STATE OF KUWAIT MINISTRY OF INFORMATION



دولة الكويت وزارة الإعلام

توريد وتركيب أجهزة (UPS-DVB T2) في محطات الإرسال التليفزيونى الخارجية (المقوع – المطلاع – الجليعة)

الممارسة رقم : وأ / /

TECHNICAL SPECIFICATIONS

المواصفات الفنية

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SECTION EL-01 GENERAL PROVISIONS

INTRODUCTION

Ministry of Information invites electrical contractors to submit their offers for supply, install, test, commission and hand over in perfect working condition 3 Nos Two parallel Redundant connected 80 KVA uninterruptible power supply units (UPS) with all related works (switch boards, cables, cabling works.....etc.). The works shall include guarantee and maintenance of all installed work and equipment for two years, as described in the detailed specification at TV transmitting stations.

PART 1 - GENERAL CONDITIONS:

- 1.1 All Electrically operated equipment, components and accessories shall be designed and constructed to operate safely and efficiently without damage for a power supply of 415 Volts with a tolerance of 6%, 3-phase, 4-wire + E and 50Hz with a tolerance 4%.
- 1.2 All the electrical works (systems design, materials, installation.....etc.) shall fully comply with the rules and regulations and standard specifications of electrical installations works issued by MEW.
- 1.3 The works include Design, supply, install, test, commission and guarantee switchboards, UPS's, isolators, cables, wires and all related works (cable trays, trunking, conduits, boxes, earthing, accessories) **for DVB Devices.**
- 1.4 Specifications described hereunder, BOQ and proposal drawing complete each other. The contractor should consider all as one document.
- 1.5 Specifications described hereunder are in brief. Therefore, the contractor must take into consideration that will be carried out all the electrical materials, labor.....etc. needed for complete installation to ensure best workmanship and operating conditions as project requirement, whether detailed in the document or not. Later on "No variation", and cost will be borne by the contractor.
- 1.6 The attached drawing only proposal and the (capacity/size) of UPS, Breakers, Switchboards and Cables are the minimum required and may be increased according to the design, loads and voltage drop calculation that will be submitted by the contractor.
- 1.7 The contractor should be visit and inspected the sites to familiarize himself with the existing sites conditions and services at tender stage prior to submitting the tender, for no claim for lack of knowledge will be considered after the tender.
- 1.8 If found any additional either electrical works or materials are required to complete the works satisfactory and keep DVBs transmitters working without interruption in case of utility power outage, but not mentioned in the specifications or BOQ, the electrical contractor shall be responsible to supply and execute the additional without any claims.
- 1.9 The contractor should be submit Clause by clause compliance statement for the specification with his offer, failing to comply with foregoing does mean cancellation of

the offer.

- 1.10 The contractor should be submit with his offer user and operation manuals for UPS and original catalogues giving full details of other equipment and materials. Failing to comply with foregoing does mean cancellation of the offer.
- 1.11 All electrical equipment, materials and drawings supplied by the contractor shall be submit to approval by MOI engineer, No installation works shall be permitted to commence, before approval of the working drawings.
- 1.12 Existing electrical panels, which will feed the project loads, shall be determined by the Ministry of Information.
- 1.13 Electrical contractor should be authorized by Kuwait Central Agency for Public Tenders CAPT (electrical works) and should be execute similar work at government authorities.
- 1.14 Electrical contractor profile should be submitted to approval, the profile included (company overview, business activities, qualification and approvals, similar work experience at government authorities) and MOI engineer has the right to exclude the sub-contractor.
- 1.15 Electrical contractor must ensure that a qualified engineer of the respective field supervises all the works, the engineer must be available at the sites during the ministry working hours. A list of the contractor's supervisory staff must be submitted to MOI for approval and all staff residence should be of electrical contractor.
- 1.16 The contractor should submit a detailed time program chart for the works to the engineer for approval, and this program should be matching with the other work.
- 1.17 All equipment and materials should be best of their kind. Samples of materials must be submitted for approval before commencing the works, the ministry reserve the right to oblige the contractor a certain type of equipment and materials as per specs.
- 1.18 The contractor shall submit before ordering of material and equipment covered by this specification complete details, these details shall include the following where applicable.
 - All technical data and supporting catalogues (in English language) and test certificate of all components from an internationally recognized testing authority.
 - Single line diagram of the circuits showing the rating of all components the type and size of the incoming and outgoing feeders.
 - Wiring diagram for the switchgear showing the control protection and instrument-wiring.
- 1.19 The contractor shall take all necessary precautions not to damage any existing services and should fix any damage done by him during the installation of the equipment, at no extra charge.

- 1.20 The contractor must ensure cleanliness and safety of the site throughout the whole period of execution of the project. No scrap or waste materials should be allowed to accumulate on site; removal of such materials should be carried out on short intervals to avoid mishap, accidents or inconvenience to the site users. If the contractor fails to clear the site off such waste and debris within 48 hours after being notified, the ministry reserves the rights to carry out the necessary cleaning works and charge the contractor without accepting any claims.
- 1.21 All the tests shall be done without any repair or adjustment to the satisfaction of MOI engineer. Any failure in the system during durability test does require another sequence of tests.
- 1.22 Due and careful consideration shall be taken to ensure that all materials and equipment shall be suitable for prolonged and trouble free service in the climatic conditions at site in Kuwait.
- 1.23 Approval of design, drawings, equipment, materials,.....etc., does not relieve the contractor from his contractual obligations if later on found that they do not comply with the specification requirements and an error occurred, The Contractor shall then undertake the necessary work to repair the error at his expense without any claims.
- 1.24 All electrical materials related to other services such as HVAC, Plumping, Fire Fighting.....etc., such breakers, isolators, cables, cable trays and all accessories included in this section and should be carried out by the contractor.

1.25 Applicable Standards:

All electrically operated equipment and materials shall comply as minimum to The following:

- 1- With latest ME&W Regulation and Standards.
- 2- With latest relevant recommendations of the International Electrotechnical Commission (IEC) if available.
- 3- If (IEC) is not available, with the latest relevant British Standard specification (BSS).

1.26 Electricity Supply:

The equipment required shall be suitable in all respect to the power supply System, characteristics of which are:

a.	System Voltage	415 Volts + / - 6%
b.	Frequency	$50 \text{ Hz.} \pm 4 \text{Hz}$
c.	Neutral	Solidly earthed

1.27 Grounding:

- The Contractor shall measure the resistivity of various places and design suitable grounding system.
- All metal components and all other parts made of metal shall be bonded together and connected by means of specified grounding system. All the non-current metal parts of electrical installation shall be earthed properly.

- Each rack shall have a grounding point. A grounding cable shall be taken to each piece of equipment. All earth cables shall be terminated using the appropriate sized crimps.
- All equipment shall be grounded to a Technical Ground independent of the electrical building ground. Particular care shall be taken to avoid short-circuiting these grounds together by appropriate choice of grounding points.
- All equipment's DBs shall be fitted with isolated earth terminal bar and connected to16mmsq cu / PVC earth wire from existing technical bar while the DB enclosure must be bonded to safety earth.

1.28 Labeling and Finishes

- All equipment shall be clearly labeled with an identification relating to the designation of that component on the relevant functional or schematic diagrams.
- All cables at source & destinations will be marked with proper labeling equipment.

1.29 As Built Documents:

Upon completion of all works involved the following drawings, three (3) "As-Built" drawings A1 size, AutoCAD format with two CDs, Also for each type of equipment offered three original sets of installation, operation, maintenance, engineering and spare parts manuals shall be submitted.

1.30 Completion Period:

The successful contractor should be design, supply, install, test, commission, and hand over in perfect condition all electrical works involved in this tender in a maximum period of Three months, from the date of handing over the site.

1.31 Guarantee and maintenance:

The contractor shall be responsible for guarantee and maintenance for all installed system and equipment all the project time line and during the warranty period with spare parts, the contractor shall be responsible for supplying all the spare parts during the guarantee and maintenance period free of charge to MOI. The maintenance includes all repair and replacement of defective parts with labour and all material required.

The contractor should provide preventive maintenance and 24 hours, 7 days a week on-call service for all installed system and equipment for the guarantee and maintenance period.

Preventive maintenance schedules should be submitted to MOI engineer for approval.

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 reserve the right to execute the repairs under full the contactor responsibility and charge the contractor the repairing cost without accepting any claims from the

contractor's side.

1.32 Training:

The contractor must Train MOI personnel and shall take place after commissioning and before issuing the final handing over certificate, the training shall be comprehensive, regarding, theoretical and practical aspects of the offered systems.

1.33 Spare Parts:

Spare parts required to supply and delivered to the MOI central stores. As the following:

Switch Boards:

- 1. One Spare moulded case circuit breakers of all different frame sizes,
- 2. 6 Nos Spare of (MCB, RCBO & ELCB) of each Rating.

PART 2 - SCOPE OF WORKS:

This section of specification should be covers the functional and technical requirements for designing, supplying, testing, commissioning and handing over in perfect working condition of all electrical works according to contract documents, which shall include but not be limited to the following:

- **2.1** Provision of all labour, equipment and materials required to complete the works according to the design intent. Installation, test, commission and put to operation.
- **2.2** Provision of additional materials and any other work necessary for completion of the works and safe, correct operation of each system, whether such item or work is detailed in specifications or not.
- **2.3** Disconnect, dismantle, remove and transfer to MOI stores unused electrical services such as DB's, breakers, wires, cables.....etc. as per instruction of MOI engineer.
- **2.4** Supply to replace, install, test and commission 3 Nos. 3P MCCB (design rate) in existing EMSBs, the works includes supply and connect branch busbars and all accessories required, the work should be done by the manufacturer of panels.
- **2.5** Supply, install, fix on base, terminate, connect, test, and commission of 3 Nos. (I/P-MSB-UPS), as per proposal single line diagram.
- **2.6** Supply, install, fix on base, terminate, connect, test, and commission of 3 Nos. (O/P-MSB-UPS), as per proposal single line diagram.
- 1- Supply, install, fix on base, terminate, connect, commission and handing over in perfect working condition (3x2-Nos. UPS, 80KVA/KW, 3-phase, 50 hz, 415V), with the following requirement:
 - 2 Nos active redundant parallel connected, for each Transmitting station.
 - Unity power factor.
 - On line double conversion.
 - Static bypass and maintenance bypass.
 - IGBT rectifier / inverter technology.

- Battery management system.
- External VRLA batteries, 20 min backup time @ 80KW/ each UPS Frame.
- Designed for intelligent energy management.
- Remote audible visual alarm system.
- Monitoring and service support compatible with DCIM.
- **2-** Supply, install, terminate, and connect earthing system including copper tape and all other necessary accessories to complete the system, for bonding electrical equipment with existing copper tape.
- **3-** Supply, install, terminate, test and commission **All Cables and Wires works** with trenches, cable trays, cable trunking, conduits etc. The sizes and the current carrying capacities of all the cables shall be designed as per the MEW regulations.

END OF SECTION

SWITCH BOARDS

GENERAL

- The main switch boards (I/P-MSB & O/P-MSB) for UPS shall be indoor construction, dead front, metal enclosed multi-cubicle type, free standing, dust and vermin protected, front operated and of clean and modern appearances.

- The switchboards shall be assembled and co-ordinated by one manufacturer and shall be constructed to Form 3B in accordance with the requirements of IEC 61439.

- The switchboards shall be made of folded steel construction; minimum 2mm thickness, fully rust proofed and stove enamelled.

- All exposed bolts or screw heads shall be chrome or cadmium plated.

- All doors and removable covers or plates shall be provided with suitable PVC or neoprene gaskets to prevent the ingress of dust, vermin and insects.

- Each unit of the switch board shall be housed in its own cell fitted with a hinged door mechanically interlocked in such a manner that the cell door can only be opened when the switch is in the "OFF" position.

- Switching units shall be arranged in separate compartments or sections to prevent when handling the elements in the section and to prevent the spreading of faults from one section to the other.

- Adequate cableways shall be provided in the switchboard accessible by hinged lids or removable covers.

- The equipment in the switch boards shall be accessible with indicating instruments mounted not higher than 2 m and the centre lines of operating devices not higher than 1.9 m above switchboard base. The switchboard shall be properly fixed to the floor with foundation bolts grouted in the floor or bolted to channels laid across the cable trench.

- The switchboards shall have top or bottom cable entry as required. Main incoming cables shall be bottom entry, with necessary cable glands.

- The switchboards shall contain the circuit breakers, busbars, bus compilers, instruments.....etc., as specified hereunder with ratings and arrangement as shown on the Drawings and shall be complete with all-internal wiring and connections.

- The switchboards shall be tested, at the manufacturers premises as well as after installation in accordance with tests stipulated in IEC 61439 and witnessed by the Engineer. TTA certificates by the manufacturer shall be submitted to the Engineer.

- The switchgear should be Schneider or Siemens.

BUSBARS

- Busbars shall be of electrolytic hard drawn copper to BS-159 with rating as indicated on the Drawings, air insulated and rigidly supported by suitable non-hygroscopic, anti-tracking insulators so as to withstand forces due to thermal expansion under normal operating conditions and the fault currents specified and neatly arranged for 500 V, Hz, 3 phase, 4 wire operation.

- Busbars shall extend through the length of the board with the same cross section throughout.

- Busbars bracing shall maintain the same mechanical strength and current carrying capacity under normal operating conditions and fault conditions as indicated on the drawings.

- Busbars shall be housed in separate adequately ventilated compartment, which shall not contain any wiring or apparatus other than that required for connection to busbars. Access to

busbars and busbar connections shall be gained only by removal of covers secured by bolts or studs. Busbars shall be covered with coloured PVC.

- Bus bar rating shall be not less than 125% of the main incomer rating.

CURRENT TRANSFORMERS

- Current transformer shall be of the bar primary type, air cooled and suitably insulated. They shall be of Class 1 accuracy for measurements and of Class 10P10 accuracy for protection in accordance with IEC185. The secondary windings shall be rated at 5A.

INSTRUMENTS

- The measuring instruments shall include ammeters, voltmeters and selector switches and associated accessories.

- Measuring instruments shall be moving iron vane type, flush pattern with dust and moistureproof enclosures. The instruments shall have anti-glare glass fronts, anti-parallax scales and white faces with black numerals and markings. All instruments shall be a long scale 240° , with full load indicating approximately at 180° The instrument cases shall be semi-flush mounted and shall be 36 x 36mm square. Accuracy shall be one per cent of full-scale values. Moving elements shall be provided with zero adjustments external to the cases, located at face of dial.

- Ammeters shall be moving iron type, to BS 89 scaled in accordance to their circuit breakers. - Ammeters shall be capable of withstanding twice the rated current for ten (10) minutes and overload sustained under fault conditions, without damage or loss of accuracy.

- Voltmeters shall be moving iron type to BS 90 scaled 0-500V and provided with 6-position selector switches allowing reading of line to line and line to neutral voltages.

- Voltmeters shall withstand twice the rated full-scale voltage, for 1.0 minute, without damage.

- Digital indictors for above-mentioned measuring instruments may be provided subject to the Engineer's approval.

MOULDED CASE CIRCUIT BREAKERS

- The moulded case circuit breakers shall comply with IEC60947-1 and IEC 60947-2 standards and shall be of the quick make and quick break type having free toggle mechanism ensuring full contact pressure until time of opening, whether actuated automatically or manually. They shall be of utilization category 'A' having rated service breaking capacity (Ics) 60KA. The circuit breakers shall be suitable for isolation as per IEC 60947-2 and shall have rated operation voltage of 690V 50 Hz and the insulation voltage of 690 V, 50 Hz. The breaker shall be available in 3 or 4 pole version as per the drawing. All poles shall operate simultaneously for circuit breaker opening, closing and tripping. The mechanism shall be completely enclosed in the compact moulded case. The moulded case circuit breaker shall provide class II insulation (according to IEC 60664-1:2020 between the front and internal power circuits. The breaker shall be designed for both vertical and horizontal mounting and it shall be possible to supply power either from the upstream or downstream side without any adverse effects on the electrical performance. Evidence of the service breaking capacity (Ics) shall be produced by test certificates from a member of LOVAC, the internationally recognized HV testing laboratories.

- All MCCBs shall be factory tested by the manufacturer before dispatch and routine test certificates shall be available. Random sampling test by the manufacturer is not acceptable.

- Breakers contacts shall be made of non-welding and non-corrodible composition. Circuit breakers shall be actuated by a toggle or handle that clearly indicates the three positions 'ON', 'OFF' and 'TRIP' thus indicating clearly abnormal conditions of the circuit. In order to ensure suitability for isolation complying with IEC-60947-2, the operating mechanism shall be designed such that the toggle or handle can only be in OFF position if the powers are all actually separated. The moulded case circuit breakers shall be able to receive a locking device in the "isolated" position and there shall be a "push to trip" button in front to test the operation and the opening of the poles. The circuit breaker rating, the push to trip button, outgoing circuit identification and the contact position indication must be clearly visible and accessible from the front, through the front panel or the door of the switchboard. Single pole breakers with a handle tie or a bar equivalent construction are not acceptable for a multi-pole breaker. Moulded case circuit breakers shall be the fixed type. Plug in type breaker connection are not acceptable.

- Breakers shall have the ratings and rated service breaking capacities (Ics) as per IEC 60947-2 the breakers shall be of current limiting type.

- Circuit breakers shall have inverse time tripping characteristic with automatic release secured through action of a combination of thermal-magnetic or electronic trip units, which shall trip free of the handle and operate in response to an overload or a short circuit.

- It shall be possible to equip the moulded case circuit breaker with a motor mechanism if needed and closing of mechanism shall take place in less than 100 ms. the operating mechanism shall be of the stored energy type only. The addition of motor mechanism or a rotary handle shall in no way affect circuit breaker characteristics and shall not block the device settings.

- It shall be possible to assemble earth fault protection of MCCBs by adding a residual current device directly to the circuit breaker case and it shall operate without an auxiliary power supply. The add-on RCDs shall comply with appendix B of IEC 947-2 standard. They shall be immunised against nuisance tripping as per IEC 255 and IEC 801-2 to 801-5 standards.

- MCCB with ratings up to 250A shall be equipped with thermal magnetic or electronic trip units, which are fully interchangeable. The breakers with ratings over 250A shall be equipped with electronic trip units, which shall remain operational for ambient temperatures up to 70oC. Electronic trip unit shall comply with appendix F of IEC 60947-2 standard. It shall be possible to fit lead seals to prevent unauthorised access to the settings of the electronic and thermal magnetic trip units.

- MCCB equipped with thermal magnetic trip units shall have adjustable thermal protection 80% to 100% times rated current as well as adjustable magnetic protection. The 4-pole breakers shall have the Neutral pole tripping threshold equal to that of the phases unless indicated otherwise on the drawings.

CURRENT SENSORS (TOROID)

- a) Shall be a rectangular type for bus-duct feeders
- b) Shall be circular/ring type for cable feeders
- c) The toroids shall be of the closed type with an inside diameter ranging from 30 to 200mm.
- d) The toroids shall have cable guides to ensure that feeder cable is centered within the toroid.
- e) The maximum link resistance from the toroid to the relay must not exceed 3 ohms.

EARTH BUS

- The earth bus shall be copper, minimum half the size of the main busbars extending throughout the length of the switchboard and fixed to brass nuts brazed to the steel members of the switchboards. The earth bus shall be extended at the ends for connection to the earth electrodes and shall have provision for terminating earth continuity conductors.

CIRCUITS AND CONNECTIONS

- All outgoing circuits shall have separate compartment and/or be screened so that equipment for any one circuit can be maintained without risk of contact with live connections on any other circuit.

- Feeders for circuits rated up to 63A shall be connected to terminal blocks located in separate compartments at top or bottom, conveniently arranged to facilitate termination of cables and suitably identified.

- For feeders rated more than 63A copper links shall be suitably extended, rigidly supported and covered with coloured PVC sleeves.

- All feeders shall be provided with cable lugs and brass cable glands.

- Removable gland plates suitable for the glands required for the specified cables shall be provide. Where cables are single core, the gland plates shall be of a non-ferrous metal.

- All control wiring shall be of stranded copper, not less than 2.5 mm2 with PVC insulation to BS 231 Control wiring shall be neatly bunched in harness form, or shall be enclosed in purpose made plastic trunking. Where wiring runs through sheet steel panels holes, suitable grommets shall be provided.

- wiring associated with external circuits shall be connected to terminal strips conveniently arranged.

- Each connection shall have separate incoming and outgoing terminals and no more than two wires shall be connected to any terminal.

- All spare contacts shall be wired to terminal strips suitable positioned.

- All wiring shall be identified using plastic ferrules at both ends.

END OF SECTION

SECTION EL-03 WIRES & CABLES

GENERAL

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.

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.

APPLICABLE STANDARDS REFERRED IN THIS SECTION

A. Cables and wires shall comply with the following standards as appropriate.

- 1. BS 6746 : PVC insulation and sheaths
- 2. BS 5467 IEC 502 : Armored cables with thermosetting insulation.
- 3. BS 5468 IEC 502 : Cross linked polyethylene Insulation
- 4. BS 6360 : Copper Conductors for Cables
- 5. BS 6234 : Polyethylene Insulation and Sheath for Cables.
- 6. BS 2897 : Aluminum Strip Armored for Cables
- 7. BS 1442 : Galvanized Mild Steel wire for Armouring Cables.
- B. Cable termination shall comply with the following specifications:
 - 1. BS 4121 : Mechanical cable glands.

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.

4. Unless otherwise specified, cables and wires of the following specified voltage ratings shall be used as 600/1000V rated cables: Main and sub-main distribution panels.

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. PRODUCTS

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.

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. 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.

EXECUTION 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.

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.

INSTALLING CABLE IN CABLE TRAYS

A. Generally

1. Install cables on trays in a single layer.

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.

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.

- The Cables should be Gulf Cables.

END OF SECTION

SECTION EL-04 CABLE TRAYS

GENERAL

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.

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.

REFERENCE STANDARDS

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

QUALITY ASSURANCE

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

SUBMITTALS

Shop Drawings and Product Data

PRODUCTS

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.

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.

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.

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.

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.

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 UNINTERRUPTIBLE POWER SUPPLY (UPS)

GENERAL

1.1. Related Documents

A. Drawings and general provisions of the specification, including General Conditions, scope of works, and other applicable specification sections in the Project Manual apply to the work specified in this Section.

1.2. Summary

- A. **Scope**: Provide design and engineering, labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for a solid state uninterruptible power supply (UPS) as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. Section Includes: This specification describes a three-phase, on-line, continuous operation, solid state uninterruptible power supply (UPS). The UPS shall operate as an active power control system, working in conjunction with the building electrical system to provide power conditioning and on-line power protection for the critical loads.

1.3. System description

- A. The UPS shall consist of easy to repair rectifiers/inverters.
- B. The UPS shall be provided with separate feeds for rectifier/inverter and the static bypass switch.
- C. **Modes of operation**: The UPS shall operate as an on-line system in the following modes:
 - 1. Normal mode: The UPS provides power to the connected load from mains. The UPS converts mains to conditioned power for the connected load while recharging the batteries (float or boost charge).
 - 2. Battery mode: The UPS transfers to battery mode if the mains supply fails. The UPS provides power to the connected load from the connected batteries for a finite period. When the mains supply returns, the UPS transfers back to normal mode.
 - 3. Frequency converter mode: In frequency converter mode, the UPS presents a stable output frequency (at 50 or 60 Hz) and the static bypass switch is not available.
 - 4. Battery recharge: Upon restoration of the input source, the UPS shall simultaneously recharge the battery and regulate the power to the load.
 - 5. Static bypass mode: The UPS supplies the load with power from the bypass source. If the conditions for normal or battery mode are not met, the load will be transferred from the inverter to the bypass source with no interruption in power to the load.
 - 6. ECO mode: In ECO mode the UPS is configured to use static bypass mode as the preferred operation mode under predefined circumstances. The inverter is in standby in ECO mode and in case of interruption to the

mains, the UPS transfers to battery mode and the load is supplied from the inverter.

- 7. Maintenance bypass mode: In maintenance bypass mode, the mains is sent via the (external) maintenance bypass breaker (MBB) to the load. Battery backup is not available in maintenance bypass mode.
- 8. Auto-restart mode: When auto-restart is enabled, the UPS automatically restarts the inverter and bypass when the mains returns. By default, auto-restart is enabled.
- D. The UPS shall be provided with RS485, USB, and dry contact signaling and Web/SNMP integration. This system must provide a means for logging and alarming of all monitored points.
- E. The UPS shall have nominal voltage of 3×400 V (adjustable for 3×380 V, 3×415 V), 50/60 Hz 4-wire configurations.

1.4. References

A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

B. International Organization for Standardization (ISO):

1. ISO 9001, "Quality Management Systems - Requirements."

1.5. Standards

A. Safety:

2.

- IEC 62040-1: 2008-06, 1st edition Uninterruptible Power Systems (UPS)
 Part 1: General and safety requirements for UPS
 - IEC 62040-1: 2013-01, 1st edition amendment 1
- B. **EMC/EMI/RFI**: IEC 62040-2: 2005-10, 2nd edition Uninterruptible Power Systems (UPS) Part 2: Electromagnetic compatibility (EMC) requirements
- C. **Performance**: IEC 62040-3: 2011-03, 2nd edition Uninterruptible Power Systems (UPS) Part 3: Method of specifying the performance and test requirements
- D. **Environmental**: IEC 62040-4: 2013-04, 1st edition Uninterruptible Power Systems (UPS) Part 4: Environmental aspects Requirements and reporting

1.6. Submittals

A. Proposal Submittals:

- 1. System bill of materials (level one).
- 2. Product technical specifications or equipment brochures.
- 3. Product specifications.
- 4. System operation diagram.
- 5. Installation manual.
- 6. Drawings for requested optional accessories.

B. Delivery Submittals:

- 1. Installation manual, which includes unpacking and installation of all systems.
- 2. Operation manual, which includes start-up and operating instructions.

1.7. Quality Assurance

A. Qualifications

- 1. **Manufacturer Experience**: Manufacturer shall be a firm engaged in the manufacture of solid state UPS of type and size required, and whose products have been in satisfactory use in similar service for a minimum of 20 years.
- 2. Manufacturer should have local office and after sales support locally to provide the required support to the project.
- 3. ISO **9001 Certification**: The manufacturer shall be ISO 9001 & 14001 certified.Certification assures that the vendor's quality control & environmental measures have been certified by an accredited registrar and meet internationally recognized standards.
- 4. **Installer Qualifications**: Installer shall be manufacturer local supplier, the local supplier should be have minimum of 15 years as a local supplier for manufacturer and carried out similar type UPS inside ministry of information (MOI) and this equipment have proven high performance for operating efficiency.

B. Regulatory requirements

Comply with applicable requirements of the laws, codes, ordinances, and regulations of local authorities having jurisdiction. Obtain necessary approvals from such authorities.

C. Factory Testing

Prior to shipment the manufacturer shall complete a documented test procedure totest functions of the UPS and batteries (via a discharge test), when supplied by the UPS manufacturer, and warrant compliance with this Section.

D. Pre-installation Conference

Prior to commencing the installation, meet at the Project site to review the material selections, installationprocedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the Contractor, the Installer, and any trade that re-quires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the MOI Engineer.

E. Source Responsibility

Materials and parts comprising the UPS shall be new, of current manufacture, and shall not have been in prior service, except as required during factory testing. Active electronic devices shall be solid state and shall not exceed the manufacturer's recommended tolerances for temperature or current to ensure maximum reliability. Semiconductor devices shall be sealed. Relays shall be provided with dust covers. The manufacturer shall conduct inspections on incoming parts, modular assemblies, and final products.

1.8. Delivery, Storage, and Handling

- A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
- C. Products shall be packaged in a manner to prevent penetration by debris and to allowsafe delivery by modes of ground transportation and air transportation where specified.
- D. Prior to shipping, products shall be inspected at the factory for damage.
- E. Equipment shall be protected against extreme temperature and humidity and shall bestored in a conditioned or protected environment.
- F. Equipment containing batteries shall not be stored for a period exceeding six months without powering up the equipment for a period of eight hours to recharge the batteries.

1.9. Project Conditions

Do not install the solid state UPS until space is enclosed and weatherproof, wet work inspace is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at valuesnear those indicated for final occupancy.

A. Environmental requirements

- 1. Storage ambient temperature: -25 °C to 55 °C.
- 2. Operating ambient temperature: $0 \degree C$ to $40 \degree C$.
- 3. Relative humidity: 0 to 95%, non-condensing.
- 4. Storage altitude: 0 to 15000 m above sea level.
- 5. Operating altitude with no derating: 0 to 1500 m above sea level.
- 6. Protection class: IP20.
- 7. Color: RAL 9003, gloss level 85%.

1.10. Warranty

- A. General: See General Conditions.
- B. **Special Warranty:** The Contractor shall warrant the work of this Section to be inaccordance with the Contract Documents and free from faults and defects in materials and workmanship for period indicated below. This special warranty shall extend the two-years period of limitations contained in the General Conditions. Thespecial warranty shall be countersigned by the Installer and the manufacturer.
 - 1. **UPS:** The UPS shall be covered by a full parts and labor warranty from the manufacturer for a period of 24 months from date of installation and acceptance by the MOI.
 - 2. **Battery:** The battery manufacturer's warranty shall be passed through to MOI and shall have a minimum period of two year.

1.11. Maintenance

A. The manufacturer shall, upon request, provide spare parts kits for the UPS in a timely manner as well as provide access to qualified and trained service

personnel to provide preventative maintenance and service on the UPS when required.

- B. The UPS shall be repairable by replacing standard subassemblies requiring no adjustments.
- C. The manufacturer shall offer additional preventative maintenance and service contracts covering both the UPS and the batteries. Accredited professional service representatives employed exclusively in the field of critical power systems service shall perform maintenance and service. The manufacturer shall also offer extended warranty contracts.

PRODUCT

2.1. Manufacturer

Schneider Electric, OR

Approved equal. However, if a brand other than is proposed, the decision of the Engineer shall be final and a "differentiation report" must be submitted. This report shall address each paragraph of the specification individually and list any difference from what is specified. If there are no differences, a report stating so shall be provided. If, after installation, omitted differences are found, the Contractor shall correct differences to the satisfaction of the Owner and Engineer or unsatisfactory equipment shall be removed and equipment acceptable to the Owner and Engineer shall be installed at no additional cost to the project. Also, make modifications to the facilities infrastructure as needed to accommodate the substitute, at no additional cost to the project. Examples of modifications include, but are not limited to the following:

- 5. Structural reinforcement to accommodate heavier equipment.
- 6. Increased sizes of circuit breakers, raceways, and wiring.
- 7. Larger back-up generators (including upgraded accessories and wiring) to avoid instability caused by most double conversion UPS systems.
- 8. Larger HVAC equipment (including duct work and wiring) to accommodate increased heat dissipation of less efficient UPS systems.

2.2. System Description

B. General

- 1. The UPS shall be housed in a freestanding cabinet with casters and shall contain the following breakers.
 - **a.** Unit input breaker (UIB)
 - **b.** Static switch input breaker (SSIB)
 - **c.** Unit output breaker (UOB)
 - **d.** Maintenance bypass breaker (MBB)
- 2. Installation access shall be from the backside of the system.
- 3. The UPS shall be in a self-contained cabinet and shall be available in the following models: 80 kVA
- 4. Backfeed contactor included for input. Bypass backfeed protection must be implemented by:

- **a.** Installation of upstream circuit breaker with shunt-trip connected to the UPS, or
- **b.** Installation of optional backfeed box SP3OPT009/SP3OPT010.
- 5. The UPS shall contain a bypass static switch, and a display. The UPS shall be of the double conversion on-line topology with power factor corrected inputs.
- 6. The UPS shall be sized for _80__ kVA and _80__ kW load.
- The UPS battery shall be sized for __80kVA_ at a power factor of _1_ for __20__ minutes.
- 8. The UPS system shall have a runtime of _20__ minutes.
- 9. The UPS shall have a short circuit withstand capability of 10 kA.
- 10. The UPS shall contain an EPO.

C. System input

- Nominal Input voltage rating: 3×400 V (adjustable for 3×380 V or 3×415 V).
- 2. Input voltage window: 342 V to 477 V at full load.
- 3. Earthing principle: [TN-S] [TN-C] [TT] or [IT].
- 4. Input frequency range: 40-70 Hz
- 5. Input power factor: > 0.99 for full linear loads
- 6. Total harmonic distortion: < 3% for full linear loads

D. System output

- 1. Nominal output voltage rating: 400 V 3-phase.
- 2. Output voltage regulation (static): +/- 1%
- 3. Dynamic load response: 20 ms.
- 4. Output frequency: 50 or 60 Hz.
- 5. Output voltage harmonic distortion:
 - **a.** <3% at 100% linear load.
 - **b.** <5% at 100% non-linear load.
- 6. Overload capability at 30 °C:
 - **a.** 110% for 60 minutes.
 - **b.** 125% for 10 minutes.
 - **c.** 150% for 1 minute.
- 7. Output power factor: 1.0.
- 8. Efficiency in normal operation at 100% load:
 - **a.** 80 kVA: 94.9%
- 9. Audible noise at full load and a 30 °C ambient temperature according to ISO 3746:
 - **a.** 80 kVA: 65 dBA

E. Components

- 1. Rectifier
 - **a.** The UPS shall include an active power factor corrected, Insulated Gated Bipolar Transistor (IGBT) rectifier.
 - **b.** The input current limiter shall be designed to:
 - 1) support 100% load at 342 V input voltage
 - 2) charge batteries at
 - a) 30% of the UPS output rating for an 80 kVA UPS
 - 3) provide regulation with mains deviation between 150 V and 477 V.
 - c. DC bus voltage shall be $\pm 370/400$ VDC for the input voltages 380/400/415 V.

- **d.** The battery charging shall keep the float voltage of \pm 215.5 VDC to \pm 337.5 VDC for 32-50 blocks.
- e. The battery charging voltage shall be compensated against temperature variations (battery temperature compensation) to always maintain optimal battery float charging. Temperature compensation rate is adjustable and shall be 3mV/degree/cell for ambient temperatures > 28 °C and 0mV/°C for ambient temperatures < 28 °C.
- **f.** Input power factor shall be 0.99 lagging at 100% load with out the use of passive filters. Rectifier shall employ electronic waveform control technology to maintain the current sinusoidal.
- **g.** Pulse Width Modulation (PWM) current control shall be used. Digital Signal Processors (DSP) shall be used for all monitoring and control tasks. Analog control is not acceptable.
- 2. Batteries
 - **a.** Standard battery technology shall be sealed lead acid.
 - **b.** Support of:
 - 1) 32-34 battery blocks at 90% load
 - 2) 36-50 battery blocks at 100% load
 - **c.** Battery voltage shall be battery temperature compensated as outlined in the rectifier section above.
 - **d.** End of discharge voltage: \pm 153.6 VDC to \pm 240 VDC for 32-50 blocks.
 - e. Battery charge current limit: The selection shall be made from the UPS Soft Tuner.
 - **f.** The battery charging circuit shall remain active when the PFC operates normally.
 - g. Battery Manufacture:
 - 1- YUASA
 - 2- EXIDE
- 3. Inverter
 - **a.** The inverter shall consist of fast switching IGBT.
 - **b.** The inverter shall be a 3-level inverter.
 - **c.** Inverter shall be PWM controlled using DSP logic. Analog control shall not be acceptable.
 - **d.** The inverter modules shall be rated for an output power factor at 1.0.
 - e. Nominal output voltage shall be 3×400 V (adjustable for 3×380 V or 3×415 V).
- 4. Static bypass switch
 - **a.** The static switch shall consist of fully rated Silicon Controlled Rectifiers (SCRs). Part rated SCRs with a wrap around contactor are not acceptable.
 - **b.** The static bypass switch shall automatically transfer the load to bypass input supply without interruption after the logic senses one of the following conditions:
 - 1) Inverter overload beyond rating.
 - 2) Battery runtime expired and bypass available.
 - 3) Inverter inoperable.
 - 4) Control system inoperable.
 - **c.** The inverter shall be active (on).

d. The static bypass switch shall be equipped with a manual means of transferring the load to bypass and back to inverter.

F. Mechanical

- 1. The UPS is housed in a freestanding cabinet with casters.
- 2. The cable entry shall be from the back of the UPS.
- 3. The UPS has the following dimensions and shall meet an ingress level of minimum IP20:
 - **a.** 80 kVA: 915×360×850 mm.

G. Display, controls, and alarms

- 1. A display shall be located on the front of the system. The display interface shall consist of a touchscreen display, and status LEDs.
- 2. The following metered data, shall be available on the alphanumeric display:
 - a. Year, month, day, hour, minute, second of occurring events
 - **b.** Input voltage
 - c. Input current
 - **d.** Input frequency
 - e. Output voltage
 - **f.** Output current
 - **g.** Output frequency
 - **h.** Battery voltage
 - i. Battery current
 - **j.** Battery temperature
- 3. The display shall allow the user to display active alarms.
- 4. The following controls or programming functions shall be accomplished by use of the display unit. Push button membrane switches shall facilitate these operations.
 - **a.** Silence audible Alarm
 - **b.** Set the display language
 - **c.** Display and set the date and time
 - d. Transfer load to and from static bypass
 - e. Test battery condition on demand
- 5. The following shall make up the UPS front panel LEDs:
 - a. Alarm
 - 1) Steady red: Critical alarm
 - 2) Flashing red: Warning alarm
 - 3) Off: No alarm condition
 - **b.** Bypass
 - 1) Steady yellow: The load is supplied by the bypass source
 - 2) Flashing yellow: There is an alarm condition on the bypass source
 - 3) Off: The load is not supplied by the bypass source
 - c. Battery
 - 1) Steady yellow: The load is supplied by the battery source
 - 2) Flashing yellow: The battery source is unavailable
 - 3) Off: The load is not supplied by the battery source
 - d. Inverter
 - 1) Steady green: Inverter on
 - 2) Off: Inverter off
- 6. For purposes of remote communications with the UPS a network management card shall be available.

- H. Accessories
 - 1. Software and connectivity
 - a. The Ethernet Web/SNMP Adaptor shall allow one or more network management systems (NMS) to monitor and manage the UPS in TCP/IP network environments. The management information base (MIB) shall be provided in .MIB formats. The SNMP interface adaptor shall be connected to the UPS via the RJ45 serial port on the standard communication interface board.
 - **b.** Unattended Shutdown.

2. Remote UPS monitoring

- Three methods of remote UPS monitoring shall be available:
- **a.** Web Monitoring: Remote monitoring shall be available via a web browser such as Internet Explorer.
- **b.** Simple Network Management Protocol (SNMP): Remote UPS Monitoring shall be possible through a standard MIB II compliant platform.
- c. Modbus protocol through RS485 port.

3. Software compatibility

The UPS manufacturer shall have available software to support shutdown and or remote monitoring for the following systems:

a. Microsoft Windows 7 and Microsoft Windows 10

Part 3 EXECUTION

3.1. Examination

- A. Verification of conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect/Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 - 1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2. Installation

Preparation and installation shall be in accordance with reviewed product data, final shop drawings, manufacturer's written recommendations, and as indicated on the Drawings.

3.3. Manufacturer assisted start-up

A manufacturer assisted UPS start-up shall available, manufacturer trained service personnel shall perform the following inspections, test procedures, and on-site training:

A. Visual Inspection

- 1. Inspect equipment for signs of damage.
- 2. Verify installation per manufacturer's instructions.
- 3. Inspect cabinets for foreign objects.
- 4. Inspect batteries.

B. Mechanical Inspection

- 1. Check all UPS, external battery cabinets internal power wiring connections.
- 2. Check all UPS, external battery cabinets terminal screws, nuts, and/or spade lugs for tightness.

C. Electrical Inspection

- 1. Verify correct input and bypass voltage.
- 2. Verify correct phase rotation of all mains connections.
- 3. Verify correct UPS control wiring and terminations.
- 4. Verify voltage of batteries.
- 5. Verify neutral and ground conductors are properly landed.

D. Site Testing

- 1. Ensure proper system start-up.
- 2. Verify proper firmware control functions.
- 3. Verify proper firmware bypass operation.
- 4. Verify proper maintenance bypass switch operation.
- 5. Verify system set points.
- 6. Verify proper inverter operation and regulation circuits.
- 7. Simulate input power failure.
- 8. Verify proper charger operation
- 9. Document, sign, and date all test results.
- E. **On-Site Operational Training**: During the manufacturer assisted start-up, operational training for site personnel shall include keypad operation, LED indicators, start-up and shutdown procedures, maintenance bypass and AC disconnect operation, and alarm information.

3.4. Manufacturer field service

- A. **Worldwide service**: The UPS manufacturer shall have a worldwide service organization. Available, consisting of factory trained field service personnel to perform start-up, preventative maintenance, and service of the UPS system and power equipment. The service organization shall offer 24 hours a day, 7 days a week, 365 days a year service support.
- B. Local Service: The local authorized service partner should have more than 30 years of experience in Kuwait market.

3.5. Demonstration

Provide the services of a manufacturer-authorized service representative of the manufacturer to provide start-up service and to demonstrate and train the Owner's personnel.

- A. Test and adjust controls and safety. Replace damaged or inoperable controls and equipment.
- B. Train the Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance.
- C. Review data in operation manual with the Owner's personnel.

3.6. Maintenance contracts

A complete offering of preventative and full-service maintenance contracts for the

UPS system and the battery system shall be available. All contract work shall be performed by trained service personnel.

3.7. Training

UPS service training workshop: A UPS service training workshop shall be available from the UPS manufacturer. The service training workshop shall include a combination of lecture and practical instruction with hands-on laboratory sessions. The service training workshop shall include instruction about safety procedures, UPS operational theory, sub-assembly identification and operation, system controls and adjustment, preventative maintenance, and troubleshooting.

END OF SECTION

SECTION EL-06 EARTHING SYSTEM

DESCRIPTION OF WORK

- A. The Contractor shall supply and install earthing, bonding and protection systems as indicated on the 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.
 - 4. Technical earth for equipment of transmitters.

PRODUCTS 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".

EXECUTION

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 colored 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.
- 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 to distribution board enclosure.
- 2. Connect the isolated earth bar inside DBs to separate technical earth system by 16mm CU/PVC wire.
- N. Cable Armour Earthing
- 1. Connect steel and aluminum 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 equipment distribution Boards,

and interconnected to the nearest technical earthing box.

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-07 ELECTRICAL IDENTIFICATION

GENERAL WORK INCLUDED

A. Nameplates and tape labels.

B. Wire and cable markers.

SUBMITTALS

A. Submit schedule for nameplates and tape labels.

PRODUCTS

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.

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 DB wires with numbered plastic ring.

EQUIPMENT IDENTIFICATION

A. Provide two-layer plastic labels fixed with rivets or crews.

B. Indicate code of the switchgear, distribution board,.....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 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.

EXECUTION 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.

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 circuits, and with control wire number as indicated on approved schematic and interconnection diagrams, equipment manufacturer's shop drawings.

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, identify equipment designation, identify voltage rating and source.

2. Individual circuit breakers, switches, identify circuit and load served including location.

3. Individual circuit breakers, enclosed switches, identify load served.

END OF SECTION

ITEM	DESCRIPTION	QTY	UNIT	UNIT RATE KD	AMOUNT KD
1	Supply and install 3P MCCB, 160A to replace MCCB at existing EMSB, the works include supply and install all accessories required.	3	Nos		
2	Supply, install, connect, test and commission 2x80 KVA/415V/50Hz uninterruptible power supply (UPS) parallel redundant connected with batteries 20 minute backup time as per specified.	3	Nos		
3	Supply, install, connect, test and commission, I/P-MSB-UPS as shown in the drawing.	3	Nos		
4	Supply, install, connect, test and commission, O/P-MSB-UPS as shown in the drawing.	3	Nos		
5	Supply, install, connect, test and commission, 4C x 50 mm sq. CU/XLPE /SWA/ PVC cables. as shown in the drawing.	LS	LS		
6	Supply, install, connect, test and commission, 4C x 25 mm sq. CU/XLPE /SWA/ PVC cables. as shown in the drawing.	LS	LS		
7	Supply, install, terminate, and connect earthing system including copper tape and all other necessary accessories to complete the system, for bonding electrical equipment with existing copper tape.	LS	LS		
CARRIED TO COLLECTION					

EL-08 BILL OF QUANTITIES

