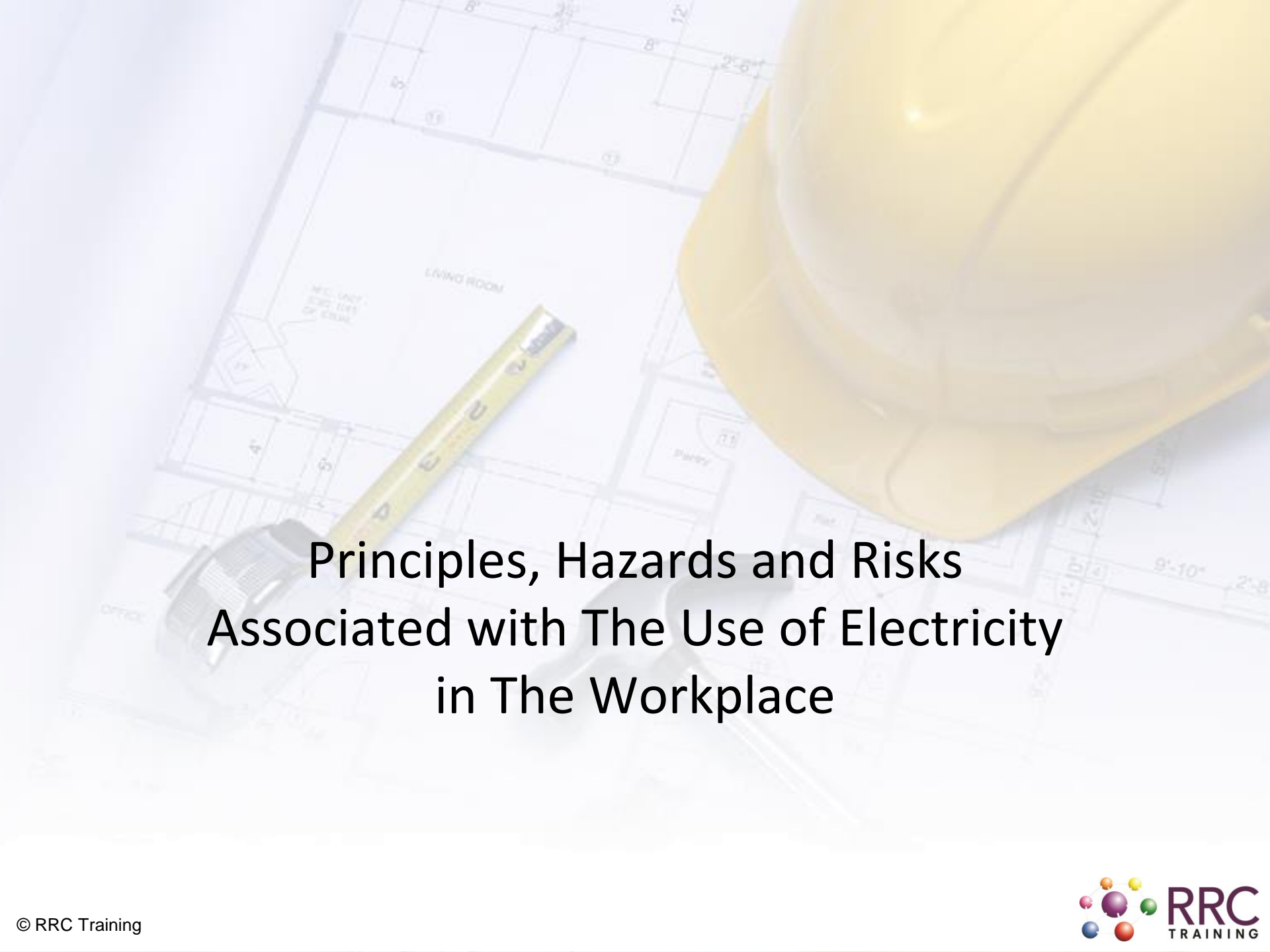




# **Electrical Safety**

## **BSS –DIPLOMA & Adv. Diploma**



# Principles, Hazards and Risks Associated with The Use of Electricity in The Workplace

# Electrical Terms...

- **Conductors:**

- A material that allows electricity to flow easily:- e.g. copper, steel, water

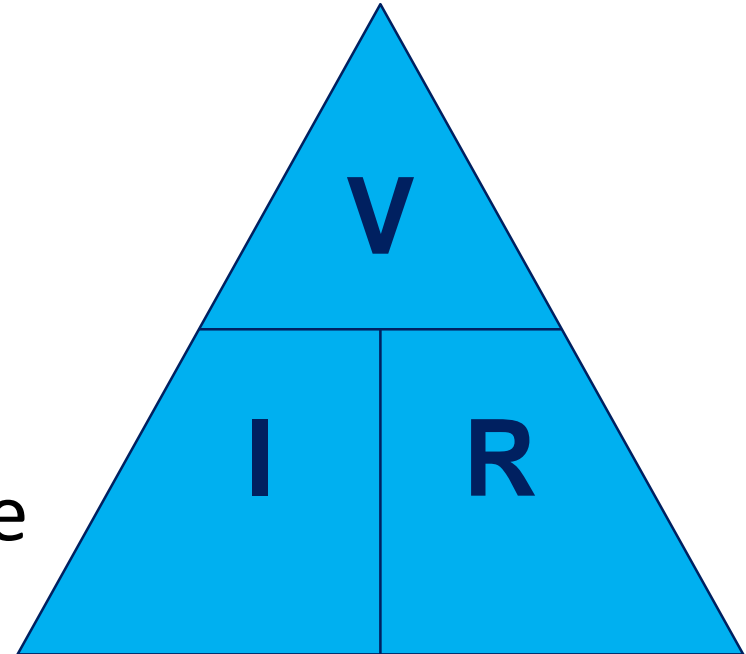
- **Insulators:**

- Materials that have a high resistance to electrical current: e.g. plastic, rubber, wood.

# Ohm's Law

$$I = V/R$$

Current  
= Voltage/Resistance





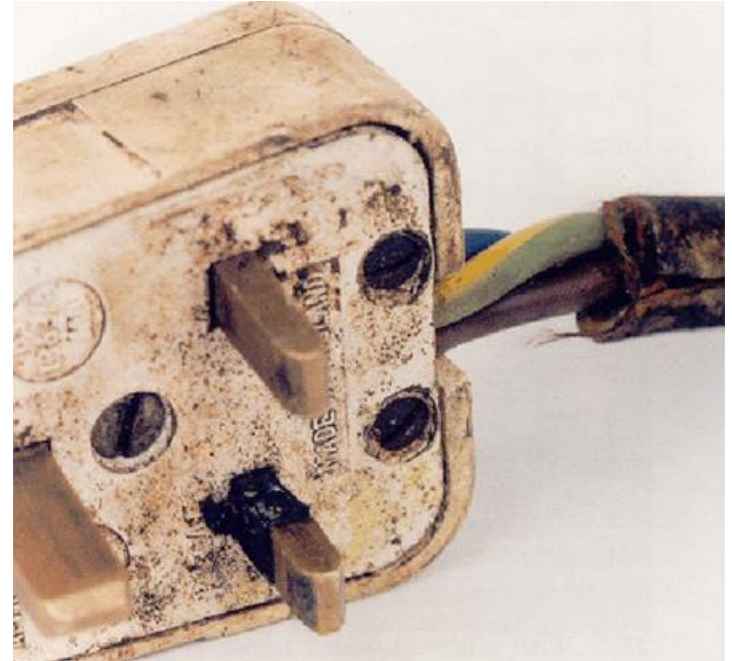
# Electrical Terms

- **Volts (Pressure difference):**
  - The unit of measurement of electrical pressure.
- **Amps (Current):**
  - The unit of measurement of flow
- **Ohms (Resistance):**
  - The unit of measurement of resistance

# The Hazards of Electricity

## PRIMARY HAZARDS

- **Electric shock**
- **Electric fire & explosion**
- **Electric flash**
- **Electric burns**



# The Hazards of Electricity

## Secondary Hazards

- Person falling from height
- Dropping of tools & objects
- Health hazards due to release of toxic gas & production of UV rays
- Psychological effects

Emotionally anxious

Distracted

More prone to accidents



# Health Effects

- Damage to the nervous system
- Irregular heartbeat (fibrillation)
- Internal burns
- Muscular contractions
- Physical trauma
- Stopping breathing (respiratory paralysis)
- Stopping the heart (cardiac arrest)
- Surface burns to the skin



# Severity of Shock Influenced By:

- **Voltage** – the higher the voltage, the greater the current
- **Duration** – the length of time that a person is exposed
- **Resistance** – skin condition, clothing, etc.
- **Current path** – the route that the electricity takes through the body
- **Contact surface area** – the more skin that is in contact, the more severe the injury
- **Environmental factors** – metal surfaces, humidity, etc.

# Fire and Explosion

## Causes

- ❖ Selection of improper/substandard equipment and materials.
- ❖ Electrical installation not in accordance with statutory regulations.
- ❖ Overloading of equipment.
- ❖ Maintenance negligence.
- ❖ Failure of insulation level.
- ❖ Poor internal connections
- ❖ Flammable atmosphere present
- ❖ Lightning.
- ❖ Water seepage.
- ❖ Static electricity.



# Arcing

- Ability of electricity to “jump” across an air gap
- Usually involves high voltage
- Main hazards
  - Electric shock
  - Burns (direct, indirect)
  - Damage to eyes from UV radiation emitted

# Group Discussion Point

What type of incidents could occur when using portable electrical equipment?



# Portable Electrical Equipment

Accidents with Portable Electrical Equipment can be due to:

- Using unsuitable equipment
- Using in damaged conditions
- Misuse
- Physical abuse such as driving over cables
- Repairs carried out improperly
- Continued use of faulty, defective equipment
- Chemical/abrasion damage to the cables
- Lack of inspection testing or maintenance



# PRECAUTIONS USING Portable Electrical Equipment

- Reduced voltage operation
- Use of residual current devices
- Protected against overload
- Cables insulated
- Casing without damage
- Sufficient socket outlets
- Use of cable drums
- Correct maintenance and repair
- Regular inspections and checks
- Properly trained staff





# End of Section Quiz

1. Explain what is meant by the terms:
  - Voltage?
  - Current?
  - Resistance?
2. What are the hazards associated with electricity?
3. How can electrical equipment cause fires?





# Control Measures

# Electrical Safety

- Display electrical equipment & cable routing layout
- All electrical installation to be tested & commissioned as per standard.
- All DB's should be covered
- Earthing of all electrical installations
- Regular maintenance

# ELECTRICAL SAFETY

- ❑ Records to be maintained, RCD
- ❑ Display caution boards
- ❑ Provide RCD for portable equipment
- ❑ LOCKOUT TAGOUT
- ❑ Follow rules and regulations
- ❑ Follow safety measures
- ❑ Adopt protective system
- ❑ Insulation
- ❑ Regular inspection

# Protective Systems

- Fuses
- Earthing
- LOTO
- Reduced and low voltage systems
- Residual Current Devices (RCD's)
- Double insulation

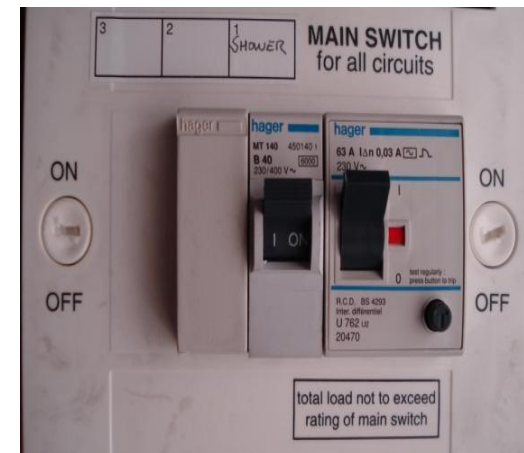
# Fuses

- **Designed to protect the equipment not the people!**
- Form a weak link in a circuit
- Designed to overheat and melt if the current exceeds the fuse rating
- ◆ Fuses are proven safety devices for overload conditions
- ◆ Check the fuses for their current ratings



# Circuit Breaker

- **Protects equipment not people**
  - Electromagnetic device designed to break the circuit when overloaded
  - Circuit breakers protect circuits from overload (fire)



# Earthing

- Outer metal casing connected to earth by wire
- Provides fault current with a low resistance path to earth
- Electric shock should be minor





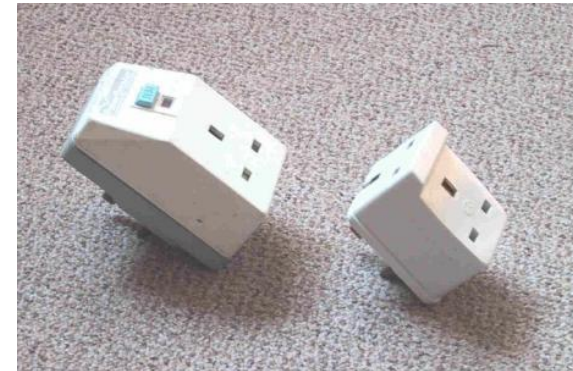
# Lockout/Tag out

- ❖ The purpose of lockout/tag out is to prevent unexpected energization or start up of equipment could cause injury
- ❖ The placement of a lock and tag on an isolating device which ensures that the equipment being controlled cannot be re-energized until the locking device is removed.
- ❖ The ultimate goal of lockout/tag out is to protect the safety and health of employees.



# Residual Current Devices

- **Designed to protect people!**
- Interrupt supply in event of a small leak of current to earth
- Very sensitive: 30 mA
- Very fast: 30 ms
- Compare current in live and neutral
- Should be regularly tested



# Residual Current Devices

Advantages	Disadvantages
<ul style="list-style-type: none"><li>■ Rapid and sensitive</li><li>■ Excellent protection for people in the event of electric shock</li><li>■ Difficult to defeat</li><li>■ Easy to use, test and reset</li></ul>	<ul style="list-style-type: none"><li>■ May isolate crucial equipment if one RCD covers a number of distribution points, e.g. freezers and computers</li><li>■ Mechanical device, which could fail</li><li>■ Only protects against earth leakage faults (no overload protection)</li></ul>

# Competent Persons – Refresher!

What do we mean by the term  
“competence”?



# Competent Persons

- Knowledge
  - Of electricity and electrical work
- Ability
  - Understanding of the system, hazards and precautions
  - Understanding of when it is safe/unsafe
- Training
- Experience
  - Experience of electrical work

# Electricity

Hazards specific to construction:

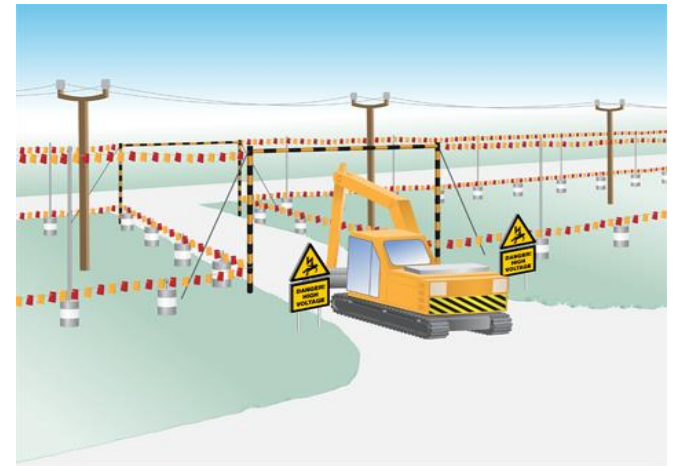
- Contact with overhead power lines
- Contact with buried services





# Overhead Power Line – Precautions

- Isolating the power supply
- Using SSW and permit systems
- Sleeve low voltage power lines
- Using barriers, signage and goal-posts
- Using banksmen
- Using non-conducting equipment





# Buried Cables

- May be struck during excavations
- Can result in: Arcing, shock, burns, fire
- Precautions
  - Check plans
  - Isolating the power supply
  - Using SSW and permit systems
  - Competent person
  - Insulating PPE Boots, Gloves and etc
  - Insulated tools
  - Detection equipment
  - Expose by hand digging
  - Identify and label

# Precautions for Working Live

- Trained and Competent Staff
- Accompanied by another person
- Adequate Information about the risks
- Suitable insulated tools
- Insulated barriers or screens
- Suitable instruments and test probes
- Personal protective equipment / rubber mats
- Permit to work
- Restricted access

# Group Syndicate Activity

- What action should be taken on finding a person suspected to have suffered an electric shock?

# Emergency Action

- Don't touch the casualty
- Isolate the supply
- Summon help
- Give cardio / pulmonary resuscitation
  - Airways
  - Breathing
  - Circulation
- Treat burns
- Remain with the casualty until the emergency services arrive

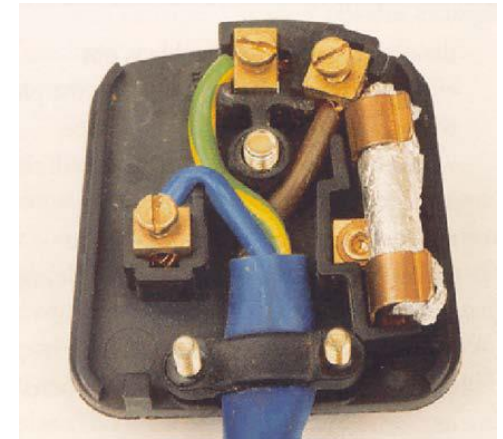
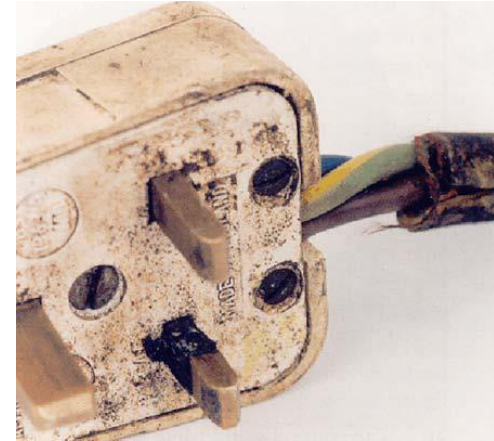
# Inspection and Maintenance

- User checks
- Formal visual inspection
- Combined inspection and testing



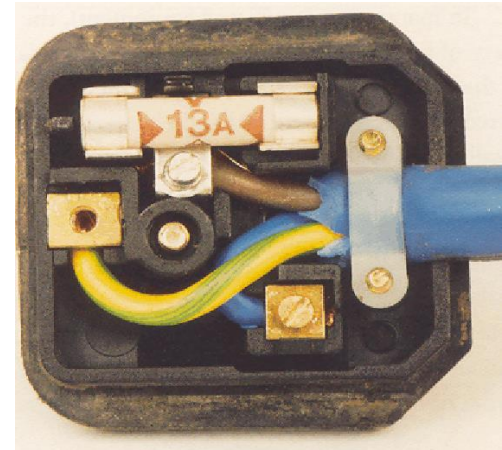
# User Checks

- Damage to cable sheath
- Damage to plug
- Flex fully insulated
- Inadequate joints
- Unsecured casing
- Wet or contaminated
- Damage to casing of equipment
- Burns/scorch marks



# Formal Visual Inspection

- User checks **plus**:
  - Remove plug cover and check fuse
  - Check cord grip
  - Check terminals are secure and no signs of internal damage
  - Done by competent person





# How Often Should You Inspect and Test?

Frequency is determined by:

- Legal standards and codes of practice
- Type of equipment
- Manufacturers' recommendations
- Initial integrity/soundness of the equipment
- Age of the equipment
- Working environment
- Frequency and duration of use
- Foreseeable abuse of the equipment
- Effects of any modifications or repairs
- Analysis of previous maintenance records



# Group Question

**What are the advantages and limitations of Portable Appliance Testing?**

# Advantages and Limitations of Portable Appliance Testing

## Advantages:

- Demonstrates legal compliance
- Detects faults not visible to the eye
- Allows early removal/repair of unsafe equipment
- Identifies trends or patterns of faults

# Advantages and Limitations of Portable Appliance Testing

## Limitations:

- Provides proof of safety at one moment in time only
- Does not ensure safe use or prevent misuse
- Items may be missed and then remain untested
- Can't be applied to all equipment (e.g. computers)

# End of Section Quiz

1. What are the advantages RCD, fuses?
2. What do we mean by the term “LOTO”?
3. Live working is going on, What controls are needed?
4. What things should be checked during user inspections?