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# Facilitator Guidebook

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The qualification is aligned with **NSQF** and this guide supports the **Skill India** initiative and is dedicated to trainers committed to excellence in skill development. SSDF welcomes feedback for continuous improvement

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**About this Guidebook**

This guidebook presents a structured, holistic approach to training and capacity-building in electrical safety measures for switchgear and protective devices. It is tailored to equip trainers and trainees with a blend of theoretical concepts and practical skills necessary to assess, manage, and mitigate electrical risks in industrial and commercial environments.

The content aligns with the National Occupational Standards (NOS) and the National Skills Qualification Framework (NSQF), ensuring that learners are competent in risk management, safety compliance, and emergency preparedness specific to electrical systems.

Trainers utilizing this material should have prior experience in electrical engineering, industrial safety management, and protective device applications. The guide ensures that trainees can confidently handle electrical systems, respond to hazards, and comply with global safety benchmarks like OSHA, **NFPA 70E, IEC 60364, and IS/IEC 60947**.

**Key Learning Areas**

**1. Performance Criteria**

- Conducting safety inspections of electrical equipment
- Implementing Lockout/Tagout (LOTO) procedures
- Maintenance safety protocols for switchgear
- Proper use of insulating tools and personal protective equipment (PPE)

**2. Professional Skills**

- Decision-making in fault conditions
- Inspection and testing of circuit protection devices
- Safety audits and compliance evaluations
- Reporting and documentation of incidents and near misses

**Essential Topics Covered**

This guidebook includes critical areas of training and awareness-building:

1. **Electrical Risk Assessment**
2. Switchgear Classification and Operation Safety
3. Maintenance & Inspection Procedures
4. Lockout/Tagout (LOTO) and Permit Systems
5. PPE for Electrical Work
6. Arc Flash and Electrocution Prevention
7. Grounding and Bonding Practices
8. Fire Safety in Electrical Installations
9. Emergency Response and First Aid
10. Regulatory Standards and Global Codes (OSHA, NFPA, IEC, IS)

**Purpose and Impact**

By mastering the fundamentals outlined in this guide, trainers and professionals can:

- Cultivate a culture of electrical safety and risk prevention
- Reduce workplace injuries and equipment failures
- Ensure regulatory compliance and improved audit outcomes
- Promote operational excellence in switchgear management
- Encourage continuous learning and application of **safe electrical practices**

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Electrical Sign’s

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# 1. Module 1: Electrical Risk Assessment and Implementation of Safety Measures

## 1.1. Introduction

Electrical systems, including switchgear and protective devices, are crucial for power distribution but pose serious risks if not properly maintained. Faults like short circuits or insulation failures can cause shocks, fires, and equipment damage.

Systematic electrical risk assessments help identify hazards early by monitoring key parameters and enable the implementation of effective safety measures. These include both technical controls and safety procedures.

## 1.2. Key Learning Outcomes

By the end of this unit, learners will be able to:

- Identify faults or abnormalities in electrical systems and recognize associated hazards.
- Understand critical parameters for monitoring and measurement in electrical safety.
- Assess and secure an incident area to prevent further injury, including safely switching off power sources.
- Check victim responsiveness and perform appropriate first aid, such as placing an unconscious but breathing victim in the recovery position.
- Inform emergency response teams promptly and provide essential incident details, including shock type.
- Conduct hazard reviews and implement Corrective and Preventive Actions (CAPA) following electrical incidents.
- Revise and update electrical safety protocols based on investigation findings.

## 1.3. : Overview of the Industry

### 1.3.1. Unit Objectives

- Provide an introduction to the electrical switchgear and protective devices industry.
- Explain the importance of identifying electrical faults and hazards.
- Describe key parameters used in monitoring electrical systems for safety.
- Outline the process of managing electrical emergencies and post-incident reviews.

### 1.3.2. Resources to be Used

- PowerPoint presentations outlining the electrical industry landscape and safety principles.
- Real-life incident videos demonstrating faults, hazards, and emergency response.
- Safety standards documents (OSHA, IEC 60947, NFPA 70E).
- Case studies on electrical faults and corrective actions.
- First aid manuals related to electrical shock treatment.

### 1.3.3. Ask

- What types of faults or abnormalities have you seen in electrical systems?
- Can you identify potential hazards from these faults?
- What immediate actions should be taken if someone is shocked by electricity?

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- Why is it important to conduct a hazard review after an electrical incident?

### 1.3.4. Do

- Group brainstorming: List common faults and abnormalities in electrical switchgear (e.g., overheating, arcing, insulation failure).
- Watch a video showing a switchgear fault and emergency response steps.
- Role-play: Simulate securing an incident area after an electrical fault.

### 1.3.5. Explain

- **Electrical faults and abnormalities** can include short circuits, overloads, grounding faults, and insulation breakdowns. These faults pose risks like electric shock, arc flash, fire, and equipment damage.
- Monitoring parameters such as voltage, current, insulation resistance, and temperature are essential to detect early warning signs of faults.
- Immediate actions during electrical emergencies include isolating the power source safely, assessing victim condition, and calling emergency services.
- Providing clear information about the type of shock (high-voltage or low-voltage) helps responders prepare appropriate treatment.
- After an incident, conducting a **hazard review** identifies root causes and implements CAPA to prevent recurrence. This also involves updating safety protocols based on findings.

### 1.3.6. Tips

- Always use insulated tools and PPE when inspecting or working near electrical equipment.
- Never touch a victim who is still in contact with live electrical parts—first isolate power.
- Keep emergency numbers readily available and ensure all staff know how to report incidents.
- Document all incidents and corrective actions thoroughly.
- Promote regular training on electrical fault identification and emergency response.

### 1.3.7. Activity: Team Spot

- Divide participants into small groups.
- Each group lists 3 common electrical faults and 3 hazards they create.
- Groups then discuss appropriate immediate actions for each hazard, including securing the area and victim care.
- Present findings to the whole group.

### 1.3.8. Notes for Facilitation

- Encourage learners to share personal experiences or local incidents related to electrical faults.
- Reinforce the critical importance of safety protocols during emergencies.
- Use visuals and practical demonstrations to clarify technical concepts.
- Make sure all participants understand the sequence of emergency actions.

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### 1.3.9. Summary

- Electrical switchgear faults are common and dangerous if not promptly identified and managed.
- Monitoring key parameters helps prevent accidents by early detection of abnormal conditions.
- Securing the incident site, providing first aid, and informing emergency teams are critical steps during electrical emergencies.
- Post-incident reviews and CAPA improve workplace safety continuously.

### 1.3.10. Exercise

- **Question:** What is the first step to take when you identify a fault causing an electrical shock?
  a) Move the victim immediately
  b) Switch off the power source if safe to do so
  c) Call the emergency response team after checking the victim
  d) Touch the victim to check responsiveness
- **Answer:** b) Switch off the power source if safe to do so

## 1.4. Roles and Responsibilities of Electrical Risk Assessment and Implementation of Safety Measures

### 1.4.1. Unit Objectives

- Define the roles and responsibilities of personnel in electrical risk assessment and safety implementation.
- Understand the chain of command during an electrical emergency.
- Clarify responsibilities in securing the area, victim care, emergency notification, and CAPA.

### 1.4.2. Resources to be Used

- Role descriptions and safety responsibility charts.
- Emergency response procedure manuals.
- Incident reporting forms and CAPA templates.
- Group discussion guidelines.

### 1.4.3. Ask

- Who is responsible for switching off power sources during electrical emergencies?
- What roles are involved in providing first aid to an electrical shock victim?
- Who must be informed immediately after an electrical incident occurs?
- How is CAPA developed and who implements it?

### 1.4.4. Do

- Assign roles to participants: safety officer, supervisor, electrician, first aider, and emergency coordinator.
- Simulate an electrical shock incident and have participants act out their responsibilities.
- Review and critique the response for gaps and improvements.

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### 1.4.5. Explain

- **Safety Officer:** Oversees risk assessments, ensures compliance, organizes training, and leads post-incident CAPA implementation.
- **Supervisor:** Monitors site safety secures areas during incidents, and ensures workers follow safety procedures.
- **Electrician/Technician:** Identifies faults, assists in isolating power, and follows lockout/tagout procedures.
- **First Aider:** Checks victim responsiveness, administers first aid, including placing unconscious but breathing victims in recovery position.
- **Emergency Coordinator:** Contacts local emergency services immediately with detailed incident information, including shock type (high/low voltage).
- **All Personnel:** Report hazards and near misses, participate in safety reviews, and support CAPA actions.

### 1.4.6. Tips

- Regularly train all staff on their safety roles, especially emergency procedures.
- Maintain clear communication channels during emergencies.
- Document all actions taken during incidents to support investigations.
- Promote a culture where safety responsibilities are taken seriously by everyone.

### 1.4.7. Activity: Team Spot

- Teams develop a responsibility matrix assigning tasks during an electrical emergency.
- Discuss how these roles communicate and support each other to manage the incident effectively.
- Present their matrix and discuss possible improvements.

### 1.4.8. Notes for Facilitation

- Highlight that quick, coordinated responses save lives and reduce damage.
- Use examples of incidents where roles were unclear and the consequences.
- Encourage questions about specific roles and responsibilities relevant to your workplace.

### 1.4.9. Summary

- Electrical safety depends on clearly defined roles and responsibilities for risk assessment, emergency response, and CAPA.
- Every team member plays a vital role in preventing injuries and managing incidents.
- Effective communication and training are essential for smooth safety operations.

### 1.4.10. Exercise

- **True or False: Only the safety officer is responsible for reporting electrical incidents to emergency services.**
- **Answer:** False (All personnel should report hazards, but designated emergency coordinators usually contact emergency services.)

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# 2. Module 2: Electrical Systems and Workplace Safety Processes

## 2.1. Introduction

Electrical systems play a crucial role in modern industrial operations. Working with switchgear systems demands not only technical knowledge but also a strong emphasis on safety, hazard prevention, and emergency preparedness. This module focuses on the classification and functioning of switchgear, safety processes, device inspection, fire prevention, and regulatory compliance.

### 2.1.1. Key Learning Outcomes

After completing this module, learners will be able to:

- Classify LV, MV, and HV switchgear with examples.
- Identify key switchgear devices (MCCBs, ACBs, VCBs, relays, fuses) and their roles.
- Apply proper earthing/grounding techniques.
- Perform basic maintenance and inspection routines.
- Recognize emergency protocols during electrical failures.
- Follow relevant standards like IEC, IS, OSHA, and NFPA 70E.
- Use PPE and safety tools correctly.
- Explain how fuses, circuit breakers, and relays operate.

## 2.2. Unit : Identifying and Mitigating Workplace Hazards

### 2.2.1. Unit Objectives

- Recognize electrical hazards associated with switchgear and control panels.
- Identify fire, shock, arc flash, and grounding risks.
- Implement safe handling practices to mitigate risks.

### 2.2.2. Resources

- Whiteboard/Flipcharts
- Switchgear samples (LV, MV, HV)
- PPE samples (gloves, boots, arc suit, helmets)
- Safety signs
- Fire extinguisher demonstration kit
- IS/IEC standards documentation

### 2.2.3. Say

“Hazards are not always visible. An improperly grounded panel or a damaged relay can trigger severe accidents. It is important to identify and mitigate such risks beforehand.”

### 2.2.4. Explain

- **Common Hazards**: Short circuits, arc flash, improper PPE use, moisture exposure, poor insulation.
- **Causes**: Overloads, aged components, improper maintenance.
- **Mitigation Measures**:

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- Regular inspections
- Thermal imaging
- Lockout-Tagout (LOTO)
- Compliance with IS 8623/IEC 61439

### 2.2.5. Activity

Risk Mapping Drill:
Participants observe a mock-up switchgear panel setup and identify 5 hidden hazards. Discuss how each can be mitigated.

### 2.2.6. Notes for Facilitation

- Emphasize real examples: electric fire incidents, relay misfiring.
- Involve learners in identifying unsafe practices from case studies.

### 2.2.7. Summary

- Identifying hazards early prevents accidents.
- Electrical risks require preventive safety practices.
- Proper insulation, equipment layout, and labelling are essential.

### 2.2.8. Exercise

Q1: List three causes of arc flash in an MV switchgear.
Q2: Explain how grounding mitigates shock hazard.
Q3: Mark “True/False”: PPE is not necessary for inspecting a dry switchgear.

## 2.3. Safe Operation and Handling of Switchgear Equipment

### 2.3.1. Unit Objectives

- Demonstrate safe practices while operating switchgear.
- Understand the importance of PPE and grounding.
- Learn daily inspection and maintenance steps.

### 2.3.2. Resources

- PPE (Gloves, Goggles, Arc Flash Suit)
- Insulated Tools
- Checklist templates for inspection
- Switchgear Operation Manual
- Sample control panel
- Earthing demo kit

### 2.3.3. Say

“Even the best-designed switchgear can be deadly if handled improperly. Proper tools, PPE, and procedures are
you define.”

### 2.3.4. Explain

- Safe Operating Procedures:
  - Check visual indicators and panel health before switching.
  - Use appropriate PPE (based on voltage level).
  - Never bypass interlocks.
- Inspection Routines:

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- Check for dust, smell, discoloration.
- Verify torque on terminal connections.
- Ensure proper earth continuity.

### 2.3.5. Activity

**Hands-on Practice**:
Participants perform a pre-operation checklist on a switchgear panel mock-up and demonstrate energization with correct PPE.

### 2.3.6. Notes for Facilitation

- Stress on the use of insulating mats and dry flooring.
- Demonstrate fire extinguisher use and panel shutdown in emergencies.

### 2.3.7. Summary

- Safe operation requires attention to PPE, lockout, and voltage detection.
- Maintenance should follow standard schedules and checklists.

### 2.3.8. Exercise

**Q1**: Fill in the blank: Always use _____ shoes when entering an electrical switchgear room.
**Q2**: What is the function of the interlock mechanism in a VCB?
**Q3**: Name any two signs of internal heating in a panel.

## 2.4. : Emergency Preparedness and Response

### 2.4.1. Unit Objectives

- Recognize electrical emergencies and apply appropriate response.
- Understand fire prevention and suppression methods.
- Follow evacuation and reporting protocols.

### 2.4.2. Resources

- Mock emergency alert system
- Fire extinguishers (ABC type, CO2 type)
- First Aid Kit
- Emergency Response Chart
- Safety sign boards
- Emergency Evacuation Map

### 2.4.3. Say

“Emergencies are sudden, but your response should be trained and automatic. Knowing the right action can save lives.”

### 2.4.4. Explain

- **Emergency Scenarios**: Panel fire, electric shock, explosion due to overload.
- **Response Measures**:
  - Cut-off power via emergency switch.
  - Use $CO_2$ extinguisher for electrical fires.
  - Administer CPR for shock victims.
  - Report and record the incident per safety protocol.

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- **Fire Prevention**:
  - Thermographic inspections
  - Surge protection devices
  - Maintenance of relays and trip settings

### 2.4.5. Activity

**Mock Drill**:
Simulate a panel fire. Participants must perform isolation, extinguishing, and alerting procedures in a timed environment.

### 2.4.6. Notes for Facilitation

- Review IEC 60364, OSHA emergency protocols.
- Emphasize not using water on energized equipment.

### 2.4.7. Summary

- Preparedness reduces panic.
- Electrical fires need special extinguishers and isolation.
- Training, signage, and PPE kits must be accessible.

### 2.4.8. Exercise

Electrical Fire →

- **Q1**: Match the fire type to extinguisher:
  **Q2**: True/False: Water is effective against all types of fire.
  **Q3**: What should be your first step during a panel fire?