CHAPTER 7: TESTING OF ELECTRICAL INSTALLATION

Unit of learning code: ENG/OS/EI/CR/03/5

Related Unit of Competency in Occupational Standard: Perform testing of electrical installations

7.1 Introduction to the unit of learning

This unit covers the competencies required to carry out inspection and testing of an electrical installation. The inspection and testing work covers; identification of types of test, preparation of test equipment, verifying installed fittings, conducting performance tests, recording testing results, generation of reports and issuance of certificates.

7.2 Summary of Learning Outcomes

1. Conduct physical inspection
2. Identify the test to be carried out and test equipment
3. Prepare test equipment
4. Perform the test
5. Issue installation test and wiring certificates.

easyjvet.com

7.2.1 Learning Outcome 1: Conduct physical inspection

7.2.1.1 Introduction to the learning outcome

Once the installation is complete, we need to test it against the original specification for the work. This is in order to check that the finished installation matches the requirements laid out by the customer and is fit for use in the environment where it will be used.

7.2.1.2 Performance Standard

7.2.1.2.1 Visual inspection is carried out
7.2.1.2.2 Fitting points and equipment are identified
7.2.1.2.3 Physical condition of all fittings is verified for safety appropriateness

7.2.1.3 Information Sheet

- Visual electrical installation inspection

A visual electrical inspection is a survey of your electrical wiring system. It is used to identify defects, damage or deterioration of the electrical installation and to determine whether it complies with the current BS7671 electrical safety standard. This type of

inspection does not involve any circuit testing, therefore, on its own; it cannot be used to show whether the installation is completely safe for continued use.

Visual electrical checks are best used during the interim period between testing regimes to ensure that an installation remains in a 'safe to use' state. They are not to be used as a replacement for the formal periodic inspection tests as advised by the institute of Engineering and Technology.

Importance of visual electrical installation inspection

- Electrical leads are checked for damage and repairs and also that they are not in a position where they can be damaged
- All electrical appliances are working
- Extension leads are being used correctly.
- Plugs and sockets are intact i.e. not cracked or damaged, with no dis-colouration or burn marks Socket outlets are not overloaded.

- Light sockets and switches are securely fitted with no dis-colouration or burn marks.
- Bathroom electrical outlets are at least three meters from the edge of a bath or shower cubicle and those electric heaters and boilers are permanently wired. They should not be free standing or portable.

easynet.com

- **Visual electrical inspection sheet**

Checks to be undertaken			
1	**Meter equipment**	**Confirm**	**Date for remedial work**
A	There are no visual signs of burning, overheating or damage and no burning smell at the electrical intake position (usually where the consumer unit and electricity meter are located).		
b	The electrical intake position and consumer unit are easily accessible and free from storage materials		
2	**Consumer unit (fuse box)**		

a	There are no blanks missing from the consumer unit.		
b	The consumer unit is correctly labelled for identification of circuits.		
c	There are no noticeable signs of electrical burning near the consumer unit/ electricity meter (by smell or visual evidence).*		
3	**Residual Current Device (RCD, RCBO, RCCB)**		
a	30mA RCD(s) are present in the consumer unit. *Please state if not applicable due to RCD(s) being present on all sockets (by writing NA in the tick box).*		
b	I have operated the test button(s) on these RCD(s) during the course of this inspection and confirm they are operating properly.		
c	RCD(s) not present in consumer unit, but sockets are provided with RCD protection and the test button on each has been operated within the last quarter. *Please state if not applicable because RCDs are present in the consumer unit only (by writing NA in the tick* *box).*		
d	After consulting my tenant, to the best of my knowledge the RCD and/or circuit breakers do not trip frequently.		

easytvet.com

4. **Fixtures and Fittings**			
a	All fittings [light fittings/sockets /switches/outlets/showers/storage heaters etc.] on the premises are tightly secured in their back box, with all screws present.		
b	All sockets on the premises are working (i.e. power a simple appliance such as a lamp).		
c	No fittings [light fittings /sockets/switches/outlets/showers/storage heaters etc.] on the premises show signs of burning or damage.		
d	There are no signs of modification/alteration to the electrical installation from the previous tenant.		
5 Electrical Appliances			
a	All portable electrical appliances supplied by the landlord have been visually inspected and tested in line with the risk assessment carried out by the tester.		
b	The tenant has been made aware of the danger posed by overloading sockets and understands that it is their responsibility to use appliances safely		

easytvet.com

Table 23 Visual electrical inspection sheet

Firmness of electrical joints

Electrical joints and terminations provide the required electrical connection as well as the mechanical support, and physical protection of the cable. These joins should be tight and firm.

Loose electrical connections

Loose electrical connections cause multiple problems in appliances, heat being the most common one. Electrical connections need to be mechanically tight to ensure that the resistance across that connection is as low as possible, ideally zero ohms. When a connection becomes either loose or corroded, it develops resistance.

Damaged accessories and fittings

Electrical conduits are metal, plastic or fiber pipes designed to protect electrical cables and wires. They're used in just about every residential and commercial establishment, especially for wiring that is either exposed, or fitted outdoors. Since they are essentially a safety feature, you should check and ensure that these accessories are not damaged.

Colour coding

The color code for AC power wiring is as follows

Phase 1 - Red.

Phase 2 - Yellow

Phase 3 - Blue

Neutral - Black

Ground - Green with Yellow Stripe.

easytvet.com

- **Identification of fitting points and identification of equipment**

In new installations, inspection should be carried out progressively as the installation is installed and must be done before it is energized.

As far as is reasonably practicable, an initial inspection should be carried out to verify that:

i. all equipment and material is of the correct type and complies with applicable British Standards or acceptable equivalents
ii. all parts of the fixed installation are correctly selected and erected
iii. no part of the fixed installation is visibly damaged or otherwise defective
iv. The equipment and materials used are suitable for the installation relative to the environmental conditions.

The following items must be covered in an inspection.

i. **Connection of conductors:** Every connection between conductors and equipment or other conductors must provide durable electrical continuity and adequate mechanical strength. Requirements for the enclosure and accessibility of connections must be considered.

ii. **Identification of each conductor**: Table 3 provides a schedule of colour identification of each core of a cable and its conductors.

Function	Old conductor		New conductor	
	Colour	Marking	Marking	Colour
Line 1 of a.c.	Â Red	L1	L1	Brown(1)
Line 2 of a.c.	Yellow	L2	L2	Black(1)
Line 3 of a.c.	Blue	L3	L3	Grey(1)
Neutral of a.c.	Black	N	N	Blue
Protective conductor	Green-and-yellow			Green-and-yellow

Table 24 colour identification of conductors

iii. **Routing of cables**: Cable routes shall be selected with regard to the cable's suitability for the environment, i.e. ambient temperature, heat, water, foreign bodies, corrosion, impact, vibration, flora, fauna, radiation, building use and structure. Cables should be routed out of harm's way and protected against mechanical damage where necessary. Permitted cable routes are clearly defined in the IEE On-Site Guide; alternatively, cables should be installed in earthed metal conduit or trunking.

easytvet.com

iv. **Current-carrying capacity**: Where practicable, the cable size should be assessed against the protective device based upon information provided by the installation designer.

v. **Verification of polarity**: It must be checked that no single pole switch or protective device is installed in any neutral conductor. A check must also be made that all protective devices and switches are connected in the line conductor only (unless the switch is a double pole device) and that the centre contact of Edison screw lamp holders are connected to the line conductor. No switches are permitted in the circuit protective conductor (CPC)

- **Accessories and equipment**: it must be checked that the rating of the accessories and equipments are adhered to. Particular attention should be paid to the

requirements for a cable coupler. Lamp holders should checked for correct temperature rating.

- **Verification of all fittings for safety appropriateness**

The person carrying out electrical work must inspect the installations before they are taken into use. The inspection helps ensure the electrical safety and conformity of the installations.

i. **Selection and erection to minimize the spread of fire:** A fire barrier or protection against thermal effects should be provided if necessary to meet the requirements of BS 7671. The Regulations require that each ceiling arrangement be inspected to verify that it conforms to the manufacturer's erection instructions. This may be impossible without dismantling the system and it is essential, therefore, that inspection should be carried out at the appropriate stage of the work and that this is recorded at the time for incorporation in the inspection and test documents.

easyvet.com

ii. **Protection against direct contact:** Direct contact as defined in BS 7671 is the contact of persons or livestock with live parts. Live parts are conductors or conductive parts intended to be energized in normal use including a neutral conductor but by convention not a combined Protective Earthed Neutral (PEN) conductor. Protection is provided using the following methods:

i) Insulation. Is the insulation damaged or has too much been removed? Although protection by insulation is the usual method there are other methods of providing basic protection**.**

ii) Barriers. Where live parts are protected by barriers or enclosures, these should be checked for adequacy and security. Have all covers, lids and plates been securely fitted?

iii. **Obstacles.** Protection by obstacles provides protection only against an intentional contact. If this method is used, the area shall be accessible only to skilled persons or to instructed persons under supervision. Obstacles can include a fence around a transformer sub-station and barbed wire fencing on power pylons.

iii) Out of reach. Placing out of reach protects against direct contact. Increased distance is necessary where bulky conducting objects are likely to be handled in the vicinity.

iv. Fault protection:

Fault protection is the contact of persons or livestock with exposed conductive parts which have become live under fault conditions. An exposed conductive part is a conductive part of equipment which can be touched but is not live although it can become live under fault conditions.

Examples of exposed conductive parts could include metal trunking, metal conduit and the metal case of an electrical appliance, e.g. a classroom overhead projector.

Earthing provides protection against this type of fault. We also need to check that extraneous conductive parts have been correctly bonded with protective conductors. An extraneous conductive part is a conductive part that is liable to introduce a potential, generally earth potential, and not form part of an electrical installation; examples of extraneous conductive parts are metal sink tops and metal water pipes.

easynet.com

The purpose of the bonding is to ensure that all extraneous conductive parts which are simultaneously accessible are at the same potential. Methods of fault protection are given as:

- Earthed equipotential bonding and automatic disconnection of supply (most common)use of class II equipment
- Non conducting location
- Earth-free local equipotential bonding
- Electrical separation

v. Protective devices: This is a device used to protect equipment, machinery,components and devices,in electrical and electronic circuit,against short circuit,over current and earth fault

vi. Checks on documentation: Diagrams, schedules, charts, instructions and any other information must be available if inspection and testing is to be carried out in a satisfactory manner.

vii. **Checks on warning notices:** These should be fixed to equipment operating in excess of 250 volts where this voltage would not normally be expected.

7.2.1.4 Learning activities

Your installation trainer takes your class to the nearby construction site. As a level 5 trainee in electrical installation perform the following;

i) Visual inspection of the electrical installations

ii) Identify fitting points and identify the equipment

- Check that joints and connections are properly secured and that there is no sign of overheating.
- Check switches for satisfactory electrical and mechanical conditions.
- Check that protective devices are of the correct rating and type; check for accessibility and damage.
- Check that conductors have suffered no mechanical damage and have no signs of overheating.
- Check that the condition of enclosures remains satisfactory for the type of protection required.

easytvet.com

iii) Verification of all fittings for safety appropriateness

The verification should include a check on the condition of all electrical equipment and materials, taking into account any available manufacturer's information with regard to the following:

- Safety
- Damage
- Age
- Wear tear
- Excessive loading
- External influences
- Corrosion
- Suitability

7.2.1.5 Self-Assessment

i. What is the purpose of initial verification?

ii. How do you inspect electrical wires?

iii. What is the difference between initial verification and periodic inspection?

iv. What does an electrical inspector do?

v. Why is an inspection required periodically?

7.2.1.6 Tools, Equipment used in installation testing

- Multimeter/AVO meter
- Wattmeter
- Insulation resistance tester
- Loop impedance tester
- Earth resistance tester
- Clamp meter
- Power quality analyser
- Infrared camera
- Phase sequence meter
- Frequency meter
- Synchroscope
- Tachometer
- Tacho generator
- Laser meter
- Lux meter

easytvet.com

7.2.1.7 References

1. Noel Williams, Jeffrey S. Sargent, 2014, Electrical Inspection Manual, 2014 Edition, Jones & Bartlett Learning, 2014

2. Hari Mohan Johri, 2010, Electrical Installations in Building (Inglés) Tapa blanda, edition 2010, K W Publishers Pvt Ltd

3. John Blaus, Dave Allan, 2008, Electrical installations NVQ and technical certificate book 2, second edition, Pearson education limited.

7.2.1.8 Model Answers to self-assessment

i. Initial verification is intended to confirm that the installation complies with the designer's requirements and has been constructed, inspected and tested in accordance with BS 7671.

ii. Begin your inspection by looking outside the home at the wires coming into the electrical panel. Check that the connection is fastened to the house securely and note any trees that are interfering with the wiring. Visible wiring should appear to be in good condition and covered with insulation, with no metal showing.

iii. Periodic Inspection and Testing (sometimes referred to as Periodic Electrical Inspection) is a procedure completed by qualified electricians and is carried out to ensure that the installation is safe and has not deteriorated. Unlike an initial verification, the periodic inspection should not be intrusive**.**

iv. Responsible for inspecting the installation of electrical systems and equipment to detect faulty wiring and ensure they comply with electrical codes and standards. Visits construction sites and residences, performs inspection, and makes recommendations for improvement.

v. Businesses must have a periodic inspection undertaken each year to ensure that no electrical systems have deteriorated or become dangerous to work around. With age and use, electrical installations should be carefully inspected to verify compliance for further use.

easynet.com

7.2.2 Learning Outcome 2: Identify the test to be carried out and test equipment

7.2.2.1 Introduction to the learning outcome

Testing is the process of evaluating a system or its component(s) with the intent to find whether it satisfies the specified requirements or not. In simple words, testing is executing a system in order to identify any gaps, errors, or missing requirements in contrary to the actual requirements.

7.2.2.2 Performance standards

7.2.2.2.1 The installation to be tested is identified
7.2.2.2.2 Test points are identified
7.2.2.2.3 Relevant standards for testing are applied

7.2.2.3 Information sheet

Identification of installation to be tested

i) Domesticc

Unless domestic premises are extremely large, it is unlikely that a three-phase supply would be needed, and consequently only single-phase systems will be considered here.

The requirement is that circuits which need to be separately controlled, for example lighting and power, remain energized in the event of the failure of any other circuit of the installation. Hence, an earth fault on, say, a socket-outlet circuit would cause the whole of the installation to be cut off if protected by one 30 mA RCD.

easynet.com

ii) Industrial

Industrial installation means an installation intended for use in the manufacture or processing of products involving systematic labor or habitual employment and includes installations in which agricultural or other products are habitually or customarily processed or stored for others, either by buying or reselling on.

iii) Commercial

Commercial installation means an installation intended for commerce but does not include a residential installation.

Commercial buildings are buildings that are used for commercial purposes, and include office buildings, warehouses, and retail buildings (e.g. convenience stores, 'big box' stores, and shopping malls).

iv) **Agriculture/ horticulture**

These are adverse installation conditions which are encountered on agricultural and horticultural installations. They are adverse because of the presence of livestock, vermin, dampness, corrosive substances and mechanical damage.

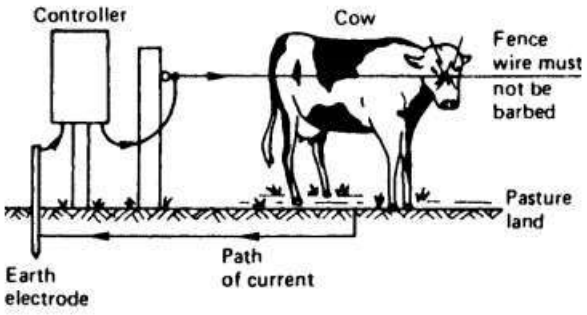

Figure 307: Farm animal control by electric fence.

easytvet.com

Identification of types of tests

Polarity tests

Electrical polarity (positive and negative) is the direction of current flow in an electrical circuit. In the context of electricity installations, a polarity test is used to confirm the correct connection of the line and neutral conductors

Effectiveness of earthing

Generally, provision of effective earthing system depends on aim and goal involved, and the environment where the earthing or grounding as the case may be, is actually required. For instance, in Power Engineering, providing adequate Earthing in a substation is an important essential safety measure. The aim and goal is to provide under and around the substation, a surface of uniform potential, at near or absolute zero earth potential.

In some cases, earthing or Grounding terminology is commonly used to mean the same thing. However, the two technical terminologies have distinction. Earthing is the connection of non-current carrying parts to ground. Example: All metallic enclosure. This is for human safety. While, Grounding is the connection of current carrying parts to the ground. Example: Generator or transformer neutral. This is for equipment safety.

Substation Earthing is also crucial and essential for effectiveness of protection and control devices, apparatus and equipment, in its efficient operations and performances. Consequently, a proper and appropriate "Earthing System grid design and design calculation" have to be embarked upon, grid mesh has to be formed, The conductor length required for gradient control has to be determined, numbers of grounding rods have to be determined, Fault Megavolt amperes (MVA) as to be calculated, soil resistivity has to be measured, grounding fault current has to be calculated etc.; All the needed parameters and data are to be got through the various equations and applied properly, because there is no room for speculation, gambling or/and trial and error approach.

- **Insulation resistance (IR) test**

An insulation resistance (IR) test measures the total resistance between any two points separated by electrical insulation. The test, therefore, determines how effective the dielectric (insulation) is in resisting the flow of electrical current. Such tests are useful for checking the quality of insulation, not only when a product is first manufactured but also over time as the product is used.

easytvet.com

Performing such tests at regular time intervals can detect impending insulation failures before they occur and prevent user accidents or costly product repairs.

- **Ring circuit continuity**

The ring final circuit, feeding 13 A sockets, is extremely widely used, both in domestic and in commercial or industrial situations. It is very important that each of the three rings associated with each circuit (phase, neutral and protective conductors) should be continuous and not broken. If this happens, current will not be properly shared by the circuit conductors.

- **Identification of test equipment**

The testing equipment are identified according to their applications.

Classification of testing equipment

Testing Instruments are used to create signals and capture responses from electrical circuits under tests. In this way, the proper operation of the DUT can be proven or faults in the device can be traced. Use of test equipment is essential to any serious work on electrical systems.

The following items are used for basic measurement of voltages, currents, and components in the circuit under test.

- voltmeter (Measures voltage)
- Ohmmeter (Measures resistance)
- Ammeter, e.g. Galvanometer or Milliammeter (Measures current)
- Multimeter e.g., VOM (Volt-Ohm-Milliammeter) or DMM (Digital Multimeter) (Measures all of the above)
- LCR meter - inductance (L), capacitance (C) and resistance (R) meter (measure LCR values)
- **Specification of test equipment**

Manufacturer specifications are an important element of cost and quality control for testing, calibration and other measurement processes. They are used in the selection of measuring and test equipment (MTE) and the establishment of equivalent equipment substitutions for a given measurement application.

easytvet.com

7.2.2.4 Learning activities

As a lead electrician in a construction site carry out the following tests on the electrical installations done by your employees.

1. Polarity test. Under this test make sure that;

i. polarity is correct at the intake position and the consumer unit or distribution board

ii. single pole switches or control devices are connected in the line conductor only

iii. socket outlets and other accessories are connected correctly

iv. centre contact bayonet and Edison screw type lamp holders have their outer or screwed contact connected to the neutral conductor

v. all multi-pole devices are correctly installed.

2. Carry out Earth-fault loop impedance tests at:

i. the origin of each installation and at each distribution board

ii. all socket outlets

iii. At the furthest point of each radial circuit.

iv. Results obtained should be compared with the values obtained by your employees during previous tests, and where an increase or decrease in values has occurred these must be investigated.

7.2.2.5 Self-assessment

iii) Why polarity test is performed?

iv) What is polarity in electricity testing?

v) Is polarity a dead Test?

vi) What is the objective of earthing?

vii) How do you use insulation tester?

7.2.2.6 Tools, Equipment, used in installation testing

- Multimeter/AVO meter
- Wattmeter
- Insulation resistance tester
- Loop impedance tester
- Earth resistance tester
- Clamp meter
- Power quality analyser
- Infrared camera
- Phase sequence meter
- Frequency meter
- Synchroscope
- Tachometer
- Tacho generator
- Laser meter
- Lux meter

easytvet.com

7.2.2.7 References

Noel Williams, Jeffrey S. Sargent, 2014, Electrical Inspection Manual, 2014 Edition, Jones & Bartlett Learning, 2014

Hari Mohan Johri, 2010, Electrical Installations in Building (Inglés) Tapa blanda, edition 2010, K W Publishers Pvt Ltd

John Blaus, Dave Allan, 2008, Electrical installations NVQ and technical certificate book 2, second edition, Pearson education limited.

7.2.2.8 Model Answers to self-assessment

i. The importance of the polarity test is to make sure that all single-pole devices like switches, circuit breakers, and fuses are allied only in the phase conductor.

ii. Polarity in electrical terms refers to the positive or negative conductors within a dc circuit, or to the Line and Neutral conductor within an ac circuit. ... In the context of electricity installations, a polarity test is used to confirm the correct connection of the line and neutral conductors.

iii. There are three checks of polarity during testing – dead and live testing and visual inspection and while they all confirm correct/incorrect polarity they do not necessarily check for the same thing. ... Unless you test for polarity you will never know and neither will the person operating the load.

easytvet.com

iv. Earthing System or Grounding System in an electrical network work as a safety measure to protect human life as well as equipment, the main objective of the Earthing system is to provide an alternative path for dangerous currents to flow so that accidents due to electric shock and damage to the equipment can be avoided.

v. If you are testing insulation resistance to ground, place the positive probe on the ground wire or the grounded metal junction box and the negative probe on the conductor or terminal. Energize the Megger for 1 minute. Read the value of the resistance at the end of the minute test and note it in your table.

7.2.3 Learning Outcome 3: Prepare test equipment

7.2.3.1 Introduction to the learning outcome

A Calibration of measuring tools and equipment is necessary to ensure that the tools and equipment used to measure and indicate accurate readings. Preparation of testing equipment involves comparison between a known measurement (the standard) and the measurement using your instrument. Typically, the accuracy of the standard should be ten times the accuracy of the measuring device being tested.

7.2.3.2 Performance Standard

7.2.3.2.1 Appropriate Test equipment are identified

7.2.3.2.2 Test equipment are checked for appropriate specifications and functionality

7.2.3.2.3 Test equipment are prepared and stored for safe and easy access in accordance with established procedure

7.2.3.3 Information Sheet

- **Identification of appropriate test equipment**

  Regardless of whether you are performing electrical installation work, equipment maintenance, verifying the absence of voltage for de-energized work, troubleshooting, voltage measurements or similar diagnostic work, collecting accurate and consistent information from these tests is imperative. To comply with electrical industry standards and regulations, there is a need to select and use the right test instruments according to the application.

  When conducting voltage verification, for energized and de-energized work, the electrical worker must select the right test instruments and equipment applicable to the work to be performed. As a minimum, these should include the following:

- Voltage indicating instrument suitable for conditions
- Environment
- Correct CAT category I, II, III, or IV
- Continuity test instrument
- Insulation resistance test instrument.

easytvet.com

Checking of test equipments for appropriate specifications and functionality

All test instruments include specific manufacturer's operational instructions.

Electrical testing in its most basic form is the act of applying a voltage or current to a circuit and comparing the measured value to an expected result. Electrical test equipment verifies the math behind a circuit and each piece of test equipment is designed for a specific application.

It is the job of a test technician to know which piece of test equipment to use for the task at hand and also understand the limitations of the test equipment they are using.

Electrical test equipment should be considered a source of lethal electrical energy. Technicians must observe all safety warnings and follow all practical safety precautions to prevent contact with energized parts of the equipment and related circuits, including the use of appropriate Personal Protective Equipment.

- **Storage of test equipments for safety and easy access in accordance with established procedure**

One key to ensuring that measuring instruments, maintain a high level of reliability and accuracy is by taking proper care of them. Below is what you should know about the care and maintenance of these special precision tools.

- Lubricate instruments appropriately to prevent corrosion
- Proper lubrication of measuring instruments will prevent damage due to corrosion and oxidation. Precision measuring instruments should be lightly oiled after each use, and any excess oil should be removed from metal surfaces with a clean, dry cloth. A visibly "wet" instrument can attract and hold minute particles that can cause internal wear of precisely fabricated parts, especially those that move against one another.
- **Store instruments in an appropriate environment**

Whenever you place an instrument in its storage location, be sure the location is well-protected from destructive elements. Do not store precision instruments where they can jostle against one another in a drawer; instead, separate instruments from one another using dividers or place them in padded cases. Avoid stacking instruments on top of each other, unless they are well-protected in cases.

easyvet.com

- **Know how to properly handle instruments during use**

Once you have a precise measuring instrument in your hand, it becomes that much more important to protect that tool from harm or providing false readings. There are a few things you should do that will help prevent damage or miscalibration during use, including avoiding sudden shocks or rough treatment. Do not drop, throw, or bang measuring instruments against hard surfaces.

- **Obtain professional recalibration assistance**

Some measuring instruments require occasional recalibration to ensure they continue to function as designed, and that is why it is important to have a professional relationship with a precision instrument manufacturer or supplier. They can keep your instruments in top-notch condition so they'll provide years of reliable service.

7.2.3.4 Learning activities

Identification of appropriate test equipment

A class has been requested by the installation trainer to use different electrical measuring instruments in testing of an electrical installation. As a level five installation student help in

i. Identification of appropriate test equipment according to the task.
ii. Checking of test equipments for appropriate specifications and functionality.
iii. Prepare and stored for safe and easy access.

7.2.3.5 Self-assessment

i) Can you do a continuity test on a live circuit?
ii) How do you test electrical continuity?
iii) What is a bad continuity reading?
iv) What does a reading of 0 ohms mean?
v) How do you check continuity on a long wire?

easytvet.com

7.2.3.6 Tools, Equipment, used in installation testing

- Multimeter/AVO meter
- Wattmeter
- Insulation resistance tester
- Loop impedance tester
- Earth resistance tester
- Clamp meter
- Power quality analyser
- Infrared camera
- Phase sequence meter
- Frequency meter
- Synchroscope

- Tachometer
- Tacho generator
- Laser meter
- Lux meter

7.2.3.7 References

Noel Williams, Jeffrey S. Sargent, 2014, Electrical Inspection Manual, 2014 Edition, Jones & Bartlett Learning, 2014

Hari Mohan Johri, 2010, Electrical Installations in Building (Inglés) Tapa blanda, edition 2010, K W Publishers Pvt Ltd

John Blaus, Dave Allan, 2008, Electrical installations NVQ and technical certificate book 2, second edition, Pearson education limited

7.2.3.8 Model Answer to self-assessment

i. You can measure the voltage and the current of a live circuit and use those figures to calculate the resistance (Ohm's Law), but you can't actually measure the resistance of a live circuit.

easytvet.com

ii. A continuity test is performed by placing a small voltage (wired in series with an LED or noise-producing component such as a piezoelectric speaker) across the chosen path. If electron flow is inhibited by broken conductors, damaged components, or excessive resistance, the circuit is "open".

iii. If you have a reading higher than 10 ohms, you have poor continuity. The resistance is higher than it should be and you need to replace the wire, fuse, outlet, battery, or device. ... If the reading is higher than 10, then your device, wire, appliance, or fuse will overheat.

iv. A measurement of Zero, or very close to zero (less than 0.5 ohms) indicates a very low resistance to current flow. Applying voltage to this low level of resistance will result in extremely high current flow.

v. To check continuity on a run of wiring, disconnect both ends of the wire. Set your multimeter to check continuity with a tone. Put one meter lead on one end of the wire and the other meter lead on the opposite end of the wire. The meter signals a tone and shows near zero ohms of resistance if the wire has continuity.

7.2.4 Learning Outcome 4: Perform the test

7.2.4.1 Introduction to the learning outcome

This outcome presents the arguments and the proposal of tests and measurements of electrical installations for buildings. The entire article applies to both large and small electrical installations with uninterruptible power supply(UPS) systems and power generators.

7.2.4.2 Performance Standard

7.2.4.2.1 Test parameters are identified
7.2.4.2.2 Test equipment are assembled
7.2.4.2.3 Test sequence procedure is decided based on the test standards
7.2.4.2.4 Safety precautions are adhered to
7.2.4.2.5 Additional precaution is observed on the installation in hazardous environment as per EHS standard
7.2.4.2.6 Tests are carried out in line with the IEE regulations
7.2.4.2.7 Functionality of all devices including protective devices is checked as per the set standards
7.2.4.2.8 Test results are recorded as per agreed format.

7.2.4.3 Information Sheet

Reading and interpretation of appropriate manuals

Manual - It is a document that shows how equipment, tool or a machine is done, operated, worked, etc., by the hand or hands rather than by an electrical or electronic device.

easytvet.com

Reasons to read owner's manual

The operator's manual explains safety guidelines when operating specific pieces of equipment. Number two, how to operate the equipment, its safety features and controls. Some manufactures refer to this as “Familiarization Training”.

Maintenance Schedule

Maintaining your equipment and tool is important. Educate yourself on what services your equipment and tool needs and when they are recommended. Many manuals include helpful logs to record your service history and repair information.

Identification of testing equipment

Continuity tester (ohmmeter)

To measure accurately the resistance of the conductors in an electrical installation we must use an instrument which is capable of producing an open circuit voltage of between 4 and 24V AC or DC, and deliver a short-circuit current of not less than 200 mA.

The functions of continuity testing and insulation resistance testing are usually combined in one test instrument.

Figure 308:Fluke T2 Voltage and Continuity Tester

Insulation resistance tester

Insulation resistance should have a high value and therefore insulation resistance meters must have the ability to measure high resistance readings. The test voltage required for measuring insulation resistance is given in BS 7671 Table 61, as shown in Table 4 below.

Circuit nominal voltage (volts)	Test voltage d.c. (volts)	Minimum insulation resistance (megohms)
SELV and PELV	250	≥0.5
Up to and including 500 V with the exception of the above	500	≥1.0
Above 500 V	1000	≥1.0

Table 25 Test voltage required for measuring insulation resistance (from BS 7671)

The figure 3 hows a typical modern insulation and continuity tester that will measure both low values of resistance, for use when carrying out continuity and polarity tests, and also high values of resistance when used for insulation resistance tests.

Figure 309 Modern insulation and continuity tester

easytvet.com

Earth loop impedance tester

Earth-loop impedance testers of the type shown in the figure 5 below they have the capability to measure both earth-loop impedance and also prospective short-circuit current, depending on which function is selected on the range selection switch. The instrument also has a series of LED warning lights to indicate whether the polarity of the circuit under test is correct. The instrument gives a direct digital read-out of the value of the measurement being taken at an accuracy of plus or minus 2 per cent.

Figure 310 Earth-loop impedance tester

Test lamp

A test light, also known as a test lamp, or voltage tester, or mains tester is a piece of electronic test equipment used to determine the presence of electricity in a piece of equipment under test. A test light is simpler and less costly than a measuring instrument such as a multimeter, and often suffices for checking for the presence of voltage on a conductor. Properly designed test lights include features to protect the user from accidental electric shock. Non-contact test lights can detect voltage on insulated conductors.

Figure 311 Neon test lamp for line voltage

Procedure of conducting identified tests

Polarity test

Step 1. Select a GS 38 approved voltage indicator and locate the Main Switch. Test between Line and Neutral terminals.

easytvet.com

Figure 312 Test between Line and Neutral terminals

Step 2. Test between Line and Earth terminals.

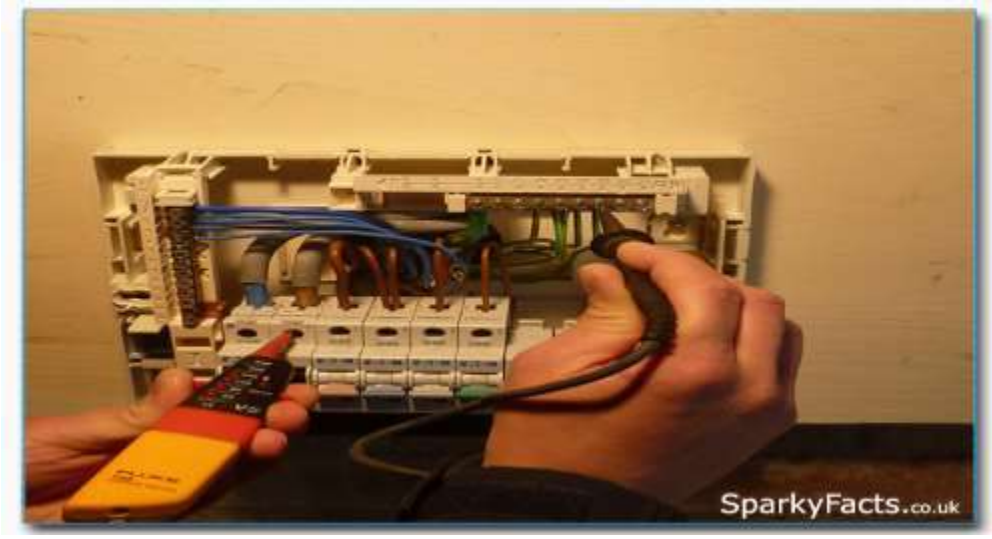

Figure 313 Test between Line and Earth terminals

Step 3. Test between Neutral and Earth terminals.

easytvet.com

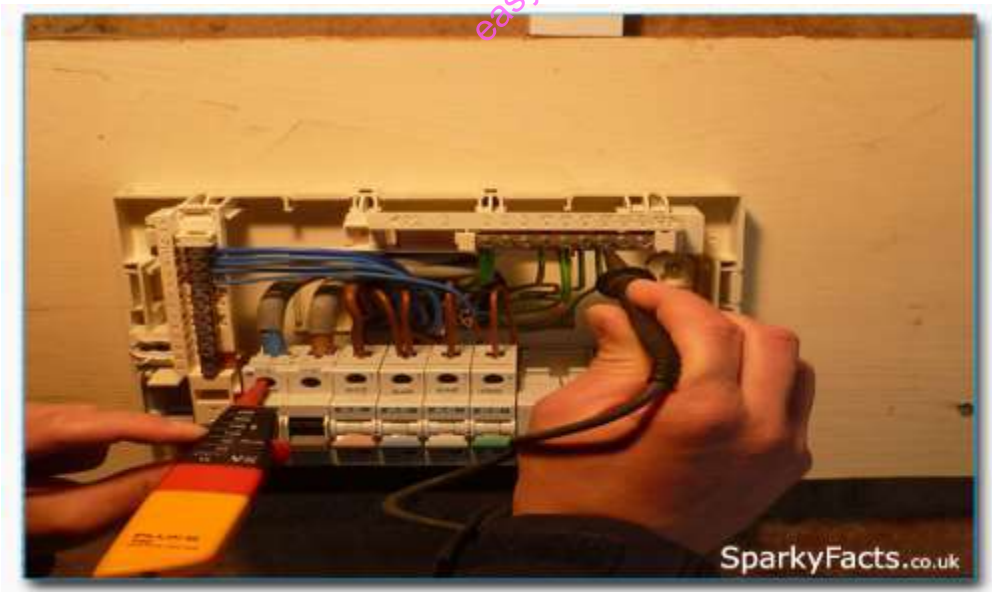

Figure 314 Test between Neutral and Earth terminals

The test instrument should indicate full voltage (230V) between Line-Neutral and Line-Earth conductors. No voltage should be detected between Neutral-Earth.

Methods of Earthing

There are several methods of earthing like wire or strip earthing, rod earthing, pipe earthing, plate earthing or earthing through water mains. Most commonly used methods of earthing are pipe earthing and plate earthing. These methods are explained below in details.

Earthing Mat

Earthing mat is made by joining the number of rods through copper conductors. It reduced the overall grounding resistance. Such type of system helps in limiting the ground potential. Earthing mat is mostly used in a placed where the large fault current is to be experienced. While designing an earth mat, the following step is taken into consideration.

i. In a fault condition, the voltage between the ground and the ground surface should not be dangerous to a person who may touch the non current-carrying conducting surface of the electrical system.
ii. The uninterrupted fault current that may flow into the earthing mat should be large enough to operate the protective relay. The resistance of the ground is low to allow the fault current to flow through it. The resistance of the mat should not be of such a magnitude as to permit the flow of fatal current in the live body.
iii. The design of grounding mat should be such that the step voltage should be less than the permissible value which would depend on the resistivity of the soil and fault required for isolating the faulty plant from the live system.

easyviet.com

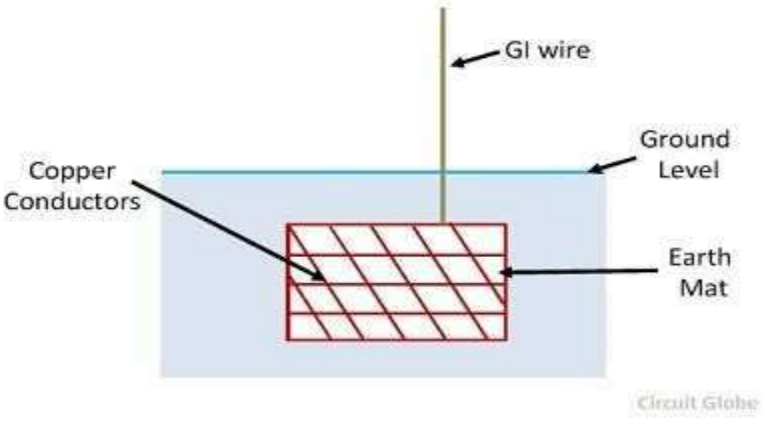

Figure 315 Earthing mat

Earthing electrode

In this type of earthing any wire, rod, pipe, plate or a bundle of conductors, inserted in the ground horizontally or vertically. In distributing systems, the earth electrode may consist of a rod, about 1 meter in length and driven vertically into the ground. In generating substations, grounding mat is used rather than individual rods.

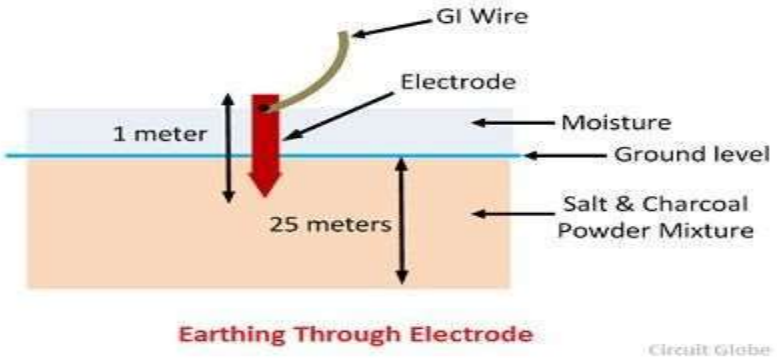

Figure 316 Earthing electrode

Pipe Earthing

easyfyer.com

This is the most common and best system of earthing as compared to other systems suitable for the same earth and moisture conditions. In this method the galvanized steel and perforated pipe of approved length and diameter in place upright in a permanently wet soil, as shown below. The size of the pipe depends upon the current to be carried and type of soil.

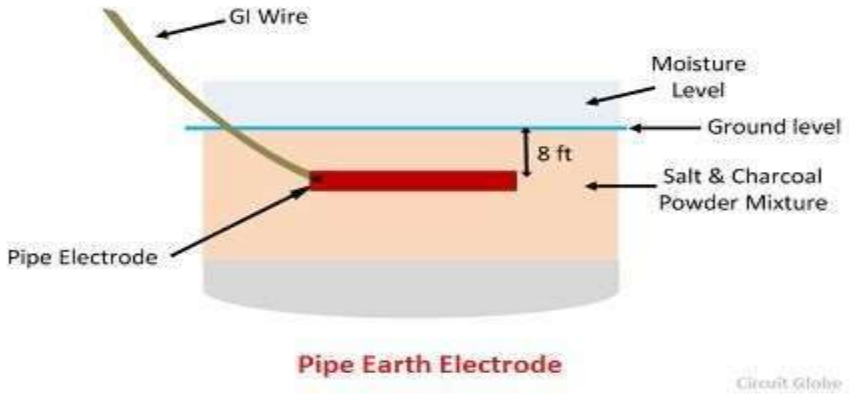

Figure 317 Pipe earthing electrode

Normally, the size of the pipe uses for earthing is of diameter 40 mm and 2.5 meters in length for ordinary soil or of greater length in case of dry and rocky soil. The depth at which the pipe must be buried depends on the moisture of the ground.

The pipe is placed at 3.75 meters. The bottom of the pipe is surrounded by small pieces of coke or charcoal at a distance of about 15 cm. Alternate layers of coke and salt are used to increase the effective area of the earth and to decrease the earth resistance respectively.

Another pipe of 19 mm diameter and minimum length 1.25 meters is connected at the top of GI pipe through reducing socket.

During summer the moisture in the soil decreases, which causes an increase in earth resistance. So a cement concrete work is done to keep the water arrangement accessible, and in summer to have an effective earth, 3 or 4 buckets of water are put through the funnel connected to 19 mm diameter pipe, which is further connected to GI pipe.

The earth wire either GI or a strip of GI wire of sufficient cross section to carry faulty current safely is carried in a GI pipe of diameter 12 mm at a depth of about 60cm from the ground.

Plate Earthing

ebaynet.com

In Plate Earthing an earthing plate either of copper of dimension 60cm×60cm×3mm of galvanized iron of dimensions 60 cm×60 cm×6 mm is buried into the ground with its face vertical at a depth of not less than 3 meters from ground level.

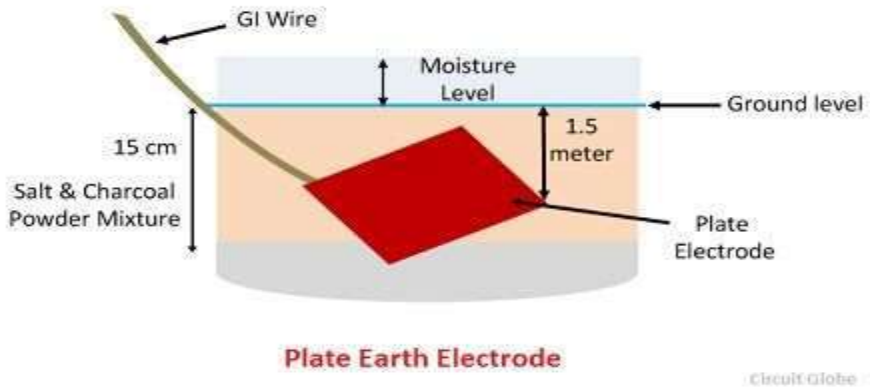

Figure 318 Plate earth electrode

The earth plate is inserted into auxiliary layers of coke and salt for a minimum thickness of 15 cm. The earth wire (GI or copper wire) is tightly bolted to an earth plate with the help of nut or bolt. The copper plate and copper wire are usually not employed for grounding purposes because of their higher cost.

Earthing Through Water Mains

In this type of earthing the GI or copper wire are connected to the water mains with the help of the steel binding wire which is fixed on copper lead as shown below.

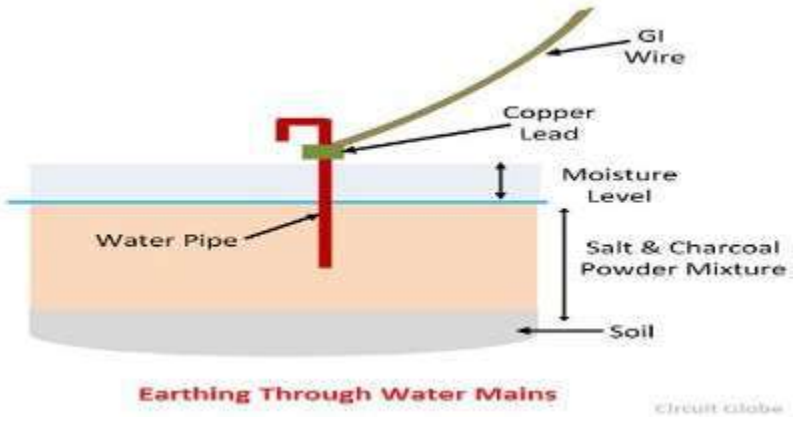

Figure 319 Earthing through water mains

The water pipe is made up of metal, and it is placed below the surface of the ground, i.e. directly connected to earth. The fault current flow through the GI or copper wire is directly get earthed through the water pipe.

easyvet.com

- **The Insulation Resistance test sequence**

To perform the tests needed, you will need an Insulation Resistance Tester or a multifunctional tester such as the Megger 1553.

NB. *Before everything, a safe isolation procedure must be carried out.*

Step 1. Select the required circuit and disconnect its live conductors from the distribution board (the earth conductor can stay)

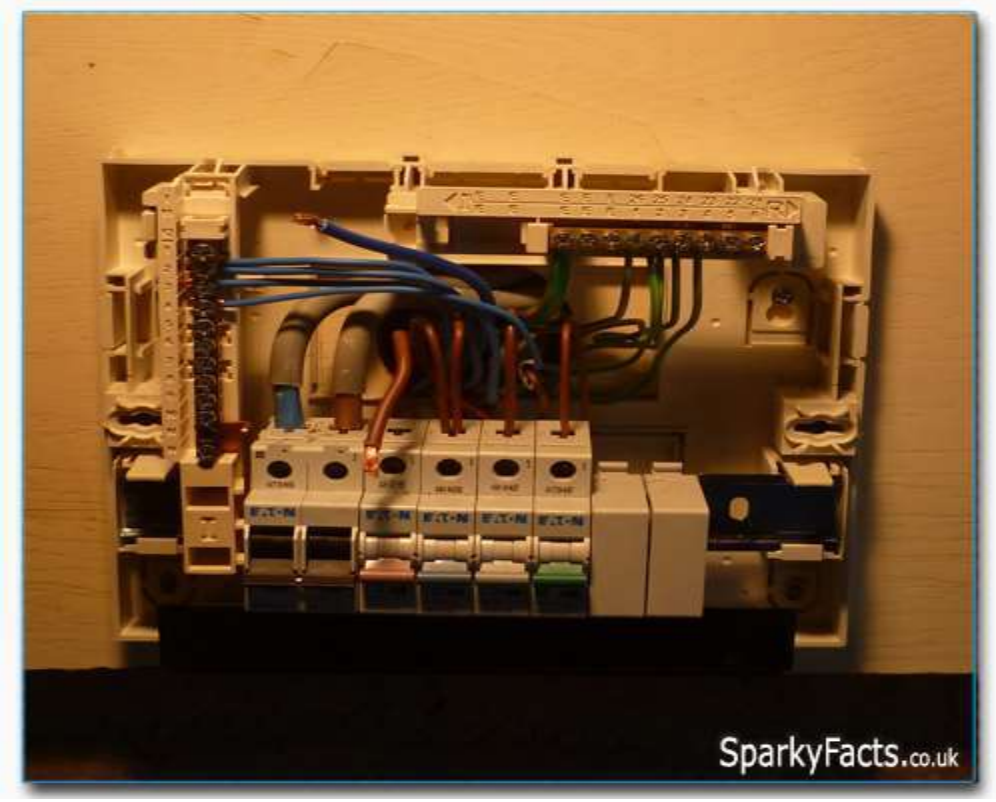

Figure 320 Insulation Resistance test sequence

easyrtet.com

Step 2. Connect one of the test leads of the Insulation Tester to the Line conductor and the other one to the Neutral conductor. Set the tester to the required voltage and press and hold the TEST button – the tester will display a value in Ohm`s or if it is out of its range than something like this: >299 MΩ

Figure 321 Insulation Resistance test sequence

Step 3. Repeat the test process with one of the test leads on the Line conductor and the other one on the Earth conductor

easytvet.com

Figure 322 Insulation Resistance test sequence

Step 4. Repeat the test process with one of the test leads on the Neutral conductor and the other one on the Earth conductor.

Figure 323 Insulation Resistance test sequence

easywet.com

Step 5. That is it - compare all test results to the minimum allowed value in BS7671 (1MΩ for a 230V a.c. circuit). If any of the values are lower, than further investigation is needed.

Test every circuit within the distribution board one by one, and record the test results on the Schedule of Test Results.

NB. *You can perform this test on a whole range of circuits in a single process. You can test between all of the Line conductors and all of the Earth conductors within the distribution board. After this step, between all of the Neutral conductors and all of the Earth conductors. The only down side is that if there is a low insulation resistance reading then you will have to test the circuits one by one to find out which one has the fault on it. However, most of the time, you can save valuable time by insulation testing the entire board this way.*

- **Ring circuit continuity**

Provided the test results are recorded methodically the test can be used to confirm:

- The ring is continuous
- There are no interconnections (rings within the ring)
- The value of R_1+R_2

The sockets are correctly connected (provided the readings in steps 2 and 3 below have been made using a test lead with a plug plugged into the socket)

The test will also reveal various types of fault. The test must be carried out at initial verification. IEE Guidance Note 3 suggests that;

It need not always be carried out on a periodic inspection if there are adequate records from previous inspections and the ring has not been modified.

Method

A low resistance ohmmeter is required.

easytvet.com

Step 1

Measure and record the end to end resistance of each conductor in the ring:

R11 line conductor resistance

Rnn neutral conductor resistance

R22 circuit protective conductor resistance

Step 2

Connect the neutral conductor of one end of the ring to the line conductor of the other end of the ring. Connect the remaining line conductor to the remaining neutral.

Measure and record the resistance between line and neutral at each socket on the ring (including any spurs). This is most conveniently done with a test lead which connects the ohmmeter directly into the socket with a plug. (Some makers supply such a lead.) This

also has the benefit that successful test results in Step 2 and Step 3 will confirm that the socket has been correctly wired and the polarity is correct.

NB *If testing through the front of the socket with a suitable lead an infinite reading will be obtained unless the switch is on.*

The result expected at each socket should be equal to one quarter of the sum of R11and Rnn (as measured in Step 1).

The readings at any spurs will be a little higher.

Step3

Connect the circuit protective conductor of one end of the ring to the line conductor of the other end of the ring. Connect the remaining line conductor to the remaining circuit protective conductor.

Measure and record the resistance between line and circuit protective conductor(CPC) at each socket on the ring (including any spurs). As before, this is most conveniently done with a test lead which connects the ohmmeter directly into the socket with a plug.

easytest.com

The result expected at each socket should be equal to one quarter of the sum of R11 and R22 (as measured in Step 1).

As before, the readings at any spurs will be a little higher.

Analysis of Ring Continuity Results

The following end-to-end readings were obtained when a ring was tested:

R11 = 0.6Ω

Rnn= 0.6Ω

R22=1.0

R11 and Rnn should be the same as the cross sectional areas of neutral and line conductors should be the same in a single phase circuit. So the results look OK.

R22 may be higher than R11 or Rnn as it is common to use a CPC of smaller CSA. In twin and earth cables used in standard ring circuits, line and neutral are 2.5 mm² and the CPC is 1.5 mm². Here we should check that the CSA of the CPC is indeed smaller than the CSA of line and neutral.

The reading expected in Step 2 is:

(R11+Rnn)/4

(0.6+ 0.6)/ 4

0.3 Ω

The reading expected in Step 3 is:

(R11 + R22) / 4

(0.6+1.0)/4

0.40 Ω

easytvet.com

The actual readings obtained in Steps 2 and 3 were recorded in the table below:

Socket number	Step 2 reading (Ω)	Step 3 reading (Ω)
1	0.31	0.41
2	0.3	0.4
3	0.32	0.41

Table 26 actual readings obtained

The readings above are very close to the expected values so this ring is OK

- **Recording and verification of results against appropriate standards**

Using instrument performance specifications plus established in-house, national, and/or international standards for data collection, quality control, and product output, protocols can

be developed to allow for testing an instrument to verify that it meets performance expectations. Calibration of measuring instruments should be done regularly.

- **Rectification of any anomalies**

Ways to reduce random errors

i. Taking repeated measurements to obtain an average value.
ii. Plotting a graph to establish a pattern and obtaining the line or curve of best fit. In this way, the discrepancies or errors are reduced.

- **Safety precautions to be observed**

It's vitally important to take safety precautions when working with electricity. Safety must not be compromised and some ground rules need to be followed first. The basic guidelines regarding the safe handling of electricity documented below will help you while working with electricity.

1. Avoid water at all times when working with electricity. Never touch or try repairing any electrical equipment or circuits with wet hands. It increases the conductivity of the electric current.

easyvet.com

2. Never use equipment with frayed cords, damaged insulation or broken plugs.

3. If you are working on any receptacle at your home then always turn off the mains. It is also a good idea to put up a sign on the service panel so that nobody turns the main switch ON by accident.

4. Always use insulated tools while working.

5. Electrical hazards include exposed energized parts and unguarded electrical equipment which may become energized unexpectedly. Such equipment always carries warning signs like "Shock Risk". Always be observant of such signs and follow the safety rules established by the electrical code followed by the country you're in.

6. Always use appropriate insulated rubber gloves and goggles while working on any branch circuit or any other electrical circuit.

7. Never try repairing energized equipment. Always check that it is de-energized first by using a tester. When an electric tester touches a live or hot wire, the bulb inside the tester lights up showing that an electrical current is flowing through the respective wire. Check all the wires, the outer metallic covering of the service panel and any other hanging wires with an electrical tester before proceeding with your work.

8. Never use an aluminum or steel ladder if you are working on any receptacle at height in your home. An electrical surge will ground you and the whole electric current will pass through your body. Use a bamboo, wooden or a fiberglass ladder instead.

9. Know the wire code of your country.

10. Always check all your GFCI's once a month. A GFCI (Ground Fault Circuit Interrupter) is a RCD (Residual Current Device). They have become very common in modern homes, especially damp areas like the bathroom and kitchen, as they help avoid electrical shock hazards. It is designed to disconnect quickly enough to avoid any injury caused by over current or short circuit faults.

easytvet.com

7.2.4.4 Learning Activities

KENM is a fashion industry in Taita Taveta county. An electrical shock occurs in one of its production lines. As the industry lead installation technician lead your team in carrying out the following tests to identify the root cause of the problem

- Continuity test
- Insulation resistance tester
- Earth loop impedance
- Polarity test

7.2.4.5 Self-assessment

i) How is continuity test performed?

ii) How is measurement of earth resistance carried out using earth tester?

iii) Show how does a Ring circuit work?

iv) What is a Megger test?

v) Using an equation explain how do you calculate loop impedance?

7.2.4.6 Tools, Equipment, used in installation testing

- Multimeter/AVO meter
- Wattmeter
- Insulation resistance tester
- Loop impedance tester
- Earth resistance tester
- Clamp meter
- Power quality analyser
- Infrared camera
- Phase sequence meter
- Frequency meter
- Synchroscope
- Tachometer
- Tacho generator
- Laser meter
- Lux meter

easytvet.com

7.2.4.7 References

Noel Williams, Jeffrey S. Sargent, 2014, Electrical Inspection Manual, 2014 Edition, Jones & Bartlett Learning, 2014

Hari Mohan Johri, 2010, Electrical Installations in Building (Inglés) Tapa blanda, edition 2010, K W Publishers Pvt Ltd

John Blaus, Dave Allan, 2008, Electrical installations NVQ and technical certificate book 2, second edition, Pearson education limited

7.2.4.8 Answers to the self-assessment

i. A continuity test is performed by placing a small voltage (wired in series with an LED or noise-producing component such as a piezoelectric speaker) across the chosen path. If electron flow is inhibited by broken conductors, damaged components, or excessive resistance, the circuit is "open".

ii. Earth resistivity is usually measured using the Wenner method, which involves the use of four temporary earth spikes. The spikes do not need to be moved as part of the testing procedure however – their location and spacing is determined by the depth at which it is required to determine the earth resistivity.

iii. The power sockets in a house are connected by means of a ring circuit. In a ring circuit the live, neutral and earth wires form a loop of cable going from the consumer unit to all of the sockets in turn and then back to the consumer unit. The live wire carries current to the house/appliance at a high voltage.

iv. The Megger test is a method of testing making use of an insulation tester resistance meter that will help to verify the condition of electrical insulation. The IR gives a measure of the enduring power of an insulator to bear the service voltage without any current leakage path.

v. Therefore, where reliable measured values are available for the external earth loop impedance (Ze) and for the loop resistance of the line and protective conductors (R_1 + R_2) of the circuit, it is permissible to derive the loop impedance of a circuit by using the following formula: $Zs = Ze + (R_1 + R_2)$.

easytvet.com

7.2.5 Learning Outcome 5: Issue installation test results and wiring completion certificates

7.2.5.1 Introduction to the learning outcome

An installation certificate is a test certificate produced by an electrician after they have carried out wiring work. It confirms that they have tested the work and it's safe.

The Electrical Installation Certificate is to be used only for the initial certification of a new installation or for an alteration or addition to an existing installation where new circuits have been introduced. It is not to be used for a Periodic Inspection for which a Periodic Inspection Report form should be used.

7.2.5.2 Performance Standard

7.2.5.2.1 Test certificate is issued to the relevant parties

7.2.5.2.2 Wiring certificate is issued to the relevant parties

7.2.5.3 Information sheet

Installation test results certificate

- Meaning terms

easytvet.com

"**Electrical Installation Certificate**" (**EIC**) is the declaration of conformity from the installing contractor that the new electrical work described has been installed in accordance with the wiring regulations in force at the time of installation. It includes circuit charts and records test results taken prior to commissioning. An EIC cannot be issued by anyone other than the installing contractor and will include a date for re-inspection and testing.

Variants of this certificate include:

- Minor Works Certificate" for installation works not requiring a new circuit from the distribution board.
- Domestic Installation Certificate" a reduced EIC tailored specifically for dwellings.

An Electrical Installation Certificate will be issued for all Installation work carried out by contractor.

Types of electrical safety certificates.

There are four types of electrical safety certificates.

- Electrical installation certificate

- Periodical test, inspection & report
- Domestic installation certificate
- Minor works certificate

Electrical installation certificate / Domestic installation certificate

This is issued to the customer on the completion of any electrical installation works. It details the type of works undertaken; any deviations from the regulations as listed in BS 7671, who designed, installed and tested the works and when the next inspection is due.

Periodical test, inspection & report

This is used for the testing of existing electrical installations that have come up for their next inspections or for installations that do not have a current installation certificate. It will detail most if not all of the deviations that need to be addressed and will fall into four categories / codes.

Code 1.	Major deviation from the regulations, immediate remedial works are required and the system is unsafe to remain in service in its present condition.
Code 2.	Minor deviation from the regulations, remedial works are required to the electrical installation, this should be carried out soon and in there, present condition does not provide immediate danger to life or property.
Code 3.	Requires further investigation.
Code 4.	Does not comply with BS 7671: as amended (2004)

Table 27 Periodical test, inspection & report

easytvet.com

Minor works certificate

This is used for small works like additional sockets or lights that are not in special locations. A minor works certificate cannot be used for the provision of a new circuit.

Issuing authority

The certificate can be issued by accredited, competent persons, such as a registered electrician.

Client details : .....

Address of installation : .....

Postcode : .....

Description and Extent of Installation : .....

Description : .....

Extent : .....

New installation

Addition

Alteration

For design, Construction and Inspection and Testing

I being the person responsible for the Design, Construction and Inspection and Testing of the Electrical Installation (as indicated by my signature below) and particulars of which are described above, having exercised reasonable skill when carrying out the Design, Construction and Inspection & Test, hereby CERTIFY that the said work for which I have been responsible is to the best of my knowledge and belief in accordance with BS 7671, amended to ..... (date) except for the departures, if any, detailed below.

Departures from BS 7671 (if any)

.....

The extent of liability of the signatory is limited to the work described above as the subject of this certificate.

Name : ..... Position : .....

Signature : ..... Date : .....

For and on behalf of : .....

Address : ....

..... Tel no. : .....

easytvet.com

Next Inspection

I recommend that this installation is further inspected and tested after an interval of not more than : .....

Supply characteristics and earthing arrangements

Earthing arrangements	Number and Type of live conductors	Nature of supply	Protective device characteristics
TN-S	1 phase – 2 wire	Nominal voltage :	Type : .....
TN-C-S	1 phase – 3 wire	Frequency :	Current rating : .....
TT	2 phase – 3 wire	Prospective fault current :	
	3 phase – 4 wire	External loop impedance :	

Figure 324 Electrical installation certificate

- Importance of installation test certificate

Electrical certifications provide vital information about the legal compliance and safety of electrical installations in your home. Securing these certificates from a local authority approved inspector, hired electrician, or third party certifier is important because these documents are typically requested as part of legal procedures when putting your property up for sale. Inability to produce such documents may cause much delay in your legal proceedings.

An electrical installation certificate is to be expected, regardless how small or large the job had been. Ask your electrician for an electrical installation certificate, which confirms that the work that had been carried out meets all standards for electrical safety according to British standard (BS 7671). Every electrical work in all dwellings is covered by building regulations. This means that for any notifiable work, you should always be given a certificate that confirms the compliance of the work with regulations that apply.

Wiring certificate

- Meaning

This is a certificate issued by the Energy and Petroleum Regulatory Authority (EPRA) for qualified electricians.

- Types of certificates issued by EPRA

  Class A

  Class B

  Class C

easytvet.com

Energy & Petroleum Regulatory Authority

Requirements before commencing application

Electricians

Scanned copies of your: certificates, National ID/Passport and bank payment slip

Contractors

Scanned copies of: business registration certificate, PIN Certificate, bank payment slip, Local authority business permit, electrician licence, lease agreement/title deed and a copy of list of tools.

Application Fees Class: C-2: 250/= C-1: 500/= B: 750/= A-1 & A-2: 1000/=

Bank: *Kenya Commercial Bank*

Account Name: *Energy Regulatory Commission*

Account Number: *1107180198*

Branch: *Moi Avenue*

Application Guideline:

1. Open ERC Website www.erc.go.ke
2. Click on the tab "online services"
3. Click "access our online portal"
4. For new users click on the "register" tab. For existing users login using your user name and password
5. Click "apply for a new licence"
6. For electricians select "individual" for contractors select "business/company"
7. Select the class of licence you wish to apply for.
8. Select the tab that corresponds to your academic qualifications
9. Enter your personal details and press save. Ensure that you enter your correct email address. Create a unique username and password.
10. Open your email, you will find a message from ERC. Open our portal through the link given in your inbox and fill in the rest of the details.
11. Fill in your work experience, academic qualifications, knowledge of rules, and other ERC

easytvet.com

Figure 325 EPRA certificate

Issuing authority

Energy and Petroleum Regulatory Authority (*EPRA*)

7.2.5.4 Learning Activities

Installation certificate

As a lead and qualified electrician, prepare an installation certificate for your junior who have completed a new electrical installation.

7.2.5.5 Self-Assessment

i) What does an electrical certificate cover?

ii) What makes you a qualified electrician?

iii) What kind of degree does electrician need?

iv) How does one apply for ERC certificate in Kenya?

7.2.5.6 Tools and equipment

- Multimeter/AVO meter
- Wattmeter
- Insulation resistance tester
- Loop impedance tester
- Earth resistance tester
- Clamp meter
- Power quality analyser
- Infrared camera
- Phase sequence meter
- Frequency meter
- Synchroscope
- Tachometer
- Tacho generator
- Laser meter
- Lux meter

easytvet.com

7.2.5.7 References

1, Noel Williams, Jeffrey S. Sargent, 2014, Electrical Inspection Manual, 2014 Edition, Jones & Bartlett Learning, 2014

2, Hari Mohan Johri, 2010, Electrical Installations in Building (Inglés) Tapa blanda, edition 2010, K W Publishers Pvt Ltd

3, John Blaus, Dave Allan, 2008, Electrical installations NVQ and technical certificate book 2, second edition, Pearson education limited

7.2.5.8 Model Answers to self-assessment

i. When a Certificate of Electrical Compliance is Required

The certificate guarantees that the work undertaken in your state complies with both the Electricity Safety Act and the Electricity Safety Regulations.

ii. You'll need to have an industry recognized level 3 qualification for example a level 3 diploma in electro technical services. Most people get into this career via an apprenticeship. It normally takes two to four years to become fully qualified. GCSEs grade D or above, including Math and English, would be an advantage.

iii. No college education is required to become an electrician, but significant training takes place through an apprenticeship program, which provides in-class and hands-on instruction. They can be employed in a number of electrical jobs or work freelance, both of which mandate licence.

iv. Procedure

a) Open ERC Website ERC Website.

b) Click on the tab “online services”

c) Click “access our online portal”

d) For new users click on the “register” tab.

e) Click “apply for a new license”

f) For electricians select “individual” for contractors select “business/company”

g) Select the class of license you wish to apply for.

easytvet.com