

Managing Physical Hazards

Lecture 5 : Electrical and Energy the Workplace Related Hazards

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**Undergraduate Diploma in
Occupational Health and Safety**

Lecture Overview

1. Focus on Electrical Hazards and Energy Risks

This lesson examines electrical hazards and hazardous energy risks that can cause serious injury or fatalities in the workplace. Topics include electric shock, arc flash, arc blast, stored energy, and unexpected equipment start-up. Learners will understand how these hazards occur, who is at risk, and why proper control measures are essential for maintaining a safe working environment.

2. Common Workplaces for Each Hazard

Electrical and energy hazards are present in construction sites, manufacturing plants, warehouses, workshops, and office buildings. Construction workers may face temporary wiring risks, while manufacturing employees work with high-voltage machinery. Warehouse staff use powered equipment, and office environments contain overloaded circuits and faulty cords. Recognising workplace-specific risks helps employees apply appropriate safety precautions.

3. Importance of Prevention and Compliance

Preventing electrical incidents requires proper training, regular equipment inspections, lockout/tagout procedures, and adherence to safety regulations. Compliance with workplace safety standards reduces accidents, legal liability, and operational downtime. Employers and employees share responsibility for maintaining safe systems of work. A proactive safety culture ensures hazards are identified early and controlled before injuries or damage occur.



Learning Objectives

- **Identify Electrical Hazards**

Learners will develop the ability to identify common electrical hazards such as exposed wiring, damaged insulation, overloaded circuits, faulty equipment, wet conditions near electrical sources, and improper use of extension leads. Recognizing warning signs early helps prevent electric shock, burns, arc flash incidents, and potential fires in the workplace.

- **Recognize High-Risk Environments**

Participants will understand which environments present increased electrical risk, including construction sites, manufacturing facilities, plant rooms, workshops, and areas exposed to moisture or flammable materials. High-risk tasks such as maintenance work, use of portable electrical tools, and working near live systems will also be highlighted to improve hazard awareness.

- **Understand Legal Duties**

This section explains employer and employee responsibilities under health and safety legislation. Employers must provide safe systems of work, maintain equipment, conduct risk assessments, and ensure proper training. Employees must follow procedures, report defects, and use equipment correctly. Understanding legal duties supports compliance and reduces the likelihood of incidents and penalties.

- **Appreciate Inspections and Certification**

Learners will understand the importance of routine inspections, testing, and electrical certification to ensure systems remain safe and compliant. Regular checks help identify faults before they become dangerous. Certification confirms that installations meet required standards, providing assurance that equipment and wiring are suitable, properly maintained, and safe for continued use.



Why Electrical Hazards Matters

- Leading Cause of Workplace Injuries

Electrical hazards remain a significant cause of serious workplace injuries and fatalities across industries.. Globally around 5–6% of workplace fatalities are linked to electricity, with construction and maintenance roles most affected. Many incidents involve contact with overhead lines, faulty equipment, or unexpected energisation.

- Often Invisible Hazards

Electrical dangers are frequently unseen, making them especially hazardous. Unlike mechanical risks, electricity cannot be detected without proper testing or controls. Workers may unknowingly encounter live wires, stored energy, or faulty insulation. Studies show that over 70% of electrical fatalities occur in non-electrical occupations, highlighting how hidden risks can affect anyone in the workplace.

- Potential for Severe Consequences

Electrical incidents often result in severe or life-threatening outcomes. Injuries may include electric shock, burns, cardiac arrest, or falls following contact. Around 10% of severe electrical injuries involve cardiac arrest, and arc flash incidents can cause long hospital stays. Even non-fatal shocks may lead to permanent disability, making prevention critical in all workplaces.



Types of Electrical Hazards (1/5)

1. Electric Shock

Electric shock occurs when a person comes into contact with live electrical components, allowing current to pass through the body. The severity depends on factors such as voltage level, current flow, duration of contact, and the path electricity takes through the body. Even low-voltage systems can cause serious harm in wet or confined environments where resistance is reduced. Effects may include muscle contractions, loss of control, respiratory paralysis, severe burns, or cardiac arrest. In workplaces, shocks often result from exposed wiring, damaged insulation, or unsafe work practices. Preventing electric shock requires proper insulation, lockout procedures, residual current protection, and regular equipment inspection to ensure that workers are not exposed to live electrical parts during normal operation or maintenance.

2. Arc Flash

An arc flash is a sudden and intense release of electrical energy caused by a fault between conductors or between a conductor and ground. It produces extremely high temperatures, potentially exceeding 20,000°C, along with intense light and heat radiation. These conditions can instantly cause severe burns, ignite clothing, and damage eyesight. Arc flashes typically occur during equipment faults, poor maintenance, or accidental contact with live components. Workers performing switching operations or maintenance are at higher risk. The rapid heat can vaporise metal, creating a fireball and molten droplets. Prevention includes proper risk assessments, use of arc-rated personal protective equipment (PPE), maintaining safe approach distances, and ensuring electrical systems are properly maintained and isolated before work begins.



Types of Electrical Hazards (2/5)

3. Arc Blast

An arc blast often accompanies an arc flash and involves a powerful pressure wave created by the rapid expansion of air and vaporised metal. This explosion-like force can throw workers across a room, cause serious blunt-force injuries, and damage hearing due to the intense noise. The blast may also propel molten metal, tools, or equipment fragments at high speeds, increasing the risk of secondary injuries. Arc blasts are particularly dangerous in enclosed spaces where pressure cannot dissipate easily. Injuries may include fractures, head trauma, lung damage, and long-term hearing loss. Preventive measures include maintaining safe distances, using proper barriers, ensuring equipment is de-energised before work, and following safe switching and maintenance procedures.

4. Electrical Burns

Electrical burns can result from direct contact with live electrical parts, arc flashes, or overheated electrical equipment. Unlike typical thermal burns, electrical burns often cause deep internal tissue damage while appearing minor on the surface. This makes them particularly dangerous and difficult to assess immediately. Internal damage may affect muscles, nerves, and organs along the path of the electrical current. In severe cases, electrical burns can lead to permanent disability or amputation. Workers may also suffer secondary burns from ignited clothing or nearby hot surfaces. Preventing electrical burns requires proper insulation, use of appropriate PPE, safe isolation procedures, and ensuring that equipment is properly maintained and protected from overheating or electrical faults.



Types of Electrical Hazards (3/5)

5. Fire and Explosion Hazards

Electrical systems are a common source of workplace fires and explosions. Faults such as short circuits, overloaded circuits, poor connections, and damaged wiring can generate excessive heat or sparks. In environments containing flammable gases, vapours, or combustible dust, even a small spark can trigger a major explosion. Electrical fires can spread rapidly through cable systems or building materials, causing significant damage and endangering lives. Poor maintenance, improper installation, and unauthorised modifications increase these risks. Preventive measures include proper circuit protection, use of explosion-rated equipment in hazardous areas, regular inspections, and ensuring electrical installations meet recognised safety standards and are not subjected to excessive load or environmental stress.

6. Overloaded Circuits

Overloaded circuits occur when electrical demand exceeds the circuit's design capacity. This often happens when too many devices are connected to a single outlet or when high-powered equipment is used on unsuitable wiring. Overloading causes overheating, which can degrade insulation and increase the likelihood of short circuits and fires. Warning signs include warm sockets, tripping breakers, or flickering lights. In workplaces, temporary setups and extension leads are common sources of overload. Continued overloading can permanently damage equipment and create hidden fire hazards. Preventive actions include proper load planning, using correctly rated circuits, avoiding daisy-chaining extension leads, and ensuring electrical systems are designed and installed to handle expected operational loads safely.



Types of Electrical Hazards (4/5)

7. Faulty or Damaged Equipment

Faulty or damaged electrical equipment is a major cause of workplace electrical incidents. Problems such as frayed cables, cracked insulation, loose connections, exposed conductors, or damaged plugs can create shock and fire hazards. Portable tools and extension leads are especially vulnerable due to frequent movement and wear. Using defective equipment increases the risk of electric shock, overheating, and sudden failure during operation. Employees may overlook minor damage, not realising the danger it poses. Preventive measures include regular visual inspections, formal testing programs, removing damaged equipment from service immediately, and ensuring only qualified personnel perform repairs. Proper storage and handling also help reduce wear and extend equipment safety and lifespan.

8. Improper Grounding (Earthing)

Improper grounding occurs when electrical systems are not correctly connected to earth, preventing safe dissipation of fault currents. Without effective earthing, exposed metal parts can become energised, increasing the risk of electric shock. Faulty grounding may also prevent protective devices like circuit breakers from operating correctly. This hazard is often linked to poor installation, ageing infrastructure, or unauthorised modifications. Workers may be exposed without realising the system is unsafe. Proper grounding ensures excess electrical energy is safely diverted into the earth, reducing danger during faults. Regular inspections, certified installation practices, and compliance with electrical standards are essential to ensure grounding systems remain effective and reliable.



Types of Electrical Hazards (5/5)

9. Wet Conditions and Electricity

Water significantly increases the conductivity of electrical current, making shocks more likely and more severe. Wet environments reduce the body's natural resistance, allowing electricity to pass more easily through tissues. This makes tasks involving outdoor work, cleaning operations, or damp locations particularly hazardous. Even low-voltage equipment can become dangerous in wet conditions. Water can also damage insulation, leading to hidden faults or short circuits. Slips and falls combined with electrical hazards further increase injury risk. Preventive measures include using weatherproof equipment, residual current devices (RCDs), keeping electrical tools dry, and avoiding use of electrical equipment in wet areas unless specifically designed for such environments.

10. Stored Electrical Energy

Stored electrical energy remains present in components such as capacitors, batteries, and some electronic systems even after power is switched off. This hidden energy can be unexpectedly released during maintenance or dismantling, causing shock, burns, or arc flash incidents. Workers may assume equipment is safe once isolated, not realising residual energy is still present. Large industrial systems and renewable energy installations can store significant charge. Proper discharge procedures and verification testing are essential before work begins. Lockout/tagout systems, clear labelling, and trained personnel help control this risk. Understanding stored energy hazards is critical for safe maintenance and preventing unexpected energisation incidents.



Energy Beyond Electricity

Stored Mechanical Energy

Stored mechanical energy is energy held in objects due to their position or configuration, such as in springs, flywheels, or stretched elastic bands. It can be converted into motion or work, enabling mechanical systems to operate efficiently without immediate electrical input.

Thermal Energy

Thermal energy is the internal energy of a system caused by particle motion, producing heat. It can be harnessed for heating, engines, or industrial processes. Temperature differences drive energy transfer, enabling applications like steam turbines or heat exchangers.

Pressurised Systems

Pressurised systems store energy in fluids or gases under pressure, such as hydraulic or pneumatic systems. Releasing this pressure performs work, powering machinery, brakes, or actuators. Controlling pressure allows efficient energy transfer without relying solely on electrical sources.

Chemical Energy

Chemical energy is stored in molecular bonds and released during reactions, like combustion or metabolism. It powers vehicles, batteries, fuels, and industrial processes. Controlled reactions convert chemical potential into heat, motion, or electricity for practical applications.



Hidden Electrical Risks (1/2)

Damaged Insulation

Insulation protects wires from contact with other conductors and humans. Damage due to abrasion, heat, moisture, or rodents can expose live wires, increasing the risk of electric shock, short circuits, and fires. Regular inspection is crucial to detect wear and prevent hazards.

Improper Repairs

Electrical systems repaired without following proper standards can leave loose connections, exposed wires, or non-compliant components. Do it yourself (DIY) fixes or unlicensed work increase the likelihood of malfunctions, arcing, or unexpected short circuits, creating serious safety risks. Professional maintenance ensures reliability and safety.



Hidden Electrical Risks (2/2)

Exposed Conductors

Exposed wires, terminals, or connectors present a direct shock hazard. They can occur due to missing covers, broken insulation, or corrosion. Contact with live conductors can cause severe injury, burns, or fatal electrocution. Protective enclosures and safety barriers are essential.

Aging Infrastructure

Older electrical systems may use outdated materials, degraded insulation, or worn-out components. Over time, corrosion, loose connections, and outdated circuit protection increase the likelihood of short circuits, overloads, and fires. Upgrading and regular inspection mitigate risks associated with aging systems.



Temporary Electrical Installations

Temporary Electrical Installations - These are electrical systems set up for short-term use, often at construction sites, events, exhibitions, or outdoor works. They include portable generators, extension cords, temporary lighting, and distribution boards. While convenient, they carry higher risks than permanent installations.

Common Hazards:

Overloading - Temporary circuits may not handle the connected load, causing overheating, tripped breakers, or fires.

Exposed Wiring - Cables and connectors may be left exposed to weather, foot traffic, or machinery, increasing the risk of shock or damage.

Improper Earthing - Temporary setups often neglect grounding, which can lead to electric shock if a fault occurs.

Moisture and Weather Exposure - Outdoor temporary installations are vulnerable to rain, puddles, or humidity, creating electrocution hazards if equipment isn't rated for wet conditions.

Unauthorised or Unskilled Setup - Non-professionals may install equipment incorrectly, causing loose connections, exposed conductors, or unsafe repairs.

Trip and Mechanical Hazards - Cables running across walkways can cause trips, falls, or mechanical damage to the wires, increasing shock or fire risk.



Legislation (REWS SL 545.24)

In Malta, electrical installation safety is regulated under the **Electrical Installations Regulations (Subsidiary Legislation 545.24)**, issued under the **Regulator for Energy and Water Services Act (Chapter 545 of the Laws of Malta)** and enforced by the Regulator for Energy and Water Services (REWS). This law requires that all new electrical installations, extensions, or significant alterations to existing systems be inspected, tested, and certified by a licensed electrician before being connected to the national electricity grid. The electrician must issue an Electrical Installation Report (EIR) confirming that the wiring, earthing, bonding, circuit protection, and overall installation comply with established safety standards and technical regulations. The legislation aims to prevent electric shock, fire hazards, and damage to property by ensuring installations meet approved safety criteria. Electricity supply cannot legally be provided unless the required certification is submitted to REWS and accepted. Non-compliance may result in refusal of connection, administrative penalties, or legal liability in the event of accidents or damage caused by unsafe electrical installations



Construction Sector – Electrical Hazards

The construction sector is particularly prone to electrical hazards due to the temporary nature of installations, frequent use of portable tools, and exposure to varying environmental conditions. Workers often operate near live wires, power tools, generators, and temporary lighting systems. Key hazards include **contact with live conductors**, **damaged insulation**, **overloaded circuits**, **improper earthing**, and **exposed extension cords**. Wet conditions, dust, and high foot traffic further increase the risk of **electric shocks**, **burns**, and **arc flashes**.

Temporary installations, such as portable distribution boards or generators, are especially risky if set up by untrained personnel. Older or poorly maintained equipment can fail under heavy loads, causing short circuits and fires. Improper grounding or lack of protective devices like RCDs (Residual Current Devices) significantly increases the likelihood of fatal electrocution.



Construction Sector – Electrical Hazards

Scenario with Controls:

At a construction site, a worker was using a handheld grinder connected to a temporary extension cord. The cord had damaged insulation and lay on a wet surface. Without protective measures, the worker received an electric shock.

Control Measures Implemented:

- The extension cord was immediately replaced with one rated for wet conditions.
- A Residual Current Device (RCD) was installed to cut off power in case of faults.
- Workers were trained on safe handling of temporary electrical equipment.
- All cords and tools were regularly inspected for damage before use.
- These measures prevented further incidents and ensured safe operation of temporary electrical systems.



Maintenance Activities – Electrical Hazards

Electrical Hazards in Maintenance Activities

Maintenance work on electrical systems is inherently risky because it often involves interacting with live equipment, aged infrastructure, or temporary setups. Common hazards include **electric shock**, **arc flash**, **short circuits**, and **equipment malfunctions**. Workers may encounter damaged insulation, exposed conductors, overloaded circuits, or improper earthing while repairing or servicing machines, lighting, or control panels. Confined spaces, wet surfaces, and inadequate lighting further increase the risk of accidents.



Maintenance Activities – Electrical Hazards

Scenario with Control Measures:

In a manufacturing facility, a maintenance technician was tasked with repairing a motor on a production line. The motor's electrical panel had worn insulation and no lockout/tagout procedure in place. While testing the motor, the technician received an electric shock.

Control Measures Implemented:

- A strict **Lockout/Tagout (LOTO)** procedure was enforced to isolate the equipment before maintenance.
- The damaged wiring was repaired by a qualified electrician.
- The technician wore appropriate **PPE**, including insulated gloves and boots.
- All electrical panels underwent regular inspections and preventive maintenance schedules were established.
- Staff were trained in hazard identification and emergency response.



Manufacturing Sector – Electrical Hazards

The manufacturing industry heavily relies on electrically powered machinery, automated systems, conveyors, and control panels, making electrical hazards a major safety concern. Workers are frequently exposed to high-voltage equipment, moving machinery, and complex wiring systems, increasing the likelihood of accidents. Common hazards include electric shock from contact with live wires or poorly insulated machinery, arc flashes or blasts caused by short circuits or equipment faults, overloaded circuits that overheat wires and can trigger fires, exposed conductors or damaged insulation, improper grounding, and faulty maintenance practices performed by untrained personnel. Risk factors are further exacerbated by wet floors, dust, oil spills, confined spaces, high operational loads, and temporary or outdated electrical installations.

Control measures include regular equipment inspections, preventive maintenance, the use of personal protective equipment such as insulated gloves and mats, Lockout/Tagout (LOTO) procedures during maintenance, and comprehensive staff training on electrical hazards and emergency response. For example, in a steel manufacturing plant, a maintenance worker attempting to repair a motor without isolating the power supply suffered an electric shock due to damaged insulation on a high-voltage line. Following the incident, the plant implemented strict LOTO procedures, mandatory PPE use, and scheduled inspections of all electrical equipment, significantly improving workplace safety.



Manufacturing Sector – Electrical Hazards

Manufacturing Workplace Scenario

In a plastic manufacturing plant, a technician was assigned to repair a conveyor motor. The motor's electrical panel had exposed conductors and partially damaged insulation. The technician began work without isolating the power supply or using insulated tools. While attempting to remove a faulty connection, the technician received an electric shock, causing a severe hand injury. Investigation revealed that no Lockout/Tagout (LOTO) procedure was followed, and the worker had not been provided with proper personal protective equipment (PPE).

Control Measures Implemented:

Lockout/Tagout (LOTO): All electrical panels and machinery were isolated before maintenance, preventing accidental energisation.

Personal Protective Equipment (PPE): Insulated gloves, mats, and safety footwear were made mandatory for all maintenance personnel.

Regular Inspections: All electrical equipment, wiring, and insulation were inspected for damage, with repairs completed by qualified electricians.

Training: Staff were trained on hazard identification, safe handling of electrical equipment, and emergency response.

Signage and Barriers: Warning signs and barriers were installed around high-voltage machinery to prevent unauthorized access during maintenance.



Health Care Sector – Electrical Hazards

Hospitals are high-risk environments for electrical hazards due to the extensive use of medical equipment, life-support systems, imaging machines, and electronic monitoring devices that operate continuously. Electrical hazards in hospitals can arise from **faulty wiring, damaged insulation**, overloaded circuits, exposed conductors, and improper grounding. The constant presence of **water or fluids**, especially in patient care areas, laboratories, and operating rooms, increases the likelihood of electric shock or short circuits. Portable devices, such as infusion pumps, ventilators, and diagnostic machines, often rely on extension cords or temporary power sources, which, if mismanaged, can create trip hazards or accidental contact with live parts.

Other contributing factors include outdated infrastructure, improper maintenance practices, and untrained staff handling electrical devices without proper precautions. Hazards can result in **electric shock, burns, fires, or interruption of critical medical services**, posing serious risks to patients and healthcare personnel. Preventive measures include regular inspection and testing of electrical systems, proper grounding of medical equipment, use of Residual Current Devices (RCDs), enforcing strict maintenance protocols, staff training in electrical safety, and ensuring that all temporary or portable devices are used according to manufacturer guidelines. Hospitals must implement these measures rigorously to protect both patients and staff from potentially life-threatening incidents.



Health Care Sector – Electrical Hazards

Scenario:

In a busy hospital ICU, a nurse was preparing a ventilator for a patient when the device suddenly sparked due to a damaged power cord. The nurse received a mild electric shock and the ventilator shut down temporarily, risking the patient's critical care. Investigation revealed that the equipment had not been inspected recently, and the damaged cord went unnoticed.

Control Measures Implemented:

- **Regular Equipment Inspections:** All medical devices underwent scheduled inspections and preventive maintenance to identify damaged cords, worn plugs, and faulty components.
- **Use of Residual Current Devices (RCDs):** RCDs were installed to immediately cut off power in case of faults, preventing shocks.
- **Staff Training:** Nurses and technicians received training on identifying electrical hazards, proper handling of medical devices, and reporting damaged equipment.
- **Proper Labelling and Reporting:** Any device showing wear or faults was immediately tagged out of service until repaired by qualified personnel.
- **Replacement of Damaged Cords and Equipment:** Faulty power cords were replaced promptly, and critical devices were backed up with secondary power sources to avoid interruptions in patient care.
- These measures minimized electrical hazards, ensuring both patient safety and staff protection.



Hospitality Sector – Electrical Hazards

The hospitality sector, including hotels, restaurants, and event venues, relies heavily on electrical systems to power lighting, kitchen appliances, heating and cooling systems, entertainment equipment, and point-of-sale devices, making electrical hazards a significant safety concern. Common hazards include **damaged wiring, exposed conductors, overloaded circuits, faulty appliances, and improper grounding**, which can lead to electric shocks, burns, or fires. The frequent presence of water in kitchens, bathrooms, and laundry areas increases the risk of electrocution and short circuits. Portable equipment such as coffee machines, blenders, kettles, and temporary lighting for events can create additional risks if cords are frayed, improperly routed, or used with unsuitable outlets. Other factors include aging infrastructure, lack of regular maintenance, and untrained staff handling electrical devices without adequate precautions. Hazards can result in serious injury to staff or guests, property damage, and operational disruptions. Preventive measures include regular inspection and maintenance of all electrical systems, proper grounding of appliances, installation of Residual Current Devices (RCDs), staff training in electrical safety, safe routing of cords, and immediate repair or replacement of damaged equipment. Implementing these measures is critical to maintaining a safe environment in hospitality settings



Hospitality Sector – Electrical Hazards

Scenario:

In a hotel kitchen, a chef was using an industrial blender when the appliance sparked due to a damaged power cord that had frayed insulation. The chef received a minor electric shock, and the blender stopped working. Investigation revealed that the cord had not been inspected during routine maintenance, and no Residual Current Device (RCD) was in place on the circuit.

Control Measures Implemented:

- **Equipment Inspection and Maintenance:** All kitchen appliances were scheduled for regular inspections to identify damaged cords, plugs, or internal wiring.
- **Installation of RCDs:** Residual Current Devices were installed on all high-risk circuits to immediately cut power in the event of faults.
- **Staff Training:** Kitchen staff were trained to check appliances before use, avoid using damaged equipment, and report electrical hazards promptly.
- **Safe Equipment Handling:** Guidelines were introduced for proper handling, storage, and cleaning of electrical appliances to prevent damage from moisture or impact.
- **Replacement of Damaged Equipment:** The faulty blender and any appliances showing signs of wear were repaired or replaced promptly.



Environmental Risk Factors

Moisture and Water- Moisture and water are major electrical hazards because they conduct electricity, increasing the risk of shock, short circuits, and equipment failure. Leaks, spills, condensation, or flooding can compromise insulation and grounding. Water exposure in industrial, hospital, or outdoor environments can trigger fires or electrocution. Proper sealing, waterproof equipment, and keeping electrical devices away from wet areas are essential control measures.

Dust and Debris - Dust and debris can accumulate on electrical equipment, causing overheating, insulation breakdown, or short circuits. Fine particles from wood, metal, or construction materials can penetrate motors, switches, or panels, reduce efficiency and increasing fire risk. Regular cleaning, protective enclosures, and proper ventilation help prevent dust-related electrical hazards in workshops, construction sites, and industrial settings.

Heat and Corrosion - Excessive heat can degrade insulation, melt wiring, or cause components to fail, while corrosion from chemicals or humidity weakens metal connections, creating electrical faults. High temperatures and corrosive environments accelerate aging of cables and devices. Adequate cooling, proper ventilation, corrosion-resistant materials, and routine inspections are critical to maintaining safe and reliable electrical systems.



Human Risk Factors

Lack of Training - Workers without proper electrical safety training are more likely to mishandle equipment, fail to recognize hazards, and bypass safety procedures. Untrained staff may incorrectly repair, connect, or operate electrical systems, increasing the risk of shocks, fires, or equipment damage. Regular training programs, safety briefings, and competency assessments are essential to ensure workers understand safe practices and can respond effectively to electrical emergencies.

Complacency - Complacency occurs when workers underestimate risks or become careless around electrical systems. Ignoring warning signs, skipping inspections, or assuming equipment is safe can lead to serious accidents, such as shocks, burns, or arc flashes. Reinforcing a culture of vigilance, regular safety reminders, and monitoring adherence to protocols helps prevent complacency-related electrical incidents.

Unsafe Shortcuts - Taking shortcuts, like bypassing lockout/tagout (LOTO) procedures, using damaged tools, or ignoring proper wiring standards, increases exposure to electrical hazards. These unsafe practices can cause electric shocks, fires, and equipment failure. Enforcing strict procedures, supervision, and promoting a safety-first mindset ensures electrical work is completed safely without shortcuts.



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Competent Person

Competency in Electrical Works

Competency in electrical works refers to the combination of **knowledge, skills, and experience** required to safely perform electrical installation, maintenance, and repair tasks. Competent electricians are trained to work in accordance with **safety standards, regulations, and codes of practice**, ensuring that electrical systems are installed, tested, and maintained without creating hazards such as electric shock, fire, or equipment damage. Competency is often validated through licensing systems that categorise work based on complexity, voltage level, and risk.



Competent Person (Licence A)

License A (High-Voltage / Full Competency License)

- License A holders are qualified to work on **all types of electrical systems**, including high-voltage (above 1,000 volts) and complex installations in industrial, commercial, or large-scale infrastructure projects.
- They are authorized to **design, install, maintain, and certify** electrical systems, including main switchboards, transformers, and high-capacity distribution networks.
- License A electricians usually undergo **extensive training**, apprenticeships, and examinations covering electrical theory, safety protocols, and statutory regulations.
- Responsibilities include supervising other electricians, issuing compliance certificates, and ensuring adherence to national electrical codes and occupational safety standards.



Competent Person (Licence B)

License B (Low-Voltage / Restricted Competency License)

- License B holders are certified to work on **low-voltage electrical systems**, typically under 1,000 volts, such as residential wiring, lighting, small appliances, and office or retail installations.
- They can perform **installation, maintenance, and repair** of circuits, outlets, and equipment within their licensed scope but are **not authorised** to handle high-voltage systems or issue formal compliance certificates.
- Training focuses on practical skills, safe working practices, and low-voltage electrical codes.
- License B electricians often work under supervision of a License A holder for higher-risk tasks.



The Importance of Competence

Competence in electrical work is critical for **ensuring safety, reliability, and compliance** in any electrical installation or maintenance task. Working with electricity involves high risks, including electric shock, burns, fires, and equipment failure. A competent worker has the **knowledge, practical skills, and judgment** to assess hazards, follow proper procedures, and operate safely with live or potentially energized systems.

Competent electricians reduce the likelihood of accidents by **correctly installing, maintaining, and testing electrical systems** according to national standards and regulations. Competence also ensures that systems perform efficiently and reliably, preventing downtime, costly repairs, or property damage. In high-risk environments such as industrial plants, hospitals, or construction sites, competence directly protects workers, clients, and the public.

Additionally, electrical competence ensures **legal and regulatory compliance**. Many jurisdictions require licensed electricians to certify installations, perform inspections, and authorize system energization. Incompetent work can lead to legal penalties, insurance issues, and liability for injuries or damage.

Overall, competence in electrical work safeguards life, property, and operational continuity, while promoting professional standards and accountability in the workforce.



Inspection and Testing

Regular **electrical inspections** are essential to ensure the safety and efficiency of electrical systems. These inspections typically involve a visual examination of wiring, panels, circuit breakers, and protective devices to detect signs of overheating, corrosion, loose connections, or damaged insulation. By adhering to electrical codes and safety standards, regular inspections help prevent accidents such as electric shocks or fires, while also maintaining reliable operation of equipment and reducing unexpected failures.

Functional testing goes a step further by verifying that all equipment operates correctly under normal conditions. This includes checking motors, lighting, control circuits, and safety mechanisms, as well as simulating operational scenarios to ensure systems respond as intended. Functional tests confirm that alarms, interlocks, and protective devices are working properly, providing confidence that the system is reliable and ready for use.

Preventive identification of faults focuses on detecting potential problems before they lead to system breakdowns. Using diagnostic tools such as multimeters, insulation testers, and thermal imaging cameras, technicians measure electrical parameters and monitor trends to identify abnormal conditions. This proactive approach reduces unplanned downtime, lowers repair costs, extends the lifespan of equipment, and enhances overall workplace safety by addressing issues before they escalate into serious faults.



PAT Testing

PAT Testing (Portable Appliance Testing) is the process of inspecting and testing electrical appliances to ensure they are safe to use. It is commonly performed in workplaces, schools, and public buildings to prevent accidents such as electric shocks or fires. The process involves a combination of visual inspections and electrical tests, including checking plugs, cables, and the appliance body for damage, wear, or faulty connections. PAT testing can identify defects like exposed wiring, insulation breakdown, or overheating components. Appliances are usually labelled with test dates and results for record-keeping. While not a legal requirement for all devices, regular PAT testing is part of good safety practice and helps maintain compliance with health and safety regulations.



Certification Requirements

In Malta, **proof of compliance** with electrical safety standards is legally required for all electrical installations. Under the *Electrical Installations Regulations* (S.L. 545.24), systems must be designed, installed, tested, and certified by a person holding an appropriate authorisation issued by the Regulator for Energy and Water Services (REWS). This certification serves as formal evidence that the installation meets national and EU safety and technical requirements.

Legal documentation must accompany every certified installation. An authorised electrician or warranted engineer issues a signed certificate after completing the installation and testing, which includes documented results and schematic details. These records show compliance with Maltese laws and are often required by utility providers like Enemalta and by building authorities before services are connected or inspected.

After any **installation or modification**, certification must be obtained and retained. When electrical work is completed — including extensions or alterations — the authorised provider must update documentation and issue a compliance certificate reflecting the changes. This ensures that all work is recognised as safe and legal under local regulations and helps safeguard property occupants while fulfilling statutory obligations



Maintenance Programs

Scheduled Inspections

Maintenance programs rely on planned, periodic inspections to ensure electrical systems and equipment remain safe and fully operational. Scheduled inspections include visual checks, testing of protective devices, and evaluation of wiring, panels, and control systems. By following a consistent timetable, organizations can maintain compliance with safety regulations, identify minor issues before they escalate, and verify that equipment continues to meet operational standards. Regular inspections also provide documentation that can support audits and insurance requirements.

Early Fault Detection

A key benefit of maintenance programs is the early identification of faults. Through routine testing and monitoring, potential problems such as loose connections, worn components, or abnormal electrical readings can be detected before they cause system failures. Early fault detection reduces the likelihood of costly downtime, prevents safety hazards, and allows for timely corrective action. Predictive techniques, including thermal imaging and insulation resistance testing, enhance the ability to identify hidden or developing issues.

Improves System Reliability

Maintenance programs directly contribute to system reliability and efficiency. By addressing faults proactively and ensuring components are in optimal condition, equipment performance is stabilized, and unplanned outages are minimized. This proactive approach extends the lifespan of electrical systems, reduces repair costs, and enhances overall operational productivity. A well-structured maintenance program also boosts confidence among users and stakeholders that electrical infrastructure is safe, dependable, and prepared to meet both current and future demands.



Maintenance Programs

Scheduled Inspections

Maintenance programs rely on planned, periodic inspections to ensure electrical systems and equipment remain safe and fully operational. Scheduled inspections include visual checks, testing of protective devices, and evaluation of wiring, panels, and control systems. By following a consistent timetable, organizations can maintain compliance with safety regulations, identify minor issues before they escalate, and verify that equipment continues to meet operational standards. Regular inspections also provide documentation that can support audits and insurance requirements.

Early Fault Detection

A key benefit of maintenance programs is the early identification of faults. Through routine testing and monitoring, potential problems such as loose connections, worn components, or abnormal electrical readings can be detected before they cause system failures. Early fault detection reduces the likelihood of costly downtime, prevents safety hazards, and allows for timely corrective action. Predictive techniques, including thermal imaging and insulation resistance testing, enhance the ability to identify hidden or developing issues.

Improves System Reliability

Maintenance programs directly contribute to system reliability and efficiency. By addressing faults proactively and ensuring components are in optimal condition, equipment performance is stabilized, and unplanned outages are minimized. This proactive approach extends the lifespan of electrical systems, reduces repair costs, and enhances overall operational productivity. A well-structured maintenance program also boosts confidence among users and stakeholders that electrical infrastructure is safe, dependable, and prepared to meet both current and future demands.



Warning Signs of Electrical Dangers

Electrical hazards often give early warning signs that should never be ignored. One common indicator is frequent circuit breaker trips or blown fuses, which suggest overloaded circuits or short circuits. Flickering or dimming lights can indicate loose connections, faulty wiring, or overloaded circuits. Burning smells or scorch marks around outlets, switches, or appliances signal overheating, insulation damage, or arcing. Buzzing or crackling sounds from electrical devices or outlets are also serious red flags. Physical signs like discolored or warm outlets, damaged plugs, or exposed wires point to potential shocks or fire risks. Additionally, tingling sensations when touching appliances indicate current leakage or grounding problems. Recognizing these warning signs early allows prompt inspection, testing, and repair by a qualified electrician, reducing the risk of fire, electrocution, and equipment damage. Being vigilant about these signs is essential for maintaining a safe electrical environment.



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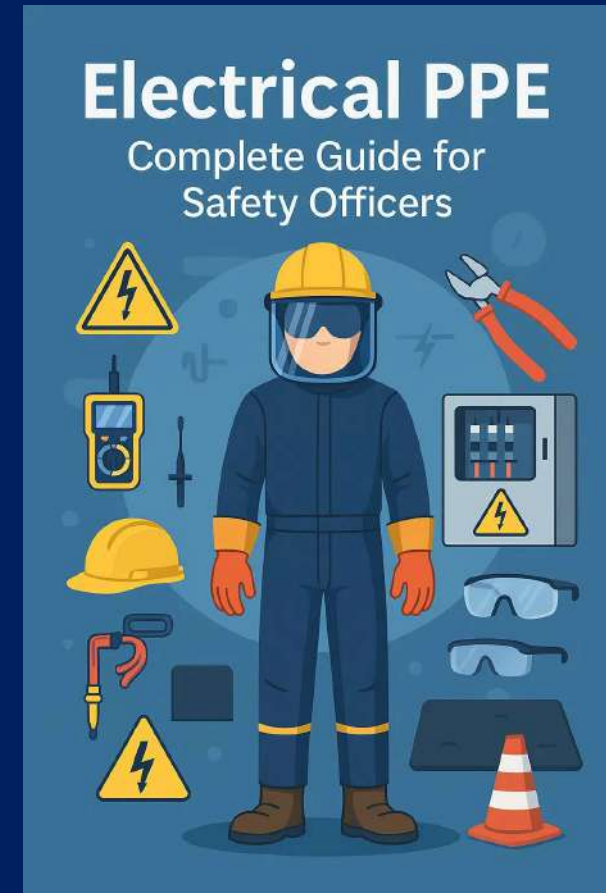


Warning Signage of Electrical Dangers



PPE (Electrical Works)

- **Insulated gloves and sleeves** – Protect against electric shock.
- **Flame-resistant (FR) clothing** – Reduces injury from arc flashes or sparks.
- **Safety helmet** (non-conductive) – Protects head from impact and electrical hazards.
- **Safety boots with insulating soles** – Prevents current flow from the ground.
- **Eye protection** (goggles or face shield) – Guards against sparks, debris, or molten metal.
- **Hearing protection** – Required in high-noise environments or during arc flash events.
- **Additional PPE** – Such as insulating mats, tool covers, or voltage-rated equipment when working on live circuits.



Preventive Measures – Electrical Safety

Preventive measures focus on **avoiding electrical hazards before they occur**. Key strategies include:

Regular Inspections and Testing: Routine checks of wiring, panels, outlets, and appliances help identify worn insulation, loose connections, or corrosion before they cause failure. Tools like multimeters, insulation testers, and thermal cameras are often used.

Scheduled Maintenance Programs: Preventive maintenance ensures components are cleaned, tightened, and replaced as needed, reducing the likelihood of unexpected breakdowns.

Use of Safety Devices: Circuit breakers, residual current devices (RCDs), fuses, and surge protectors are installed to automatically disconnect power during overloads or faults.

Proper Installation Practices: Following electrical codes, correct earthing/grounding, and proper cable sizing prevent hazards such as overheating, short circuits, or shocks.



Control Measures – Electrical Safety

Control measures aim to **minimize risk when hazards are present** and protect workers during electrical activities:

Personal Protective Equipment (PPE): Insulated gloves, FR clothing, safety boots, helmets, and eye protection prevent injury from shocks, arc flashes, or sparks.

Lockout/Tagout (LOTO) Procedures: Ensuring circuits or equipment are de-energized and locked prevents accidental energisation during maintenance.

Safe Work Practices: Maintaining safe distances from live equipment, using insulated tools, and following standard operating procedures reduce exposure to hazards.

Warning Signage and Barriers: Labels, signage, and physical barriers alert personnel to high-voltage areas and restricted zones.



RDC – Residual Current Device

A **Residual Current Device (RCD)** is a safety device designed to quickly disconnect electrical power when it detects an imbalance between live (phase) and neutral currents. This imbalance usually occurs when current leaks to the ground, often due to faulty wiring, damaged insulation, or a person coming into contact with a live conductor. RCDs act within milliseconds, significantly reducing the risk of electric shocks or electrocution. They are commonly installed in homes, workplaces, and industrial systems as part of the main distribution board or on individual circuits. Unlike fuses or circuit breakers, which protect equipment from overloads or short circuits, an RCD specifically protects **people from current leakage**, making it a vital life-saving device. Regular testing using the device's test button ensures its proper operation and reliability.



Lecture Summary

- **Understanding Electrical and Energy Hazards**

Workplace electrical hazards, including shocks, burns, arc flashes, and fires, pose serious risks. Energy sources extend beyond electricity to mechanical, thermal, pressurized, and chemical systems, all requiring careful management to prevent accidents.

- **High-Risk Environments**

Temporary installations, construction sites, manufacturing plants, hospitals, and hospitality environments present unique hazards due to live systems, high-voltage equipment, moisture, or complex operations. Awareness of environmental and human factors is crucial.

- **Human Factors and Safety Culture**

Lack of training, complacency, and unsafe shortcuts increase accident likelihood. A strong safety culture, awareness, and continuous education are essential for preventing incidents.

- **Legal Responsibilities**

Employers must provide safe systems, comply with regulations, and ensure accountability. Certification, documentation, and inspections prove compliance and support legal obligations.



Lecture Summary

•Competence and Authorisation

Only trained, knowledgeable, and authorized personnel should perform electrical work. Competence ensures safe installations, correct repairs, and reduces accidents significantly.

•Inspections, Testing, and Maintenance

Regular inspections, functional testing, preventive fault detection, and scheduled maintenance programs improve reliability, extend equipment life, and reduce risks.

•Warning Signs and Preventive Measures

Burning smells, flickering lights, and tripping breakers indicate electrical hazards. Preventive measures include proper design, protective devices, and routine inspections.

•Safe Work Practices and PPE

Avoid live work where possible, follow procedures, and use appropriate personal protective equipment (PPE). Reporting hazards promptly reinforces safety culture and prevents accidents.





**Undergraduate Diploma in
Occupational Health and Safety**