TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS FOR Agriculture training center in Anbar

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1. SCOPE OF WORK:

The Electrical Contractor shall supply all labour, materials and equipment necessary for the complete installation, testing and commissioning of the entire electrical works which shall broadly include but not limited to the following as per specifications, drawings and bill of quantities.

a. Light Fittings & Fans
b. Light, Fan, Socket Wiring
c. Switchgear & Earthing
d. L.V. Main/ Sub-main Cables & Accessories
e. Cable Tray / Ladder / PVC Pipes.
f. Earthing.
g. Telephone System.

2. GENERAL:

The entire electrical installation shall be carried out by an approved licensed Electrical Contractor authorized to undertake such works.

All works are to comply with the 17th Edition of the IEE Regulations for Electrical Installations UK, the Electricity Act 1910, the Electricity Rules 1937, and in accordance with the requirements of the local inspector, the utility supply authorities (IGTS/ National center for construction laboratories), Contract Drawings/specifications, BOQ and to the satisfaction of the Consultant/Owner.

3. APPROVAL FROM ELECTRICAL INSPECTOR:

The Contractor shall be responsible for completing all formalities such as serving notices, submitting drawings / documents and obtaining all permits, sanctions, connections and having the installation passed and commissioned by the relevant authorities and obtain an approval certificate from the concerned Electrical Inspector's Office for the total load of the premises including the load of HVAC machines elevators, pumps, etc. All costs involved in obtaining such permits, sanctions, approvals from the concerned authorities are deemed to be included in the contract price and no extra payment shall be made to the Contractor.

4. STANDARDS:

All materials and equipment such as distribution boards, cables/wires, conduits and conduit accessories, wiring accessories (switches, sockets, dimmers etc.) Circuit breakers, switch boxes lighting fixtures, lamps etc. are to comply with the specifications, the relevant British Standards, Iraqi Standards Institute and underwriters laboratories requirements or equivalent IEC, DIN Standards & NEC Standard. In general, following standards & codes of practices shall be followed.

a). Relevant BS specifications and codes of practices and IEC publications and DIN standards.
b) NFPA/ National electric code.
c) BS 6121: Mechanical cable glands
d) BS 6346 specification for 600V/1000V & 1900/3300 V armored electric cables having PVC insulation.
e) IEC 60034: Rotating electrical machine
f) IEC 60287: Electric cable- calculation of the current rating.
g) BS 7671: Requirements for electrical installations
h) IEC 60909: Short circuit current calculations in 3 phase a.c system.
i) ERA: current rating standards 69-30 parts 5,6,7.
j) Electricity Act 1937

Samples of all materials / equipment are to be submitted to the Consultant / Project Manager/ Owner for approval before purchase or fabrication / installation.

5. SHOP DRAWINGS:

The locations, routings, and installation heights of electrical equipment, conduits cable trays etc. given on the design drawings are approximate. Based on site conditions and in coordination with civil and mechanical drawings the contractor shall prepare shop drawings showing proposed routes of conduits and positions of equipment, including mounting and fixing details and submit the same to Owner/ Construction Manager/ Consultant for approval. Five sets of drawings (hard & soft copy) and technical literature/ brochures for all the electrical equipment / systems are to be submitted four weeks in advance of the execution of the works and approval obtained before execution / installation of works.

6. DRAWINGS OF LV SWITCHGEAR/DISTRIBUTION BOARDS

The Contractor is required to submit the preliminary drawings of LV switchgear, Main Distribution Board, PFI Plant and associated Distribution / Computer Distribution Panels from one of the approved manufacturer to the Project Manager/ Consultant/ Owner for approval. These drawings will be issued for construction after getting written approval form the Owner.

7. CLIMATIC CONDITIONS:

Equipment and materials supplied shall withstand under all conditions of continuous operation and without developing any defects, the following environmental conditions.

Maximum temperature	:	50 deg. C
Minimum temperature	:	00 deg. C
Relative humidity	:	90 %

7a. EQUIPMENT PROTECTION:

Unless otherwise stated all equipment supplied shall conform as a minimum to the following protection classes:

Indoor	I.P. 40
Outdoor	I.P. 54 or 65 as applicable

Certification from manufacturer is required / to be submitted.

8. FACTORY INSPECTION OF LV SWITCHGEAR/ PANELS

The Contractor will arrange a check visit of Consultants / project Manager for the Inspection and testing of LV Switchgear. Distribution / Computer distribution boards, PFI plant etc.
before delivery the items to site. The Project Manager will have the right to object/ reject any substandard material/ panel found to be unsuitable or not in accordance with the specifications. The Contractor will require to replace the substandard material and rectify the defect/defect objected by the Consultants/Project Manager.

8a. TESTING AND COMMISSIONING:

During execution and on completion of the works, Project Manager the following tests shall be performed and a satisfactory performance certificate in respect of each test shall be submitted with the final bill. All equipment/instruments for the tests are to be provided by the Contractor at no extra cost. All test to be performed in the presence of supervisor Engineer.

a) Earth Resistance test and earth loop impedance test.

b) Insulation resistance / Meggar test of the entire electrical installation between phases, phase to earth and phase to neutral.

c) Polarity tests on switches, MCB's, fuses, etc.

d) Operation tests and commissioning of the entire electrical installation including all equipment.

e) Lux level measurement of each area

f) Fluke Test Telecommunication Cables and terminations.

Certificates of Test shall be compiled, for each section of the installation. A master set of these documents shall be kept as the original of the Test Dossier. This dossier will bear the signature of Owner witnessing the tests.

9. MAINTENANCE AND WARRANTY:

The Contractor shall be responsible for the entire electrical works and all equipment supplied by him and warranty the same for a period of twelve months from the date of the completion certificate. Any defect due to the workmanship or equipment failure shall be replaced by the Contractor free of charge during that period.

10. AS-BUILT DRAWINGS:

On completion of the works the Contractor shall supply one reproducible and three copies of as-built drawings which clearly indicate all amendments, junction boxes, pull boxes, etc. These shall be provided at no extra cost. The as-built drawings shall indicate the entire electrical installation as actually carried out on site including telephone, fire alarm, sound system, computer system, electrical wiring, LV switchgear panels, distribution panels, PFI plant & electrical works of building etc and schematic diagrams.

11. SITE CONDITIONS:

The Contractor shall visit the site before submitting his quotation and acquaint himself with the site conditions, and check the specifications, design drawings and the bill of quantities.
Omissions/errors, if any, are to be brought to the attention of the Consultant or included in the bid. After award of the contract no claims shall be entertained.

12. OPERATION AND MAINTENANCE MANUALS:

The Contractor shall submit four sets of manuals & wall mounted charts for all the electrical equipment supplied and installed by him which shall include detailed operation and maintenance instructions for each item as recommended by the manufacturer. These manuals shall be submitted on completion of the works.

13. ASSOCIATED CIVIL WORKS:

The cost of any civil works, (cutting, chiseling, excavation, backfilling, grouting, drilling etc. and making good) associated with any item of the electrical works shall be included in the quoted price for the item. The Contractor shall be responsible for carrying out these civil works and making good and the cost shall be deemed to be included in the quoted price.
The Contractor shall take care not to damage the structure during execution of his work. If so done, he shall repair and make good all losses at his own cost.

14. CONDUIT AND CONDUIT ACCESSORIES:

Wiring shall generally be in PVC conduit for electrical use minimum 20mm diameter, minimum wall thickness 1.25mm, concealed in structural slab, wall or screed with at least 50mm cover or clipped to the surfaces with metallic saddles, as required. All conduit accessories shall be of the same quality as the conduit. Saddless for fixing conduit on surface shall be provided at 1000 mm spacing.

No conduit shall be laid in the light-weight concrete over the sunken slabs of bathrooms/ toilets.

Manufactured smooth bends shall be used where conduits change directions. Sharp 90 degrees bends and tees shall not be allowed. Round PVC junction boxes for ceiling points shall have adequate capacity for wires and connectors.

The drawings are schematic and do not generally indicate pull boxes, however, these shall be installed in conduit runs to limit the pulling lengths as required.

Where indicated heavy gauge (1.6mm minimum wall thickness) steel conduit, minimum 20mm dia. Protected with two coats of red oxide anti-corrosion primer and two coats of black enamel inside and outside shall be used for wiring. All conduit accessories shall also be treated as above.

Where indicated hot-dip galvanized steel conduit minimum 20mm dia. shall be used for wiring. All accessories shall also be galvanized.

Final connection to motors and other equipment shall be in flexible steel conduit encased in weather-proof plastic.

15. OUTLET BOXES PULL BOXES ETC.

The outlet boxes for installing switches, sockets, dimmers, etc. shall be of 16 SWG sheet steel de-rusted, degreased, rust-proofed and powder coated. These boxes shall be of suitable dimensions to receive the conduits and the accessories and have ample wiring space. A suitable brass earth terminal shall be provided for connecting the earth continuity conductor in the outlet box. Pull boxes shall generally be of the same specifications as the outlet boxes. All boxes shall have adequate number of knock-outs and have a minimum depth of 50mm.

16. SWITCHES, SOCKETS, CEILING ROSES ETC.

These shall be of white molded plastic suitable for flush mounting in sheet steel outlet boxes. Lighting switches shall be single pole rated for 13 Amps. 250 volts A/C. The switches shall operate with snap action. 3-Pin switch socket outlets shall be rated for 15 Amps, 250 volts A/C. Ceiling roses shall be suitable for 5 amps. 250 volts and shall have white plastic molded base plate with copper terminals. The cover of the ceiling rose shall have a suitable cable inlet hole. All other outlets (Computer, telephone etc.) Shall have face plates that match the design of the face plates of switches and sockets. All external switches, sockets and accessories shall be of heavy duty, cast construction, weatherproof type. 5 Amps socket outlets shall be of 3-pin type with integral switch. Power outlets for computers shall be 13A, 250V switch socket 3-Pin with flat terminals. 16A, 2-Pin + Earth Shukko socket outlets to DIN standards shall be provided as indicated on the drawings.

All outdoor switches and sockets shall be of the weather proof type.

17. LV CABLES AND WIRES

In general LV cables and wires shall be with stranded copper conductors PVC insulated, PVC sheathed/unsheathed, single/multi-core, armored/unarmored. For lighting and socket outlet circuits they shall be 450/750 volts grades to BS 6004.

All power cables for main, sub-main feeders and power equipment etc. shall be of 600/1000 volts grade to BS-6346 Phase, neutral and grounding conductors shall be color coded red/yellow/blue, black and green. Each circuit shall have its own neutral and grounding conductor. The looping-in system shall be used throughout the installation. Any joint in wires is not permitted.

Final connection to lighting fixtures from ceiling rose/outlet box shall be made with 3 core 1.0 sq.mm pvc/pvc cable in flexible PVC conduit. Copper lugs shall be used for termination of cables. All multi-core cables shall be provided with glands of suitable size at entry to the panels.

Power cables shall be clipped to the surface by means of heavy duty spacer saddles and Clamps. The saddles and clamps shall be made of cast-iron or steel. Alternatively, power cables shall be installed on cable trays or in cable trunking including all installation materials and fixing accessories as specified. All installation materials and fixing accessories such as glands, lugs, saddles, clamps, brackets etc. shall be provided without any additional cost.

Cables installed in under floor trenches shall be laid in single tier when laid on the bed of the trench. Cables may also be clamped on the walls of the trench by means of heavy duty spacer saddles and clamps of insulated material or fixed on brackets grouted into the side of the trench at a maximum of 600mm intervals. The center to center distance between cables shall be equal to twice the diameter of the cable. Cable terminations and joints shall be as per manufacturer's

recommendations. Conductor connections and terminations shall be made with compression ferrules and lugs. Cable entry into panels shall be made with brass cable glands. Cable terminal lugs/ wire pins shall be of the mechanical compression type, soldered type lugs shall not be used.

The routing and general arrangement of all cables i.e. power, instrumentation, voice and data should be planned concurrently with main pipe racks and wheel access ways etc. to provide unimpeded direct routes wherever possible. Power cable shall be segregated from instrumentation, voice and data cables to eliminate any possibility of electrical interference with voice, data/ control circuitry.

Cable shall be run in continuous unbroken lengths and joints will not be permitted. Unless the route length exceeds the maximum manufactured drum length, or there is specific authorization for jointing of the cable by consultant/construction manager/ owner.

Each cable shall be subjected to an insulation resistance and continuity test after installation and prior to final dressing in to position and termination. Results shall be recorded and approved by consultant/ construction manager/ owner.

All cables including lighting and small power sub-circuits shall be identified and tagged at each end adjacent to their termination point with approved markers on carrier strip. In addition, all underground cables shall be fitted with non-corrodible identification bands at all points where they enter or leave the area, cable ducts, trench ducts or similar. Lighting and power sub-circuits cable shall be identified at each luminaries/ socket outlet.

Underground cables shall be laid in trenches 1000mm deep, Cables shall be laid at the bottom on a 150mm layer of sand. The cables shall then be covered by another 150mm layer of sand. Concrete tiles shall cover the entire length and width of the cable trench on top of the sand layer, caution tape is placed on the top of concrete tiles. The trench shall then be filled with earth. Concrete cable route markers shall be provided at every 20 meter interval and at change of direction.

All jointing and termination work shall be carried out by practicing, fully trained tradesmen, qualified in such a work for the operating voltage concerned.

Brass glands shall be used which are of the thread fixing, hexagon bodied displacement seal type or equal. They shall be compatible with associated cable and maintain the degree of protection of the equipment enclosure. All glands shall be fitted with PVC or PVC shrouds.

The entire body of the cable must enter the gland. The cable shall be on a straight axis from a point at least six diameters before entering the gland. Seals shall be checked for correct size at the point of application.

Care shall be taken to ensure that creepage and clearance distances are maintained e.g. no washers or loose stands.

In addition to cable identification cable cores shall be positively identified at every terminal point, in accordance with the drawings.

Ferrules used for identification shall be of the interlocking permanently engraved type, designed to encircle the core completely. Markers of the adhesive type will not be permitted. Ferrules shall be correctly sized. There shall be no improvisation and engravings must not be altered.

18. TELEPHONE SYSTEM

Telephone cables shall be based on structured cabling system. It shall be covered under this contract. However, under this contract outlet boxes, conduit / trunking etc. with pull wires and main Tel. Cable shall be executed.

The outlet back boxes shall be of appropriate size. The minimum size of conduit used for the telephone system shall be 25mm in diameter.
Telephone junction boxes shall be fabricated from 16-gauge sheet steel, derusted, degreased, primed with zinc chromate and painted with two coats of enamel with hinged covers. TIP tag blocks with soldering type terminals on both sides with ample space for wiring shall be installed. Outdoor Telephone junction boxes and Main Distribution Frame shall be floor mounted in sheet steel cabinets to IP-54 grade of protection on a concrete base (where required).

19. EARTHING:

The earthing system shall comprise of copper earthing rod as specified 3600mm long copper rod bored 30 ft including 2" dia GI Pipe and earth electrode of 25mm dia as per site requirement as advised by Consultant, from ground level in a 250 Kg mixture of salt and charcoal. This work includes excavation, perfect back filling and all necessary materials as per drawing and as per standard practice according to the satisfaction of Consultant. Two earthing leads of PVC insulated copper wires of specified size in PVC conduit shall be used to connect the earth plate(s) to the equipment. G.I Pipe for watering of earth plates shall be provided. The earth resistance test shall be performed as per the Electrical Inspectors requirements. **Earth resistance shall not exceed one ohm for each earth pit**. If the required earth resistance is not achieved, additional earthing set shall be provided and connected in parallel until the specified resistance is achieved (without any extra cost).

Concrete Inspection Chamber(s), heavy duty C.I. covers, fixing clamps all accessories etc. are deemed to be included in the Electrical Contract.

20. LIGHTING FIXTURES AND FANS:

The lighting fixtures shall be as specified in the lighting fixtures schedule. The determination of quality is based on construction material, shape, finish, operation etc. The Contractor shall submit sample of each lighting fixture specified for the approval of the architect / consultant / owner.

20.1 Fluorescent Lighting Fixtures

The Fluorescent Lighting fixtures shall be complete with lamps. The ballast shall be low loss, polyester filled type, totally enclosed and suitable to operate on 230 V. A wiring diagram, wattage, voltage and current ratings shall be printed on the body of the ballast.

The starter shall be glow type with radio interference suppressor/by-pass capacitor. All lighting fixtures shall be provided with power factor improvement capacitors to give power factor of 0.90. The internal wiring of the fixture shall be done with heat resistant wires and provided with a suitable connector. The body of the fixtures shall be minimum 22 SWG sheet steel, de-rusted, degreased, finished in heat resistant paint, stove enameled or alternatively powder coated. Appropriate size bushed wire entry holes, fixing holes and earth terminal shall be provided. The design of recess mounting light fixtures shall be coordinated with the design of the false ceiling. The installation method/detail of recess mounting fixtures shall be submitted to the architect / consultant for approval. Recess mounting fixtures shall be supported by hangers from the slab above to prevent the weight of the fixtures from being transmitted to the false ceiling. For fixing surface mounted fixtures, nylon plugs and galvanized steel bolts or screws shall be used. The pendant type fixtures shall be hung by two 20mm dia. 16 SWG white enameled tubes having swivel joint type hanger at the top for fixing directly on to the recessed outlet or on the ceiling.

20.2 Incandescent Lighting Fixtures

The incandescent lighting fixtures shall be finished as specified. They shall be in standard color unless otherwise stated on the drawing or directed by the Architect / Consultant. Weatherproof incandescent fixtures shall comprise of cast aluminum body with gasket clear glass cover. The lamp holder shall be of brass having porcelain outer ring for all incandescent fixtures. All fixtures shall be provided with earth terminals. The surface mounted fixtures shall be installed on wall or ceiling by nylon plugs and galvanized steel screws. The recess mounted fixtures shall be installed in a manner as described for fluorescent fixtures. The fixtures shall be complete with lamps.

20.3 Mercury Vapour/Metal Halide/Sodium Vapour Fixtures

These fixtures shall be of heavy gauge corrosion proof metal construction, with brass/porcelain lamp holders. They shall have an optical system of high purity anodized aluminum reflector and have clear heat resistant toughened glass cover. The fixtures shall be weather proof and water-tight. A compartment for housing of ballast shall be provided on the body of the fixtures. The ballast shall be totally enclosed, polyester filled having leak-proof and corrosion resistant steel body. Insulated terminals shall be provided with the ballast. The fixtures shall be power factor corrected to 0.95. All internal wiring shall be by means of heat resistant wires. The lamps shall be of specified wattage. The fixtures shall be complete with igniter, capacitor, terminals, lamps, etc.

20.4 Ceiling Fans

Ceiling fans shall be of capacitor type of sizes as indicated in BOQ. They shall be complete with appropriate sized, Dimensions 80*80 cm, Installation methods should be Built-in / Mounted / Suspended.

20.5 Exhaust Fans/Wall Fans

Exhaust fans shall be wall/window mounting type as required of sizes as indicated in the BOQ, complete with louvers, shutters, and all fixing accessories.

Wall Fans shall be bracket mounting type of sizes as indicated in the BOQ complete with all mounting accessories.

20.6 LED Light Panel

Power Consumption 39 Watts, Work Voltage AC100-240V / DC24V, Luminous Flux 2420Lm (Cold white), 2391Lm (Natural white), 1564Lm (Warm white), Luminosity @1.0 m 596Lux (Cold white), 588Lux (Natural white), 405Lux (Warm white), Color Temperature 2700-3300K (Warm White) 4000-5000K (Natural White) 6000-7000K (Cold White), Dimensions 60*60 cm, Installation methods Built-in / Mounted / Suspended.

21. L.V. SWITCHGEAR

Main, Sub-main Distribution Boards and MCB DBs shall be of the totally enclosed type, dust proof, damp proof and be suitable for floor/surface/flush mounting, and comply with IEC 157, IEC 158, IEC 439, BS 4752.

They shall be suitable for 400/230 volts 3 phase, 4 wires, 50 Hz system and shall have all components rated for insulation class 600 volts minimum.

All main, sub-main and MCB distribution boards shall be factory assembled. Main and Sub-main distribution boards shall be fabricated with 14SWG and MCB DBs with 16 SWG sheet steel, de-

rusted, degreased, rust proofed with two base coats of anti-corrosive paint and painted with two coats of heavy enamel paint in approved color or powder coated. Indoor distribution boards shall have enclosures of IP-40 grade.
All distribution boards shall be complete with adequately rated electrolytic tinned copper phase, neutral and earth bus bars and be complete with incoming and outgoing cable terminations arrangement, terminal block/line up terminals and shall be suitable for flush mounting of all instruments. The cabling inside the panels shall be suitably numbered and harnessed by means of straps or cords.

Cable entries shall be through removable gland plates.

All components shall be installed on mounting brackets inside the enclosure and protected from the front with screwed sheet steel safety plate. The enclosure shall be provided with rubber gasketting and a lockable hinged door with cam fastener. All distribution boards shall be front access type.

The front side of the distribution boards shall be provided with a name plate designating the board. The inside of the door shall have a chart clearly indicating the circuits with their designations. The door is to be grounded by flexible copper cable. This also applies to the common and front plate.

Suitably rated CTs shall be provided as required CTs shall be of class 0.5 for metering and 1.5 for protection.

Miniature circuit breakers (MCB) and molded case circuit breakers (MCCBs) shall be of the molded pattern and their switching levers shall be such that they are accessible through the safety plate for operation. The short circuit rating of the circuit breakers shall be as indicated on the drawing. They shall comply to IEC Standards 947-2 and 898.

Load Break Switches and contractors shall be of AC3 type for motor loads. Air circuit breakers above 630A shall be housed in separate cubicles. Aluminum plate shall be provided for cable entry to ACBs/MCCBs cubicles of 630A and above rating.

Outdoor feeder pillar shall be housed in weather proof sheet steel cabinets to IP54 or IP65 as applicable, grade fabricated with 14 SWG sheet steel, de-rusted, degreased, rust-proofed with two coats of anticorrosive paint or powder coated. They shall be floor mounted on concrete bases of required dimensions.

All components of feeder pillars shall be on mounting brackets inside the enclosure. They shall be equipped with adequately rated electrolytic tinned copper phase, neutral and earth

bus bars and be complete with cable terminations arrangement, terminal block/line up terminals.

The minimum clearances of the equipment shall be in accordance with the manufacturer's recommendations but not less than the following criteria.

a) Vertical, from highest equipment to bottom of roof beam: 500mm
b) Operation side of 400V switch gear: 1500mm
c) Operation side of distribution panels: 1500 mm

All distribution boards and isolators shall be identified with circuit designations and source of incoming supply. Lighting switches shall also be identified.

Labels for indoor or weather protected areas shall be white-black (or red) wire, laminated plastic with lettering engraved to show the middle layer. Identification and instructions shall be in black lettering. Warning or danger shall be in red.

21a. Circuit Identification

In addition to cable identification, cable cores shall be positively identified at every terminal point, in accordance with the drawings.

The cores of non-flexible cable shall be identified in accordance with the "IEE Wiring Regulations" with the addition of polarity markings for d.c circuits.

Ferrules used for identification shall be of interlocking permanently engraved type, designed to encircle the core completely. Markers of the adhesive type will not be permitted. Ferrules shall be correctly sized. There shall be to improvisation and engravings must not be altered.
Core markings shall be strictly in accordance with the drawings.

22. CABLE TRUNKING

Cable trunking shall be fabricated from sheet steel having a minimum thickness of 1.6mm and having a galvanized finish, and shall include all covers, accessories, supports, etc.

The trunking shall be of such a design that the lid is secured by mushroom headed screws having threads.

Copper links shall be provided on all the trunking interconnection to ensure that the electrical continuity is maintained throughout the trunking runs.

These copper links are to be fitted on the exterior of the trunking where they are readily visible at all times.

The inside surfaces of all trunking and trunking accessories should be smooth and free from burrs and other defects.

Slotted entries into distribution boards shall be suitably bushed by means of a non-ferrous insulating material securely fixed between the trunking at the distribution boards

Cable retaining clips shall be installed at not greater than 900mm centers within the trunking to prevent damage to cables when the covers are replaced.

Cables within the trunking shall be taped together in groups to denote circuits common to individual pieces of equipment.

The segregation of compartments in trunking shall be maintained at all cross over positions and metal separators shall be fixed to keep the wiring in each compartment completely isolated from the remainder.

The cable capacity of the trunking is to be strictly in accordance with the current edition of the I.E.E. regulations and the stipulated spare space shall be left in all cable trunking.
When trunking passes through a floor, wall, partition or ceiling which constitutes a fire barrier all orifices are to be effectively sealed to restrict the spread of fire.

Generally trunking is to be fixed at not more than 1.8m centers with additional fixing at not more than 150mm on either side of any fitting such as bends and tees. The trunking shall be suspended from structure with steel hangers or supported on walls by angle iron brackets.

23. CABLE TRAY

The Contractor shall supply and install all cable trays with covers, accessories, supports and fixing. Cable trays shall have a minimum thickness of 1.6mm up to 450mm width and 2.0mm thick over 450mm width and shall be heavy duty of the perforated pattern and made from galvanized sheet steel. All cables in any one layer are to be run in flat formation on the cable tray. Cable saddles for securing the cables shall be confined to within the width of the tray and all cable saddle fixing shall be accessible from the front of the cable tray. Cable trays shall have return flange edges.

All cable trays shall be spaced a minimum of distance of 20mm from any surface upon which they are run. All purpose made saddles supporting the cable tray must be supplied by the Contractor and must be painted with one coat of red oxide before erection.

All cable trays shall be fixed at intervals of not more than 1.2m for runs in both horizontal and vertical planes. The Contractor is to ensure that no sagging of the tray occurs. If this is apparent additional supports must be inserted to prevent the cable tray from sagging and to present a neat and workmanlike appearance.

Horizontal runs are to be hung from the ceiling with GI rods and supported on GI channels of appropriate sizes.

Cable trenches and cable trays/ ladder racks/ pipes shall be designed to allow for 25% spare space capacity for future installation.

24. UNDER FLOOR BOXES

The under floor pulls boxes for power, data and telephone cables shall be of galvanized sheet steel construction (minimum 16 SWG thickness). The boxes shall be installed in floor screed. The height of the boxes shall be between 65mm to 70mm or as required. Suitable arrangement of knock outs for conduit and trunking entry into the boxes is to be provided.

Metal adaptors forming barriers / crossovers / tees, etc. shall be provided within the boxes as required for segregation of power cables from data and telephone cables.

The cover together with the frame is to incorporate vertical adjustment. The cover is to be of minimum 14 SWG thick galvanized sheet steel.

Alternatively, the frame and the cover may be of sheet steel de-rusted, degreased, rust proofed and powder coated with the box in the screed remaining of galvanized sheet steel construction. The boxes shall include a brass earth terminal.