

Electrical safety in consumers' premises & general precautions

Safety inside Consumers' premises requires utmost importance as electricity has become part of our daily life. Electricity is an easily and casually handled commodity by consumers, but at the same time the risk involved in it is not fully understood by people in general. Electricity can cause danger and even loss of life if not handled properly and safely. Care and caution are default requirement when it comes to handling electricity. A little care makes mishap rare inside consumers premises.

Following stipulations of safety measures mandated by CEA regulations and relevant IS must be followed and practiced scrupulously both by suppliers and consumers:

- All materials, wires, cables and apparatus used shall be of sufficient rating of power, insulation, estimated fault current, mechanical strength and ISI marked. (Regulation 14)
- All materials, fittings, etc, used in earthing shall conform to Indian Standards specifications, wherever these exist (clause 4.10 of IS 3043 : 2018)
- All electrical equipment shall be installed above the Mean Sea Level (MSL) as declared by local Municipal Authorities and where such equipment is to be installed in the basement, consumer shall ensure

that the design of the basement should be such that there is no seepage or leakage or logging of water in the basement (Regulation 14)

- Consumer is responsible for safe custody of lines, wires, fitting, apparatus, pillar boxes, meters and equipment in his premises belonging to the supplier. The Consumer shall also ensure that the installation under his control is maintained in a safe condition. No flammable / dust / waste shall be dumped under the meter / switch board. The switch board shall be easily accessible in case of emergency. (Regulation 15)
- A suitable switch gear (cut-out) shall be provided in each conductor of every service line other than the earthed neutral conductor or earthed external conductor of concentric cable inside consumer's premises. Such switch gear (cut-out) shall be contained within an adequately enclosed fire proof receptacle (iron clad fixed over the cut out). It should be in an accessible position. (Regulation 16). Re-wirable fuses are most commonly used in housing wiring and small current circuits. It is also known as a kit-kat fuse. However re-wirable fuses have disadvantages of unreliable operation (due to incorrect fuse size), low breaking capacity, slow speed of operation, risk of heat, flame or fire , and power loss (due to improper or loose connection). Therefore, in order to overcome the disadvantages of the conventional cut-out / re-wirable fuses, modern MCBs with requisite capacity to carry and break the current can also be used as provided in Regulation 37, for reliable and efficient operation. A combination of RCCB and MCB in a single unit called RCBO can also be used.

- The Consumer shall be provided with a Main Earthed Terminal (MET) in his premises, for his use in an accessible position near the point of supply. (Regulation 18) (Explanation: Supplier's neutral is effectively earthed at Transformer location. In addition, one earth terminal should be provided in the meter board for the use of consumer).
- For the installations of voltage exceeding 250V, the consumer shall in addition to the aforementioned earthing arrangement, provide his own earthing system with an independent electrode. (Regulation 18) (Explanation: For Three phase services, an additional earthing system shall be made by the Consumer by an independent Earth electrode. The Earth Electrode resistance shall be 5 ohms or less and the actual measured value must be recorded in the Test report. The Main Earth Terminal (MET) provided near point of supply should be copper plate of minimum 32x3 mm size with provision of three 15 mm bolt and nuts. Neutral wire, Protective Earth (PE) conductor (GI bearer wire), tapped from the terminal pole shall be connected to the MET. Meter body, cut out body, grounding connection of exposed body of all accessories of the installation, earth wire connecting the third pin of all sockets in the installation shall be connected to the Protective Earth (PE) conductor through MET. The earth electrode erected in consumer installation shall also be connected to the MET. GI bearer wire acting as Protective Earth wire(PE) shall not be less than 7/20 SWG. The phase and neutral wire shall be carried by the GI bearer wire through reel insulators. In case of UG cable from pillar box, the armour or metallic sheath of the cable which serves as Protective Earth conductor (PE) shall be connected to the MET.

- **All single phase apparatus with which we make contacts by hand in our normal usage like mixer, grinder, iron box, water pumps, refrigerator, heater, iron box etc., must be connected only with the three pin sockets. Two pin sockets without earth connection will not protect us from electric shock.** The earth wire should be connected to third pin of all three pin sockets of entire installation and terminated in the Main Earth Terminal provided in the meter board/ point of commencement of supply.
- The body of the motor / compressor/ submersible motor and exposed parts of the various appliances such as refrigerator, motor starter, changeover switch, metallic service connection box particularly in agricultural services, GI pipes with concealed wiring, metallic heater body etc., that can be contacted by any part of human body must be grounded (Clause 5.5 of IS 3043:2018) and connected to the Protective Earth conductor through the Main Earth Terminal provided in the in the meter board / point of commencement of supply.

Thus the grounding of exposed parts of appliances enables double earthing i.e., through the Protective Earthing (PE) conductor of the network system earthing and through the consumer installation earthing.

- The service connection wires shall be in copper. It shall be of adequate size to carry the full load current of the installation. It should be taken from the aluminum Over Head conductor through PG (Poly Groove) clamp to avoid bimetallic effect.

Each Service connection shall be provided with aerial cut-out fuse in the tapping point of the pole / box, such that in case of any overload / faults / surge etc inside the consumer premises, the supply to the premises will be safely cut off. The short circuit fault in the meter / consumers installation blows the aerial cut out fuse first thereby averting fuse-blow in the LT side of feeding transformer and interrupting supply to other consumers unnecessarily. In case of UG cable the aerial carrier is substituted by the individual service connection fuses provided in the pillar box.

- Where bare conductors are used in a building, the owner of such conductor shall (a) ensure that they are inaccessible, (b) Provide switches in readily accessible position, for rendering them dead whenever necessary and (c) take such other safety measures as specified in the relevant Indian Standards. (Regulation 19)
- Before any conductor or apparatus is handled, adequate precautions shall be taken by earthing or other suitable means to discharge electrically such conductor or apparatus and any adjacent conductors or apparatus if there is danger there from and to prevent any conductor or apparatus from being accidentally or inadvertently electrically charged when persons are working thereon. (Regulation 21).

As per this regulation any demolition work or any work nearer / adjacent to live lines / live parts of the network must be carried out only after statutory permission and getting the electricity disconnected by the concerned designated authorities.

- No person shall work on any live line / apparatus and no person shall assist such person on such work unless he is designated in that behalf and takes safety precautions (Regulation 21(3))
- Flexible cables shall not be used for portable or transportable motors, generators, transformers, rectifiers, electric drills, electric sprayers, welding sets or any other portable or transportable apparatus unless they are heavily insulated for required voltage as per relevant Indian Standards (IS 694) and adequately protected from mechanical injury. (Regulation 23)
- Any work within the consumers' premises including additions, alterations, repairs and adjustments to the existing installation except such replacement of Lamps, fans, switches, domestic appliances of voltage not exceeding 250V shall be carried out only by an Electrical Contractor licensed in this behalf by the state Government and under the direct supervision of a person holding a certificate of competency and by a person holding a permit issued or recognized by the State Government. (Regulation 31)
- The Generators and solar plants of above 10kW installed in consumer installation must be inspected and approved by the electrical inspector before commissioning for capacities notified by the appropriate Government as per section 162 of the Act (Regulation 34). The Generator system should be provided with separate earthing arrangement as per IS 3043, as amended.

- Supply shall not be effected to a premises unless it is reasonably satisfied that such supply at the time of making the connection will not cause a leakage from that installation or apparatus of a magnitude detrimental to safety which shall be checked by measuring the Insulation Resistance as under (Regulation 35):
 - (1) All apparatuses shall have the IR Value as stipulated in the relevant IS.
 - (2) On application of following voltages the reading of minimum IR shall be as mentioned against each voltage level:

Voltage level of Installation/apparatus	Voltage to be applied between each live conductor and Earth for one minute	Minimum IR value required (not less than)
Not exceeding 650 Volts (For LT of both Single phase & Three Phase)	500V DC	1 Mega Ohm
Exceeding 650 Volts But not exceeding 33000 Volts (For HT)	2.5 kV DC	5 Mega Ohm

- New services / additional services / reconnection of services after a period of 6 months shall be tested and the test results must be recorded in the RTR to be submitted by the consumer. (Regulation 33)

Testing of installation and minimum IR values shall be as above.

- After inspection and testing of installation of consumer, if the IR of the installation is so low as to prevent safe use of electricity, the supplier may and if directed so to do by the Electrical Inspector shall discontinue the supply of electricity but only after giving to the consumer forty eight hours notice and shall not recommence supply until he or the Electrical Inspector is satisfied that the cause of leakage has been removed (Regulation 36)
- No person other than supplier shall interfere with service lines and apparatus placed by the supplier on the premises of the consumer. (Regulation 37)
- Multi-storeyed building more than 15 meters in height should be approved by Electrical inspector before commencement of supply or recommencement of supply after disconnected for a period of six months or more. (Regulation 38)
- It shall be ensured that the Horizontal, Vertical clearance to building and as stipulated in Regulation 62 and 63 are adequately met. In case of inadequate clearances, the consumer shall be served a caution notice, to get the lines deviated safely from the building through proper application and after payment of appropriate charges as per the sanction of competent authority. The consumers are equally responsible to voluntarily give application to get the lines deviated safely as stipulated in Regulation, on payment of said charges.

- The main isolating switch with fuse or a circuit breaker (MCB or MCCB) of the installation shall be placed as nearly as possible after the point of commencement of supply so as to be readily accessible and capable of being easily operated to completely isolate the supply to installation. (Regulation 37)
- Where the requisition for supply is for a multi-storeyed building, the applicant shall enclose the planning permission along with building plan approval with the application. The Licensee shall verify the height of the building from the planning permission / building plan approval enclosed by the applicant.

Physical measurement is not necessary. If the height of the multi-storeyed building is more than 15 metre as given in the planning permission / building plan approval, necessary approval from the Electrical Inspector in compliance with CEA (Measures relating to Safety and Electric Supply) Regulations, 2010 as amended, shall be furnished by the applicant. (Regulation 27 (11) (A) of the TNE Distribution Code and Regulation 38 of the CEA Safety Regulation, 2010)

- The main isolating switch with cut out or breaker of the installation shall be fixed in a conspicuous position not more than 1.7 meter above the ground so as to completely isolate the supply in case of emergency. (Regulation 38)
- Each switch board shall have a clear space of not less than a distance of one meter in front of it. (Regulation 39)

- Where any electric supply line for use at voltages not exceeding 650 V has been disconnected from a system for the purpose of addition, alteration or repair, such electric supply line shall not be reconnected to the system until the supplier or the owner has applied the test prescribed under regulation 35. (Regulation 42)
- Appropriate Insulation Tester shall be essentially made available in all Section offices of the supplier to be used to test the Insulation Resistance of the installation to ensure safety of installation before the Service connection is given.
- The Value of the IR value and the details of instrument (Make, Rating, Sl. No. of the instrument etc.) by which the measurement is made shall be recorded in the Test Report as a permanent record. The supplier shall maintain the record of Test results (Regulation 33).
- General terms to describe the status of IR such as 'Satisfactory' or 'OK' shall be avoided. Measured values of IR shall be recorded specifically.

Personal Protection (against Electric shock) and Installation Protection (against Earth Leakage / Fire)

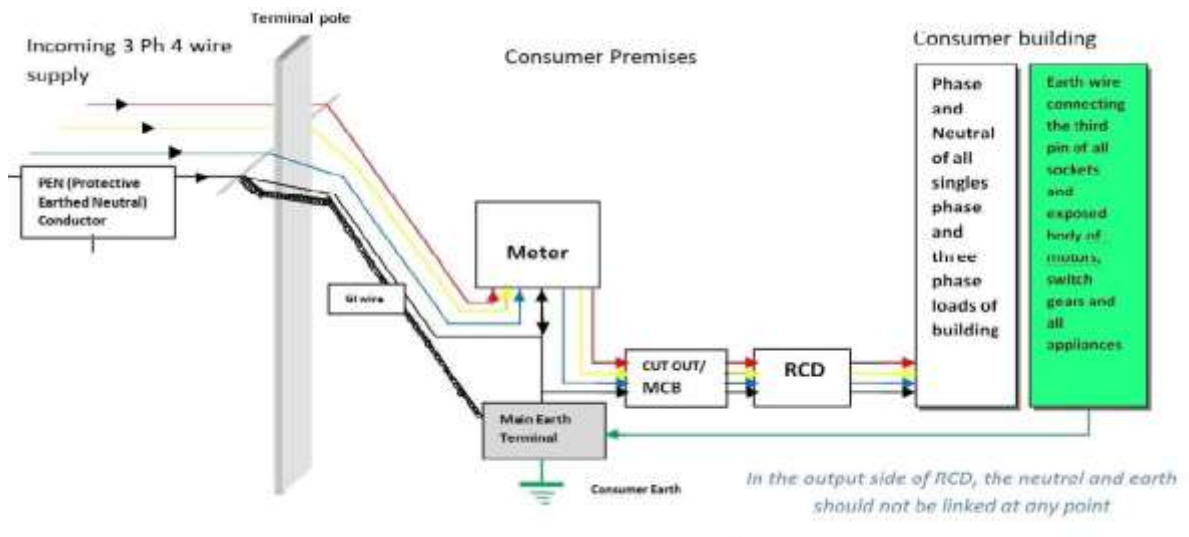
- The supply of Electricity to every installation shall be controlled by a **Residual Current Device** whose rated residual operating current shall not exceed 30 milliampere for protection against electric shock and one common RCD at point of commencement of supply with rated residual operating current of 300 milliamps for all installations

having load of more than 10 kW for protection against fire due to leakage current so as to disconnect the supply on the occurrence of earth fault or leakage of current. Service Connection shall not be given to installation without provision of RCD. (TNE Distribution Code Regulation 16 and 27 (11)(B))

- An installation, where there are large number of loads giving rise to a sum of permissible leakage currents exceeding 30 milliampere, shall be subdivided into circuits to avoid nuisance tripping and each sub-divided circuit shall be provided with independent RCD with leakage current sensitivity rating not exceeding 30 milliampere at appropriate locations.
- It is preferable for installations of higher loads say 10 kW or more to install one unit of 300mA RCBO as main control device on the main switch board for protection against electric fire and one unit of 30mA RCD for individual circuits of kitchen bathroom etc for personal protection against electric shock.
- IEC 60364-4-42 (sub clause 422.3.10) mandates installation of residual current device with sensitivity less than or equal to 300mA. The threshold current of 300mA is capable of creating the arc to set the temperature to trigger fire. RCD with 300mA of residual current rating trips before attaining this critical temperature.
- The supply system of TANGEDCO is TN-C. The protective earth (PE) and Neutral are combined in a TN-C system. As per Bureau of Indian Standards, this TN-C system is to be converted to TN-S system (Earth and Neutral separate) at the point of commencement of supply to consumer installation to install the RCD.

Dividing the PEN conductor of a TN-C system network in to separate PE and N conductor must be carried out before the RCD location. This division of PEN conductor in to separate PE and N conductor at consumer installation converts the TN-C system in to TN-C-S system in the consumer installation.

- This conversion is necessary to install the RCD and make it functional. The PE and N conductor after the RCD must not be reconnected/ looped anywhere in the installation.



- The protective earth wire should not be linked with the neutral at any point of wiring installation after the RCD location. If protective earth wire and neutral are linked after RCD location, the tripping of RCD would be affected defeating the purpose of RCD. Looping of earth wire at three pin plug point with neutral should not be done.

- The protective earth wire (bare GI wire of adequate size) of the Service Connection wire tapped at the terminal pole from PEN (Protective Earthed Neutral) conductor fed from the Distribution Transformer should not be taken to the RCD. It should be connected only to the MET (Main Earthing Terminal) provided in the meter board/ at the commencement of the supply.
- RCD can only be used to supplement to earth conductor (PE) and not to replace it (Section 24.4 of IS 3043:2018). It gives additional protection against electric shock. It is not a replacement of earthing of equipment.
- If solar net metering is installed at consumer's premises, the inverter shall be capable of automatic start / stop and synchronization with grid. One point of output circuit of PV system of voltage exceeding 50V DC shall be provided with a connection to earth, in addition to the normal system earthing. Protective earthing shall be made inside the inverter cabinet.
- The input circuits of combiner box shall be provided with over current protection. Earth fault protection for PV array and inverter shall be provided. Suitable lighting system shall be provided for the solar plant as per IS/IEC 62305-1/2/3/4-2010.

The inverter shall be provided with anti-islanding protection for the purpose of detecting islanding and stop supplying power if the grid is down. The inverter should be provided with disconnecting switch at DC input and circuit breaker and emergency stop switch at the AC output.

- No person shall be allowed to work in the solar power system unless he is designated and authorised under regulation 3(1) or appointed under regulation 6(1) or 7(1) and takes safety precautions.
- Luminous tube sign installations of voltage exceeding 650 Volts but not exceeding 33 kV should be got approved by the Electrical inspector before brought in to use. (Regulation 54)
- X Ray and high frequency installations should be got approved by the Electrical inspector before brought in to use. (Regulation 56)

General Safety precautions:

1. All new, additional, repair, replacement wiring shall be done with copper wires / cables of adequate size, ISI marked. Low cost / low quality wires, plugs, switches, serial bulbs, appliances, devices should not be used. Safety cannot be afforded for money.
2. Do not touch an electric switch / appliance when hands are wet.
3. Proper size and quality fuse wires only shall be used.
4. Do not replace fuse unless cause for blowing out is detected.
5. Do not hang wet clothes on wires tied with electrical fittings, poles, supports and antennas.
6. Use 3 pin plugs and ensure that third pin is connected to earth connection with adequate size of earth wire. In particular, electricity supply for Refrigerator, Wet grinder and other home appliances should be availed through 3 pin plug sockets with earthing provision
7. Switch off the supply before inserting and removing the plug socket outlets.
8. Replace damaged electrical components like switches, plug sockets etc., immediately when noticed or when heat smell is felt.

9. While installing the T.V. antennas: (a) Don't install them nearer to the OH electrical lines. (b) Don't tie the stay wires of T.V. antenna poles to the structures of electrical installations (eg. service poles, lamp fittings, service connection pipes etc.)
10. The outer conducting body of all electrical appliances like motors, refrigerators, heaters, electronic devices must be earthed.
11. Install switches, plug sockets etc., at an inaccessible height and away from the approach of children.
12. If any plug point is already installed at lower height in rented house and other places not owned by us, cover them with insulation tapes to protect playing children from access to electricity.
13. Periodically test the electrical installation through licensed electrical contractor for insulation strength and replace the defects if required.
14. Do not install switches inside bathrooms, toilets & other wet places.
15. Do not nail on the wall where concealed PVC conduit wiring are done.
16. Make sure that extension cords of portable/hand held appliances are free from cuts (breaks) improper insulation, patched-up insulation, kinks or joints. Don't use silk wires for such extensions.
17. Do not tie poultries, cows, and dogs, other domestic animals to the electric poles or the stay wires.
18. Do not use electric poles as support to pandas, shamiyanas, or displaying advertisement boards. Do not misuse electric poles to tie TV cable wires or data cables.
19. Do not go near or touch the transformers, pillar boxes, electrical poles, stay wires, fencing etc. Do not tie ropes between the poles of the transformer structure to display clothes of road side trades. Do not create road side / platform shops, sell things by keeping commodities beneath/ near the transformers.

20. If any snapped electricity conductor is noticed, don't touch or go near them. Caution others from touching it. Alert the electricity 24x7 control Centre by dialing **94987 94987**.
21. Do not construct buildings near the electricity lines, poles, Transformers and electric structures. Consult electricity supply officials before planning for such construction.
22. Do not construct building below the electricity lines.
23. Do not go near the fencing of electrical transformers/ earth pipes / structure yard on streets for nature's call.
24. Approach TANGEDCO officials to trim the tree branches touching the OH lines. Do not attempt to do on your own.
25. Make sure that there is easy access to switch off the main supply quickly in case of an emergency. Educate all inmates to be aware of the location of the main supply and urgency to rush and switch them off in case of any inmates suffering electric shock or accident.
26. Switch off electrical appliances when not in use. Switch off the main supply to TV, AC etc in addition to remote connection.
27. Do not use fire extinguisher on electrical equipment unless it is clearly marked for that purpose. Use sand and blanket instead. Never attempt to extinguish electrical fire with water.
28. In case of gas leaking smell is felt, don't operate any switch even in dark. It might ignite fire accident. Open all windows and doors.
29. In case of short circuit fault or a fire, switch off the Mains immediately before attempting to put out the fire.
30. Never over-load an electrical point either by individual loads or more loads by using multi pin points. While replacing electrical gadgets, replace with the same rating.
31. Do not over charge mobile, laptop and other charging devices. Do not charge them overnight. Do not keep them on bed or clothes while charging.

32. Do not use the mobile when it is being charged. Do not use the mobile in outdoors during lightning.
33. Do not charge the devices during raining / lightning.
34. Disconnect the modem, TV and electronic appliances from electric main, signal/ data cable during rain / lightning.
35. Do not use electrical appliances and phones during lightning or thunder.
36. If there is thunder or lightning, seek shelter immediately. (a) Move to a large sturdy building or to metal topped vehicle such as car or bus. Do not take shelter under trees or huts, tents, etc., at any cost. If no shelter is nearby, find a low spot away from trees, power lines and poles and metal fences.
37. Stay away from water or water logged areas during rain/ post rain.
38. Do not stand near open windows or doors during thunder or lightning.
39. Do not station Lorries underneath OH line. Do not operate Rig or lifting activities beneath the OH line. Do not carry out water curing by releasing water from hose pipes near OH line in construction sites. Do not carry long rods, flag post etc., near or beneath the OH line
40. Construct chamber with removable slab cover for earth electrode.

When RCD trips:

When RCD trips, the following procedure shall be followed in sequence:

- a. Switch off all switches including plug points.
- b. Keep the RCD closed.
- c. Switch on one by one.
- d. When RCD trips on closing a particular switch, the faulty appliances is detected.
- e. Isolate the faulty appliance.
- f. Reset the RCD
- g. Switch on remaining switches one by one.
- h. The faulty appliance must be rectified or replaced.
