

Annexure

All the Wiring & Installation shall be as per the CEA (Measures relating to Safety and Electric Supply) Regulations, National Electrical Code of India, Indian Electricity Rules and IS Standards listed below:

1. **General Wiring & Installation:** IS 732

2. **Earthing Systems:** IS 3043

3. **Wires and Cables**

- IS 694

4. **Switches and Protective Devices**

- IS 3854
- IS/IEC 60898-1
- IS 12640 (Part 1)

5. **Conduit Pipes & Accessories**

- IS 9537 (Part 2)
- IS 9537 (Part 3)

General Guidelines:

Service Mains

- The entire installation of the service line (overhead and underground) shall be carried out in strict conformity with the requirements of IS 8061 and the Indian Electricity Rules.
- While deciding the cable route, it should, as far as possible, follow the shortest distance from the nearest distributing mains to the proposed service position. It must clear underground obstructions like drainage systems, manholes, or services of other utilities, and avoid positions where heavy materials are routinely stacked, shifted, or moved.
- Service lines must terminate within an adequately ventilated and lighted position enclosed by masonry, good quality wood, or a metal enclosure. It is strictly prohibited to locate the service position near or below washing places, lavatory blocks, drainage lines, water/gas pipes, furnaces, hearths, or any area where fire hazards, gases, and fumes exist.
- Ample front space must be kept available to enable workmen to work safely on the line. Wherever medium pressure exists, this clear working space shall not be less than 1.0 metre in front of the service position.

- Where an underground service cable enters a building through a wall, it must pass through a fixed lead-in tube consisting of a GI or HDPE pipe / flexible hose embedded and firmly grouted in the wall. The pipe shall be of suitable size in diameter to ensure easy drawal, and the entry point must be properly sealed to prevent the ingress of water and entry of vermin.
- For cables running along walls or ceilings to reaching the service position, suitable clips or clamps must provide secure support at regular intervals of not less than 1.0 metre and not more than 2.0 metres, depending closely on the cable's size and weight.
- Structurally dedicated, readily accessible vertical ducts or chases of adequate capacity must be provided to accommodate rising service cables. In general construction, these vertical chases shall not be less than 450 mm wide and 150 mm deep.
- When providing an overhead service connection via weather-proof or PVC-insulated cable, it must be supported on a galvanized iron (GI) bearer wire.
- At connection points, copper-to-aluminium joints require the mandatory use of bimetallic clamps. For aluminium-to-aluminium joints, anti-corrosive grease must be thoroughly applied to the conductors before mechanically fixing the clamp.
- A prominent, compliant earth terminal must be provided directly at the service position. The earth terminal must securely connect to the armour of PVC-armoured cables, or a dedicated earth continuity conductor for PVC-unarmoured cables. For overhead lines, the GI bearer wire must be bound to the distribution line's earth wire, with a separate earth wire terminated at the consumer's service position. Metallic casings of all service cutouts must be firmly earthed.

Earthing

- The entire earthing system shall strictly conform to IS 3043.
- Piping networks (water/gas) or structural steel shall never be used as earth electrodes.
- Earthing shall be executed via standard Pipe or Plate electrodes in strict accordance with the specific dimensional and material requirements mandated by IS 3043, treated with alternative layers of charcoal/salt or standard eco-friendly chemical compounds.
- Earth pits must be outside the building footprint, shall be at a specific distance away from foundations as specified in IS 3043, and enclosed in a concrete inspection chamber with a secure cover for routine testing.
- A continuous, insulated copper earth wire must run inside the conduits alongside phase and neutral wires to all points. Minimum wire sizes:
 - 1.0 mm² or 1.5 mm² for lighting sub-circuits.
 - 2.5 mm² for power sub-circuits.

- All exposed non-current-carrying metal parts including distribution boards, metal conduit pipes, armoured cables, switch boxes and heavy appliances (pumps, ACs) must be effectively bonded to the earth system.
- The overall earth resistance of the installation must be maintained as low as possible and shall never exceed 5.0 Ohms (for LT Domestic) under any seasonal condition to ensure swift tripping of MCBs/RCDs.

Energy meters

- Energy meters shall be installed at such a place near the front entrance of the ground floor which is readily accessible to both the owner of the building and the authorized representatives of the department.
- Meters should not be located at an elevated area or a depressed area that does not have access by means of a stairway of normal rise; it should preferably be installed at a height not less than a range of 1.5 m to 1.72 m from the floor.
- The height of meter display shall be between the energy meters should either be provided with a protective covering, enclosing it completely, except the glass window through which the readings are noted or should be mounted inside a completely enclosed panel provided with a hinged or sliding doors with arrangement for locking it.
- The room/space where energy meters are installed shall be kept clear from any obstruction.
- It shall be ensured that the incoming supply is controlled by a linked main switch-fuse unit or a circuit breaker that simultaneously disconnects all phases and the neutral.
- The wiring throughout the installation shall be such that there is no break in the neutral wire in the form of a switch or fuse unit.

Distribution boards

- For all standard LT connections where a three-phase supply is drawn, it shall be ensured that the internal connected load is uniformly distributed across the R-Y-B phases to prevent neutral shifting, transformer unbalancing, or phase voltage distortions in the department's grid.
- The distribution boards for light and power circuits shall be different.
- Branch distribution boards shall be controlled by a switchfuse or circuit-breaker on the phase or live conductor. The neutral conductor shall be connected to a common link and be capable of being disconnected individually. At least one spare circuit of the same capacity shall be provided on each branch distribution board. The breaking capacity of the MCB must be rated to clear prospective short-circuit currents.

- The electrical supply to all installations must be controlled by an RCD with a rated residual operating current not exceeding 30mA.
- The main isolating breaker installed by the consumer must be coordinated with the internal sub-circuit MCBs. This ensures that any localized fault trips only the closest domestic breaker, preventing fault cascades from feeding back into the department's distribution network.
- All main switches or miniature circuit-breakers shall be either of metal-clad enclosed pattern or of any insulated enclosed pattern which shall be fixed at close proximity to the point of entry of supply

Switch Boards

- Open type switch boards shall be placed only in dry situation and in well ventilated rooms. They shall not be placed in the vicinity of storage batteries and exposed to chemical fumes.
- In a damp situation or where inflammable or explosive dust, vapour or gas is likely to be present, the switch boards shall be totally enclosed or made flame-proof as may be necessitated by the particular circumstances.
- A switch board shall not be installed so that its bottom is within 1.25 m above the floor, unless the front of the switch board is completely enclosed by a door, or the switch board is located in a position to which only authorized persons have access.
- If position of switch-board is above top of table/platform; it shall be 150 mm above the surface of table/platform top. Plug outlets if required at lower level shall be 200 mm above finished floor level and such plug sockets must be shuttered type.
- Switch boards shall not be erected above gas stoves or sinks or within 2.5 m of any washing unit in the washing room.
- Switch boards, if unavoidably fixed in places likely to be exposed to weather, to drip, or to abnormal moist atmosphere, their outer casing shall be weather-proof and shall be provided with glands or bushings or adopted to receive screwed conduit according to the manner in which cables are run. PVC and double flanged bushes shall be fitted in the holes of the switches for entry and exit of wires.
- Where so required, the switch boards shall be recessed in the wall. The depth of recess provided at the back for connection and the space at the front between the switchgear mountings shall be adequate.
- No fuse other than fuses in instrument circuit shall be fixed on the back of or behind a switchboard panel or frame.
- Equipment's which are on the front of a switchboard shall be so arranged that inadvertent personal contact with live parts is unlikely during the manipulation of switchgears, changing of fuses or similar operations.

Wiring

- Any one of the following types of wiring may be used in a residential building
 - a) Tough rubber sheathed or PVC insulated PVC sheathed wiring on wood batten,
 - b) PVC insulated wiring in steel/non-metallic surface conduits and
 - c) PVC insulated wiring in steel/non-metallic recessed conduits.

However, if aesthetics is the main consideration, recessed conduit wiring system may be adopted.

- The wiring for 16A/25A plug outlets (power circuits) shall invariably be carried out either in surface/recessed conduit wiring system.
- Power sub-circuits shall be kept separate and distinct from lighting-and fan sub-circuit.
- In compliance with standard practice, considering that not more than one circuit shall feed supply to switchboards, the total load of number of light, fan, 6 A plug outlets shall not exceed 30percent of the maximum current carrying capacity of the circuit main or 1000 W or 24 points, whichever reaches its limit first and no power sub-circuit shall exceed 3,000 Watts or 2 socket-outlets, ensuring that wires do not overheat behind walls.
- It is recommended to provide at least two lighting sub-circuits in each house. It is also recommended that a separate lighting circuit be utilized for all external lighting of steps, walkways, driveways, porch, car park, terrace, etc., with a master double-pole switch for the sub-circuit in addition to the individual switches.
- Current rating of switch shall suit the load, its type and size of conductor. For point wiring of light and fan circuits, 6A switch shall be used. For plug points on board or independent plug point, switch may be of capacity 6A/10A. For power points, minimum 16A switch shall be used.
- The high-power appliances (such as air conditioners, water heaters, and water pumps) shall be wired on dedicated power sub-circuits using standard 2.5 mm² to 4.0 mm² conductors, completely independent of the low-power lighting circuits which use 1.0 mm² or 1.5 mm² conductors.
- Plug and sockets with/without earth contact shall conform to IS 1293
- Supply to plug socket shall be given through a switch of current rating not less than that of socket be placed at adjacent position in the switch board. Plug socket provided on lighting circuit switch board shall not be more than 6A. For power circuits, 16A or combined 6/16A sockets shall be used.

Installations

- Standard rated current for B15 and B22 holders shall be minimum 2 A. In case of requirement of higher ratings, manufacturer's specification shall be referred. Lamp holders shall not be used for external electrical installation without conforming to required IP class.
- Exterior material of Lamp Holder may be plastic, ceramic or metal. Usually in fixed wiring installations, plastic material is recommended. For plastic lamp holders, a protective shield similar to skirt shall be provided to avoid accidental contact with lamp cap.
- Metal lamp holders are used for decorative lamp fixtures. For such holders, earth terminal or other means of earthing shall be in effective electrical contact with all exposed non-current carrying metal parts. Lamp holders with integrated switch shall conform to requirements specified in the respective standard.
- All ceiling roses shall be provided with earth terminal and it shall be visibly distinguishable. Location of ceiling rose shall be close to the intended location of appliance to avoid loose hanging wires.
- Lighting fixtures are used with the lighting devices to provide adequate illumination. Lighting fixtures and their integrated parts shall conform to IS 10322 series of standards.
- The means for fixing shall be capable of supporting a mass of not less than 5 kg. Where the mass of the luminaire is greater than 5 kg, it shall be ensured that the means for fixing is capable of supporting the mass of the luminaire.
- The suspension of ceiling fan shall withstand tensile load of 1000 kg and torsion load of 500 kg without breakage. Concealed type fan box shall be fixed in RCC slab by entangling the rod in the steel and embedding it in RCC slab during casting.
- Alternatively, where concealed type box is not needed, a bar without box shall be fixed. Post casting of slab, suspension arrangement is to be made with the use of truss member. Rod shall be of 10mm diameter and M.S. flat of clamp shall not be less than 30 mm x 5 mm. It shall be noted that electrical continuity is disrupted with use of rubber shackle from fan to the metallic part of ceiling. Rubber shackle also helps to dampen torsion forces.
- Down rod or suspension rod of ceiling fan are of standard length, usually of 225 mm, and with necessary holes for nut and bolts, wire to pass through and cut for clamping fan shaft with proper grip.
- In case of ceiling height more than 3 m, extra-long down rod may be required. Under such circumstances check, manufacturer's specifications shall be checked for recommended maximum height of blades from floor level for optimum output/useful air delivery.
- Down rods with extra lengths shall be continuous without joint and shall carry same mechanical properties.
- For wall mounted a.c. units suitable height may be above lintel level.

In case of Commercial Supply:

In multi-storied buildings, a number of offices and commercial centres occupy various areas. Electrical load for each of them would have to be metered separately; the meter-room normally is situated in the ground floor.

- The designer of power supply for office buildings and commercial centres shall take into account the great concentration of power demand of the electrical loads. Air-conditioning in office buildings absorbs an especially high proportion of the total power used. Consequently, such occupancies have to be provided with vertical and horizontal forms of power distribution.
- All current carrying equipment shall be totally enclosed, dust and vermin-proof and if mounted outdoor, shall be of weather-proof construction or housed in weather-proof kiosk or cabin. Switchboards shall be of open type or cubicle type. Cubicle type boards shall be with hinged doors interlocked with switch-operating mechanisms. All switches shall bear labels indicating their functions. Switchboards shall be located away from areas likely to be crowded by the public.
- For the purposes of office buildings, shopping and commercial centres, miniature circuit-breakers of adequate capacity shall be preferred to switchfuse units. They can also be effectively used in place of fuses in a distribution board
- Adequate number of socket-outlets shall be provided for electrically operated office machines such as electrical typewriter, calculators, etc., to avoid training of wires and use of multiple outlets from one socket.
- Areas where corrosive or polluting substance are present intermittently or continuously, such as school laboratories and other buildings located in high industrial pollution zones, socket-outlets shall preferably be of metal clad weather-proof type with covers.

In case of Assembly/Recreational Buildings

- The branch circuits shall in general cater to the following individual load groups:
 - a) Power installation:
 - 1) Stage machinery,
 - 2) Ventilation and air-conditioning installation
 - 3) Lifts and
 - 4) Additional power connections.
 - b) Lighting:
 - 1) In front of the theatre, such as general lighting of outdoor, foyer, corridors and stairs, and auditorium; and
 - 2) In the rear of the theatre for stage, work place dressing rooms, workshops and storehouses.
 - c) Emergency supply.

- Wiring shall be of the conduit type. Ends of conduits shall enter and be mechanically secured to the switch, control gears, equipment terminal boxes, etc. Ends of conduits shall be provided with screwed bushes. Within the enclosure, all cables shall be enclosed in screwed metal conduits adequately earthed. PVC conduits may be used in the auditorium and other places.
- Temporary wiring shall not be allowed in cabin, rewinding room, queue sheds and similar places.
- Branch and main distribution boards shall be mounted at suitable height not higher than 2 m from the floor level. A front clearance of 1 m should also be provided.

In case of Medical location

All the installation and wiring shall be done in compliance with Part 3 Section 9 of National Electrical Code and CEA (Measures relating to Safety and Electric Supply) Regulations.

In case of electrical installations in Industrial Buildings

All the installation and wiring shall be done in compliance with Part 4 National Electrical Code and CEA (Measures relating to Safety and Electric Supply) Regulations.

The execution of all works shall strictly comply with numerical constraints, technical thresholds, and material specifications detailed in the latest editions of the specified standards, inclusive of all active amendments, revisions, or replacements issued by the Bureau of Indian Standards (BIS), Central Electricity Authority (CEA), Joint Electricity Regulatory Commission (JERC), and relevant statutory bodies. It is explicitly affirmed that all numerical constraints or values mentioned in this document are subject to administrative and regulatory updates, and shall dynamically conform to the governing standards and guidelines in force as on the date of execution of the work.

References

National Electrical Code of India

(<https://archive.org/details/gov.in.is.sp.30.2023/mode/2up>)

1. General Wiring & Installation:

IS 732:2019

(<https://archive.org/details/gov.in.is.732.2019/page/12/mode/2up>): Code of Practice for Electrical Wiring Installations (Voltage below 650V). Guide for the overall design, selection of wiring materials, and testing of electrical systems in homes.

2. Earthing Systems:

IS 3043:2018 (<https://archive.org/details/gov.in.is.3043.2018/mode/2up>): Code of Practice for Earthing. Outlines the required methods for grounding electrical installations to prevent shocks and faults.

3. Wires and Cables

- IS 694:2010:
<https://archive.org/details/gov.in.is.694.2010/is.694.2010/page/n3/mode/2up>
PVC Insulated Cables for working Voltages up to and including 450/750 V. Specifies the construction and testing of domestic wires used for lighting and power circuits.

4. Switches and Protective Devices

- IS 3854:2023
<https://archive.org/details/gov.in.is.3854.2023/page/n1/mode/2up> :
Switches for Domestic and Similar Purposes.
- IS/IEC 60898-1
<https://archive.org/details/gov.in.is.iec.60898.1.2002/page/n3/mode/2up>:
Circuit breakers for overcurrent protection for household and similar installations (MCBs).
- IS 12640 (Part 1):2024
Residual Current Operated Circuit-Breakers without Integral Overcurrent Protection for Household and Similar Uses (RCCBs/ELCBs).

5. Conduit Pipes & Accessories

- IS 9537 (Part 2):1981:
<https://archive.org/details/gov.in.is.9537.2.1981/page/n3/mode/2up>
Conduits for Electrical Installations: Rigid Steel Conduits.
- IS 9537 (Part 3):1983:
<https://archive.org/details/gov.in.is.9537.3.1983/page/n3/mode/2up>
Conduits for Electrical Installations: Rigid Plain Conduits of Insulating Material (commonly used PVC conduits).