

Safety Concerns in Temporary Electrical Installations

A. K. Sahani

Abstract-- Concerned with the frequent electrical accidents in temporary electrical installations, the safety aspect of these installations is addressed in this paper. Legal provisions related to such installations are discussed and suggestions are made to ensure safety in these installations for personnel and property.

Index Terms— Legal provisions, Safety, Temporary electrical installations.

I. INTRODUCTION

ELECTRICAL lighting, used by individuals at their houses on festive or ceremonial occasions for lighting and decorative purposes, at the pandals made during festivals such as *Durga puja*, *Ganesh puja*, *Laxmi puja*, etc. and for the music and dance programmes organized therein, at the hotels and marriage lawns/houses, at the exhibitions, touring shows, circuses, fairs, etc., for lighting and for sound systems on the carriages used in processions, at films and television sets, at pandals or buildings used for various purposes during the election process and at the places of public meetings of VIPs belong to the category of temporary electrical installations. Such installations are usually of outdoor nature, i.e., they are open to sky or partially covered. These installations are intended to be used for a temporary period not exceeding 6 months. Based on the duration of their existence, these are classified as [1] –

- 1) Duration not exceeding 6 months: These include installations erected in the vicinity of construction sites for supplying the electrical needs of building/public engineering construction works. Such installations need to be frequently modified. Also, the working condition at these sites causes frequent damage to these installations.
- 2) Duration not exceeding 45 days: Installations used to supply electricity to exhibitions, fairs and musical or dance shows, etc. belong to this category.
- 3) Duration not exceeding 7 days: These include installations for a week long public function or outdoor lighting installations of buildings for view of festive or ceremonial reasons.
- 4) Duration not exceeding 24 hours: Installations used to supply electricity to loads for purposes of marriages, reception, religious and other functions, public meeting of VIPs and in processions, etc. are in this category.

Temporary outdoor electrical installations are usually unprotected from environmental hazards. Also, as these installations are temporary ones, due safety precautions are usually not taken in these. Thus, major risks involved short circuit resulting in fire accidents and exposure to live wire resulting in electric shock. Occurrence of electrical accidents in these installations is very common. Accidents occurred in the installations meant for family or small gatherings are not reported. But those occurred in public gatherings attract wide publicity. An accident occurred in *Bhagwati jagran* programme organized at a *Durga puja* pandal in Gorakhpur district of Uttar Pradesh on October 2, 2011. Metallic pipes were used to support the pandal as well as the electrical wiring and accessories. Due to leakage of electricity, the metallic structure got charged. As a result, three people were electrocuted to death and more than hundred people were reported injured. In another incident, in Sant Kabirnagar district of Uttar Pradesh, two children were electrocuted at *Manyawar Kanshiram Sahari Garib Awas Yojana* colony, when they came into contact with an electrically charged metallic tree-guard. *Ganesh puja* was being celebrated there and electrical *jhalars* were spread over the tree-guards for decorative lighting. Due to contact of naked joint with the tree-guard, it became charged and the accident took place. Unfortunately, one of the children could not be saved.

In this paper an attempt has been made to find out the reasons of accidents in temporary electrical installations. Safety precautions need to be followed, to avoid such accidents, are also suggested.

II. LEGAL ASPECTS

Electricity Act, 2003 [2] and Indian Electricity Rules, 1956 [3] address the legal provisions regarding the temporary electrical installations. These are reviewed in this section. Rules quoted hereafter are Indian Electricity Rules, 1956.

Rule 29 provides that the lines and apparatus be of sufficient ratings for power, insulation and estimated fault current and of sufficient mechanical strength for the duty which they may be required to perform under the environmental conditions of installation and shall be constructed, installed, protected, worked and maintained in such a manner as to ensure safety of personnel and property. To carry out the purposes of this rule, relevant code of practice of the Indian Standards Institution, including National Electrical Code [1], is to be followed. Also, the material and apparatus used are to conform to the relevant specifications of the Indian Standards Institution where such specifications have already been laid down.

Rule 45 requires that no electrical installation work, including additions, alterations, repairs and adjustments to

existing installations, except such replacement of lamps, fans, fuses, switches, low voltage domestic appliances and fittings as in no way alters its capacity or character, shall be carried out upon the premises of or on behalf of any consumer, owner or occupier except 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 recognised by the State Government. If any electrical installation is carried out in contravention of this provision shall not be energised or connected to the works of any supplier.

As per the provision of section 54 [2], no person other than the Central Transmission Utility or State Transmission Utility, or licensee shall transmit or use electricity at a rate exceeding two hundred and fifty watts and one hundred volts in any street or in any place in which more than one hundred persons are ordinarily likely to be assembled, without giving, before the commencement of transmission or use of electricity, not less than seven days' notice in writing of his intention to the Electrical Inspector and to the District Magistrate, or the Commissioner of Police, as the case may be, containing particulars of the electrical installation and plant, if any, the nature and the purpose of supply and complying with such of the provisions of Part XVII of the Act, as may be applicable.

III. CAUSES OF UNSAFE ELECTRICAL INSTALLATIONS

Technical requirements for temporary electrical installations are same as those for permanent ones. But these installations are never constructed or worked properly. Causes for unsafe temporary electrical installations are as follows:

- 1) As these installations are of temporary nature, owner, contractor and worker, all do not bother about their durability, reliability and safety. In order to make the installation cost effective, at every level compromise is made with the technical specifications and safety aspect is completely ignored. Violating the rule 29, defective or lower grade materials, apparatus and appliances are used in such installations. For example, use of damaged pin insulators and small pieces of conductors joined together in overhead lines was seen during the *Ardhkumbh, 2007* at Allahabad, use of Chinese PVC cables with iron wires, use of materials, apparatus and appliances non-conforming the relevant IS specifications and use of wiring with lower current rating than the required one.
- 2) Violating the rule 45, these installations are often constructed and worked by unauthorised and unskilled personnel. They are neither able to properly understand the various requirements of the installation nor competent enough to properly coordinate between its different sections. They solely rely on their experience and their approach is not based on proper reasoning. Thus, chance of misjudgement is quite usual.
- 3) Earthing is backbone of safety in electrical installations. But as its absence does not interrupt the supply or functioning of appliances, it is totally ignored or is not done properly. It is always thought of as unnecessary burden by the contractor or the worker. Thus, basic requirement from the safety point of view is usually ignored.

- 4) Regarding temporary electrical installations, prior intimation to the Electrical Inspector is usually not given. This is done only by the other departments in order to avoid their responsibility. Thus, in former case Electrical Inspector is not of any help to get the defects rectified while in the latter one intimation is made at eleventh hour and usually there is no time for rectification of defects.

IV. SUGGESTIONS TO CONSTRUCT SAFE INSTALLATIONS

In order to make temporary electrical installations safe for personnel and property, suggestions are as follows:

- 1) All temporary electrical installations should be constructed and worked by the electrical contractor possessing the license issued by the state government. All the workers and supervisors should hold the certificate of competency regarding their duties.
- 2) Legal connection should be obtained from the supplier for these installations. Also, the supplier should deal harshly any attempt of theft of energy in such installations.
- 3) Owner of such installation should give prior intimation to the Electrical Inspector as well as to the district administration. The supplier should not energise such installation without a satisfactory report from the Electrical Inspector.
- 4) Insurance companies should not provide insurance cover to an event where temporary electrical installation is to be used unless the Electrical Inspector is satisfied with its safety.
- 5) Temporary electrical installations should not be constructed under or near the existing electrical installations or near the places where flammable or combustible materials are stored.
- 6) Power supply should be disconnected before working on such installations.
- 7) All the persons working on a temporary electrical installation should be equipped with tools and devices such as gloves, rubber shoes, safety belts, ladders, helmets, etc. for protecting them from mechanical and electrical injury.
- 8) First-aid box equipped with the contents specified by the State Government should be provided at the places of temporary electrical installations. Its availability should be known to all concerned.
- 9) Persons working on a temporary electrical installation should be acquainted with and should be competent to apply the instructions for restoration of persons suffering from the electric shock.
- 10) While working on such installations, a worker should not wear metallic articles such as watches, chains, bracelets, etc.
- 11) Once an installation is energized, no worker should be allowed to work alone on any part of the installation.
- 12) Materials, apparatus and appliances used should conform the relevant IS specifications.
- 13) Defective or rejected materials should not be used in such installations.
- 14) Flammable or combustible materials such as clothes, polythenes, foams, etc. should not be used in vicinity of heat generating lamps or appliances.

- 15) Sufficient number of suitable fire extinguishers and buckets filled with clean and dry sand should be kept for electrical fire fighting.
- 16) Cables used in these installations should preferably be fire resistant.
- 17) Cables must be protected from accidental damage from sharp corners and projections. Protection should be provided at passing them through doorways and other pinch points.
- 18) Hanging, spreading and tangling of wires and cables should be avoided.
- 19) To ensure protection from physical damage, overhead cables should be supported at suitable intervals and these should be adequately secured to the supports.
- 20) To prevent possibility of any inadvertent paralleling or feedback, changeover switches must be employed where double or multiple feed of electricity supply is to be used.
- 21) Metallic structures should not be used to support the wiring or to fix the appliances. It is a common practice to spread *jhalars* over metallic railings, tree-guards, etc. for decorative purposes. It should be avoided and if done so, the supporting structure should be effectively earthed.
- 22) Materials, apparatus and appliances used should be of sufficient and proper rating to avoid overloading.
- 23) All joints and connections should be properly made.
- 24) Open wiring with single aluminium strand of overhead line conductors or with iron wires, used in construction works, should not be used, especially at places of gathering and at approachable heights.
- 25) Proper means should be used for disconnecting automatically the faulty section of the installation. In addition, manually operated means should be provided to isolate the circuit concerned.
- 26) Load in any circuit, for light and fan, should not exceed 800 W and to control its supply MCB should be used at a suitable place in each such circuit.
- 27) All such installations, which attract the provisions of section 54 [2], should be protected by an earth leakage circuit breaker (ELCB) so as to disconnect the supply instantly of the occurrence of earth fault or leakage of current.
- 28) Suitable and effective earthing should be provided at all the required places and by all means earth resistance should be kept at minimum. It should not exceed 5 Ω . Also, all earth terminals should be visible.
- 29) No water or gas pipe should be used for earth connection.
- 30) Neutral conductor should not be treated as earth wire.
- 31) Joints in earth conductor should be avoided and if necessary the joints should be made in such a way so that its electrical conductivity does not change.
- 32) Grounding conductor of wiring system should be of copper or other corrosion-resistant material.
- 33) All metallic structures in temporary installations should be effectively earthed.
- 34) Receptacles used should be of grounding type and their grounding terminal should be properly grounded.
- 35) Public address system should be effectively earthed separately and to prevent any accidental charging its cables should not be tangled with power cables.
- 36) All plug sockets used should be of 3-pin type and the third pin should be effectively earthed.
- 37) Temporary electrical installations at construction sites are often abused severely thus these should be frequently inspected for any physical damage. Damaged circuits should be repaired or replaced immediately.
- 38) At construction sites armoured cables should be used and the armour should be effectively earthed.
- 39) At a construction site, to prevent the lights going out if the circuit opens due to a fault, lighting and receptacles should be kept on different circuits [4].
- 40) Welding cables should not be tangled with the power cables.
- 41) HT and LT cables should not be tangled.
- 42) A ground fault protection should be provided in these installations.
- 43) Insulation resistance of the electrical installation should be as required in relevant code of practice of Bureau of Indian Standards. Wherever these are not laid down, it should be kept at a minimum of 1 M Ω .
- 44) At places of gathering, cables should not be laid on the ground, these should be either underground or overhead. If used underground, they should be adequately protected by covering the same with bricks or tiles.
- 45) Joints in cables should be avoided and wherever necessary, connectors should be used for these. Fire resistant insulation tapes should be provided on naked joints and on naked parts of a cable with damaged insulation.
- 46) In such installations fluorescent tubes are usually used without fittings and starters. Two leads are brought out which are manually short-circuited to start the glow. Ends of tubes remain naked. These tubes should be used as complete fittings containing all the components.
- 47) Plug socket points should not be provided at ground level. Height of these points from the ground should not be less than 1.5 m.
- 48) Light fittings should not be fixed at a height less than 2.5 m.
- 49) Bulbs or lamps used for illumination should have cover or guard to protect them from accidental breakage.
- 50) A clear space of 90 cm should be maintained in front of distribution boards in order to have easy access during an emergency. Also, adequate working space should be provided around all electrical equipment which may need adjustment or examination during operation.
- 51) To prevent accidental contact of persons or animals with naked parts, all sub-stations should be efficiently protected by fencing not less than 1.8 m in height. If the fencing used is metallic, it should be effectively earthed.
- 52) Control of such electrical installations by unauthorized persons should be prevented. For this purpose, suitable fencing, barriers or other effective means should be provided.
- 53) These installations should not be left unattended. These should be continuously observed for any defect.

V. CONCLUSION

Safety aspect of temporary electrical installations is addressed in this paper. Mandatory legal provisions regarding these installations are discussed and suggestions are made to ensure

such installations safe for personnel and property. It is concluded that these installations can be constructed as safe as a permanent one by abiding with the legal provisions, following the technical specifications and taking due care in their construction and operation.

VI. REFERENCES

- [1] National Electrical Code, Bureau of Indian Standards, BIS Standard SP 30 : 1984.
- [2] The Electricity Act, 2003 (No. 36 of 2003).
- [3] The Indian Electricity Rules, 1956 (under section 37 of The Indian Electricity Act, 1910).
- [4] www.ecmweb.com