contactors shall be single coil, electrically operated, mechanically held (latch type) and shall be rated for Tungsten, Fluorescent or discharge lighting load.
4. Contactors rating and number of poles : as indicated in the Schedule of Points.
5. Operating coil : suitable for 240 V, 50 Hz. supply.
6. Main contacts : double break silver to silver type protected by arcing contacts.
7. Contacts : self aligning, renewable from the front panel.
8. Solenoids : shaded pole pattern of such construction that lamination noise is eliminated.
9. Control of contactor : by local and remote pushbuttons as indicated. A manual operating level shall also be included.
10. Lighting contactors controlling lighting circuits of distribution boards shall be mounted in the board enclosure.

2.07 DISTRIBUTION BOARDS CONTROLLED BY CONTACTOR AND PUSHBUTTON

A. These distribution boards shall be same as specified above except that the contactors shall also be installed within the enclosure of the boards.

B. Where there exists multicontactor, number of bus sections shall be referred from schedule of points. Adequate space shall be provided to accommodate all the contactors and other contents of distribution boards. The construction of Contactor shall be such that it is not possible to come into contact with live parts. The operating coil of Contactor shall be suitable for operation at 240Volts, 50 Hz, single phase.

C. These distribution boards shall be of special design and shall consist of all components including E/L.C.B., as shown on the schedule of points. The details shall be submitted and approved by the Engineer, before placing the order.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Distribution boards shall be supplied and installed as indicated on the Drawings.

B. Distribution boards shall be installed in electrical rooms or electrical closets as indicated on the Drawings. The proposed distribution panel construction and layout, including a diagram of all internal connections on which the proposed identification markings for all cables and terminals is shown, shall be submitted to the Engineer for approval before construction commences.

3.02 TESTS AND INSPECTION

Test shall be performed at the manufacturer's plant in accordance with BS 5486.

The manufacturer shall submit the test report to the purchaser for approval.

END OF SECTION

SECTION EL-11 / EARTHING SYSTEM

PART 1 - GENERAL

1.01 GENERAL REFERENCE

A. The work of this Section is integral with the whole of the Contract Documents and is not intended to be interpreted outside that context.

B. Co-ordinate the work with all other services affecting the work of this Section.

1.02 DESCRIPTION OF WORK

A. The Contractor shall supply and install earthing, bonding and protection systems as indicated on the approval drawings and detailed in the Specification.

B. All systems shall comply fully with the relevant IEC/BS and MEW Standards.

C. Final details of installation must be approved by the Engineer. The number and location shown on the drawings are indicative only. The actual No. shall be determined at site and be subject to Engineer's approval.

D. The earthing and bonding systems shall be arranged to provide:

1. A low earth path resistance to ensure operation of protective devices.
2. Good operating condition for sensitive electronic equipment.
3. Full safety to personnel by limiting the contact voltage.

1.04 EARTHING

A. Low voltage installations within the building shall be as per MEW – Kuwait specification.

B. The Earthing and Bonding networks shall generally meet the 50V maximum continuous contact voltage limitations for protection against indirect contact resulting in automatic disconnection of supply as detailed in the relevant IEC Standards.

1.05 BONDING

A. Equipotential bonding conductors shall be provided as required to ensure electrical continuity between exposed conductive parts and restrict contact voltage.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. The main earth bars shall be constructed of high conductivity copper, drilled, mounted on insulators and fixed as required.
2. All main earth connections shall be completed using the copper weld technique.

B. Earth Continuity Conductors

1. Sizes shall be as specified by MEW/BS Standards. In no case the conductor size shall be less than half that of associated phase conductors.
2. Insulation shall be of the same material as insulation in associated sub-circuits.

C. Main Earth Loops

1. 25 x 3mm tinned copper tape, unless otherwise indicated. Proper earth link connectors shall be provided at regular intervals for the main run of the copper tape.

D. Earth Electrodes

1. Earth electrodes shall be made of three sections of high strength steel alloy core with a welded copper covering, diameter 16mm, length 3.6mt.
2. One end of the rod shall be pointed without application of heat and with driving head at other end. The sectional rods shall be coupled with strong bronze couplers. The coupler shall be threaded to fit the rod section. For driving the rod into the ground threaded steel stud shall be used.

E. Earth Connectors

1. For connection of rod electrodes : bolted type.

F. Removable Earth Links

1. To compromise a bolted copper link fixed on porcelain insulators and complete with studs, nuts and washers to take the earth tape and a bolted lug adequately sized for the final connection of the earth electrode.

G. Bolts, Washers and Nuts in Bolted Connections

1. High copper alloy or silicon bronze. Ferrous hardware is not acceptable.

H. Earth Pit Cover

1. To be of cast iron cover.
2. To have a recessed lifting hook.
3. To have a brass plate, engraved "Electrical Earth Below".

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Low voltage installations in buildings not incorporating earth electrodes shall be provided with a suitable earth path by means of supply cable protective conductor.

B. Circuit Wiring

1. To have a green coloured insulated earth continuity cable connecting the earth bus or earth terminal in panel boards to the outlet or device earthing lugs.

C. Main Earth Loops

1. Fix in mechanical equipment rooms and other areas indicated on the drawings, in convenient locations, allowing two return paths to earth.

2. Fix copper tape to structure with copper or brass saddles and/or screws. Make tees and straight joints by riveting and seating, welding or brazing.

3. Make branch connections between main loop and major equipment, such as switchboards, large motors and motor control boards, with copper tape of same size as main loop tape.

4. Make other branch connections to equipment with copper conductors of size not less than half that of relative phase conductors.

5. Equipotential bonding shall also be provided between the building conductive parts, including steel reinforcements and earth electrodes, thereby ensuring a complete equipotential system.

D. Remove Earth Links

1. Fix in every main earth lead to enable the electrode system to be disconnected for testing.

2. Install in an accessible position, above ground as close as possible to the earth electrode.

E. Exposed Earth Cables

1. Install and locate to provide maximum mechanical protection, utilising ceiling corners, suspended ceiling and webs of beams as much as possible.

F. Bolted Connections

1. Multiple bolt type

2. Where bare copper is bolted in connections contact surfaces shall be silver electroplated.

G. Brazed Connections

1. Where earthing terminal connections are to be brazed to equipment, thoroughly clean metal prior to brazing and repaint impaired surfaces to prevent corrosion.

H. Connections between Dissimilar Metals

1. Protected by :

a. Painting with a moisture resistance bituminous paint or compound or

b. Wrapping with protective tape to exclude moisture.

I. Equipment Earthing

1. Connect all non-current carrying metallic parts of the electrical/mechanical installation to the earthing system.

2. Noncurrent carrying metallic parts of the electrical installation include :

a. Metal conduit cable armour (steel and aluminium), cable trays, G.S. conduits, outlet boxes, cabinets and the like.

b. Exposed metal parts of apparatus.

c. Enclosures, doors, grilles, barriers and the like protecting or shielding electrical equipment form direct access.

3. All cable trays and trunking shall be earthed in an approved manner.

4. Series earthing of one piece of equipment to another is not acceptable.

K. Motors Earthing

1. Connect the motor terminal box to the relative earth loop. The terminal must be mechanically connected to the frame or where this is not feasible.

2. Extend the earthing conductor through an insulated bushed opening in the connection box and connect to the frame.

L. Main Switchboards Earthing

1. Connect the special earthing lug or bus-bars inside the cabinet to the main earth copper tape.

2. Connect all parts of the switchboards, other than "live" parts, to the earth bar in the board in an approved manner.

M. Distribution Boards Earthing

1. Connect an earthing conductor from the main distribution earth busbar to an earth connector welded to the cabinet and earthing bushings on the incoming and outgoing feeder conduits.

N. Cable Armour Earthing

1. Connect steel and aluminium armour to the earthing system.

O. Earth Rod Electrodes

1. Drive extensible rods of the same diameter into the ground either manually or by power driven hammer, to a suitable depth to obtain low resistivity in the particular soil.

2. Weld earth connectors to the top of the rods, in sufficient number to take all incoming cables.

P. Earth Pit

1. Construct a small concrete pit, complete with removable heavy duty cast iron cover with recessed lifting hook, at the head of the earth rod, to protect the rod and allow access to connections for testing.

Q. Technical Earth.

Separate Technical earthing system to be provided for all equipments distribution Boards, and interconnected to the nearest technical earthing box.

3.02 SITE QUALITY CONTROL

A. Testing

1. Test earthing systems by the earth megger test.

2. Where steel conduit, trunking and/or cable sheath armouring, form a part of whole of the earth continuity conductor, the resistance between any point on the earthing system and the earth electrode shall not exceed 0.5 Ohm including the connection to the main earth electrode.

2. Where the earth continuity conductor is composed entirely of copper than the said resistance shall not exceed 0.5 Ohm. The overall resistance between the earthing system and the general mass of earth shall be less than 2.0 Ohms.

3. Install additional earth electrodes if these figures are not met.

4. Submit the copies of all tests and measurements to the Engineer for approval.

END OF SECTION

SECTION EL-12 / LIGHT FIXTURES

To be read in conjunction with Section EL-01 General Provisions, Design Drawings and Conditions of Contract.

PART 1 Specific criteria:
For Light:

- Lights shall be the best of their kinds and shall comply with all standards mentioned in the document.
- Lights shall be dust proof, water proof and oil proof and shall have an IP of 55 or above.
- Lights shall have a color rendering index (CRI) of 80+ and above .
- Lights shall be no less than 50,000 hours of light
- Lux shall be not less than the average : 500 Lux
- LED chip shall be creed / vs from:
  a. Philips
  b. Osram
  c. LG
  d. Samsung
- Lights shall tolerate and operate at -10 degree Celsius and maximum 50+ degree Celsius.
- Corridors shall have an average lux of 250 lux and shall have aluminum body and reflector.
- Ladders and stairways shall have an average 75-100 Lux.
- Lights voltage shall operate at 220 – 240 v and frequency of 60 Hz and pf 0.9.
- Lights shall have an overheating protection.
- Lights shall allow any future occupancy sensor connections.
- Lights shall be made to fit offices and commercial buildings and color shall be white and daylight cool ranging from 4 K.
- Lights shall be Lens type No glare lights
- Light lamination shall be evenly distributed.
- Where there should be critical equipment, lights shall be wire-glow tested prior to installation and shall be approved by MOI engineer.

- Lights shall be one from the following:
  Philips lighting
  Orsam Lighting
  Iluma

For motion/occupancy sensors:

-
- Occupancy sensors shall have a built in switch and shall be installed to save energy no less than 35% in areas specified by MOI engineer.
- Occupancy sensors shall be passive infrared technology and shall have a timer to control the circuit and shall have a sufficient ampere to support lighting fixtures,
- Occupancy sensors should be functional after 3 pm until 6 am.
- Sensors shall have adjustable switch-off delay from 30 s to 20 minutes.
- Sensors shall cover areas according to length of areas and contractor shall design occupancy sensors according to width and length of given corridors.
- Sensors shall operate at 110-240 v, with maximum load based on light fixtures.
- Sensors should be ceiling mounted with suitable bracket. .
- System / Setup functionality shall match the requirements of the location occupants / employees . ie: practical to the most effective.

PART 2 GENERAL

2.1 SECTION INCLUDES

1. LED Interior luminaires and accessories.
2. LED Outdoor lighting and accessories.
3. LED Emergency luminaries and accessories.
4. LED Exit signs
5. Drivers.
6. Luminary's accessories.

2.3 REFERENCES

1. References according to the latest relevant British standard, IEC- or VDE specifications.
2. According to MEW latest regulation for LED Lighting.
3. CIBSE Code for Interior Lighting 1994.
4. EEC Directive : Low Voltage Directive
5. EEC Directive: Electro Magnetic Compatibility Directive

2.4 SUBMITTALS

1. Submit under provisions of Section EL-01.
2. Shop Drawings: Indicate dimensions and components for each luminary that is not standard product of the manufacturer.
3. Product Data: Provide outline drawings, lamp and ballast data, support points, weights, and accessory information for each luminary's type.
4. Outdoor light fittings shall be able to withstand the corrosive atmosphere and

high temperature and shall be complete with accessories and fixing hardware.

5. Manufacturer's Instructions: Indicator application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

6. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

2.6 OPERATION AND MAINTENANCE DATA

1. Submit under provisions of Section EL-01.
2. Maintenance Data: Include replacement parts list.

PART 3 PRODUCTS

3.1 LUMINAIRES

A. Furnish products as specified and approval design drawings.

B. Light fitting manufacturer must be certified under ISO 9001/9002.

D. All luminaries must be LED type.

E. Luminaries with Emergency Kit shall have battery back for 3 hours.

PART 4 EXECUTION

4.1 EXAMINATION

A. Examine substrate and supporting grids for luminaries.

B. Examine each luminaries to determine suitability for lamps specified.

4.2 INSTALLATION

A. Install in accordance with manufacturers instructions.

B. Recessed ceiling luminaries shall be matching the type of false ceiling.

C. Install surface mounted luminaries and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

D. Install recessed luminaries to permit removal from below.

E. Install clips to secure recessed grid-supported luminaries in place.

F. Install wall mounted luminaries and exit signs as indicated on Drawings.

G. Install accessories furnished with each luminary.

H. Connect luminaries to circuits indicated in lists of loads and points.

I. Bond products and metal accessories to final circuits grounding conductors.

J. Install specified lamps in each luminaries.

K. Ensure all ceiling grids are bonded.

L. Provide pendant length required to suspend pendant luminaries at indicated height.

M. Connect all recessed lighting fittings to corresponding ceiling roses using three core flexible cords. Flexible cords shall be of circular, silicon rubber insulated, glass fibber braided type.

Conductors of flexible cords shall be of tinned annealed copper. Cross section of the conductors shall be 2.5mm2 depending on the RCBO or MCB protecting the concerned circuit.

4.3 FIELD QUALITY CONTROL

Operate each luminaries after installation and connection. Inspect for proper connection and operation.

4.4 ADJUSTING

A. Adjust work under provisions of section EL-01.

B. Aim and adjust luminaries as per approved Drawings.

C. Adjust exit sign directional arrows as indicated in approved Drawings.

D. Change luminaries that have failed operate between substantial completion and final handing over.

4.5 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

PART 5 LIGHT FITTINGS

GENERAL

A. All light fittings shall be of excellent quality (First class), made by approved reputable manufacturers, European made and shall be suitable in all respects for trouble free operation
on 240Volts, 50Hz at 45oC. All light fittings shall from standard range of production of the manufacturer and should be supplied by local supplier for which spare parts and lamps are easily available during expected life of the fittings and associated equipment.

B. Provide list of proposed luminaries indicating manufacturer and type of Luminaries with all technical data

C. Basis for luminaries proposals shall be according to schedule of luminaries. Equal approved shall be from one of the recommended manufacturers.

D. Load per light fitting or circuits in the schedule of DB are indicative only and shall Not be considered as final load or quantities of light fittings. Follow the specification & layouts for the purpose.

E. The contractor must be supply 10% from each fitting type and at least 2 Nos. as spare Parts.

END OF SECTION

BOQ: bill of quantity

S.N	DESCRIPTION	QNTITY	UNIT	U PRICE		T-PRICE	
	The work shall involve but not be limited to the following items, as the successful tenderer shall do all the necessary works to complete the job even if it is not mentioned in the specification or BOQ.			KD	Fils	KD	Fils
	2.1 Preparation of Designs / Shop / as-built drawings for all electrical work systems to meet the documents requirements and submit to MOI Engineer for approval.	LS	LS				
	2.2 Disconnect, dismantle and transfer to ministry stores, any old, unwanted electrical installations (DBs, cables, wires, conduits, trunky, and switch sockets…….etc.). The dismantling and removal work include areas in ground and first floor electrical rooms where old cables are located.	LS	LS				
	2.3 Design, supply, install, connect and commission 3 Nos, 10-way TPN RCBO type Distribution boards DBs (2 DB power 1 DB light). The DBs must have 20% spare breakers and must be installed in the first-floor electrical room feeding all the first-floor installations. Fed from existing	3	NOS				

	400A and/or 300A MSBs in the Ground Floor, this work also includes the supply and install of a newly designed MCCBs inside the existing MSBs and new cabling work.						
	2.4 Design, Supply, install, and connect all types of Light fixtures and their Wiring accessories for all project site and rooms. The work includes wires, PVC conduits, GI/PVC conduits, boxes, light switches, accessories……etc.).	LS	LS				
	2.5 Supply, install, terminate and connect all project's Cables & Wires. The work includes all earthing systems, cable trays and related accessories (cables can be resized to bigger cables regarding voltage drop calculation which should be submitted by electrical contractor). This work also includes redistribution of old cables between MSB1 and MSB2 to the old loads.	LS	LS				
	2.6 Design, Supply, install, terminate and connect number AS PER DESIGNED twin switch sockets feeding the rooms and partitions' workstations.	LS	LS				
	2.7 Design and install Telephone system infrastructure on the first floor which includes installing	LS	LS				

	pipe works and wall outlets for future telephone system.						
	2.8 Design and install Data System infrastructure on the first floor which includes installing pipe works and wall outlets for future data system.	LS	LS				
	TOTAL AMOUNT IN KUWAITI CUURENCY						