: **PROJECT: ALSHAB TOWER**

SECTION 26 05 33

RACEWAY AND BOXES

PART 1 - GENERAL

1.01 GENERAL REFERENCE

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

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

1.02 DESCRIPTION OF WORK

A. This Section to include all supply, installation and commissioning of all conduit and tubing, surface raceways, wireways, outlet boxes, pull and Junction boxes and handholes in accordance with the Specifications and Drawings.

B. General

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

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

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

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

5. Conduit and fittings used shall be:

a. Where embedded: heavy gauge rigid PVC or as indicated on the drawings;

b. Where surface mounted, exposed conduit; galvanized steel;

c. Where installed in flame proof and hazardous areas: galvanized steel.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Basic Electrical Materials and Methods

B. Wires and Cables

C. Cable Trays

D. Under floor Raceway Assemblies

E. Wiring devices

1.04 QUALITY ASSURANCE

A. Applicable Standards referred to in this Section:

1. British Standard Specifications:

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

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

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

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

e. A153/A153M: Specification for zinc coating (HOT-DIP) on Iron and steel hardware.

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

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

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

i. BS-6099 Part 1 & 2: UPVC conduits and accessories

j. ANSI/NEMA OS 1 – Sheet-Steel outlet boxes, Device Boxes, Covers and Box Supports.

k. ANSI/NEMA OS 2 – Nonmetallic outlet boxes, Device Boxes, Covers and Box Supports.

l. NEMA 250 – Enclosure for Electrical Equipment (1000 Volts Maximum).

1.05 SUBMITTALS

A. Samples

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

B. Product Data

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

C. Shop Drawings

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

PART 2 PRODUCTS

2.01 RIGID PVC CONDUIT AND FITTINGS:

A. Physical Properties

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

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

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

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

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

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

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

B. Nominal sizes and dimensions

1. Rigid PVC conduits shall be of one of the following nominal sizes 20, 25, 32, 38 and 50mm dia rigid PVC slip type coupler and coupling bends shall be of the same nominal sizes as the conduits and shall fit to the conduits properly.

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

C. PVC Conduit Boxes

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

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

3. All boxes for switches, sockets, outlets, etc. shall be rigid PVC and their dimensions

shall be suitable for fixing the switches, sockets and other accessories.

2.02 RIGID STEEL CONDUIT & FITTINGS

A. Rigid Steel Conduit

1. All metallic conduits shall comply with BS-4568 Part I rigid steel screwed type having an interior and exterior zinc coating of uniform quality and appearance throughout all surfaces.

2. Conduits shall not be less than 20mm diameter size, the conduit size should be as per MEW regulation and specification and shall be complete with all necessary threaded fittings, couplings and connecting devices having galvanized equivalent finish.

3. Conduits and fittings shall be manufactured specially for electric wiring proposed. When manufactured by a continuous weld process, weld heads both inside and outside the tube shall be completely removed prior to galvanizing.

4. All conduits and fitting shall be free from rust or other defects on delivery to the site and shall be properly stored in covered racking so that it is protected from mechanical damage and damage by weather and water whilst stored on the site.

5. All conduits shall be coupled to boxes and trunking wireways using brass male bushes. All such bushes shall be hexagon headed heavy duty long threaded type.

6. All conduit expansion couplings used shall be fabricated from material equal or equivalent to that of the conduit with which the coupling is to be used, having factory installed packing ring and pressure ring to prevent entrance and moisture. All couplings shall be equipped with earthing ring or earthing conductor.

7. All conduit runs shall be fixed using space bar pattern saddles giving not less than 3mm clearance between the conduit and the surface to which it is fixed. Saddles shall have finish to match the conduit and saddle clips shall be secured to the bar by means of brass screws.

B. Metallic Conduit Boxes

1. Metallic Conduit Boxes shall be used throughout metallic conduit raceway systems, and shall comply with, or be of demonstrated equivalent quality and performance to BS-4568 requirements. All boxes and covers shall be galvanized, zinc plated or equal rust-proofed finish equivalent to conduit finish.

2. Circular and/or rectangular boxes shall be used for pull boxes and terminating boxes, according to size and number of conduits connected to box. Boxes shall be either malleable iron or heavy duty steel construction with welded joints and tapped holes to receive metal threaded cover retaining screws. Self tapping screws will not be permitted.

3. All boxes, other than those to which a fitting or accessory is to be directly mounted shall be fitted with covers screwed to the box by brass screws. Malleable iron covers shall be used with malleable iron boxes and heavy gauge covers shall be used with sheet steel boxes.

4. All cover and accessory fixing provisions shall be so positioned that the fixing screws lie completely clear or cables entering the box. All fixing screws shall be brass.

5. All boxes installed in interior locations, plant rooms, ducts etc., shall be fitted with approved type gaskets to provide a waterproof seal between box and cover or other items fitted to the box.

6. All boxes provided as junction boxes where cable joints are specified or permitted, shall be provided with fixed terminal blocks. Such boxes shall be suitable size to contain the terminal block and sufficient cable to allow neat connections to be made. The terminal blocks shall be fixed to the box by brass screws and shall comprise conductor connectors, with brass clamping screws enclosed in porcelain or other heat resisting insulation material which will not distort or otherwise have its properties damaged by temperatures below the highest temperature at which the insulation of any cable connected to it is destroyed.

2.03 FLEXIBLE CONDUIT AND CONNECTIONS

A. Flexible Conduit

1. Flexible conduit shall be to BS-731, Part 1, water tight, PVC sheathed, spiralled metal type. The conduit shall be terminated at boxes and equipment by means of approved compression glands.

2. Flexible conduit shall be of the unpacked type for normal atmospheric conditions and asbestos packed for damp situations. Adaptors shall be of the solid type.

3. Flexible conduit shall be used for the final connection of rigid conduit to the terminal boxes of machines, fitted with a means of drive adjustment and/or where vibrations is likely to occur.

B. Flexible Connections

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

2.04 TRUNKING

A. General:

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

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

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

4. Trunking shall not be smaller than the minimum size stated on the drawings or specified later and shall be so sized that a space factor of 35% is not exceeded. The Contractor shall check the minimum size of trunking specified is large enough for his requirements without exceeding this space factor.

B. Trunking and Connectors:

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

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

3. Finish

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

   b. For external use: Class 3 protection

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

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

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

C. Bonding links and fastening.

1. To satisfy continuity conditions of BS-4678.

D. Braided Copper Taper

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

E. Steel Screws and Fasteners

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

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

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

F. Vertical Trunking

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

G. Horizontal Trunking

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

2.05 <u>BOXES</u>

A. Size wall and ceiling boxes to allow 15mm cover for flush conduit installation.

2.06 GALVANIZED STEEL BOXES

A. Boxes and accessories: BS4662 and BS31 or BS4568 Class 4, heavy protection to suit conduit, with the threaded male bush and socket connection and galvanized steel covers on pull and junction boxes. Boxes shall have pressed brass earth terminal and adjustable lug.

B. Weather proof boxes: cast iron with machined flat edge minimum 1.5mm cover fitted with temperature resistant gasket, threaded female connections.

PART 3 - EXECUTION

3.01 PREPARATION

A. Sets and Bends

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

2. Conduits over 32mm diameter : using coupling fittings.

3.02 INSTALLATION OF CONDUIT

A. General

1. Run conduit in square, symmetrical lines, parallel to or at right angles to walls and in accordance with the accepted practice.

2. Conduit systems shall be mechanically continuous and watertight after installation. All conduit system shall be arranged wherever possible to be self draining.

3. Conduit runs between draw-in positions shall not have more than two 90° bends, or the equivalent, length of such runs shall not exceed 10m.

4. Installation shall permit easy drawing in of cables.

5. Keep conduits at least 100mm from pipes and other nonelectrical services.

6. Where conduit runs are to be concealed in the structure or are to pass through floor slabs, the Contractor shall be responsible for making the accurate positions of all chases and holes on site. The Contractor shall provide dimensioned drawings as directed by the Engineer to enable a check to be made of all holes and chases. The Contractor shall arrange the conduit routing to make maximum use of any preformed conduit holes and slots provided in structural beams. Conduit installation on shear walls shall be kept to a minimum. All routing necessary on shear walls shall be agreed with the Engineer before work is put in hand.

7. Install conduits so as not to interfere with ceiling inserts, lights or ventilation outlets.

B. Runs in Reinforced Concrete.

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

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

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

C. Horizontal or Cross Runs

1. To be avoided in partitions and side walls.

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

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

E. Concealed Conduit

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

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

Conduit Size	Spacing
Up to 25mm	600mm
32 - 38mm	900mm
50mm	1000mm

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

F. Expansion Fittings

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

G. Terminations

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

H. Conduit Boxes

1. Fix at all outlet points.

3.03 INSTALLATION OF FLEXIBLE CONDUIT

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

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

C. Conduit to motors shall be terminated in the conduit fittings on the motors, the final connection

being made with liquid tight flexible conduit and suitable liquid tight connectors.

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

3.04 SEALING

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

3.05 TEST AND INSPECTION

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

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

3.06 INSTALLATION OF TRUNKING

1. Trunking

a. Fixing Trunking:

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

b. Settlement and Expansion Joints

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

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

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

c. Connections:

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

d. Cable Retaining Straps

1. Fix at not exceeding 1m centers.

3.07.1 INSTALLATION OF BOXES

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

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

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

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

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

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

G. Use flush mounting boxes in finished areas.

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

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

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

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

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

M. Do not fasten boxes to ceiling support wires.

N. Support boxes independently of conduit.

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

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

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

3.07.2 INTERFACE WITH OTHER PRODUCTS

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

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

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

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

3.07.3 ADJUSTING

A. Adjust floor box flush with finish flooring material.

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

C. Install knockout closure in unused box opening.

END OF SECTION