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Participant Handbook

Sector
Electronics

Sub-Sector
Consumer Electronics

Occupation
After Sales Service

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NSQF Level 4

Field Technician: Other Home Appliances

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Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

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Certificate

COMPLIANCE TO

QUALIFICATION PACK - NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

ELECTRONICS SECTOR SKILL COUNCIL OF INDIA

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/ Qualification Pack: **- "Field Technician-Other Home Appliances"** QP No. **"ELE/Q3104, NSQF Level 4"**

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Authorised Signatory
(Electronics Sector Skill Council)

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The need for having a standard curriculum for the Job Role based Qualification Packs under the National Skills Qualification Framework was felt necessary for achieving a uniform skill based training manual in the form of a Facilitator Guide.

I would like to take the opportunity to thank everyone who contributed in developing this Guide for the QP Field Technician – Other Home Appliances.

The Guide is the result of tireless pursuit to develop an effective tool for imparting the Skill Based training in the most effective manner.

I would like to thank the team of KontentEdge for their support to develop the content, the SME and the team at the ESSCI along with the industry partners for the tireless effort in bringing the Guide in the current format.

CEO

Electronics Sector Skills Council of India

About this Book

This Facilitator Guide is designed to enable training for the specific Qualification Pack (QP).
Each National Occupational (NOS) is covered across Unit/s.
Key Learning Objectives for the specific NOS mark the beginning of the Unit/s for that NOS.

- Describe voltage, current and resistance
- Calculate power and energy
- Identify electronic components
- Define a field technician and his/her key responsibilities
- Maintain working standards
- List safety rules
- Explain types of equipment used
- List the properties of water affecting water -based appliances
- Describe water treatment methods
- List the different types of water purifiers
- Describe an RO water purifier
- Describe the functioning of RO water purifiers
- List the properties of RO water purifiers
- Describe the pre-installation process of RO water purifiers
- Install RO water purifiers
- Repair water purifiers
- Troubleshoot frequently occurring problems and provi de solution
- Perform the cleaning of mixer/grinder/juicer
- Troubleshooting mixer/grinder/juicer problems
- Servicing/replacing the components of mixer/grinder /juicer
- Demonstrate replacing of water purifier component
- List the safety measure to be followed while repairing
- List the work requirements
- Maintain interpersonal skills

The symbols used in this book are described below.

Symbols Used


Key Learning Outcomes


Tips


Steps


Role Play


Unit Objective


Practical


Team Activity


Activity

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ESSCI

1. Basics of Electricity and Electronics

Unit 1.1 – Basics of electric circuits

Unit 1.2 – Components of an electric circuit

ELE/N3120, ELE/N3121
ELE/N3119

Key Learning Outcomes

At the end of this module, you will be able to:

1. Explain electric circuits
2. Describe voltage, current and resistance
3. Calculate power and energy
4. Identify electronic components

UNIT 1.1: Basics of Electric Circuits

Unit Objectives

At the end of this unit, you will be able to:

1. Describe electric circuits
2. Describe voltage, current and resistance
3. Define Ohm's Law
4. Explain the difference between alternating current (AC) and direct current (DC)
5. Measure power and energy
6. Demonstrate the use of multimeter

1.1.1 Electric Circuit

It is a path made by the interconnection of electrical components. Electrons from a voltage or current source flow along this path. The following figure lists the elements present in a basic electric circuit:

A device in a circuit which consumes electric power is called load.

Example: Bulb

A source that provides electrical pressure known as voltage or EMF to electrical equipment to enable them to work.

Example: Battery

A conductor that connects the supply source and the load.

Example: Wires

Fig 1.1.1: Electric circuit constituents

An electric circuit consists of two paths/loops, as shown in the following image:

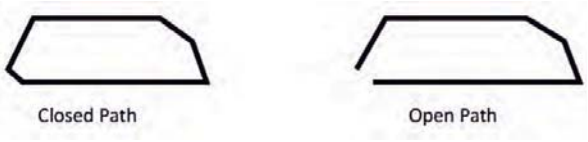

Fig 1.1.2: Closed and open path

In a typical circuit, a battery provides voltage for the load through wires. For example, the required voltage for a bulb to glow is provided by a battery. The following image shows such an electric circuit:

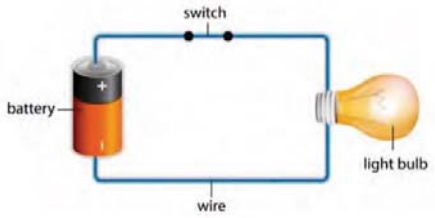

Fig 1.1.3: An electric circuit

1.1.2 Types of Electric Circuits

An electric circuit is classified into two types:

- Series circuit
- Parallel circuit

Series Circuit

In this type of a circuit, all components are connected as a chain and the current flowing through each of them is the same all over the circuit. There is a single route through which the current flows. So, the current passes through each and every component. Opening or breaking any point of a series circuit causes the whole circuit to stop functioning which then needs to be replaced. The following image represents a series circuit:

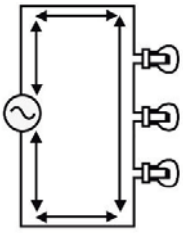

Fig 1.1.4: A series circuit

Parallel Circuit

In this type of a circuit, two or more components are connected in a parallel manner. In a parallel circuit, the components are of the same voltage. The current flow varies across the components. If any point of the circuit gets damaged, only that part needs to be replaced.

The following image represents a parallel circuit:

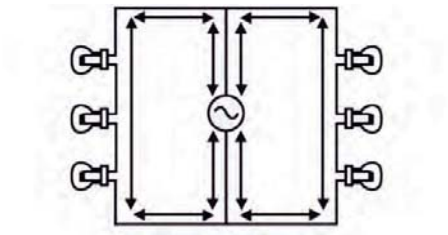

Fig 1.1.5: A parallel circuit

1.1.3 Parameters of Electric Circuit

Electricity is a natural force that comes into existence whenever there is a flow of electric charge between any two components. When working with circuits, awareness about some of the basic concepts of electricity is needed, otherwise wrong connection in a circuit may cause a high damage to the user and the circuit components. The main parameters associated with electricity are as follows:

- Voltage
- Current
- Resistance

Voltage

A force that causes electricity to move across the wire/cable is known as voltage. It can also be defined as the variance in the charge between the points of a circuit. Depending on the voltage, the electric current flows through a medium of a specific resistance. Volt is the unit of voltage and is denoted with letter V.

Current

Electric current, or simply current, is the flow of electric charge carried through electrons moving across wires. Ampere is the unit of current and denoted with letter I. The units of current are listed in the following table:

Unit	Denoted by
Micro-Ampere	(μA) = 10-6A
Millie-Ampere	(mA) = 10-3A
Ampere	(A)

AC and DC Current

The following figure lists the two types of current sources that are dependent on the direction in which the electrons flow:

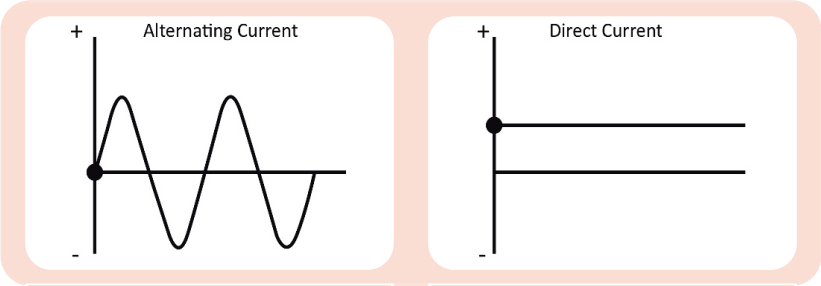

Fig 1.1.6: Difference between AC and DC current

Resistance

Resistance, as the word suggests causes hindrance to any occurring force. In other words, it is an obstruction caused by a substance to the current flow. The unit of resistance is ohm and it is denoted with the symbol, Ω. According to the ohm's law, 1Ω resistance allows 1A of current to flow from one point to the other with a 1V voltage difference.

1.1.4 Ohm's Law

According to Ohm's law, the flow of current through a conducting material is directly proportional to the conductor's voltage. The mathematical equation of Ohm's law is as follows:

I = V/R

Where,

I is the current

V is the potential difference

R is the resistance

Ohm's law states that R in the preceding relation is constant and independent of the current flowing through it as shown in the following image:

Fig 1.1.7: A simple electric circuit

1.1.5 Power Calculation and Energy Consumption

When electricity flows in an electric circuit, it results in some work done. For example, when it flows in a fan, the fan's blades rotate and when it flows in a refrigerator, it cools the things inside. Thus, when electricity flows through an appliance, it results in some work done. To calculate the electricity consumed, the following two parameters need to be considered:

- Power
- Energy

Power

The rate at which electrical energy flows through an electric circuit is known as Electrical power. Similar to mechanical power, electric power is the rate of doing electrical work, measured in watts (one joule per second) and denoted by *P*. The term wattage often refers to electric power in watts.

Thus, to denote the electric power (in watts) given by an electric current I consisting of a charge of *Q* coulombs in every t seconds through an electric potential (voltage) difference of V, use the following equation:

P= work done per unit time =-VQ/t = VI

Energy

If the electric power is the rate or speed of work done, then electric energy is the total amount of work done in a given time period. It is a product of the power of an electrical appliance and the duration of its usage. Electric energy can be explained with the following equation:

Electrical Energy(E) = Power(P) x Duration of Energy usage (T) = Power (Watt) x Time (hour)

E (Wh) = P (W) x T (h)

Power = Energy / Time

Example:

Electricity charges are paid based on "Units of Consumption"

1 unit = 1 kwh

If 500w is used for a device for 4 hours, then consumption is = 0.5 kw * 4 Hrs. = 2 Kwh (2 units). By multiplying the power consumption with rate of electricity, the electricity bill for the usag e is determined.

1.1.6 Measurement of Electrical Parameters

There are many types of measuring tools available to measure voltage, current, power and energy. Some of the measuring tools are:

- Multimeter
- Clamp meter

Multimeter

A multimeter can be used for measuring voltage, current and resistance. It can also be used for fault detection in small circuits or to find out the broken wires in a circuit. It can be of two types:

- Analog Multimeter
- Digital Multimeter

The following figure shows the differen t types of multimeters:

Analog Multimeter	Digital Multimeter
	
It consists of a needle which points at the scale built on it for giving the measured value.	It is an electronic meter which displays the measured values in a digital form.

Fig. 1.1.8: Types of multimeters

Usually, a standard multimeter can measure the following electrical quantities:

- DC Voltage
- DC Current
- AC Voltage
- AC Current
- Resistance

Clamp Meter

An electrical tester which combines a multimeter with a current sensor is known as a clamp meter. The probes in the device measure voltage, whereas the clamps measure the current. The clamps are the hinged jaws joined to an electric meter that allows users to clamp around the cable/wire anytime for measuring the current without disturbing any other element. While using a clamp meter, the wire/cable to be measured is not disconnected.
The following images shows types of clamp meter:

Fig. 1.1.9: Types of clamp meters

Usually, a standard clamp mete r can measure the following electrical quantities:

- AC current
- Temperature
- AC voltage
- Capacitance
- DC voltage
- Resistance
- DC current
- Frequency

Activity: Identification Game

Answer the following questions.

1. Which of the following equipment is used to measure voltage?

Clamp meter

Megger

Ammeter

2. What is the mathematical equation of Ohm's law?

I = P/V

I = V/R

P = -VQ/t

UNIT 1.2: Components of an Electric Circuit

Unit Objectives

At the end of this unit, you will be able to:

1. Identify the active components
2. Describe the passive components
3. List electromagnetic components

A circuit consist of a number of components that may be electrical, electronic, mechanical and so on. The following figure represents various types of circuit elements or components that are used in a control panel:

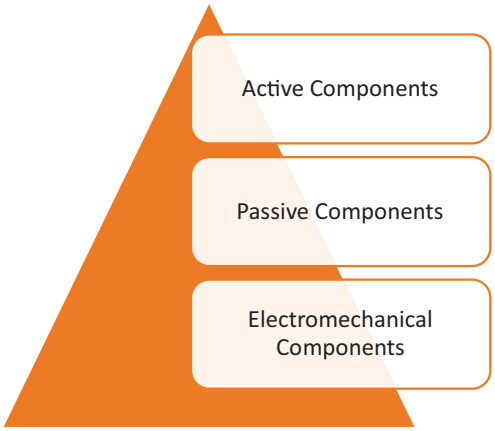

Fig. 1.2.1: Circuit elements

1.2.1 Active Components

Active components depend on a source of energy to perform their functions. These components can amplify current and can produce a power gain.

The following figure lists the different types of active components in a circuit:

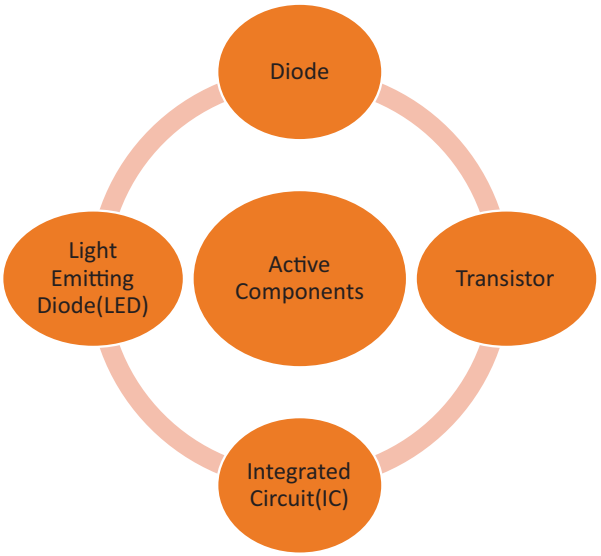

Fig. 1.2.2: Active components

Diode

A diode is a specialized electronic component with two terminals known as the anode and the cathode. It has asymmetric conductance, which means that it conducts mainly in one direction. It has very less resistance, ideally zero, to the flow of current in one direction whereas it has high resistance, ideally infinite, in the other direction. Diodes are usually made up of semiconductor materials such as germanium, silicon or selenium. Appliances such as microwave oven, water purifier and mixer/ juicer/ grinder have this component. The following image shows diodes:

Fig. 1.2.3: Diodes

Transistor

A transistor is an electronic device, made up of semiconductor material. Usually, it consists three or more terminals for connecting to an external circuit. It is utilized to amplify or switch electrical power and electronic signals. Appliances such as microwave oven, water purifier and mixer/juicer/grinder have this component.