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# Electrical Safety Audit of Central India Institute for Medical Science (CIIMS), Bajaj Nagar, Nagpur

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***Abstract*: "Safety first and always" should be the motto of every place i.e., buildings, industries & Utility. In long run, this approach helps indirectly in realizing tangible savings for the organization as it prevents accidents, which normally result in loss of man-hours, damage to equipment's and sometimes loss of life also. Safety of personnel and equipment is of paramount importance. The priorities are given below in the order:**

**a) Safety of personnel – Self, colleagues and public.**

**b) Safety of equipment.**

**c) Continuity and high quality of power supply.**

**Electricity constitutes one of the major sources of ignition for fire accidents and explosions. Over 20% of fire world wide and 40% fire in India are due to faulty electric circuits. Besides equipment damage and property loss, electrical hazards also include injuries and fatalities to personnel due to electric shock. Electricity having become an indispensable part of our life; electrical risks are to be managed effectively. Timely inspection and preventive maintenance of electrical equipment and its connected systems will go a long way in ensuring safer operations, for a longer period of time, of the electrical installations.**

***Keywords*: Electrical safety audit.**

## 1. Introduction

Hospitals have many patients admitted in critical condition. Many people who would have mobility issues and many would not even be alert in case of an emergency. Hence by ensuring Electrical Safety in hospitals, we can prevent Fire Accidents. Hospitals stack a lot of combustible materials like chemicals, Cylinders, Surgical Equipment, etc. And many hospitals also have an inbuilt Kitchen or Canteen. A Fire Accident may have a lot of casualties as the Fire may become uncontrollable in minutes. So, the hospital management should ensure that their buildings are Safe all the times from faulty electric circuits.

## 2. Objective

The main objective of Electrical Safety audit is to Study & check electrical Installation from Electrical safety point of view and identify/point out deficiencies & areas of improvement in the system. Which will help to reduce,

1) Electrical Fire accidents
2) Loss of Property
3) Loss of Life
4) To avoid emergencies
5) To reduce risk

## 3. Methodology

### *A. Approach & Methodology for Electrical Safety Audit*

*1) Kick off meeting*

Introductory meeting and discussions on approach and methodology with reference to the scope of work with Hospital Management & officers.

*2) Data collection for review of documentation/drawing /records*

List of required data/drawings were submitted to the concerned officers, for

- Various test reports for earth pits, transformer, motors and cables.
- Different drawings
- Statutory compliances
- Electricity bills
- Maintenance & failure records

*3) Standard data collection sheet for field study*

Standard data collection sheet was used as per applicable IS to be filled-in at site keeping in mind to collect the data related to the improvement in System from electrical safety point of view.

*4) Field study*

Visit was carried out to collect the system information as per standard inspection formats and observations on electrical installation to identify electrical hazards.

Verification of electrical Single Line Diagrams was carried out with reference to actual installation.

Inspection and review of protection devices/system of the electrical installation was carried.

*5) Measurements & Testing*

Measurement of different parameters like, Earth resistance, insulation resistance, Power Parameters, Lux Level, Testing of Voltage between Neutral and earth was carried out to evaluate electrical system.

*6) Data analysis & submission of report*

Review of documentation/drawing/records and analysis of collected data and measurements was carried out in comparison

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with standards and identification of areas for improvements was done. Recommendation for improvements was suggested for the same. Discussion of these observation & recommendations was carried out with management personnel and by incorporating inputs from them final report was submitted.


Fig. 1. Methodology

## 4. Details of Electrical System

Table 1
Specifications

| Description | Details |
|---|---|
| Supply Voltage KV | 11 |
| Transformer Rating KVA | 630 |
| **DG Set Rating** | |
| DG Set No.1 KVA | 250 |
| DG Set No.2 KVA | 160 |
| DG Set No.3 KVA | 140 |
| No. of Floors | Ground+4 Floor |

Table 2
Diesel generator specification

| Particulars | DG-1 | DG-2 | DG-3 |
|---|---|---|---|
| Make | Gimco | Cummins | Ashok Leylands |
| Frame No. | A6440 | NLE0324 | SK460 |
| Machine No. | NO8127650 | 4050324 | N15C123124 |
| KVA / KW | 250 KVA | 140 KVA | 160 KVA |
| Amps | 348A | 195A | 222.6A |
| Voltage | 415V | 415V | 415V |
| R.P.M. | 1500 | 1500 | 1500 |
| Frequency | 50HZ | 50HZ | 50HZ |
| Insulation Class | H | H | H |
| Power Factor | 0.8 | 0.8 | 0.8 |
| Phase | Three | Three | Three |

Table 3
Transformer specifications

| Parameter | Transformer No.1 |
|---|---|
| KVA | 630 |
| Volt's on load HV | 11000 |
| Volt's on load LV | 433 |
| Amps HV | 33 |
| Amps LV | 840 |
| Phase | 3 |
| Transformer No. | 14421 |
| Frequency Hz | 50 |
| Specification No. | 2026 |
| Year of Manufacture | 2008 |
| Impedance Voltage% | 5.08 |
| Vector Group | DYn11 |
| Cooling Type | ON AN |
| Oil in Liters | 750 |
| Total weight | 2430 Kg |
| Make | Ramkrishna Electrials Pvt.Limited |

## 5. Thermal Scanning

Thermal imaging is simply the process of converting infrared (IR) radiation (heat) into visible images that depict the spatial distribution of temperature differences in a scene viewed by a thermal camera.


Fig. 2. Sample thermal image-1

Observation: Temperature rise is alarming.
Recommendation: It should be checked and attended immediately.

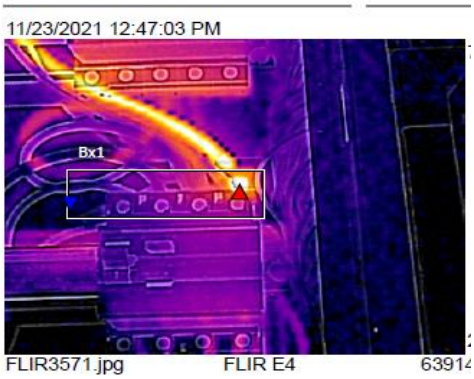


Fig. 3. Sample thermal image-2

Observation: Temperature is found very high.
Recommendation: It should be checked and attended at the earliest opportunity.

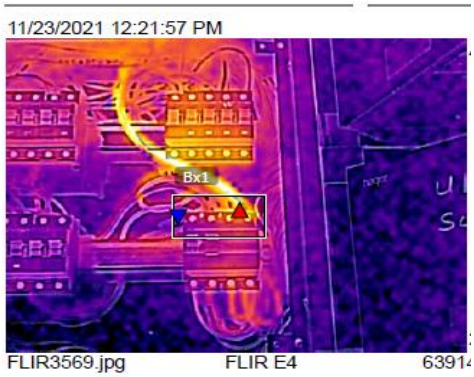


Fig. 4. Sample thermal image-3

Observation: Temperature is found high.
Recommendation: It should be checked during next scheduled maintenance activity.

Table 4
Electrical safety identifications, their causes/impact & recommendation

| Electrical safety Identifications/Observation | Causes / Impact | Recommendations | Priority for Corrections |
|---|---|---|---|
| Protection device like ELCB/RCCB at DB Incomer not provided | Absence of ELCB/RCCB will result into unsafe electrical installations as in case of earth leakage current, electrical circuits will not be isolated and may lead to fire/ accident. | ELCB / RCCB of appropriate rating & 30mA leakage current sensitivity should be provided. | High |
| Protection devices are found bypassed | In case of fault, circuit will not be isolated and may lead to fire/accident. | Provide proper protection devices | High |
| Brick Masonry with Top cover is not provided at some of the earth pits. | Earth pits are not maintained as per standard. | Brick Masonry with Top cover should be provided. | Medium |
| There is no interlocking between GOD/AB Switch handle & Outgoing ACB for transformer. | GOD /AB Switch can be operated on load, which may cause heavy sparking. | Electrical interlocking should be done with GOD /AB Switch handle & incomer VCB or Outgoing ACB, such that GOD/AB Switch will operate on no load only i.e., when circuit breaker is in off position. | Medium |
| Rubber mat not provided | May cause shock due to leakage current during operation | Rubber mat should be provided | High |
| CO2 fire extinguishers not provided | May create emergency in case of fire. | Provide CO2 fire extinguishers. | High |
| Proper lighting arrangement not provided. | It will increase downtime in case of emergency. | Proper lighting arrangement should be provided. | High |
| Firefighting bucket with dry sand not provided | May create emergency in case of fire. | Firefighting bucket with dry sand not provided | High |
| Transformer oil test for BDV and Acidity not carried out | To ensure that it is still fit for purpose | Transformer oil testing for BDV and Acidity should be carried out | Medium |
| Updated Electrical Single line diagrams is not available | It will increase downtime in case of emergency. | Updated Electrical Single line diagrams is not available | Medium |
| Testing of provided Relay/releases is not carried out | Faulty protection does not isolate the supply in case of fault. | Testing of provided protection Relay/releases should be carried out. | High |
| Labeling on the sub panel & DB's for the identification of circuits not provided. | May create confusion in case of problems & will increase downtime in case of emergency. | Proper labeling on the switchboard for the identification of circuits should be provided to avoid confusion in case of problems & to decrease downtime. | Medium |
| Cable glands/Flexible conduits glands for mechanical support to cables are not provided. | For mechanical support | Gland should be provided for mechanical support to cables/flexible conduit & to avoid strain on electrical connections. | Medium |
| Concealed type wiring is not provided. | Open wiring may cause external fire. | Provide Concealed type wiring | High |
| Overheating is observed | May cause fire | Terminal connections should be check and attended. | High |
| Stabilizer terminal cover is not provided | May cause shock | Proper cover should be provided | High |
| Cable tags are not provided | May create confusion in case of problems & will increase downtime in case of emergency. | Proper cable identification tags should be provided to avoid confusion in case of problems & to decrease downtime. | Medium |
| current harmonics distortion is there | Current harmonics cause unwanted current and overheating. | Electrical Switchgears & cables should not be loaded up to their rated capacity. They should be derated. | Medium |
| Current unbalance is there | It may cause extra heating | Load should be equally distributed in 3 phase equally as far as possible. | Medium |

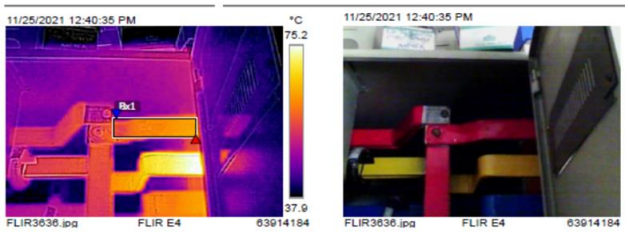

Fig. 5. Sample thermal image-4

Observation: Temperature is found ok.
Recommendation: Temperature should be monitored regularly.

## 6. Conclusion

Identified deficiencies are categories into low, medium and high-risk analysis. It is found that the installation is in medium risk.

## References

[1] CEA (measures relating to Safety and Electrical Supply) Regulations, 2010.
[2] IS 14489, Code of Practice of Occupational Health & Safety Audits.
[3] Good engineering practices followed in similar establishments.
[4] National Building Code, 2015.
[5] NFPA (applicable codes to Fire Safety).
[6] Various Indian Standard (BIS)-Electrical.