Fire in buildings due to electrical short circuit is common from the day of invention of electricity. Statistics shows approximately 40 % fires in buildings are due to electrical reason such as short circuit in low voltage system. Result of these accidents are known.

Electrical installation in industrial and commercial premises are physically inspected & statutory compliances are verified. Equipment layout, protective device sizing, conductor sizing etc are well taken care with the available knowledge. Periodic inspection of earth resistance, insulation resistance, hotspot measurement, load current measurement are carried out, but still the reason behind "fire due to electrical short circuit" is unknown.

General reasons such as panels are under stair case, electrical panels not in an accessible area, electrical room used for storage, rodents damaging cables, protective devices are bye passed…. etc are known from the past. Even under some of the above condition a reliable electrical installation shall not create fire.

Quality products and support from manufacturers about the use of electrical products are very well available now days. Even with good quality products, electrical system as a whole is the most neglected service in a building, often due to the reason that electrical installation is the last service designed and installed in a building. Some time cost saving and generally space saving is of prime importance.

Safety is achieved by automatic disconnection of power supply during a fault. Protective devices shall disconnect the supply as soon as possible (with in milli seconds to few seconds) when there is a fault. If this do not happen, fault becomes fire. One KG of plastic insulation material used in electrical system creates almost 500 cubic meters of thick toxic smoke.

For human safety and against fire, L.V electrical supply is categorized as TN-S, TN-C-S, TT, IT etc. In all these networks, safety is achieved by automatic disconnection of power supply, (except IT) but the way of achieving is different in each network. It's not a surprise to know that large number of electrical engineers either are not aware of these networks nor take care of this fundamental design criteria.

CEA safety regulation insists certain type of LV electricity supply for public low voltage electricity distribution, but several utilities don't follow it. As a result, protective device will not immediately disconnect the power supply resulting in "fire due to short circuit". Owners of damaged buildings will be in deep financial burden if insurance company find out this mistake and refuse to pay.

Standard such as IS 732, IS 3043 explains different ways of achieving safety. Fault loop impedance plays major role in automatic disconnection of power supply. Above Indian standards recommend measurement of fault loop impedance, but never followed in India due to lack of awareness.

Electrical safety consists of basic protection (direct contact) and fault protection (indirect contact). Recommended protective measures as per Indian standards for fault protection are

1. Extra low voltage
2. Use of Class II equipment or by equivalent insulation
3. A non-conducting location
4. Earth free local equipotential bonding
5. Electrical separation
6. Earthed equipotential bonding and automatic disconnection of supply.

Out of the above earthed equipotential bonding and automatic disconnection of supply is the commonly used protective measure. About 80 % of accidents are due to earth fault.

Fault current returning back to neutral of the source via the fault (or faulty device) is the fault loop. Fault loop impedance determines the amount of loop current, which decide the fault clearance time. IS 3043 and IS 732 provide information on fault loop calculation and protective device selection. As per IS 3043 in a TN network "the characteristics of protective devices and the cross sectional area of the conductor shall be so chosen that if a fault of negligible impedance occurs anywhere between phase conductor or exposed conductive part and protective conductor, automatic disconnection of the supply will occur within possible minimum time". Remember the fault clearance time for shock hazard in case of a 230 volt fault is 150 milli second in dry condition and 35 milli second in wet condition.

If protective devices disconnect the supply with in this time, large number of "Fire due to Short Circuits" can be eliminated. Unfortunately, this fundamental safety requirement is neglected all over India resulting in fire due to short circuit.

IS 3043 explains that the loop impedance need to be calculated or measured based with the formula provided. Further it explains "In general, every circuit is provided with a means of overcurrent protection. If the earth fault loop impedance is low enough to cause these devices to operate within the specified times (that is, sufficient current can flow to earth under fault conditions), such devices may be relied upon to give the requisite automatic disconnection of supply. If the earth fault loop impedance does not permit the overcurrent protective devices to give automatic disconnection of the supply under earth fault conditions, the first option is to reduce that impedance."

Above explanation in IS3043 has nothing do with a vertical pipe or plate in soil in a TN network which we are supposed to follow. Instead of confirming the above clause we measure the resistance of earth electrodes [such as pipes, rods, plates etc] in soil and do research in reducing its resistance. Unprofessional practices followed all over India such as connecting transformer neutral, body, equipment body, UPS, sensitive equipment etc to separate earth electrodes in soil is totally against the recommended safety concept "earthed equipotentialisation and automatic disconnection of supply".

IS3043 recommend TN-S system with PME for industrial and commercial application which is one of the safest networks. TN-S with PME is also called as double earthing (two distinct and separate earth fault return path), which is a method to reduce loop impedance, reduce fault voltage and create equipotentialisation. Its unfortunate that current installation in India do not confirm these requirements of the standard.

In UK for public LV electricity distribution, the utility is supposed to follow TN-C-S network. Utility also provide fault loop impedance of the distribution so that the consumer can decide the rating of protective device at the origin of installation.

Understanding the recommended safety measure "Earthed equipotentialisation and automatic disconnection of supply" and implementing in buildings will reduce "fire due to short circuit" to a great extend. Safety measures such as fire / smoke detection, automatic suppression, evacuation, etc will be of little use if this fundamental electrical safety requirement is not made mandatory in all buildings.■

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