

Explanatory notes for wiring work

This scope pertains to internal electrification of residential and service buildings on 3 phase, 415 volts or single phase, 230 Volts, 50 Hz Ac supply system, including provision of conduits with accessories, metal boxes and Boards, wiring, metering, protection, switchgear, UPS, stabilizers, energy savers, provision of fans & luminaries, pre-commissioning / commissioning tests and handing over. Separate conduits shall be laid for:

- i) Emergency and non-emergency circuits
- ii) Power and lighting circuits

Regulations and standards:

The system shall be governed by IS:732, I.E. Rules 1956, National Electric Code (NEC), ECBC, National Building code, relevant BIS Standards and Codes applicable to internal electrification and distribution works.

1.2 The definitions of terms shall be in accordance with IS:732-1989 (Indian Standard Code of Practice for Electrical Wiring), except for the definitions of point wiring, circuit, sub-main and main wiring.

Wiring

1.4.1 (a) Main wiring: Main wiring shall mean the wiring from one main/distribution switchboard to another.

(b) Sub-main wiring: Sub main wiring shall mean the wiring from the distribution board to the 1st tapping point inside the switch box, from where point wiring starts.

(c) PVC insulated, multi stranded, Flame Retardant low smoke, flexible copper conductor cables of 1.1 kV grade, conforming to IS: 694/1990, ISI marked shall be used. The size/s shall be as specified in the Bill of Quantities (BOQ).

(d) Minimum size of wiring cable/s for light and power points shall be as below:

- Light/ Fan wiring - 1.5 Sq. mm
- Light plug point - 2.5 Sq. mm
- Circuit wiring for Light/ Fan Point - 2.5 Sq. mm.
- Circuit wiring for Light plug point - 4.0 Sq. mm
- Group Point wiring - 2.5 Sq. mm
- Power wiring - 4.0 Sq. mm
- Power wiring with more than 1 kW load – the size shall be assessed by the contractor based on load calculations and approved by the Engineer.

2. Materials:

1. Conduits:

i) All Non-Metallic conduits, pipes and accessories shall be of suitable materials complying with IS: 9537/Pt.3 or latest and IS: 3419 or latest for rigid conduit and IS: 6946 or latest for flexible conduits. The Interior of the conduits shall be free from obstructions. The rigid conduits pipes shall be ISI marked.

ii) The conduits shall be circular in cross-section. The conduits shall be designated by their nominal outside diameter.

iii) No non-metallic conduit not less than 20 mm in diameter shall be used.

iv) Wiring capacity: The maximum number of PVC insulated Aluminium/copper conductor cables of 650/1100V grade conforming to IS: 694-1990 that can be drawn in one conduit of various sizes shall be selected accordingly.

2. Conduit accessories:

i) The conduit wiring system shall be complete in all respects including accessories.

- ii) Rigid conduit accessories shall be normally of grip type.
- iii) Flexible conduit accessories shall be of threaded type.
- iv) Bends, couplers etc., shall be solid type in recessed type of works.
- v) Saddles for fixing conduits shall be heavy gauge non-metallic type with base.
- vi) For all sizes of conduit, the size of clamps shall be 4.5 mm (7 SWG) diameter.

3. Outlets:

- i) The switch boxes shall be made of either rigid PVC moulding, or mild steel, or cast iron on all sides except at the front.
- ii) PVC boxes shall comply with the requirements laid down in IS: 14772 or latest. These boxes shall be free from burrs, fins and internal roughness. The thickness of the walls and base of PVC boxes shall not be less than 2mm. The clear depth of PVC boxes shall not be less than 60 mm.
- iii) The specification for metallic boxes shall be as per requirements.
- iv) 3mm specification for metallic boxes shall be as per requirements.

3. Installation:

1. Aspects for concealed/Recessed conduit works:

- i) The erection of conduits of each circuit shall be completed before the cables are drawn in.
- ii) Conduit Joints: All joints shall be sealed/cemented with approved cement. Damaged conduit pipes/fittings shall not be used in the work. Cut ends of conduit pipes shall have no sharp edge nor any burrs left to avoid damage to the insulation of conductors while pulling them through such pipes.
- iii) Bends in Conduit:
 - a. All bends in the system may be formed either by bending the pipes by an approved method of heating, or by inserting suitable accessories such as bends, elbows or similar fittings, or by fixing non-metallic Inspection boxes, whichever is most suitable. Where necessary, solid type fittings shall be used.
 - b. Radius of bends in conduit pipes shall not be less than 7.5 cm.
 - c. Care shall be taken while bending the pipes to ensure that the conduit pipe is not injured, and that the internal diameter is not effectively reduced.
- iv) **Outlets:** All switches, plugs, fan regulators etc., shall be fitted in flush pattern. The fan regulators can be mounted on the switch box covers, if so stipulated in the tender specifications, or if so directed by the Engineer-in-charge.

- v) Painting: After Installation, all accessible surface of metallic accessories shall be painted.

2. Additional requirements for recessed conduit work:

i) Making Chase:

- a. The chase in the wall shall be neatly made, and ample dimensions to permit the conduit to be in the manner desired.
- b. In the case of building under construction, the conduits shall be buried in the wall before plastering, and shall be finished neatly after erection of conduit.
- c. In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work.

ii) Fixing conduits in chase:

- a. The conduit pipe shall be fixed by means of staples, or by means of non-metallic saddles, placed at not more than 60 cm apart or shall be fixed by any other approved means of fixing.
- b. At either side of the bends, saddles/staples shall be fixed at a distance of 15 cm from the centre of the bends.

iii) Erection in RCC work:

- a. The conduit pipes shall be laid in position and fixed to the steel reinforcement bars by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.
- b. Fixing of standard bends or elbows shall be avoided as far as practicable, and all curves shall be maintained by bending the conduit pipe itself with a long radius which will permit easy drawing in of conductors.
- c. Location of inspection/junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

iv) Fixing inspection boxes:

- a. Suitable inspection boxes to the minimum requirement shall be provided to permit inspection, and to facilitate replacement of wires, if necessary.
- b. These shall be mounted flush with the wall or ceiling concrete. Minimum 65mm depth junction boxes shall be used in roof slabs and the depth of the boxes in other places shall be as per IS: 2667 or latest.
- c. Suitable ventilating holes shall be provided in the inspection box covers.
- v) Fixing switch boxes and accessories: Switch boxes shall be mounted flush with the wall. All outlets such as switches, socket outlets etc., shall be flush mounting type, unless otherwise specified.
- vi) Flush wire: To facilitate subsequent drawing of wires in the conduit, GI flush wire of 1.6mm/1.2mm (16/18 SWG) shall be provided along with laying of the recessed conduit.
- vii) Bunching of cables: For ease of maintenance, cables carrying direct current or alternative current shall always be bunched so that the outgoing and return cable are drawn in the same conduit.

4. Earthing requirements:

A protective (earth) conductor shall be drawn inside the conduit in all distribution circuits to provide for earthing of non-current Carrying metallic parts of the installation. These shall be terminated on the earth terminal in the switch boxes, and/or earth terminal blocks at the Distribution boards.

Capacity of Circuits (Sub-main):

- a. Lighting circuit from each sub main shall feed light/fan/call bell/6A outlet points. Each circuit shall not have more than 800 Watt connected load or more than 8 points.
- b. Power sub main circuit will have only one 16A outlet per circuit. Not more than 4 Nos. 6A outlets outlet shall be allowed from one sub-main.
- C. All Loads more than 1 KW each shall be controlled by suitably rated MCB and cable size shall be decided as per calculations.

Wiring Specification for Service Buildings:

- 1. All the light points, fan points should be wired with 2 Nos. of PVC insulated 1.5 Sq.mm multistranded copper conductor wires and 2/3 pin 5A plug sockets wired with 2 Nos. of PVC insulated 2.5 Sq.mm multistranded copper conductor wires and 5/15 A power plugs with 2 Nos. of PVC insulated 4 Sq.mm copper conductor wires along with earth continuity wires (separate circuit should be drawn from sub distribution board to the 5/15 A power plug).
- 2. All power circuits should be wired with 2 Nos. of PVC insulated 4 Sq.mm multistranded copper conductor wires along with 2.5 Sq.mm PVC insulated multistranded copper wire as

earth continuity. The individual circuit should be taken from nearest main distribution board/sub distribution board/ distribution board as per the directions of Engineer at site.

3. All the fittings should be earthed properly with earth continuity wire. The size of the earthing wire should not be less than half of the size of the conductor along which it is provided, the minimum being 1.5 Sq.mm.

4. The PVC insulation should conform to IS; 694/90 or latest and copper conductor should conform to IS: 8130/84 or latest.

5. All cables/conductors, wiring material makes shall be any one of the approved make/brand.

6. All the lights, fans, 5A modular plug sockets should be controlled by 5A modular switch of approved make/brand.

7. The modular type bell push should be of approved make/brand.

8. All the FT light fittings & fans should be connected from three terminal ceiling rose with three-core PVC insulated copper flexible cable.

9. The 5/15 A modular power plug should be of approved make/brand.

10. The 2/3 pin 5A modular plug socket should be of approved make/brand.

11. All the boards should be of MS/polycarbonate fire retardant unbreakable type as specified in the schedule.

12. The FT fitting shall be fixed on 2 Nos. of round blocks and connected from ceiling rose with PVC insulated flexible copper cable.

13. All the incoming mains from sub distribution board to meter board should be connected with 2 Nos. of suitable size PVC insulation confirming to IS: 694/1990 or latest and Copper conductor conforming to IS; 8130/84 or latest along with 1 No. of suitable size PVC insulated multistranded copper wire as earth continuity.

14. All the sub-circuit mains from meter board to individual distribution boards/switch boards should be connected with 2 Nos. of suitable size PVC Insulation conforming to IS: 694/1990 or latest along with 1 No. of suitable size PVC insulated multistranded copper wire as earth continuity.

15. The patch works left after electrical wiring/rewiring, are to be attended and to be brought back as it was prevailing earlier duly taking up necessary plastering and distempering/white washing etc., Further, while doing drilling etc., it should be ensured that no damage is caused to the walls of the building.

16. PVC conduits shall be laid in parallel/perpendicular to the walls/roof shall be arranged properly. Further the total wiring in the service buildings shall appear elegant.

17. As per Railways site Engineer's instructions, the wiring is to be taken up in PVC concealed wiring suitable to the site conditions.

18. Conformity with the Indian Electricity Rules.

The installation work shall be generally carried out in conformity with the requirement of Indian Electricity Rules 1956 as amended from time to time.

All the materials, fittings, equipment and other accessories used in the electrical installations shall conform to relevant Indian standard specification wherever they exist and shall be of approved make. In case an Indian standard.

Specification does not exist the materials and other items shall be approved by the competent authority. Specification of materials used generally in the wiring installations and electrical

fittings to be of approved makes. Approval of samples to be obtained by the contractor from the Engineer-in-charge of the Railways before commencement of the work.

19. Workmanship: Good workmanship is an essential requirement for compliance of the wiring of installation. The work of electrical installation shall be carried out under the supervision of a person holding a certificate of competency issued by recognized authority.

20. All the wiring work should be carried out in the presence of Railway's Engineer at site and in accordance with the of Indian Electricity Act 1910 & with IE rules 1956 amended up to date. During wiring colour code of cables/conductors as per IE Rules 1956 shall be strictly followed.

21. The specification to be strictly followed for point wiring, sub-circuit wiring, main circuit wiring etc., specified in the scope of work and tender schedule and the work shall conform to relevant Indian standard code of practice. For the electrical installation works, relevant codes of practice for safety shall be followed.

22. The sample of fittings/switches and any schedule item should be got approved by Sr. DEE/M/GTL of the division before commencement of the work. The approved samples will be kept with the nominated Section Engineer. The divisional officer will exercise adequate care to ensure that approved fittings, switch boards, modular switches and other accessories etc., are suitable as per aesthetics of civil engineering structure.