

Basic Approach of an Electrical Safety Assessment in RMG Industries: Development of Electrical Hazards

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Electrical assessment for safety is a recognized tool in the Occupational Health & Safety Management System Standards and in demonstrating due diligence to Occupational Health & Safety Regulations. By this system identifying potential electrical hazards to prevent or minimize the loss of life and property is perceived seriously. In this paper we have studied the requirements not only to reduce the risk of potential breakdowns and unplanned maintenance but also to bring further added value benefits in reducing repair costs, extending equipment life and improving operational efficiencies to follow a proper way of electrical safety audit. By focusing on a wider spectrum of inspection, testing methods and operational reviews in design of a power system is an assessment in safety and functional performances correctible and perfectible during its life cycle with risk and quality management. This paper provides the Electrical Safety Audit Process and considered several aspects of electrical audit system.

Keywords: Safety, Audit, Hazards, Electrical, Standards.

Field of Research: Electrical Engineering or Electrical Safety

1. Introduction

Electrical Safe Work Practices including electrical safety principles, guidelines for qualification of personnel, job planning requirements and Management and Personal Responsibility will be important for providing safety environment in work place (Doherty, M., CSA Z462-08 2011). Croft and Hartwell (1953) discussed about the electrical hazards which continue to threaten safety of people and property in the form of shocks, burns, injury, fire & explosion with electricity having become indispensable part of our life, electrical risks are to be managed effectively. This can be achieved by conducting electrical safety audit (ESA) of the installation. The performance of electrical assessment systems depends on, among other things, the type and quality of maintenance and the safe operation of the equipment. It is necessary to evaluate the quality of the maintenance and safety procedures utilized within the safe work practice program.

In past, people were not aware about electrical safety issues. They were not able to learn actual way to achieve proper knowledge regarding safety issues. Therefore that system had presented many critical electrical issues. Identifying potential electrical hazards to prevent or minimize loss of life and property is perceived seriously by many industries the world over. The development of electrical safety approaches are improved from previous condition (Doughty 1991). At present most industries trying to comply with safety standards start with NFPA 70 (Michael Fontaine, NFPA 70 2012) or

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comply with other standards (like as BNBC, NTPA, IEC etc.). Electrical safety assessment is more important to ensure electrical safety and development. The main objectives of this study for safety audit systems are, to establish identify of deviations from designed and planned functioning and maintenance procedures and standards. This system ensures that the plant and operating and maintenance procedures match the design intent and standards, Resolve component obsolescence as well as adequacy of safety inspections.

2. Benefits of Electrical Safety Assessments

A well-prepared and well-executed safety assessments program can make a substantial difference in helping companies prevent accidents and injuries. The main benefits (Prasad Bhukya 2014) of safety assessments are following below:

- Identify hidden failure modes and electrical safety risks - Loose connections, insulation breakdown, and excessive heat can all cause or be an indication of unexpected failures.
- Identify actions required to meet new performance targets or regulations.
- Provide documented evidence of inspection and maintenance for client confidence.
- Operational benefits that assist the management of industrial site improve the comfort, safety and productivity.

3. Electrical Safety Audit Methodology

The objectives of the assessment are accepted with detailed visual inspection of the installed electrical and automation equipment. At first detailed description of type of data is required for planning of audit (Internal OHS Methodology 2012). After analyzing the information by the audit team members, a schedule is prepared, post discussions with the factory management.



Figure 1: Methodology of Electrical Safety Assessment

Site study will be undertaken on mutual convenience and during the audit an attempt will be made by the auditors to identify the activities that can lead to major fires, explosions and toxic releases

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which will have both onsite and offsite consequences. After the site study a report is prepared and submitted. The total methodology of electrical assessment represent in figure.1.

Electricity hazard continue to threaten safety of people and property in the form of shocks, burns, injury, fire and explosion. With electricity having become an indispensable part of our life, electrical risks are to be managed effectively.

3.1 Audit Planning

The audit requires careful planning and diligent preparation. An audit program (Becker 2010) must have proper guidelines and procedures that describe how the audit should be conducted and what corrective actions should be taken. These procedures should define audit activities, such as planning the audit, on-site activities and follow-up.

3.2 Audit Opening Meetings

The Internal Auditor should, opening Meeting with senior management personnel to know about the electrical overview of the factory, operations system, status of Occupational Safety and Health, addressing the following agenda items:

1. Introduction the audit
2. Explanation of the audit process
3. Confirmation of the audit scope and duration
4. Review the collected data & design of the equipment
5. Expected closing meeting time & report format

3.3 Audit Scope

Defining scope of electrical safety audits based on specific requirement is the first step in the process of Electrical safety auditing. The audit scope presented completed with findings, defects report, analysis and recommendations. Typically Electrical safety audits scope of work could include:

- Visual check of generators, motors, transformers, switchboards, LT & HT panel and cables.
- Collection of data covering various management and technical elements of Occupational Safety and Health.
- General review of the operational process and likely benefits and enhancements Review of hazardous area classification and selection of flameproof electrical equipment in the plant, including maintenance aspects.
- To identify areas of overloading by carrying out load current measurements and compared against cable current carrying capacity calculation
- Assessing the integrity of insulation of cables by carrying out insulation resistance tests on a sample basis
- Recording of the equipment nameplate data, breaker and protection settings
- To identify training needs of the plant employees from the point of view of electrical safety.
- Hotspot detection using infra-red hot spot detection equipment/ thermal imaging.

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Hotspot could indicate (If necessary):

- High contact resistance
- Loose/tight connections
- Unequal loading
- Over loading

3.4 Audit Frequency

Determine a nominal risk classification (Roberts 2013), based on the known operational risks of the organization. Table 1 shows the classification of risk with take action necessary. The risk classification includes:

High Risk: Observations RED- Immediate correction required.

Medium Risk: Observations ORANGE - Monitor and take actions at earliest convenient.

Low Risk: Observations YELLOW- Monitor and take action as necessary.

Table 1: Classification of Risk

Risk Classification	Take Action Necessary
High Risk	Immediate
Medium Risk	6 Months
Low Risk	1 Year

3.5 Physical Inspection

Before conducting Electrical Safety Audit (ESA), auditor shall prepare to wear personal protective equipment (PPE) based on standards & code of practice. Good Engineering practice found during other electrical safety audits in similar installations can also be included in the checklist for identifying the hazards (Roberts 2014).

Identifying the Hazards

- List types of electrical hazards to personnel and describe the nature of the hazards related to:
- Electric shocks, arcs and blasts
- Fault current and potential difference
- Electrical safety in industrial plants
- List the characteristics of an arc flash hazard
- List the characteristics of an arc blast hazard
- Explain how other injury hazards are related to shock, flash, and blast

Personal Protective Equipment (PPE)

- List the basic types of personal protective equipment (PPE) for tasks involving electrical hazards.
- Describe how each type protects against hazards and identify the limitations of PPE.
- Explain the need for flame resistant (FR) clothing and layering of clothing for protection and list clothing prohibited where electrical hazards are present.

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- Select PPE for a given Hazard Risk Category including gloves, eye, head, face protection and (FR) clothing.
- Describe the requirements for use, care, maintenance and storage of PPE.

3.6 Document Review

Electrical safety assessments must have considered comprehensive document reviews of safety and industrial health exposures in a given area or complete factory. Electrical safety audit involves document review of:

- Detailed review of the drawings and documentation for the equipment
- Review of the importance given to electrical safety in the company safety policy, safety committee, continuous electrical risk identification, etc.
- Measurement of the insulation resistance for the generators, motors, transformers, switchboards, drives and cables.
- Review of the following test records, evaluating the test results and to suggest recommendations as per applicable standards
- Transformer oil tests.
- Insulation resistance tests
- Earth resistance tests

3.7 Audit Closing Meetings

In closing meeting of the Audit Team with the senior management personnel of the industry to discuss and brief about the audit findings and recommendations. Analysis of collected data through plant visits, inspection of the equipment, discussion with plant personnel.

3.8 Final Report Submission

The report should begin with an executive summary that provide owners/ manager of facility with brief synopsis of recommendations available and the highlights of each observation. The following format may be used in writing the report for the Safety Audit:

- Executive summary
- Introduction
- Detailed of the factory
- Methodology
- Observation, findings and recommendation

4. Specific Recommendation for Electrical Safety Audit

The following elements are recommended for an electrical safety program:

- Inspect/evaluate the electrical equipment for code compliance
- Maintain the electrical equipment's insulation, enclosure integrity and operational reliability: esp. breakers and fuses.
- Plan every job and document first time procedures

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- Educate management and supervision.
- Make all employees responsible for, and accountable for, safe behavior.
- De-energize whenever possible.
- Identify and minimize the hazard.
- Protect the worker from shock, arc and other hazards.
- Use the right tools and PPE for the job.
- Audit the principles of the applicable standards.

5. Conclusion

Electrical safety audit is an effective tool in identifying and perusing a comprehensive safety management program. A properly designed, planned and executed safety audit can bring out many hazards that could save life & property of the organization. An auditor is expected to help the auditee to identify the potential electrical hazards, to make the auditee understand the consequences and also to help them through the process of implementation of Electrical safety recommendations.

This study could be significantly useful for an RMG industry for minimizing essential energy cost and also raps several other benefits like improved production, better quality, higher profit and most important satisfaction of heading towards developing electrical hazards.

It is recommended always should be prioritized for high risk issues. The limitation of this approach which has people doesn't take it seriously to solve immediate risk issues. That's reason they were facing so many electrical hazards. Sothat While making recommendations, the standard on which it is based should be referred. Deficiencies and Recommendations: The observation of deficiencies should give specific cases with locations and details. The recommendations however do not seek to correct these specific instances only but suggest improvements in the system throughout the industry.

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