

SECTION: 2.10

**CONDUIT WIRING**

**1.0 Scope**

1.1 The scope of work shall cover supply, installation testing and commissioning of all conduit wiring.

**2.0 Standards**

2.1 The following standards and rules shall be applicable

- 1) IS : 732: 1989 Code of Practice for Electrical wiring installation (System voltage not exceeding 650V)
- 2) IS :1646:1982 Code of Practice for fire safety of building (General) Electrical Installation.
- 3) IS : 1653:1972 Rigid steel conduits for electrical wiring
- 4) IS : 2667:1976 Fittings for rigid steel conduits for electrical wiring
- 5) IS : 3480:1966 Flexible steel conduits for electrical wiring
- 6) IS : 3837:1976 Accessories for rigid steel conduit for electrical wiring
- 7) IS : 694:1977 PVC insulated wires.
- 8) IS : 2509:1973 Rigid non-metallic conduits for Electrical wiring
- 9) IS : 6946 Flexible (Pliable) non-metallic conduits for electrical installation
- 10) IS : 1293 3 pin plugs and sockets
- 11) IS : 8130 Conductors for insulated electric cables and flexible cord
- 12) IS:9537- 1980 Specification for conduits for Electrical installations
- 13) Indian Electricity Act 1910 and rules issued there under.
- 14) Regulations for the electrical equipment in buildings issued by the Tariff Advisory Committee of the Insurance Association of India.

2.2 All standards and codes mean the latest.

### 3.0 Materials

#### 3.1 General

3.1.1 All materials used shall conform to latest Indian standards and be stamped. They should also be standard products of approved manufacturers.

3.1.2 Materials used on the job shall be new and samples got approved by the project-in-charge. Approved samples shall be neatly mounted on a board and exhibited on the site all the time for comparison.

#### 3.2 Conduits and Raceways.

3.2.1 Conduits can be

- i) mild steel - black enamelled
- ii) mild steel - galvanized ( Heavy duty)
- iii) Rigid PVC (Heavy duty)

as specified and required by the schedule of work. Wall thickness in each case shall be as follows:

Outside Dia	Steel		PVC
	Black enamelled (mm)	Galvanised (mm)	
(a) Upto 32 mm dia	1.4	1.4	2.0 mm
(b) Over 32 mm dia	1.6	1.6	2.0 mm

3.2.2 PVC conduits shall be fire-retarding, rigid type and shall be used only where the conduits are embedded in concrete or wall chases with adequate cover.

3.2.3 Flexible conduits shall be heavy duty galvanised spiral type with PVC coating IP40 quality and connected with appropriate fittings. Flexibles without end fittings shall not be accepted. Wherever permitted, PVC flexibles may be used.

3.3 Accessories

3.3.1 Conduit fittings such as bends, elbows, reducers, chase nipples, split couplings, plugs, junction boxes & inspection boxes etc. shall be heavy duty specifically designed and manufactured for their particular application. All conduit fittings shall conform to IS: 2667-1964 and IS: 3887-1966. Wherever galvanised conduits are specified in the schedule of work, the fittings also shall be galvanised. In the case of PVC conduits, heavy duty PVC fittings shall be used.

3.4 Wires

3.4.1 All wires shall be single core multi-strand copper. PVC insulated to IS : 694 and shall be 1100V grade as specified and required in the schedule of work. The PVC insulation shall be halogen free unless otherwise specified.

3.4.2 All wires shall be colour coded as follows :

<u>Phase</u>	<u>Colour of wire</u>
R	Red
Y	Yellow
B	Blue
N	Black
Earth	Green (insulated)
Control (if any)	Grey

3.5 Switches & Sockets

3.5.1 Switches shall be moulded modular design with silver-plated contacts. Sockets shall be 3 pin with switch. All switch & socket mounting boxes shall be electro- galvanised steel specially made for the switches and sockets used. Combination of multiple switch units and sockets should be used in appropriate manner to minimise the no. and size of switch boxes.

3.5.2 Weather and water proof switches / sockets of approved make shall be used in all out door situations and where shown.

3.5.3 For industrial applications, industrial type of sockets with a pad lockable switch in a suitable galvanised steel box/fire retarded toughened plastic box shall be used. Cover plates shall be of galvanised metal in industrial applications.

**4.0 Installation**

4.1 The size of conduit shall be selected in accordance with the number of wires permitted under table given below. The minimum size of the conduit shall be 20 mm dia unless otherwise indicated or approved. Size of wires shall be not less than 1.5 sq. mm copper or 2.5 sq. mm aluminium, but shall be as specified in the schedule of work.

Nominal Cross sec. Area (mm <sup>2</sup> )	Overall dia (mm)	Conduit diameter (mm)			
		20	25	32	40
		Number of wires			
1.50	3.4	3	6	9	-
2.50	4.2	2	4	8	-
4.00	4.8	2	3	6	-
6.00	5.6	-	3	6	-
10.00	7.0	-	2	4	5

Raceways should not be filled for more than 30%

4.2 Conduits shall be kept at a minimum of 100 mm from the pipes of other non-electrical services.

4.3 Separate conduits / raceways shall be used for each of the following:

- 1) Normal lights and 5A 3 pin sockets on lighting circuit
- 2) Power outlets - 15A 3 pin, 20A/ 32A industrial outlets.
- 3) Emergency lighting
- 4) Telephones & Data
- 5) Fire alarm system, Public address system
- 6) Call bell wiring

- 4.4 Shop drawing for Conduit layout shall be prepared by the contractor taking into account the site conditions and got approved before proceeding with the work. Wiring for short extensions to outlets in hung ceiling or to vibrating equipments, motors etc., shall be installed in flexible conduits. No flexible extension shall exceed 1.25m in length.
- 4.5 Conduits run on surfaces shall be supported on galvanised steel 6 mm thick saddles which in turn are properly screwed to the wall or ceiling. Saddles shall be at intervals of not more than 500 mm. Fixing screws shall be with round or cheese head and of cadmium plated brass. Exposed conduits shall be neatly run parallel or at right angles to the walls of the building. Unseemly conduit bends and offsets shall be avoided by using fabricated galvanised steel junction/pull through boxes for better appearances. No cross-over of conduits shall be allowed unless it is necessary and entire conduit installation shall be clean and neat in appearance.
- 4.6 Conduits embedded into the walls shall be fixed by means of staples at not more than 500 mm intervals. Chases in the walls shall be neatly made and refilled after laying the conduit and brought to the finish of the wall but final finish will be done by the building contractor.
- 4.7 Conduits buried in concrete structure shall be put in position and securely fastened to the reinforcement and got approved by the Engineer, before the concrete is poured. Proper care shall be taken to ensure that the conduits are neither dislocated nor choked at the time of pouring the concrete. Suitable galvanised steel fish wires of not less than 0.63 mm dia shall be drawn in all conduits before they are embedded. Where conduit passes through expansion joints in the building, adequate expansion fittings shall be used to take care of any relative movement.
- 4.8 Inspection boxes shall be provided for periodical inspection to facilitate withdrawal and removal of wires. Such inspection boxes shall be flush with the wall or ceiling in the case of concealed conduits. Inspection boxes shall be spaced at not more than 12 meters apart or two 90 degree solid bends or equal. All junction and pull boxes shall be covered by an approved cover plate truly cut and fixed with cadmium plated brass screws. These junction boxes shall form part of point wiring or conduit wiring as the case may be including the cost of removing the cover for painting and refixing. No separate charges shall be allowed except where specially mentioned.

- 4.9 Conduits shall be free from sharp edges and burs and the threading free from grease or oil. The entire system of conduits must be completely installed and rendered electrically continuous before the conductors are pulled in. Conduits should terminate in junction boxes of not less than 32mm deep and the termination shall be rigid with check nuts and a smooth bushing. No wires shall be exposed in any part of the installation.
- 4.10 An insulated earth wire of not less than 2.5 sq.m copper shall be run in each conduit as specified in the schedule of work.

## **5.0 Lighting & Power Wiring**

- 5.1 All final branch circuits for lighting and appliances shall be stranded single conductor cables run inside conduits. The conduit shall be properly threaded and screwed into sockets, bends, junction boxes. No part of the wiring shall be exposed without a suitable conduit piping.
- 5.2 Branch circuit conductor sizes shall be as shown in the schedule of quantities and or drawings.
- 5.3 Final branch circuits shall preferably be kept in a separate conduit upto the Distribution Board. A conduit should carry only circuits belonging to the same phase unless it is a 3ph supply. Each lighting branch circuit shall be loaded conservatively so that the circuit current is substantially lower than the current carrying capacity of the conductor or as shown on drawings. Each conduit shall not hold more than three branch circuits of the same phase.
- 5.4 Flexible cords for connection to appliances, fans and pendants shall be 650/1100V grade (three or four cores i.e. with insulated neutral wire of same size) with tinned stranded copper wires, insulated, twisted and sheathed with strengthening cord. Colour of sheath shall be subject to the Engineer's approval.
- 5.5 Looping system of wiring shall be used. Wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors. No such joints shall be made unless the length of the subcircuit, submain or main is more than the length of the standard coil.
- 5.6 Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in 14 SWG galvanised steel boxes. Cadmium plated brass screws shall be used.

- 5.7 Power wiring shall be distinctly separate from lighting wiring. Conduits not less than 25 mm and wires not less than 2.5 sq.mm copper shall be used as specified in the schedule of work. Power outlets belonging to two phases shall maintain a minimum distance of 2.0m
- 5.8 Every conductor shall be provided with identification ferrules at both ends matching the drawings.

## **6.0 Testing**

- 6.1 The entire installation shall be tested for:
- a) insulation resistance
    - i) between phases
    - ii) between each phase and earth
  - b) earth continuity
  - c) polarity of all switches

No installation shall be commissioned unless and until the insulation resistance is 2.0 megohms between phases and 1.0 megohms between phase and neutral. All tests shall be witnessed by the Engineer-in-charge and attested.

A test certificate shall be submitted as required

## **7.0 Mode of measurement**

- 7.1 The definition of point wiring shall be in accordance with the enclosed sketch drawing.
- 7.2 The final subcircuit wiring commencing from the distribution board till the first switch box or light fitting shall be considered as a circuit or primary point.
- 7.3 All other continuing wiring shall be regarded as secondary point. Secondary point should include wiring from circuit point onwards together with all junction boxes, connectors, earthwire, fixing accessories, connection to all light fittings switches etc. as specified and shown on drawings.

- 7.4 All switches sockets with boxes, inter connections, earthing shall be paid for per unit of 1 switch, 2 switch, 3 switch, 4 switch units, 5A switch-sockets, 20A/30/60A M.C sockets generally as shown in the schedule of work.
- 7.5 All empty conduit runs, including junction boxes, fish wires etc. shall be paid on the basis of unit length.
- 7.6 Buzzer indicator of the ways specified shall consist of indicating lamps, reset button, electromagnet, cover plate, chromium plated brass screws etc. shall be considered as one unit for measurement and payment.
- 7.7 Two way light points shall be classified as separate point and shall consist of 2 Nos 2 way switches, wiring from the 1st 2 way switch to the 2nd 2 way switch and to the first light controlled. Subsequent lights, if any, shall be measured as secondary points.