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Participant Handbook

Sector
Electronics

Sub - Sector
Consumer Electronics &IT Hardware

Occupation
After sales service

Reference ID : **ELE/Q3105, Version 2.0**
NSQF Level 5

Field Engineer RACW

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Shri Narendra Modi
Prime Minister of India

Certificate

COMPLIANCE TO
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Is hereby issued by the

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for

Skilling Content : **Field Technician – RACW**

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I would like to take the opportunity to thank everyone who contributed in developing this handbook for the QP Field Technician – RACW.

The handbook 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 handbook in the current format.

CEO

Electronics Sector Skills Council of India

About this Book

This Participant Handbook 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.

- Define matter, its states and change in states
- Explain properties of heat
- Explain types of heat transfer and energy conservation
- Explain the working of refrigerators
- Describe electric circuits
- Describe voltage, current and resistance
- Define Ohm's law
- List the different types of tools used for installing appliances
- Identify the correct methods of using tools
- Explain the working of DC refrigerator
- Explain the working of FF refrigerator
- Install DC and FF refrigerators
- Define the factors, comfort zone and heat load of ACs
- Identify the different parts and working of Window ACs
- Follow safety precautions for installation of Window ACs
- Identify the different types of washing machines
- Describe the basic functions of washing machines
- Identify the different parts of washing machines
- Install semi-automatic washing machines
- Understand customer requirements
- Interact with customers
- Suggest resolution to the problems of customers

The symbols used in this book are described below.

Symbols Used


Key Learning Outcomes


Steps


Role Play


Tips


Notes


Unit Objectives


Activity

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1. Introduction to Refrigerator, Air Conditioner and Washing Machine (RACW)

Unit 1.1 – Basic Science Related to RACW

Unit 1.2 – Basics of Refrigerators

Unit 1.3 – Basics of Air Conditioners

Unit 1.4 – Basics of Washing Machines

Unit 1.5 – Electronic Waste (e-waste) Management

Key Learning Outcomes

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

1. Define matter, its states and change in states
2. Explain properties of heat
3. Explain types of heat transfer and energy conservation
4. Explain the working of refrigerators
5. Explain the refrigeration cycle
6. Explain the working of air conditioners
7. Identify the AC comfort zone factors
8. Identify the types of AC and basic differences between them
9. Explain the working of washing machines
10. Explain the role of a field engineer for RACW
11. Explain about e-waste and e-waste management

UNIT 1.1: Basic Science Related to RACW

Unit Objectives

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

1. Define matter, its states and change in states
2. Explain properties of heat and types of heat, to show the conversion of temperature from one scale to other
3. Explain types of heat transfer and energy conservation

1.1.1 Matter and its States

The basic working of refrigeration and air conditioning (RAC) involves changes in states of liquids and gases over different temperature ranges. Therefore, to understand the concept of RAC, first it is important to understand the basics of matter, its states and changes in its states.

Matter is defined as anything that occupies space, has length, width, height and mass. The following image shows the definition of matter as explained in the preceding statement:

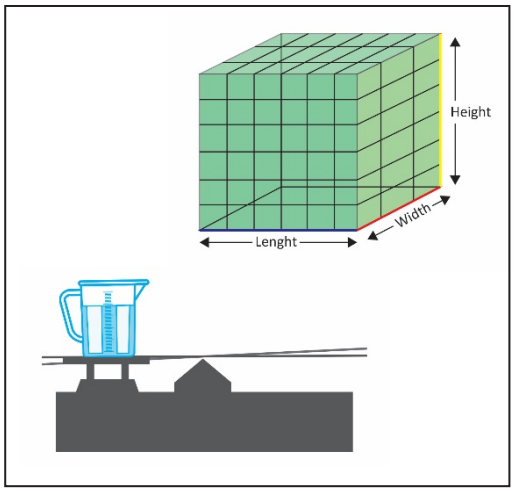


Fig 1.1.1: Definition of matter

Typically, matter is classified into three states as shown in the following figure:

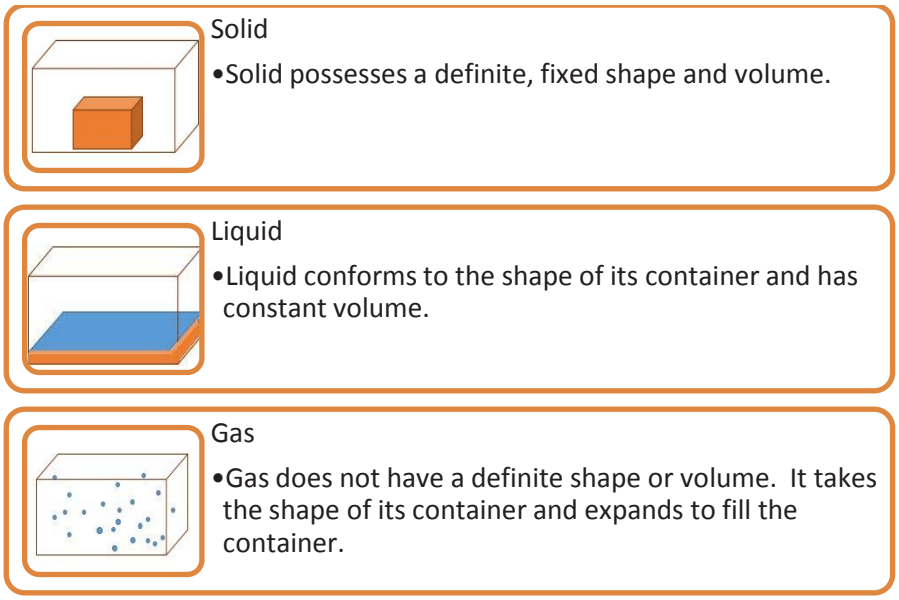


Fig. 1.1.2: States of matter

Change in States

When a state of matter is subjected to any kind of pressure or temperature change, the structure of matter and its property, change from one state to another. For example, water below zero degrees Celsius is in ice form which is solid and above 100 degrees Celsius is in steam form which is gaseous state.

The following image shows change in states as depicted in the above statement:

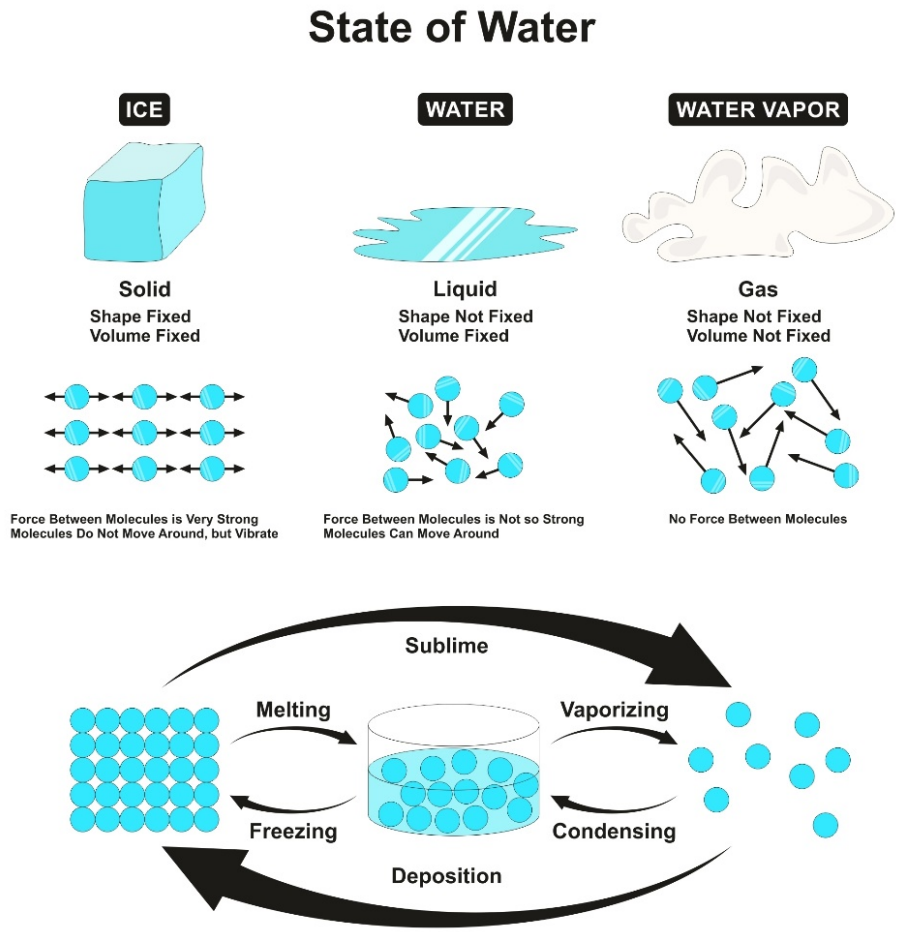


Fig 1.1.3: Change in states

The following figure defines the process of change in states based on temperature changes:

Melting	•The process in which there is a change in the state of a substance from solid to liquid, due to increase in temperature on application of heat or pressure, is known as melting.
Freezing	•The process in which there is a change in the state of a substance from liquid to solid, below the freezing temperature of the substance, is known as freezing.
Vaporisation	• The process in which there is a change in the state of a substance from liquid to gaseous (vapour), at temperatures below the boiling temperature at certain pressure, is known as vapourisation.
Condensation	• The process in which there is a change in the state of a substance from gaseous form to liquid form is known as condensation.
Sublimation	• The process in which there is a change in the state of a substance directly from solid form to gaseous form, without becoming a liquid, is known as sublimation.
Deposition	•The process in which there is a change in the state of a substance directly from gaseous form into solid form is known as deposition.

Fig. 1.1.4: Basic terms in change of states of matter

1.1.2 Heat and Transfer of Heat

Heat can be defined as a form of energy which is transmitted from a hotter object to a cooler one, as shown in the following image:

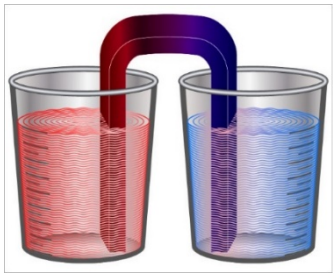


Fig. 1.1.5: Heat transfer

Temperature can be measured in terms of temperature using a thermometer. It is a measure of amount of heat (whether a substance is hot or cold). It is measured by a device known as thermometer. For measuring temperature, there are several scales and units. Most commonly used scales are the Celsius scale (denoted by °C), the Fahrenheit scale (denoted by °F) and the Kelvin scale (denoted by K).

Temperature Conversion

To convert temperature from one scale to another there are some basic standard formulae which are as shown in the following figure:

Fahrenheit scale to Celsius scale:

$$T\,(°C) = (T(°F) - 32) \times 5/9$$

Kelvin scale to Celsius scale:

$$T\,(°C) = T(K) - 273.15$$

Fig. 1.1.6: Basic standard formulae

Types of Heat

Heat can be classified into different types. The following figure shows the different types of heat:

Sensible heat

- It is the form of heat energy, which is commonly sensed by touch or measured directly with a thermometer.

Latent heat

- It is the form of heat energy, which cannot be sensed by touch or measured using a thermometer. It causes an object to change its phase.

Specific heat

- It is the ratio of the quantity of heat needed to increase the temperature of unit mass of a substance by one degree to the quantity of heat needed to increase the temperature of same mass of water by the same amount

Fig. 1.1.7: Types of heat

Latent heat which is involved while melting a solid or while freezing a liquid is known as the latent heat of fusion. Latent heat which is involved while vaporizing a liquid/solid or condensing a vapour is known as the latent heat of vaporization.

The unit for latent heat is joules or calories.

For example:

- When water is continuously boiling, the temperature stays at 100 °C until the entire amount of water evaporates. This happens because all the heat is transmitted to the liquid as latent heat of vaporization and is taken away by the vapour.
- When ice melts, the temperature stays at zero degrees C. The temperature of liquid water that results due to the latent heat of fusion is also zero degrees C.

Heat of vaporisation in a substance is in a very large amount. Hence, steam carries immense thermal energy that is released on its condensation. This quality makes water a suitable and desirable working fluid for heat engines.

Types of Heat Transfer

Heat transfer occurs in three ways, as shown in the following figure:

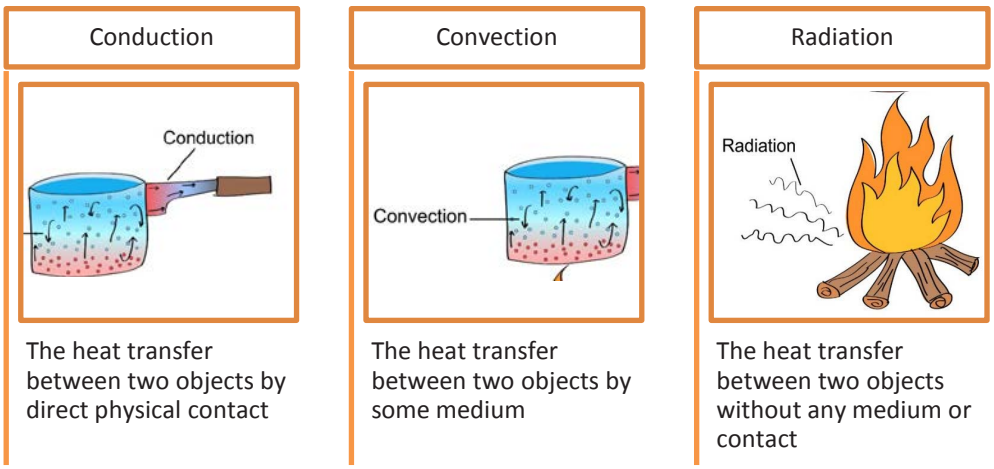


Fig.1.1.7: Types of heat transfer

1.1.3 Energy Conversion

The law of conservation of energy states that energy can be transformed from one form to another, but it cannot be created or destroyed. Energy is the capacity to perform any kind of action such as lifting or heating of an object.

Energy is used to provide heating, refrigeration, lighting or performing mechanical work.

UNIT 1.2: Basics of Refrigerators

Unit Objectives

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

1. Identify the need for refrigerators
2. Explain the working of refrigerators and basic components
3. Explain the refrigeration cycle

1.2.1 Refrigerator

A refrigerator is used to cool substances to a temperature below the temperature of the surrounding environment to preserve substances.

Refrigeration is a process of transferring the temperature from low to high temperature reservoir by removing heat which cools the substances inside the refrigerator. The following image shows a refrigerator

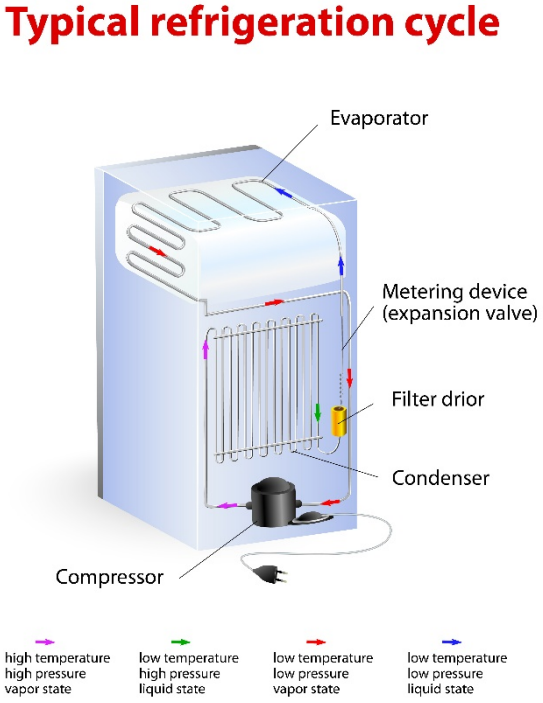


Fig. 1.2.1: A refrigerator

The basic principle of refrigeration is passing a liquid at low temperature continuously around an object which needs to be cooled, by taking the heat away from the object.

In refrigeration, the low temperature reduces the reproduction of bacteria and other microorganisms to reduce the spoilage rate. The temperature range for food storage is around three to five-degree C.

The technology utilizes a compartment that is thermally insulated and a heat pump which conveys the heat from the interior of the fridge to the exterior environment. It has four main components–compressor, condenser, capillary tube and evaporator.

1.2.2 Refrigeration Cycle

In the refrigeration cycle, the refrigerant liquid flows through the compressor to the condenser where the condenser fan liquefies the refrigerant. The drier then collects the refrigerant fluid and sends it to the evaporator. In the evaporator, the fluid then transfers the cooled fluid to the substance in the chamber. This continues through the suction and discharge line between the components to complete the refrigeration cycle. The following image shows a refrigeration cycle:

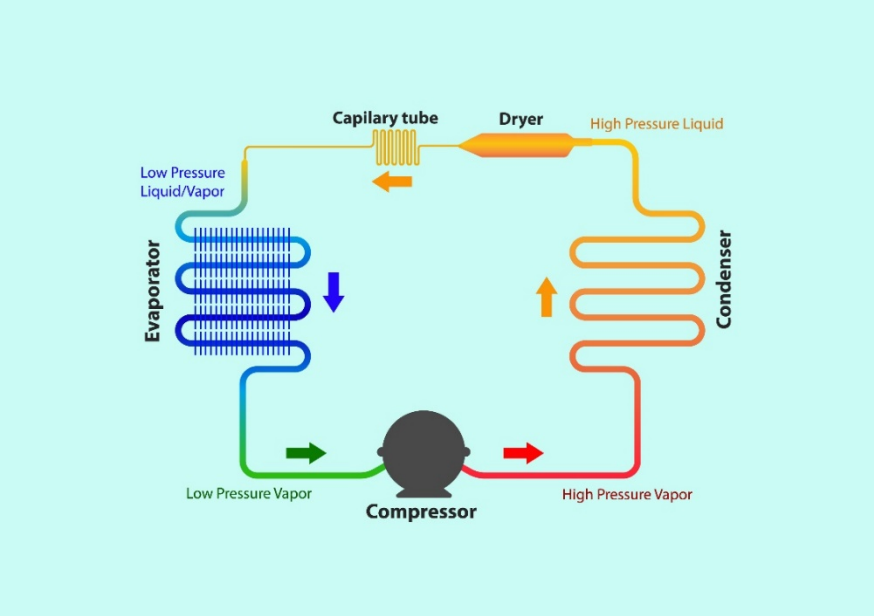


Fig. 1.2.2: A refrigeration cycle

1.2.3 Basic Components in a Refrigeration Cycle

The basic components in a refrigeration cycle are:

- Compressor
- Condenser
- Capillary Tube
- Evaporator

The following figure shows the basic components of a refrigeration cycle:

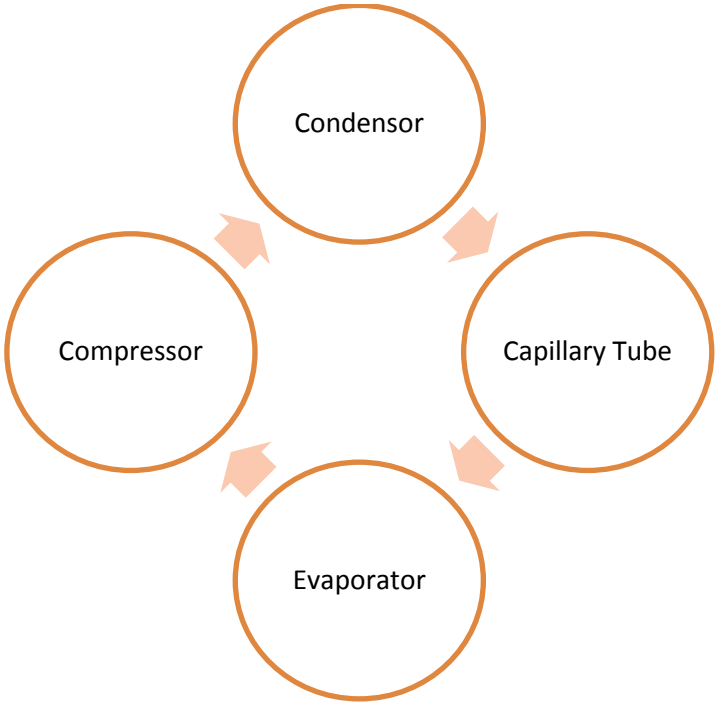


Fig. 1.2.3: Components of a refrigeration cycle

Compressor

The function of a compressor is to receive the refrigerant from the evaporator through a suction valve which is at low pressure and send it to the condenser through an exhaust valve which is at high pressure and temperature.

A compressor is utilized to increase the pressure of the refrigerant. The following image depicts a compressor:

Fig. 1.2.4: A compressor

Types of Compressors:

The following image shows different types of compressors:

Reciprocating Compressor | Rotary Compressor | Scroll type Compressor

Fig. 1.2.5: Types of Compressors

In household refrigerators, reciprocating type of compressor is used.

Working of a reciprocating compressor:

The following figure shows the steps of a reciprocating compressor:

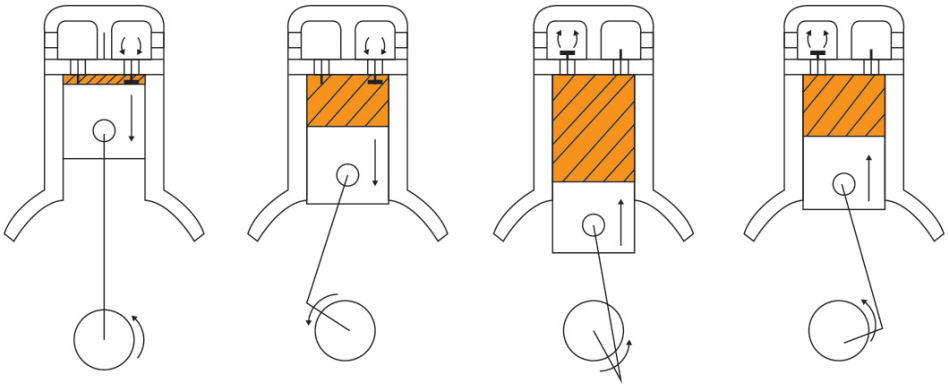


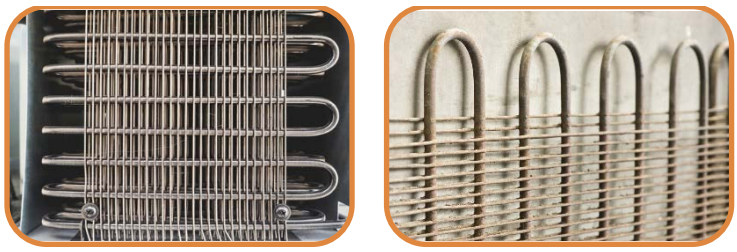
Fig. 1.2.6: Steps of a reciprocating compressor

Condenser

The condenser is also known as the heat exchange coil. The refrigerator is equipped with a condenser on the outside because the refrigerant temperature is more than the atmospheric temperature. So, the vapour is condensed to liquid state to get it at normal temperature.

The input of the condenser is the refrigerant from the compressor. This refrigerant is a vapour at a high pressure and a high temperature. The output of the condenser is the refrigerant at high-pressure and in a liquid form.

The following image shows types of condensers used in refrigerators:



Skin condenser Wire mesh condenser

Fig. 1.2.7: Types of condensers

Capillary Tubes

Capillary tubes are used as an expansion valve which restricts the flow of liquid to reduce the pressure. These tubes are about 2 m in length and have an inside diameter of 0.6 mm which allows considerable resistance to the flow. This causes a sudden drop in pressure and temperature.

The high-pressure refrigerant in the liquid form from the condenser is the input of the capillary tubes and a low pressure refrigerant in the liquid form to the evaporator is its output.

The following image shows a capillary tube:

Fig. 1.2.8: A capillary tube

Evaporator

Evaporator is used as a heat exchanger which carries the cold refrigerant over a body and the refrigerant absorbs the heat. The liquid refrigerant expands in the evaporator.

The low-pressure refrigerant in the liquid form from the capillary tube is the input of the evaporator and a low-pressure refrigerant in the vapour form to the compressor is its output.

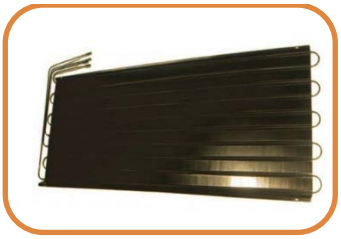
The following image shows an evaporator:

Fig. 1.2.9: An evaporator

The following image shows different types of evaporators:

Fin type evaporator

Roll bond evaporator



Tube plate evaporator

Fig. 1.2.10: Types of evaporators

UNIT 1.3: Basics of Air Conditioners

Unit Objectives

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

1. Explain the working of air conditioners (AC)
2. Identify the AC comfort zone factors
3. Identify the types of AC and basic differences between them

1.3.1 Air Conditioner

Air conditioners (AC) are used to attain a comfortable environment by cooling or dehumidifying rooms or any closed environment. As per the requirements of an individual, there are different types of ACs used in different conditions. The capacity of the AC is measured in tons.

There are some basic requirements for a comfort zone created by an AC.

- Fresh air supply with supply of oxygen and removal of carbon-dioxide.
- Heat removal and moisture removal.
- Sufficient air movement and air distribution in the space.
- Removing odour and dust.

Air conditioning controls the following three attributes of atmosphere in a closed environment:

Parameters	Winter	Summer
Temperature	230C~250C	190C~210C
Relative Humidity	50%~60%	35%~40%
Air movement	4.5~7.5	Air movement

Fig 1.3.1: Three attributes of atmosphere

Any heat generated from the space to the air conditioner is called “Load”.

Heat load depends on:

- Dimensions of the room
- Electrical equipment in the room
- Type of room
- Incident heat from wall/ceiling/door/windows
- Number of human beings
- Work performed by a human body

For the calculation of AC load comfort zone there are some basic parameters that need to be maintained by the AC. The following image shows the AC load calculation factors:

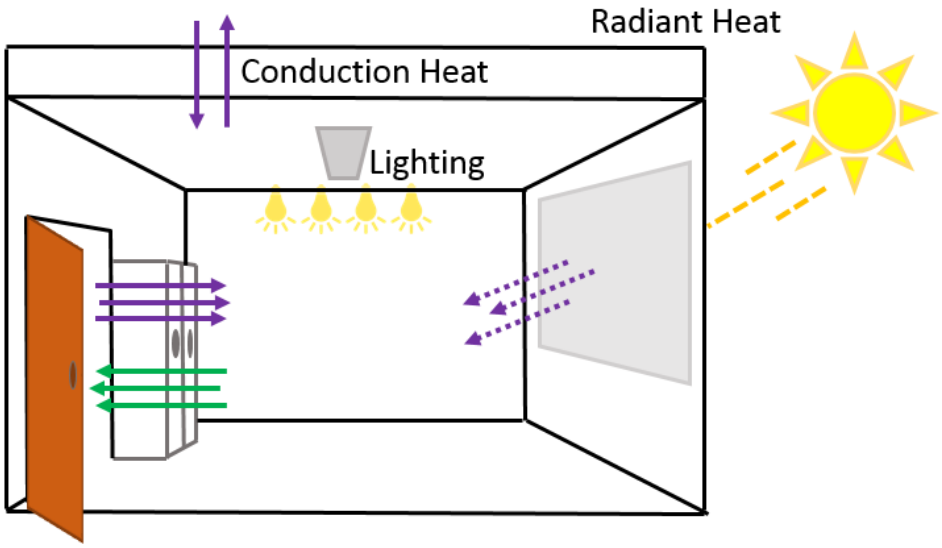


Fig. 1.3.2: AC load calculation factors

Working of Air Conditioners

Air conditioner uses a fan which distributes the conditioned air to help maintain a thermally comfortable and improved air quality environment. The AC works on the principle of refrigeration cycle.

1.3.2 Types of AC

There are different types of ACs available and the AC system used depends upon factors such as the dimension of the area which needs to be cooled, heat generated in the area and so on. So, it is on the technician to calculate and understand the load capacity and select an AC system appropriate for the area.

Window AC

Window AC is a unitary air conditioning system which is most commonly used for a medium sized single room. In this type of AC all the basic components of an AC system like condenser, compressor, evaporator, cooling coil etc. are installed in a single compartment. As the name suggests, this type of AC can be installed or fitted in a window slot provided in a room's wall.

The following image shows a window AC:

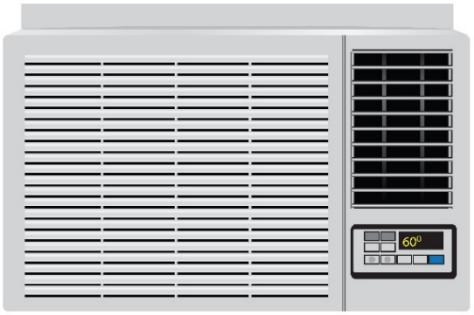


Fig. 1.3.3: A window AC

Split or Ductless AC

Split or ductless AC is a split AC system which is used in hotels and apartments. They are made up of an indoor and an outdoor unit. The indoor unit contains the evaporator and the cooling fan and the outdoor unit contains the compressor, expansion valve and a condenser. This type of AC gives convenience where there is no slot present in the room or the wall. These types of ACs take more space than window AC. The following image shows a split AC:

Fig. 1.3.4: A split or ductless AC

Portable AC

Portable AC is a unitary type AC system. It is an AC system which can be placed anywhere on the floor of a room. It uses a hose vent to discharge the exhaust heat through the exterior wall of the room. The following image shows a portable AC:

Fig. 1.3.5: A portable AC

Central Air Conditioning

Central AC system is used in large areas such as halls, factories, hotels and big spaces. It saves the cost of installation of individual AC units which is expensive and helps maintain an environment with similar conditions.

In a central AC system, large compressors are used. A condensing unit is placed outside the building or the room which includes a compressor, a condensing fan and a condenser coil. Another unit which is the evaporative unit is placed in a central location and different locations are air conditioned by using a ductwork. The following image shows a central AC system:

Fig. 1.3.6: A central AC system

The following table shows the comparison among window AC, split AC and cassette AC:

AC Parameter	Window AC	Split AC	Cassette AC
Suitability	Small rooms having a window sill	Any room with no mandatory requirement of a window	Extensive indoor spaces
Noise production	On the higher side	Very less	Silent
Capacity	Ranges from 0.75 Ton to 2 Ton	Ranges from 0.8 Ton to 2 Ton	Ranges from 1 Ton to 4 Ton
Advanced Features	Possesses features such as humidity control, dust filter	Possesses features such as humidity control, dust control, bacteria control	Possesses features such as humidity control, dust control, bacteria control
Interference with home decor	Slight chances of interference with the curtains on the windows and drapes	Designer indoor units match nicely with the wall décor	Minimal interference with the interior décor
Ease of Installation	Requires very less effort	Indoor and outdoor units require a little amount of effort	Requires special false ceiling

Fig. 1.3.7: AC parameters

UNIT 1.4: Basics of Washing Machines

Unit Objectives

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

1. Identify types of washing machines
2. Explain the basic working of a washing machine

1.4.1 Washing Machines

A washing machine is a machine which is used to perform all the laundry work such as soaking, washing, rinsing and drying clothes. The machine uses electrical energy which is supplied to the motor and the motor thus performs the mechanical work of spinning. In the spinning compartment water, soap and clothes are put. Due to constant spinning in different directions the clothes are cleaned. The machine can perform all the laundry functions and are available in various types and models as per the use of any individual. The following image shows a washing machine:

Fig. 1.4.1: A washing machines

The Washing Cycle

The complete process of washing of laundry including soaking, washing, rinsing and drying is known as a wash cycle of a washing machine. The following figure shows the components of a spinning cycle of a washing machine:

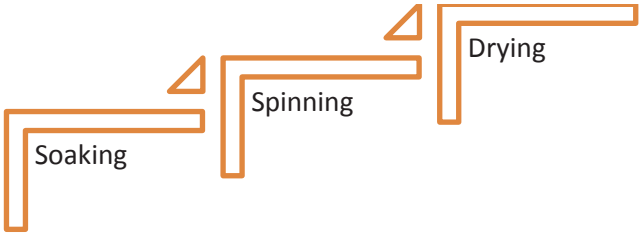


Fig. 1.4.2: Components of a spinning cycle of a washing machine

1.4.2 Working of Washing Machine

The washing machine contains several parts which work together to complete the washing of the laundry. The following image shows the components of a washing machine:

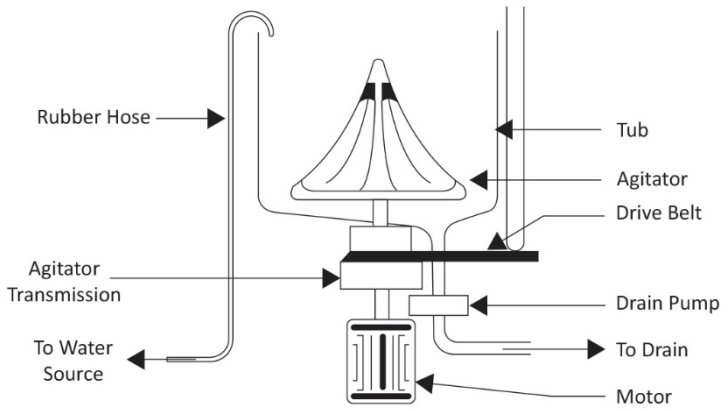


Fig. 1.4.3: Components of a washing machine

The detailed working of components of a washing machine is as follows:

- Tub or drum: It consist of basically two drums an inner drum and an outer drum. The outer drum is the bigger drum which we cannot see. It holds the water in it and remains stationary whereas the inner drum or tub is the one in which the clothes are loaded. It consists of small holes and paddles around the edges to slosh the cloths. The drum can be mounted vertically or horizontally as per the machine type.
- Agitator: In a top loading washing machine, mostly a paddle in the middle of the drum rotates to turn the clothes around in the water instead of an inner drum (which is mostly used in front loaded washing machines). This is called as an agitator.
- Motor: Motor is used to provide the rotatory motion to the drum or agitator of the washing machine.
- Drive belt: Drive belt is used to transfer the motion from the motor to the drive shaft of the tub.
- Inlet and outlet ports: Motorised pumps are used to fill water in the tub, through the inlet port located at the top of the machine up to a safe limit. There is an outlet port which removes the dirty water after the completion of a wash cycle. The outlet port also opens if the water is filled in the tub above the safe limit.

1.4.3 Types of Washing Machines

There are basically two types of washing machines, categorised on the basis of loading of the laundry in the machine.

Top loading washing machines

This type of design for washing machine allows the user to place the laundry in a vertically mounted perforated basket which is in a tub filled with water with an agitator in the centre. When the laundry is loaded from the top the motor on the bottom rotates the basket in circular motion. The shape is designed such that the clothes hit the wall of the basket and then fall in the middle of the basket. Due to this constant turbulent movement, the clothes are washed. The following image shows a top loading washing machine:

Fig. 1.4.4: A top loading washing machine

Front loading Washing Machines

In the case of a front-loading washing machine (also known as horizontal axis washer) the laundry is loaded in the machine from the front of the machine and the container is placed in a horizontal position.

The horizontally installed washer motion helps the fabric to be soaked in only as much water as is needed to moisten the fabric. This helps in less usage of water and detergent as well as good washing of clothes. The following image shows a front-loading washing machine:

Fig. 1.4.5: A front loading washing machine

UNIT 1.5: Electronic Waste (e-waste) Management

Unit Objectives

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

1. Explain about electronic waste (e-waste)
2. Identify the properties of e-waste
3. Identify the methods of e-waste management
4. Explain the role of field engineer for RACW
5. Identify the importance of work

1.5.1 Electronic Waste (E-waste)

Electronic waste also called as e-waste is the electrical/electronic waste. Used electronic devices or their part which cannot be resold, recycled or disposed comes under e-waste. This kind of waste can be harmful for the environment and living organisms. Some examples of e-waste are shown in the following images:

Fig 1.5.1: Electronic waste (e-waste)

Some of the examples of e-waste are:

- Copper or other metal parts from the refrigerator/AC
- Housing of electrical components
- Electrical wires
- Chips of electronic circuits

Effects from E waste:

- Air pollution: The burning of waste and chemical reaction due to contact of different electrical components or their decomposition produces harmful gases in the air.
- Land pollution: E-waste dumped in the soil makes the soil infertile and also reacts with the natural nutrients of the soil to make it poisonous.
- Water pollution: The chemicals in e-waste react with water to create chemicals which poison the water.

1.5.2 E-waste Management

Electronic waste management includes all the actions which are performed to manage the e-waste from its origin to its final disposal. Basically, it includes collection, transportation, treatment and disposal of e-waste. It also includes monitoring of the waste and

regulations to control its management. It also includes legal and regulatory framework that are related to the waste management for e- waste recycling.

Basic steps included in e-waste management to be performed by the field engineer are:

- Identification of e-waste:
  The field engineer should be able to identify the items which cannot be used again and then properly discard the waste safely.
- Handling the waste:
  The field engineer should be able to handle the waste properly without affecting the environment or any living organism.
- Recycling the waste:
  E-waste such as old metallic tubes and electric housing components which can be reused in another place can be sold to recyclers by the field engineer for the recycling process.

1.5.3 Role of a Field Engineer

Field engineers are the front-line executives who are directly in contact with the customer. They must be present in the field, on the location to carry out any kind of servicing or installation. It is important to understand the technical features of RACW as per the latest market trends. The field engineer should also be able to interact with the customer, colleague or supervisor effectively to resolve the issues quickly and take actions to get 100% productivity from the work.

Some basic responsibilities of a field engineer for RACW are:

1. The individual at work is responsible for installation of various appliances at customer's premises.
2. Responsible for identifying and rectifying faults in various appliances of the customer.
3. The individual attends to the machine in the field and tries to solve the issues at the site only.
4. The job requires the individual to have attention to details, ability to listen, patience, steady hands, logical thinking and customer orientation.
5. The individual must work on the desk with different types of equipment used for testing and repairs.

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2. Basics of Electricity and Electronics

Unit 2.1 – Basics of Electric Circuits

Unit 2.2 – Components of Electric Circuits

Unit 2.3 – Inverter Technology

Unit 2.4 – Units of Measurement in RACW

Key Learning Outcomes

At the end of this module, 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. Describe the active components
7. Describe the passive components
8. List electromagnetic components
9. List the basic functions of inverters
10. Identify the advantages of inverters
11. Explain the controller functions

UNIT 2.1: Basics of Electric Circuits

Unit Objectives

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

1. Describe electric circuits
2. Define 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

2.1.1 Electric Circuits

An electric circuit 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 2.1.1: Electric circuit constituents

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

Closed Path

Open Path

Fig 2.1.2: 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:

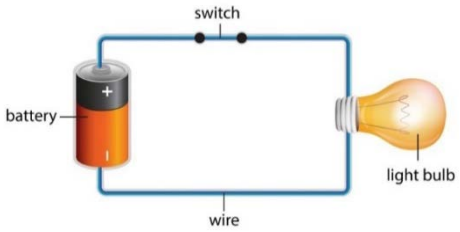

Fig 2.1.3: An electric circuit

2.1.2 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 one 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 in a series circuit causes the whole circuit to stop functioning which then needs to be replaced. The following image represents a series circuit:

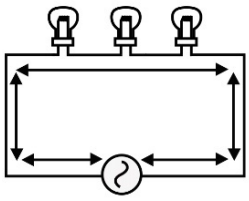

Fig 2.1.4: A series circuit

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:

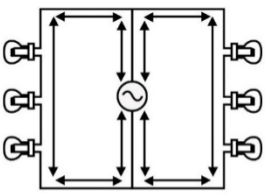

Fig 2.1.5: A parallel circuit

2.1.3 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 a wrong connection in a circuit may cause 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)

Fig 2.1.6: Units of current

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:

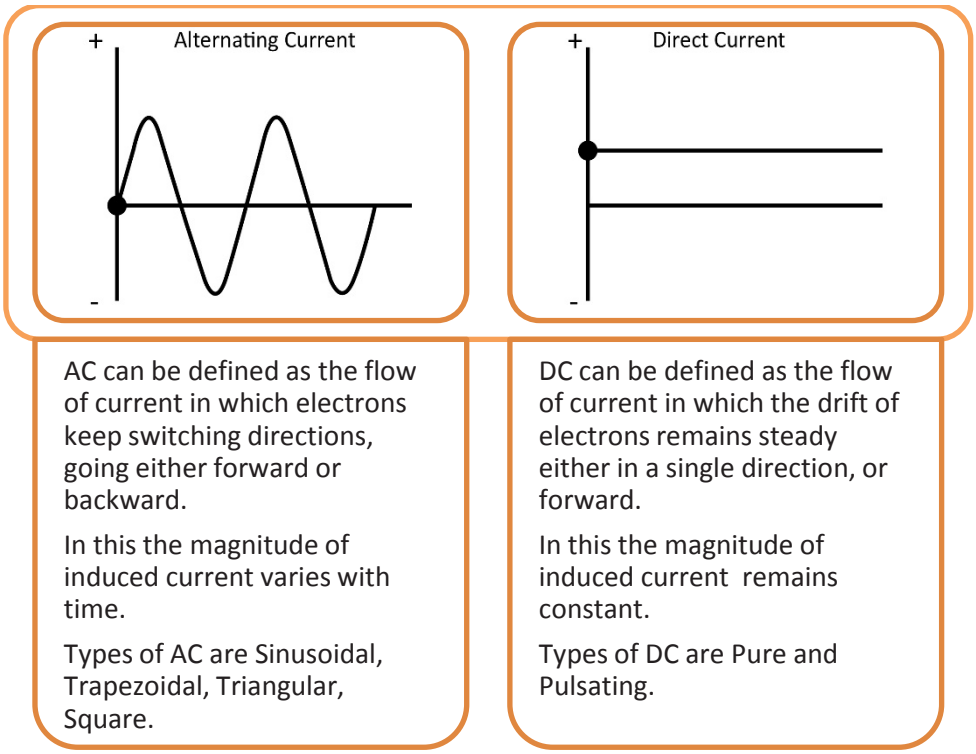

Fig 2.1.6: Difference between AC and DC current

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 Ohm's law, 1Ω resistance allows 1A of current to flow from one point to the other with a 1V voltage difference.

2.1.4 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 2.1.7: A simple electric circuit

2.1.5 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 usage is determined.

UNIT 2.2: Components of an Electric Circuit

Unit Objectives

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

1. Describe the active and passive components
2. List electromagnetic components

A circuit consists 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:

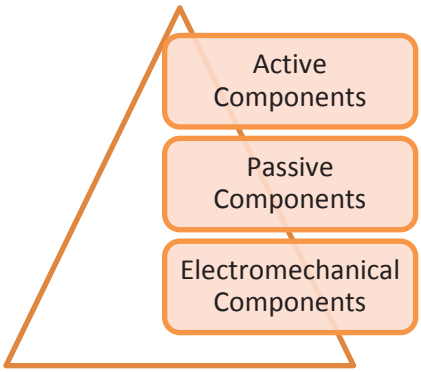

Fig. 2.2.1: Circuit elements

2.2.1 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:

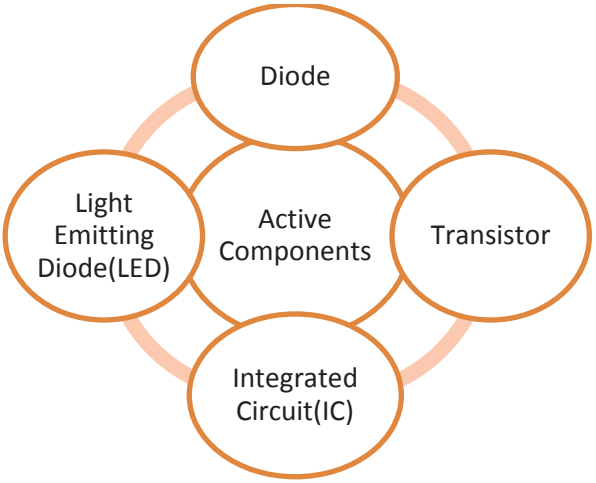

Fig. 2.2.2: Active components

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 refrigerators, air conditioners and washing machines have this component. The following image shows diodes:

Fig. 2.2.3: Diodes

Transistor

A transistor is an electronic device, made up of a semiconductor material. Usually, it consists of 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 refrigerators, air conditioners and washing machines have this component.

The following image shows a transistor:

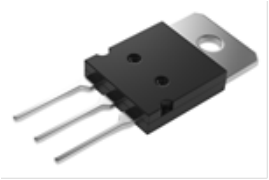

Fig. 2.2.4: A transistor

IC

An IC, also known as a microchip, is a semiconductor wafer on which a number of small resistors, capacitors and transistors are fabricated. It can work as an oscillator, an amplifier, a timer, a counter, a microprocessor or as computer memory. Appliances such as refrigerators, air conditioners and washing machines have this component. The following image shows an integrated circuit:

Fig. 2.2.5: An integrated Circuit (IC)

LED

An LED is made of a p-n junction diode which releases light when it is activated. It is a two-lead semiconductor source of light. Energy is released as photons when a suitable voltage is applied to the leads. Appliances such as refrigerators, air conditioners and washing machines have this component. The following image shows an LED:

Fig. 2.2.6: An LED

2.2.2 Passive Components

Passive components are those components which can perform their specific functions without any power source. These components are incapable of controlling current.

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

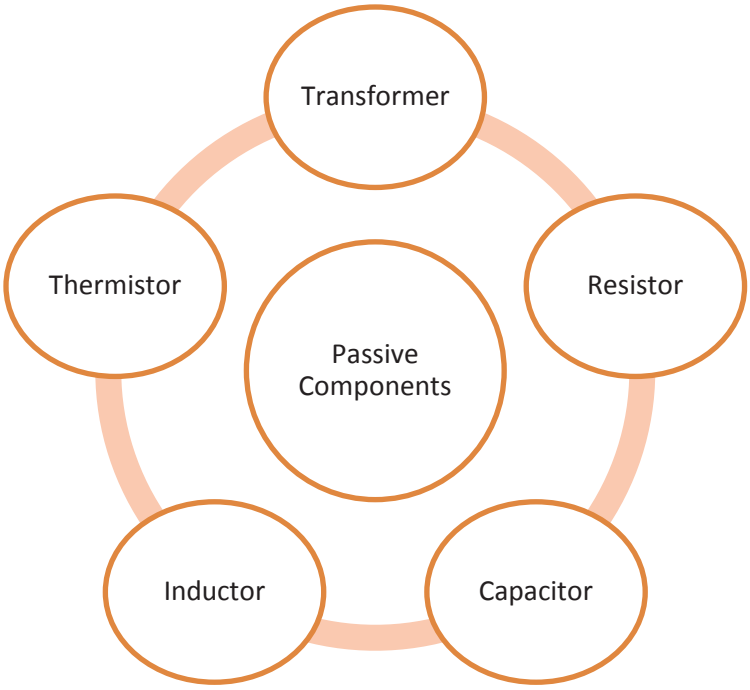

Fig. 2.2.7: Passive components

Transformer

A transformer consists of a metal core with coils of wire around it. It is a device used to convert alternating current (AC) to the required values by decreasing or increasing the alternating voltages in an electronic or electric system. Appliances such as refrigerators, air conditioners and washing machines have this component.

The following image shows a transformer:

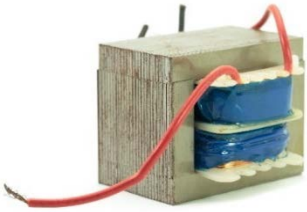

Fig. 2.2.8: A transformer

Resistor

A resistor is a component in an electronic circuit which is built to resist or limit the flow of current in that circuit. It may be a small carbon device or big wire-wound power resistor. Its size varies in length from 5mm up to 300mm. Appliances such as refrigerators, air conditioners and washing machines have this component.

The following image shows resistors:

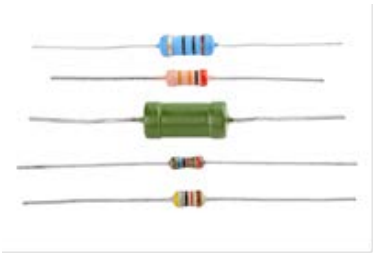

Fig. 2.2.9: Resistors

Capacitor

A capacitor is a device which is made up of one or more pairs of conductors and an insulator separating them. It is used to store electric charge. Appliances such as refrigerators, air conditioners and washing machines have this component. The following image shows capacitors:

Fig. 2.2.10: Capacitors

Inductor

An inductor consists of a coil or a wire loop. This component is used to store energy in the form of a magnetic field. The more the turns in the coil, the more will be the inductance. Appliances such as refrigerators, air conditioners and washing machines have this component.

The following image shows inductors:

Fig. 2.2.11: Inductor

Thermistor

A thermistor is a kind of resistor which is more sensitive to temperature as compared to other resistors. It is extensively used as an inrush current limiter, temperature sensor, self-regulating heating element and self-resetting overcurrent protector.

Appliances such as washing machines have this component. The following image shows a thermistor:

Fig. 2.2.12: A thermistor

2.2.3 Electromechanical Components

Electromechanical components convert electric energy into mechanical energy (mechanical movement) or vice versa for carrying out electric operations. The following figure lists various electromechanical components:

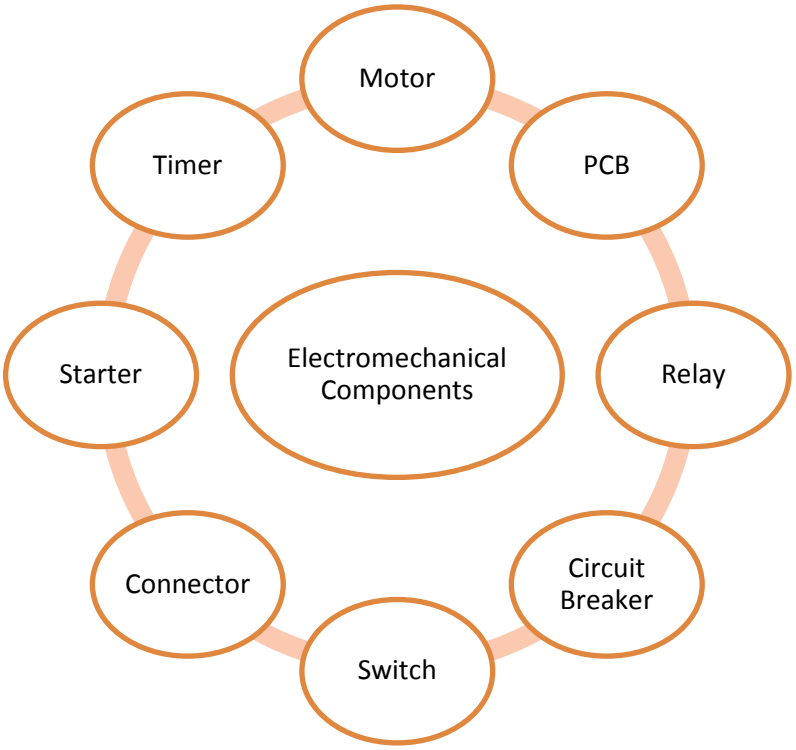

Fig. 2.2.13: Electromechanical components

Motor

A motor is an electrical component which is used to transform electrical energy into mechanical energy to produce linear or rotary force. Unlike magnetic solenoids, they generate usable mechanical powers.

In a normal motoring mode, force is generated inside the motor through the interaction between its winding currents and magnetic field. Appliances such as refrigerators, air conditioners and washing machines have this component. The following image shows the motor used in a mixer grinder:

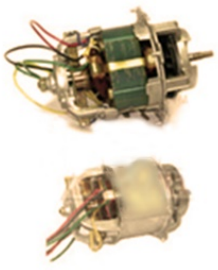

Fig. 2.2.14: Amixer grinder motor

Types of motors are:

1. Capacitor start motor
2. Relay start motor

Capacitor Start Motor

In a capacitor start motor, the capacitor is connected in series with the starter winding, which causes current in starter winding. When the motor reaches 75% of the rated speed, the capacitor and the starter winding is disconnected by a switch.

A capacitor start motor is used in air conditioners and washing machines. The following image shows a circuit diagram of a capacitor start motor:

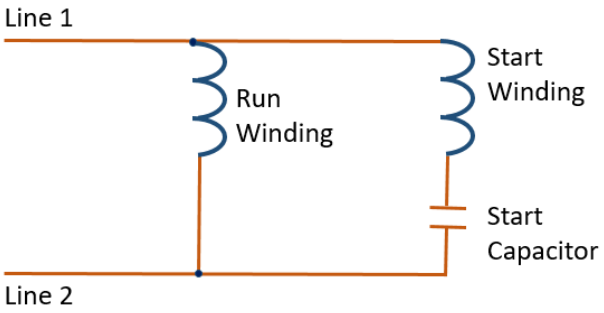

Fig. 2.2.15: Circuit diagram of capacitor start motor

Relay Start Motor

In a relay start motor a relay is connected between the starter and run winding, which causes current in starter winding. Then the resistance of motor increases with current, which cuts the start winding then the motor works only on run winding.

Relay start motor is used in refrigerators. The following image shows a circuit diagram of a relay start motor:

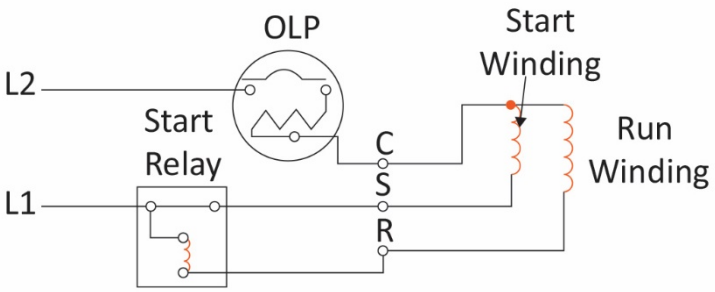

Fig. 2.2.16: Circuit diagram of relay start motor

Printed Circuit Board (PCB)

A PCB acts as a base for the components that are mounted on its surface and are interconnected with wires, conductive tracks and so on. The components are generally soldered on the circuit board according to the specified design. Appliances such as

refrigerators, air conditioners and washing machines have this component. The following image shows a PCB:

Fig. 2.2.15: A PCB

Connector

A connector is a device which is used to join two circuits together. The connector may be a port, a plug, a cable connector and so on. All appliances have this either in the form of a cable connector or a plug, as shown in the following image:

Fig. 2.2.16: Plug

Switch

A switch is a component used to make or break connections in an electrical circuit. A switch is used to divert the current from one conductor to another. It can be operated manually to control a circuit such as a light switch or can be operated by a moving object. It is made to control a wide range of currents and voltages.

The following image shows a typical switch used in small appliances such as refrigerators, air conditioners and washing machines:

Fig. 2.2.17: A rotary switch

Relay

A relay is a switch that controls an electrical circuit by opening and closing contacts in another circuit, electromechanically or electronically. In electromechanical relays, the opening and closing of contacts is done by a magnetic force. The electromechanical relays are operated by an electromagnet which is a coil of wire wrapped round an iron core. In solid state relays, the switching is electronic as there are no contacts. Appliances such as

refrigerators, air conditioners and washing machines have this component. The following image shows both the relays:

Fig. 2.2.18: Solid state relay and electromagnetic relay

Circuit Breaker

A circuit breaker is a requisite component of an electrical power system required for its control and protection. It is a switching device which can be operated manually as well as automatically. Its main function is to shield an electric circuit from harm caused by overload or short circuit. It interrupts the current flow when protective relays find out a fault. Appliances such as refrigerators, air conditioners and washing machines have this component. The following image shows a circuit breaker:

Fig. 2.2.19: A circuit breaker

Starter

A starter is a device that is used to start, stop, reverse and protect a motor. It controls the supply of electric power to the motor. It has two important parts, contactors and overload protection. Appliances such as air conditioners and washing machines have this component. The following image shows a starter:

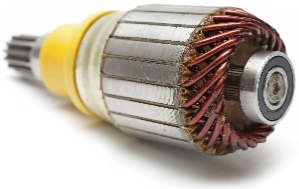

Fig. 2.2.20: A starter

Timer

A timer, also known as a time switch, is a special type of clock that measures time intervals. It operates a switch that is controlled using a timing device. A timer may be built into a power circuit such as a water heater timer. It may also be built into the equipment such as a timer that turns on/off washing machine after a set period.

Even air conditioners have timers that turn it off after a set period. In case of refrigerators, there is a defrost timer that turns on after a set period of 15 to 30 minutes to melt the frost from the evaporator coil.

The following image shows some appliances that have a timer:

Fig. 2.2.21: A timer

UNIT 2.3: Inverter Technology

Unit Objectives

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

1. List the basic functions of inverters
2. Identify the advantages of inverters
3. Explain the controller functions

2.3.1 Inverter

The inverter technology is used to control the motor speed of the compressor. A DC inverter has an adjustable electrical inverter with variable frequency drive which helps control the speed of the electromotor. This drive converts the input AC current flow to DC and then the current is modulated to a desired frequency. This helps improve the efficiency of the appliances and the life of the compressor. It also reduces the noise produced by the appliances.

The following figure shows the basic workflow of an inverter in an AC:

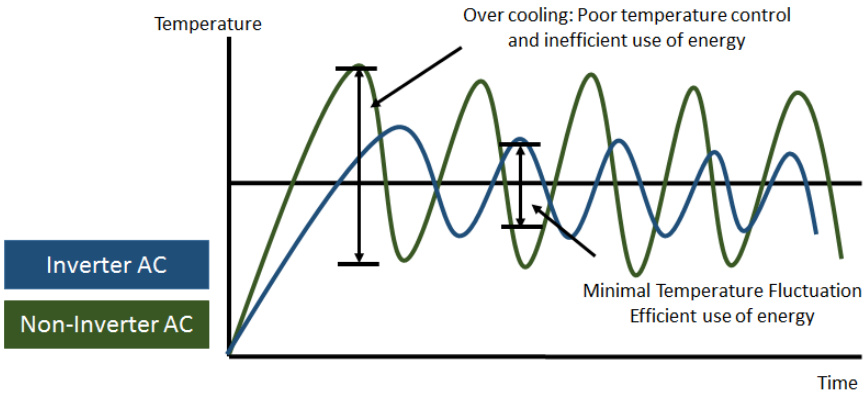

Fig. 2.3.1: Basic workflow of an inverter in an AC

The inverter's main functions are listed in the following figure:

- Converting DC electricity into AC
- Wave shaping of the produced AC electricity
- Regulation of the value effectiveness of the produced voltage

Fig. 2.3.2: Basic functions of an inverter

2.3.2 Advantages of Inverters

The following table shows advantages of inverter-based appliances over non-inverter-based appliances:

Item	Non-Inverter	Inverter
Time to reach pre-set temperature	Relatively long due to fixed capacity	Short because of increased capacity
Fluctuations after reach pre-set temperature	Major fluctuations due to start/stop operations	Minor fluctuations due to load adaptable operations
Sudden current flow when the compressor started	5-6 times rated value	1.5 times rated value due to gradual increase at the start
Low temperature range during heating	Decrease in capacity	Decrease in capacity compensated by increased rotational speed
Defrosting time	Relatively long due to fixed capacity	Short due to maximum capacity operations
Unit composition	Relatively simple	Extra parts required
Trouble diagnosis	Relatively easy	Complicated

Fig. 2.3.3: Advantages of inverter-based application

2.3.3 Controllers

Refrigerators, air conditioners and washing machines all require a control system to regulate the heating, cooling and air conditioning operations. A sensing device compares the actual state like the current temperature and pressure with the target state. Then it is the function of the control system to take action to start or stop the functioning of components like compressor, condenser etc. The following image shows an AC controller:

Fig. 2.3.4: An AC Controller

There are different types of controllers as shown in the given figure:

Compressor On/OFF Controller	•It starts working as per the set temperature and the ambient temperature status. •While cooling, the compressor is turned ON when the ambient temperature is higher than the set temperature and when the temperature drops below the dead band temperature.
Compressor AC/DC Inverter Controller	•This type of controller has better control as the compressor in this does not turn OFF completely. •In it the frequency of the compressor rotation varies as per the load. •This type of controller is more energy efficient and ecofriendly. •For cooling function a setting of 24 °C and in heating function a setting of 28 °C is considered as a good energy saving setting.
Fan Controller	•The fan controller enables us to put the fan is Low, Medium, High or Auto mode. •The Auto mode works by determining the room temperature and set temperature.
Timer Controller	•It is a clock based controller which turns the system ON/OFF as per the settings. •To make the user set the time to enable working of the systems. •In air conditioning, customer can set the AC to switch ON or OFF for a set time. • In washing machine systems user can set the spin period and drying period by using timer control.
Ionizer Controller	•It is located in the indoor unit and has a module of high voltage electronic setting that ionizes the air with negative ions. •This helps remove dust and contaminants from the surrounding air

Fig 2.3.5: Type of controllers

2.3.4 Four Way Valves

A four-way valve is an electro mechanical valve which is used to reverse the refrigerant flow of direction by using an electrical magnet. This is basically a heat pump reversing valve present in air conditioners and refrigerators. The heat pump is made up of four valves (A, B, C, D). The working of four-way valves involves two modes – heating and cooling mode.

Cooling Mode

Tube A is connected to the compressor discharge port which is at high pressure. Tube B is connected to the return valve return port of the compressor which is at low pressure. Thus, A has high pressure refrigerant and B has low pressure refrigerant.

The heat pump pushes the valve and allows the refrigerant at high pressure from tube A to tube D to outer coil, which drops the pressure of the metering device. Then the inner coil cools the area (inside of a house) and then comes back into tube C. The following image shows the working of a four-way valve in cooling mode.

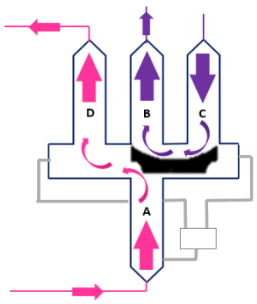

Fig. 2.3.6.: A four-way valve in cooling mode

Heating Mode

In the heating mode the refrigerant at high pressure goes from tube A to tube C which enables the refrigerant to flow in the inner coil to heat the inner area (inside of the house). This provides heat in the inner area. Then the pressure drops as the refrigerant goes through a metering device which lowers the pressure and it comes back into tube D.

Then the slider enables the refrigerant at low pressure to go from tube D to tube B and come back to the compressor to repeat the cycle. The following image shows a four-way valve in the heating mode

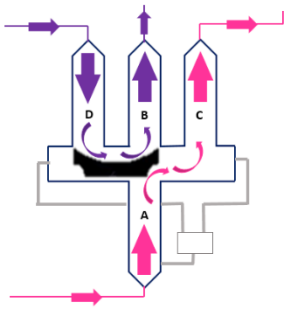

Fig. 2.3.7.: A four-way valve in heating mode

UNIT 2.4: Units of Measurement in RACW

Unit Objectives

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

1. Identify the standard units
2. List the conversion of BTU into other units
3. Explain efficiency and ratings of refrigeration and air conditioning

2.4.1 British thermal unit (BTU)

BTU or Btu (British thermal unit) is a traditional unit used in heat measurement. The BTU can be defined as the amount of heat which is required to raise the temperature of one pound of water by one-degree Fahrenheit. In metric system this unit is Calorie which can be defined as the amount of heat required to raise the temperature of one gram of water by one degree Celsius.

Heat is considered equivalent to energy.

1 BTU = 1055 joules

Conversions

One BTU is approximately equal to all these units as shown in the following figure:

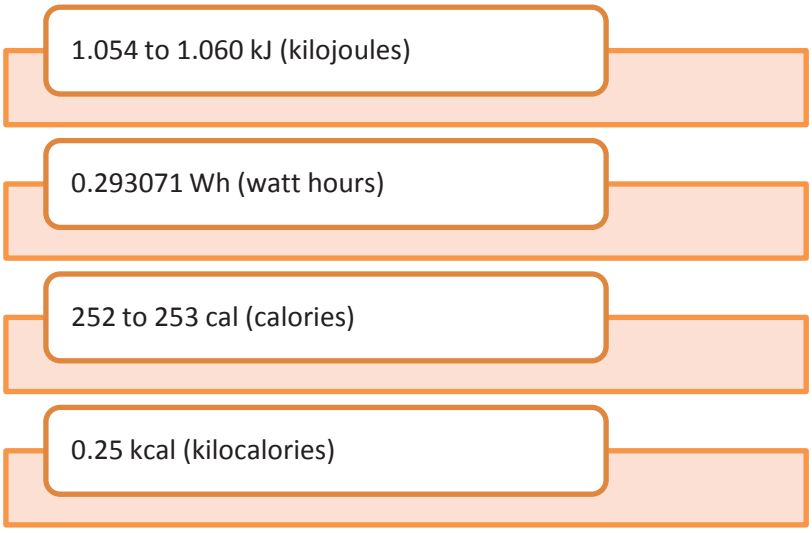

Fig. 2.4.1.: Conversion of BTU

2.4.2 Tons of Refrigeration and Rating

TR (Ton of refrigeration) is a unit of power which is used to explain the heat extraction of a refrigerator or an air conditioning system.

Ton of refrigeration can be defined as the rate of transfer of heat which causes the melting of one ton (907 kg) of pure ice which is at 0°C (32 °F) in a time period of 24 hours.

Refrigeration ton is equal to 12,000 BTU/hour or 3.5 kW.

The performance of refrigerators and air conditioners are specified by its capacity in BTU/h.

EER (Energy Efficiency Ratio)

The EER (Energy Efficiency Rating) is a score rating for the appliance used to measure their capacity and efficiency. It can be calculated by the ratio of cooling capacity to power consumption.

Higher EER means better efficiency

Calculated EER of 1TR

Cooling capacity = 3,514 W

Power consumption = 1,500 W

EER = 3,514/1,500 = 2.34

BEE standards

BEE (Bureau of Energy Efficiency) star rating system is based on EER. It is ranged from 0 to six. The higher the number of stars, better the efficiency of the appliance. This rating is mandatory as per the ACT to be followed by all the manufacturers. The following is the table which shows the EER ratings as per the BEE standards star rating band.

EER (W/W)		
Star Rating Min Max	**Star Rating Min Max**	**Star Rating Min Max**
1 Star *	2.70	2.89
2 Star **	2.90	3.09
3 Star ***	3.10	3.29
4 Star ****	3.30	3.49
5 Star *****	3.50	

Fig. 2.4.2.: EER ratings

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3. Tools and Equipment Handling

Unit 3.1 – Identify the Use of Tools and Equipment

Unit 3.2 – Safety and Maintenance of Tools

Key Learning Outcomes

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

1. List the different types of tools used for installing appliances
2. Identify the correct methods of using tools
3. Maintain and handle tools properly
4. Identify the safety methods to be followed while handling tools

UNIT 3.1: Identify the Use of Tools and Equipment

Unit Objectives

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

1. Identify the types of tools used for installation
2. Identify the equipment used in installation of appliances

3.1.1 Introduction to Tools

Tools are non-consumable items that can be used in installing or servicing electronic appliances. Tightening of bolts, stripping wires and measuring angles and length can be easily done with the help of specific tools.

Hand tools are the tools which are operated easily to perform tasks by using power and grip of hand. Some examples of hand tools are screw driver, hammer, measuring tape, wrenches and so on.

Tools are essential for a field technician as it helps the technician to complete the task of installing appliances easily with less effort.

The following is an image of basic tools used in installation of appliances:

Fig. 3.1.1: Tools used in appliance installation

3.1.2 Basic Tools

The following tools are used for basic installation and servicing of appliances:

1. **Detachable small handle screwdriver**: A screw driver which can be used from either end. One end has a '+' shape for '+' shaped screws and other end for '-' shaped screws.
2. **Detachable long handle screw driver:** A similar kind of screw driver with long stem. This also can be used from either end. One end has a plus '+' shape for '+' shaped screws and other end for minus'-' shaped screws.
3. **Slim line slot head screw driver:** Used where we cannot reach with our hands or even fingers. It has a long and thin stem and has a minus'-' shape.

4. **Round screw driver:** Used to screw and un-screw the minus '-', plus '+', star '*', hexagonal or any other type of screws. It has a magnetic front socTat which can hold bits of various shapes.
5. **Bit pad:** A pad with eight-ten bits of varied shapes to use with round screw driver.
6. **Extension bit/rod:** A component that is attached to the front of the round screw driver to increase its length. Once attached, it increases the reach of the screw driver by an inch to three-four inches. The following is an image of a screw driver set:

Fig. 3.1.2: A screw driver set with bits

7. **Tester**: It is used to check the presence of electric current in various sockets and wires during installation process. The following is an image of a tester:

Fig. 3.1.3: A tester

8. **Double ended round spanner:** A round spanner that can be used at either end. Each end has a different size. Generally, a set of spanner has a combination of sizes 10-11mm, 12-13 mm or 13-14mm.
9. **Simple spanner:** A normal spanner (wrench) which can be used at either end. These are also two in number. One is a combination of 10-11mm and other being a combination of 12-13mm and 14-15mm. The following is an image of spanner set:

Fig. 3.1.4: Spanner with wrench heads

10. **Adjustable wrench:** It is a spanner that can be adjusted as per the head size of a nut/bolt. It is helpful in situations where the installation engineer encounters a head which is either bigger or smaller than the limited sized spanner they otherwise carry along with them.

11. **Measuring tape:** It is a self-retracting pocket tape measure which is used to measure wall thickness and other measurements while carrying out installation. The following is an image of a measuring tape:

Fig. 3.1.5: A measuring tape

12. **Spirit level meter:** It is an ideal tool for precise determination of horizontals, inclines and angles of surface. The following is an image of a spirit level meter:

Fig. 3.1.6: A spirit level meter

13. **Heavy duty hammer:** It is used for driving nails, fitting parts, and breaking objects. It has a handle and a head, with most of the weight in the head. One side of the head has a little slit that is used to pull out nails from walls or wooden brackets. The head of the hammer can be used as a reliable guide for minimum bend radius of coaxial cable while clipping it to the wall. The following is an image of a heavy duty hammer:

Fig. 3.1.7: A heavy duty hammer

14. **Pliers:** Pliers are hand tools, designed primarily for gripping objects by using leverage. Three types of pliers are used by installation engineers:

    a. **Combination pliers:** These are used for gripping small objects, to cut and bend wire and cable and to hammer other small tools such as a chisel or screwdriver and small nails. These pliers have a gripping joint at their snub nose, and cutting edge in their craw. They also have insulated handle grips that reduce (but do not eliminate) the risk of electric shock from contact with live wires.

    b. **Side cutter or heavy duty cutter:** These are used to cut wires and nails.

    c. **Wire stripper/cutter:** Used for stripping wires, removing insulation on electrical wire while leaving the wire intact. It is an adjustable plier which can be adjusted using a screw driver to enable its usage on a thicker wire as well.

The following is an image of pliers and cutters:

Fig. 3.1.8: Cutters and pliers

15. **Compression tool**: This is used to compress the connector on to the wire end. The connector is then connected to the LNBF of Antenna or to STB jack.
16. **Cable preparation tool:** It is used to cut the cable and prepare it for use during installation. The following is an image of cable crimping tools:

Fig. 3.19: Cable crimping tools

Note: Compression and crimping tools are generally used together. Crimp tool is used to cut the wire and the compression tool is used to fix the connector to the end of a wire. Never try to cut the outer sheet of coaxial cable manually as it may cause problems later

17. **Component box:** A small box to keep small spare parts like screws, nuts, bolts, p-clips etc.
18. **Drill machine:** It is used to create holes and through-holes in concrete and masonry (max. diameter 20 mm). It is also used for drilling metal sheets, wood, drywall and driving screws. It operates at 600 W. It can be operated in two modes, normal as well as hammer. The normal motion is a rotatory motion whereas hammer motion is a combination of rotatory and hammer motion. There are separate bits for both the modes. The following is an image of a drill and drill bits:

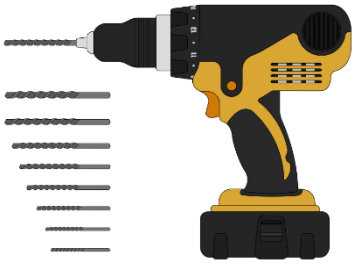

Fig. 3.1.10: A drill machine and drill bits

19. **Bits:** The way drill machine has two modes, normal and hammer. Bits are also of two types. One set of bit is used for normal drilling whereas the other for hammer drilling. Hammer drilling bit has got a different shape and has grooves for better grip. Hammer bit

is generally used for concrete and comes in varied sizes such as 6mm, 8mm, 10mm, 12mm and of 47mm length.

20. **Digital multimeter**: It is an electronic device which is capable of taking various electronic measures such as current, voltage or resistance. The basic measurements that are normally made include voltage, current (both AC and DC) as well as resistance. Advanced multimeters have a variety of other functions such as measurement of frequency (not up to a high level of precision), capacitance and temperature. The following is an image of a multimeter:

Fig. 3.1.11: A digital multimeter

21. **Torch:** A battery operated source of light. It is kept in the tool kit to use in case the light fades or is not appropriate during the time of installation.

22. **Hacksaw**: It is used by the installer to cut a plastic pipe or a plastic conduit. It is a hand saw with a C shaped frame which holds a blade. The following is an image of hacksaw:

Fig. 3.1.12: A hacksaw

23. **Cutting knife:** It is used at workplace to cut the tape of sealed package without damaging the packaging content. It is also known as a utility knife. The following is an image of cutting knife:

Fig. 3.1.13: A cutting knife

24. **Keyhole saw:** It is used to cut holes in drywall or softer woods for new electric switch in the wall. It has a plastic or wood handle with a pointed blade. In some keyhole saw, various blades can be fitted in the same handle. The following figure shows a keyhole saw:

Fig. 3.1.14: A keyhole saw

25. **Tube cutter**: This tool is used to cut a copper or a plastic pipe in a clean, convenient and faster manner. It is also known as a pipe cutter. The following image shows a tube cutter:

Fig. 3.1.15: A tube cutter

26. **Torque wrench:** It is used to measure the torque in nuts or bolts. It is mainly used in prevention of over tightening of bolts and steam pipe and water pipe repairs underground. The following figure shows a torque wrench:

Fig. 3.1.16: A torque wrench

27. **Wrench:** This tool is used to turn fasteners such as nuts and bolts by applying torque and tighten the screw. The following image shows a wrench:

Fig. 3.1.17: A wrench

28. **Refrigerant gas detector:** This tool is used to detect a gas leak around the appliance or in the surrounding. The following figure shows a gas detector:

Fig. 3.1.18: A gas detector

29. **Digital 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 image shows clamp meter:

Fig. 3.1.19: A clamp Meter

UNIT 3.2: Safety and Maintenance of Tools

Unit Objectives

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

1. Safety measures to be taken while handling tools

3.2.1 Safety while Handling Tools

The tools selected for a particular set of job should be specifically suitable for the job. The tool should have a proper handle grip so as to avoid slipping of the tool while working. The tools should be used only for the purpose they are made for and not for any other purpose. The tools should be used under the safe working limits as per the design specification of the tool.

A technician should always wear personal protective wear such as safety gloves, safety helmet, safety goggles, safety shoes, ear protecting plugs and safety mask. The following are the images of personal protective equipment:

Fig. 3.2.1: Personal protective equipment (PPE)

The tools should be carried in proper toolbox in a managed and organised way. The tools should be kept at a secure place to avoid any unauthorised access and accident from the tools. Before working, check the work piece to prevent any damage to the tool to be used on the work piece.

While working at heights, tools should be tied or put in safe place to avoid any slipping and dropping of the tool. The tools should be operated in a correct position with proper strength for holding and operating the tool effectively. While using tools, correct procedure should be followed as per the manufacturer's instruction to operate the tool. While using sharp edged tools, ensure that the direction of movement of the tool should be away from the body. After the completion of work tools should be put in the appropriate place securely.

3.2.2 Maintenance and Housekeeping of Tools

As tools are essential for a service technician, regular maintenance and check needs to be done to maintain the tools in good condition. Using or working with a damaged, broken or unsuitable tool is hazardous.

To keep the tools in good conditions following steps should be checked:

- Get the tools from the store as per the requirement and return the tools in good condition after completion of work.
- A regular routine check of the tools should be done to examine the condition of the tools.
- Get the damaged and worn out tools fixed else get the tools replaced.
- Before and after completion of the work clean the tools properly.
- Edges of sharp edged tools should be maintained sharp.
- The tools should be kept in the store department in an ordered way in proper toolboxes.
- Sharp tools should be kept with protective guard over the sharp edges.
- Broken tools should be discarded with care.
- Regular examination, repair and maintenance of the tools should be carried out only by a competent person.
- Report about any issue related to damage or faulty tool/equipment to the store supervisor or senior.

3.2.3 Safety while Working

While working at a site, make sure you follow the safety regulations to avoid any accident. Safety is the primary concern as per the company's policy and standards.

Safety should be followed:

- While handling tools/equipment's
- Climbing an elevated surface or using ladders

The given safety points should be considered while working:

- Overloading – While using tools/equipment's make sure that they are not overloaded or operated beyond working limits. The ladder or structure over which you need to work should not be overloaded as well.
- Overreach – Do not try to reach beyond a point while working on a ladder or an elevated surface. Keep the safety line tied with the safety belt while working.
- Resting tools – Avoid resting or hanging of tools over an elevated surface.
- Carrying tools – Always carry tools safely or use tool belts for carrying tools.
- Stability – Always ensure to make a stable point of contact on the ground and especially on an elevated surface like a roof or a ladder. Ensure making three points of contact rule for stable position before starting the work.
- Standardised equipment – Make sure you are using standardised equipment like tools, ladders and safety equipment.

- Maintenance – Always maintain your tools and equipment in good condition and clean them before using.

First Aid

While working at the site and handling tools and equipment a person might suffer some injury. So, to handle such a situation the technician should carry a first aid kit which can help provide the first aid necessary. The first aid box may contain:

- Instructions to provide first aid.
- Sterile and antiseptic liquids.
- Bandages of appropriate sizes and cotton.
- Scissors, clippers and tweezers.
- Cold pads.
- Disposable gloves.

The technician should also have a basic knowledge to provide first aid. Also in case of any accident, contact emergency services as soon as possible via communication methods.

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4. Refrigeration

Unit 4.1 – Uses of Refrigeration and Refrigeration Cycle

Unit 4.2 – Basic Components of Refrigerators

Unit 4.3 – Refrigerants

Unit 4.4 – Need and Types of Refrigerators

Unit 4.5 – Safety Precautions, Policies and Procedures

Unit 4.6 – DC Refrigerators

Unit 4.7 – FF Refrigerators

Unit 4.8 – Installing DC & FF Refrigerators

Unit 4.9 – Repairing DC & FF Refrigerators

Unit 4.10 – Sealed Systems

Unit 4.11 – Copper Pipe Processing

Key Learning Outcomes

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

1. Describe the refrigeration cycle
2. List the basic components of a refrigerator
3. Explain the properties and types of refrigerants
4. Describe environmental effects of refrigerants
5. List the types of refrigerators
6. Follow safety precautions, policies and procedures
7. Explain the working of DC refrigerator
8. Explain the working of FF refrigerator
9. Install DC and FF refrigerators
10. Repair DC and FF refrigerators
11. Describe sealed system
12. Explain copper pipe processing

UNIT 4.1: Refrigeration Cycle

Unit Objectives

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

1. Define refrigeration
2. Identify the uses of refrigeration
3. Explain refrigeration cycle

4.1.1 Refrigeration

Imagine a scenario where a food item such as an apple is left out in the open at room temperature. The food starts spoiling at a fast rate due to the presence of bacteria in the air. The same apple stays fresh for a longer period of time if it is kept in a refrigerator. Since ancient times, it was discovered that the growth rate of bacteria slows down in lower temperature. This led to the development of refrigeration process as a way to preserve and store food.

Refrigeration is the process of removing unwanted heat from an object or an area and transferring it to another object or area. This enables an item to be stored below room temperature by keeping it in a system that is designed to cool or freeze.

A system/ machine that provides refrigeration under controlled conditions is called refrigerator. A refrigerator uses a chemical substance called refrigerant to transfer heat from one area to another. The following figure shows a domestic refrigerator:

Fig. 4.1.1: A refrigerator

4.1.2 Uses of Refrigeration

Refrigeration has had a huge impact on lifestyle, agriculture, manufacturing and processing industry. It has made it possible to preserve food for long periods of time, to store and distribute agriculture produce over long distances, to facilitate many chemical processes, to manufacture different medicines and to provide comfort air conditioning.

The following image shows the major uses/ applications of the refrigeration:

Fig 4.1.2: Uses of refrigeration

Food industry

One of the most important applications of refrigeration has been in the food processing, preservation and distribution industry. It has enabled processing of raw food into packaged food such as beverages, dairy products and frozen foods. Processed food can be stored and preserved at temperatures at or below zero-degree C. Cold storages, refrigerated trucks and rail cars have made it possible to cover large distribution areas without affecting the quality and taste of the produce.

Chemical and process industry

Many chemical processes require temperatures below zero-degree C to work. Refrigeration has made it possible to separate and liquefy gases in petrochemical industry, dehumidify air, solidify solutes, remove heat from chemical reactions, recover solvents and control fermentation.

Pharmaceutical industry

Refrigeration has changed the face of the pharmaceutical and medical industry. It has made it possible to manufacture several antibiotics and other drugs that require a process known as freeze drying. It is now possible to store and distribute medicines, vaccines, blood plasma, and tissues and preserve blood and bone marrow. It has enabled the use of local anaesthesia for surgeries.

Air conditioning

Air conditioning is based on the principle of refrigeration and has been developed to provide comfort to humans. Air conditioning in buildings such as homes, schools, offices, hotels, restaurants and so on ensure that the core body temperature is maintained around 37 degrees C thereby providing comfort and satisfaction.

Apart from comfort, refrigeration has provided suitable conditions in the industries to carry out processes required in the manufacture of various products. Some applications of industrial air conditioning are in:

- IT industry
- Printing industry
- Textile industry
- Semi-conductor industry
- Mines and power plants

4.1.3 Refrigeration Cycle

The basic principle behind the refrigeration process is that when a liquid expands into gas, it extracts heat from its surrounding area. A refrigerant is a chemical liquid which evaporates at a very low temperature enabling it to extract heat at a faster rate. This refrigerant is propelled through a closed system to ensure that it is not dispersed in the surroundings and can be used again and again.

The following figure shows the refrigeration cycle:

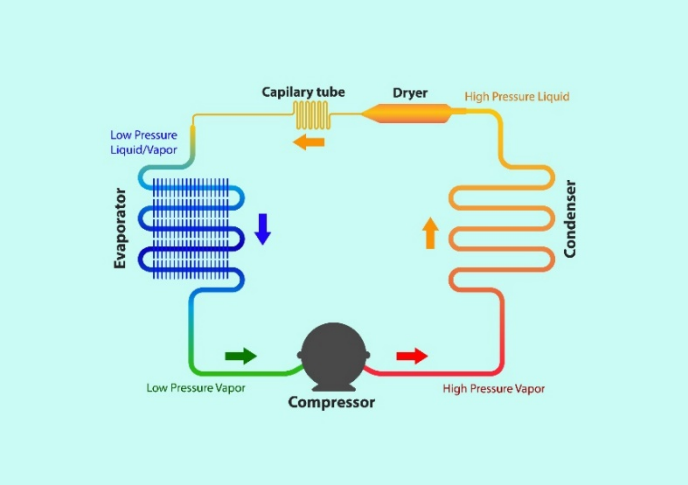


Fig 4.1.3: Refrigeration cycle

A refrigeration cycle consists of two sides or pressure areas, the evaporating or low pressure side and the condensing or high pressure side. A metering device such as an expansion valve or a capillary tube separates the two areas on one side. On the other side, a compressor is placed between the two areas. The metering device controls the flow of refrigerant and the compressor compresses the refrigerant into high pressure gas. The low-pressure refrigerant passes through the evaporator causing it to evaporate. This low-pressure vapour then enters the compressor where it is compressed into a high temperature, high pressure vapour. It then goes into the condenser where it gives up its heat to the cooler air passing through the condenser. The refrigerant condenses back into high pressure liquid which travels to the metering device. It is made to pass through a small opening resulting in a drop of temperature and pressure. This low-pressure refrigerant then enters the evaporator again, thereby completing the refrigeration cycle.

UNIT 4.2: Basics Components

Unit Objectives

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

1. Identify the basic components of a refrigerator
2. Describe the working of the components of a refrigerator

4.2.1 Components of a Refrigerator

A refrigerator consists of four main components as shown in the following figure:

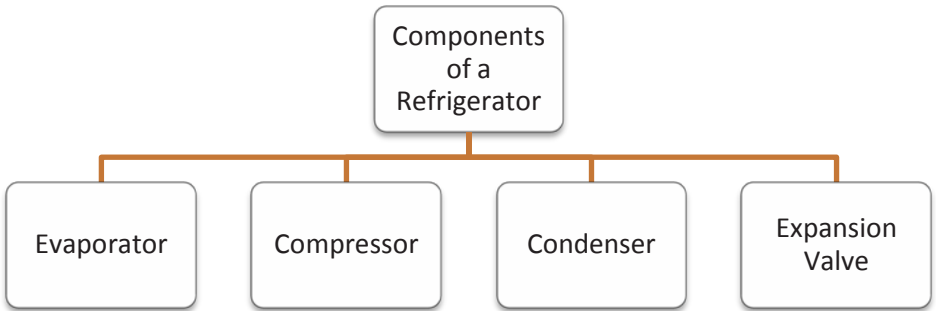


Fig. 4.2.1: Components of a refrigerator

Evaporator

The evaporator turns the cold, low pressure refrigerant into vapour. It is in the freezer section of the refrigerator and has a fan blowing across coils of copper or aluminium tubing. The cooler refrigerant absorbs the warmer heat from the surroundings and its temperature rises. This cools down the surrounding and a warm, low pressure refrigerant is sucked into the compressor. The following is an image of an evaporator:

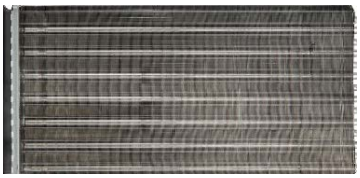


Fig. 4.2.2: An evaporator

Compressor

The compressor is the most important part of the refrigeration system. It pulls in the low-pressure refrigerant from the evaporator through a suction line and compresses it into a high pressure vapour. The following is an image of a compressor:

Fig. 4.2.3: A compressor

The compressor is a mechanical device that consists of a power source, that is the motor and a compressing mechanism sealed inside a metal housing. There are five main types of compressors that are used in any refrigeration system. These are as shown in the following figure:

Reciprocating compressor	A positive displacement compressor that delivers gas at high pressure by using pistons
Scroll compressor	A positive displacement rotary compressor with a fixed and rotating scroll. Gas is compressed by confining in between the two scrolls
Screw compressors	A positive displacement rotary compressor made up of two intermeshing screws/ rotors. Gas is compressed by confining in between the two rotors
Rotary compressors	A positive displacement compressor that uses a rotary impeller to drive the air through a curved chamber to compress it.
Centrifugal compressors	A compressor that uses centrifugal force generated by rotating impeller blades to compress gas

Fig. 4.2.4: Types of compressors

Condenser

The condenser is a device that removes heat from the refrigerant and changes it to a liquid form. It consists of coils of aluminium exposed to the atmosphere and a fan that blows across the coils. It is located at the back of a refrigerator. When the hot, high pressure refrigerant flows through the copper tubes, fan cools the vapour refrigerant and changes it into liquid. This liquid refrigerant enters the expansion valve. The following is an image of a condenser:

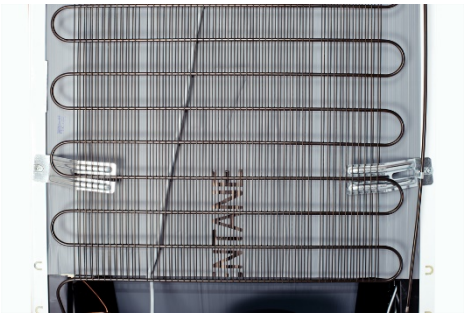


Fig. 4.2.5: A condenser

Thermal Expansion Valve

The thermal expansion valve is a type of metering device. It consists of a spring loaded valve connected to a diaphragm. A thin, capillary tube connects the valve with a thermal bulb. The expansion valve restricts the flow of the regular temperature; high pressure refrigerant. The refrigerant expands as it passes through leading to a drop in its temperature and pressure as it leaves the valve and enters the evaporator thereby completing the refrigeration cycle. The following is an image of a thermal expansion valve:

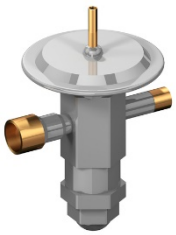


Fig. 4.2.6: A thermal expansion valve

Unit 4.3: Refrigerant

Unit Objectives

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

1. Define refrigerant
2. List the properties of refrigerant
3. Identify the types of refrigerants
4. Explain the environmental effects of refrigerants

4.3.1 Refrigerant

A refrigerant is a chemical compound that is used in the refrigeration cycle to transfer heat from one area to another. For ages, people have been using certain substances such as ice, water, brine and air as natural refrigerants to bring down the temperature of an area or substance. Refrigerants are used in all cooling devices such as refrigerators, freezers and air-conditioners. Most commonly used commercial refrigerants are chlorofluorocarbons (CFCs), ammonia, sulphur dioxide and non-halogenated hydrocarbons.

Refrigerants can be classified into two broad categories as shown in the following figure:

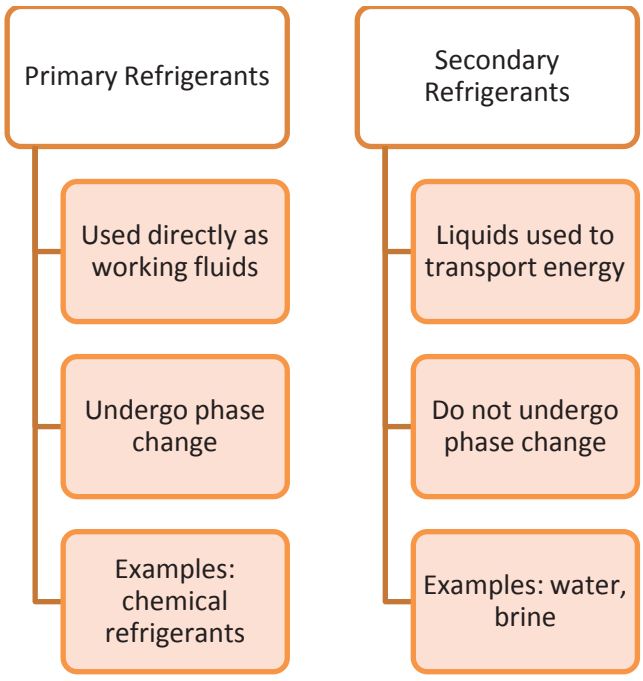


Fig. 4.3.1: Categories of refrigerants

Properties of Refrigerants

An ideal refrigerant should satisfy certain thermodynamic, chemical and physical properties to be able to be used safely and efficiently in refrigerating equipment. In addition, they should not pose any danger to health and property. The following figure shows the properties that an ideal refrigerant should possess:

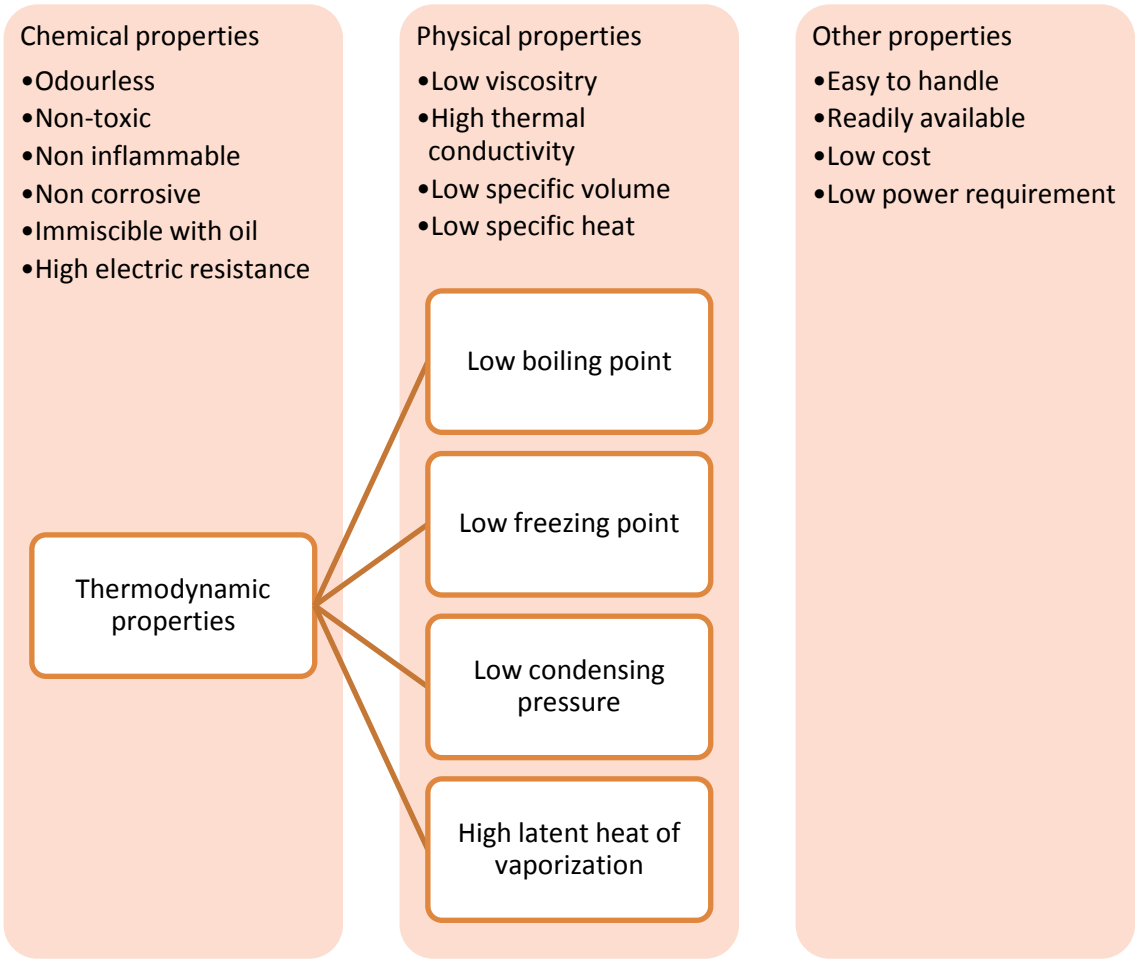


Fig. 4.3.2: Properties of refrigerants

Selection of Refrigerants

Even though a variety of refrigerants are available commercially now days, no one refrigerant has proved to be ideal under all circumstances. In some applications a non-toxic, non-inflammable refrigerant is a must but in other application these two characteristics might not be that important. Therefore, when selecting an appropriate refrigerant care must be taken to choose the one which has properties closest to ideal refrigerant for that application.

4.3.2 Types of Refrigerants

There are two main categories in which refrigerants are divided. These are shown in the following figure:

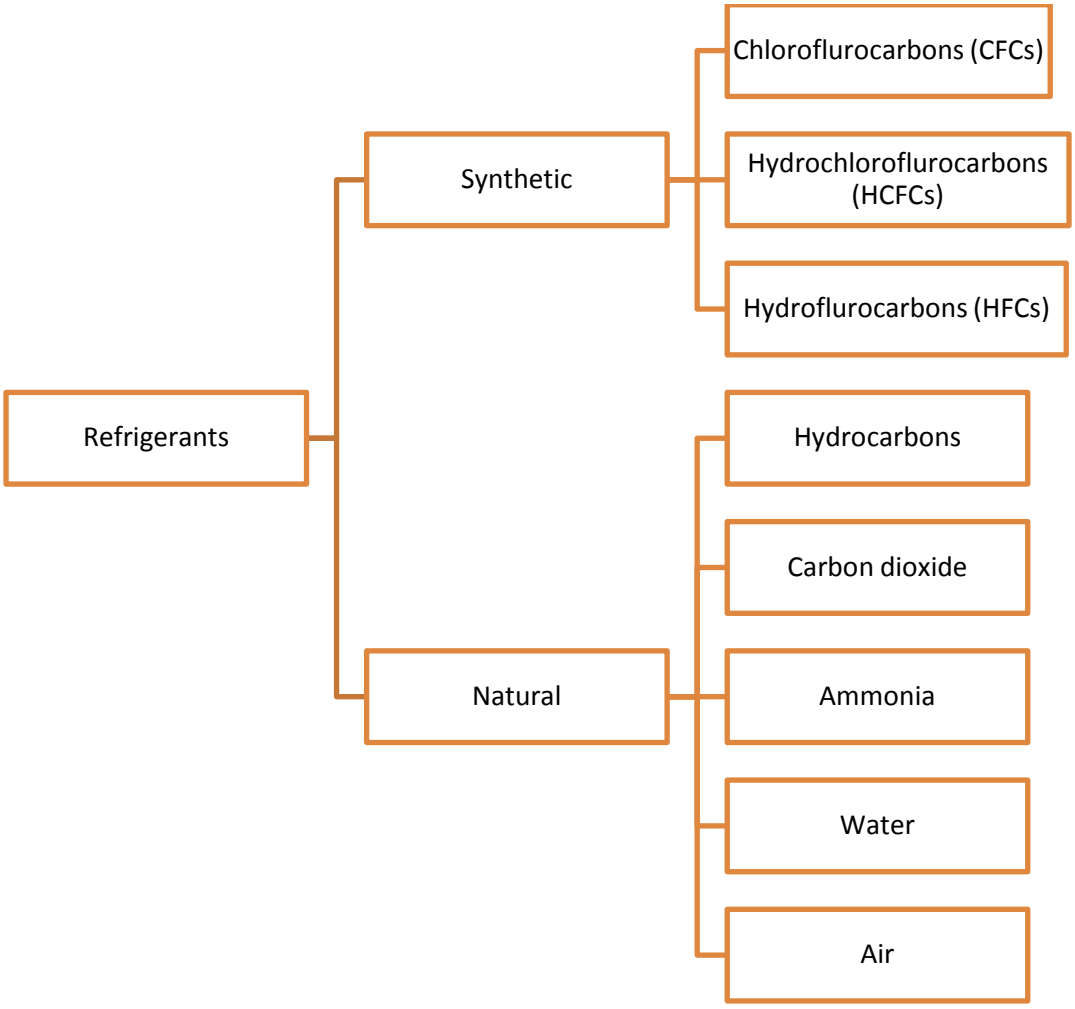


Fig. 4.3.3: Types of refrigerants

Synthetic Refrigerants

Synthetic Refrigerants are man-made refrigerants. They are very harmful to the environment and have led to ozone depletion and a rise in global warming.

Chlorofluorocarbons (CFCs)

CFC is an organic compound that is made up of Chlorine, Fluorine and Carbon. They were developed in the 1930s and were used in nearly all households, commercial, industrial and automotive industries. CFCs are chemically very stable. They are compatible with most substances. They are non-toxic, non-flammable and non-reactive. The most common CFC refrigerants are R11, R12, R13, R13B1, R113, R114, R500, R502 and R503. However, it was discovered that chlorine in CFC is damaging the ozone layer leading to its depletion. Therefore, their use has been prohibited since 1987 by the Montreal protocol.

The following image shows the molecular structure of CFC:

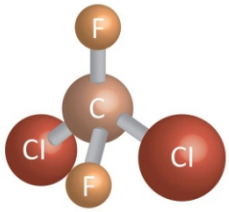


Fig. 4.3.4: Chlorofluorocarbon (CFC)

Hydrochlorofluorocarbons (HCFCs)

HCFC is an organic compound that is made up of Hydrogen, Chlorine, Fluorine and Carbon. They too have been widely used since 1930s in household, commercial, industrial and automotive industries. They are energy-efficient, low-in-toxicity and cost effective. They are less stable than CFCs but are equally compatible with most substances. The most common HCFC refrigerants are R22, R123 and R124. They are less damaging to the ozone layer and have helped to bring down the CFC consumption by 75%. However, their main drawback is that they are strong greenhouse gases. The following image shows the molecular structure of HCFC:

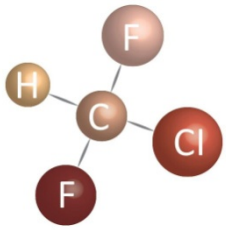


Fig. 4.3.5: Hydrochlorofluorocarbon (HCFC)

Hydrofluorocarbons (HFCs)

HFC is an organic compound that is made up of Hydrogen, Fluorine and Carbon. They have been widely used since 1990s in all applications that were initially using CFCs and HCFCs. HFCs are chemically very stable. They are compatible with most substances. The most common HFC refrigerants are R134a, R32, R125 and R143a. As they do not contain chlorine, they pose no damage to the ozone layer. However, their main drawback is that they are strong greenhouse gases.

The following image shows the molecular structure of HFC:

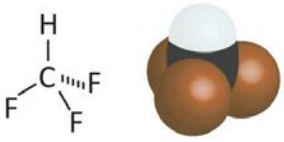


Fig. 4.3.6: Hydrofluorocarbon (HFC)

Natural Refrigerants

Natural Refrigerants are present in nature and do not need to be artificially created. As they have no impact either on ozone layer or on global warming, they are considered safe and cost-effective refrigerant.

Hydrocarbons (HCs)

HFC is an organic compound that is made up of Hydrogen and Carbon. They were widely used until 1930s and have been reapplied since 1990s. HCs are chemically very stable and are compatible with most substances. The most common HC refrigerants are R600A, R290, R1270 and their blends. They pose no damage to the ozone layer. The following image shows the molecular structure of HFC:

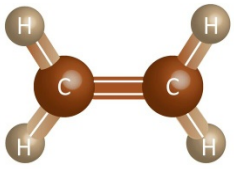


Fig. 4.3.7: Hydrocarbon (HC)

Ammonia (NH3, R717)

Ammonia is an organic compound that is made up of Hydrogen and Nitrogen. It has been widely used as refrigerant since 1800s and is at present used for commercial refrigeration and chillers. It is chemically stable but reacts with carbon dioxide, water or copper. It is very cost effective and easily available. It has no impact on ozone layer. The following image shows the molecular structure of ammonia:

Fig. 4.3.8: Ammonia

Carbon dioxide (CO2, R744)

Carbon dioxide is an organic compound that is made up of Carbon and Oxygen and has been widely used as a refrigerant in 1800s and then reapplied from 1990s. It is used in industrial refrigeration, cold storage and hot-water pumps. It is chemically very stable and compatible with most substances. It is non-inflammable and has low toxicity. It is very cost effective and easily available. It has no impact on ozone layer.

The following image shows the molecular structure of carbon dioxide:

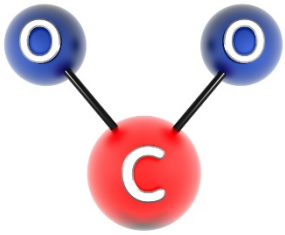


Fig. 4.3.9: Carbon dioxide

The following table shows the properties of different types of refrigerants used in commercial applications:

Refrigerant		Description	Image
CFC	R12	• Known by Dupont brand name , Freon • Colourless and odourless • Non-inflammable, non-toxic, non-poisonous, non-corrosive and non-irritating • Used with reciprocating, rotary and centrifugal compressors • Has high ODP • Phased out to be replaced by R134a • Colour code: white	
HCFC	R22	• Suitable for installations requiring low evaporating temperature • Used with reciprocating, rotary and centrifugal compressors • Non-inflammable, non- poisonous, non-corrosive and non-irritating • Colour code: green	
	R290	• Highest latent heat • Largest vapour density • Miscible in oil • Compatible with copper • Low molecular mass • Low vapour pressure • Saves up to 20% energy	

HFC	R134a	• Eco-friendly • Used as replacement for R12 • Non-inflammable, non- toxic, non-corrosive • Used with reciprocating, rotary, screw and centrifugal compressors • Colour code: Light blue	
HC	R600a	• Most common refrigerant for refrigerators • Colourless and odourless • Inflammable • Colour code: Orange	
HC Blends	R410a	• Blend of R32 and R125 • Ozone friendly • Does not contain chlorine • Chemically stable • Non-inflammable and non-poisonous • Colour code: Pink	

Fig. 4.3.10: Properties of refrigerants

4.3.3 Environmental Impact of Refrigerants

The excessive use of refrigerating devices containing various types of refrigerants has led to a very adverse impact on the environment. The two major consequences are depletion of ozone layer and a rise in global warming.

Ozone Layer

Ozone is a naturally occurring molecule that consists of three oxygen atoms. The ozone molecules form a deep gaseous layer in the stratosphere of earth's upper atmosphere known as ozone layer. This ozone layer protects life on earth by absorbing harmful ultra-violet rays of the Sun and preventing them from entering the earth's atmosphere. These ultraviolet rays can cause disorders such as skin cancer, cataracts and can destroy cell organism, terrestrial plant life and human immune system.

The following image shows the how ozone layer provides UV protection:

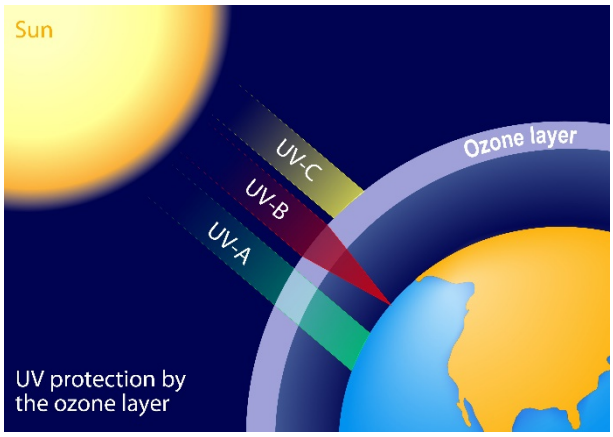


Fig. 4.3.11: Ozone layer

Ozone Layer Depletion

Over the past few decades, an increase in UV_B radiation was observed. This was the result of damage to the ozone layer. It was found that the main cause of ozone layer depletion was increase in the level of chlorine and bromine gases in the stratosphere. These gases were released due to the production and emission of refrigerants such as CFCs and HCFCs which are now labelled as ozone-depleting substances (ODS).

When these ozone depleting substances reach the stratosphere, they get exposed to the ultraviolet rays. The UV rays cause the chlorine atom to break away from the CFC molecule. This free chlorine atom reacts with the ozone gas and displaces a free oxygen atom from the ozone molecule. The oxygen atom hits the chlorine monoxide molecule and frees another chlorine atom. Thus, the cycle repeats leading to the depletion of ozone layer. The following figure shows the process of ozone layer depletion:

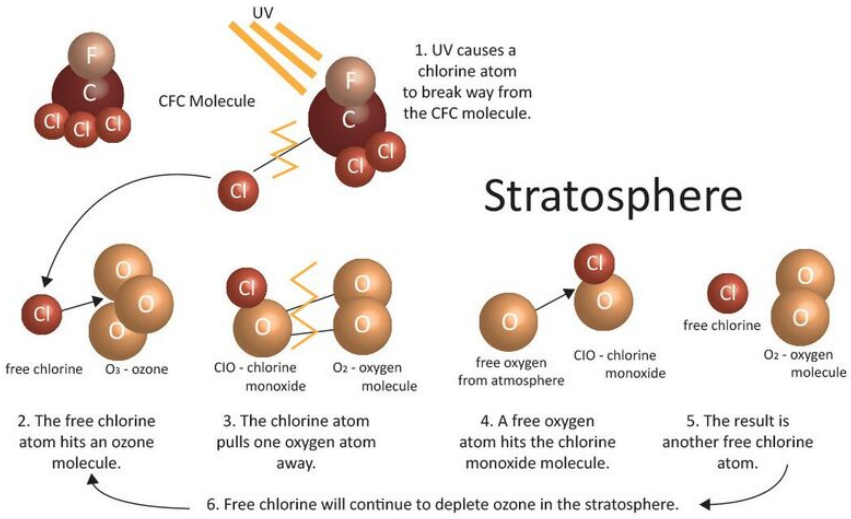


Fig. 4.3.12: Ozone layer depletion

Ozone layer depletion reduces ozone in the stratosphere but increases its presence in the lower atmosphere where it acts as a pollutant and a greenhouse gas. The depletion of ozone layer leads to global warming, which in turn leads to climatic changes around the world.

Global Warming

Global warming refers to the gradual but continuous increase in the temperature of earth's surface, oceans and atmosphere. When the rays of the sun reach the earth's surface, some are absorbed by the atmosphere, some are reflected from land and clouds and the rest are absorbed by the earth's surface. This heats up the earth's surface which then emits infrared radiation. Normally these radiations are absorbed by the atmosphere. However, when the concentration of air pollutants and certain gases known as greenhouse gases (GHG) increase in the atmosphere, they trap the harmful infrared radiations and warm up the atmosphere. This leads to global warming causing a change in the earth's climate.

Greenhouse Gases (GHG)

The main cause of global warming is the emission of greenhouse gases. A greenhouse gas is a gas that holds and traps heat in the atmosphere by absorbing infrared radiation. They remain in the atmosphere for a long period of time and are causing the planet to get hotter. The main greenhouse gases are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), ozone (O3) and artificial chemicals such as CFCs as shown in the following figure:

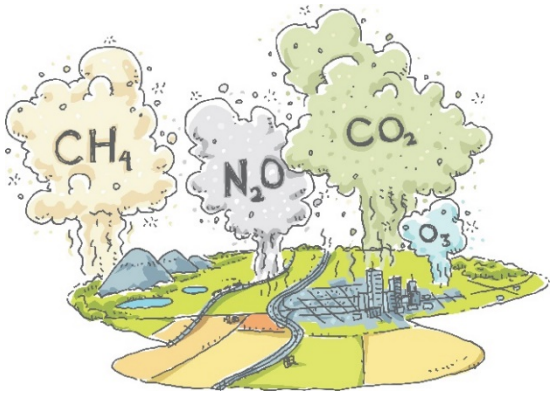


Fig. 4.3.13: Greenhouse gases

Greenhouse Effect

The greenhouse effect is the process of warming up of the earth's atmosphere as a result of trapping of heat by greenhouse gases. The greenhouse gases act like a blanket and allow the sunlight to escape but trap the heat within the atmosphere. This hot air causes the earth to heat up which in turn leads to global warming.

The following figure shows the concept of the greenhouse effect:

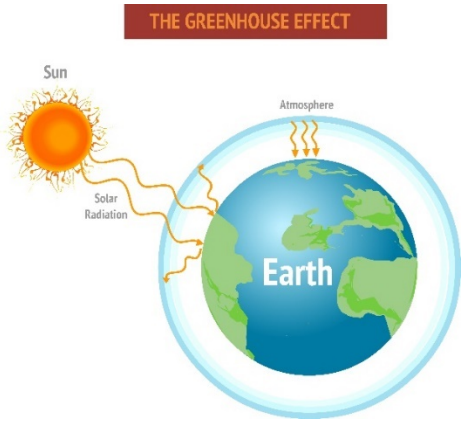


Fig. 4.3.14: Greenhouse effect

Environmental Characteristics

Refrigerants are ranked according to their impact on the ozone layer (the Ozone Layer Depletion Potential, ODP) or as greenhouse gases (the Global Warming Potential, GWP). The following table shows the environmental characteristics of various refrigerants:

Refrigerant		ODP	GWP (100 years)
CFC	CFC 11	1	4000
CFC Blend	R502	0.33	5260
HCFCs	HCFC-22	0.555	1700
HFCs	HFC- 134A	0	1300
HCs	HC-290	0	3
HFC Blends	R404a	0	3260

Fig. 4.3.15: Environmental characteristics of refrigerants

Montreal Protocol

The harmful effect of ODS led to the signing of an international treaty in September 1987 known as the Montreal protocol. The main aim of the treaty was to take steps to protect the ozone layer by reducing and eventually banning global production of ozone damaging chemicals such as CFCs, HCFCs and halons. The following table shows the phase out schedule of the ODS:

ODS	Developed countries	Developing countries
CFCs	Phased out by 1995 end	Total phase out by 2010
HCFCs	Phased out by 2020 end	Total phase out by 2040
Halons	Phased out by 1993 end	Total phase out by 2010

Fig. 4.3.16: Phase out schedule of ODs

UNIT 4.4: Types of Refrigerators

Unit Objectives

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

1. Identify different types of refrigerators
2. Compare Direct Cool (DC) and Frost-Free refrigerators
3. Describe the working of Peltier refrigerators

4.4.1 Types of Refrigerators

A refrigerator is one of the most essential appliances in the kitchen. There are many types of refrigerators that are available in the market today and it is very important to select the right type of refrigerator.

Refrigerators can be divided into two broad categories:

- Direct Cool
- Frost Free

The following figure shows the different types of refrigerators:

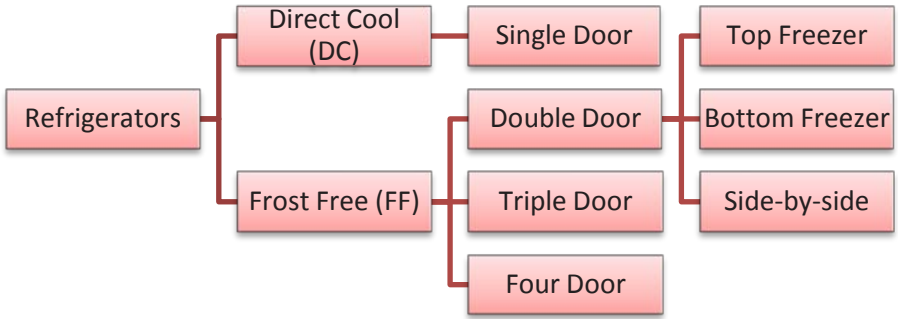


Fig. 4.4.1: Types of refrigerators

Direct Cool (DC)

The Direct Cool refrigerator works on the principle of vapour condensation and natural convection. They are single door refrigerators which need to be defrosted manually or semi-automatically.

The following figure shows a direct cool refrigerator:

Fig. 4.4.2: A Direct cool refrigerator

Frost Free

The Frost-Free refrigerators do not require manual defrosting. They contain a small element that melts the built up ice without interfering in the cooling cycle of the refrigerator. The following figure shows a frost-free refrigerator:

Fig. 4.4.3: A frost free Refrigerator

Top Freezer

The Top freezer has the freezer compartment on the top and the refrigerator at the bottom. It has a spacious design with wide shelves which allow easy access to items at the back. It is the most economical and energy efficient model.

The following figure shows a top freezer refrigerator:

Fig. 4.4.4: A top freezer refrigerator

Bottom Freezer

The bottom freezer has the refrigerator on the top and the freezer compartment at the bottom. It makes it easy to reach the food items in the refrigerator without needing to bend. The freezer section is either a door or a pull-out drawer. It is slightly expensive than the top freezer model.

The following figure shows a bottom freezer refrigerator:

Fig. 4.4.5: A bottom freezer refrigerator

Side-by-Side

The unit is divided vertically with the refrigerator and the freezer compartments parallel to each other. The doors of both compartments open from the middle. It provides easy access to both fresh and frozen foods. It is more expensive than the basic models.

The following figure shows a side-by-side refrigerator:

Fig.4.4.6: A side-by-side refrigerator

Triple Door / French Door

The French door features side-by-side refrigerator compartments and a bottom freezer. It is one of the most expensive models and is available in many designs. They are wider than the double-door models.

The following figure shows a French door refrigerator:

Fig. 4.4.7: A French door refrigerator

Four Door

The four door model is a variant of the French door one where the freezer compartment is also split in two.

The following figure shows a four door refrigerator:

Fig. 4.4.8: A four door refrigerator

4.4.2 Direct Cool Vs Frost Free refrigerators

The following figure lists the various differences between Direct Cool and Frost-Free refrigerators:

Direct Cool	Frost Free
Single door model only	Multiple door models
Cooling achieved by natural convection	Cooling achieved by forced convection
Single thermostat controls cooling	Multiple thermostats control cooling
Non-uniform cooling	Uniform cooling
Slow cooling	Fast cooling
Manual defrost	Automatic defrost
Capacity upto 300 lites only	Capacity upto 800 litres

Fig. 4.4.9: Direct cool Vs frost free refrigerators

4.4.3 Peltier Refrigerator

The Peltier refrigerator is based on the principle of thermoelectric cooling and uses the Peltier effect to create a heat flux between two different types of conductors (a thermocouple). The thermocouple consists of an array of positive or negative (P/N) type semiconductors. This array is soldered between two ceramic plates, thermally parallel and electrically in series. When DC voltage is applied to the module, current flows and a temperature difference is created. The array absorbs heat from one surface and releases it to other surface. This results in one surface becoming cold and the other becoming hot. The following figure shows a typical thermoelectric module:

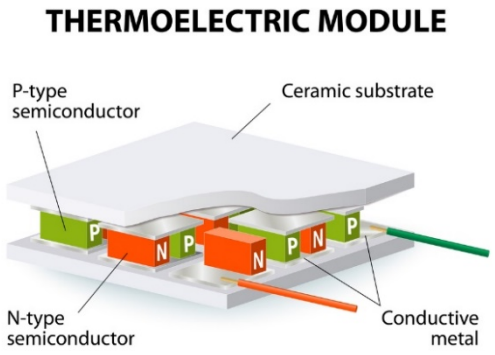


Fig. 4.4.10: Thermoelectric module of Peltier refrigerator

The Peltier refrigerator has a solid state active heat pump that transfers heat from one side of the device to another.

The following figure shows the circuit diagram of Peltier refrigerator:

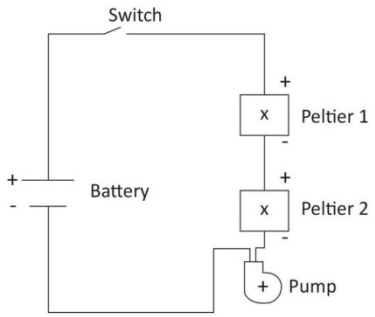


Fig. 4.4.11: Circuit diagram of Peltier refrigerator

The Peltier refrigerator has certain advantages and disadvantages as shown by the following figure:

Advantages	Disadvantages
•Environment friendly (No CFC) •Light weight •Portable •No vibrations/ noise •No moving parts •Can alternate between heating and cooling •Excellent cooling	•Less efficient •For low heat flux applications only •Disspates limited amount of heat flux

Fig. 4.4.12: Advantages and disadvantages of Peltier refrigerator

UNIT 4.5: Safety Precautions, Policies and Procedures

Unit Objectives

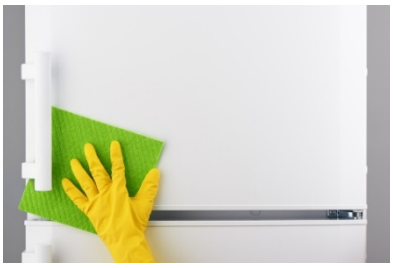
At the end of this unit, you will be able to:

1. Explain the maintenance procedure to the customer
2. Identify the safety precautions

4.5.1 Maintenance of Refrigerators

A refrigerator is one of the most important and expensive appliances in a kitchen. To ensure that it runs well for years, it is essential to follow certain simple maintenance and cleaning procedures. Regular maintenance will keep it working at highest efficiency and lower the energy consumption.

The following table lists the checklist for routine maintenance of refrigerators:

Maintenance	Description
Cleaning the exterior 	• Clean the exterior with soft wet cloth • Avoid using soap or detergent
Cleaning the interior 	• Remove all food items • Remove drawers and shelves • Mix ½ teaspoon baking soda in lukewarm water • Dip a clean cloth in it • Clean the interior with this solution • Avoid using soap or detergent
Food Storage 	• Store vegetables and fruits in the vegetable tray • Avoid overstocking to ensure that air circulation is not blocked • Store liquids in airtight containers • Store all frozen foods in freezer

Thermostat position 	• Use thermostat to vary the temperature inside the refrigerator • Always set the thermostat as recommended in the user manual
Defrosting 	• Remove all the stored items • Remove the ice trays • Defrost the refrigerator • Wipe the refrigerator dry • Leave the door open • Make sure to defrost regularly

Fig. 4.5.1: Routine maintenance of refrigerators

In addition to the routine maintenance, it is vital to do preventive maintenance of refrigerators to prevent break downs.

The following table lists the checklist for preventive maintenance of refrigerators:

Maintenance	Description
Clean the condenser coils 	• Pull the refrigerator out • Use long-handle bristle brush • Remove dust and dirt from the coils • Use vacuum cleaner to blow away dust particles
Check door seal 	• Ensure seals are free of food residue • Mix ½ teaspoon baking soda in lukewarm water • Dip a clean toothbrush in it • Clean the door seals with this solution
Clean freezer vents 	• Keep food packages away from the vent openings • Clean the air return so that crumbs and twist ties don't clog them

Fig. 4.5.2: Preventive maintenance of refrigerants

Safety Precautions

It is critical to follow safety precautions while installing or servicing a refrigerator. Any negligence or carelessness can pose a threat to health and safety and cause personal injuries. The following figure represents the general guidelines to be followed while working with electrical systems:

- Follow the correct procedures to ensure zero accidents at work.
- Obey safety signs, stickers and tags on the equipment/devices.
- Use an appropriate tool for the respective task.
- Read labels and instructions given on the components.
- Wear appropriate clothing and remove metal objects before working.
- Use prescribed protective safety equipment only.
- Follow electrical safety rules when working with electrical machinery/equipment.
- Report all unsafe acts or unsafe conditions to the supervisor.

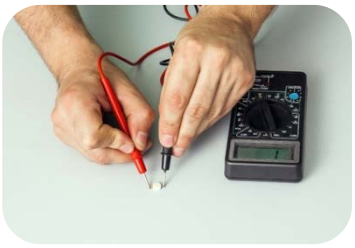
Fig 4.5.3: Safety guidelines

In addition to these general guidelines, few more safety precautions should be followed while installing or repairing refrigerators.

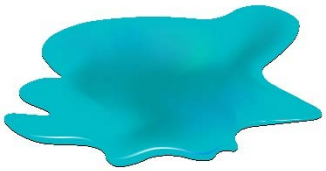
The following figure shows the safety precautions that should be followed while installing or repairing refrigerators:

Unplug the unit prior to service

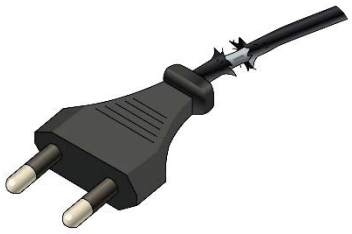
Wear rubber gloves



Check current, voltage and capacity



Ensure water does not drip into electrical parts



Ensure that the power cord or plug is not damaged

Do not use multi plugs in the same socket

Fig 4.5.4: Safety precautions

UNIT 4.6: DC Refrigerator

Unit Objectives

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

1. Explain the working of a DC refrigerator
2. Identify the compartments
3. Describe the working of different parts
4. Explain the wiring diagram

4.6.1 Features of Direct Cool Refrigerator

DC refrigerators are single door refrigerators having separate compartments within one unit. The top compartment is the freezer which stores frozen food. The middle compartment is the storage where food items are kept. The bottom compartment consists of vegetable drawers to store fresh vegetables and fruits.

The following image shows the compartments in DC refrigerator:

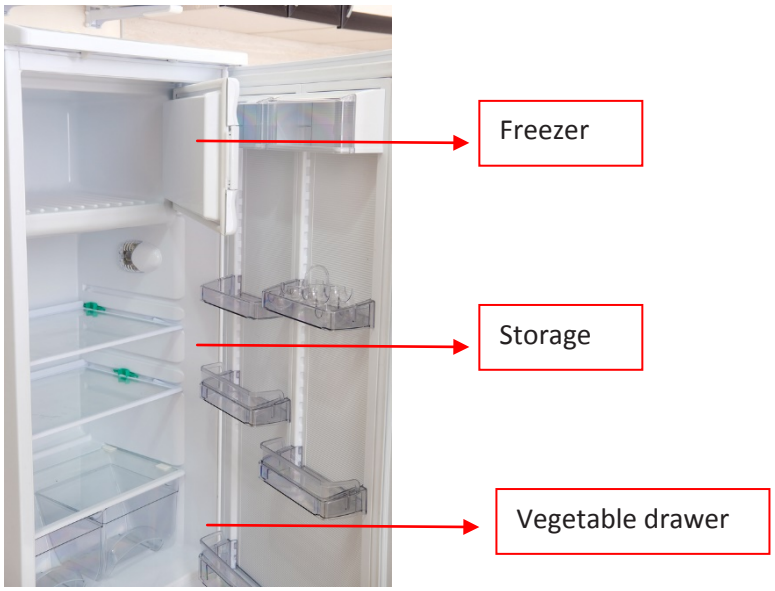


Fig 4.6.1: Compartments in a DC refrigerator

All the compartments are maintained at different temperatures according to their function and the food they store. The following table shows the functions and temperatures of the different compartments in DC refrigerator:

Compartment	Food stored		Temperature
Freezer		Frozen meat, fish, ice cream	-16^0 C to -18^0 C
Chiller		Milk, butter, cheese	1^0 C to 3^0 C
Refrigerator		Cooked food, cut fruits	3^0 C to 6^0 C
Vegetable drawer		Fruits and vegetables	6^0 C to 8^0 C
Door shelf		Water bottles, juices, eggs	8^0 C to 10^0 C

Fig 4.6.2: Functions and temperatures of compartments in a DC refrigerator

Working of DC Refrigerator

DC refrigerators are based on the principle of cooling through vapour condensation and natural convection. The air within the inner compartments of the DC refrigerator is hot and moist. This air rises up and comes in contact with the evaporator. The evaporator absorbs the heat and moisture from the hot air. As a result, the air in the freezer compartment becomes cold and dry. Being heavier, this cold air moves down and cools the remaining compartments. The cold air again pushes the hot air up. In this way, the cycle keeps on repeating till the set temperature is attained. The compressor then switches off. When the temperature rises again, the thermostat restarts.

The following image shows the refrigeration cycle inside a DC refrigerator:

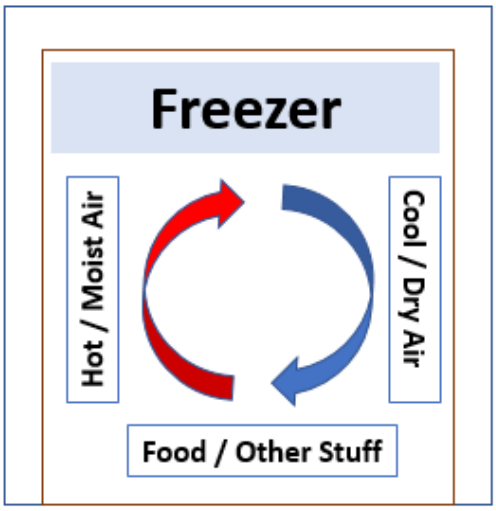


Fig 4.6.3: Working of a DC refrigerator

Components of DC Refrigerator

The following table shows the components inside a DC refrigerator:

Component	Description
Drier	• Absorbs moisture content in the sealed system and prevents the moisture from entering the capillary.
Accumulator	• Located in the suction line between the evaporator and compressor • Stores excess liquid refrigerant or oil that has not evaporated • Designed to avoid damage to the compressor
Overload protector (OLP)	• Mounted in series with the common terminal of compressor • Designed to protect the compressor from overload

Thermostat	• Regulates the temperature inside the refrigerator • Controls the running and stopping time of the compressor
PTC Relay	• Disconnects the power supply to the compressor when it reaches 80% of its speed
Door Switch	• Controls the operation of cabinet bulb
Cabinet bulb	• Glows when the refrigerator door opens
Drain pipe	• Connects the chill tray with the drain pan
Drain pan	• Collects the drain water
Door gasket	• Located at the edges of the door • Prevents flow of air from inside the refrigerator to outside and vice versa

Fig 4.6.4: Components of DC refrigerator

Defrosting DC Refrigerator

The evaporator absorbs the moisture from the air in the freezer compartment. When this moisture condenses, it results in the formation of frost on the evaporator. If the refrigerator door is opened frequently or if the humidity in air is more, it will lead to more frost. As ice is a bad conductor of heat, excess frost adversely impacts the heat transfer in the refrigerator. Therefore, to ensure efficient cooling, a DC refrigerator needs to be defrosted regularly.
The following image shows frost formation in the freezer compartment of a DC refrigerator:

Fig 4.6.5: Frost formation in the freezer of DC refrigerator

Defrost Method

Press the default switch manually. The power supply to the compressor gets switched off automatically. The air inside the compartments starts to heat up making the frost on the evaporator melt. The defrosted water gets accumulated in a chill tray and is carried by a drain pipe to a drain pan. As soon as the temperature of evaporator reaches a pre-set value (zero-degree C), the thermostat restores the power to the compressor and the cooling cycle starts.

Before defrosting the refrigerator, remember to:

- Turn off the freezer
- Remove frozen items from the freezer

Wiring Diagram of DC Refrigerator

A wiring diagram represents the electrical circuit of an appliance. It depicts the power and signal connections between the devices and the components in an electrical circuit. This information is useful while installing or servicing a device.

The following figure shows the wiring diagram of a DC refrigerator with electronic controls (PCB):

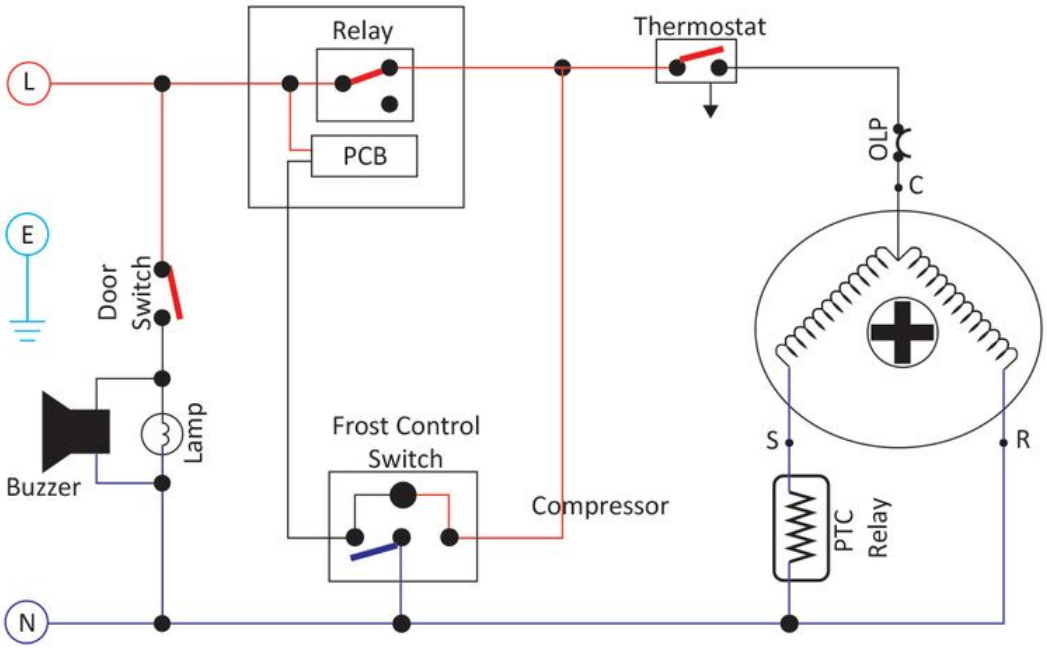


Fig 4.6.6: Wiring diagram of DC refrigerator with electronic controls

The following figure shows the wiring diagram of a DC refrigerator with timer for auto defrost:

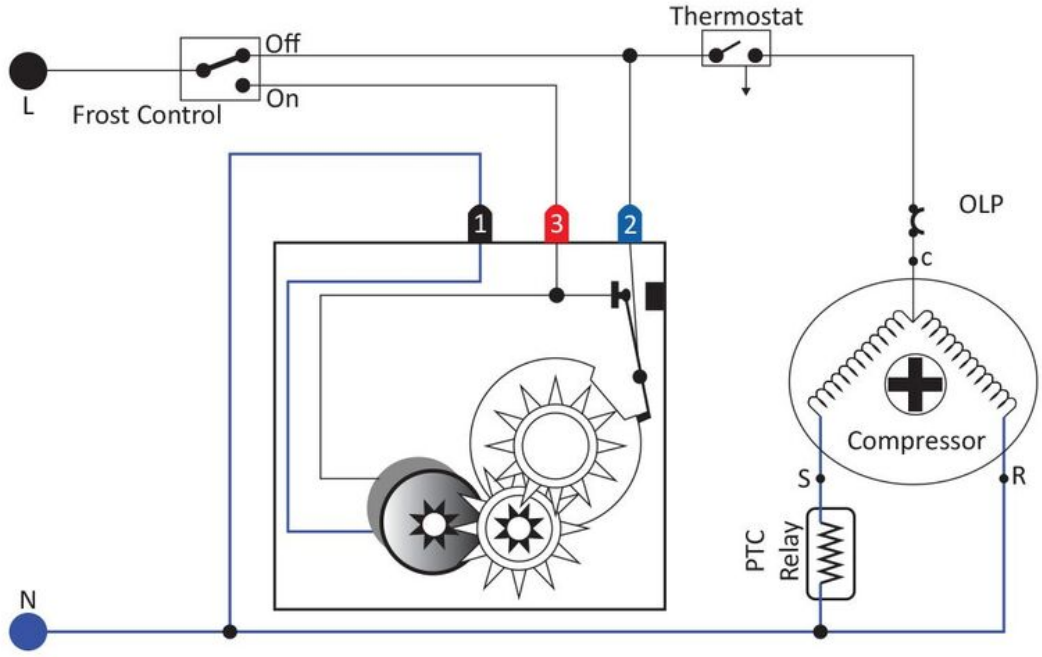


Fig 4.6.7: Wiring diagram of DC refrigerator with timer for auto defrost

UNIT 4.7 – FF Refrigerator

Unit Objectives

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

1. Explain the working of FF refrigerator
2. Identify the compartments in FF refrigerator
3. Describe the working of different parts in FF refrigerator
4. Explain the wiring diagram

4.7.1 Features of Frost Free Refrigerator

FF refrigerators are multi-door units that that are based on the principle of auto-defrost technique. In FF refrigerators, the freezer and the refrigerator compartments open separately. This ensures that when one compartment is opened, there is no cooling loss in another. They are spacious and wider than the DC refrigerators.

The following image shows a typical FF refrigerator:

Fig 4.7.1: A typical FF refrigerator

The following table shows the different compartments in FF refrigerator:

Compartment	Food stored		Temperature
Freezer		Frozen meat, fish, ice cream	-16^0 C to -18^0 C
Chiller		Milk, butter, cheese	1^0 C to 3^0 C

Refrigerator top compartment		Dairy products, cooked meat/fish	2^0 C to 3^0 C
Refrigerator middle compartment		Cooked or raw vegetable or food	3^0 C to 6^0 C
Vegetable drawer		Fruits and vegetables	6^0 C to 8^0 C
Door shelf		Water bottles, juices, eggs	8^0 C to 10^0 C

Fig 4.7.2: Compartments in a FF refrigerator

Working of FF Refrigerator

FF refrigerators work on the principle of forced convection wherein a fan is used to force the heat transfer. The freezer and the refrigerator compartment are connected to each other to allow air to pass from the freezer to the refrigerator compartment. A damper regulates this flow of air. A blower fan generates forced air circulation to cool the compartments. The fan sucks in the hot air and pushes it through the evaporator fins. The evaporator fins are at sub-zero temperature and absorb heat and moisture from the hot air. The resulting cold, dry air is pushed to the freezer and the refrigerator compartments. This cycle continues till the pre-set temperature for both the compartments is achieved. An electrical thermostat regulates the temperature in the freezer/refrigerator compartments by switching the compressor on and off.

Components of FF Refrigerator

Some of the components of the FF refrigerator are similar to the DC refrigerator.
The components which differ are shown in the following table:

Component	Description
Evaporator fan motor	• Drives the evaporator fan to facilitate the movement of air
Condenser fan	• Sucks hot air from the condenser and throws it outside
Bi-metal thermostat	• Contains a bi-metal coil that contracts when cold and expands when heated • Fixed in the evaporator • Cuts off the defrost heater after defrosting is over
Thermal fuse	• Protects the freezer compartment from damage • Fixed in the evaporator
Defrost timer	• Automatically starts the defrost timer
Damper thermostat	• Non-electrical device • Regulates the temperature inside the refrigerator
Defrost heater	• Melts the frost formed in the freezer
Door switch	• Controls the operation of refrigerator lamp

Fig 4.7.3: Components of FF refrigerator

Defrosting FF Refrigerator

The defrost system of a FF refrigerator consists of the defrost timer, heater and thermostat. The defrost timer is the most important component of the defrost system. It is a motorized device with the defrost heater circuit on one end and the cooling system on the other. It opens and closes these contacts at pre-set intervals such that when one of the contacts is switched on, the other is switched off.

The following image shows a typical defrost cycle:

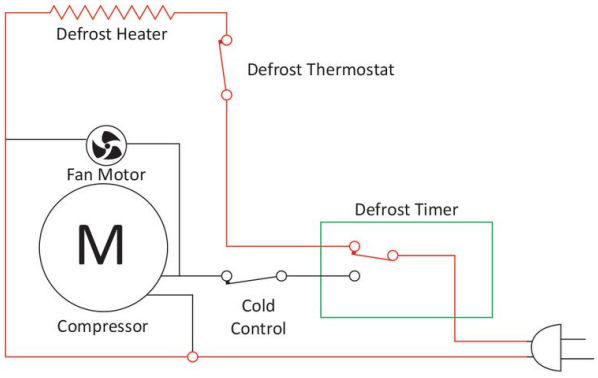


Fig 4.7.4: Defrost cycle of a FF refrigerator

The defrost timer automatically starts the defrost cycle after an interval of eight hours of compressor ON time. The defrost heater, located beneath the evaporator, starts melting the frost around the evaporator coils. The melted water flows out of a duct into a drain pan located on top of the compressor. The heat from the compressor evaporates the accumulated water. A soon as the frost is melted, the temperature of the evaporator coil increases due to the heat. The bi-metal sensor mounted on the evaporator coil senses the increase in temperature and turns off the heater.

Wiring Diagram of FF Refrigerator

A wiring diagram uses symbols to give information about the arrangement and the relative position of the components of an electrical circuit. It helps in understanding and troubleshooting problems by ensuring that all the components are present, and all the connection have been made.

The following figure shows the wiring diagram of a FF refrigerator with manual controls:

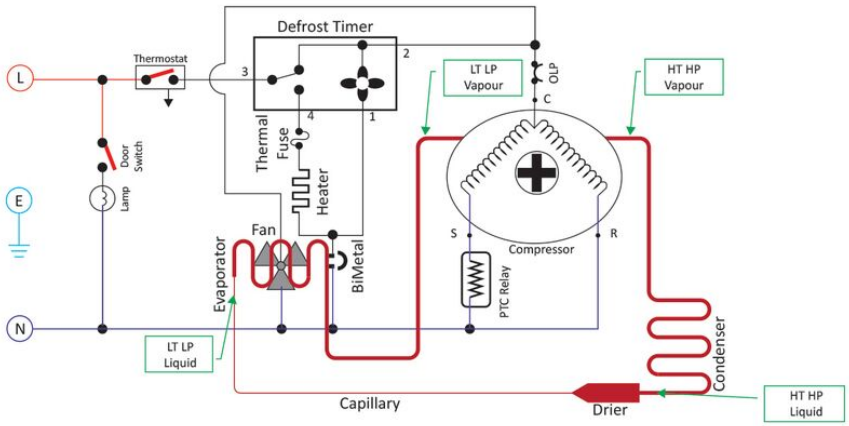


Fig 4.7.5: Wiring diagram of a FF refrigerator with manual controls

The following figure shows the wiring diagram of a FF refrigerator with electronic controls (PCB):

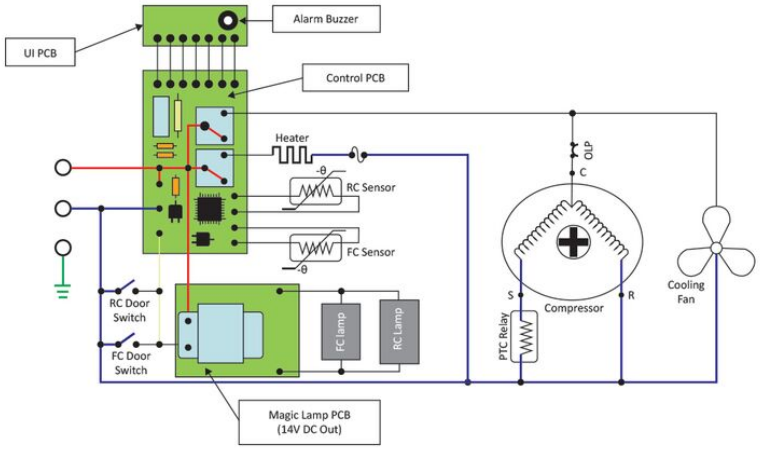


Fig 4.7.6: Wiring diagram of a FF Refrigerator with electronic controls

UNIT 4.8: Install DC & FF Refrigerator

Unit Objectives

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

1. Explain the site requirements for installation
2. Perform installation of DC/ FF refrigerator
3. Explain the steps involved in test run
4. Demonstrate and explain the features

4.8.1 Site Requirements for Installation

The first step of an installation process is to conduct a site survey and ensure that it meets all the requirements. The successful operation of a refrigerator is dependent on proper installation. The selected site should comply with all the safety codes and should not interfere with normal movement of people.

The following figure shows the site requirements of installing DC or FF refrigerator:

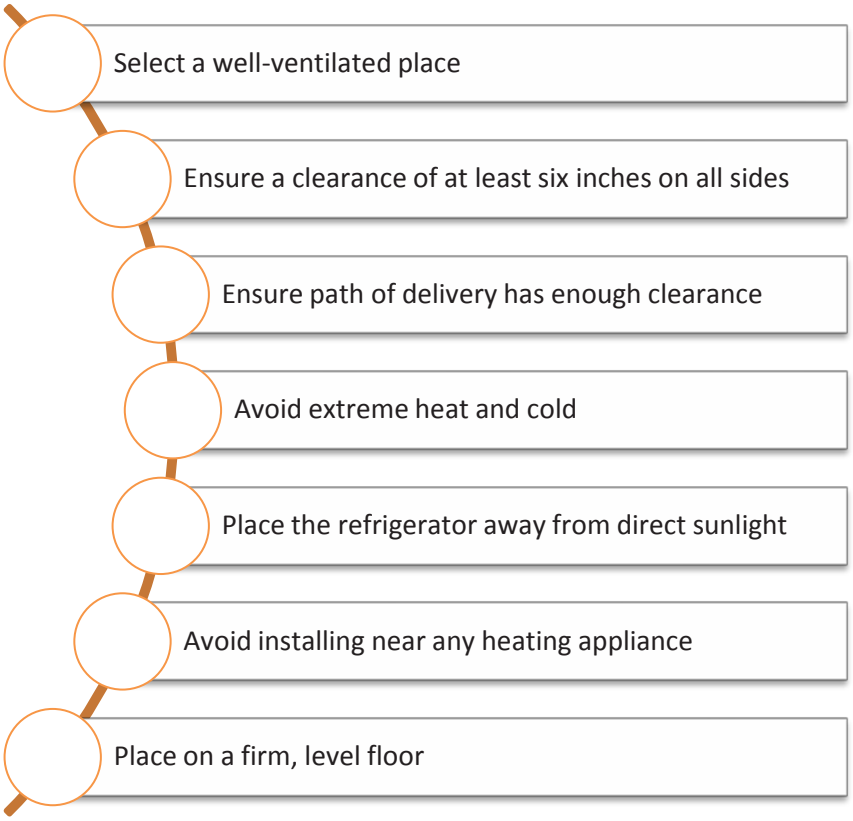


Fig 4.8.1: Site requirements

After checking the site requirements, the next step is to check the power supply at the location site.

The following figure shows the power requirements for installation:

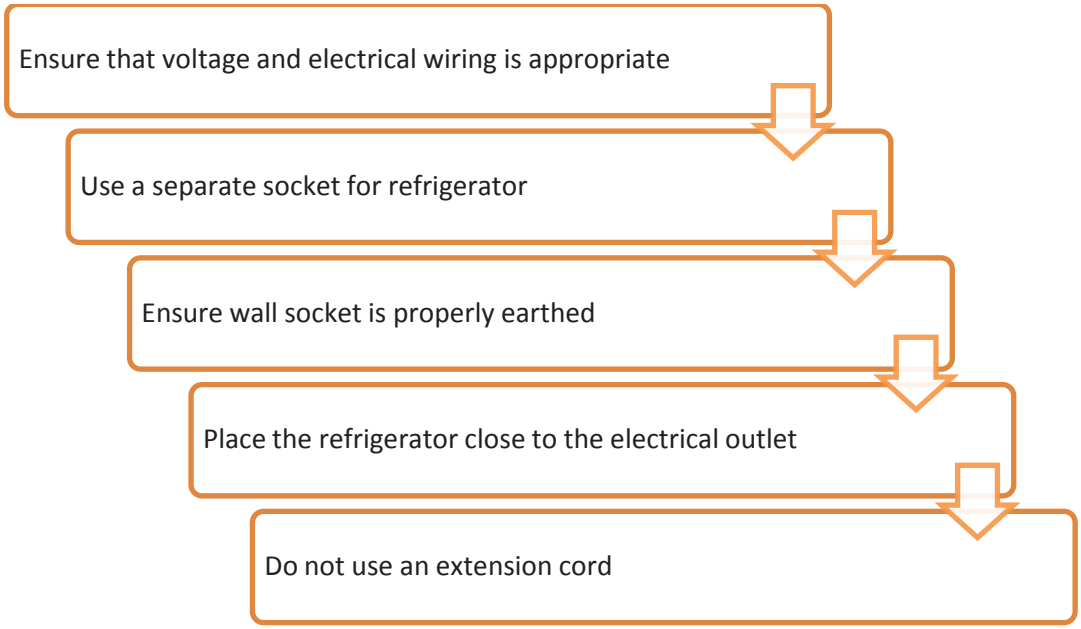


Fig 4.8.2: Power supply requirements

4.8.2 Installation Process

The installation process consists of transporting the unit from the delivery truck to the location, unpacking the unit, disposing the packing material and installing the refrigerator at the designated place.

Transporting Refrigerator

The refrigerator is an expensive electrical device. It should be handled with care during transportation.

The following figure shows the precautions that should be taken when transporting a refrigerator:

Fig 4.8.3: Transporting precautions

Unpacking Refrigerator

To protect the refrigerator from any kind of damage, it is properly packed and delivered. Once it is transported from the delivery truck, it needs to be carefully unpacked.

The following figure shows the tools that are needed for unpacking and handling a refrigerator:

Trolley truck

Utility knife

Cutter

Fig 4.8.4: Tools used in handling and unpacking

The following figure shows the steps for unpacking a refrigerator:

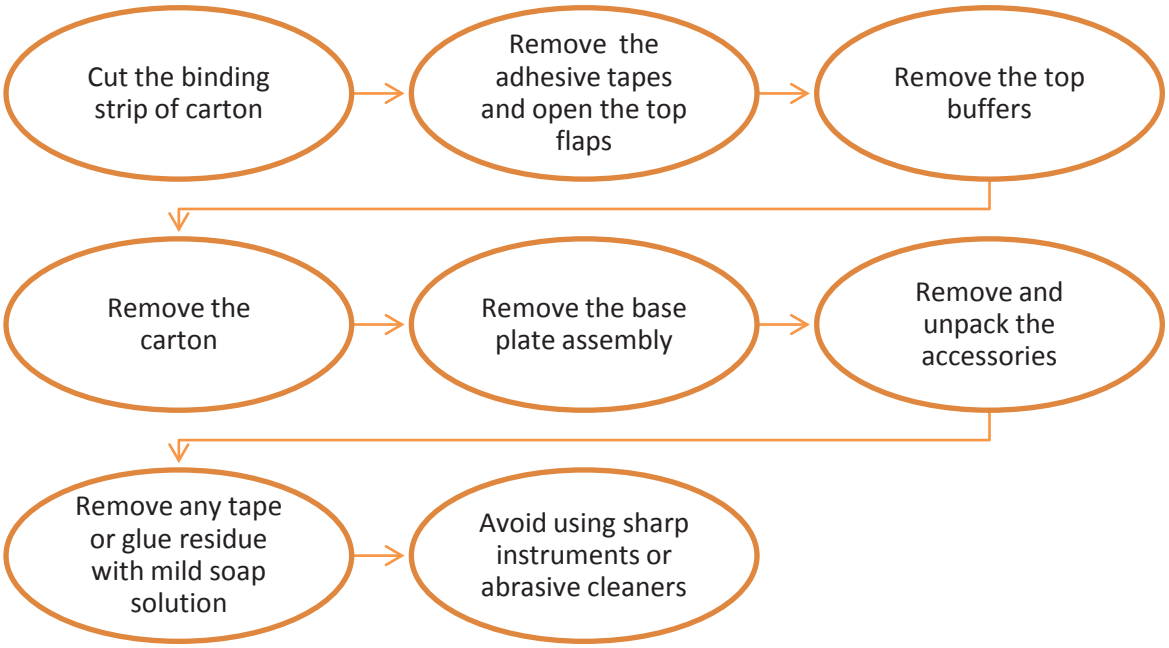


Fig 4.8.5: Unpacking guidelines

Check and understand the symbols on the package to know about the cautions and warnings related to the installation. The symbols along with their meanings are shown in the following images:

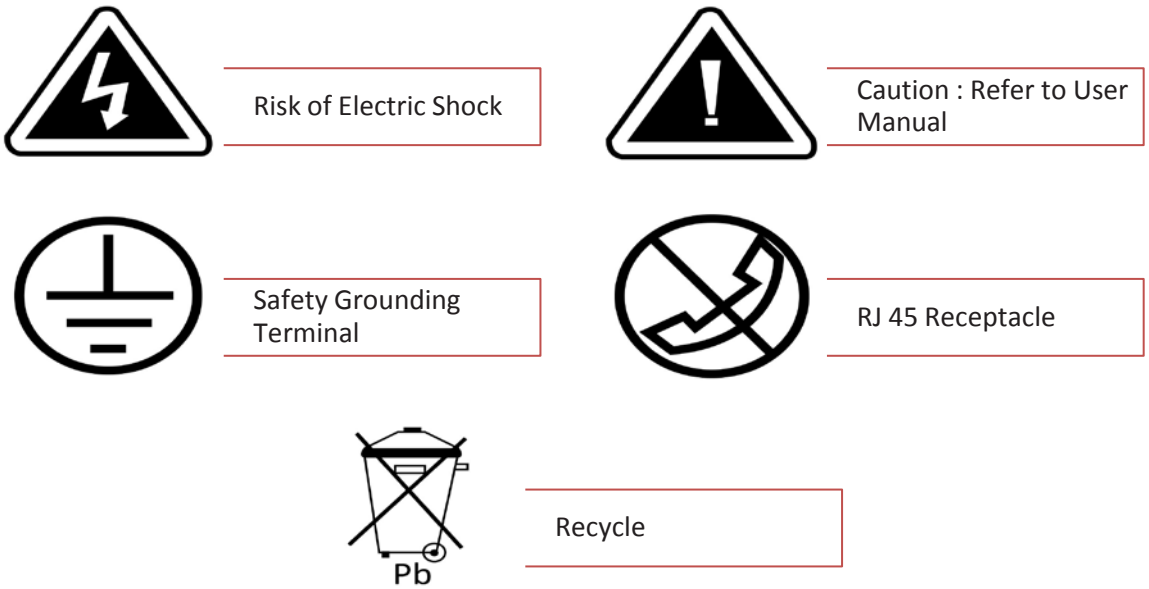


Fig 4.8.6: Symbols on a refrigerator package

Disposing Packing Material

After the refrigerator has been unpacked, it is important to dispose of the packaging material properly. Most of the packaging materials are nowadays made of recyclable materials. Avoid disposing the packaging materials with domestic waste. Place them in recycling bin. Dispose the non-recyclable materials such as Styrofoam in proper disposal locations.

Fig 4.8.7: Disposing packing material

Installing the Refrigerator

Once the work area has been cleaned, inspect the refrigerator for any damage to the cabinet or the sealed system. Lift the refrigerator gently and place it in its proper position. Level the refrigerator properly with the help of the adjustable legs to ensure that it stands firm on the ground. Keep the front end slightly higher than the rear end to help in door closing. Fit all the accessories in their proper place.

Connecting Electric Supply

Before plugging-in the refrigerator, check the power supply with the help of a voltmeter. If the voltage is below 170V or above 250V, advise the customer to install voltage stabilizer. This will safeguard the sealed system from any possible damage due to voltage fluctuation.

The following figure shows the steps to connect the electric supply:

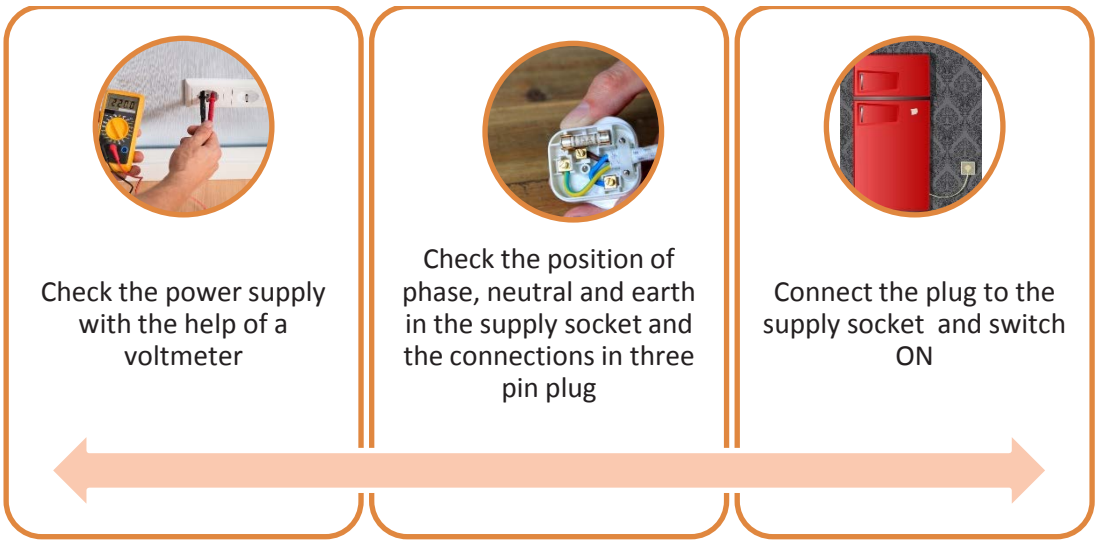


Fig 4.8.8: Connecting electric supply

The thermostat should be switched on to normal position as shown in the following image:

Fig 4.8.8: Thermostat in normal

It takes two to three hours for the temperature in the refrigerator to stabilize. Observe the compressor and fan for some time.

Complete the Documentation

After completing the installation at the site, the technician should complete the documentation to record the details related to installation. Along with completing the documentation, the field technician should tell the customer about some do's and don'ts for using the refrigerator such as, keep the area near the product clean and dry. The field technician should also tell the customer about important pages to be referred to from the owner's manual.

The following figure shows the installation documents:

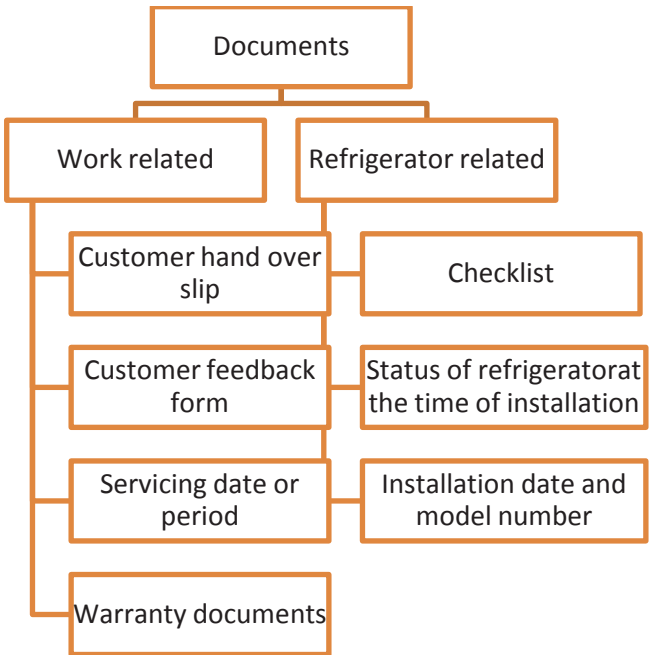


Fig 4.8.9: Installation documents

Interact with Supervisor or Superior

A technician must communicate with the supervisor in case they face problem with the installation process. If there is any damage found in the product, the supervisor needs to be informed immediately. In addition, the technician needs to report to the senior about the task status and submit the documents collected from the customer's site. Listen carefully to the senior if he/she has any queries or any suggestions.

Achieve Productivity and Quality

To achieve productivity and quality as per company standards follow the working instructions given by the company.
The following figure lists some ways to achieve productivity and quality:

Fig 4.8.10: Ways to achieve productivity and quality

UNIT 4.9: Repair DC and FF refrigerators

Unit Objectives

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

1. Repair DC & FF refrigerator

4.9.1 Break-Downs

A refrigerator is one of the few appliances that work continuously, day in and day out. It is a vital part of a customer's daily life. A breakdown or even a minor technical problem in the refrigerator can bring his/her life to a halt. An RACW technician should have the knowledge and skill to repair all kinds of refrigerators. He should be able to diagnose and troubleshoot the problem. He should carry out repairs according to the requirements of that particular model.

It is very important for a technician to correctly identify the fault in the refrigerator. Wrong identification of fault will lead to waste of time and money and it can also cause damage to the equipment.

The following figure shows the steps for identifying the fault:

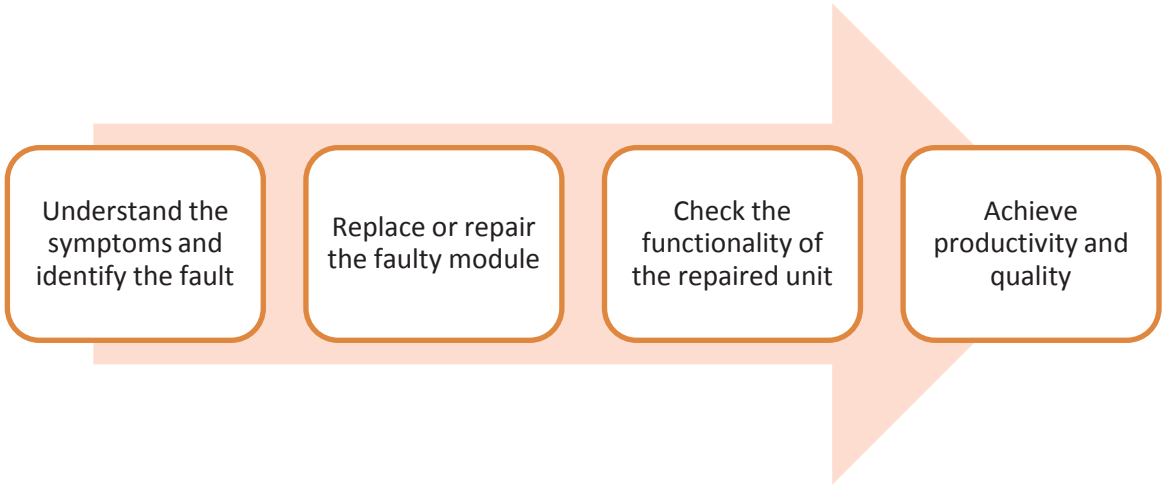


Fig 4.9.1: Steps for identifying the fault

Component Check Guide

It is very important to have the knowledge and skill to correctly perform a check on individual components when they are out of circuit to ensure that they are working properly.

The following table shows the check guide for various components:

S No.	Part name	Checking method	Approximate value
1.	OLP	Continuity between terminals	0 ohm -> continuity Cut In: 65 C Cut Off: 125 C
2.	Bi-metal	Continuity between terminals	Open -> no continuity Cut In: -5 C Cut Off: +15 C
3.	Thermostat	Continuity between terminals in Switch OFF condition	Open -> no continuity
		Continuity between terminals in Switch ON condition	0 ohm -> continuity
4.	Defrost timer	Keep timer knob at cooling cycle, Check continuity between 2 and 3	0 ohm
		Keep timer knob at cooling cycle, Check continuity between 4 and 3	Open
		Rotate timer knob to defrost cycle, Check continuity between 2 and 3	Open
		Rotate timer knob to defrost cycle, Check continuity between 4 and 3	Open
5.	Temperature sensor	Check resistance between terminals	2 - 3 ohm
6.	PTC relay	Check resistance between terminals	10 - 33 ohm
7.	Heater	Check resistance between terminals	300 - 370 ohm
8.	Fan motor	Check resistance between terminals	0.3 – 0.35 k ohm

Fig 4.9.2: Check guide for components

Troubleshooting Guide

The following table represents the common problems in the working of a refrigerator along with their potential causes and solutions:

Fault/Symptoms	Potential Causes	Recommended Solutions
Excess frost in freezer	Defective bi-metal or thermal fuse or defrost heater	1. Check the continuity of each component 2. Replace defective component
Refrigerator temperature not maintained	Improper installation	1. Check installation 2. Check ventilation
Condensation in refrigerator compartment	Air leakage	1. Check for leakage 2. Do proper insulation
Improper cooling	Gas leakage	1. Check for gas leakage 2. Repair the leakage 3. Refill refrigerant
Frequent compressor tripping	Defective condenser fan motor	1. Check condenser fan motor 2. Replace defective motor
Fan runs even when door is open	Defective door switch	1. Check door switch 2. Replace if defective
Internal bulb does not switch ON	Defective bulb	1. Replace light bulb
No cooling in refrigerator	Defective sealed system	1. Refer to unit on sealed system
Refrigerator unit not working	Fuse blown	1. Check fuse 2. Replace if defective
	Defective thermostat	1. Short thermostat connection 2. Check if refrigerator working 3. If yes, repair/replace thermostat

Refrigerator unit not humming	Low voltage	1. Check voltage 2. If not within range, connect stabilizer
	Defective relay	1. Short relay connection 2. Check if refrigerator working 3. If yes, repair/replace relay
Refrigerator running continuously	Defective thermostat	1. Short thermostat connection 2. Check if refrigerator working 3. If yes, repair/replace thermostat
Refrigerator very noise	Improper installation	1. Check installation 2. Check foundation 3. If loose, tighten base screws
Refrigerator compartment very hot	Improper thermostat adjustment	1. Check thermostat 2. Replace if defective
	Defective door seals	1. Check door gasket 2. Replace if defective
	Defective fan motor	1. Check continuity between fan and switch 2. Check fan and switch 3. Replace the defective part
	No air circulation	1. Check air circulation 2. Check for any restriction in air path
Excessive cold in food compartment	Defective damper	1. Check damper 2. If blocked, remove ice and dry it 3. Check if drain pipe is choked
Compressor not working	Low voltage	1. Check voltage 2. If not within range, install stabilizer
	Defective compressor	1. Check compressor 2. Replace if defective
	Defective overload protector	1. Check continuity of overload protector 2. Replace if defective
	Defective start relay	1. Check resistance of relay 2. Replace if abnormal

Compressor motor heats up	Excessive load	1. Reduce load
	Low voltage	1. Check voltage 2. If not within range, install stabilizer
Compressor motor stop intermittently	Low voltage	1. Check voltage 2. If not within range, install stabilizer
	Improper motor winding	1. Check resistance of motor winding 2. Replace if abnormal
Current leakage	Improper grounding	1. Check grounding of all components 2. Replace if ungrounded
	Earth wire removed	1. Connect earth wire to the body

Fig 4.9.3: Common problems of refrigerator

Replacing Dysfunctional Module

In case the technician is unable to repair the components or fix the fault, or if the components cannot be replaced at customer's site, then the faulty module/component is sent to the service centre. The field technician then collects the functional module from the service centre and replaces the defective component at the customer's site.

Confirming Functionality of the Repaired Module

After the dysfunctional module has been repaired or replaced, check the new module with testing equipment such as multimeter and ammeter. This is done to ensure that the module is working fine with the other parts of the refrigerator.

The following figure shows the steps for confirming functionality of the repaired module:

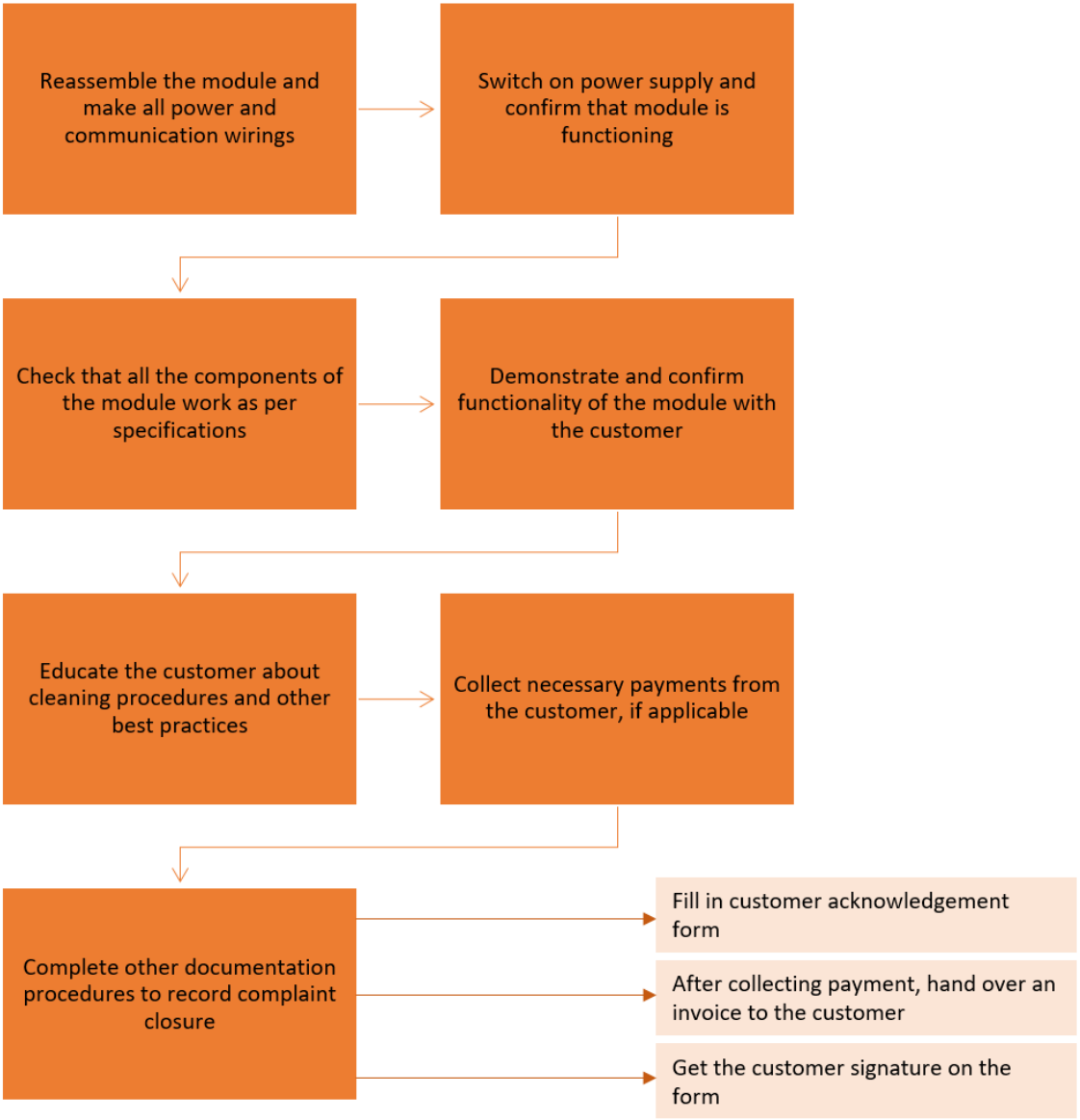


Fig 4.9.4: Steps to confirm functionality of the repaired unit

Achieving Productivity and Quality as per Company's Norms

To achieve productivity and quality as per company standards, a technician should follow the working instructions given by the company.

The following figure shows the steps for achieving productivity and quality practise the following:

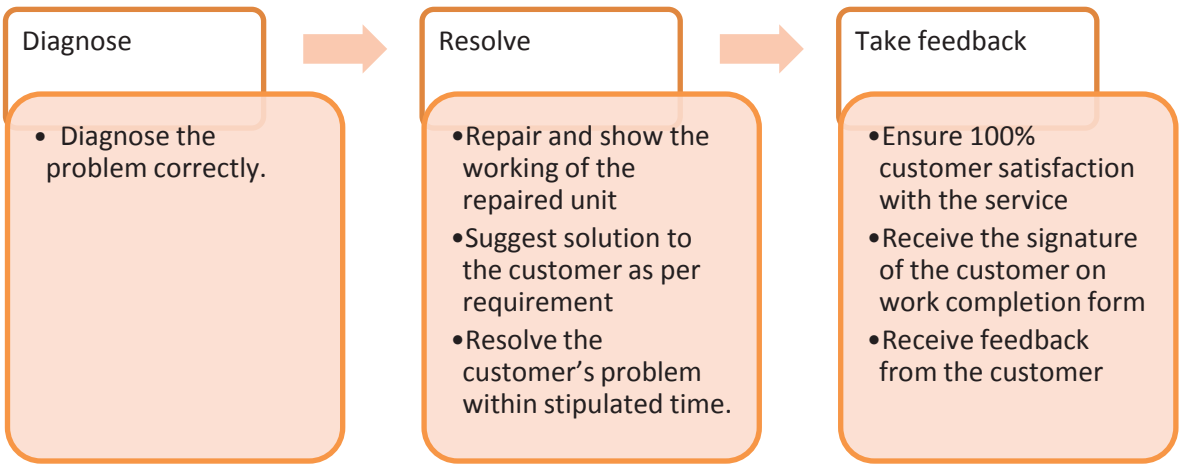


Fig 4.9.5: Work flow to achieve productivity and quality in repairing

UNIT 4.10: Sealed System

Unit Objectives

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

1. Define sealed system
2. Perform sealed system repairs

4.10.1 Refrigerator Sealed System

A sealed system essentially means any system whose working is concealed and is closed to the atmosphere. A refrigerator sealed system is the system in which the cooling takes place. It consists of evaporator, condenser, compressor, suction tube and metering device. All the parts containing refrigerant are sealed with brazing or welding and have capped valves and service ports to enable repair.

The following figure shows the components of a sealed system:

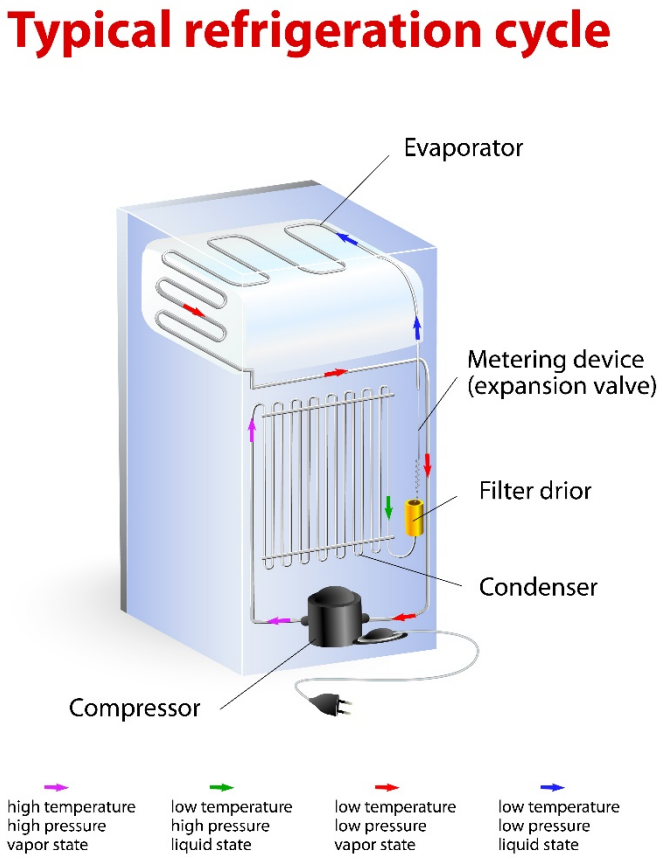


Fig 4.10.1: Components of a sealed system

Advantages of Sealed System

The individual components and pipes in a sealed system have only brazed connections; they do not have joints. The entire pipeline is in a single piece. The following figure shows the advantages of sealed system:

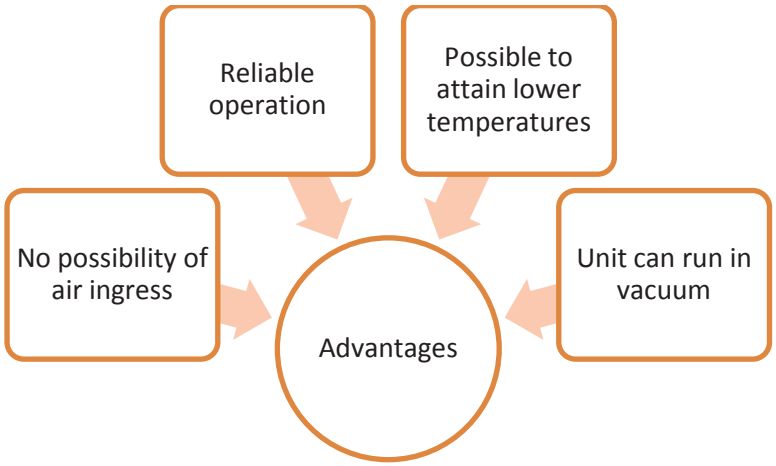


Fig 4.10.2: Advantages of a sealed system

4.10.2 Sealed System Repairs

Proper repair of sealed system is dependent foremost upon a thorough understanding of the normal operating procedures, the types of failures that can occur in a sealed system and the correct diagnosis of the problem.

The following figure shows the types of failures that can necessitate repairs:

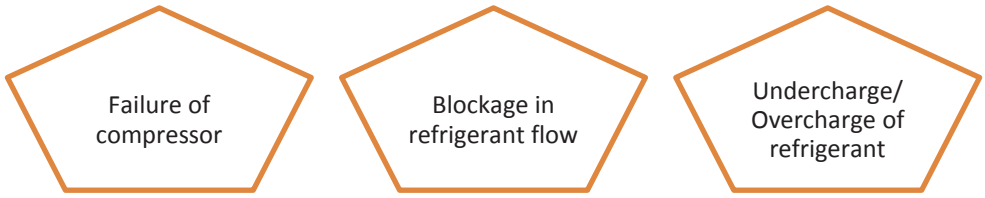


Fig 4.10.3: Types of failures

Failure of Compressor

The inflow and outflow of refrigerant in a compressor is regulated by two valves. A defective valve leads to inefficiency and subsequently a failure of compressor. The compressor is unable to maintain correct pressure differential needed for proper evaporation and condensation of refrigerant.

Blockage in Refrigerant Flow

The system must be free of any contaminants or moisture. Moisture is especially very harmful to the system. Water mixes with the refrigerant and forms salt and sludge. These salts and debris block the flow of refrigerant through the capillary tube.

Undercharge/ Overcharge of Refrigerant

The system should be charged properly with the factory recommended refrigerant. It is highly unlikely for a unit to leave the factory with incorrect charge. Undercharge or overcharge of refrigerant is usually a result of poor system processing after repairs. It occurs when a unit is incorrectly charged after performing repair. Undercharge reduces the system's ability to absorb heat and overcharge has an adverse impact on the cooling efficiency as well as on power consumption.

Once the problem has been isolated, appropriate repairs can be undertaken. The following figure shows the prerequisites for a successful repair:

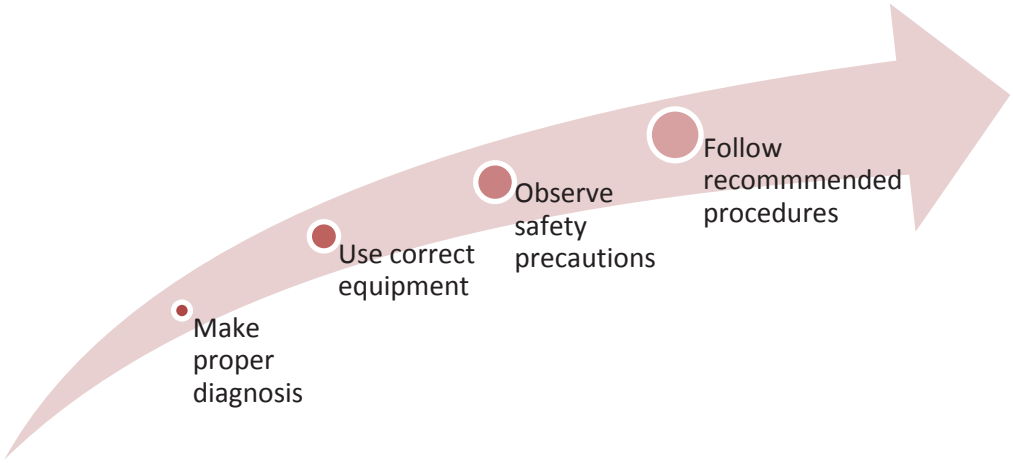


Fig 4.10.4: Prerequisites for successful repair

Sealed system repair consists of specific steps that need to be followed. The following figure shows the steps of sealed system repair:

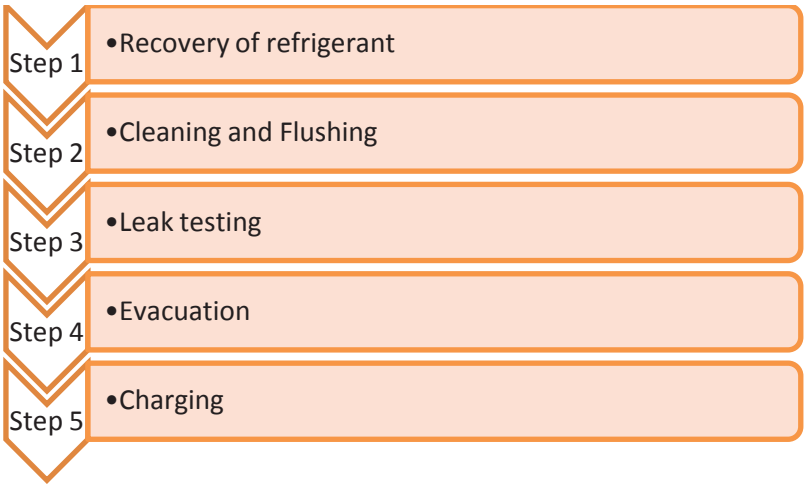


Fig 4.10.5: Steps of sealed system repair

Recovery of Refrigerant

Recovery of a refrigerant refers to the process of removing a refrigerant from a system and storing it in a recovery cylinder. A recovery cylinder is different from the conventional cylinder in two ways. First, the cylinder valve has the refrigerant filling port enabled and secondly, its upper part is painted yellow to mark it as a recovery cylinder. There are three different methods of recovering a refrigerant, as shown in the following figure:

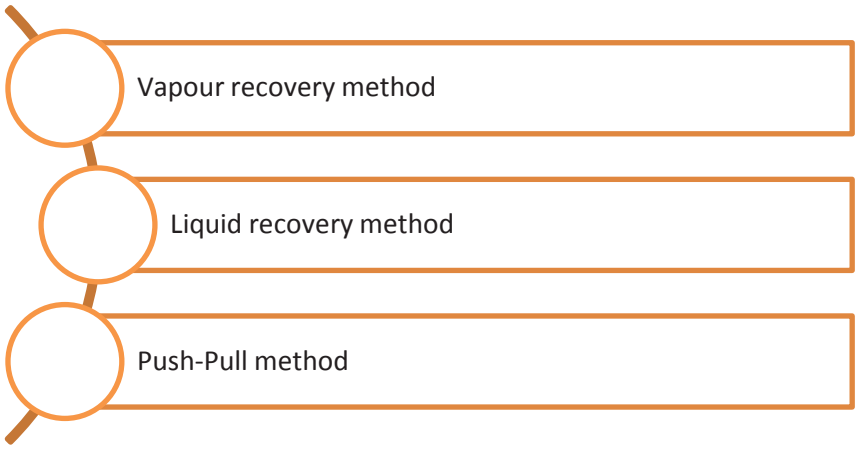


Fig 4.10.6: Methods of refrigerant recovery

Vapour Recovery Method

It is the most common method of refrigerant recovery. The refrigerant which is in vapour form is drawn into the recovery system from the refrigeration unit. It passes through the compressor to the condenser. The gas cools down to liquid and is stored in the recovery cylinder.

The following figure shows the steps of the vapour recovery method:

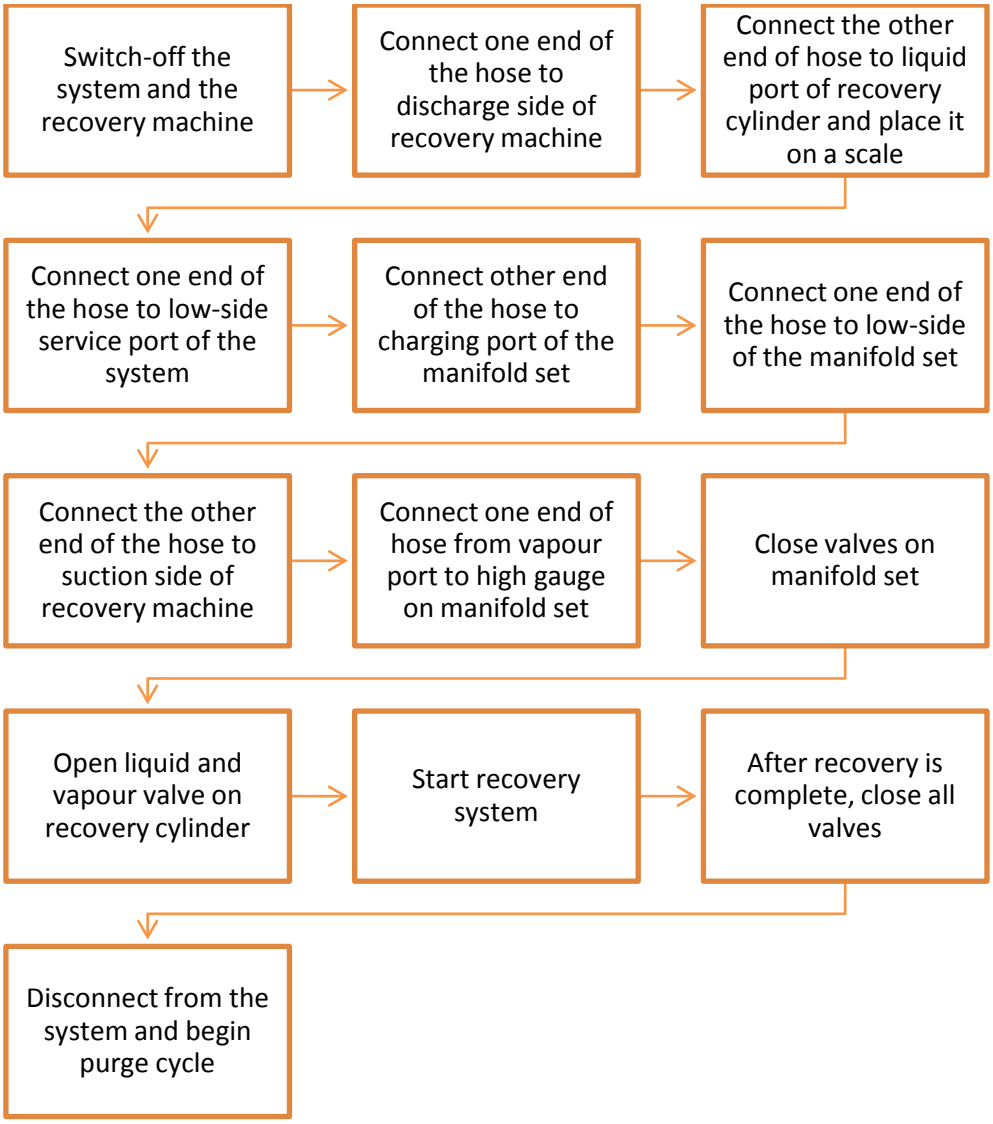


Fig 4.10.7: Vapour recovery method

Liquid recovery Method

This method is preferred when the refrigerant has to be recovered from oil-less compressors having constant-pressure valves. The recovery method is similar to the vapour recovery method with the difference that it enables liquid refrigerant to be recovered.

The following figure shows the steps of the liquid recovery method:

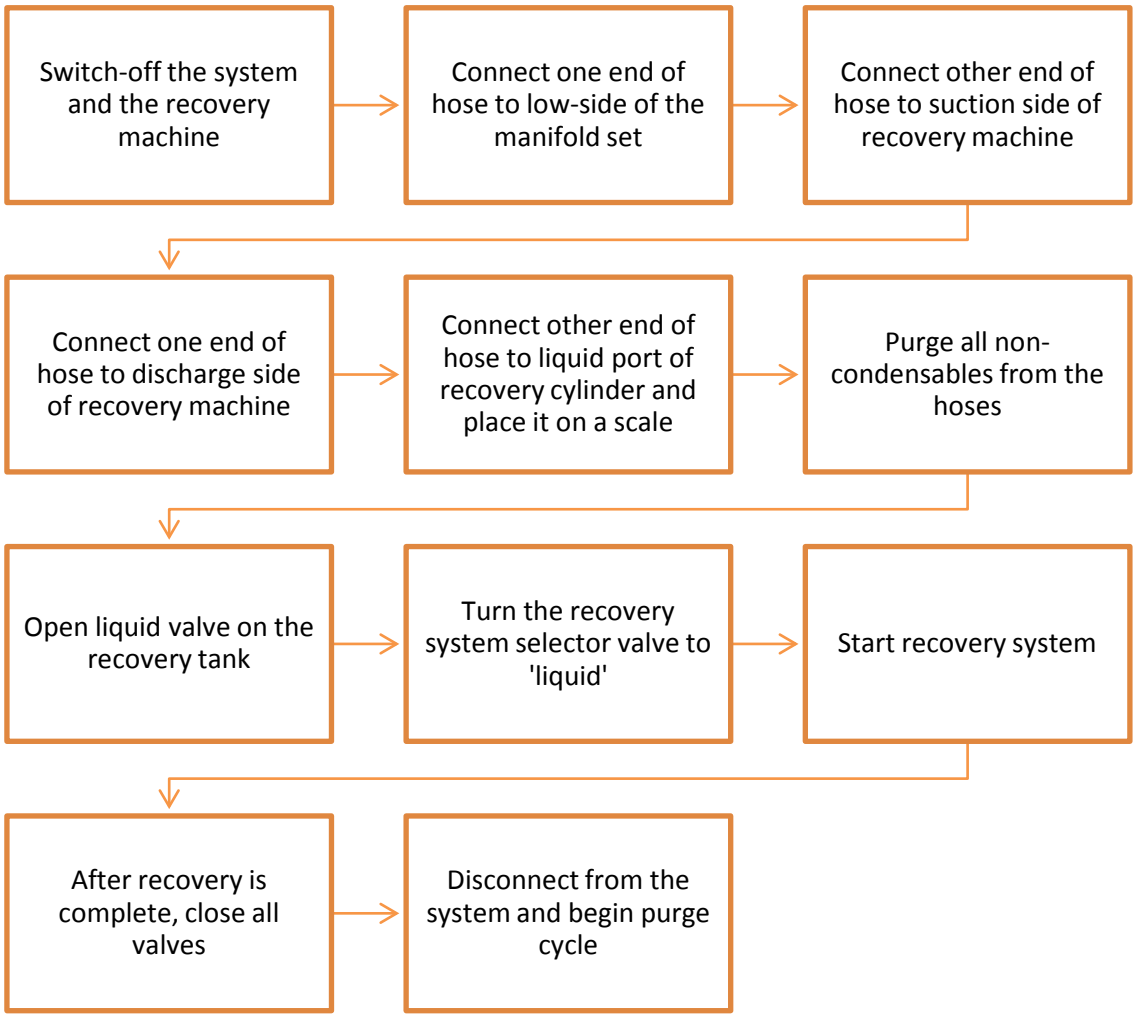


Fig 4.10.8: Liquid recovery method

Push-Pull Method

This method is used to recover bulk liquid from a system. The recovery machine creates potential difference to siphon the refrigerant from one tank to another. The recovery unit pulls vapour from the recovery cylinder. This produces a high-pressure gas that pushes the liquid out of the system into the recovery cylinder.

The following figure shows the steps of the push-pull method:

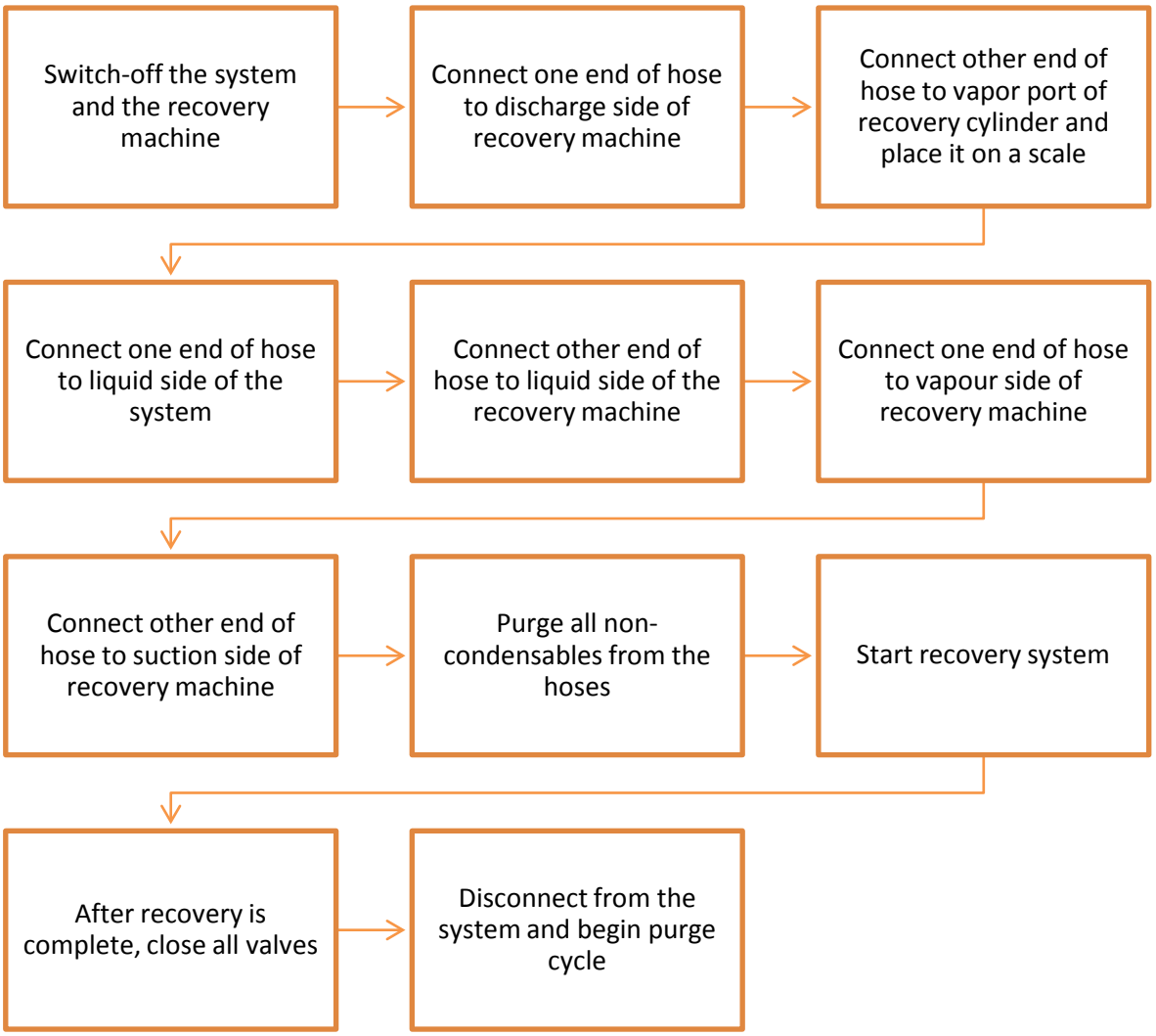


Fig 4.10.9: Push-pull method

Cleaning and Flushing

When a refrigeration system suffers a failure, it becomes contaminated with disintegrated particulate, sludge, acids, carbon residues, and moisture. These contaminants need to be cleaned and flushed out of the system. The most common cause of contamination is compressor failure.

The following figure shows the guidelines that must be followed when flushing a system:

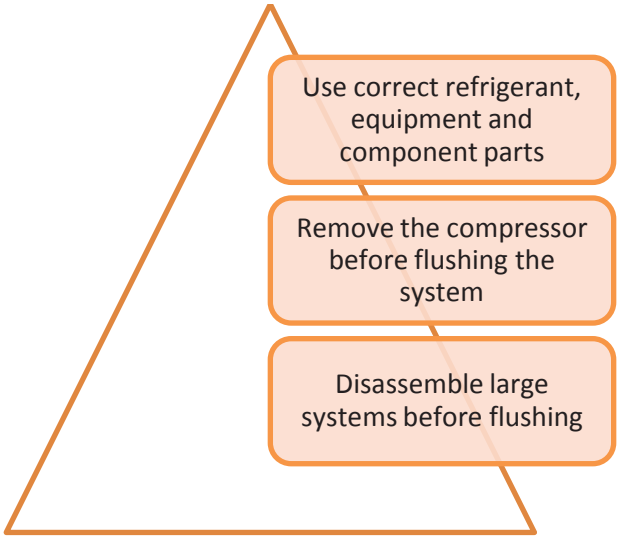


Fig 4.10.10: Guidelines for flushing system

It is very important to use correct equipment, ensure that it is in good working condition and undertake periodic and regular maintenance of the tools.

The following figure shows the equipment required for flushing a system:

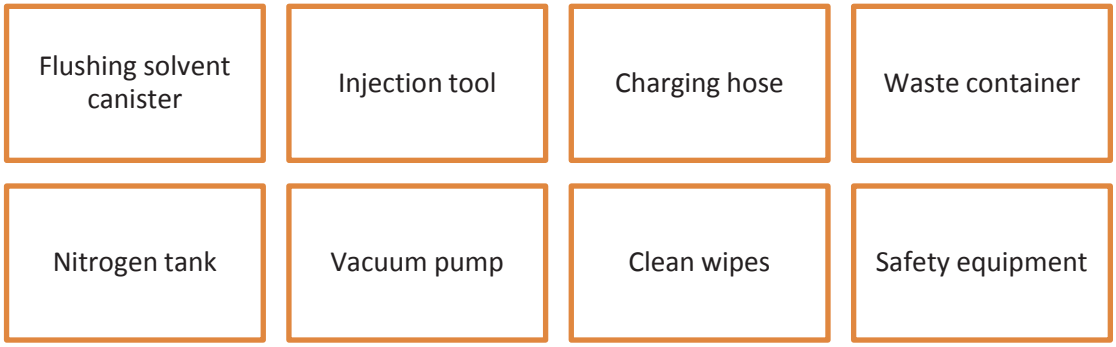


Fig 4.10.11: Equipment for flushing system

Before starting the flushing operation, confirm the availability of all required tools and equipment.

The following figure shows the steps of flushing a system:

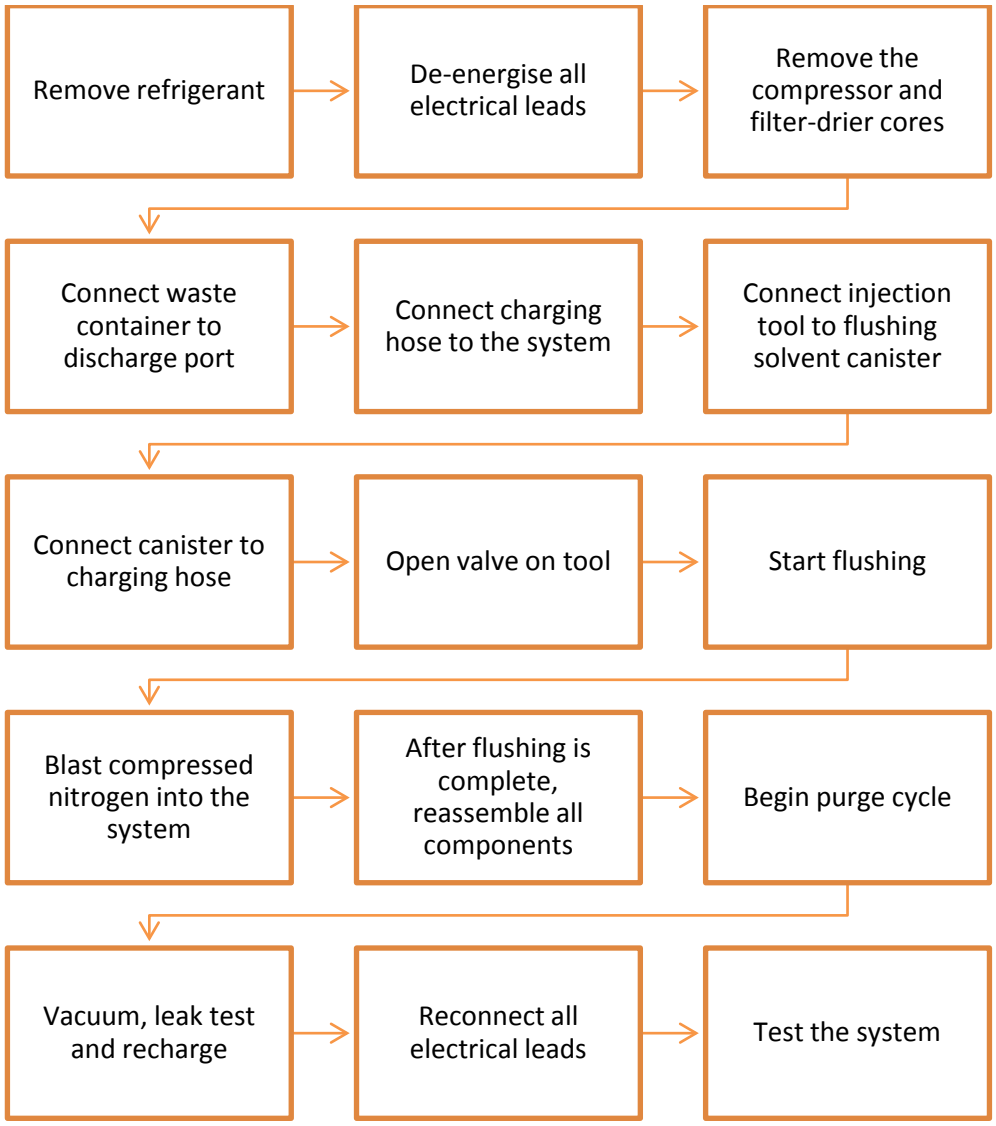


Fig 4.10.12: Steps for flushing system

Leak Testing

The refrigerators can operate properly only with a fixed charge of refrigerant. If it is diagnosed during troubleshooting that the refrigerant is insufficient, then the system needs to be checked for leaks. Theses leaks are then repaired, and the system is recharged with refrigerant.

The following figure lists the various causes of refrigerant leaks:

Vibration	•Leads to misalignment of eals and loosening of bolts
Frequent temperature changes	•Leads to expansion and contracrtion in metal parts
Frequent pressure changes	•Leads to difference in material stress
Incorrect material used	•Fail under pressure or temperature changes
Poor connections	•Result in leakage from joints, connections or caps on valves
Corrosion	•Decays the materials creating holes
Accidental damage	•Leads to impact on refrigerant containing parts

Fig 4.10.13: Causes of refrigerant leaks

Once the possibility of leak is diagnosed, it is critical to check the whole system for multiple leaks and mark them for repair. Leak detection is carried out manually by the technician to identify possible leaks.

The following figure shows the methods for leak detection:

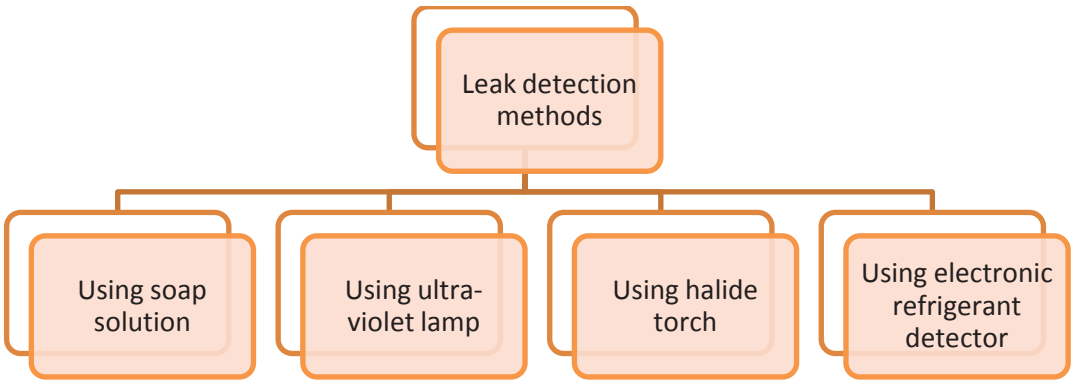


Fig 4.10.14: Methods of leak detection

Using Soap Solution

It is the most effective and economical method used by technicians to detect leakage.

A soap solution is applied to joints, connections and fittings while the system is running. The appearance of bubbles confirms leakage.

The following image shows leak detection using soap solution:

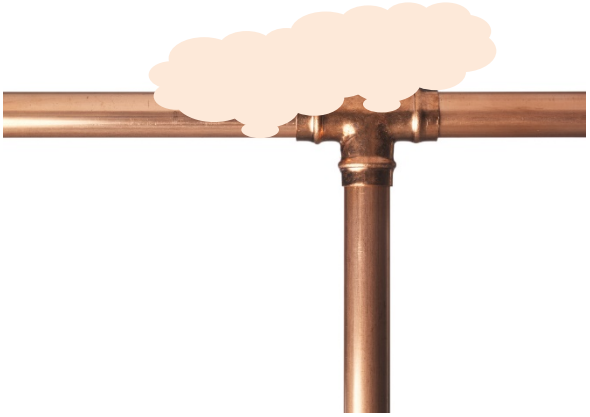


Fig 4.10.15: Leak detection using soap solution

Using Ultra-Violet Lamp

In case of large refrigeration systems, it is difficult to access all joints and connections. So, it is not possible to use soap solution or electronic detector to check for leakage. In such situations, ultra-violet lamp is used. An additive dye is added to the refrigerant. When a ultra-violet lamp is pointed, the leak glows in yellow-green colour.

The following image shows leak detection using ultra-violet lamp:

Fig 4.10.16: Leak detection using ultra-violet lamp

Using Halide Torch

The halide torch is used to detect leakage of CFCs and HCFCs. It contains a copper catalyst over which the refrigerant is drawn with the help of a blue flame. When the refrigerant burns over the copper catalyst, the chlorine in it reacts and the colour of the flame changes to green. It does not work in case of refrigerants such as HFCs which do not contain chlorine.

The following image shows a halide torch:

Fig 4.10.17: A halide torch

Using Electronic Refrigerant Detector

An electronic refrigerant detector is a battery or AC powered device containing an element sensitive to a particular chemical component in the refrigerant. As it approaches the source of leak, the audible or visible signal increases in frequency and intensity.
The following image shows leak detection using electronic refrigerant detector:

Fig 4.10.17: Leak detection using electronic refrigerant detector

Evacuation

Evacuation refers to the process of removing vapours, fluids and non-condensable gases such as air and nitrogen from the refrigeration system.
The following figure shows the equipment needed for evacuating a system:

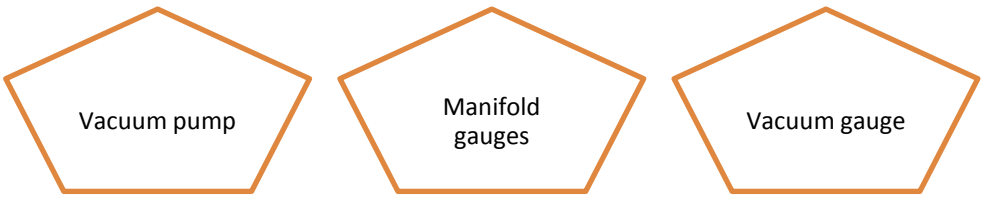


Fig 4.10.18: Equipment for evacuating a system

The following figure shows the steps of evacuating a system:

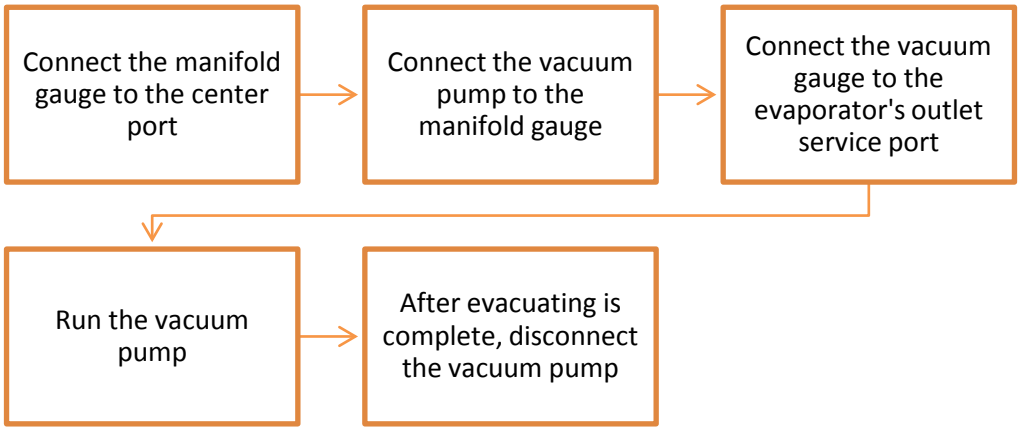


Fig 4.10.19: Steps for evacuating a system

Charging

Every refrigeration system needs an optimum level of refrigerant to function efficiently. When the level of refrigerant drops, it needs to be filled-up. Charging refers to the process of adding the refrigerant in proper quantity to a refrigeration system.

The following figure shows the steps of charging a system:

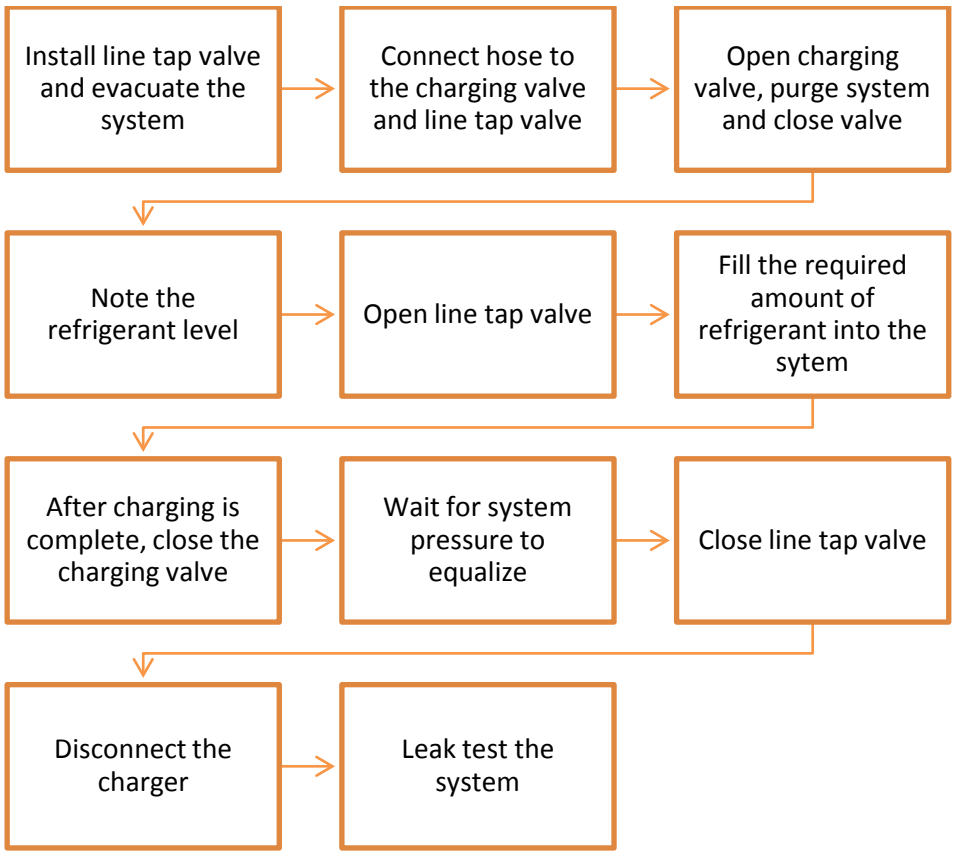


Fig 4.10.20: Steps for charging a system

UNIT 4.11: Copper Tube Processing

Unit Objectives

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

1. Perform tube cutting and bending
2. Perform tube deburring and flaring
3. Perform tube brazing

4.11.1 Copper Tubes

Initially, the condenser coils were made of aluminium as it was cheap and had high transfer properties. However, it was noticed that it requires high maintenance. It was not possible to repair aluminium tubes; they needed to be replaced every time. It was replaced by copper. The following figure shows the reasons for replacing aluminium with copper:

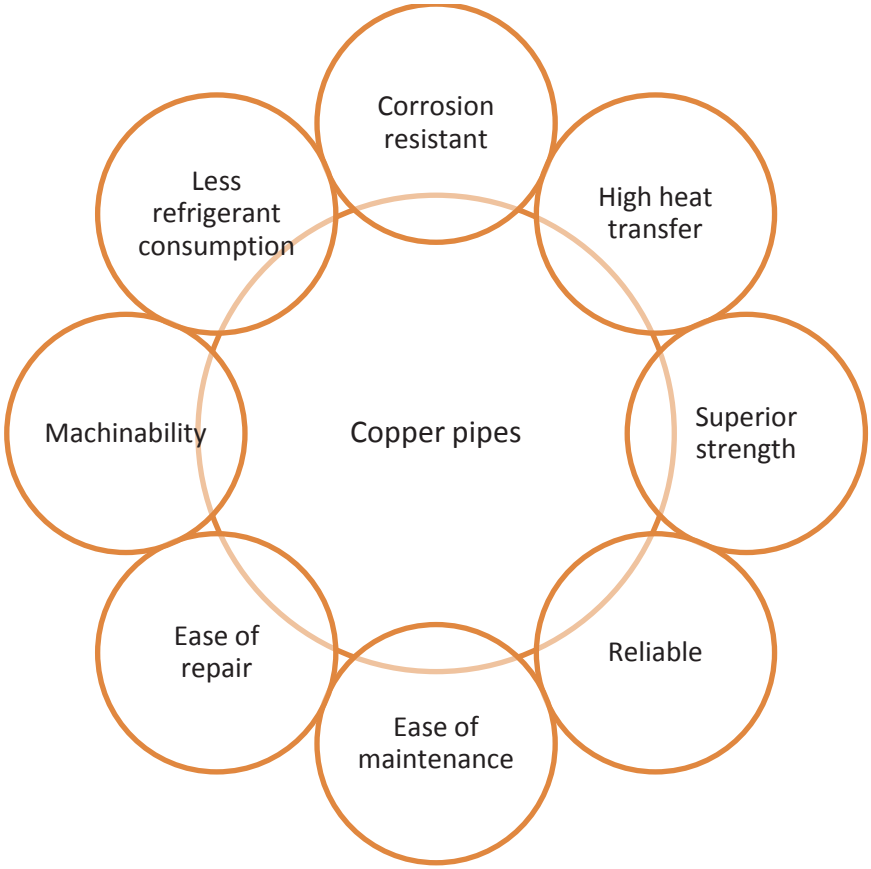


Fig 4.11.1: Advantages of copper pipes

Tube Cutting

A copper tube should always be cut with a tube cutter, a tool built specifically for that purpose.

The following figure shows the steps of cutting a copper tube:

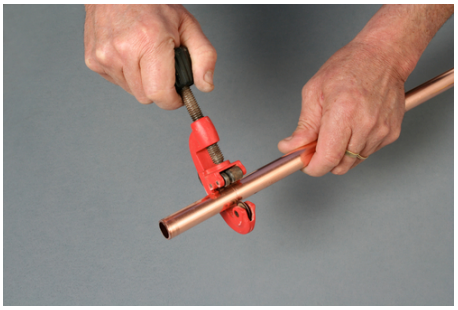
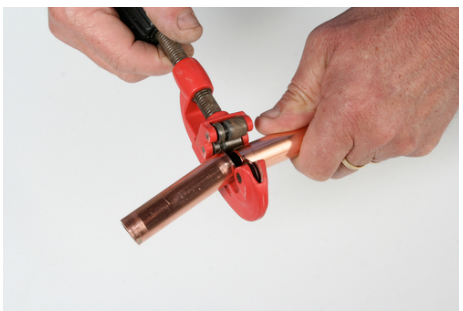
Step No.	Task	Image
1.	Insert the copper tube in the tube cutter	
2.	Tighten the blade so that it fits snugly	
3.	Turn the cutter a few times till a groove is cut in the circumference of the tube	
4.	Align the groove with the blade and twist till the tube is cut	

Fig 4.11.2: Steps of cutting a copper tube

Tube Bending

A copper tube should always be bent with a tube bender, a tool built specifically for that purpose.

The following figure shows the steps of bending a copper tube:

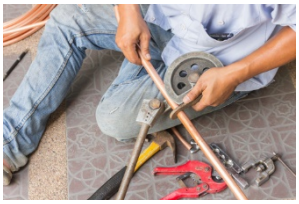
Step No.	Task	Image
1.	Insert the copper tube in the wheel groove of the tube bender	
2.	Place the tube holding clip over the tube and bring the handle down	
3.	Pull both the handles towards each other in a smooth motion to bend the tube	
4.	Remove the bent tube and release tube holding clip	

Fig 4.11.3: Tube bending

Tube Deburring

When a copper tube is cut, it leaves some burrs behind. Burrs are metal shavings inside the wall of the tube. They need to be removed as they can cause leakage in joints and connections. Burrs are removed with the help of a burr remover, a tool built specifically for that purpose.

The following figure shows the steps of deburring a copper tube:

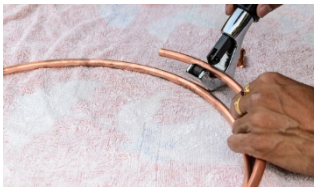
Step No.	Task	Image
1.	Insert the blade of the deburring tool at the edge of the tube	
2.	Rotate the blade around the walls of the tube shaving off the burrs.	

Fig 4.11.4: Tube deburring

Tube Flaring

Flaring is the process of joining two copper tubes mechanically. A copper tube should always be flared with a tube flarer, a tool built specifically for that purpose.

The following figure shows the steps of bending a copper tube:

Step No.	Task	Image
1.	Cut the desired length of the tube	
2.	Remove internal burrs with a deburrer	

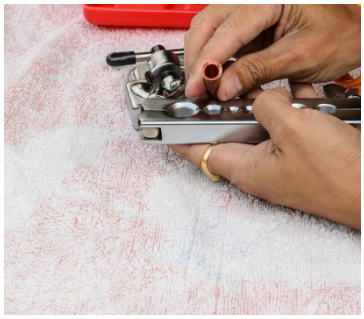
3.	Assemble the flaring tool	
4.	Insert the tube between the flaring bars of tool. Align the cone at the end of the tube and tighten the screw	
5.	Unclamp the compression cone	
6.	Remove the tube from the flaring tool and inspect the flared tube	

Fig 4.11.5: Tube flaring

Tube Brazing

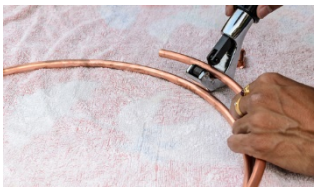
Brazing is the process of joining two metals by filling the joint with a different metal, melted at very high temperature. The filler or the brazing rod is melted by the heat of the metals rather than the flame.

The following figure shows the most commonly used brazing techniques:

Torch brazing	•Uses fuel gas flame such as acetylene, hydrogen or propane to generate heat
Induction brazing	•Uses a rapidly alternating current to generate heat
Resistance brazing	•Uses resistance of a metal to an electric current to generate heat
Furnance brazing	•Uses a furnance to generate heat

Fig 4.11.6: Brazing techniques

The following figure shows the steps of brazing a copper tube:

Step No.	Task	Image
1.	Cut the desired length of the tube	
2.	Remove internal burrs with a deburrer	
3.	Assemble the tubes and the fitting. Purge residues out of tubes before brazing	

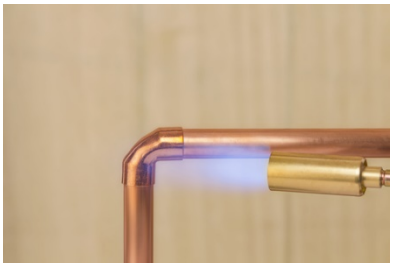
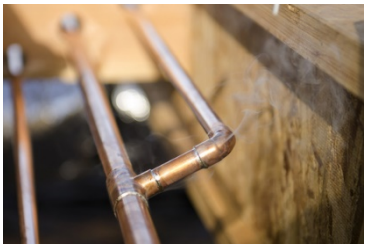
4.	Apply uniform heat to both the tubes and the fitting	
5.	Apply the filler material	
6.	Complete the joint evenly and remove heat	

Fig 4.11.7: Brazing techniques

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5. Air Conditioners

Unit 5.1 – Basic Concepts of Air Conditioners (ACs)

Unit 5.2 – Working and Installation of Window ACs

Unit 5.3 – Servicing Window ACs

Unit 5.4 – Installing Split ACs

Unit 5.5 – Servicing Split ACs

Key Learning Outcomes

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

1. Define the factors, comfort zone and heat load of ACs
2. Identify the different parts and working of Window ACs
3. Follow safety precautions for installation of Window ACs
4. Test-run a Window AC
5. Describe wiring diagrams for Window ACs
6. Test electronic components of Window ACs
7. Service and repair Window ACs
8. Identify the different parts and working of Split ACs
9. Follow safety precautions for installation of Split ACs
10. Test-run a Split AC
11. Describe wiring diagrams for Split ACs
12. Test electronic components of Split ACs

UNIT 5.1: Basic Concepts of Air Conditioners (ACs)

Unit Objectives

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

1. Define the factors for air conditioning
2. Define heat load and comfort zone of ACs
3. Describe the types of ACs

The main objective of having a confined space air conditioned is to make it comfortable for its occupants. This means making the indoors cooler or warmer irrespective of the heat or cold outside. The basic principle at which AC works is similar to a refrigerator, except the AC does not confine the coolness inside its unit but spreads it outside the unit into the room using a fan. The refrigeration cycle of ACs is also similar to that of refrigerators using the same principles and components.

5.1.1 Factors for Air Conditioning

Air conditioning typically means modifying (cooling or heating) the air inside a closed environment. This modification is affected by four factors, as shown in the following diagram:

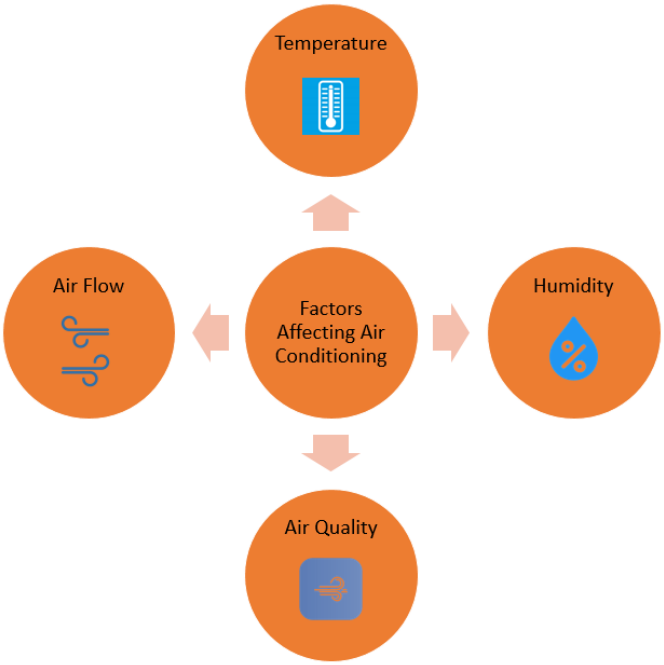

Fig. 5.1.1: Factors affecting air conditioning

The preceding factors decide the working of the ACs as well as how effective the ACs would be in that closed environment.

For example, typically, ACs should lower the temperature in summers and increase the temperature in winters for a closed room or space. The decrease in temperature is done by removing the humidity and heat that is generated by the environment and living beings (such as humans and their pets) existing in that environment. ACs should also work to improve the air quality, by removing odour and dust particles suspended in the air due to heat. Lastly, ACs need to ensure that there is proper air movement and circulation to avoid any suffocation due to air modification.

5.1.2 Heat Loads and Comfort Zones

Any physical activity, running home or commercial appliances, lighting, sun light/rays, open windows and other factors, which contribute to heat generation in a confined space or room is called heat load, as shown in the following image:

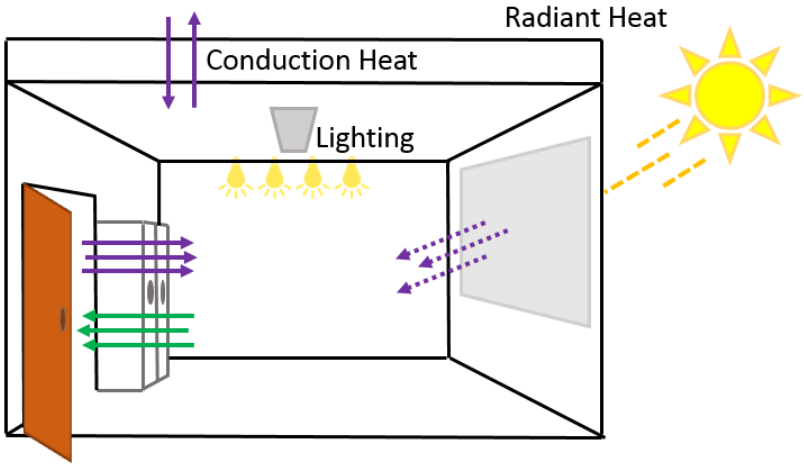

Fig. 5.1.2: Heat loads

Typically, the following factors in a home or office environment contribute to the heat load:

- Area of the space
- Running appliances (such as computers)
- Entry area for sun rays/light, such as windows, ceilings and so on
- People
- Activity/movement in the room, such as moving furniture, frequent opening of the door/windows and so on
- Artificial light used to illuminate the room

The capacity of ACs needed to cool the room/space, depends on the preceding factors. Higher is the number and intensity of these factors, more is the capacity of the AC needed to cool the room.

The capacity of ACs is measured in terms of ton, which means the amount of heat that an air conditioner can remove from a confined space within an hour.

Comfort zone is achieved when the internal conditions, air and environment, of a room or closed space is controlled to maintain a comfortable temperature for the occupants irrespective of the outdoor weather or temperature, as shown in the following image:

Fig. 5.1.3: Comfort zone

5.1.3 Types of ACs

There are primarily two types of ACs used in a home and office environment:

- Window ACs, as shown in the folloiwng image:

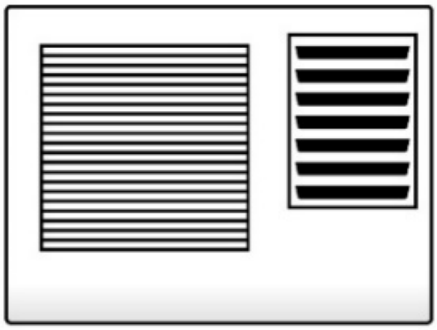

Fig. 5.1.4: Window AC

- Split ACs, as shown in the folloiwng image:

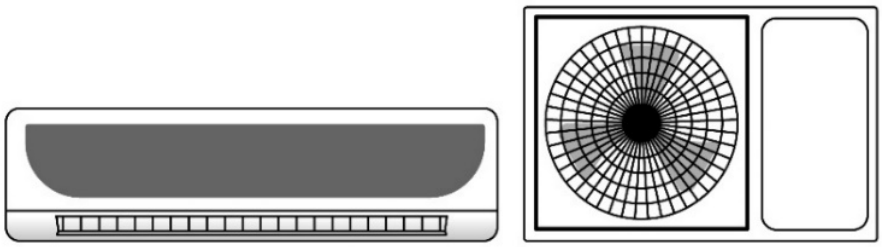

Fig. 5.1.5: Split AC

The working of the ACs, window or split used in homes or offices, is shown in the following diagram:

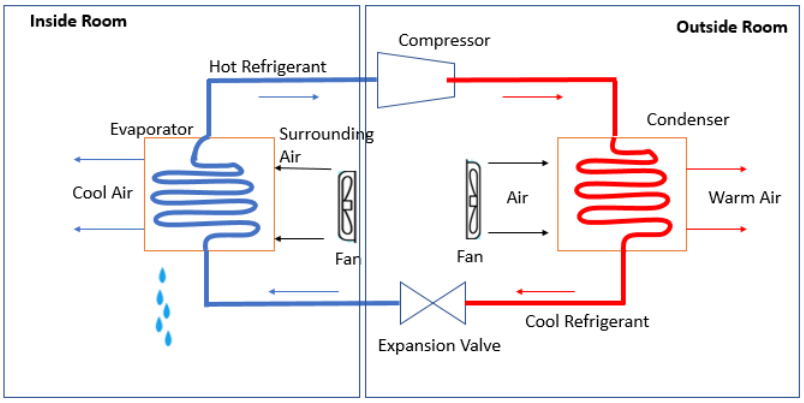

Fig. 5.1.6: Working of AC

The ACs shown in the preceding images work on a principle of reverse cycle or heat pumps. They work by taking the heat from the air outside and transfering it into a closed space. These ACs use a refrigerant to cool the air that is being transferred inside. An addiitonal feature that these ACs may have is to filter the air inside.

Every AC contains a compressor inside its unit that is used for compressing and pumping the refrigerant gas. The following figure shows the steps of a refrigeration cycle:

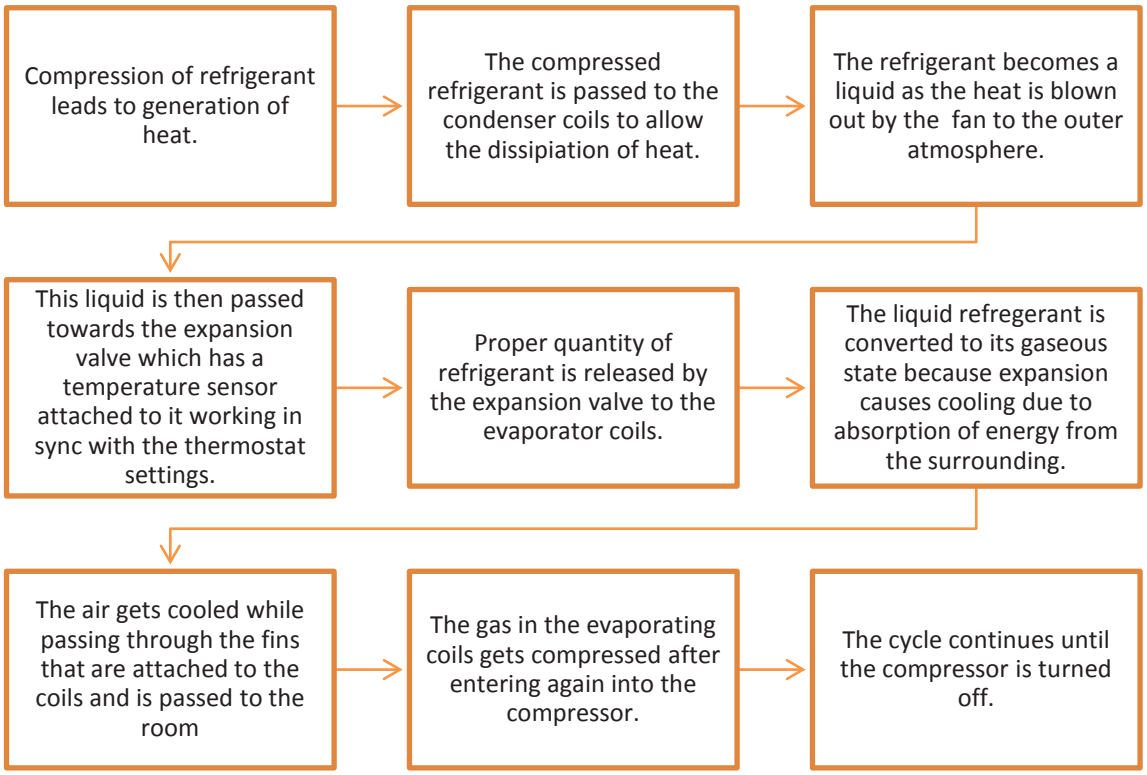

Fig. 5.1.7: Steps of refrigeration cycle

Heat is drawn by the air conditioner from the indoor and is released to the outdoor. The indoor plays as a source and the outdoor acts as a heat sink.

UNIT 5.2: Working and Installation of Window ACs

Unit Objectives

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

1. Identify the different parts and working of Window ACs
2. Follow safety precautions for installation of Window ACs
3. Test-run a Window AC

5.2.1 Working of a Window AC

Window ACs are the most common type of ACs used in homes and small offices. These are also the cheapest type of ACs.

Window ACs require a window or a hole in the wall, the size of the AC unit, and one part of the unit is inside the window/wall and the part is outside in the open, preferably with lots of space available.

Window ACs consist of two main units:

- Inside unit, which cools the room/space, consists of:
  - Return air grill
  - Air filter
  - Control panel
  - Thermostat sensor
  - Adjustable louvers
  - Evaporator coil
- Outside unit, which absorbs the heat in the room and transfers outside the room, consists of:
  - Blower motor
  - Partition
  - Fan
  - Compressor
  - Condesor coil
  - Drain tray/pipe

The assembly of a window AC is shown in the following figure:

- A solid base on which all the parts are assembled.
- A casing on which the base is installed. The casing is fixed on the wall or in the window.
- An insulated partition which segregates the inside unit from the outside unit.
- A front panel which has horizontal and vertical louvers, which can be adjusted as per the desired direction of air flow.
- A control panel which has various controls to manage temperature, fan speed, etc. for the AC.
- A refrigeration system comprising of condesor, compressor, expansion valve and evaporator. This sytem uses the same refrigeration cycle as that of a refrigerator.
- An air circulation system, contains:
  - Blower which absorbs the inside air and filters it. The air then passes through the cooling coil to get chilled and then blow into the room again.
  - Condeser fan
  - Fan motor
- A drainage system allows removing of dew drops accumulate in the bottom base unit.
  - The AC unit is installed with a slight tilt angle towards outside for the collection of dew when the room air gets chilled.
  - There is a small opening at the back connected to the small drain pan and the piping for the drainage of water.
- An electrical protection system contains a thermostat that senses the coil temperature.
  - It protects the motor connected to compressor against getting overheated.
  - It prevents burning of winding coil due to overheating while the air conditioner is running for long time by tripping the compressor and stopping it until it cools down.

Fig. 5.2.1: Assembly of a window AC

The parts of window ACs is the same as explained in the preceding units and is shown in the following image:

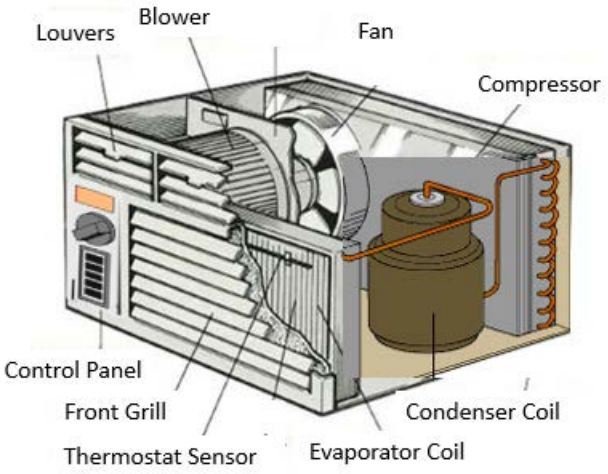

Fig. 5.2.2: Parts of a window AC

5.2.2 Installation and Safety Precautions

Prerequisites for Installation

Before going for installation of a window AC at a customer site, ensure that the instructions shown in the following figure are performed:

- Carry all tools and personal protective gear required, neatly organized
- Check that all tools and equipment, such as a drill, is working properly
- Ensure all the units have been delivered before visting the site
- Check the packing to see if it is porper and has not been tampered or damaged
- Carefully unpack the unit and its parts, such as remote, grill, filter, and so on
- Wear insulated shoes for installtion
- Ensure there is a step ladder avaialble if isntalltion is to be installed at a height

Fig. 5.2.3: Prerequisites for installation

In case drilling or gas refilling needs to be done in the wall, then follow the precautions shown in the following figure:

Drilling	Ensure there is no loose wiring and plug has been properly insulated.
	Use proper drill bits and key to lossen/tighten the bits.
	Keep steady hands while drilling and wear goggles to protect eyes from debris and dust.
Gas Refilling	Discharge the refrigerant in open space.
	Use gloves while handling the refrigerant.
	Check the cylinder to ensure that it is sealed properly as per standards.
	Hold and store cylinder in upright position.
	Keep cylinders away from heat.

Fig. 5.2.4: Precautions taken at during installation

Installation

Before installation, ensure you have carefully examined the site for installation and checked all conditions for installations, such as proper availability of space for indoor and outdoor unit, proper electrical points available, proper window/hole in wall available, and so on.
The installation of a window AC looks similar to the one shown in the following diagram and the specified dimensions should be maintained while installing:

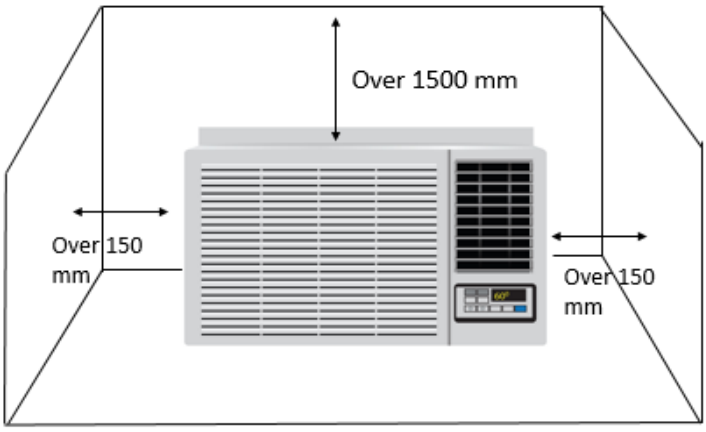

Fig. 5.2.5: Specification of dimensions of the AC unit

To install a window AC, perform the following steps:

1. Remove the AC carefully from its packaging.
2. Remove the glass/grill from the window where the AC needs to be installed.

3. Ensure that the hole/window is as per the dimensions required by the AC. If the hole/window is bigger, then apply proper wooden panelling or insulation around it to make it fit for the AC's size.
4. Analyse the frame of the hole/window to ensure that it has enough strength for holding the weight of the AC unit.
5. Fix the outer casing of the AC to the frame of the window. Ensure that it is firm and properly fixed. The casing need to be fixed strongly so that it can take the whole weight of the AC.
   In case the hole is in a wall, then the casing needs to be fitted into the wall by drilling strong holes in the wall and securing the casing with strong screws.
   Also, ensure that the casing is titled at a small angle (2-3 degrees) on the outside (back of the AC). This would ensure that the dew collected from the cooling coil is drained outside from the drain tray and pipe.
6. Using a colleague help, pick up the main AC unit and slide it in the casing carefully. Ensure the unit is sitting firmly in the casing and secure it properly using screws.
7. Connect the electrical wires to the control panel.
8. Place the front panel grill and filters.
9. Connect the power supply to the AC's cord. Check if the AC is working.

5.2.3 Test-run a Window AC

After installation of the AC, it is important to check if the AC is functioning properly and if it's controls (such as the remote) is also working properly. Moreover, you should also explain the basic functions of the AC to the customer after installation.

To test-run the AC, perform the following steps:

1. Ensure all electrical wiring has been done and the main power cord of the AC has been plugged in to the power point, as shown in the following image:

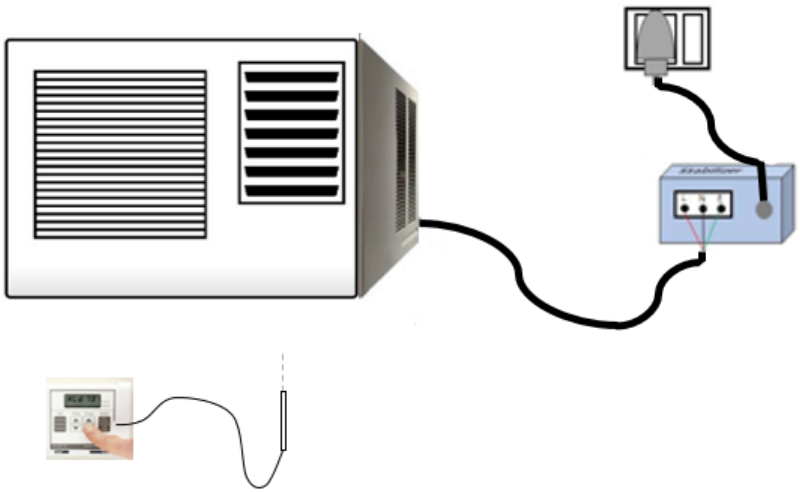

Fig. 5.2.6: Electrical wiring of AC unit

2. Ensure that all front grills and filters have been properly placed.

3. Switch on the AC and set the temperature at 18°C as shown in the following figure:

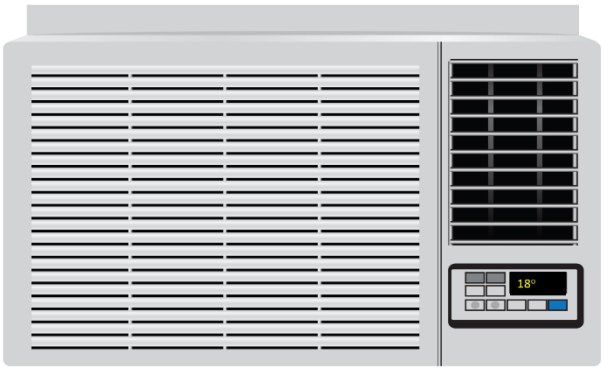

Fig. 5.2.7: Setting temperature

4. Let the AC run for 15-20 minutes.
5. Check the functioning of the front control panel.

Fig. 5.2.8: Checking the functioning of front control panel

6. Check the functioning of the remote control and all its buttons.

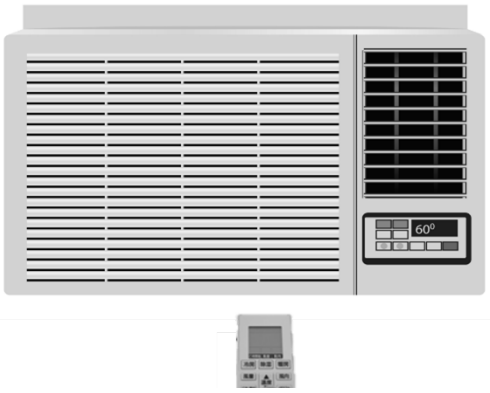

Fig. 5.2.9: Checking the functioning of remote

7. Check the cooling effect in the room after 15-20 minutes.
8. Check the following temperatures:
   a. Outdoor unit should be approx. 42°C
   b. Grill should be approx. 9°C

UNIT 5.3: Servicing Window ACs

Unit Objectives

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

1. Describe wiring diagrams for window ACs
2. Test electronic components of window ACs
3. Service and repair window ACs

5.3.1 Wiring Diagrams for Window ACs

A field technician is required to service and repair the window ACs as per customer requests and complaints.

To be able to carefully service and repair an AC, the field technician should be able to read and understand the wiring diagrams of the ACs and understand the electric circuits and connections properly.

A simplest wiring diagram of a window AC is shown in the following figure:

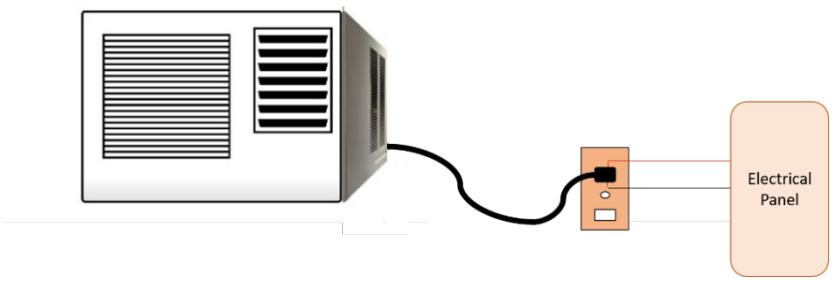

Fig. 5.3.1: Wiring diagram of a window AC

The following figure shows a wiring diagram of the inside unit of an AC:

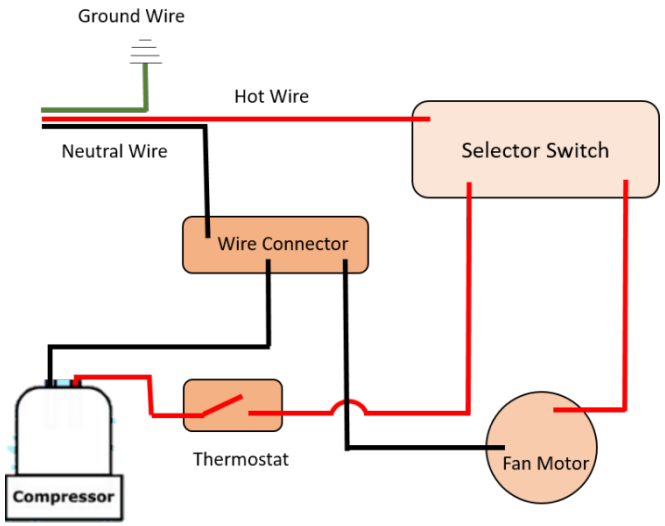

Fig. 5.3.2: Wiring diagram of the inside unit of a window AC

The power cable is split into three wires inside the unit as described in the following figure:

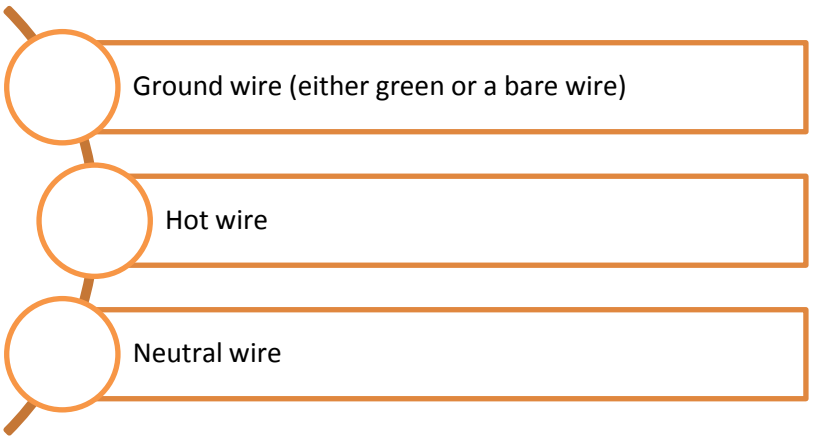

Fig. 5.3.3: Wires of a power cord

The ground wire is connected to the metal case of the unit.

The hot wire that feeds power to the important parts of the window unit, along with the compressor and the fan motor, connects the selector switch to the other parts, as follows:

- Hot wire → Selector switch → Thermostat switch → Compressor
- Hot wire → Selector switch → Fan motor

Neutral wire is directly connected to fan motor as well as the compressor through the wire connector that is placed at the back of the selector switch in order to keep all neutral wires common to each other as being connected to the same point.

The following figure shows another wiring diagram of an AC window with overload protection:

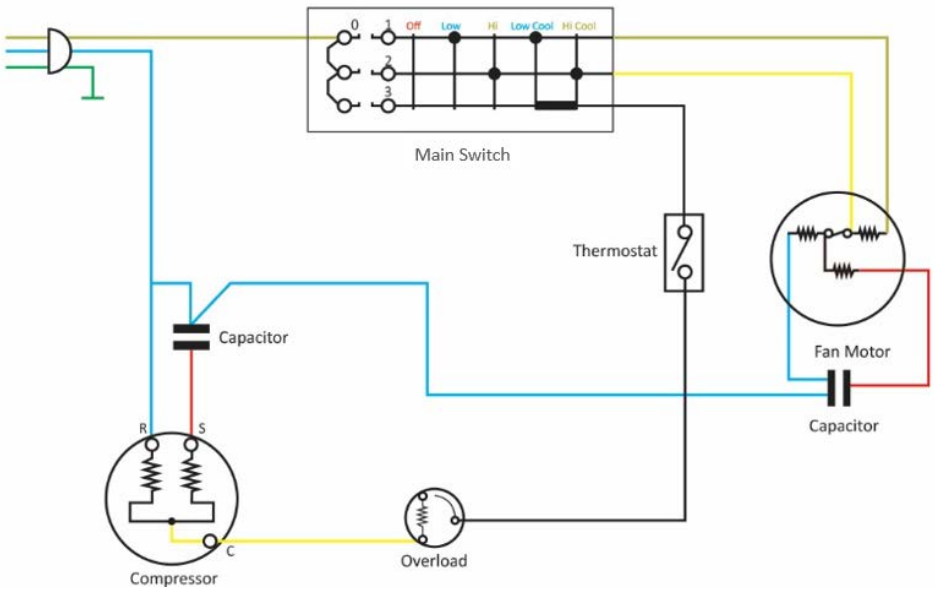

Fig. 5.3.4: Wiring diagram of an AC window with overload protection

5.3.2 Testing Electronic Components

A field technician should start with testing the various modes of operation to check which components of the window AC are operating fine or not. The following figure shows the steps of checking various components:

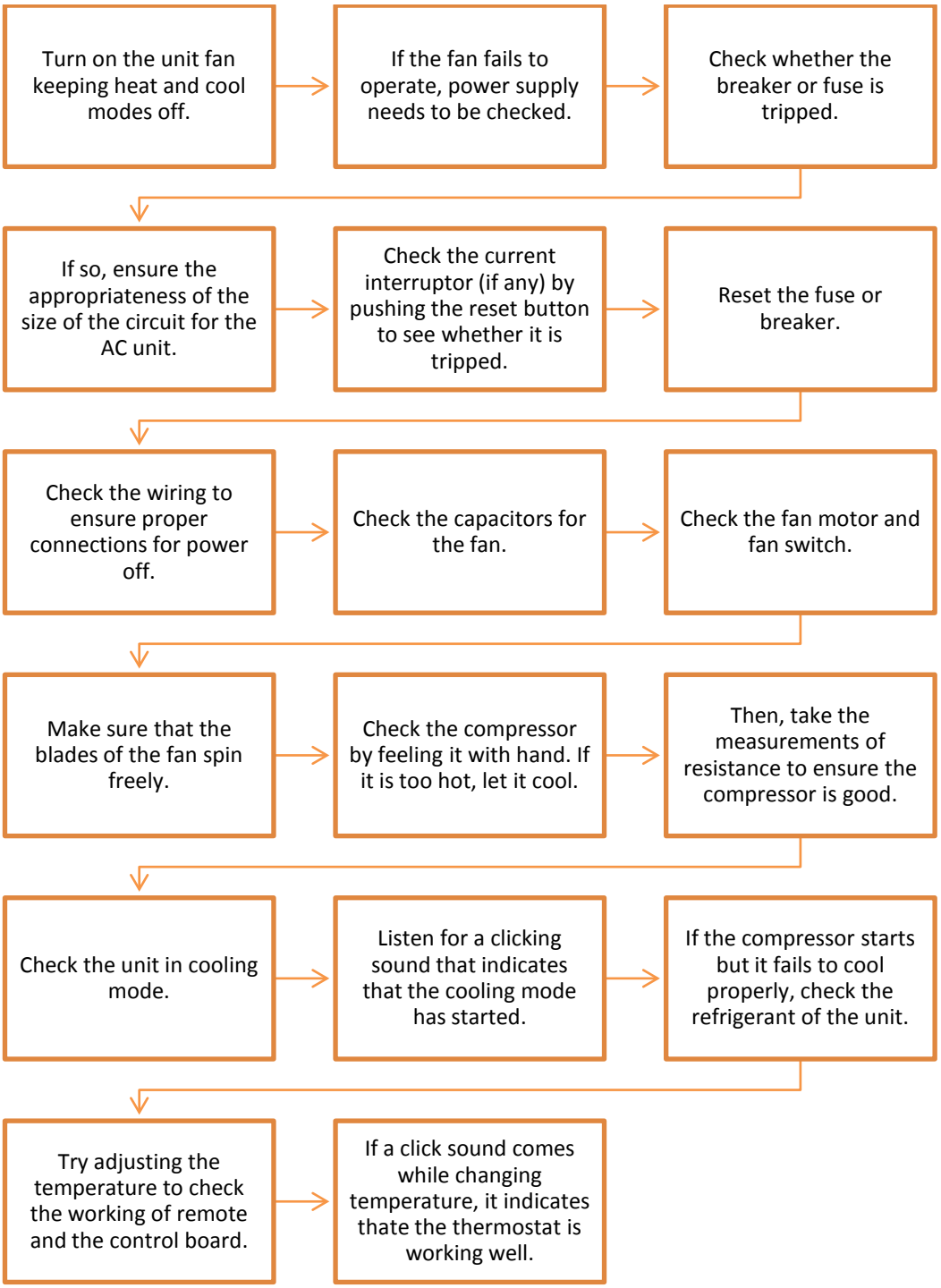

Fig. 5.3.5: Checking of various components

Testing the Compressor

In window AC units, rotary compressors are generally used. A field technician needs to follow the steps to test the compressor.

Step 1: Check the power outlet to make sure it is working well.

Step 2: Turn the power off and take out the unit's terminal cover by removing the mounting screws located at the four corners of the front of the air conditioner unit. Ensure that the terminals and wires are not damaged.

Step 3: Check the compressor to make sure that there is no cracked valve inside it.

Step 4: Test the electrical terminals using a multimeter. A typical unit has three terminals; C, R, and S. The continuity between every two terminals (C - R, C - S, and R - S) should be tested.

- Check the wire connections and if the wire is found faulty, replace it.
- If the resistance is higher (higher than 30 ohms), check if the compressor is hot. If so, it may be that the internal overload is open and wait for the compressor to cool down.
- If the resistance is high but the unit is cool, it indicates that the compressor motor is bad.

Step 5: Check the resistance of each of the terminals to the compressor's body. If the resistance reading is low, it signifies that the motor is grounded and the compressor needs a replacement.

Testing Capacitor of AC

The following figure lists the steps to test the capacitor of a window AC:

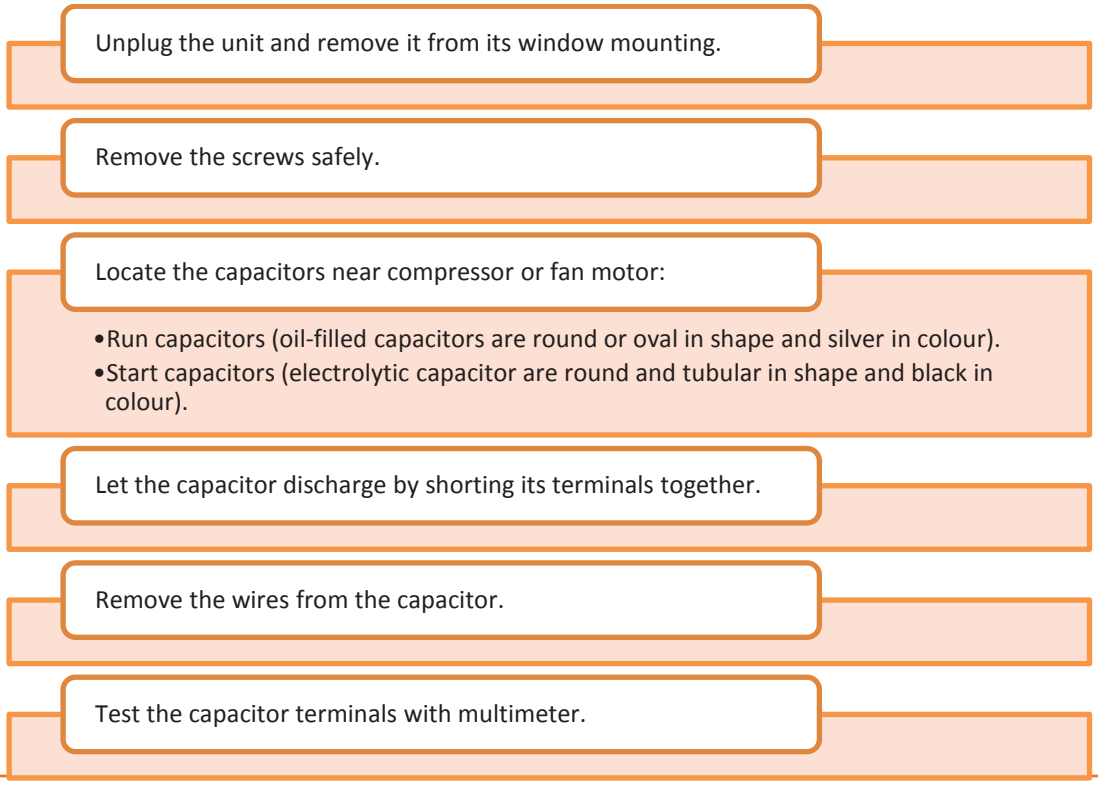

Fig. 5.3.6: Steps for testing the capacitors

5.3.3 Repairing/Servicing Window ACs

An AC requires servicing and repairs due to wear and tear with usage. Improper maintenance also leads to requirement for repair. The following figure lists some categories of issues with ACs:

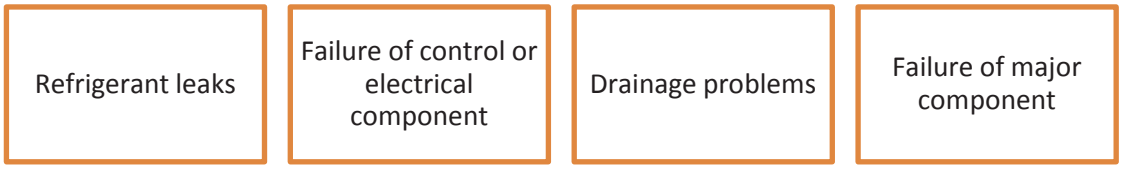

Fig. 5.3.7: Some categories of issues with ACs

The following figure lists some specific symptoms that indicate the air conditioner needs a servicing:

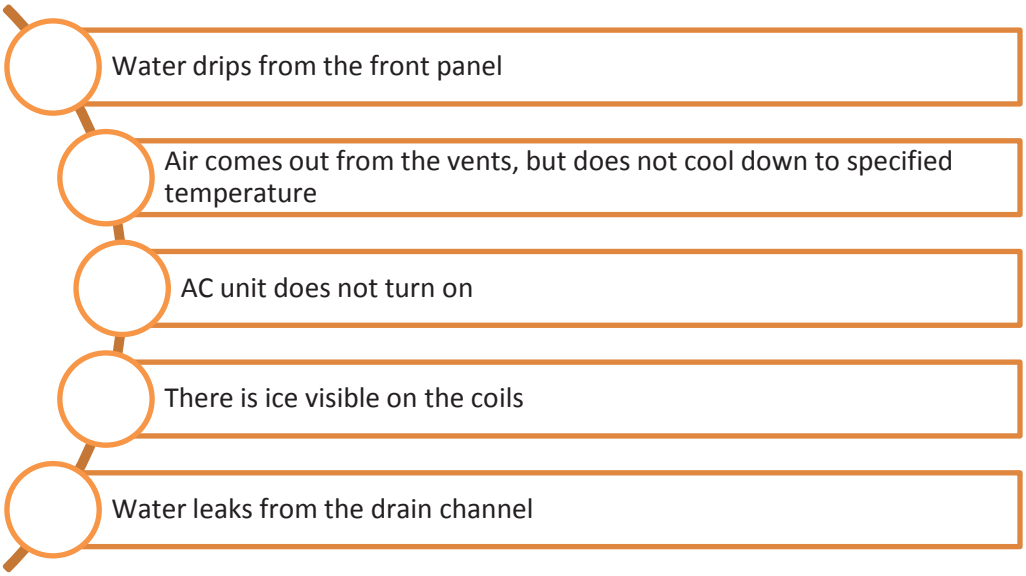

Fig. 5.3.8: Some specific symptoms of AC problems

A field technician needs to perform the following steps before starting the repairing:

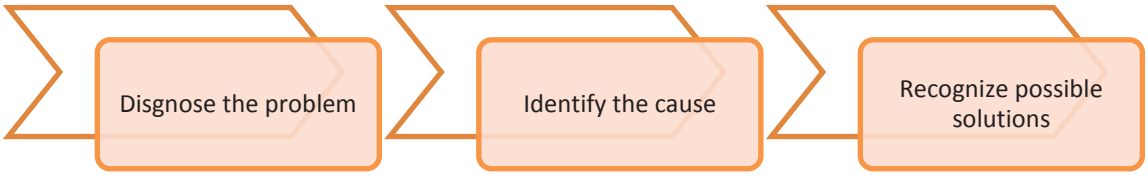

Fig. 5.3.9: Troubleshooting steps

The following table lists some AC problems and their possible troubleshooting steps:

Problem	Possible Troubleshooting Steps
The AC unit does not turn on	• Check the fuses or the breaker. • Check the wiring and the selector switch.
Air coming out from the unit is not cold enough	• Check that the fan selector is set to "Fan Only" mode. • Check whether the thermostat is set at high warm position. • Keep the exhaust vent control in "Open" position. • Ensure that the location of the thermostat sensing bulb is correct. • Check the cleanliness of the coils. • Check the level of the refrigerant.
The room is warm while the unit is cooling	• Check whether the fan selector is set to "Fan Only" mode. • Check whether the thermostat is set at high warm position. • Keep the exhaust vent control in "Open" position. • Ensure that the location of the thermostat sensing bulb is correct. • Check the position of the air directional louvers. • Ensure that the front is not blocked. • Check that the outside louvers are not blocked by bricks or anything else. • Ensure that the cooling capacity is sufficient for the room size. • Check the cleanliness of the coils. • Check the level of the refrigerant.

Water is dripping inside	• Ensure that the unit is slightly tilted towards the outside.
	• Check whether there is any blockage in the drain. If there is any obstruction, clean the drain by.
	  ○ Removing the unit from the window.
	  ○ Disconnecting the power and washing the unit.
	  ○ Letting the unit to dry thoroughly and re-applying power.

The fins on the coils are not working properly	• Use fine comb to make the fins straight. • Ensure flattening is minor, as more of it will affect the operation.
The winding coil on the front side gets frozen	• Check the cleanliness of the coils. • Check the cleanliness of the air filter. • Ensure that the thermostat is working properly. • Check the level of the refrigerant.

AC cycles keeps On and Off very frequently	• Check whether the thermostat sensor is positioned properly. • Ensure that the sensor is not touching the evaporator coil. • Adjust the wire carefully. • Ensure that the front panel or the thermostat is not blocked with drapes. • Check for any refrigerant leak. • Ensure that the condenser is not covered with leaves. • Check that the fins are not damaged.
AC unit blows circuit breaker or fuses	• Check the size of the circuit (amps). ○ Most window ACs require 120 volts and can be operated in a circuit with 15 amp. A dedicated circuit may be needed by some larger units. The circuit is blown if it is shared with other loads being operated simultaneously. ○ Try running a dedicated circuit with 20 amp for the unit.

Fig. 5.3.10: Troubleshooting steps

Repairing a Thermostat

Thermostat, located behind the control panel, has a special sensing bulb connected to it to sense temperature controlled by thermostat. It extends from the thermostat to area of the evaporator coil. A field technician should follow the steps shown in the following figure to service a thermostat:

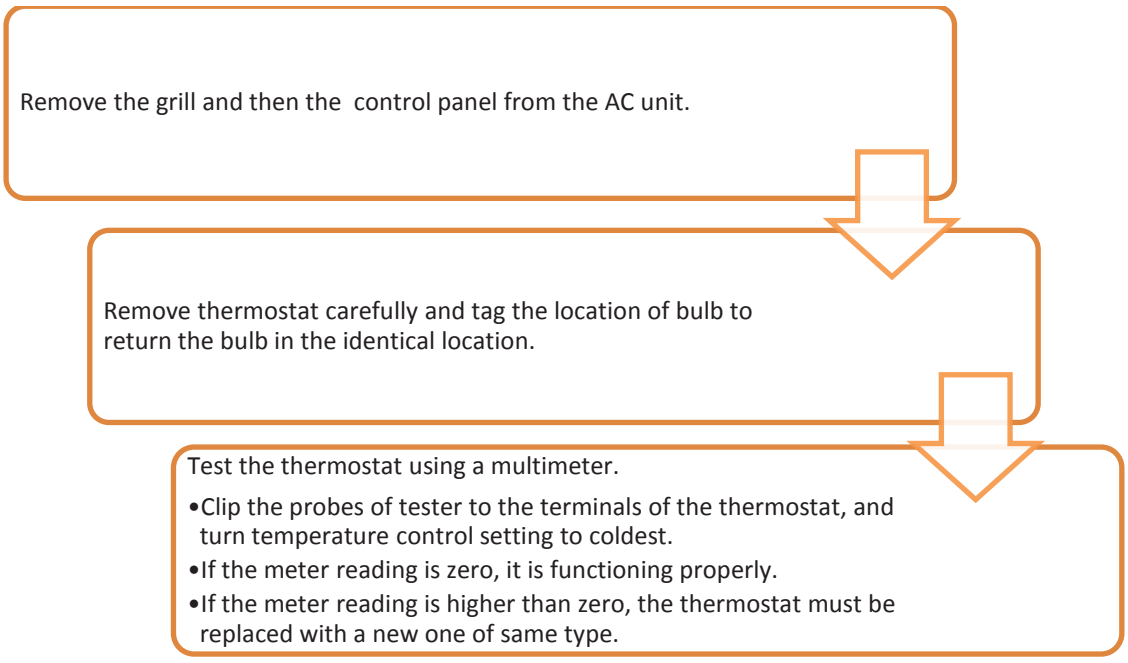

Fig. 5.3.11: Steps for servicing a thermostat

Repairing a Fan

Generally loose or dirty blades of a fan leads to malfunctioning. Cleaning and tightening the fan blades usually fixes the problems with fan. The following figure lists the steps to repair the fan of an AC unit:

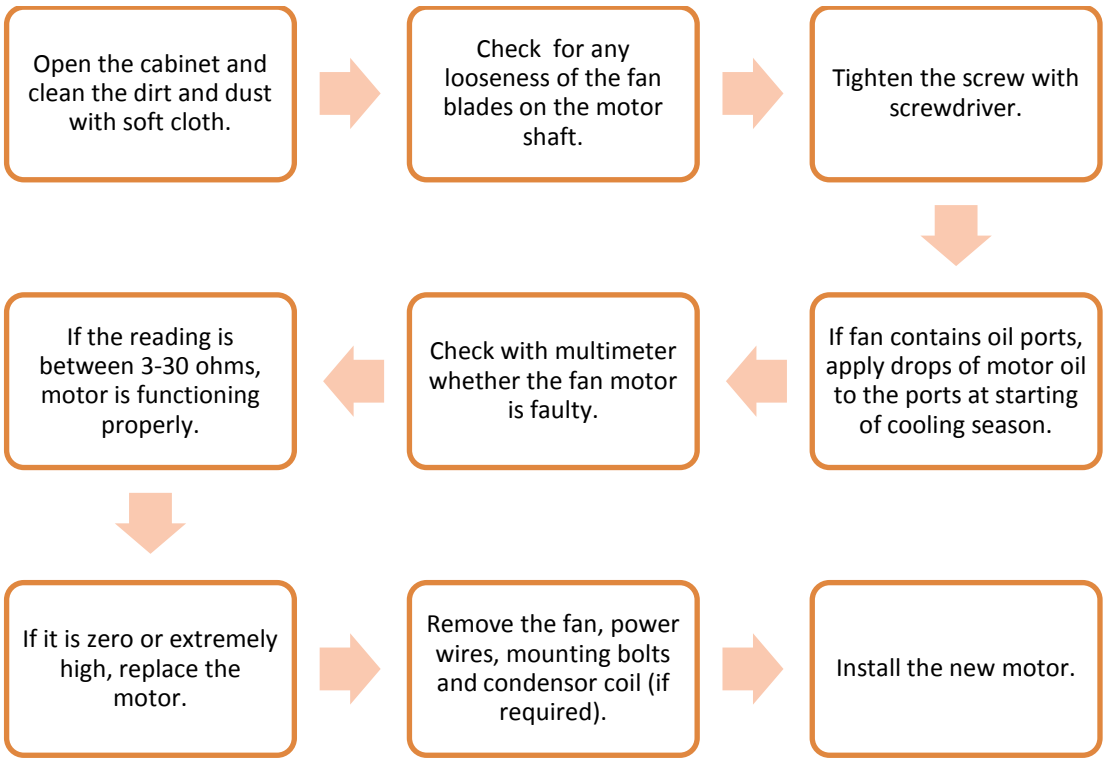

Fig. 5.3.11: Steps for repairing the fan of the AC unit

UNIT 5.4: Installing Split ACs

Unit Objectives

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

1. Identify the different parts and working of split ACs
2. Follow safety precautions for installation of split ACs
3. Perform IDU and ODU installation
4. Connect IDU and ODU
5. Test-run a split AC

5.4.1 Parts of a Split AC

The main reasons for split air conditioner are getting popular are their elegant looks and silent operation. There are two units in a split AC:

- Indoor unit: It is installed inside the room which cools the room.
- Outdoor unit: It is installed in open space outside the room at a convenient location for installation and maintenance.

Apart from the two units there is copper tubing that connects them.

The following figure lists the parts of a split air conditioner:

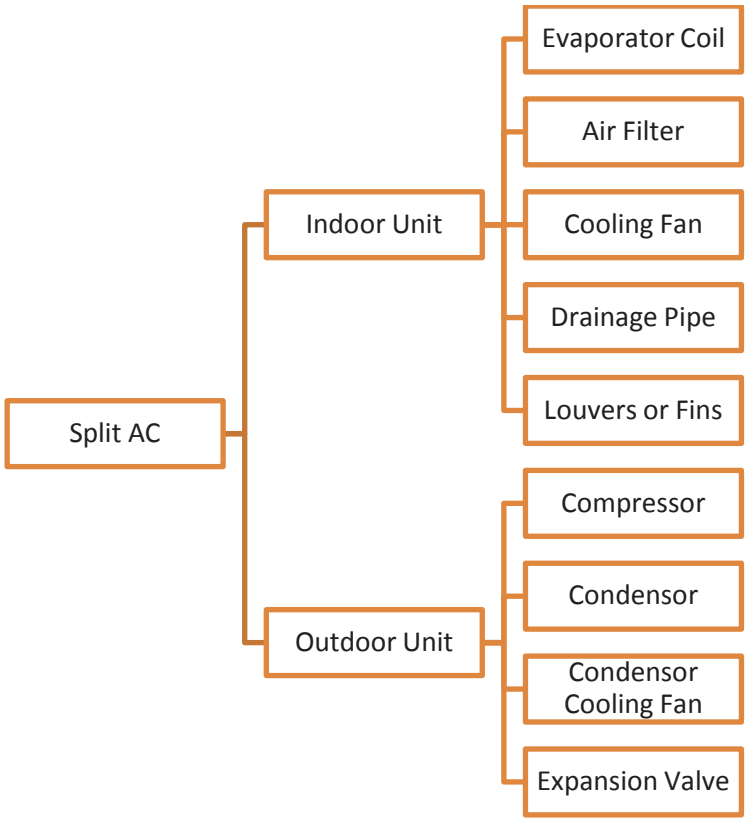

Fig. 5.4.1: Parts of a split air conditioner

Outdoor Unit

A great amount of heat is generated inside in outdoor unit by the compressor and the condenser. There should be sufficient air flow around the unit. The following figures show the outdoor unit of a split AC:

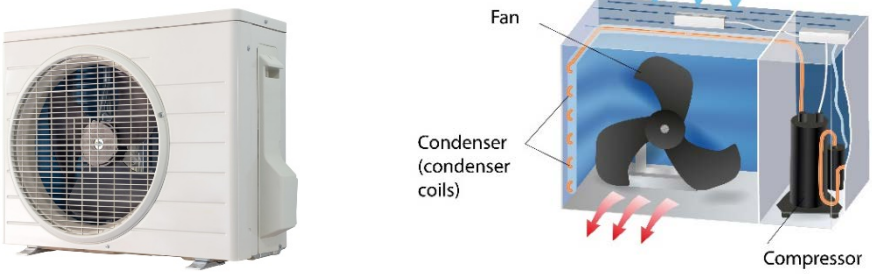

Fig. 5.4.2: Outdoor unit of a split AC

Compressor

The compressor increases the pressure of the refrigerant by compressing it and sends to the condenser. Compressors are of hermetically sealed type in which the motor used for driving the shaft is not visible externally.

Condenser

The condenser is the coiled copper tubing covered with the aluminum fins and contains one or more rows based on air conditioning unit size. It allows the refrigerant with high temperature and pressure received from the compressor to give up the heat. The copper and aluminum let the heat from the refrigerant be removed at faster rate.

Condenser Cooling Fan

The condenser cooling fan located in front of the condenser coil and compressor, is driven by a motor and has three or four blades. With the rotation of the blades the fan absorbs the air from the outside and with the aluminum fins blows the air over the condenser and the compressor and thus cool them. The hot air is passed to the open space allowing air circulation.

Expansion Valve

It is generally a copper capillary tubing with many rounds of coils. It allows a sudden drop of temperature and pressure of the refrigerant coming from the condenser.

Indoor Unit

The indoor unit of the split AC is comprised of a box type housing which encloses the important parts. The following figure lists the types of indoor units:

Wall mounted	Ceiling mounted	Floor mounted

Fig. 5.4.3: Types of indoor unit of a split AC

The following figure shows the indoor unit of a split AC:

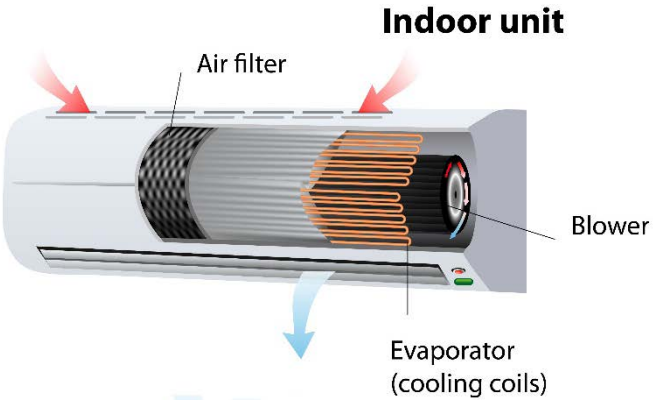

Fig. 5.4.4: Indoor unit of a split AC

Evaporator Coil or the Cooling Coil

It is comprised of several turns of a coil in one or more rows. The number of rows is based on the capacity of the conditioning system. The coil is encapsulated with aluminum fins so that maximum amount of heat can be transferred to the air inside the room from it. The following figure shows the working of the evaporating coil:

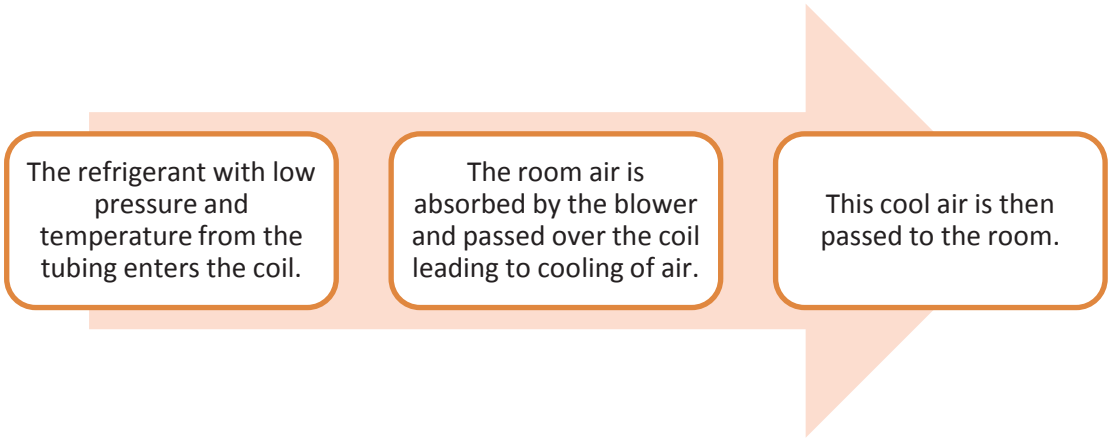

Fig. 5.4.5: Working of the evaporating coil

The temperature of the refrigerant inside the evaporating coil rises after the heat is absorbed from the room air. It passed through the copper tubing to the compressor of the outdoor unit. The refrigerant tubing of both sides are encapsulated with the insulation tape.

Air Filter

The air filter allows supply of clean air to a room by removing dirt particles from it. The room air is passed through the air filter before it is passed to the cooling coil.

Cooling Fan or Blower

It pulls in the warm and dirty air from the room and blows out cool and clean air. The fan speed can be changed as it is connected to a small motor having multiple speed options.

Drain Pipe

When the room air is passed over the cooling coil, the air temperature reaches below the dew point temperature. This results in forming of dew drops on the surface of the cooling coil due to condensation of the water vapor present in the air. These water drops are accumulated inside the indoor unit. A drain pipe is connected from the space to an external place outside where water can easily be disposed off.

Louvers or Fins

Cool air is supplied by the cooling fan into the room through the louvers that allow changing the direction of the air as per the requirements. The following figure lists the types of louvers:

Horizontal louvers	•They are connected to a small motor and their position can be canged using a remote control. •If the position is set to fixed chilled air is passed in a specific direction. •If it is set to rotation mode the fresh air is passed throughout the room.
Vertical louvers	•They are manually operated and the position can easily be set according to the requirements. •Air flow is controlled in upward and downward directions.

Fig. 5.4.6: Two types of louvers

Refrigerant Piping or Tubing

The refrigerant piping comprised of copper tubing, connects the outdoor and indoor unit. It is flexible enough to be coiled easily.

The low pressure and low temperature refrigerant goes from the expansion valve to the copper tubing, that is also connected to the cooling coil at the other end. The following figure shows the connection of indoor and outdoor unit through refrigerant tubing:

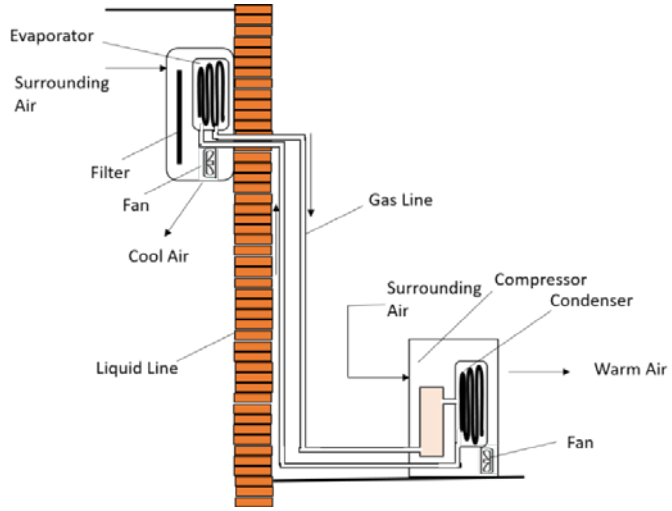

Fig. 5.4.7: Connection of indoor and outdoor unit through refrigerant tubing

The distance between the two units (indoor and outdoor) should be less as there is some loss of the cooling effect when the refrigerant flows through the tube.
The tubing is covered with the insulation as it is exposed to the atmosphere which may be high temperature. The cooling effect will be lost if the tubing is not covered.
There is another refrigerant tubing connecting the units for the refrigerant to travel from evaporating coil to the compressor. Both the tubing are covered using an insulation tape.

5.4.2 Precautions

It is vital to follow certain safety precautions while installing air conditioners. The following figure represents the general guidelines that should be followed to prevent any potential injury or property damage:

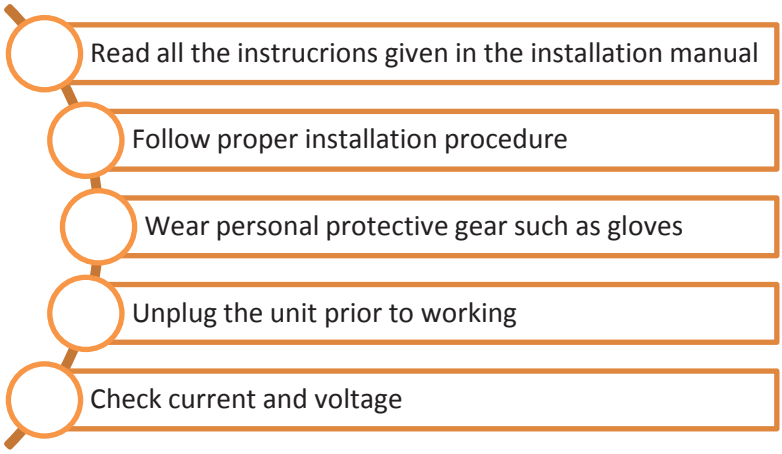

Fig. 5.4.8: Safety precautions

Safety Precautions While Wiring

In addition to these general safety precautions, it is imperative to follow precautions while working with electrical systems. Any negligence or carelessness can cause electrical shock leading to severe personal injury or death. The following figure represents the electrical safety precautions to be followed:

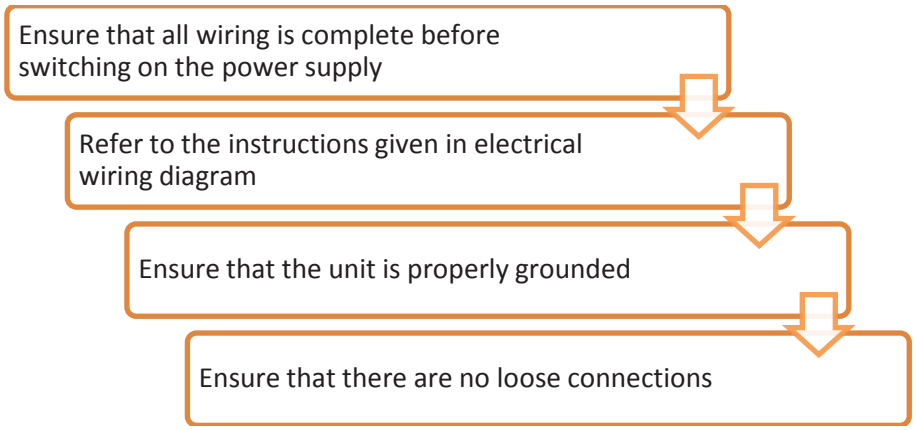

Fig. 5.4.9: Electrical safety precautions

Safety Precautions While Transporting

The air conditioner units are very heavy. Special care needs to be taken to lift the units as in the following: .

- Never try to lift the unit alone.
- Always ask someone for help.
- Proper posture should be maintained when lifting the unit from the ground.
- Make sure to bend the knees to minimize any risk of back injury.
- Look out for the sharp edges and the aluminium fins of the air conditioner.

Safety Precautions While Installing

While installing, the following precautions should be taken for safety**:**

In a wall	•Ensure that the wall can bear the load of the unit. •A frame made of wood or metal must be constructed to provide additional support.
In a room	•Insulate the tubing that runs inside a room to avoid damage to wall and floors due to water.
In uneven or moist locatinons	•Provide a solid, level foundation for the outdoor unit. •Use a raised concrete blocks to avoid any type of abnormal vibration and water damage.
In areas with high winds	•Use bolts and a metal frame to anchor the outdoor unit securely . •Provide a suitable obstruction to air.
In snowy areas	•Install the outdoor unit on a platform that is raised higher than accumulated snow. •Provide snow outlets.

Fig. 5.4.10: Installation safety Precautions

Safety Precautions While Connecting Refrigerant Tubing

The following precautions need to be taken while connecting the refrigerant tubing:

- Always keep the tubing runs short
- When connecting two tubes, use flaring method
- Check for any leakage before doing the test run

5.4.3 Installation of Split AC

The first step to install a split AC is to select the best location for the installation. The following figure lists the points to be considered for location of an AC:

- Do not install the unit at such a location where there is a heat source nearby
- Ensure there are no obstacles in air circulation
- Ensure there is proper ventilation on all sides
- Ensure there is easy access to drainage
- Do not install the conditioning unit near the entrance or exit doorway
- Make sure that the unit is accessible for maintainance

Fig. 5.4.11: Installation location

Indoor Unit Installation

The steps of installation of indoor unit are as follow:

Step 1: Select an appropriate location for the unit as shown in the following figure:

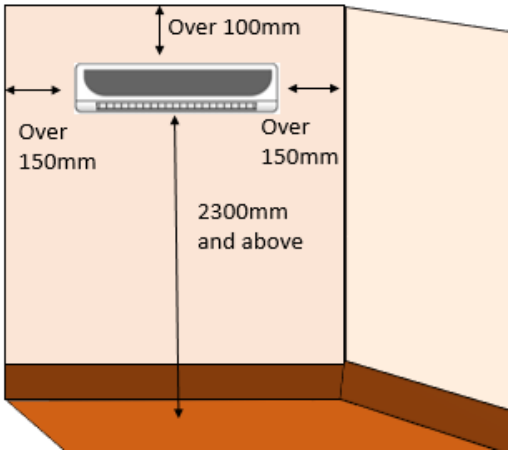

Fig. 5.4.12: Indoor unit installation location

Step 2: Fix the mounting plate to the wall inside the room and secure it with screws as shown in the following figure:

- Hold the mounting plate against the wall.
- Use a level to check whether the plate is levelled horizontally.
- Fix it to the wall by drilling holes in the wall at appropriate spots.
- Insert anchors into the drilled holes and secure the plate to the wall using tapping screws.

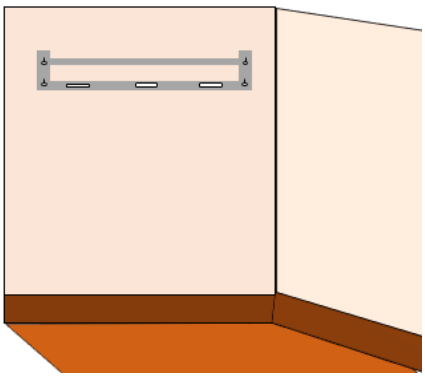

Fig. 5.4.13: Secure the mounting plate

Step 3: To fit the piping, drill a hole in the wall as shown in the following figure:

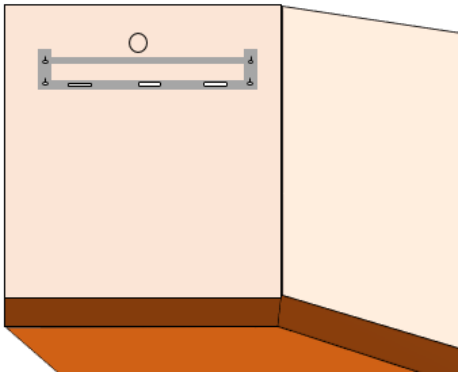

Fig. 5.4.14: Drill a hole for piping

- Drill a hole having a diameter of around 7.5 cm through the wall.
- Make sure that the slope of the hole towards the exterior is kept downward so that adequate drainage is possible.
- Insert a flexible flange through the hole.

Step 4: Make sure that the electrical connections are proper:

- Remove the cover by lifting the front panel of the unit.
- Ensure that the wires are connected to the terminals of the screw.

Step 5: Connect the pipes:

- Run the piping towards the hole.
- Cut a length from the PVC pipe that is shorter than the length between the wall surfaces of the interior and the exterior side (around 6 mm).
- Place the cap on the end of the PVC pipe that is inside the room.
- Couple the drain pipe, the copper pipes and the power cables together using an electrical tape as shown in the following figure:

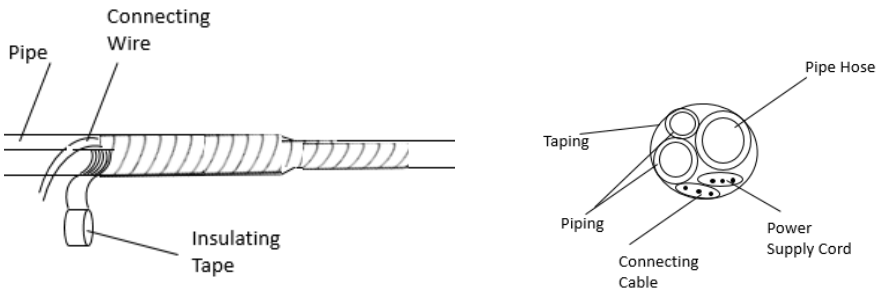

Fig. 5.4.15: Connect the pipes

- Tighten the connection by using 2 wrenches, working in opposite directions to secure the pipe to the indoor unit and attach the drainage pipe to the base of the indoor unit.
- Run the pipes and cables coupled together through the hole making sure that the water is drained in a proper place by the drainage pipe, and the drain hose is sloping downward for efficient drainage, as shown in the following figure:

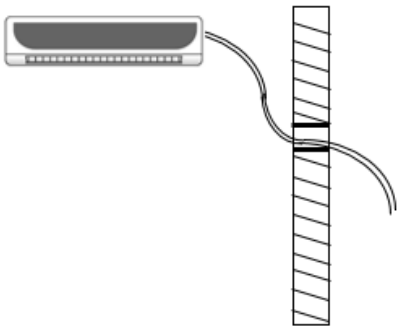

Fig. 5.4.16: Direction of drain hose

The following images show some examples of incorrect installation:

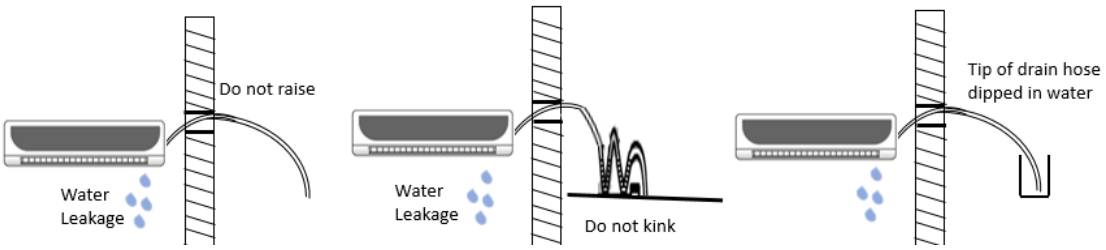

Fig. 5.4.17: Examples of incorrect installation

Step 6: Secure the indoor unit by pressing it against the mounting plate, as shown in the following figures:

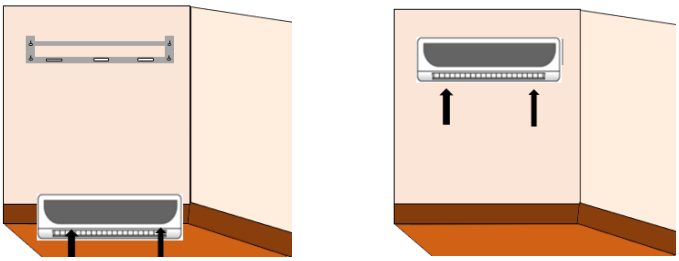

Fig. 5.4.18: Secure the indoor unit

Outdoor Unit Installation

The steps of installation of indoor unit are as follows:

Step 1: Select an appropriate location for the unit, as shown in the following figure:

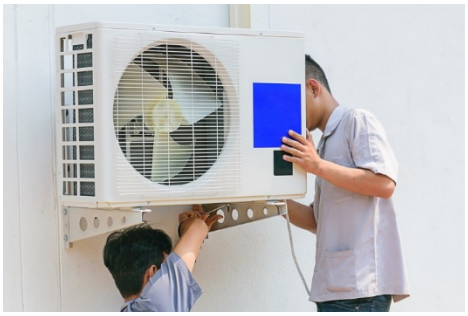

Fig. 5.4.19: Outdoor unit location

Step 2: Hold the mounting plate against the outside wall:

- Secure it properly.
- Ensure that it is in a level position.
- Provide rubber cushioning under the feet of the unit so that vibration is minimized.

Step 3: Connect the wires.

- Remove the cover and connect the cables and wires consulting the wiring diagram and following the manufacturer's instructions to connect the cable wires.
- Use a cable clamp to fasten the cables.
- Replace the cover.

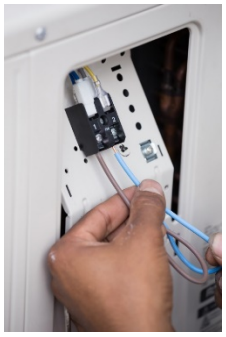

Fig. 5.4.20: Connecting electric wires

Step 4: Fasten the flare nuts to the pipes on the outdoor unit, as shown in the following figure:

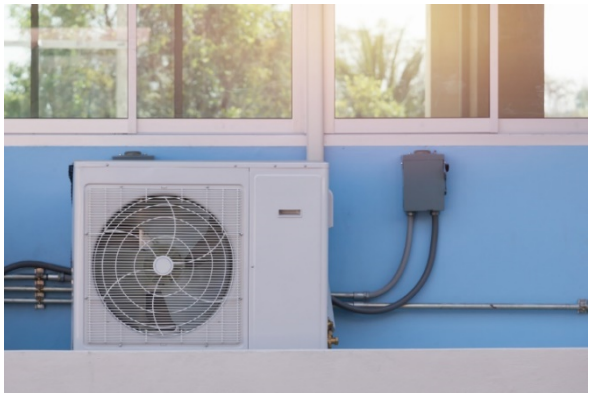

Fig. 5.4.21: Secure flare nuts

Completing the Installation of a Split Air Conditioner

After the installation of the indoor and outdoor units of the split AC, the given steps should be followed:

Step 1: Check the amount of air and the humidity of the refrigerant circuit, performing the following steps:

- Detach the caps from the service port and the valves (both 2 way and 3 way).
- Attach the hose of a vacuum pump to the service port.
- Turn the vacuum pump on.
- Switch the vacuum pump off after closing the low pressure knob.
- Check whether the valves and joints have any leak
- Replace the caps after disconnecting the vacuum.

The following figure shows removing air and humidity:

Fig. 5.4.22: Remove air and humidity

Step 2: Use insulating covering and insulating tape to wrap the joints of the piping, as shown in the following figure:

Fig. 5.4.23: Wrap piping joints with insulating tape

Step 3: Use clamps to affix the piping to the wall and use expanding polyurethane foam to seal the hole in the wall.

5.4.4 Test-run a Split AC

It is important to measure and record the test run properties to check whether the unit is installed properly, and to store the information after completing installation for further service. The following figure shows the items to be measured:

Temperature (inside and outside the room)	Suction and blow out temperature	Wind velocity and volume
Voltage	Ampearage	Presence of noise and abnormal vibration
Piping temperature	Operating pressure	Compressive pressure

Fig. 5.4.24: Items to be measured

In addition to the preceding items, the structure and appearance of the unit should also be checked to ensure that it complies with the standards. The following figure shows the checks that need to be performed:

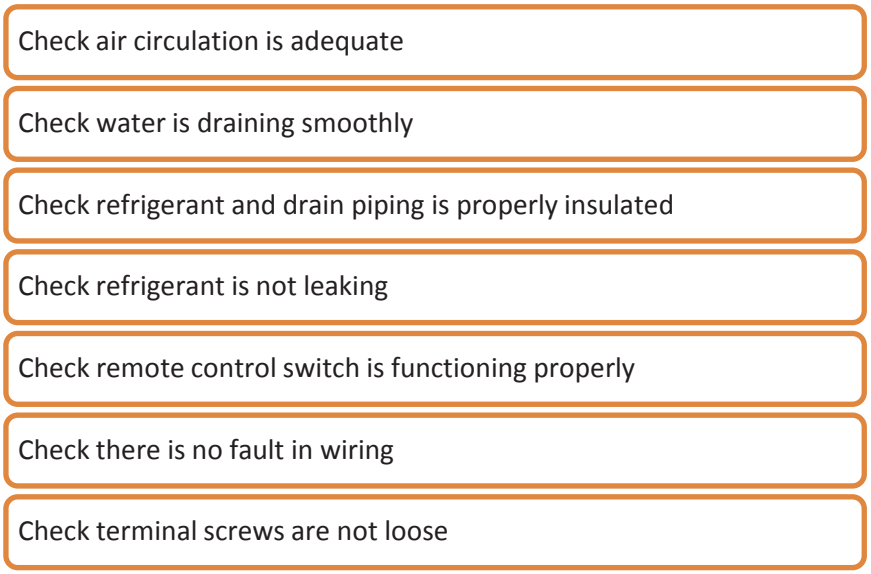

Fig. 5.4.25: Checks to be performed

The following figure shows the tasks that the field technician needs to do the after completing the installation:

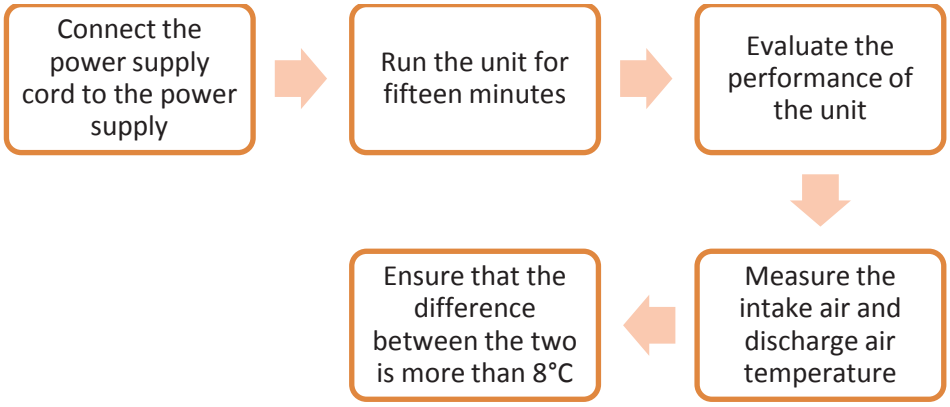

Fig. 5.4.26: Tasks to be performed after installation

UNIT 5.5: Servicing Split ACs

Unit Objectives

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

1. Describe wiring diagrams for split ACs
2. Test electronic components of split ACs
3. Perform dry and wet servicing

5.5.1 Safety Precautions While Servicing

While servicing an AC, the field technician should take the following precautions:

- While working with electrical parts and connection, switch off the power at the main power box.
- Keep fingers as well as clothing away from the moving parts.
- Clean the site after installation is finished, ensuring that there are no metal scraps of wiring left inside the unit which is being serviced.

5.5.2 Wiring Diagram of Split AC

A field technician is required to service and repair the split ACs as per customer requests and complaints.

To be able to carefully service and repair an AC, the field technician should be able to read and understand the wiring diagrams of the ACs and understand the electric circuits and connections properly. A typical wiring diagram of a split AC is shown in the following figure:

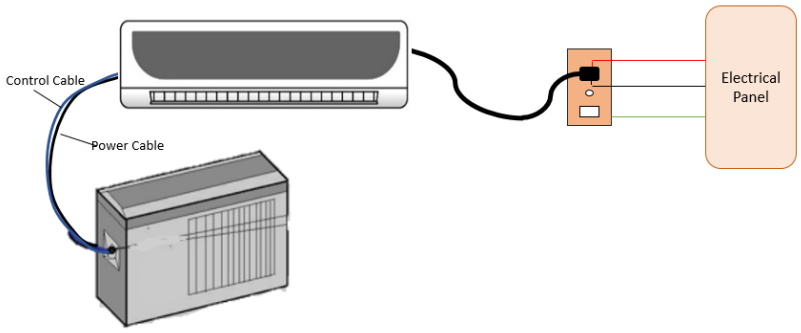

Fig. 5.5.1: Typical wiring diagram of a split AC

The following figure shows the wiring diagram of a split AC outdoor unit:

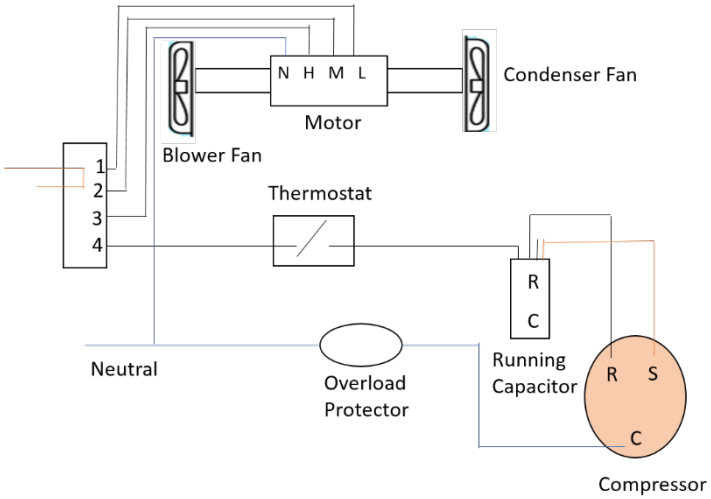

Fig. 5.5.2: Wiring diagram of the outdoor unit of a split AC

5.5.3 Perform PMS (Dry and Wet Servicing)

Dry servicing refers to quick servicing of the AC which should be done every six months. Wet servicing is detailed cleanup of the AC units that should be done once in a year.

Steps for Dry Servicing

For indoor unit the steps for dry servicing are as follow:

Step 1: Open the cover and take the filter out as shown in the figure:

Fig. 5.5.3: Taking the filter out

Step 2: Clean the coil to remove the dust by using a brush as shown in the following figure:

Fig. 5.5.4: Cleaning the dust

Step 3: Wash the filters as shown in the following figure and put them back in their places.

Fig. 5.5.5: Washing the filter

The field technician should also clean the outdoor unit to remove the dust and check the drainage pipe. The following figure shows cleaning of outdoor unit:

Fig. 5.5.6: Cleaning of outdoor unit

Steps for Wet Servicing (Indoor Unit)

The steps for cleaning the indoor unit are as follow:

Step 1: Remove the cover and the filters and then remove the front cabinet after unscrewing it as shown in the following figure:

Fig. 5.5.7: Remove the front cabinet

Step 2: Hang the wash bag around the indoor unit especially the fan coil unit as shown in the following figure:

Fig. 5.5.8 Hanging the wash bag around the indoor unit

Step 3: Spray the cleaning agent on the rotary blades and coils and wash them after 10-15 minutes. The following figure shows cleaning the indoor unit:

Fig. 5.5.9: Cleaning the indoor unit

Step 4: Remove the bag filled with water.

Step 5: Wash the filter, front cover and the front cabinet and then fix them to the proper place. The following figure shows washing on front cover:

Fig. 5.5.10: Washing front cover

The steps for servicing the outdoor unit are as follow:

Step 1: Open the main connection cover and measure the voltage and current as shown in the figure:

Fig. 5.5.11: Measuring voltage and current

Step 2: Measure pressure of the service valve using manifold gate. The following figure shows measuring of pressure:

Fig. 5.5.12: Measuring pressure using manifold gate

Step 3: Remove the wires after switching off the power.

Step 4: Remove the fan unscrewing it using T spanner. The following figure shows the parts of outside unit:

Fig. 5.5.13: Parts of outside unit

Step 5: Remove fan motor and cover the outdoor connection box.

Fig. 5.5.14: Covering the connection box

Step 6: Spray coil cleaner and wash the coil and compressor and clean the outdoor body and other parts.

Step 7: Wash the fan and let it dry.

Step 8: Fix the parts to their correct position.

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6. Washing Machines

Unit 6.1 – Functions and Parts of Washing Machines

Unit 6.2 – Installing Washing Machines

Unit 6.3 – Servicing and Repairing Washing Machines

Unit 6.4 – Troubleshooting Common Problems

Key Learning Outcomes

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

1. Identify the different types of washing machines
2. Describe the basic functions of washing machines
3. Identify the different parts of washing machines
4. Install semi-automatic washing machines
5. Test the components of semi-automatic washing machines
6. Repair semi-automatic washing machines
7. Install top loading, fully automatic washing machines
8. Install front loading, fully automatic washing machines
9. Test the components of fully automatic washing machines
10. Repair fully automatic washing machines

UNIT 6.1: Functions and Parts of Washing Machines

Unit Objectives

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

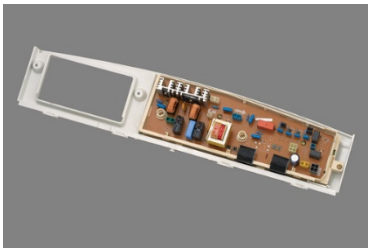
1. Identify the different types of washing machines
2. Describe the features and functionalities of different parts of a washing machine
3. Identify the various washing cycles
4. Describe different type of switches

6.1.1 Basic Components of Washing Machines

A washing machine contains several parts which work together to complete the washing of the laundry. The following image shows parts of washing machine:

Fig 6.1.1: Parts of a washing machine

Some basic parts of a washing machine along with their functions are:

Components	Function	Image
Printed circuit board (PCB)	It is used to control different functions of a washing machine such as controlling water levels, detergent dispensing mechanism, various wash cycles controls and so on.	

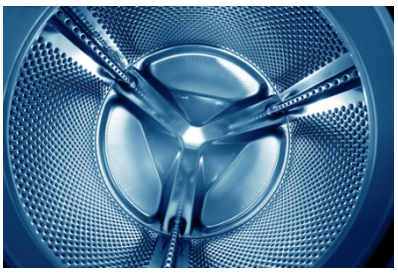
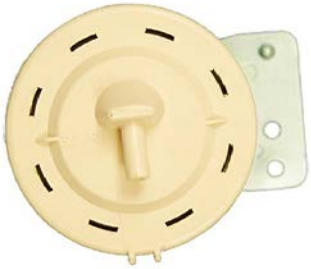
Lint Filter	Lint filter is used to filter the lint in the washing machine which comes from shirts, sweaters, socks etc. while washing.	
Drain Pump	It is located at the bottom of the washing machine and pumps up water in tub to drain	
Drum Washer/tub	It helps in cleaning clothes by moving clothes through water using the rotation of the tub and gravity. It moves the clothes in and out of the water with the help of side paddles.	
Inlet Valve (Solenoid Valve)	It is also known as solenoid valve as its functioning is controlled by solenoid**.** Solenoid controls the ports that control the setting of sending electrical signals to open and close the flow of hot and cold water in the drum washer.	
Pressure Sensor	It is used to detect water level in the drum. One end is connected to the bottom of the tub and another one connected to the switch. As the water rises more than required, the end of it, connected to a switch closes the electrical contact.	

Fig. 6.1.2: Basic parts of washing machine

The Gear Mechanism

The drive mechanism of washing machine depends on gear mechanism for two jobs as described:

- In the process of agitating the clothes which means moving them back and forth inside the tub
- In the process of spinning the dryer, moving water out

The gears inside the machine work in coordination with the motor. If the motor spins in one direction, the gearbox helps in agitating the clothes and if the motor spins in another direction, the gearbox goes in spinner.

Linear movement is described as the movement of gearbox in a straight line as in the case of agitating the clothes.

Angular movement is defined as the movement of gearbox in the same angular direction and at the same speed as in case of spinning the clothes (moving water out).

The twisting and turning of machine is measured by a formula known as torque which is defined as a force around a given radius. In case of washing machine, when the gearbox goes in a spin, the torque applied in the outer and inner shaft is same.

RPM is defined as revolutions per minute. It is used to determine the number of rotations taken by the spinner and the agitator.

Working of a Washing Machine

The washing process of a washing machine comes under the working of washing machine. Different parts of a washing machine play different roles in the washing process of clothes. The washing process of washing machine comprises of the points as described below.

The washing process comprises of different cycles as shown in the following figure:

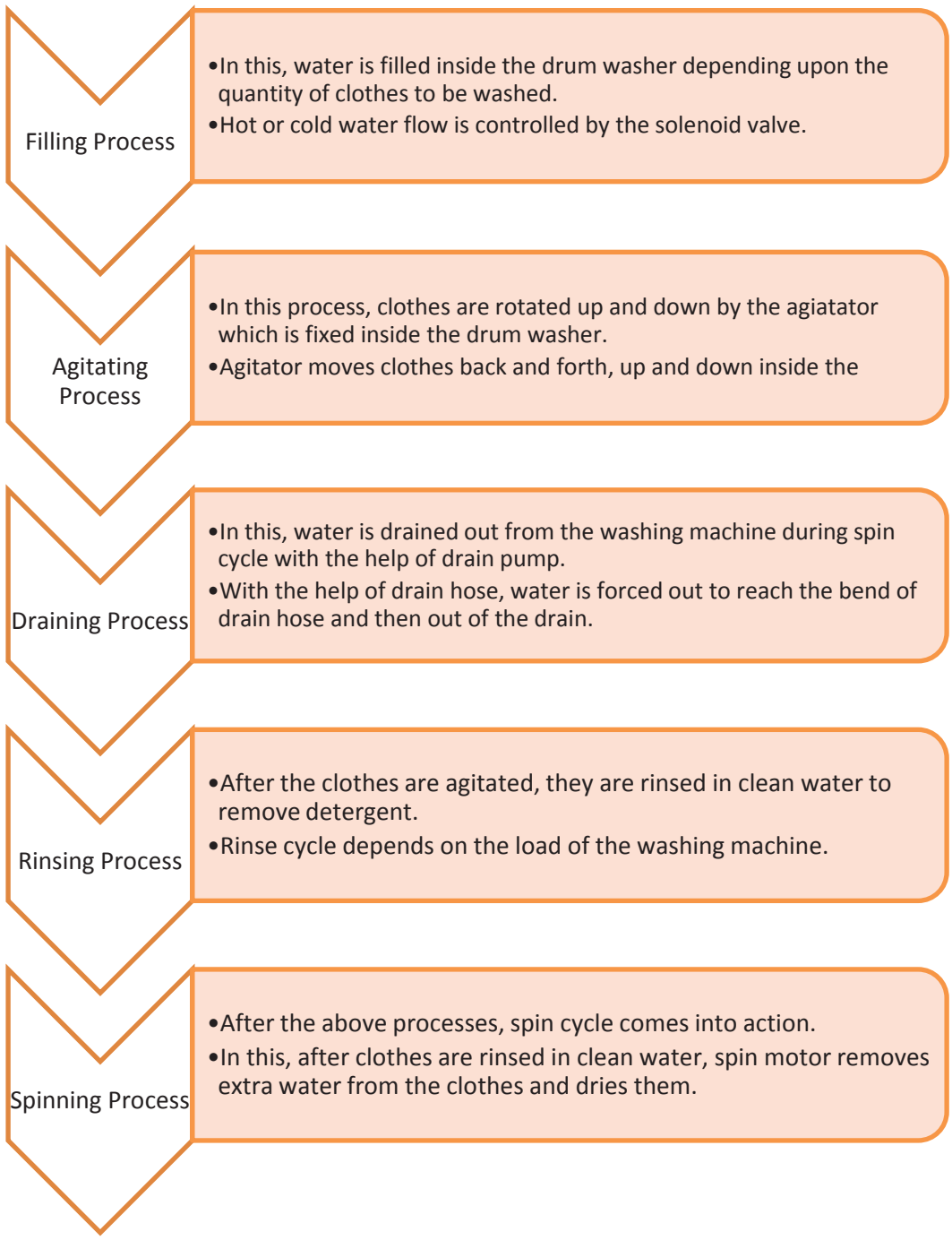


Fig 6.1.3: Different cycles of washing process

6.1.2 Types of Washing Machines

Washing machines are classified depending upon their features and functionalities. The following figure shows different types of washing machines:

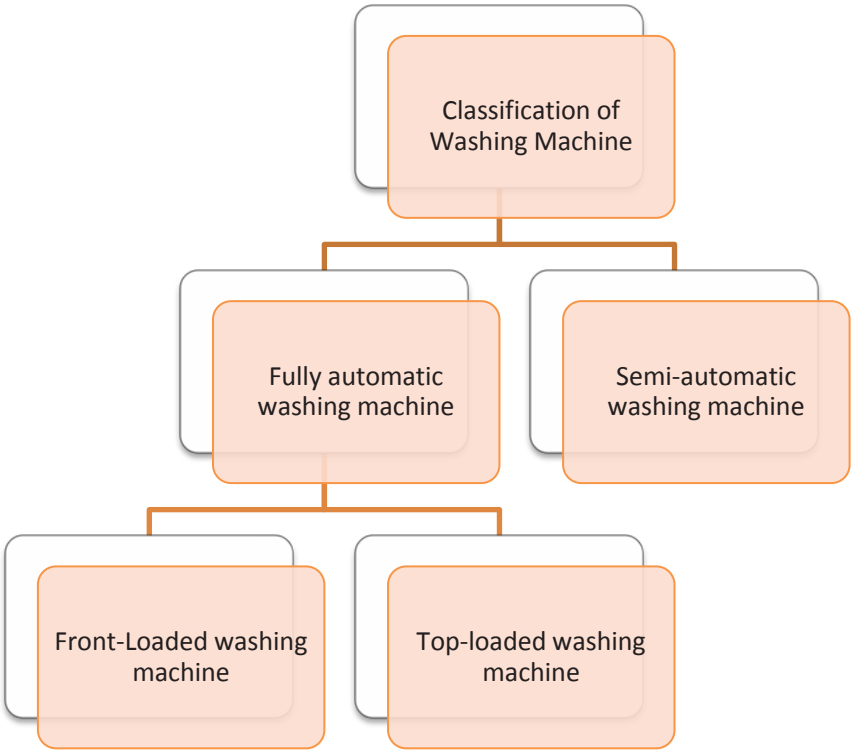


Fig 6.1.4: Classification of washing machines

The explanation for these machines is as follows:

- **Fully automatic Machine**: This type of machine works automatically in different cycles. From filling process till spinning process, it doesn't require any manual handling. It sets the temperature of water and also drains off water. In this each cycle begins automatically after the previous cycle ends. It is further divide into:
    - Top-Loading washing machine
    - Front-Loading washing machine

  The following table describes the differences between front load and top load washing machine based on their features and functionalities:

Top-Loading	Front-Loading
Top loading washing machine is a mid-range and economical machine.	Front Loading washing machine is a premium machine.
Top loading machines are easier to move, and the lid opens from the topside.	Front loading washing machines are heavier than the top loading ones and their lid is operated from the front side.

In this type of a washing machine, clothes can be added in between the washing process.	Once the washing process has started, a front-loading machine cannot be stopped.
Top Loading machines give moderate performance.	Front loading machines give better performance.
In top loading machines, the maintenance cost is low	As this machine has some serviceable parts, its maintenance cost is high

Fig 6.1.5: Difference between top loading and front loading washing machine

- **Semi-automatic washing machine**: This machine works manually, and it is better than fully automatic machine as it saves water and detergent. It consists of two tubs:
  - Wash Tub
  - Spin Tub

  In **wash tub**, it agitates the clothes and in this, we can fill the water according to the requirement and conditions. Drain process is also done manually by rotating the drain switch.

  In **spin tub,** extra water from the clothes is removed by setting the time period for which it will rotate.

  The following image shows a semi-automatic washing machine:

Fig 6.1.6: A semi-automatic machine

6.1.3 Different type of Switches

A switch is a component used to make or break connections in an electrical circuit. It can be operated manually to control a circuit such as a light switch or can be operated by a moving object. It is made to control a wide range of currents and voltages.

The following image shows different type of switch:

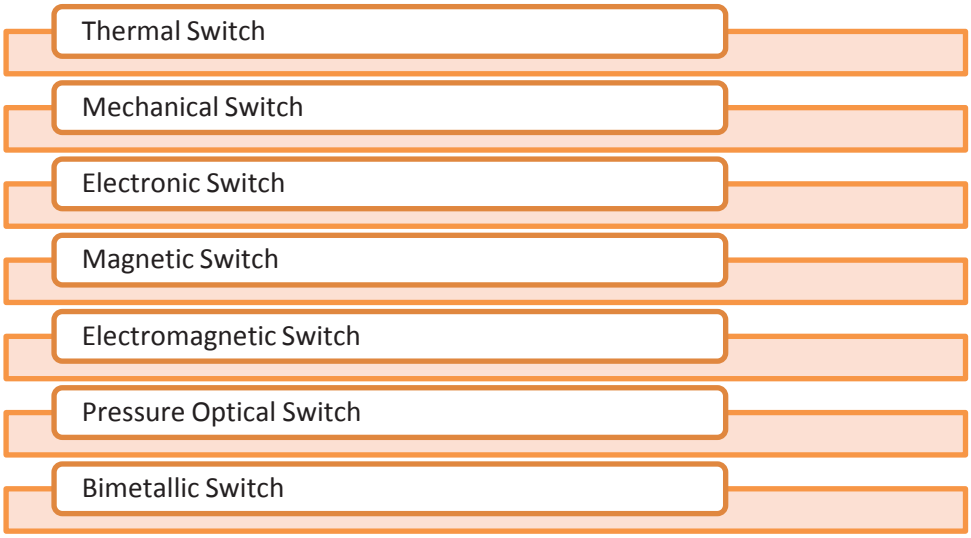


Fig 6.1.7: Types of switches

- **Thermal Switch:** It is also known as a thermal cut off switch as it cuts off electrical signals when the temperature exceeds its limit. It is used in washing machines to prevent washing machine motor from overheating.
  The following image shows a thermal switch for washing machine:

Fig 6.1.8: Thermal cut off switch

- **Mechanical Switch:** This switch is basically a master timer switch which decides that for how much time the washing motor will rotate and also the direction of the spinner, thus it also acts as a spin direction controller.
  The following image shows a mechanical switch for washing machine:

Fig 6.1.9: A mechanical switch

- **Electronic Switch**: This switch is used in an electrical circuit to interrupt flow of electric current. In washing machines, electronic switches are used with transistors. The following image shows an electronic switch:

Fig 6.1.10: Electronic switch

- **Magnetic Switch**: This switch helps in determining whether the lid is closed or not in case of front loaded washing machine. In this, magnet is attached in the lid and a switch is connected in the frame of washing machine. When the lid touches the frame of the washing machine, switch is closed and it starts the washing process.
  The following image shows magnet switch:

Fig 6.1.11: A magnetic switch

- **Electromagnetic switch**: This switch is helpful in allowing the entry of hot or cold water in the tub with the help of solenoids attached at one end of hot side and other end of cold side. It manages the flow of water depending upon the temperature required.
  The following image shows electromagnet switch:

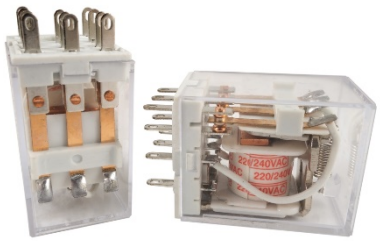


Fig 6.1.12: An electromagnetic switch

- **Pressure optical switch:** This switch determines how much water is flowing inside the tub through a water valve. This switch comes into action, when the pressure of water exceeds its limit. Thus, it saves overflow of water in the drum washer.
  The following image shows pressure optical switch:

Fig 6.1.12 A pressure optical switch

- **Bimetallic Switch**: This switch is used in washing machines for automatically controlling the temperature (in case the appliance gets heated, then the switch will turn off the appliance and will turn it on again after the temperature has come down to the expected normal level).
  The following image shows a pressure optical switch:

Fig 6.1.13: A bimetallic switch

UNIT 6.2: Installing Washing Machines

Unit Objectives

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

1. Identify the specifications for setting up the washing machine
2. Understand customer requirements and site conditions
3. Understand how to connect the washing machine
4. Understand standard operating procedures

6.2.1 Specifications for Setting up Washing Machine

To be utilized productively, a washing machine needs to be installed properly along with its supporting accessories which are important in its proper functioning. A washing machine comes with various functionalities which makes day to day work easy. A field technician should read the product manual and set up the appliance according to it and keeping in mind customer's requirement.

Recommended Appliance Requirements

Some manufacturers of washing machine often provide the consumer with a set of requirements that are different from those that are needed to run a usual washing machine. These requirements are generally known as the recommended requirements. They are always at a level above that of the minimum requirements. They show an ideal situation which is required to run the appliance.

Along the same lines, it is recommended that a field technician, prior to a client visit, checks the site conditions. This will help in the analysis and identification of the actual conditions at a customer's site.

6.2.2 Check Customer Requirements

A field technician is responsible for the installation or repair/maintenance of the washing machine. When work is allocated, it is important to understand and analyse the requirement before going ahead with the plan of action or visiting the customer's site.

The following figure shows the workflow for the role of a field technician:

New Installation:	Carry the needed equipiment, manual and warranty
	Carry the bill/invoice for new purchase
	Confirm the address and inform about the time of visit
Maintenance /Repair:	Ask about the service, repair, maintenance and Annual Maintenance Contract (AMC) of the equipment
	Carry the required tools and equipment parts
	Confirm the address and inform about the time of visit

Fig.6.2.1: The workflow for installation and repair

Before visiting the customer for installation or repair, it is important to understand the requirement of the customer. The following figure represents the various activities which should be done before a visit to the customer's site is scheduled:

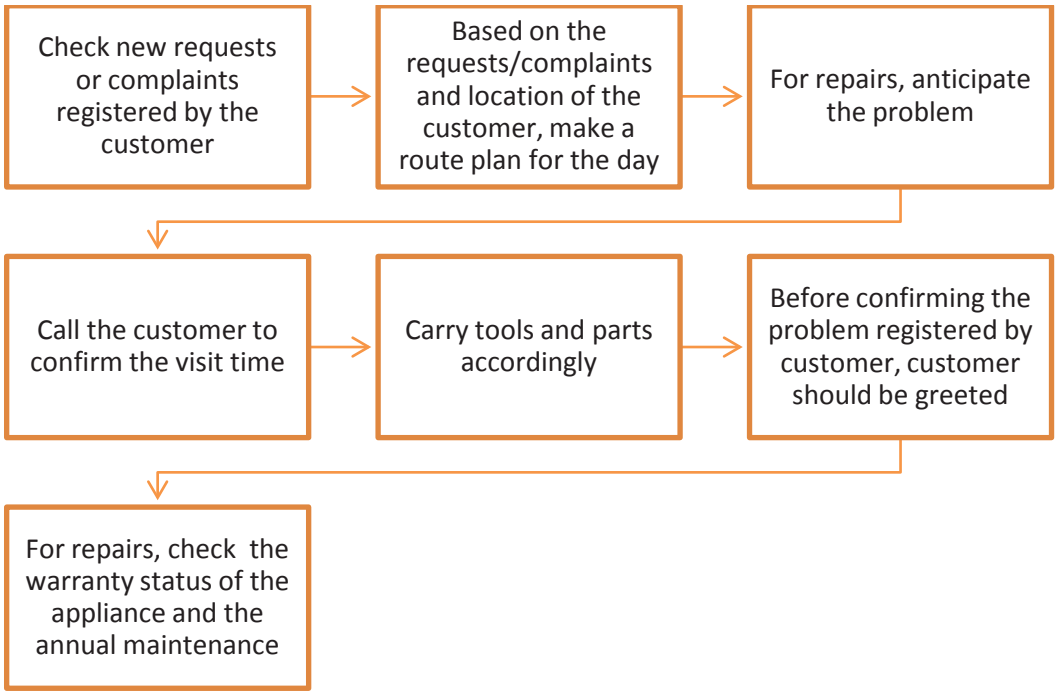


Fig.6.2.2: To-do list for a field technician

6.2.3 Unpacking the Washing Machine

There are certain steps involved in complete unpacking and taking out a washing machine. The following figure lists the main steps involved in a placing washing machine set up:

- Open the packaging of the new product
- Take out the appliance/modules carefully
- Check the parts/components inside the package
- Before placing the machine, seek input from the customer
- Plumbing installation material for inlet and outlet valves should be there
- Read installation manual to set the washing machine at a suitable distance from the water tank
- Ensure that the machine is placed against an exterior wall so that the drain hose can be installed in the inside wall
- Ensure that the washing machine is placed close to the nearest plugging point
- Place the machine on a stand as instructed by the company in the installation manual and ensure that it is in an obstruction-free area.

Fig.6.2.3: Steps involved in setting up a washing machine

Opening the Packaging

After getting the washing machine to the site, remove the package carefully and check the parts inside it. They should match the checklist and the colour, and the design of the washing machine should be as per the customer's order. The following figure represents the steps involved for unpacking the washing machine package to ensure proper installation:

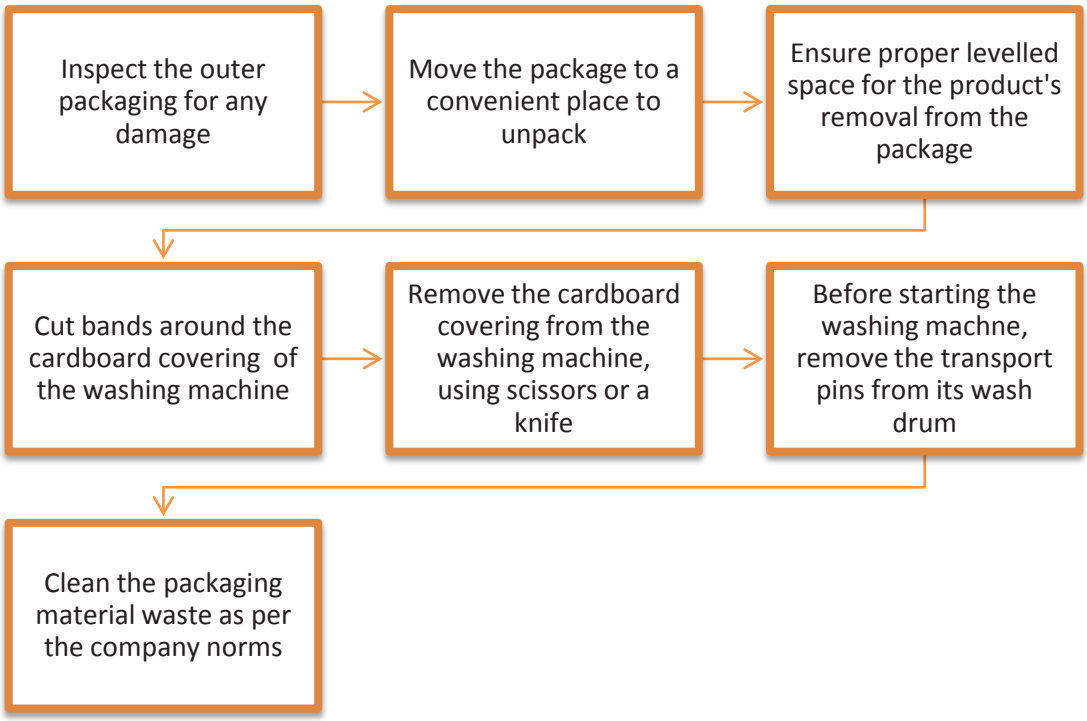


Fig.6.2.4: Steps for unpacking a washing machine package

The tools used for handling and unpacking a system are shown in the following figure:

Fig. 6.2.5: Tools used in handling and unpacking a system

Take out the Washing Machine

Take out all the supporting accessories and the washing machine carefully from the package. Check and understand the symbols on the package to know about the cautions and warnings related to the installation.

The following figure depicts some common warning symbols along with their meanings:

A warning or a notice that is important.

The contents of the package are sensitive to water and should be protected.

The contents of a package are fragile.

The direction in which the box should be positioned. The line shows the bottom and the arrows point upwards.

Packaging materials have been made from recyclable materials.

Warning that the material may produce electric shock.

Fig. 6.2.6: Common warning symbols on a package

Checking the Components

To ensure smooth installation, the parts inside the package must be checked so that if there is any part missing or any damage found, it can be informed to the company as early as possible. In addition, do the following things:

- Check all the parts for any damage that may be caused during shipping. If any damage is found, it should be reported to the carrier and the dealer
- Check that the design and colour of the washing machine is matching to the customer's order
- Check inside the package for all the supporting accessories of the washing machine
- Match the accessories against the delivery checklist

Connect all the Accessories of a Washing Machine

After checking all the parts, the next step is to connect all the accessories such as water pipe, stand on which washing machine will place, plug to provide power source to washing machine and so on. The following image shows different accessories connected to the washing machine:

Fig. 6.2.7: Different accessories connected to the washing machine

The last step of the assembling process is to provide power to the washing machine. The power can be provided by simply inserting the power plug into the socket and turning it on.

6.2.4 Standard Operating Procedures

Standard operating procedures provide a stable platform for performance measurements. All companies, be it small or large, have documented work standards to ensure consistent progress. It is the responsibility of the field technician to follow these standards. The technician should adhere to the work standards to meet the targets and achieve sustainability in the workplace. He/she should also follow the safety standards to stay safe while working with electrical and electronic components.

The following figure lists a few standard operating procedures for a field technician:

Fig. 6.2.8: Standard operating procedures for a field technician

UNIT 6.3: Servicing and Repairing Washing Machine

Unit Objectives

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

1. Identify the customer's requirements
2. Understand how to connect all the parts/components of washing machine
3. Understand how to install the parts of washing machine

6.3.1 Customer Requirements

Understanding the needs of a customer is one of the foremost parts of a technician's job role. This includes the following practices:

- Greet the customer and talk politely
- Understand the customer's requirement
- Provide the best possible and cost-effective solution to the customer
- Ensure that the customer is satisfied with the service

When work is allocated, it is important for the field technicians to understand and analyse the requirement before going ahead with the plan of action or visiting the customer's site. This means that they should be able to understand what their customers want and also know how to satisfy their needs. They need to know how to deal effectively with the customers.

Further, the technician should place the washing machine as per the customer's need. Primarily, the field technician must listen to the customer, even if the viewpoint is the same let the customer vent it off. After the customer has finished, express feeling and then respond accordingly.

Provide immediate response to the problem detailed by the customer, if possible. At times, it may mean bending the rules, but customer satisfaction is the key to success and going out of the way can just hit the nail on its head.

6.3.2 Connecting the Components

After the correct placement of the components, the next step is to connect them with the washing machine. The following figure shows how to connect various parts to the system:

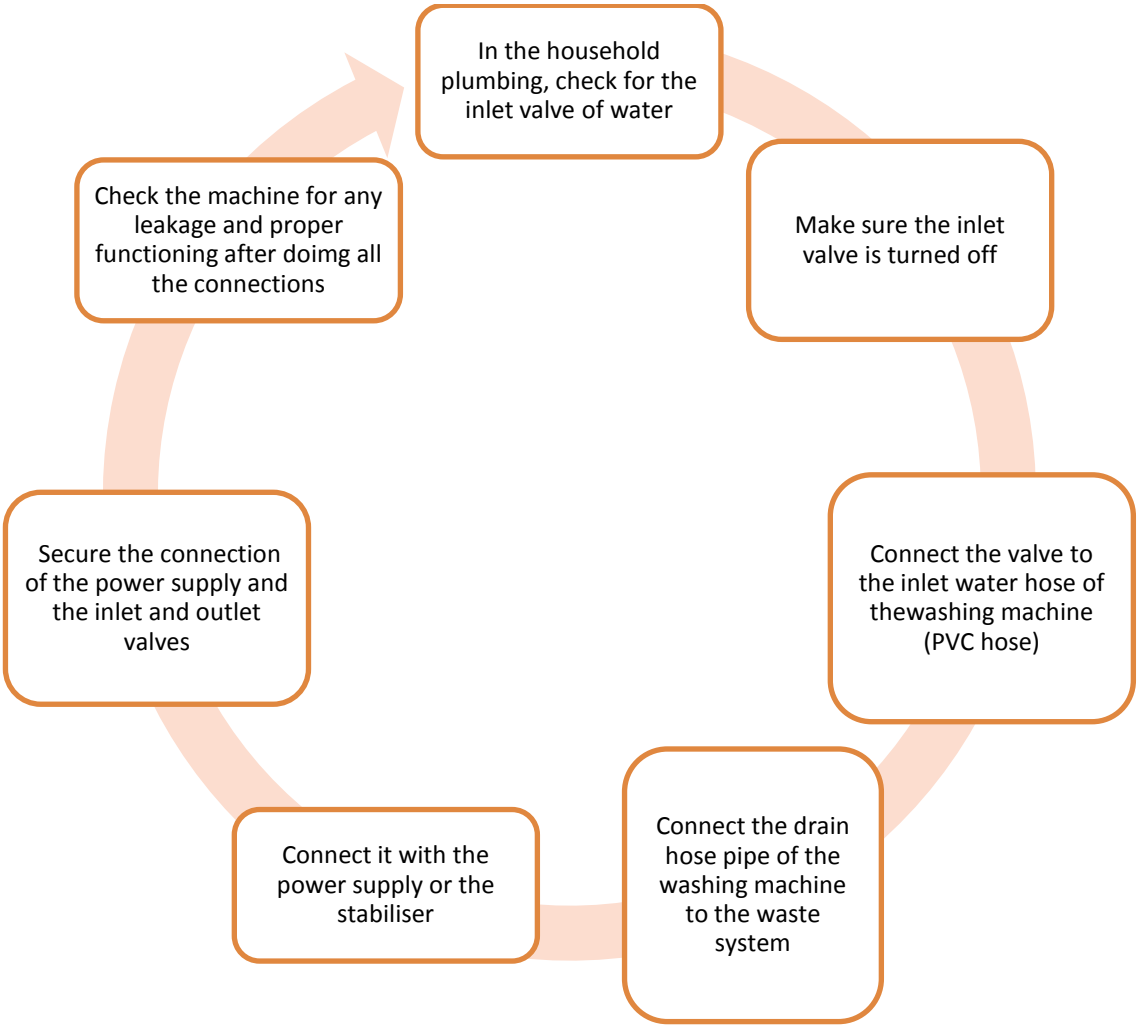


Fig. 6.3.2: Steps to connect various parts

6.3.3 Installing the Washing Machine

The step by step procedure to install a washing machine is as follows:

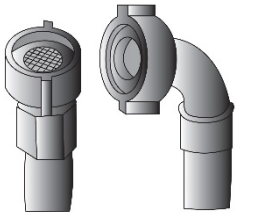
1. Firstly, decide the place where the machine has to be installed, keeping in mind the customer's requirement.
2. Place for installing washing machine should be steady & flat level surface to minimize the vibration noise and smooth operation.
3. Approximate clearance required on all sides should be 10 cm.
4. If surface is not flat enough use stands with adjustable legs or use proper packing.
5. Water supply point should be close to the installation place.
6. Standard water inlet pipe available with the washing machine is 1.5 meter.
7. Check the type of tap
8. Check the available water pressure (for fully automatic and front-loading machine).
9. Outer packaging of the washing machine must be removed properly
10. Bend the machine towards the back and slowly take it off the bottom packer.
11. Pull out the bottom packer in the front beneath the machine
12. Remove the bowl packer by lifting the lid
13. Take out all the accessories and hoses
14. Safely keep the bowl packer and the bottom packer for future concern

To install the drain hose:

1. Pull the exposed part of the hose to pull out the drain hose out from the back of the washing machine
2. Fit the host guide to the drain hose to guide the drain hose over the standpipe
3. From the end of the guide, the extension of the drain hose should not exceed more than 20 mm
4. The length of the drain hose can be trimmed according to the requirement.
5. The drain hose can be placed in the standpipe or a tub.

To install the inlet hose:

1. Both the ends of the inlet hoses are connected to the taps.
2. If the inlet hoses are colour coded, then the red end is connected to the hot end and the blue end is conneced to the cold end.
3. The inlet hoses with elbow ends are connected to the respective hot and cold inlet valves of the machine.
4. The minimum requirement for the height of the taps in washing machines is 1150 mm.



Inlet Hose Ends

6.3.4 Check the Functioning

After installing all the required accessories of the washing machine, it is mandatory to check the working of the appliance, to identify problems (if any) and to ensure its smooth functioning.

A field technician can achieve productivity and quality in work by educating the customer about the proper place where the machine is to be installed as per the guidelines mentioned in the installation manual given by the company.Also, the technician should tell the customer about the use of the volatage regulators and to switch off the machine during voltage fluctuations.

Providing Guidance to the Customer

Demonstrating a product is a way of promoting or showing the operation of equipment to the users. The goal of demonstrating the workability of equipment is to make them aware of the operation of that equipment and answer their queries related to its operation.

There is nothing better than a good demonstration session. It is only after a demonstration (demo) that the users understand the operation of particular equipment.

There are a few rules which must be considered while preparing for the demo. The following figure lists these rules:

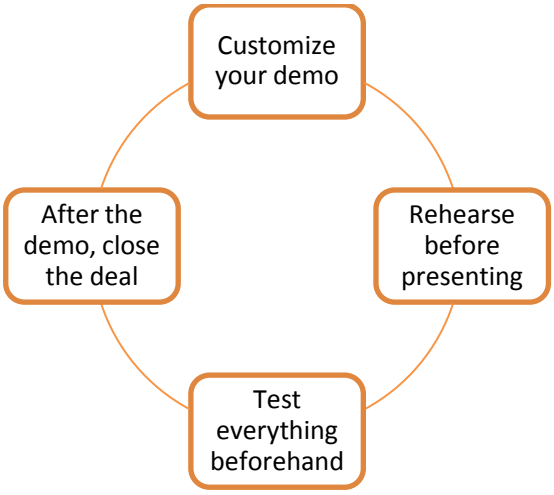


Fig. 6.3.3: Rules to be followed to prepare for an effective demo

In addition, it is the responsibility of a field technician to make the customers aware of the user manual and tell them how to read it.

It can be a user manual which contains instructions for the installation of a washing machine or it may be a help book giving solutions to common problems that may arise with equipment. The following figure lists the steps for reading a manual:

Step 1: Determine information	One must be able to determine and read as per the specified requirement rather than reading the entire document.
Step 2: Scan the document	Scan the document to determine its layout style and get a better idea about the manner in which the content is presented.
Step 3: Find information	Look up for the required information using headings, index or the table of contents.
Step 4: Take notes	It is essential to take notes for any important topic that one may come accross while reading the document. Tips and warnings mentioned in the manual should also be noted.
Step 5: Use glossary	A person may come across technical terms while reading the document. Meanings of such terms can be looked up in the glossary section at the end of the manual.

Fig. 6.3.4: Steps to read a manual

Customers can have varied queries and issues. It the core responsibility of the field technician to respond to them.

Take Feedback from Customer

Just like it is essential to address issues within the facility, it is also important to get feedback of the customer. The customer is always special, and the customer's feedback is the most important thing for an organization.

The procedure as shown in the following figure should be followed:

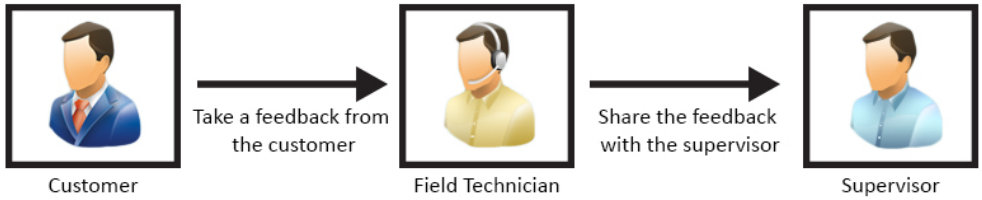


Fig. 6.3.5: Procedure to be followed for taking customer feedback

The time taken to resolve an issue and the difficulties that a customer encountered while communicating the problem should be understood. The misunderstandings observed during the interaction should be clearly documented.

The methods of interaction and behavioural aspects also need to be considered in drawing conclusions after each task or problem handling routine. Getting honest feedback from the clients helps to improve the organizational functioning.

The field technician can get a feedback form filled by the customer at the facility.

UNIT 6.4: Troubleshooting Common Problems

Unit Objectives

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

1. Understand symptoms and identify faults in the washing machine
2. Understand the repairing procedure of washing machine
3. Identify faulty part and perform troubleshooting

6.4.1 Understanding Symptoms and Identifying Fault

A field technician should know how to identify faults and symptoms related to that. The following figure shows steps required to understand symptoms and identify the fault:

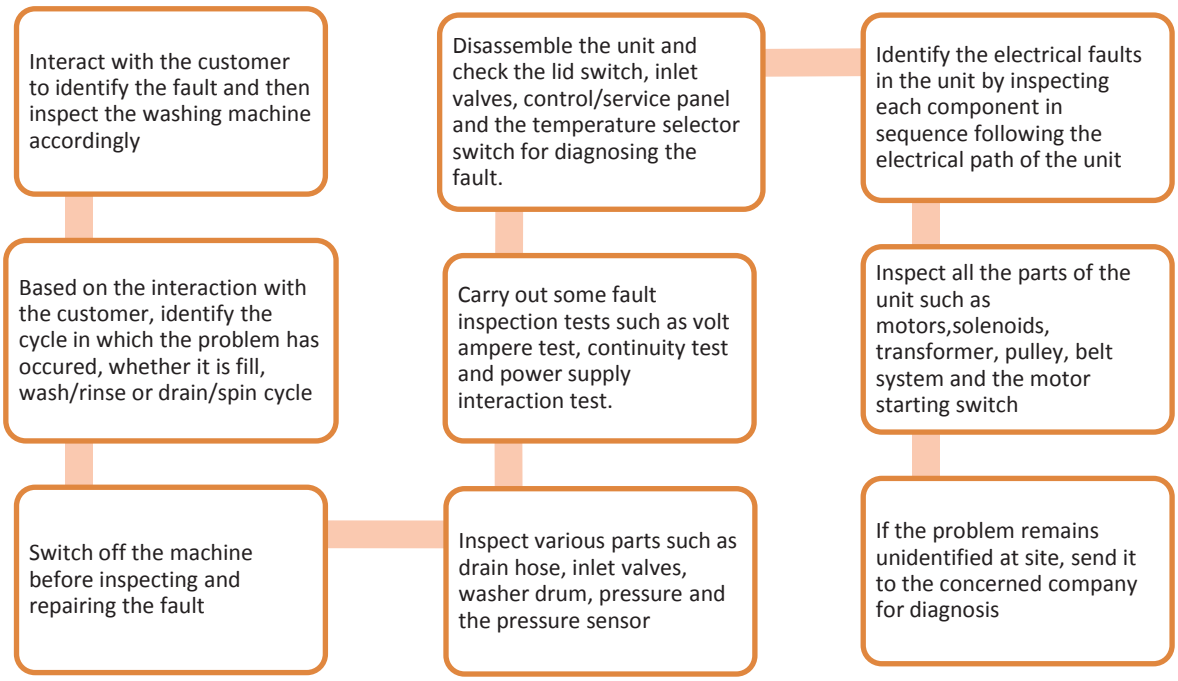


Fig. 6.4.1: Steps required to understand the symptoms and identify the fault

6.4.2. Repairing Washing Machine

The following table shows area of problem and its solutions:

Areas of Problem	Solution
Water source problem	Ensure that there are no crimps in the water hose and also the water supply should be turned on
Accumulation of soap inside the unit	Clean the accumulated soap and run the unit for a complete wash cycle

Problem in components of the unit	Replace the faulty components

Fig. 6.4.2: Repairing washing machine

If the faulty module or part cannot be replaced, make sure to replace it during the second visit with a functional one.

6.4.3 Identify the Faulty Part and Perform Troubleshooting

Troubleshooting refers to repair of faulty products or processes. It begins with searching for the source of a problem and ends with finding the solution for that problem to ensure that the product or process functions properly. Good troubleshooting consists of the following four steps:

- Identification of the symptoms
- Elimination of the causes of a problem
- Verification of the solution
- Restoration of the product or process

In other words, the first thing to do is to identify the symptoms that are causing a failure in the system. The next step is to diagnose the cause of that malfunction, till a solution is reached. This is followed by returning the product to its original state.

The following table lists some common problems and their solutions:

Reason	Description	Deal Method
Fill overtime	No water level change in three minutes during the washing cycle.	Check the water inlet valve Air pipe gets broken or bad airproof. Check to have hung up the drain hose.
Lots of water in the tub	The water level is higher than the overflow water level when the washing machine is at power on, delay fault or running condition.	Check the water inlet valve, the drain pump and the PC board.
Overflow	The water level is higher than the overflow water level.	The water inlet valve fails.
Bad connection of drain pump	The PC board cannot get the drain pump signal.	Check the drain pump wire connection.

Drain overtime	The water level does not change in three minutes during drain.	Check the drain pump. Check the filter of the drain pump to prevent jam. Check the drain hose to prevent jam.
Cannot lock the door lock	Fails to lock the door lock for six times when the PC board tries to lock the door lock after you press the START key.	Check the door hook and the door lock to get correct location.
Cannot unlock the door lock	Fails to unlock the door lock six times.	Check the door lock.
Water level sensor fail	The frequency of the water level sensors is out of the specification.	Check the water level sensor.
Temperature sensor fail	Temperature sensor (NTC) gets broken.	Check the temperature sensor (NTC).
The motor cannot drive	The motor fails to drive for 3 times.	Check the PC board and the motor.
No speed feedback signal	The PC board cannot get feedback signal when the motor drives.	Check the speed feedback line of the motor to prevent fall off.

Fig. 6.4.3: Common problem and solutions

Some common problem and their solutions:

Problems	Check
Washing machine is not working	• Close the lid. • Check the washer by pressing the start/pause button • Check the water pressure • Check the source of the water supply
Problem in spin basket and drain hose	• Remove the drain hose and soak it in hot water. • Also, add hot water in the spin basket and let it rest for 10 mins. • Clean the drain hose connector by putting hot towel on it. • After cleaning, connect the drain hose again and check its functioning.

Spinning does not work	• Add hot water in the spin basket and let it rest for 10 minutes • Make sure that the laundry is evenly spread in the spin basket • If not, spread the clothes properly and then check its functioning.
Error in child lock	• This lock is used for the safety of children to prevent them from drowning inside the wash tub. • Check for the error message which will display “CL” or “DE”. If this error message is displayed on the screen, the water will be drained with an alarm. • After the water is drained completely, turn off the machine and then turn it on. The error message will be removed, and the machine will operate normally.
Water has overflowed	• Restart after spinning. • If the error sign is still seen, call the agency.
The water leaks at the water supply hose connector.	• Clean the filter net by brushing with a toothbrush. • In case, the water supply is shut down, turn off the water valves.

Fig. 6.4.4: Common troubleshooting

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सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ESSCI
Skilling India in Electronics

7. Soft Skills and Work Ethics

Unit 7.1 – Effective Communication and Coordination at Work

Unit 7.2 – Working Effectively and Maintaining Discipline at Work

Unit 7.3 – Maintaining Social Diversity at Work

ELE/N9905

Key Learning Outcomes

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

1. State the importance of work ethics and workplace etiquette
2. State the importance of effective communication and interpersonal skills
3. Explain ways to maintain discipline in the workplace
4. Discuss the common reasons for interpersonal conflict and ways of managing them effectively.

UNIT 7.1: Efffecte Communicacation aCoordinainati t Work

Unit Objectives

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

1. Work efffectely at the workplace.
2. Demonstrate practicesrelated to gender and PwD sensitazation.

7.1.1 Importance of Work Ethics and Workplace Etiquette

Workplace ethics are a set of moral and legal guidelines that organizations follow. These guidelines influence the way customers and employees interact with an organization. Workplace ethics essentially guide how an organization serves its clients and treats its employees.

For example, if a company seeks to fulfil the promises it makes, it may develop processes and set up a robust support system to address this policy and build customer/client loyalty. To achieve this goal, the company may implement specific incentive programs for employees to encourage them to produce high-quality work and ensure the organization fulfils the promises it makes to its clients/ customers.

Many organizations, often the large ones, set detailed ethical codes to guide their operations and control how the organizational processes impact the stakeholders. These ethics usually help organizations maintain certain standards of responsibility, accountability, professionalism and among others, as they navigate through different challenges and day-to-day circumstances. By following these guidelines, organizations often experience several benefits that improve the lives of stakeholders, such as customers, employees, leaders, etc.

Examples of Common Workplace Ethics

Fig. 7.1.1 Examples of Common Workplace Ethics

Workplace ethics are essential for a successful organization with a satisfied and loyal team. High ethical standards help in ensuring all stakeholders, such as customers, investors, employees, and other individuals involved in the workplace operations, feel the organization is safeguarding their interests. By creating and implementing ethical guidelines, organizations can keep the best interests of their employees in mind while maintaining a positive influence on those they impact through their processes.

As a result, employees maintain the organization's best interests by being ethical in their daily work duties. For example, fairly-treated employees of an organization who understand the organization's commitments to environmental sustainability are usually less likely to behave in a manner that causes harm to the environment. Thus, they help maintain a positive public image of the organization. It means that workplace ethics help in maintaining reciprocal relationships that benefit organizations at large and the individuals associated with and influenced by the organizational policies.

Benefits of Workplace Ethics

There are various benefits of implementing workplace ethics. When organizations hold themselves to high ethical standards, leaders, stakeholders, and the general public can experience significant improvements. Following are some of the key benefits of employing ethics in the workplace:

Fig. 7.1.2 Benefits of Workplace Ethics

7.1.2 Interpersonal Communication

Interpersonal communication is a process that involves sharing ideas and emotions with another person, both - verbally and non-verbally. It is essential to interact effectively with others in both personal and professional lives. In professional life or the workplace, strong interpersonal skills play a crucial role in achieving effective collaboration with colleagues.

Interpersonal Skills

Interpersonal skills, in other terms, are known as people skills, which are used to communicate and interact with others effectively. These are soft skills one uses to communicate with others and understand them. One uses these skills in daily life while interacting with people

Examples of Interpersonal Skills

Fig 7.1.3 Examples of Interpersonal Skills

Numerous interpersonal skills involve communication. Communication can be verbal, such as persuasion or tone of voice — or non-verbal, such as listening and body language.

Importance of Interpersonal Skills

Interpersonal skills are essential for communicating and collaborating with groups and individuals in both personal and professional life. People with strong interpersonal skills often are able to build good relationships and also tend to work well with others. Most people often enjoy working with co-workers who have good interpersonal skills.

Among other benefits of good interpersonal skills is the ability to solve problems and make the best decisions. One can use the ability to understand others and good interpersonal communication skills to find the best solution or make the best decisions in the interest of everyone involved. Strong interpersonal skills help individuals work well in teams and collaborate effectively. Usually, people who possess good interpersonal skills also tend to be good leaders, owing to their ability to communicate well with others and motivate the people around them.

Interpersonal communicationis the key to working in a team environment and working ccollectely to achieve shared goals. Following are the interperso

Verbal Communication

The ability to speak clearly, appropriately and confidently can help one communicate effectively with others. It is vital to select the appropriate vocabulary and tone for the target audience.

For example – one should speak formally and professionally in the work environment, while informal language is acceptable in an intimate environment with close friends and family. Also, one should avoid using complex or technical language while communicating with an audience that may not be familiar with it. Using simple language in a courteous tone helps achieve better communication, irrespective of the audience.

Active Listening

Active listening is defined as the ability to pay complete or undivided attention to someone when they speak and understand what they are saying. It is important for effective communication because without understanding what the speaker is saying, it becomes difficult to carry forward a conversation. One should ensure to use appropriate verbal and non-verbal responses, e.g. eye contact, nodding, or smiling, to show interest in what the speaker says. Active listening is also about paying attention to the speaker's body language and visual cues. Asking and answering questions is one of the best ways to demonstrate an interest in conversing with the other person.

Active listening is critical for communicating effectively without ambiguity. It helps one understand the information or instructions being shared. It may also encourage co-workers to share their ideas, which ultimately helps achieve collaboration.

Body Language

One's expression, posture, and gestures are as important as verbal communication. One should practice open body language to encourage positivity and trust while communicating. Open body language includes - maintaining eye contact, nodding, smiling and being comfortable. On the other hand, one should avoid closed body language, e.g. crossed arms, shifting eyes and restless behaviour.

Empathy

Empathy is the ability to understand the emotions, ideas and needs of others from their point of view. Empathy is also known as emotional intelligence. Empathetic people are good at being aware of others' emotions and compassionate when communicating with them. Being empathetic in the workplace can be good to boost the morale of employees and improve productivity. By showing empathy, one can gain the trust and respect of others.

Conflict Resolution

One can use interpersonal communication skills to help resolve disagreements and conflicts in the workplace. This involves the application of negotiation and persuasion skills to resolve arguments between conflicting parties. It is also important to evaluate and understand both sides of the argument by listening closely to everyone involved and finding an amicable solution acceptable to all.

Good conflict resolution skills can help one contribute to creating a collaborative and positive work environment. With the ability to resolve conflicts, one can earn the trust and respect of co-workers.nal communicationskills that vital for success at work:

Teamwork

Employees who communicate and work well in a team often have better chances of achieving success and common goals. Being a team player can help one avoid conflicts and improve productivity. One can do this by offering to help co-workers when required and asking for their feedback and ideas. When team members give their opinions or advice, one should positively receive and react to the opinions/advice. One should be optimistic and encouraging when working in groups.

Improving Interpersonal Skills

One can develop interpersonal skills by practising good communication and setting goals for improvement. One should consider the following tips to improve their interpersonal skills:

- One should ask for feedback from co-workers, managers, family or friends to figure out what needs improvement concerning their interpersonal skills.
- One can identify the areas of interpersonal communication to strengthen by watching others.
- One can learn and improve interpersonal skills by observing co-workers, company leaders and professionals who possess good interpersonal skills. This includes watching and listening to them to note how they communicate and the body language used by them. It is vital to note their speed of speaking, tone of voice, and the way they engage with others. One should practice and apply such traits in their own interactions and relationships.
- One should learn to control their emotions. If stressed or upset, one should wait until being calm to have a conversation. One is more likely to communicate effectively and confidently when not under stress.
- One can reflect on their personal and professional conversations to identify the scope of improvement and learn how to handle conversations better or communicate more clearly. It helps to consider whether one could have reacted differently in a particular situation or used specific words or positive body language more effectively. It is also vital to note the successful and positive interactions to understand why they are successful.
- One should practice interpersonal skills by putting oneself in positions where one can build relationships and use interpersonal skills. For example, one can join groups that have organized meetings or social events. These could be industry-specific groups or groups with members who share an interest or hobby.
- Paying attention to family, friends and co-workers and making efforts to interact with them helps a lot. One should complement their family, friends and co-workers on their good ideas, hard work and achievements. Trying to understand someone's interests and showing interest in knowing them can help one build strong interpersonal skills. Offering to help someone, especially in difficult situations, helps build stronger and positive workplace relationships.
- One should avoid distractions, such as a mobile phone, while interacting with someone. Giving someone full attention while avoiding distractions helps achieve a clear exchange of ideas. By listening with focus, one can understand and respond effectively.

- One can attend appropriate courses on interpersonal skills or sign up for workshops at work to improve interpersonal skills. One can find many resources online also, such as online videos.
- For personal mentoring, one can approach a trusted family member, friend, co-worker, or current/ former employer. A person one looks up to with respect and admires is often a good choice to be selected as a mentor. One can even hire a professional career or communication coach.

Interpersonal communication skills often help one boost their morale, be more productive in the workplace, complete team projects smoothly and build positive and strong relationships with co-workers.

Notes

UNIT 7.2: Working Efffectely and Maintaining Discipline at Work

Unit Objectives

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

- Discuss the importance of following organizational guidelines for dress code, time schedules, language usage and other behavioural aspects
- Explain the importance of working as per the workflow of the organization to receive instructions and report problems
- Explain the importance of conveying information/instructions as per defined protocols to the authorised persons/team members
- Explain the common workplace guidelines and legal requirements on non-disclosure and confidentiality of business-sensitive information
- Describe the process of reporting grievances and unethical conduct such as data breaches, sexual harassment at the workplace, etc.
- Discuss ways of dealing with heightened emotions of self and others.

7.2.1 Discipline at Work

Discipline is essential for organizational success. It helps improve productivity, reduce conflict and prevent misconduct in the workplace. It is important to have rules concerning workplace discipline and ensure that all employees comply with them. In the absence of discipline, a workplace may experience conflicts, bullying, unethical behaviour and poor employee performance. An efficient workplace disciplinary process helps create transparency in the organization. Benefits of disciplinary standards:

All employees follow the same rules which helps establish uniformity and equality in the workplace

Managers and supervisors have defined guidelines on what accon to take while initi atg disciplinary y aon

With well-defined and enforced disciplinary rules, an organiizaon can avoid various safety, security, rupati nal risks

Fig 7.2.1 Benefits of Disciplinary Standards

Maintaining an organized and cohesive workforce requires maintaining discipline in both personal and professional behaviour. It is important to follow the appropriate measures to keep employees in line without affecting their morale.

Defining Discipline

The first and crucial step in maintaining workplace discipline is to define what is meant by discipline. It helps to evaluate common discipline problems and devise guidelines for handling them effectively.

Among a number of areas, discipline usually covers:

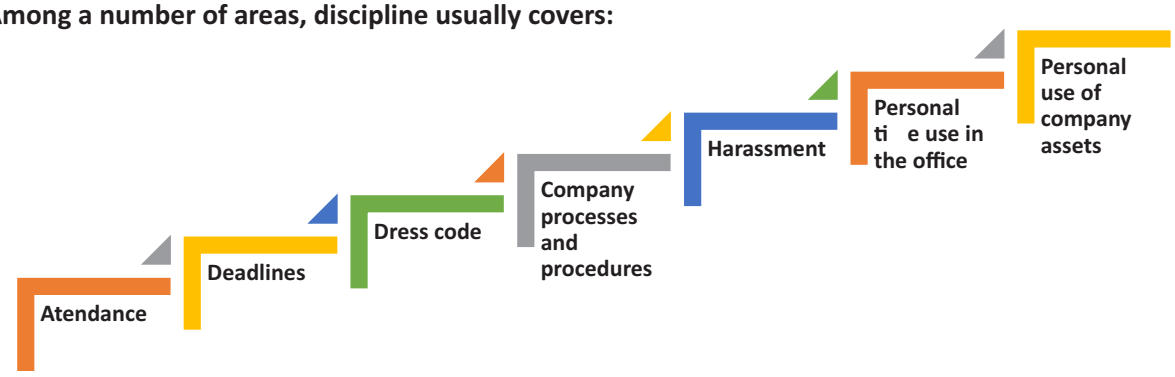


Fig 7.2.2 Examples of Workplace Discipline

According to demography and local issues, it may also include substance use and related issues.

It is vital for a workplace to have an employee handbook or company policy guide, to serve as a rulebook for employees to follow. The employee handbook/ company policy guide should be reviewed and updated periodically according to any issues or areas, or concerns identified concerning workplace discipline. Such manuals should also cover all the laws and regulations governing workplace behaviour.

Defining and documenting workplace rules aids in their implementation, ensuring little or no ambiguity. All employees in a workplace should also have easy access to the workplace guidelines so that they can refer to them to get clarity whenever required. To maintain discipline at work, it is also critical to ensure uniform application of workplace guidelines to all employees without exception.

7.2.2 Employee Code of Conduct

The employee code of conduct manual serves as a guide for employees to inform them regarding the behaviour expected from them at work. It helps create a good work environment with consistent behaviour from employees. The manual should list examples of acceptable and not acceptable behaviours at work. The code of conduct should be discussed with employees so that they have the clarifications required.

For example, an organization may create guidelines concerning the conduct with clients to ensure no contact is made with them except for business purposes, also prescribing the use of appropriate means of communication.

Employees should have a clear understanding concerning their job responsibilities and the behaviour expected from them with all stakeholders, e.g. company personnel, clients and associated third parties. It is critical to have documented guidelines for employees to follow concerning all aspects of work. It should also document the disciplinary action to be followed in case of non-compliance, e.g. verbal and

then written warning, temporary suspension or eventual termination of service in case of repeated non-compliance with the employee code of conduct. Employees should know what the company rules are and what will happen if they break the rules. However, disciplinary action should be initiated only when reasonably required to avoid its misuse for employee harassment.

There should also be an effective mechanism for employees to raise their concerns/ grievances and have them addressed while maintaining privacy, as required, e.g. raising concerns regarding the behaviour of a co-worker.

The employee code of conduct manual must be duly reviewed and approved by the concerned stakeholders, such as the Human Resources (HR) department and company executives.

7.2.3 Interpersonal Conflicts

Interpersonal conflict is any type of conflict between two or more people. These are found in both - personal and professional relationships - among friends, family, and co-workers. In the workplace, interpersonal conflict is often observed when a person or group of people interfere with another person's attempts at completing assignments and achieving goals. It is critical to resolve conflicts in the workplace to boost the morale of employees, repair working relationships among them, and improve customer satisfaction.

Reasons for Workplace Conflicts

Workplace conflicts are often observed when two or more people have different points of view. This can happen between managers, co-workers, or clients and customers. In general, interpersonal conflicts are caused by a lack of communication or unclear communication.

Some of the leading reasons for workplace conflicts are:

- Difference in values
- Personality clashes
- Poor communication

Example of poor communication – if a manager reassigns a task to another employee without communicating with the employee to whom it was originally assigned, interpersonal conflict can arise among them. This may potentially make the first employee, i.e. who was originally assigned the task, feel slighted and mistrusted by the manager. It may even cause animosity in the first employee toward the employee who has now been assigned the task.

Types of Interpersonal Conflict

Following are the four types of interpersonal conflicts:

a. **Policy-related interpersonal conflict**

When a conflict relates to a decision or situation that involves both parties, it can be called a policy-related interpersonal conflict. Example – two people or groups working on the same project, trying to adopt different approaches. To resolve policy-related interpersonal conflicts, the parties involved should try to look for a win-win situation or make a compromise. This is especially critical to resolve trivial issues so that work is not affected and common goals are achieved.

b. **Pseudo-conflicts**

Pseudo-conflict arises when two people or groups want different things and cannot reach an agreement. Pseudo-conflicts usually involve trivial disagreements that tend to hide the root of the issue.

c. **Ego-related interpersonal conflicts**

In ego conflicts, losing the argument may hurt or damage a person's pride. Sometimes ego conflicts arise when a number of small conflicts pile up on being left unresolved. To resolve ego-related conflicts, it's best to find the root of the issue and work towards a resolution.

d. **Value-related interpersonal conflicts**

Sometimes conflicts may occur between people when they have different value systems. Such conflicts can be difficult to identify initially, making the people involved think the other party is being disagreeable or stubborn, wherein they just have different values. Some co-workers may highly value their personal/ family time after office that they may be unreachable to clients during non-office hours, while others may place a high value on client satisfaction and may still be available for clients during non-office hours. Conflict may arise among such people when they may be required to coordinate to help a client during after-office hours. Value-related interpersonal conflicts are often difficult to settle since neither party likes to compromise.

Resolving Interpersonal Conflicts

Conflicts are usually likely in the workplace; they can, however, be prevented. Often resolving interpersonal conflicts through open communication helps build a stronger relationship, paving the way for effective coordination and success. Some ways to resolve interpersonal conflict:

- **Communication -** A great way to resolve interpersonal conflicts is for the opposing parties to listen to one another's opinions and understand their viewpoints. Meeting in person and keeping the conversation goal-oriented is important. One can have effective communication by following some measures, e.g. staying on the topic, listening actively, being mindful of the body language, maintaining eye contact, etc.

- **Active Listening -** One should patiently listen to what the other person is saying without interrupting or talking over them. It helps one display empathy and get to the root of the issue. Asking questions to seek clarification when required helps in clear communication and conveys to the other person that one is listening to them. Practising active listening is a great way to improve one's communication skills.
- **Displaying Empathy -** Listening attentively and identifying the anxieties/ issues of co-workers is a great way to show empathy and concern. It is essential to understand their feelings and actions to encourage honesty and avoid future conflict.
- **Not Holding Grudges -** With different types of people and personalities in a workplace, it is common for co-workers to have conflicts. It is best to accept the difference in opinions and move on. Being forgiving and letting go of grudges allows one to focus on the positive side of things and perform better at work.

Work-related interpersonal conflicts can be complicated because different people have different leadership styles, personality characteristics, job responsibilities and ways in which they interact. One should learn to look above interpersonal conflicts, resolving them to ensure work goals and environment are not affected.

7.2.4 Importance of Following Organizational Guidelines

Policies and procedures or organizational guidelines are essential for any organization. These provide a road map for the operations of the organization. These are also critical in ensuring compliance with the applicable laws and regulations by guiding the decision-making process and business operations.

Organizational guidelines help bring uniformity to the operations of an organization, which helps reduce the risk of unwanted and unexpected events. These determine how employees are supposed to behave at work, which ultimately helps the business achieve its objectives efficiently.

However, organizational guidelines are ineffective and fail to serve their purpose if they are not followed. Many people don't like the idea of following and abiding by specific guidelines. Such people should be made to understand the benefits of following the organizational guidelines. Some of the key benefits are given below:

With well-defined organizational guidelines in place, no individual can act arbitrarily, irrespective of their position in the organization. All individuals will know the pros and cons of taking certain actions and what to expect in case of unacceptable behaviour. Benefits of following organizational guidelines:

- Consistent processes and structures - Organization guidelines help maintain consistency in operations, avoiding any disorder. When all employees follow the organizational guidelines, an organization can run smoothly. These ensure that people in different job roles operate as they are supposed to, knowing what they are responsible for, what is expected of them, and what they can expect from their supervisors and co-workers. With clarity in mind, they can do their jobs with confidence and excellence. With every person working the way intended, it's easy to minimise errors.

  With all the staff following organizational guidelines, the organization has a better scope of using time and resources more effectively and efficiently. This allows the organization to grow and achieve its objectives.
- **Better quality service -** By following organizational guidelines, employees perform their duties correctly as per the defined job responsibilities. It helps enhance the quality of the organization's products and services, helping improve the organization's reputation. Working with a reputable organization, employees can take pride in their work and know they are contributing to the reputation.
- **A safer workplace -** When all employees follow organizational guidelines, it becomes easy to minimise workplace incidents and accidents. It reduces the liabilities associated with risks for the organization and limits the interruptions in operations. Employees also feel comfortable and safe in the workplace, knowing their co-workers are ensuring safety at work by following the applicable guidelines.

Different organizations may have different guidelines on dress code, time schedules, language usage, etc. For example – certain organizations in a client-dealing business requiring employees to meet clients personally follow a strict dress code asking their employees to wear formal business attire. Similarly, organizations operating in specific regions may require their employees to use the dominant regional language of the particular region to build rapport with customers and serve them better. Certain organizations, such as banks, often give preference to candidates with knowledge of the regional language during hiring.

Working hours may also differ from one organization to another, with some requiring employees to work extra compared to others. One should follow the organizational guidelines concerning all the aspects of the employment to ensure a cohesive work environment.

7.2.5 Workflow

Workflow is the order of steps from the beginning to the end of a task or work process. In other words, it is the way a particular type of work is organised or the order of stages in a particular work process.

Workflows can help simplify and automate repeatable business tasks, helping improve efficiency and minimise the room for errors. With workflows in place, managers can make quick and smart decisions while employees can collaborate more productively.

Other than the order that workflows create in a business, these have several other benefits, such as:

- Identifying Redundancies - Mapping out work processes in a workflow allows one to get a clear, top-level view of a business. It allows one to identify and remove redundant or unproductive processes.

  Workflow gives greater insights into business processes. Utilizing such useful insights, one can improve work processes and the bottom line of the business. In many businesses, there are many unnecessary and redundant tasks that take place daily. Once an organization has insight into its processes while preparing workflow, it can determine which activities are really necessary.

  Identifying and eliminating redundant tasks creates value for a business. With redundant tasks and processes eliminated, an organization can focus on what's important to the business.

- Increase in Accountability and Reduction in Micromanagement - Micromanagement often causes problems in a business setting as most employees don't like being micromanaged, and even many managers don't like the practice. Micromanagement is often identified as one of the reasons why people quit their job.

  However, the need for micromanagement can be minimized by clearly mapping out the workflow. This way, every individual in a team knows what tasks need to be completed and by when and who is responsible for completing them. This makes employees more accountable also.

  With clearly defined workflow processes, managers don't have to spend much time micromanaging their employees, who don't have to approach the manager to know what the further steps are. Following a workflow, employees know what is going on and what needs to be done. This, in turn, may help increase the job satisfaction of everyone involved while improving the relationships between management and employees.

- Improved Communication - Communication at work is critical because it affects all aspects of an organization. There are instances when the main conflict in an organization originates from miscommunication, e.g. the management and employees disagreeing on an aspect, despite pursuing the same objectives. Poor communication is a common workplace issue that is often not dealt with.

- This highlights why workflow is important. Workplace communication dramatically can increase with the visibility of processes and accountability. It helps make the daily operations smoother overall.

- Better Customer Service - Customers or clients are central to a business. Therefore, it is imperative to find and improve ways to improve customer experience. Relying on outdated manual systems may cause customer requests or complaints to be overlooked, with dissatisfied customers taking their business elsewhere. However, following a well-researched and defined workflow can help improve the quality of customer service.

By automating workflows and processes, an organization can also reduce the likelihood of human error. This also helps improve the quality of products or services over time, resulting in a better customer experience.

7.2.6 Following Instructions and Reporting Problems

All organizations follow a hierarchy, with most employees reporting to a manager or supervisor. For organizational success, it is vital for employees to follow the instructions of their manager or supervisor. They should ensure they perform their duties as per the given instructions to help achieve the common objectives of the organization and deliver quality service or products. This consequently helps maintain the reputation of the organization.

It is also important to be vigilant and identify problems at work or with the organizational work processes. One should deal with the identified within their limits of authority and report out of authority problems to the manager/ supervisor or the concerned person for a prompt resolution to minimise the impact on customers/clients and business.

7.2.7 Information or D ta Sharing

Information or data is critical to all organizations. Depending on the nature of its business, an organization may hold different types of data, e.g. personal data of customers or client data concerning their business operations and contacts. It is vital to effective measures for the appropriate handling of different types of data, ensuring its protection from unauthorized access and consequent misuse.

One should access certain data only if authorised to do so. The same is applicable when sharing data which must be shared only with the people authorised to receive it to use it for a specific purpose as per their job role and organizational guidelines. For example – one should be extra cautious while sharing business data with any third parties to ensure they get access only to the limited data they need as per any agreements with them. It is also critical to monitor how the recipient of the data uses it, which should strictly be as per the organizational guidelines. It is a best practice to share appropriate instructions with the recipient of data to ensure they are aware of the purpose with which data is being shared with them and how they are supposed to use and handle it. Any misuse of data must be identified and reported promptly to the appropriate person to minimise any damage arising out of data misuse.

These days most organizations require their employees and business partners or associated third parties to sign and accept the relevant agreement on the non-disclosure of business-sensitive information. In simple terms, business-sensitive information is confidential information. It is proprietary business information collected or created during the course of conducting business, including information about the business, e.g. proposed investments, intellectual property, trade secrets, or plans for a merger and information related to its clients. Business-sensitive information may sometimes also include information regarding a business's competitors in an industry.

The release of business-sensitive information to competitors or the general public poses a risk to a business. For example, information regarding plans for a merger could be harmful to a business if a competitor gets access to it.

7.2.8 Reporting Issues at Work

Most organizations have defined guidelines on appropriate reporting processes to be followed for reporting different types of issues. For example – one can report any grievances or dissatisfaction concerning co-workers to their manager/supervisor, e.g. data breaches or unethical conduct. If the concern is not addressed, then the employee should follow the organizational guidelines and hierarchy for the escalation of such issues that are not addressed appropriately.

For example – any concern related to sexual harassment at the workplace should be escalated to the concerned spokesperson, such as Human Resources (HR) representative, and if not satisfied with the action taken, it should be reported to the senior management for their consideration and prompt action.

7.2.9 Dealing with Heightened Emotions

Humans are emotional beings. There may be occasions when one is overwhelmed by emotions and is unable to suppress them. However, there may be situations when one must manage emotions well, particularly at work.

Stress in one's personal and professional life may often cause emotional outbursts at work. Managing one's emotions well, particularly the negative ones, is often seen as a measure of one's professionalism. Anger, dislike, frustration, worry, and unhappiness are the most common negative emotions experienced at work.

Ways to manage negative emotions at work:

- **Compartmentalisation –** It's about not confining emotions to different aspects of one's life. For example, not letting negative emotions from personal life affect work-life and vice versa. One should try to leave personal matters and issues at home. One should train their mind to let go of personal matters before reaching work. Similarly, one can compartmentalise work-related stresses so that negative emotions from work don't affect one's personal life.

- **Deep breathing and relaxation –** Deep breathing helps with anxiety, worry, frustration and anger. One should take deep breaths, slowly count to ten - inhaling and exhaling until one calms down. One can also take a walk to calm down or listen to relaxing music. Talking to someone and sharing concerns also helps one calm down.

- **The 10-second rule -** This is particularly helpful in controlling anger and frustration. When one feels their temper rising, they should count to 10 to calm down and recompose. If possible, one should move away to allow temper to come down.

- **Clarify -** It is always good to clarify before reacting, as it may be a simple case of misunderstanding or miscommunication.

- **Physical activity -** Instead of losing temper, one should plan to exercise, such as running or going to the gym, to let the anger out. Exercise is also a great way to enhance mood and release any physical tension in the body.

- **Practising restraint -** One should avoid replying or making a decision when angry, not allowing anger or unhappiness to cloud one's judgement. It may be best to pause any communication while one is angry, e.g. not communicating over email when angry or upset.

- **Knowing one's triggers -** It helps when one is able to recognise what upsets or angers them. This way, one can prepare to remain calm and plan their reaction should a situation occur. One may even be able to anticipate the other party's reaction.

- **Be respectful -** One should treat their colleagues the same way one would like to be treated. If the other person is rude, one need not reciprocate. It is possible to stay gracious, firm and assertive without being aggressive. Sometimes, rude people back away when they don't get a reaction from the person they are arguing with.

- **Apologise for any emotional outburst –** Sometimes, one can get overwhelmed by emotions, reacting with an emotional outburst. In such a case, one should accept responsibility and apologise immediately to the affected persons without being defensive.

- **Doing away with negative emotions -** It is recommended to let go of anger, frustration and unhappiness at the end of every workday. Harbouring negative emotions affects one emotionally, affecting their job performance also. Engaging in enjoyable activities after work is a good stress reliever.

Notes

UNIT 7.3: Maintaining Social Diversity at Work

Unit Objectives

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

1. Explain the concept and importance of gender sensitivityand equality.
2. Discuss ways to create sensitivityfor different genders and Persons with h Disabiliti(PwD).

7.3.1 Gender Sensitivity

Gender sensitivity is the act of being sensitive towards people and their thoughts regarding gender. It ensures that people know the accurate meaning of gender equality, and one's gender should not be given priority over their capabilities.

Fig 7.3.1 Gender Equality

Women are an important source of labour in many sectors, yet they have limited access to resources and benefits. Women should receive the same benefits and access to resources as men. A business can improve its productivity and quality of work by providing better support and opportunities to women.

Important Terms

- **Gender Sensitivity-** Gender sensitivity is the act of being sensitive to the ways people think about gender.
- **Gender Equality -** It means persons of any gender enjoy equal opportunities, responsibilities, and rights in all areas of life.
- **Gender Discrimination –** It means treating an individual unequally or disadvantageously based on their gender, e.g. paying different wages to men and women for similar or equal job positions.

Strategies for Enhancing Gender Equity

To enhance gender equity, one should:

- Follow gender-neutral practices at all levels at work.
- Participate together in decision-making.
- Help in promoting women's participation in different forums.
- Assist women in getting exposure to relevant skills and practices.
- Assist women in capacity building by mentoring, coaching or motivating them, as appropriate.
- Assist in the formation and operation of women support groups.
- Assist in the implementation of women-centric programmes.
- Combine technical training with reproductive health and nutrition for coffee farming households.
- Assist in making a work environment that is healthy, safe, and free from discrimination.

Bridging Gender Differences

Men and women react and communicate very differently. Thus, there are some work differences as both genders have their style and method of handling a situation.

Although, understanding and maturity vary from person to person, even between these genders, based on their knowledge, education, experience, culture, age, and upbringing, as well as how one's brain functions over a thought or problem.

In order to bridge the gap, one should:

- Not categorize all men and women in one way.
- Be aware of the verbal and non-verbal styles of communication of every gender to avoid any miscommunication and work better.
- Be aware of partial behaviour and avoid it.
- Encourage co-workers of different genders to make room by providing space to others.

Ways to reduce Gender Discrimination

- Effective steps against sexual harassment by the concerned authorities and general public.
- Gender stereotypes are how society expects people to act based on their gender. This can only be reduced by adopting appropriate behaviour and the right attitude.
- Objectification of females must be abolished.

Ways to Promote Gender Sensitivity in the Workplace

Practices that promote gender diversity should be adopted and promoted.

- All genders should receive equal responsibilities, rights, and privileges.
- All genders should have equal pay for similar or the same job roles/ positions.
- Strict and effective workplace harassment policies should be developed and implemented.
- An open-minded and stress-free work environment should be available to all the employees, irrespective of their gender.
- Women should be encouraged to go ahead in every field of work and assume leadership roles.
- Follow appropriate measures for women's empowerment.
- Men should be taught to be sensitive to women and mindful of their rights.

7.3.2 PwD Sensitivity

Some individuals are born with a disability, while others may become disabled due to an accident, illness or as they get old. People with Disabilities (PwD) may have one or more areas in which their functioning is affected. A disability can affect hearing, sight, communication, breathing, understanding, mobility, balance, and concentration or may include the loss of a limb. A disability may contribute to how a person feels and affect their mental health

Important Terms

·**Persons with Disabilities (PwD) –** Persons with Disabilities means a person suffering from not less than 40% of any disability as certified by a medical authority.

·**Types of Disability:**

a. Blindness – Visually impaired
b. Low Vision
c. Leprosy Cured
d. Hearing impairment
e. Locomotor disability
f. Mental retardation
g. Mental illness

PwD Sensitivity

PwD sensitivity promotes empathy, etiquette and equal participation of individuals and organizations while working with individuals with a disability, e.g. sensory, physical or intellectual.

Ways to be PwD Sensitive

To be sensitive to PwD, one should:

- Be respectful to all Persons with Disabilities (PwD) and communicate in a way that reflects PwD sensitivity.
- Always be supportive and kind towards a PwD with their daily chores.
- Be ready to assist a PwD to help them avail of any benefit/ livelihood opportunity/ training or any kind that helps them grow.
- Encourage and try to make things easier and accessible to PwD so that they can work without or with minimum help.
- Protest where feasible and report any wrong act/behaviour against any PwD to the appropriate authority.
- Learn and follow the laws, acts, and policies relevant to PwD.

Appropriate Verbal Communication

As part of appropriate verbal communication with all genders and PwD, one should:

- Talk to all genders and PwD respectfully, maintaining a normal tone of voice with appropriate politeness. It is important to ensure one's tone of voice does not have hints of sarcasm, anger, or unwelcome affection.
- Avoid being too self-conscious concerning the words to use while also ensuring not to use words that imply one's superiority over the other.
- Make no difference between a PwD and their caretaker. Treat PwD like adults and talk to them directly.
- Ask a PwD if they need any assistance instead of assuming they need it and offering assistance spontaneously.

Appropriate Non-verbal Communication

Non-verbal communication is essentially the way someone communicates through their body language. These include:

- **Facial expressions -** The human face is quite expressive, capable of conveying many emotions without using words. Facial expressions must usually be maintained neutral and should change according to the situation, e.g. smile as a gesture of greeting.
- **Body posture and movement -** One should be mindful of how to sit, stand, walk, or hold their head. For example - one should sit and walk straight in a composed manner. The way one moves and carries self, communicates a lot to others. This type of non-verbal communication includes one's posture, bearing, stance, and subtle movements.

- **Gestures -** One should be very careful with their gestures, e.g. waving, pointing, beckoning, or using one's hands while speaking. One should use appropriate and positive gestures to maintain respect for the other person while being aware that a gesture may have different meanings in different cultures.

- **Eye contact -** Eye contact is particularly significant in non-verbal communication. The way someone looks at someone else may communicate many things, such as interest, hostility, affection or attraction. Eye contact is vital for maintaining the flow of conversation and for understanding the other person's interest and response. One should maintain appropriate eye contact, ensuring not to stare or look over the shoulders. To maintain respect, one should sit or stand at the other person's eye level to make eye contact.
- **Touch -** Touch is a very sensitive type of non-verbal communication. Examples are - handshakes, hugs, pat on the back or head, gripping the arm, etc. A firm handshake indicates interest, while a weak handshake indicates the opposite. One should be extra cautious not to touch others inappropriately and avoid touching them inadvertently by maintaining a safe distance.

Rights of PwD

PwD have the right to respect and human dignity. Irrespective of the nature and seriousness of their disabilities, PwD have the same fundamental rights as others, such as:

- Disabled persons have the same civil and political rights as other people
- Disabled persons are entitled to the measures designed to enable them to become as self-dependent as possible
- Disabled persons have the right to economic and social security
- Disabled persons have the right to live with their families or foster parents and participate in all social and creative activities.
- Disabled persons are protected against all exploitation and treatment of discriminatory and abusive nature.

Making Workplace PwD Friendly

- One should not make PwD feel uncomfortable by giving too little or too much attention
- One should use a normal tone while communicating with a PwD and treat them as all others keeping in mind their limitations and type of disability
- Any help should be provided only when asked for by a PwD
- One should help in ensuring the health and well-being of PwD.

Expected Employer Behaviour

Some of the common behavioural traits that employees expect from their employers are:

- Cooperation: No work is successful without cooperation from the employer's side. Cooperation helps to understand the job role better and complete it within the given timeline.
- Polite language: Polite language is always welcomed at work. This is a basic aspect that everybody expects.
- Positive Attitude: Employers with a positive attitude can supervise the work of the employees and act as a helping hand to accomplish the given task. A person with a positive attitude looks at the best qualities in others and helps them gain success.
- Unbiased behaviour: Employers should always remain fair towards all their employees. One should not adopt practices to favour one employee while neglecting or ignoring the other. This might create animosity among co-workers.
- Decent behaviour: The employer should never improperly present oneself before the employee. One should always respect each other's presence and behave accordingly. The employer should not speak or act in a manner that may make the employee feel uneasy, insulted, and insecure.

Exercise

1. List down three examples of workplace ethics.
2. List down three examples of interpersonal skills.
3. Identify two reasons for workplace conflicts.
4. Identify two ways of resolving interpersonal conflicts
5. List down two ways of dealing with heightened emotions at work.
6. List down two types of non-verbal communication.

Notes

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ESSCI
Skilling India in Electronics

8. Basic Health and Safety Practices

Unit 8.1 - Workplace Hazards

Unit 8.2 - Fire Safety

Unit 8.3 - First Aid

Unit 8.4 - Waste Management

ELE/N1002

Key Learning Outcomes

By the end of this module, participa ts will be able to:

1. Discuss job-site hazards, risks and accidents
2. Explain the organizational safety procedures for maintaining electrical safety, handling tools and hazardous materials
3. Describe how to interpret warning signs while accessing sensitive work areas
4. Explain the importance of good housekeeping
5. Describe the importance of maintaining appropriate postures while lifting heavy objects
6. List the types of fire and fire extinguishers
7. Describe the concept of waste management and methods of disposing of hazardous waste
8. List the common sources of pollution and ways to minimize them
9. Elaborate on electronic waste disposal procedures
10. Explain how the administer appropriate first aid to victims in case of bleeding, burns, choking, electric shock, poisoning and also administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock

UNIT 8.1: Workplace Hazards

Unit Objectives

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

- Discuss job-site hazards, risks and accidents
- Explain the organizational safety procedures for maintaining electrical safety, handling tools and hazardous materials
- Describe how to interpret warning signs while accessing sensitive work areas
- Explain the importance of good housekeeping
- Describe the importance of maintaining appropriate postures while lifting heavy objects
- Explain safe handling of tools and Personal Protective Equipment to be used.

8.1.1 Workplace Safety

Workplace safety is important to be established for creating a safe and secure working for the workers. The workplace has to be administered as per the rules of the Occupational Safety and Health Administration (OSHA). It refers to monitoring the working environment and all hazardous factors that impact employees' safety, health, and well-being. It is important to provide a safe working environment to the employees to increase their productivity, wellness, skills, etc.

The benefits of workplace safety are:

- Employee retention increases if they are provided with a safe working environment.
- Failure to follow OSHA's laws and guidelines can result in significant legal and financial consequences.
- A safe environment enables employees to stay invested in their work and increases productivity.
- Employer branding and company reputation can both benefit from a safe working environment.

8.1.2 Workplace Hazards

A workplace is a situation that has the potential to cause harm or injury to the workers and damage the tools or property of the workplace. Hazards exist in every workplace and can come from a variety of sources. Finding and removing them is an important component of making a safe workplace.

Common Workplace Hazards

The common workplace hazards are:

·Biological: The threats caused by biological agents like viruses, bacteria, animals, plants, insects and also humans, are known as biological hazards.

- **Chemical:** Chemical hazard is the hazard of inhaling various chemicals, liquids and solvents. Skin irritation, respiratory system irritation, blindness, corrosion, and explosions are all possible health and physical consequences of these dangers.
- **Mechanical:** Mechanical Hazards comprise the injuries that can be caused by the moving parts of machinery, plant or equipment.
- **Psychological:** Psychological hazards are occupational hazards caused by stress, harassment, and violence.
- **Physical:** The threats that can cause physical damage to people is called physical hazard. These include unsafe conditions that can cause injury, illness and death.
- **Ergonomic:** Ergonomic Hazards are the hazards of the workplace caused due to awkward posture, forceful motion, stationary position, direct pressure, vibration, extreme temperature, noise, work stress, etc.

Workplace Hazards Analysis

A workplace hazard analysis is a method of identifying risks before they occur by focusing on occupational tasks. It focuses on the worker's relationship with the task, the tools, and the work environment. After identifying the hazards of the workplace, organisations shall try to eliminate or minimize them to an acceptable level of risk.

Control Measures of Workplace Hazards

Control measures are actions that can be taken to reduce the risk of being exposed to the hazard. Elimination, Substitution, Engineering Controls, Administrative Controls, and Personal Protective Equipment are the five general categories of control measures.

- **Elimination:** The most successful control technique is to eliminate a specific hazard or hazardous work procedure or prevent it from entering the workplace.

- **Substitution:** Substitution is the process of replacing something harmful with something less hazardous. While substituting the hazard may not eliminate all of the risks associated with the process or activity, it will reduce the overall harm or health impacts.

- **Engineering Controls:** Engineered controls protect workers by eliminating hazardous situations or creating a barrier between the worker and the hazard, or removing the hazard from the person.

- **Administrative Controls:** To reduce exposure to hazards, administrative controls limit the length of time spent working on a hazardous task that might be used in combination with other measures of control.

- **Personal Protective Equipment:** Personal protective equipment protects users from health and safety hazards at work. It includes items like safety helmets, gloves, eye protection, etc.

8.1.3 Risk for a Drone Technician

A drone technician may require to repair the propeller, motor and its mount, battery, mainboards, processor, booms, avionics, camera, sensors, chassis, wiring and landing gear. A technician may face some risks while repairing the drones' equipment.

- The technician is susceptible to being physically harmed by propellers.
- Direct contact with exposed electrical circuits can injure the person.
- If the skin gets in touch with the heat generated from electric arcs, it burns the internal tissues.
- Major electrical injuries can occur due to poorly installed electrical equipment, faulty wiring, overloaded or overheated outlets, use of extension cables, incorrect use of replacement fuses, use of equipment with wet hands, etc.

8.1.4 Workplace Warning Signs

A Hazard sign is defined as 'information or instruction about health and safety at work on a signboard, an illuminated sign or sound signal, a verbal communication or hand signal.'

There are four different types of safety signs:

- Prohibition / Danger Alarm Signs
- Mandatory Signs
- Warning Signs
- And Emergency

1. Prohibition Signs: A "prohibition sign" is a safety sign that prohibits behaviour that is likely to endanger one's health or safety. The colour red is necessary for these health and safety signs. Only what or who is forbidden should be displayed on a restriction sign.

Fig. 8.1.1. Prohibition arning Signs

2. Mandatory Signs:

Mandatory signs give clear directions that must be followed. The icons are white circles that have been reversed out of a blue circle. On a white background, the text is black.

Fig. 8.1.2. Mandatory Signs

3. Warning Signs

Warning signs are the safety informationcommunicaatiosigns. They are shown as a 'yellow colour triangle'.

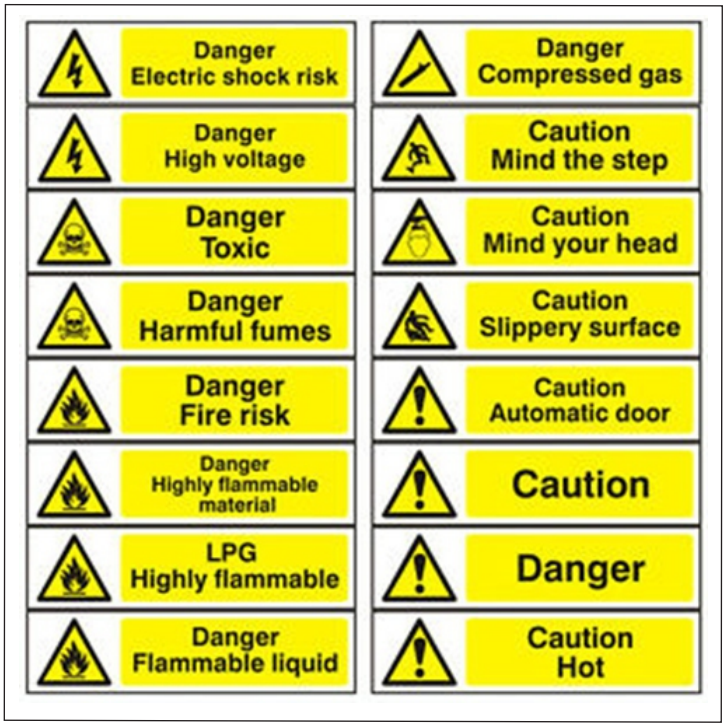


Fig. 8.1.3. Warning Signs

4. Emergency Signs

The locationor routes to emergency ffacilitieare indicated by emergency signs. These signs have a green backdrop with a white emblem or writing.These signs convey basic informaatioand frequently refer to housekeeping, company procedures, or logistics.

Fig. 8.1.4. Emergency Signs

8.1.5 Cleanliness in the Workplace

Workplace cleanliness maintenance creates a healthy, efficient and productive environment for the employees. Cleanliness at the workplace is hindered by some elements like cluttered desks, leftover food, waste paper, etc. A tidy workplace is said to improve employee professionalism and enthusiasm while also encouraging a healthy working environment.

Benefits of cleanliness in the workplace:

1. Productivity: Cleanliness in the workplace can bring a sense of belonging to the employees, also motivating and boosting the morale of the employees. This results in increasing their productivity.
2. Employee Well-being: Employee well-being can be improved by providing a clean work environment. Employees use fewer sick days in a workplace where litter and waste are properly disposed of, and surfaces are cleaned regularly, resulting in increased overall productivity.
3. Positive Impression: Cleanliness and orderliness in the workplace provide a positive impression on both employees and visitors.
4. Cost saving: By maintaining acceptable levels of cleanliness in the workplace, businesses can save money on cleaning bills and renovations, which may become necessary if the premises are not properly kept.

Reasons for Cleaning the Workplace

- Cleaning of dry floors, mostly to prevent workplace slips and falls.
- Disinfectants stop bacteria in their tracks, preventing the spread of infections and illness.
- Proper air filtration decreases hazardous substance exposures such as dust and fumes.
- Light fixture cleaning improves lighting efficiency.
- Using environmentally friendly cleaning chemicals that are safer for both personnel and the environment.
- Work environments are kept clean by properly disposing of garbage and recyclable items.

8.1.6 Lifting and Handling of Heavy Loads

Musculoskeletal Injuries (MSIs), such as sprains and strains, can occur while lifting, handling, or carrying objects at work. When bending, twisting, uncomfortable postures and lifting heavy objects are involved, the risk of injury increases. Ergonomic controls can help to lower the risk of injury and potentially prevent it.

Types of injuries caused while lifting heavy objects:

- Cuts and abrasions are caused by rough surfaces.
- Crushing of feet or hands.
- Strain to muscles and joints

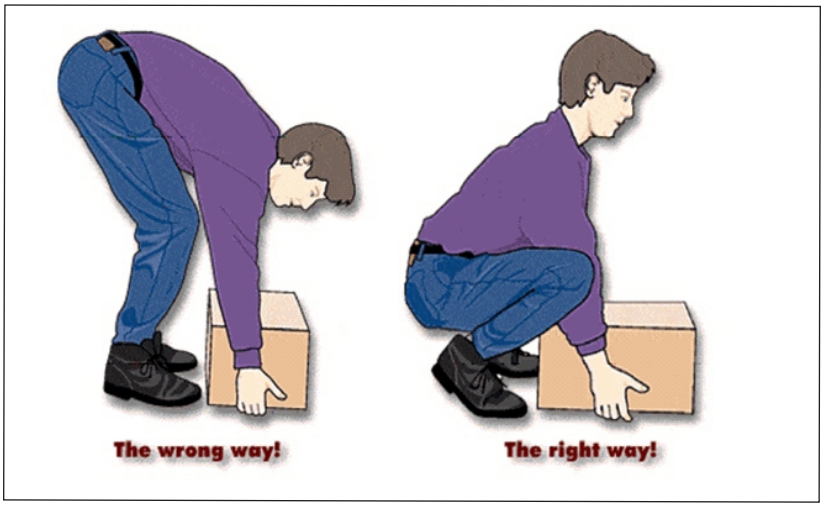


Fig. 8.1.5. Lifting loads echnique

Preparing to lift

A load that appears light enough to bear at first will grow increasingly heavier as one carries it further. The person carrying the weight should be able to see over or around it at all times.

The amount of weight a person can lift, depends on their age, physique, and health

It also depends on whether or not the person is used to lifting and moving hefty objects.

Common Causes of Back Injuries

The Most Common Causes of Back Injuries are:

1) **Inadequate Training:** The individual raising the load receives no sufficient training or guidance.
2) **Lack of awareness of technique:** The most common cause of back pain is incorrect twisting and posture, which causes back strain.
3) **Load size:** The load size to consider before lifting. If the burden is too much for one's capacity or handling, their back may be strained and damaged.
4) **Physical Strength:** Depending on their muscle power, various persons have varied physical strengths. One must be aware of their limitations.
5) **Teamwork:** The operation of a workplace is all about working together. When opposed to a single person lifting a load, two people can lift it more easily and without difficulty. If one of two people isn't lifting it properly, the other or both of them will suffer back injuries as a result of the extra strain.

Techniques for Lifting Heavy Objects

Technique	Demonstraton
1. Ensure one has a wide base of support before lifting the heavy object. Ensure one's feet are shoulder-width apart, and one foot is slightly ahead of the other at all times. This will help one maintain a good balance during the lifting of heavy objects. This is known as the Karate Stance.	
2. Squat down as near to the object as possible when one is ready to lift it, bending at the hips and knees with the buttocks out. If the object is really heavy, one may wish to place one leg on the floor and the other bent at a straight angle in front of them.	

3. Maintain proper posture as one begin to lift upward. To do so, one should keep their back straight, chest out, and shoulders back while gazing straight ahead.	
4. By straightening one's hips and knees, slowly elevate the thing (not the back). As one rises, they should extend their legs and exhale. Lift the heavy object without twisting the body or bending forward.	
5. Do not lift bending forward.	
6. Hold the load close to the body.	

7. Never lift heavy objects above the shoulder	
8. Use the feet (not the body) to change direction, taking slow, small steps.	
9. Set down the heavy object carefully, squatting with the knees and hips only.	

Table 8.1.1 Techniques for lifting he vy objects

[3]*Source:https://ww .braceability.ccom/blogs/articles/7-prop-heavavy-liftinechniques*

8.1.7 Safe Handling of Tools

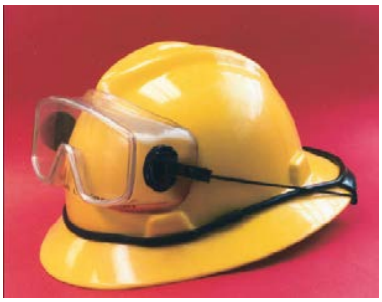
Workers should be trained on how to use tools safely. When tools are misplaced or handled incorrectly by workers, they can be dangerous. The following are some suggestions from the National Safety Council for safe tool handling when they are not in use:

- Never carry tools up or down a ladder in a way that makes it difficult to grip them. Instead of being carried by the worker, tools should be lifted up and down using a bucket or strong bag.
- Tools should never be tossed but should be properly passed from one employee to the next. Pointed tools should be passed with the handles facing the receiver or in their carrier.
- When turning and moving around the workplace, workers carrying large tools or equipment on their shoulders should pay particular attention to clearances.
- Pointed tools such as chisels and screwdrivers should never be kept in a worker's pocket. They can be carried in a toolbox, pointing down in a tool belt or pocket tool bag, or in hand with the tip always held away from the body.
- Tools should always be stored while not in use. People below are put in danger when tools are left sitting around on an elevated structure, such as a scaffold. In situations when there is a lot of vibration, this risk increases.

8.1.8 Personal Protective Equipment

Personal protective equipment, or "PPE," is equipment worn to reduce exposure to risks that might result in significant occupational injuries or illnesses. Chemical, radiological, physical, electrical, mechanical, and other job dangers may cause these injuries and diseases.

PPE used for protection fom the following injuries are:

Injury Protecton	Protecton	PPE
Head Injury Protecton	Falling or flying objects, stationary objects, or contact with electrical wires can cause impact, penetration, and electrical injuries. Hard hats can protect one's head from these injuries. A common electrician's hard hat is shown in the figure below. This hard hat is made of nonconductive plastic and comes with a set of safety goggles.	
Foot and Leg Injury Protecton	In addition to foot protection and safety shoes, leggings (e.g., leather) can guard against risks such as falling or rolling objects, sharp objects, wet and slippery surfaces, molten metals, hot surfaces, and electrical hazards.	 
Eye and Face Injury Protecton	Spectacles, goggles, special helmets or shields, and spectacles with side shields and face shields can protect against the hazards of flying fragments, large chips, hot sparks, radiation, and splashes from molten metals. They also offer protection from particles, sand, dirt, mists, dust, and glare.	

Protecton against Hearing Loss	Hearing protection can be obtained by wearing earplugs or earmuffs. High noise levels can result in permanent hearing loss or damage, as well as physical and mental stress. Self-forming earplugs composed of foam, waxed cotton, or fibreglass wool usually fit well. Workers should be fitted for moulded or prefabricated earplugs by a specialist.	
Hand Injury Protecton	Hand protection will aid workers who are exposed to dangerous substances by skin absorption, serious wounds, or thermal burns. Gloves are a frequent protective clothing item. When working on electrified circuits, electricians frequently use leather gloves with rubber inserts. When stripping cable with a sharp blade, Kevlar gloves are used to prevent cuts.	
Whole Body Protecton	Workers must protect their entire bodies from risks such as heat and radiation. Rubber, leather, synthetics, and plastic are among the materials used in whole-body PPE, in addition to fire-retardant wool and cotton. Maintenance staff who operate with high-power sources such as transformer installations and motor-control centres are frequently obliged to wear fire-resistant clothes.	

Table 8.1.2. Personal protective equipment

Notes

UNIT 8.2: Fire Safety

Unit Objectives

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

1. List the types of fire and fire e extinguiss.

8.2.1 Fire Safety

Fire safety is a set of actions aimed at reducing the amount of damage caused by fire. Fire safety procedures include both those that are used to prevent an uncontrolled fire from starting and those that are used to minimise the spread and impact of a fire after it has started. Developing and implementing fire safety measures in the workplace is not only mandated by law but is also essential for the protection of everyone who may be present in the building during a fire emergency.

The basic Fire Safety Responsibilities are:

- To identify risks on the premises, a fire risk assessment must be carried out.
- Ascertain that fire safety measures are properly installed.
- Prepare for unexpected events.
- Fire safety instructions and training should be provided to the employees.

8.2.2 Respond to a Workplace Fire

- Workplace fire drills should be conducted on a regular basis.
- If one has a manual alarm, they should raise it.
- Close the doors and leave the fire-stricken area as soon as possible. Ensure that the evacuation is quick and painless.
- Turn off dangerous machines and don't stop to get personal items.
- Assemble at a central location. Ascertain that the assembly point is easily accessible to the employees.
- If one's clothing catches fire, one shouldn't rush about it. They should stop and descend on the ground and roll to smother the flames if their clothes catch fire.

8.2.3 Fire Extinguisher

Fire extinguishers are portable devices used to put out small flames or minimise their damage until fire-fighters arrive. These are maintained on hand in locations such as fire stations, buildings, workplaces, public transit, and so on. The types and quantity of extinguishers that are legally necessary for a given region are determined by the applicable safety standards.

Types of fire extinguishers are:

There are five main types of fire extinguishers:

1. Water.
2. Powder.
3. Foam.
4. Carbon Dioxide (CO2).
5. Wet chemical.

1. **Water:** Water fire extinguishers are one of the most common commercial and residential fire extinguishers on the market. They're meant to be used on class-A flames.

2. **Powder:** The L2 powder fire extinguisher is the most commonly recommended fire extinguisher in the Class D Specialist Powder category, and is designed to put out burning lithium metal fires.

3. **Foam:** Foam extinguishers are identified by a cream rectangle with the word "foam" printed on it. They're mostly water-based, but they also contain a foaming component that provides a quick knock-down and blanketing effect on flames. It suffocates the flames and seals the vapours, preventing re-ignition.

4. **Carbon Dioxide (CO2):** Class B and electrical fires are extinguished with carbon dioxide extinguishers, which suffocate the flames by removing oxygen from the air. They are particularly beneficial for workplaces and workshops where electrical fires may occur since, unlike conventional extinguishers, they do not leave any toxins behind and hence minimise equipment damage.

5. **Wet Chemical:** Wet chemical extinguishers are designed to put out fires that are classified as class F. They are successful because they can put out extremely high-temperature fires, such as those caused by cooking oils and fats.

Notes

UNIT 8.3: First Aid

Unit Objectives

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

1. Explain how the administer appropriate first aid to victims in case of bleeding, burns, choking, electric shock, poisoning
2. Explain how to administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock.

8.3.1 First Aid

First aid is the treatment or care given to someone who has sustained an injury or disease until more advanced care can be obtained or the person recovers.

The aim of first aid is to:

- Preserve life
- Prevent the worsening of a sickness or injury
- If at all possible, relieve pain
- Encourage recovery
- Keep the unconscious safe.

First aid can help to lessen the severity of an injury or disease, and in some situations, it can even save a person's life.

8.3.2 Need for First Aid at the Workplace

- In the workplace, first aid refers to providing immediate care and life support to persons who have been injured or become unwell at work.
- Many times, first aid can help to lessen the severity of an accident or disease.
- It can also help an injured or sick person relax. In life-or-death situations, prompt and appropriate first aid can make all the difference.

8.3.2 Need for First Aid at the Workplace

In the workplace, first aid refers to providing immediate care and life support to persons who have been injured or become unwell at work.

Many times, first aid can help to lessen the severity of an accident or disease.

It can also help an injured or sick person relax. In life-or-death situations, prompt and appropriate first aid can make all the difference.

8.3.3 Treating Minor Cuts and Scapes

Steps to keep cuts clean and prevent infectionsand scars:

- **Wash Hands:** Wash hands first with soap and water to avoid introducing bacteria into the cut and causing an infection. One should use the hand sanitiser if one is on the go.
- **Stop the bleeding:** Using a gauze pad or a clean towel, apply pressure to the wound. For a few minutes, keep the pressure on.
- **Clean Wounds:** Once the bleeding has stopped, clean the wound by rinsing it under cool running water or using a saline wound wash. Use soap and a moist washcloth to clean the area around the wound. Soap should not be used on the cut since it may irritate the skin. Also, avoid using hydrogen peroxide or iodine, as these may aggravate the wound.
- **Remove Dirt:** Remove any dirt or debris from the area. Pick out any dirt, gravel, glass, or other material in the cut with a pair of tweezers cleaned with alcohol.

8.3.4 Heart Atack

When the blood flow carrying oxygen to the heart is blocked, a heart attack occurs. The heart muscle runs out of oxygen and starts to die.

Symptoms of a heart attack can vary from person to person. They may be mild or severe. Women, older adults, and people with diabetes are more likely to have subtle or unusual symptoms.

Symptoms in adults may include:

- Changes in mental status, especially in older adults.
- Chest pain that feels like pressure, squeezing, or fullness. The pain is most often in the centre of the chest. It may also be felt in the jaw, shoulder, arms, back, and stomach. It can last for more than a few minutes or come and go.
- Cold sweat.
- Light-headedness.
- Nausea (more common in women).
- Indigestion.

- Vomiting.
- Numbness, aching or tingling in the arm (usually the left arm, but the right arm may be affected alone, or along with the left).
- Shortness of breath
- Weakness or fatigue, especially in older adults and in women.

First Aid for Heart Attack

If one thinks someone is experiencing a heart attack, they should:

- Have the person sit down, rest, and try to keep calm.
- Loosen any tight clothing.
- Ask if the person takes any chest pain medicine, such as nitro-glycerine for a known heart condition, and help them take it.
- If the pain does not go away promptly with rest or within 3 minutes of taking nitro-glycerine, call for emergency medical help.
- If the person is unconscious and unresponsive, call 911 or the local emergency number, then begin CPR.
- If an infant or child is unconscious and unresponsive, perform 1 minute of CPR, then call 911 or the local emergency number.

Notes

UNIT 8.4: Waste Management

Unit Objectives

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

1. Describe the concept of waste management and methods of disposing of hazardous waste.
2. List the common sources of pollutionand ways to minimize them.
3. Elaborate on electronic waste disposal procedures.

8.4.1. Waste Management and Methods of Waste Disposal

The collection, disposal, monitoring, and processing of waste materials is known as waste management. These wastes affect living beings' health and the environment. For reducing their effects, they have to be managed properly. The waste is usually in solid, liquid or gaseous form.

The importance of waste management is:

Waste management is important because it decreases waste's impact on the environment, health, and other factors. It can also assist in the reuse or recycling of resources like paper, cans, and glass. The disposal of solid, liquid, gaseous, or dangerous substances is the example of waste management.

When it comes to trash management, there are numerous factors to consider, including waste disposal, recycling, waste avoidance and reduction, and garbage transportation. Treatment of solid and liquid wastes is part of the waste management process. It also provides a number of recycling options for goods that aren't classified as garbage during the process.

8.4.2 Methods of Waste Management

Non-biodegradable and toxic wastes, such as radioactive remains, can cause irreversible damage to the environment and human health if they are not properly disposed of. Waste disposal has long been a source of worry, with population increase and industrialisation being the primary causes. Here are a few garbage disposal options.

1. **Landfills:** The most common way of trash disposal today is to throw daily waste/garbage into landfills. This garbage disposal method relies on burying the material in the ground.
2. **Recycling:** Recycling is the process of transforming waste items into new products in order to reduce energy consumption and the use of fresh raw materials. Recycling reduces energy consumption, landfill volume, air and water pollution, greenhouse gas emissions, and the preservation of natural resources for future use.

3. **Composting:** Composting is a simple and natural bio-degradation process that converts organic wastes, such as plant remnants, garden garbage, and kitchen waste, into nutrient-rich food for plants.
4. **Incineration:** Incineration is the process of combusting garbage. The waste material is cooked to extremely high temperatures and turned into materials such as heat, gas, steam, and ash using this technology.

8.4.3 Recyclable, Non-Recyclable and Hazardous Waste

1. **Recyclable Waste:** The waste which can be reused or recycled further is known as recyclable waste.
2. **Non-recyclable Waste:** The waste which cannot be reused or recycled is known as non-recyclable waste. Polythene bags are a great example of non-recyclable waste.
3. **Hazardous Waste:** The waste which can create serious harm to the people and the environment is known as hazardous waste.

8.4.4 Sources of Pollution

Pollution is defined as the harm caused by the presence of a material or substances in places where they would not normally be found or at levels greater than normal. Polluting substances might be in the form of a solid, a liquid, or a gas.

- **Point source of pollution:** Pollution from a point source enters a water body at a precise location and can usually be identified. Effluent discharges from sewage treatment plants and industrial sites, power plants, landfill sites, fish farms, and oil leakage via a pipeline from industrial sites are all potential point sources of contamination.

  Point source pollution is often easy to prevent since it is feasible to identify where it originates, and once identified, individuals responsible for the pollution can take rapid corrective action or invest in longer-term treatment and control facilities.
- **Diffuse source of pollution:** As a result of land-use activities such as urban development, amenity, farming, and forestry, diffuse pollution occurs when pollutants are widely used and diffused over a large region. These activities could have occurred recently or in the past. It might be difficult to pinpoint specific sources of pollution and, as a result, take rapid action to prevent it because prevention often necessitates significant changes in land use and management methods.

Pollution Prevention

Pollution prevention entails acting at the source of pollutants to prevent or minimise their production. It saves natural resources, like water, by using materials and energy more efficiently.

Pollution prevention includes any practice that:

- Reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal;
- Reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants (these practices are known as "source reduction");
- Improved efficiency in the use of raw materials, energy, water, or other resources, or Conservation is a method of safeguarding natural resources.
- Improvements in housekeeping, maintenance, training, or inventory management; equipment or technology adjustments; process or method modifications; product reformulation or redesign; raw material substitution; or improvements in housekeeping, maintenance, training, or inventory control.

8.4.5 Electronic Waste

Lead, cadmium, beryllium, mercury, and brominated flame retardants are found in every piece of electronic waste. When gadgets and devices are disposed of illegally, these hazardous compounds are more likely to contaminate the earth, pollute the air, and leak into water bodies.

When e-waste is dumped in a landfill, it tends to leach trace metals as water runs through it. The contaminated landfill water then reaches natural groundwater with elevated toxic levels, which can be dangerous if it reaches any drinking water bodies. Despite having an environmentally benign approach, recycling generally results in international shipment and dumping of the gadgets in pits.

Some eco-friendly ways of disposing of e-waste are:

- Giving back the e-waste to the electronic companies and drop-off points
- Following guidelines issued by the government
- Selling or donating the outdated technology-based equipment
- Giving e-waste to a certified e-waste recycler

Exercise

1. Name all five types of fire extinguishers.
2. Explain PPE in brief.
3. List the common workplace hazards.
4. Fill in the blacks:
   i. A "_____ sign" is a safety sign that prohibits behaviour that is likely to endanger one's health or safety.
   ii. _____ entails acting at the source of pollutants to prevent or minimise their production.
   iii. _____ is the treatment or care given to someone who has sustained an injury or disease until more advanced care can be obtained or the person recovers.
   iv. The threats caused by biological agents like viruses, bacteria, animals, plants, insects and also humans, are known as _____.
   v. The workplace has to be administered as per the rules of the _____.

Notes

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National
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Corporation
Transforming the skill landscape

ESSCI

9. Employability & Entrepreneurship Skills

Unit 9.1 – Personal Strengths & Value Systems

Unit 9.2 – Digital Literacy: A Recap

Unit 9.3 – Money Matters

Unit 9.4 – Preparing for Employment & Self-Employment

Unit 9.5 – Understanding Entrepreneurship

Unit 9.6 – Preparing to be an Entrepreneur

Key Learning Outcomes

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

1. Explain the meaning of health
2. List common health issues
3. Discuss tips to prevent common health issues
4. Explain the meaning of hygiene
5. Discuss the purpose of Swacch Bharat Abhiyan
6. Explain the meaning of habit
7. Discuss ways to set up a safe work environment
8. Discuss critical safety habits to be followed by employees
9. Explain the importance of self-analysis
10. Discuss motivation with the help of Maslow's Hierarchy of Needs
11. Discuss the meaning of achievement motivation
12. List the characteristics of entrepreneurs with achievement motivation
13. List the different factors that motivate you
14. Discuss the role of attitude in self-analysis
15. Discuss how to maintain a positive attitude
16. List your strengths and weaknesses
17. Discuss the qualities of honest people
18. Describe the importance of honesty in entrepreneurs
19. Discuss the elements of a strong work ethic
20. Discuss how to foster a good work ethic
21. List the characteristics of highly creative people
22. List the characteristics of highly innovative people
23. Discuss the benefits of time management
24. List the traits of effective time managers
25. Describe effective time management technique
26. Discuss the importance of anger management
27. Describe anger management strategies
28. Discuss tips for anger management
29. Discuss the causes of stress
30. Discuss the symptoms of stress
31. Discuss tips for stress management
32. Identify the basic parts of a computer
33. Identify the basic parts of a keyboard
34. Recall basic computer terminology
35. Recall the functions of basic computer keys
36. Discuss the main applications of MS Office
37. Discuss the benefits of Microsoft Outlook
38. Discuss the different types of e-commerce
39. List the benefits of e-commerce for retailers and customers
40. Discuss how the Digital India campaign will help boost e-commerce in India

41. Describe how you will sell a product or service on an e-commerce platform
42. Discuss the importance of saving money
43. Discuss the benefits of saving money
44. Discuss the main types of bank accounts
45. Describe the process of opening a bank account
46. Differentiate between fixed and variable costs
47. Describe the main types of investment options
48. Describe the different types of insurance products
49. Describe the different types of taxes
50. Discuss the uses of online banking
51. Discuss the main types of electronic funds transfers
52. Discuss the steps to prepare for an interview
53. Discuss the steps to create an effective Resume
54. Discuss the most frequently asked interview questions
55. Discuss how to answer the most frequently asked interview questions
56. Discuss basic workplace terminology
57. Discuss the concept of entrepreneurship
58. Discuss the importance of entrepreneurship
59. Describe the characteristics of an entrepreneur
60. Describe the different types of enterprises
61. List the qualities of an effective leader
62. Discuss the benefits of effective leadership
63. List the traits of an effective team
64. Discuss the importance of listening effectively
65. Discuss how to listen effectively
66. Discuss the importance of speaking effectively
67. Discuss how to speak effectively
68. Discuss how to solve problems
69. List important problem-solving traits
70. Discuss ways to assess problem solving skills
71. Discuss the importance of negotiation
72. Discuss how to negotiate
73. Discuss how to identify new business opportunities
74. Discuss how to identify business opportunities within your business
75. Explain the meaning of entrepreneur
76. Describe the different types of entrepreneurs
77. List the characteristics of entrepreneurs
78. Recall entrepreneur success stories
79. Discuss the entrepreneurial process
80. Describe the entrepreneurship ecosystem
81. Discuss the purpose of the Make in India campaign
82. Discuss key schemes to promote entrepreneurs

83. Discuss the relationship between entrepreneurship and risk appetite
84. Discuss the relationship between entrepreneurship and resilience
85. Describe the characteristics of a resilient entrepreneur
86. Discuss how to deal with failure
87. Discuss how market research is carried out
88. Describe the 4 Ps of marketing
89. Discuss the importance of idea generation
90. Recall basic business terminology
91. Discuss the need for CRM
92. Discuss the benefits of CRM
93. Discuss the need for networking
94. Discuss the benefits of networking
95. Discuss the importance of setting goals
96. Differentiate between short-term, medium-term and long-term goals
97. Discuss how to write a business plan
98. Explain the financial planning process
99. Discuss ways to manage your risk
100. Describe the procedure and formalities for applying for bank finance
101. Discuss how to manage your own enterprise
102. List important questions that every entrepreneur should ask before starting an enterprise

UNIT 9.1: Personal Strengths & Value Systems

Unit Objectives

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

1. Explain the meaning of health
2. List common health issues
3. Discuss tips to prevent common health issues
4. Explain the meaning of hygiene
5. Discuss the purpose of Swacch Bharat Abhiyan
6. Explain the meaning of habit
7. Discuss ways to set up a safe work environment
8. Discuss critical safety habits to be followed by employees
9. Explain the importance of self-analysis
10. Discuss motivation with the help of Maslow's Hierarchy of Needs
11. Discuss the meaning of achievement motivation
12. List the characteristics of entrepreneurs with achievement motivation
13. List the different factors that motivate you
14. Discuss the role of attitude in self-analysis
15. Discuss how to maintain a positive attitude
16. List your strengths and weaknesses
17. Discuss the qualities of honest people
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23. Discuss the benefits of time management
24. List the traits of effective time managers
25. Describe effective time management technique
26. Discuss the importance of anger management
27. Describe anger management strategies
28. Discuss tips for anger management
29. Discuss the causes of stress
30. Discuss the symptoms of stress
31. Discuss tips for stress management

9.1.1 Health, Habits, Hygiene: What is Health?

As per the World Health Organization (WHO), health is a "State of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity." This means being healthy does not simply mean not being unhealthy – it also means you need to be at peace emotionally and feel fit physically. For example, you cannot say you are healthy simply because you do not have any physical ailments like a cold or cough. You also need to think about whether you are feeling calm, relaxed and happy.

Common Health Issues

Some common health issues are:

- Allergies
- Asthma
- Skin Disorders
- Depression and Anxiety
- Diabetes
- Cough, Cold, Sore Throat
- Difficulty Sleeping
- Obesity

9.1.1.1 Tips to Prevent Health Issues

Taking measures to prevent ill health is always better than curing a disease or sickness. You can stay healthy by:

- Eating healthy foods like fruits, vegetables and nuts
- Cutting back on unhealthy and sugary foods
- Drinking enough water everyday
- Not smoking or drinking alcohol
- Exercising for at least 30 minutes a day, 4-5 times a week
- Taking vaccinations when required
- Practicing yoga exercises and meditation

How many of these health standards do you follow? Tick the ones that apply to you.

1. Get minimum 7-8 hours of sleep every night. ☐
2. Avoid checking email first thing in the morning and right before you go to bed at night. ☐
3. Don't skip meals – eat regular meals at correct meal times. ☐
4. Read a little bit every single day. ☐
5. Eat more home cooked food than junk food. ☐
6. Stand more than you sit. ☐
7. Drink a glass of water first thing in the morning and have at least 8 glasses of water through the day. ☐
8. Go to the doctor and dentist for regular check-ups. ☐
9. Exercise for 30 minutes at least 5 days a week. ☐
10. Avoid consuming lots of aerated beverages. ☐

9.1.1.2 What is Hygiene?

As per the World Health Organization (WHO), "Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases." In other words, hygiene means ensuring that you do whatever is required to keep your surroundings clean, so that you reduce the chances of spreading germs and diseases.

For instance, think about the kitchen in your home. Good hygiene means ensuring that the kitchen is always spick and span, the food is put away, dishes are washed, and dustbins are not overflowing with garbage. Doing all this will reduce the chances of attracting pests like rats or cockroaches, and prevent the growth of fungus and other bacteria, which could spread disease.

How many of these health standards do you follow? Tick the ones that apply to you.

1. Have a bath or shower every day with soap – and wash your hair with shampoo 2-3 times a week. ☐
2. Wear a fresh pair of clean undergarments every day. ☐
3. Brush your teeth in the morning and before going to bed. ☐
4. Cut your fingernails and toenails regularly. ☐
5. Wash your hands with soap after going to the toilet. ☐
6. Use an anti-perspirant deodorant on your underarms if you sweat a lot. ☐
7. Wash your hands with soap before cooking or eating. ☐
8. Stay home when you are sick, so other people don't catch what you have. ☐
9. Wash dirty clothes with laundry soap before wearing them again. ☐
10. Cover your nose with a tissue/your hand when coughing or sneezing. ☐

See how healthy and hygienic you are, by giving yourself 1 point for every ticked statement! Then take a look at what your score means.

Your Score

- **0-7/20:** You need to work a lot harder to stay fit and fine! Make it a point to practice good habits daily and see how much better you feel!
- **7-14/20:** Not bad, but there is scope for improvement! Try and add a few more good habits to your daily routine.
- **14-20/20:** Great job! Keep up the good work! Your body and mind thank you!

9.1.1.3 Swachh Bharat Abhiyan

We have already discussed the importance of following good hygiene and health practices for ourselves. But, it is not enough for us to be healthy and hygienic. We must also extend this standard to our homes, our immediate surroundings and to our country as a whole.

The 'Swachh Bharat Abhiyan' (Clean India Mission) launched by Prime Minister Shri Narendra Modi on 2nd October 2014, believes in doing exactly this. The aim of this mission is to clean the streets and roads of India and raise the overall level of cleanliness. Currently this mission covers 4,041 cities and towns across the country. Millions of our people have taken the pledge for a clean India. You should take the pledge too, and do everything possible to keep our country clean!

9.1.1.4 What are Habits?

A habit is a behaviour that is repeated frequently. All of us have good habits and bad habits. Keep in mind the phrase by John Dryden: "We first make our habits, and then our habits make us." This is why it is so important that you make good habits a way of life, and consciously avoid practicing bad habits.

Some good habits that you should make part of your daily routine are:

- Always having a positive attitude
- Making exercise a part of your daily routine
- Reading motivational and inspirational stories
- Smiling! Make it a habit to smile as often as possible
- Making time for family and friends
- Going to bed early and waking up early

Some bad habits that you should quit immediately are:

- Skipping breakfast
- Snacking frequently even when you are not hungry
- Eating too much fattening and sugary food
- Smoking, drinking alcohol and doing drugs
- Spending more money than you can afford
- Worrying about unimportant issues
- Staying up late and waking up late

Tips

- Following healthy and hygienic practices every day will make you feel good mentally and physically.
- Hygiene is two-thirds of health – so good hygiene will help you stay strong and healthy!

9.1.2: Safety: Tips to Design a Safe Workplace

Every employer is obligated to ensure that his workplace follows the highest possible safety protocol. When setting up a business, owners must make it a point to:

- Use ergonomically designed furniture and equipment to avoid stooping and twisting
- Provide mechanical aids to avoid lifting or carrying heavy objects
- Have protective equipment on hand for hazardous jobs
- Designate emergency exits and ensure they are easily accessible
- Set down health codes and ensure they are implemented
- Follow the practice of regular safety inspections in and around the workplace
- Ensure regular building inspections are conducted
- Get expert advice on workplace safety and follow it

9.1.2.1 Negotiable Employee Safety Habits

Every employer is obligated to ensure that his workplace follows the highest possible safety protocol. When setting up a business, owners must make it a point to:

- Immediately report unsafe conditions to a supervisor
- Recognize and report safety hazards that could lead to slips, trips and falls
- Report all injuries and accidents to a supervisor
- Wear the correct protective equipment when required
- Learn how to correctly use equipment provided for safety purposes
- Be aware of and avoid actions that could endanger other people
- Take rest breaks during the day and some time off from work during the week

Tips 

- Be aware of what emergency number to call at the time of a workplace emergency
- Practice evacuation drills regularly to avoid chaotic evacuations

9.1.3 Self-Analysis – Attitude, Achievement Motivation

To truly achieve your full potential, you need to take a deep look inside yourself and find out what kind of person you really are. This attempt to understand your personality is known as self-analysis. Assessing yourself in this manner will help you grow, and will also help you to identify areas within yourself that need to be further developed, changed or eliminated. You can better understand yourself by taking a deep look at what motivates you, what your attitude is like, and what your strengths and weaknesses are.

9.1.3.1 What is Motivation?

Very simply put, motivation is your reason for acting or behaving in a certain manner. It is important to understand that not everyone is motivated by the same desires – people are motivated by many, many different things. We can understand this better by looking at Maslow's Hierarchy of Needs.

9.1.3.2 Maslow's Hierarchy of Needs

Famous American psychologist Abraham Maslow wanted to understand what motivates people. He believed that people have five types of needs, ranging from very basic needs (called physiological needs) to more important needs that are required for self-growth (called
self-actualization needs). Between the physiological and self-actualization needs are three other needs – safety needs, belongingness and love needs, and esteem needs.

These needs are usually shown as a pyramid with five levels and are known as Maslow's Hierarchy of Needs.

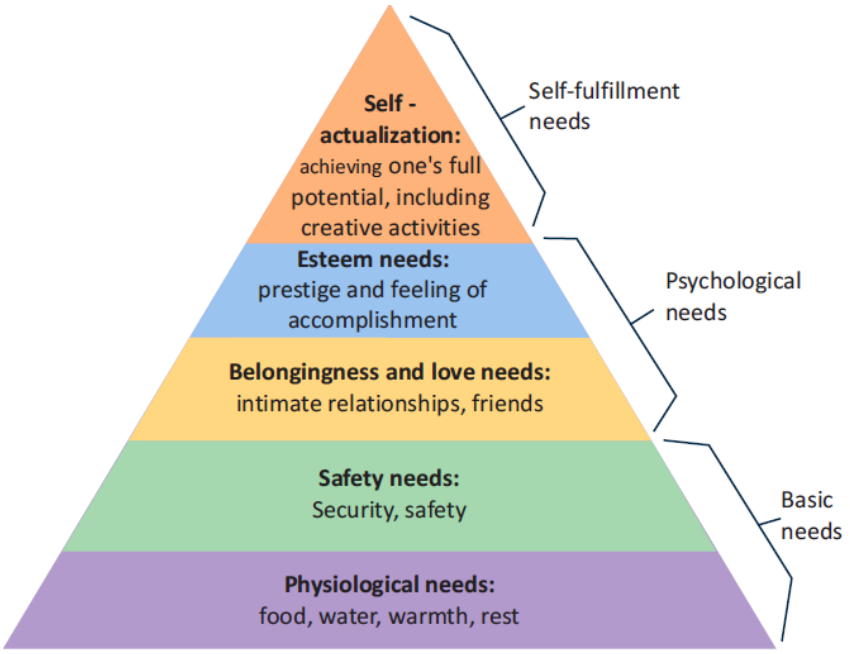

Fig. 9.1.1: Maslow's Hierarchy of Needs

The lowest level depicts the most basic needs. According to Maslow, our behaviour is driven by our basic needs, until those needs are fulfilled. Once they are fulfilled, we move to the next level and are motived by the next level of needs. Let's understand this better with an example.

Rupa comes from a very poor family. She never has enough food, water, warmth or rest. According to Maslow, until Rupa is sure that she will get these basic needs, she will not even think about the next level of needs – her safety needs. But, once Rupa is confident that her basic needs will be met, she will move to the next level, and her behaviour will then be motivated by her need for security and safety. Once these new needs are met, Rupa will once again move to the next level, and be motivated by her need for relationships and friends. Once this need is satisfied, Rupa will then focus on the fourth level of needs – her esteem needs, after which she will move up to the fifth and last level of needs – the desire to achieve her full potential.

9.1.3.3 Understanding Achievement Motivation

We now know that people are motivated by basic, psychological and self-fulfillment needs. However, certain people are also motivated by the achievement of highly challenging accomplishments. This is known as Achievement Motivation, or 'need for achievement'.

The level of motivation achievement in a person differs from individual to individual. It is important that entrepreneurs have a high level of achievement motivation – a deep desire to accomplish something important and unique. It is equally important that they hire people who are also highly motivated by challenges and success.

What Motivates You?

What are the things that really motivate you? List down five things that really motivate you. Remember to answer honestly!

I am motivated by:

Characteristics of Entrepreneurs with Achievement Motivation

Entrepreneurs with achievement motivation can be described as follows:

- Unafraid to take risks for personal accomplishment
- Love being challenged Future-oriented Flexible and adaptive
- Value negative feedback more than positive feedback
- Very persistent when it comes to achieving goals
- Extremely courageous
- Highly creative and innovative
- Restless - constantly looking to achieve more
- Feel personally responsible for solving problems

Think about it:

- How many of these traits do you have?
- Can you think of entrepreneurs who display these traits?

9.1.3.4 How to Cultivate a Positive Attitude?

The good news is attitude is a choice. So, it is possible to improve, control and change our attitude, if we decide we want to!

The following tips help foster a positive mindset:

- Remember that you control your attitude, not the other way around
- Devote at least 15 minutes a day towards reading, watching or listening to something positive
- Avoid negative people who only complain and stop complaining yourself
- Expand your vocabulary with positive words and delete negative phrases from your mind
- Be appreciative and focus on what's good in yourself, in your life, and in others
- Stop thinking of yourself as a victim and start being proactive
- Imagine yourself succeeding and achieving your goals

9.1.3.5 What is Attitude?

Now that we understand why motivation is so important for self-analysis, let's look at the role our attitude plays in better understanding ourselves. Attitude can be described as your tendency (positive or negative), to think and feel about someone or something. Attitude is the foundation for success in every aspect of life. Our attitude can be our best friend or our worst enemy. In other words:

"The only disability in life is a bad attitude."

When you start a business, you are sure to encounter a wide variety of emotions, from difficult times and failures to good times and successes. Your attitude is what will see you through the tough times and guide you towards success. Attitude is also infectious. It affects everyone around you, from your customers to your employees to your investors. A positive attitude helps build confidence in the workplace while a negative attitude is likely to result in the demotivation of your people.

9.1.3.6 What Are Your Strengths and Weaknesses?

Another way to analyse yourself is by honestly identifying your strengths and weaknesses. This will help you use your strengths to your best advantage and reduce your weaknesses. Note down all your strengths and weaknesses in the two columns below. Remember to be honest with yourself!

Strengths	Weaknesses

Tips

- Achievement motivation can be learned.
- Don't be afraid to make mistakes.
- Train yourself to finish what you start.
- Dream big.

9.1.4 Honesty & Work Ethics: What is Honesty?

Honesty is the quality of being fair and truthful. It means speaking and acting in a manner that inspires trust. A person who is described as honest is seen as truthful and sincere, and as someone who isn't deceitful or devious and doesn't steal or cheat. There are two dimensions of honesty – one is honesty in communication and the other is honesty in conduct.

Honesty is an extremely important trait because it results in peace of mind and builds relationships that are based on trust. Being dishonest, on the other hand, results in anxiety and leads to relationships full of distrust and conflict.

9.1.4.1 Qualities of Honest People

Honest individuals have certain distinct characteristics. Some common qualities among honest people are:

- They don't worry about what others think of them. They believe in being themselves – they don't bother about whether they are liked or disliked for their personalities.
- They stand up for their beliefs. They won't think twice about giving their honest opinion, even if they are aware that their point of view lies with the minority.
- They are think skinned. This means they are not affected by others judging them harshly for their honest opinions.
- They forge trusting, meaningful and healthy friendships. Honest people usually surround themselves with honest friends. They have faith that their friends will be truthful and upfront with them at all times.

They are trusted by their peers. They are seen as people who can be counted on for truthful and objective feedback and advice.

- **Honesty and employees:** When entrepreneurs build honest relationships with their employees, it leads to more transparency in the workplace, which results in higher work performance and better results.
- **Honesty and investors:** For entrepreneurs, being honest with investors means not only sharing strengths but also candidly disclosing current and potential weaknesses, problem areas and solution strategies. Keep in mind that investors have a lot of experience with startups and are aware that all new companies have problems. Claiming that everything is perfectly fine and running smoothly is a red flag for most investors.

- **Honesty with oneself:** The consequences of being dishonest with oneself can lead to dire results, especially in the case of entrepreneurs. For entrepreneurs to succeed, it is critical that they remain realistic about their situation at all times, and accurately judge every aspect of their enterprise for what it truly is.

9.1.4.2 Importance of Honesty in Entrepreneurs

One of the most important characteristics of entrepreneurs is honesty. When entrepreneurs are honest with their customers, employees and investors, it shows that they respect those that they work with. It is also important that entrepreneurs remain honest with themselves.

Let's look at how being honest would lead to great benefits for entrepreneurs.

- **Honesty and customers:** When entrepreneurs are honest with their customers it leads to stronger relationships, which in turn results in business growth and a stronger customer network.

9.1.4.3 What are Work Ethics?

Being ethical in the workplace means displaying values like honesty, integrity and respect in all your decisions and communications. It means not displaying negative qualities like lying, cheating and stealing.

Workplace ethics play a big role in the profitability of a company. It is as crucial to an enterprise as high morale and teamwork. This is why most companies lay down specific workplace ethic guidelines that must compulsorily be followed by their employees. These guidelines are typically outlined in a company's employee handbook.

9.1.4.4 Elements of a Strong Work Ethic

An entrepreneur must display strong work ethics, as well as hire only those individuals who believe in and display the same level of ethical behavior in the workplace. Some elements of a strong work ethic are:

- **Professionalism:** This involves everything from how you present yourself in a corporate setting to the manner in which you treat others in the workplace.
- **Respectfulness:** This means remaining poised and diplomatic regardless of how stressful or volatile a situation is.
- **Dependability:** This means always keeping your word, whether it's arriving on time for a meeting or delivering work on time.
- **Dedication:** This means refusing to quit until the designated work is done, and completing the work at the highest possible level of excellence.
- **Determination:** This means embracing obstacles as challenges rather than letting them stop you, and pushing ahead with purpose and resilience to get the desired results.

- **Accountability:** This means taking responsibility for your actions and the consequences of your actions, and not making excuses for your mistakes.
- **Humility:** This means acknowledging everyone's efforts and had work, and sharing the credit for accomplishments.

9.1.4.5 How to Foster a Good Work Ethic?

As an entrepreneur, it is important that you clearly define the kind of behaviour that you expect from each and every team member in the workplace. You should make it clear that you expect employees to display positive work ethics like:

- **Honesty:** All work assigned to a person should be done with complete honesty, without any deceit or lies.
- **Good attitude:** All team members should be optimistic, energetic, and positive.
- **Reliability:** Employees should show up where they are supposed to be, when they are supposed to be there.
- **Good work habits:** Employees should always be well groomed, never use inappropriate language, conduct themselves professionally at all times and so on.
- **Initiative:** Doing the bare minimum is not enough. Every team member needs to be proactive and show initiative.
- **Trustworthiness:** Trust is non-negotiable. If an employee cannot be trusted, it's time to let that employee go.
- **Respect:** Employees need to respect the company, the law, their work, their colleagues and themselves.
- **Integrity:** Each and every team member should be completely ethical and must display above board behaviour at all times.
- **Efficiency:** Efficient employees help a company grow while inefficient employees result in a waste of time and resources.

Tips

- Don't get angry when someone tells you the truth and you don't like what you hear.
- Always be willing to accept responsibility for your mistakes.

9.1.5 Creativity & Innovation

What is Creativity?

Creativity means thinking outside the box. It means viewing things in new ways or from different perspectives, and then converting these ideas into reality. Creativity involves two parts: thinking and producing. Simply having an idea makes you imaginative, not creative. However, having an idea and acting on it makes you creative.

Characteristics of Highly Creative People

Some characteristics of creative people are:

- They are imaginative and playful
- They see issues from different angles
- They notice small details
- They have very little tolerance for boredom
- They detest rules and routine
- They love to daydream
- They are very curious

What is Innovation?

There are many different definitions of innovation. In simple terms, innovation means turning an idea into a solution that adds value. It can also mean adding value by implementing a new product, service or process, or significantly improving on an existing product, service or process.

Characteristics of Highly Innovative People

Some characteristics of highly innovative people are:

- They embrace doing things differently
- They don't believe in taking shortcuts
- They are not afraid to be unconventional
- They are highly proactive and persistent
- They are organized, cautious and risk-averse

Tips

- Take regular breaks from your creative work to recharge yourself and gain fresh perspective.
- Build prototypes frequently, test them out, get feedback, and make the required changes.

9.1.6 Time Management

Time management is the process organizing your time, and deciding how to allocate your time between different activities. Good time management is the difference between working smart (getting more done in less time) and working hard (working for more time to get more done).

Effective time management leads to an efficient work output, even when you are faced with tight deadlines and high pressure situations. On the other hand, not managing your time effectively results in inefficient output and increases stress and anxiety.

Benefits of Time Management

Time management can lead to huge benefits like:

- Greater productivity
- Higher efficiency
- Better professional reputation
- Reduced stress
- Higher chances for career advancement
- Greater opportunities to achieve goals

Not managing time effectively can result in undesirable consequences like:

- Missing deadlines
- Inefficient work output
- Substandard work quality
- Poor professional reputation
- Stalled career
- Increase in stress and anxiety

9.1.6.1 Traits of Effective Time Managers

Some traits of effective time managers are:

- They begin projects early
- They set daily objectives
- They modify plans if required, to achieve better results
- They are flexible and open-minded
- They inform people in advance if their help will be required
- They know how to say no
- They break tasks into steps with specific deadlines
- They continually review long term goals
- They think of alternate solutions if and when required
- They ask for help when required
- They create backup plans

9.1.6.2 Effective Time Management Techniques

You can manage your time better by putting into practice certain time management techniques. Some helpful tips are:

- **Plan out your day as well as plan for interruptions.** Give yourself at least 30 minutes to figure out your time plan. In your plan, schedule some time for interruptions.
- **Put up a "Do Not Disturb" sign** when you absolutely have to complete a certain amount of work.
- **Close your mind to all distractions.** Train yourself to ignore ringing phones, don't reply to chat messages and disconnect from social media sites.
- **Delegate your work.** This will not only help your work get done faster, but will also show you the unique skills and abilities of those around you.
- **Stop procrastinating.** Remind yourself that procrastination typically arises due to the fear of failure or the belief that you cannot do things as perfectly as you wish to do them.
- **Prioritize.** List each task to be completed in order of its urgency or importance level. Then focus on completing each task, one by one.
- **Maintain a log of your work activities.** Analyse the log to help you understand how efficient you are, and how much time is wasted every day.
- **Create time management goals** to reduce time wastage.

Tips

- Always complete the most important tasks first.
- Get at least 7 – 8 hours of sleep every day.
- Start your day early.
- Don't waste too much time on small, unimportant details.
- Set a time limit for every task that you will undertake.
- Give yourself some time to unwind between tasks.

9.1.7 Anger Management

Anger management is the process of:

1. Learning to recognize the signs that you, or someone else, is becoming angry
2. Taking the best course of action to calm down the situation in a positive way

Anger management does not mean suppressing anger.

Importance of Anger Management

Anger is a perfectly normal human emotion. In fact, when managed the right way, anger can be considered a healthy emotion. However, if it is not kept in check, anger can make us act inappropriately and can lead to us saying or doing things that we will likely later regret.

Extreme anger can:

- **Hurt you physically**: It leads to heart disease, diabetes, a weakened immune system, insomnia, and high blood pressure.
- **Hurt you mentally**: It can cloud your thinking and lead to stress, depression and mental health issues.
- **Hurt your career**: It can result in alienating your colleagues, bosses, clients and lead to the loss of respect.
- **Hurt your relationships**: It makes it hard for your family and friends to trust you, be honest with you and feel comfortable around you.

This is why anger management, or managing anger appropriately, is so important.

9.1.7.1 Anger Management Strategies

Here are some strategies that can help you control your anger:

Strategy 1: Relaxation

Something as simple as breathing deeply and looking at relaxing images works wonders in calming down angry feelings. Try this simple breathing exercise:

1. Take a deep breath from your diaphragm (don't breathe from your chest)
2. Visualize your breath coming up from your stomach
3. Keep repeating a calming word like 'relax' or 'take it easy' (remember to keep breathing deeply while repeating the word)
4. Picture a relaxing moment (this can be from your memory or your imagination)

Follow this relaxation technique daily, especially when you realize that you're starting to feel angry.

Strategy 2: Cognitive Restructuring

Cognitive restructuring means changing the manner in which you think. Anger can make you curse, swear, exaggerate and act very dramatically. When this happens, force yourself to replace your angry thoughts with more logical ones. For instance, instead of thinking 'Everything is ruined' change your mindset and tell yourself 'It's not the end of the world and getting angry won't solve this'.

Strategy 3: Problem Solving

Getting angry about a problem that you cannot control is a perfectly natural response. Sometimes, try as you may, there may not be a solution to the difficulty you are faced with. In such cases, stop focusing on solving the problem, and instead focus on handling and facing the problem. Remind yourself that you will do your best to deal with the situation, but that you will not blame yourself if you don't get the solution you desire.

Strategy 4: Better Communication

When you're angry, it is very easy to jump to inaccurate conclusions. In this case, you need to force yourself to stop reacting, and think carefully about what you want to say, before saying it. Avoid saying the first thing that enters your head. Force yourself to listen carefully to what the other person is saying. Then think about the conversation before responding.

Strategy 5: Changing Your Environment

If you find that your environment is the cause of your anger, try and give yourself a break from your surroundings. Make an active decision to schedule some personal time for yourself, especially on days that are very hectic and stressful. Having even a brief amount of quiet or alone time is sure to help calm you down.

9.1.7.2 Tips for Anger Management

The following tips will help you keep your anger in check:

- Take some time to collect your thoughts before you speak out in anger.
- Express the reason for your anger in an assertive, but non-confrontational manner once you have calmed down.
- Do some form of physical exercise like running or walking briskly when you feel yourself getting angry.
- Make short breaks part of your daily routine, especially during days that are stressful.
- Focus on how to solve a problem that's making you angry, rather than focusing on the fact that the problem is making you angry.

9.1.8 Stress Management

We say we are 'stressed' when we feel overloaded and unsure of our ability to deal with the pressures placed on us. Anything that challenges or threatens our well-being can be defined as a stress. It is important to note that stress can be good and bad. While good stress keeps us going, negative stress undermines our mental and physical health. This is why it is so important to manage negative stress effectively.

Causes of Stress

Stress can be caused by internal and external factors.

Internal causes of stress

- Constant worry
- Rigid thinking
- Unrealistic expectations
- Pessimism
- Negative self-talk
- All in or all out attitude

External causes of stress

- Major life changes
- Difficulties with relationships
- Having too much to do
- Difficulties at work or in school
- Financial difficulties
- Worrying about one's children and/or family

9.1.8.1 Symptoms of Stress

Stress can manifest itself in numerous ways. Take a look at the cognitive, emotional, physical and behavioural symptoms of stress.

Cognitive Symptoms	Emotional Symptoms
• Memory problems • Concentration issues • Lack of judgement • Pessimism • Anxiety • Constant worrying	• Depression • Agitation • Irritability • Loneliness • Anxiety • Anger

Physical Symptoms	Behavioural Symptoms
• Aches and pain • Diarrhoea or constipation • Nausea • Dizziness • Chest pain and/or rapid heartbeat • Frequent cold or flu like feelings	• Increase or decrease in appetite • Over sleeping or not sleeping enough • Withdrawing socially • Ignoring responsibilities • Consumption of alcohol or cigarettes • Nervous habits like nail biting and pacing

9.1.8.2 Tips to Manage Stress

The following tips can help you manage your stress better:

- Note down the different ways in which you can handle the various sources of your stress.
- Remember that you cannot control everything, but you can control how you respond.
- Discuss your feelings, opinions and beliefs rather than reacting angrily, defensively or passively.
- Practice relaxation techniques like meditation, yoga or tai chi when you start feeling stressed.
- Devote a part of your day towards exercise.
- Eat healthy foods like fruits and vegetables. Avoid unhealthy foods especially those containing large amounts of sugar.
- Plan your day so that you can manage your time better, with less stress.
- Say no to people and things when required.
- Schedule time to pursue your hobbies and interests.
- Ensure you get at least 7-8 hours of sleep.
- Reduce your caffeine intake.
- Increase the time spent with family and friends.

UNIT 9.2: Digital Literacy: A Recap

Unit Objectives

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

1. Identify the basic parts of a computer
2. Identify the basic parts of a keyboard
3. Recall basic computer terminology
4. Recall the functions of basic computer keys
5. Discuss the main applications of MS Office
6. Discuss the benefits of Microsoft Outlook
7. Discuss the different types of e-commerce
8. List the benefits of e-commerce for retailers and customers
9. Discuss how the Digital India campaign will help boost e-commerce in India
10. Describe how you will sell a product or service on an e-commerce platform

9.2.1 Computer and Internet basics

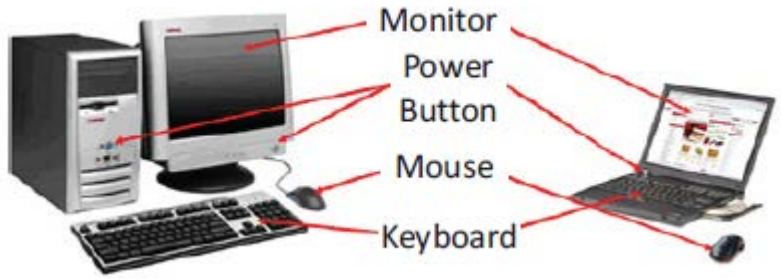

Fig.9.2.1. Parts of a Computer

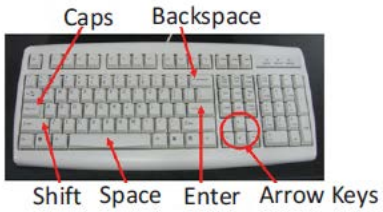

Fig.9.2.2. Parts of a Keyboard

Basic Parts of a Computer

1. **Central Processing Unit (CPU):** The brain of the computer. It interprets and carries out program instructions.
2. **Hard Drive:** A device that stores large amounts of data.
3. **Monitor:** The device that contains the computer screen where the information is visually displayed.

4. **Desktop:** The first screen displayed after the operating system loads.
5. **Background:** The image that fills the background of the desktop.
6. **Mouse:** A hand-held device used to point to items on the monitor.
7. **Speakers:** Devices that enable you to hear sound from the computer.
8. **Printer:** A device that converts output from a computer into printed paper documents.
9. **Icon:** A small picture or image that visually represents something on your computer.
10. **Cursor:** An arrow which indicates where you are positioned on the screen.
11. **Program Menu:** A list of programs on your computer that can be accessed from the Start menu.
12. **Taskbar:** The horizontal bar at the bottom of the computer screen that lists applications that are currently in use.
13. **Recycle Bin:** A temporary storage for deleted files.

Basic Internet Terms

- **The Internet:** A vast, international collection of computer networks that transfers information.
- **The World Wide Web:** A system that lets you access information on the Internet.
- **Website:** A location on the World Wide Web (and Internet) that contains information about a specific topic.
- **Homepage:** Provides information about a website and directs you to other pages on that website.
- **Link/Hyperlink:** A highlighted or underlined icon, graphic, or text that takes you to another file or object.
- **Web Address/URL:** The address for a website.
- **Address Box:** A box in the browser window where you can type in a web address.

Basic Computer Keys

- **Arrow Keys:** Press these keys to move your cursor.
- **Space bar:** Adds a space.
- **Enter/Return:** Moves your cursor to a new line.
- **Shift:** Press this key if you want to type a capital letter or the upper symbol of a key.
- **Caps Lock:** Press this key if you want all the letters you type to be capital letters. Press it again to revert back to typing lowercase letters.
- **Backspace:** Deletes everything to the left of your cursor

Tips

- When visiting a .com address, there no need to type http://or even www. Just type the name of the website and then press Ctrl + Enter. (Example: Type 'apple' and press Ctrl + Enter to go to www.apple.com)
- Press the Ctrl key and press the + or - to increase and decrease the size of text.
- Press F5 or Ctrl + R to refresh or reload a web page.

9.2.2 MS Office and Email

About MS Office

MS Office or Microsoft Office is a suite of computer programs developed by Microsoft. Although meant for all users, it offers different versions that cater specifically to students, home users and business users. All the programs are compatible with both, Windows and Macintosh.

Most Popular Office Products

Some of the most popular and universally used MS Office applications are:

- **Microsoft Word**: Allows users to type text and add images to a document.
- **Microsoft Excel**: Allows users to enter data into a spreadsheet and create calculations and graphs.
- **Microsoft PowerPoint**: Allows users to add text, pictures and media and create slideshows and presentations.
- **Microsoft Outlook**: Allows users to send and receive email.
- **Microsoft OneNote**: Allows users to make drawings and notes with the feel of a pen on paper.
- **Microsoft Access**: Allows users to store data over many tables.

Why Choose Microsoft Outlook?

A popular email management choice especially in the workplace, Microsoft Outlook also includes an address book, notebook, web browser and calendar. Some major benefits of this program are:

- **Integrated search function**: You can use keywords to search for data across all Outlook programs.
- **Enhanced security**: Your email is safe from hackers, junk mail and phishing website email.
- **Email syncing**: Sync your mail with your calendar, contact list, notes in One Note and…your phone!
- **Offline access to email:** No Internet? No problem! Write emails offline and send them when you're connected again.

Tips

- Press Ctrl+R as a shortcut method to reply to email.
- Set your desktop notifications only for very important emails.
- Flag messages quickly by selecting messages and hitting the Insert key.
- Save frequently sent emails as a template to reuse again and again.
- Conveniently save important emails as files.

9.2.3 E-Commerce

What is E-Commerce?

E-commerce is the buying or selling of goods and services, or the transmitting of money or data, electronically on the internet. E-Commerce is the short form for "electronic commerce."

Examples of E-Commerce

Some examples of e-commerce are:

- Online shopping
- Online auctions
- Online ticketing
- Electronic payments
- Internet banking

Types of E-Commerce

E-commerce can be classified based on the types of participants in the transaction. The main types of e-commerce are:

- **Business to Business (B2B)**: Both the transacting parties are businesses.
- **Business to Consumer (B2C)**: Businesses sell electronically to end-consumers.
- **Consumer to Consumer (C2C):** Consumers come together to buy, sell or trade items to other consumers.
- **Consumer-to-Business (C2B)**: Consumers make products or services available for purchase to companies looking for exactly those services or products.
- **Business-to-Administration (B2A)**: Online transactions conducted between companies and public administration.
- **Consumer-to-Administration (C2A)**: Online transactions conducted between individual and public administration.

9.2.3.1 Benefits of E-Commerce

The e-commerce business provides some benefits for retailers and customers.

Benefits for retailers

- Establishes an online presence
- Reduces operational costs by removing overhead costs
- Increases brand awareness through the use of good keywords
- Increases sales by removing geographical and time constraints

Benefits for customers

- Offers a wider range of choice than any physical store
- Enables goods and services to be purchased from remote locations
- Enables consumers to perform price comparisons

9.2.3.2 Digital India Campaign

Prime Minister Narendra Modi launched the Digital India campaign in 2015, with the objective of offering every citizen of India access to digital services, knowledge and information. The campaign aims to improve the country's online infrastructure and increase internet connectivity, thus boosting the e-commerce industry.

Currently, the majority of online transactions come from tier 2 and tier 3 cities. Once the Digital India campaign is in place, the government will deliver services through mobile connectivity, which will help deliver internet to remote corners of the country. This will help the e-commerce market to enter India's tier 4 towns and rural areas.

E-Commerce Activity

Choose a product or service that you want to sell online. Write a brief note explaining how you will use existing e-commerce platforms, or create a new e-commerce platform, to sell your product or service.

Tips

- Before launching your e-commerce platform, test everything.
- Pay close and personal attention to your social media.

UNIT 9.3: Money Matters

Unit Objectives

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

1. Discuss the importance of saving money
2. Discuss the benefits of saving money
3. Discuss the main types of bank accounts
4. Describe the process of opening a bank account
5. Differentiate between fixed and variable costs
6. Describe the main types of investment options
7. Describe the different types of insurance products
8. Describe the different types of taxes
9. Discuss the uses of online banking
10. Discuss the main types of electronic funds transfers

9.3.1 Personal Finance – Why to Save?

Importance of Saving

We all know that the future is unpredictable. You never know what will happen tomorrow, next week or next year. That's why saving money steadily through the years is so important. Saving money will help improve your financial situation over time. But more importantly, knowing that you have money stashed away for an emergency will give you peace of mind. Saving money also opens the door to many more options and possibilities.

Benefits of Saving

Inculcating the habit of saving leads to a vast number of benefits. Saving helps you:

- **Become financially independent**: When you have enough money saved up to feel secure you can start making your choices, from taking a vacation whenever you want, to switching careers or starting your own business.
- **Invest in yourself through education**: Through saving, you can earn enough to pay up for courses that will add to your professional experience and ultimately result in higher paying jobs.
- **Get out of debt**: Once you have saved enough as a reserve fund, you can use your savings to pay off debts like loans or bills that have accumulated over time.
- **Be prepared for surprise expenses:** Having money saved enables you to pay for unforeseen expenses like sudden car or house repairs, without feeling financially stressed.
- **Pay for emergencies**: Saving helps you deal with emergencies like sudden health issues or emergency trips without feeling financially burdened.

- **Afford large purchases and achieve major goals**: Saving diligently makes it possible to place down payments towards major purchases and goals, like buying a home or a car.
- **Retire**: The money you have saved over the years will keep you comfortable when you no longer have the income you would get from your job.

Tips

- Break your spending habit. Try not spending on one expensive item per week, and put the money that you would have spent into your savings.
- Decide that you will not buy anything on certain days or weeks and stick to your word.

9.3.2 Types of Bank Accounts

In India, banks offer four main types of bank accounts. These are:

1. Current Accounts
2. Savings Accounts
3. Recurring Deposit Accounts
4. Fixed Deposit Accounts

Current Accounts

Current accounts offer the most liquid deposits and thus, are best suited for businessmen and companies. As these accounts are not meant for investments and savings, there is no imposed limit on the number or amount of transactions that can be made on any given day. Current account holders are not paid any interest on the amounts held in their accounts. They are charged for certain services offered on such accounts.

Saving Accounts

Savings accounts are meant to promote savings, and are therefore the number one choice for salaried individuals, pensioners and students. While there is no restriction on the number and amount of deposits made, there are usually restrictions on the number and amount of withdrawals. Savings account holders are paid interest on their savings.

Recurring Deposit Accounts

Recurring Deposit accounts, also called RD accounts, are the accounts of choice for those who want to save an amount every month, but are unable to invest a large sum at one time. Such account holders deposit a small, fixed amount every month for a pre-determined period (minimum 6 months). Defaulting on a monthly payment results in the account holder being charged a penalty amount. The total amount is repaid with interest at the end of the specified period.

Fixed Deposit Accounts

Fixed Deposit accounts, also called FD accounts, are ideal for those who wish to deposit their savings for a long term in return for a high rate of interest. The rate of interest offered depends on the amount deposited and the time period, and also differs from bank to bank. In the case of an FD, a certain amount of money is deposited by the account holder for a fixed period of time. The money can be withdrawn when the period expires. If necessary, the depositor can break the fixed deposit prematurely. However, this usually attracts a penalty amount which also differs from bank to bank.

9.3.2.1 Opening a Bank Account

Opening a bank account is quite a simple process. Take a look at the steps to open an account of your own:

Step 1: Fill in the Account Opening Form

This form requires you to provide the following information:

- Personal details (name, address, phone number, date of birth, gender, occupation, address)
- Method of receiving your account statement (hard copy/email)
- Details of your initial deposit (cash/cheque)
- Manner of operating your account (online/mobile banking/traditional via cheque, slip books)
- Ensure that you sign wherever required on the form.

Step 2: Affix your Photograph

Stick a recent photograph of yourself in the allotted space on the form.

Step 3: Provide your Know Your Customer (KYC) Details

KYC is a process that helps banks verify the identity and address of their customers. To open an account, every individual need to submit certain approved documents with respect to photo identity (ID) and address proof. Some Officially Valid Documents (OVDs) are:

- Passport
- Driving License
- Voters' Identity Card
- PAN Card
- UIDAI (Aadhar) Card

Step 4: Submit All your Documents

Submit the completed Account Opening Form and KYC documents. Then wait until the forms are processed and your account has been opened!

Tips

- Select the right type of account.
- Fill in complete nomination details.
- Ask about fees.
- Understand the rules.
- Check for online banking – it's convenient!
- Keep an eye on your bank balance.

9.3.3 Costs: Fixed vs Variable

What are Fixed and Variable Costs?

Fixed costs and variable costs together make up a company's total cost. These are the two types of costs that companies have to bear when producing goods and services. A fixed cost does not change with the volume of goods or services a company produces. It always remains the same.

A variable cost, on the other hand, increases and decreases depending on the volume of goods and services produced. In other words, it varies with the amount produced.

Differences between Fixed and Variable Costs

Let's take a look at some of the main differences between fixed and variable costs:

Criteria	Fixed Costs	Variable Costs
Meaning	A cost that stays the same, regardless of the output produced.	A cost that changes when the
Nature	Time related.	Volume related.
Incurred	Incurred irrespective of units being produced.	Incurred only when units are produced
Unit cost	Inversely proportional to the number of units produced	Remains the same, per unit.
Examples	Depreciation, rent, salary, insurance and tax	Material consumed, wages, commission on sales and packing expenses

Tips

- When trying to determine whether a cost is fixed or variable, simply ask the following question: Will the particular cost change if the company stopped its production activities? If the answer is no, then it is a fixed cost. If the answer is yes, then it is probably a variable cost.

9.3.4 Investment, Insurance and Taxes

Investment

Investment means that money is spent today with the aim of reaping financial gains at a future time. The main types of investment options are as follows:

- **Bonds:** Bonds are instruments used by public and private companies to raise large sums of money – too large to be borrowed from a bank. These bonds are then issued in the public market and are bought by lenders.
- **Stocks:** Stocks or equity are shares that are issued by companies and are bought by the general public.
- **Small Savings Schemes:** Small Savings Schemes are tools meant to save money in small amounts. Some popular schemes are the Employees Provident Fund, Sukanya Samriddhi Scheme and National Pension Scheme.
- **Mutual Funds:** Mutual Funds are professionally managed financial instruments that invest money in different securities on behalf of investors.
- **Fixed Deposits:** A fixed amount of money is kept aside with a financial institution for a fixed amount of time in return for interest on the money.
- **Real Estate:** Loans are taken from banks to purchase real estate, which is then leased or sold with the aim of making a profit on the appreciated property price.
- **Hedge Funds:** Hedge funds invest in both financial derivatives and/or publicly traded securities.
- **Private Equity:** Private Equity is trading in the shares of an operating company that is not publicly listed and whose shares are not available on the stock market.
- **Venture Capital:** Venture Capital involves investing substantial capital in a budding company in return for stocks in that company.

Insurance

There are two types of insurance, Life Insurance and General Insurance.

Life Insurance Products

The main life insurance products are:

- **Term Insurance:** This is the simplest and cheapest form of insurance. It offers financial protection for a specified tenure, say 15 to 20 years. In the case of your death, your family is paid the sum assured. In the case of your surviving the term, the insurer pays nothing.

- **Endowment Policy:** This offers the dual benefit of insurance and investment. Part of the premium is allocated towards the sum assured, while the remaining premium gets invested in equity and debt. It pays a lump sum amount after the specified duration or on the death of the policyholder, whichever is earlier.
- **Unit-Linked Insurance Plan (ULIP):** Here part of the premium is spent on the life cover, while the remaining amount is invested in equity and debt. It helps develop a regular saving habit.
- **Money Back Life Insurance:** While the policyholder is alive, periodic payments of the partial survival benefits are made during the policy tenure. On the death of the insured, the insurance company pays the full sum assured along with survival benefits.
- **Whole Life Insurance:** It offers the dual benefit of insurance and investment. It offers insurance cover for the whole life of the person or up to 100 years whichever is earlier.

General Insurance

General Insurance deals with all insurance covering assets like animals, agricultural crops, goods, factories, cars and so on.

General Insurance Products

The main general insurance products are:

- **Motor Insurance:** This can be divided into Four-Wheeler Insurance and Two-Wheeler insurance.
- **Health Insurance:** The main types of health insurance are individual health insurance, family floater health insurance, comprehensive health insurance and critical illness insurance.
- **Travel Insurance:** This can be categorised into Individual Travel Policy, Family Travel Policy, Student Travel Insurance and Senior Citizen Health Insurance.
- **Home Insurance:** This protects the house and its contents from risk.
- **Marine Insurance:** This insurance covers goods, freight and cargo against loss or damage during transit by rail, road, sea and/or air.

Taxes

There are two types of taxes:

1. Direct Taxes
2. Indirect Taxes.

Direct Tax

Direct taxes are levied directly on an entity or a person and are non-transferrable. Some examples of Direct Taxes are:

- **Income Tax:** This tax is levied on your earning in a financial year. It is applicable to both, individuals and companies.
- **Capital Gains Tax:** This tax is payable whenever you receive a sizable amount of money. It is usually of two types – short term capital gains from investments held for less than 36 months and long term capital gains from investments held for longer than 36 months.

- **Securities Transaction Tax:** This tax is added to the price of a share. It is levied every time you buy or sell shares.
- **Perquisite Tax:** This tax is levied is on perks that have been acquired by a company or used by an employee.
- **Corporate Tax:** Corporate tax is paid by companies from the revenue they earn.

Indirect Tax

Indirect taxes are levied on goods or services. Some examples of Indirect Taxes are:

- **Sales Tax:** Sales Tax is levied on the sale of a product.
- **Service Tax:** Service Tax is added to services provided in India.
- **Value Added Tax:** Value Added Tax is levied at the discretion of the state government. The tax is levied on goods sold in the state. The tax amount is decided by the state.
- **Customs Duty & Octroi:** Customs Duty is a charge that is applied on purchases that are imported from another country. Octroi is levied on goods that cross state borders within India.
- **Excise Duty:** Excise Duty is levied on all goods manufactured or produced in India

Tips

- Think about how quickly you need your money back and pick an investment option accordingly.
- Ensure that you are buying the right type of insurance policy for yourself.
- Remember, not paying taxes can result in penalties ranging from fines to imprisonment.

9.3.5 Online Banking, NEFT, RTGS etc.

What is Online Banking?

Internet or online banking allows account holders to access their account from a laptop at any location. In this way, instructions can be issued. To access an account, account holders simply need to use their unique customer ID number and password.

Internet banking can be used to:

- Find out an account balance
- Transfer amounts from one account to another
- Arrange for the issuance of cheques
- Instruct payments to be made
- Request for a cheque book
- Request for a statement of accounts
- Make a fixed deposit

Electronic Funds Transfers

Electronic funds transfer is a convenient way of transferring money from the comfort of one's own home, using integrated banking tools like internet and mobile banking.

Transferring funds via an electronic gateway is extremely convenient. With the help of online banking, you can choose transferring funds:

- Into your accounts of the same bank.
- Into other people's accounts of the same bank.
- Into accounts in different banks through NEFT.
- Into other bank accounts though RTGS.
- Into various accounts through IMPS.

NEFT

NEFT stands for National Electronic Funds Transfer. This money transfer system allows you to electronically transfer funds from your respective bank accounts to any other account, either in the same bank or belonging to any other bank. NEFT can be used by individuals, firms and corporate organizations to transfer funds between accounts.

In order to transfer funds via NEFT, two things are required:

- A transferring bank
- A destination bank

Before you can transfer funds through NEFT, you will need to register the beneficiary who will be receiving the funds. In order to complete this registration, you will require the following information:

- Recipient's name
- Recipient's account number
- Recipient's bank's name
- Recipient's bank's IFSC code

RTGS

RTGS stands for Real Time Gross Settlement. This is a real time funds transfer system which enables you to transfer funds from one bank to another, in real time or on a gross basis. The transferred amount is immediately deducted from the account of one bank, and instantly credited to the other bank's account. The RTGS payment gateway is maintained by the Reserve Bank of India. The transactions between banks are made electronically.

RTGS can be used by individuals, companies and firms to transfer large sums of money. Before remitting funds through RTGS, you will need to add the beneficiary and his bank account details via your online banking account.

In order to complete this registration, you will require the following information:

- Name of the beneficiary
- Beneficiary's account number
- Beneficiary's bank address
- Bank's IFSC code

IMPS

IMPS stands for Immediate Payment Service. This is a real-time, inter-bank, electronic funds transfer system used to transfer money instantly within banks across India. IMPS enables users to make instant electronic transfer payments using mobile phones through both, Mobile Banking and SMS. It can also be used through ATMs and online banking. IMPS is available 24 hours a day and 7 days a week. The system features a secure transfer gateway and immediately confirms orders that have been fulfilled.

To transfer money through IMPS, you need to:

- Register for IMPS with your bank
- Receive a Mobile Money Identifier (MMID) from the bank
- Receive a MPIN from the bank

Once you have both these, you can login or make a request through SMS to transfer a particular amount to a beneficiary.

In order for the beneficiary to receive the transferred money, he must:

- Link his mobile number with his respective account
- Receive the MMID from the bank

In order to initiate a money transfer through IMPS, you will need to enter the following information:

- The beneficiary's mobile number
- The beneficiary's MMID
- The transfer amount
- Your MPIN

As soon as money has been deducted from your account and credited into the beneficiary's account, you will be sent a confirmation SMS with a transaction reference number, for future reference.

9.3.5.1 Differences between NEFT, RTGS & IMPS

Criteria	NEFT	RTGS	IMPS
Settlement	Done in batches	Real-time	Real-time
Full form	National Electronic Fund Transfer	Real Time Gross Settlement	Immediate Payment Service
Timings on Monday – Friday	8:00 am – 6:30 pm	9:00 am – 4:30 pm	24x7
Timings on Saturday	8:00 am – 1:00 pm	9:00 am – 1:30 pm	24x7
Minimum amount of money transfer limit	₹1	₹2 lacs	₹1
Maximum amount of money transfer limit	₹10 lacs	₹10 lacs per day	₹2 lacs
Maximum charges as per RBI	Up to 10,000 – ₹2.5 above 10,000 – 1 lac - ₹5 above 1 – 2 lacs ₹15 above 2 – 5 lacs ₹25 above 5 – 10 lacs ₹25	above 2 – 5 lacs ₹25 above 5 – 10 lacs ₹50	Up to 10,000 – ₹5 above 10,000 – 1 lac – ₹5 above 1 – 2 lacs – ₹15

Fig.9.3.2: Differences Between NEFT, RTGS & IMPS

Tips

- Never click on any links in any e-mail message to access your online banking website.
- You will never be asked for your credit or debit card details while using online banking.
- Change your online banking password regularly.

UNIT 9.4: Preparing for Employment & Self-Employment

Unit Objectives

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

1. Discuss the steps to prepare for an interview
2. Discuss the steps to create an effective Resume
3. Discuss the most frequently asked interview questions
4. Discuss how to answer the most frequently asked interview questions
5. Discuss basic workplace terminology

9.4.1 Interview Preparation: How to Prepare for an Interview?

The success of your getting the job that you want depends largely on how well your interview for that job goes. Therefore, before you go in for your interview, it is important that you prepare for it with a fair amount of research and planning. Take a look at the steps to follow in order to be well prepared for an interview:

1. **Research the organization that you are having the interview with.**
    - Studying the company beforehand will help you be more prepared at the time of the interview. Your knowledge of the organization will help you answer questions at the time of the interview, and will leave you looking and feeling more confident. This is sure to make you stand out from other, not as well informed, candidates.
    - Look for background information on the company. Ty and find an overview of the company and its industry profile.
    - Visit the company website to get a good idea of what the company does. A company website offers a wealth of important information. Read and understand the company's mission statement. Pay attention to the company's products/services and client list. Read through any press releases to get an idea of the company's projected growth and stability.
    - Note down any questions that you have after your research has been completed.
2. **Think about whether your skills and qualifications match the job requirements.**
    - Carefully read through and analyse the job description.
    - Make a note of the knowledge, skills and abilities required to fulfil the job requirements.
    - Take a look at the organization hierarchy. Figure out where the position you are applying for fits into this hierarchy.

3. **Go through the most typical interview questions asked, and prepare your responses.**
   - Remember, in most interviews a mix of resume-based, behavioural and case study questions are asked.
   - Think about the kind of answers you would like to provide to typical questions asked in these three areas.
   - Practice these answers until you can express them confidently and clearly.
4. **Plan your attire for the interview.**
   - It is always safest to opt for formal business attire, unless expressly informed to dress in business casual (in which case you should use your best judgement).
   - Ensure that your clothes are clean and well-ironed. Pick neutral colours – nothing too bright or flashy.
   - The shoes you wear should match your clothes, and should be clean and suitable for an interview.
   - Remember, your aim is to leave everyone you meet with the impression that you are a professional and highly efficient person.
5. **Ensure that you have packed everything that you may require during the interview.**
   - Carry a few copies of your resume. Use a good quality paper for your resume print outs.
   - Always take along a notepad and a pen.
   - Take along any information you may need to refer to, in order to fill out an application form.
   - Carry a few samples of your work, if relevant.
6. **Remember the importance of non-verbal communication.**
   - Practice projecting confidence. Remind yourself to smile and make eye contact. Practice giving a firm handshake.
   - Keep in mind the importance of posture. Practice sitting up straight. Train yourself to stop nervous gestures like fidgeting and foot-tapping.
   - Practice keeping your reactions in check. Remember, your facial expressions provide a good insight into your true feelings. Practice projecting a positive image.
7. **Make a list of questions to end the interview with.**
   - Most interviews will end with the interviewer(s) asking if you have any questions. This is your chance to show that you have done your research and are interested in learning more about the company.
   - If the interviewer does not ask you this question, you can inform him/her that you have some queries that you would like to discuss. This is the time for you to refer to the notes you made while studying the company.
   - Some good questions to ask at this point are:
     - What do you consider the most important criteria for success in this job?
     - How will my performance be evaluated?
     - What are the opportunities for advancement?
     - What are the next steps in the hiring process?
   - Remember, never ask for information that is easily available on the company website.

Tips

- Ask insightful and probing questions.
- When communicating, use effective forms of body language like smiling, making eye contact, and actively listening and nodding. Don't slouch, play with nearby items, fidget, chew gum, or mumble.

9.4.2 Preparing an Effective Resume

A resume is a formal document that lists a candidate's work experience, education and skills. A good resume gives a potential employer enough information to believe the applicant is worth interviewing. That's why it is so important to create a résumé that is effective. Take a look at the steps to create an effective resume:

Step 1: Write the Address Section

The Address section occupies the top of your resume. It includes information like your name, address, phone number and e-mail address. Insert a bold line under the section to separate it from rest of your resume.

Example:

Jasmine Watts
Breach Candy, Mumbai – India
Contact No: +91 2223678270
Email: jasmine.watts@gmail.com

Step 2: Add the Profile Summary Section

This part of your resume should list your overall experiences, achievements, awards, certifications and strengths. You can make your summary as short as 2-3 bullet points or as long as 8-10 bullet points.

Example:

Profile Summary

- A Content Writer graduated from University of Strathclyde having 6 years of experience in writing website copy.
- Core expertise lies in content creation for e-learning courses, specifically for the K-12 segment.

Step 3: Include Your Educational Qualifications

When listing your academic records, first list your highest degree. Then add the second highest qualification under the highest one and so on. To provide a clear and accurate picture of your educational background, it is critical that include information on your position, rank, percentage or CPI for every degree or certification that you have listed.

If you have done any certifications and trainings, you can add a Trainings & Certifications section under your Educational Qualifications section.

Example:

Educational Qualifications

- Masters in International Management (2007) from Columbia University with 8.8 CPI.
- Bachelor of Management Studies (2004) from Mumbai University with 87% marks.
- 10+2 with Math, Stats (2001) from Maharashtra Board with 91% marks.
- High School (1999) from Maharashtra Board with 93% marks.

Step 4: List Your Technical Skills

When listing your technical skills, start with the skills that you are most confident about. Then add the skills that you do not have as good a command over. It is perfectly acceptable to include just one skill, if you feel that particular skill adds tremendous value to your résumé. If you do not have any technical skills, you can omit this step.

Example:

Technical Skills

- Flash
- Photoshop

Step 5: Insert Your Academic Project Experience

List down all the important projects that you have worked on. Include the following information in this section:

- Project title
- Contribution
- Organization
- Description
- Platform used

Example:

Academic Projects

Project Title: Different Communication Skills

Organization: True Blue Solutions

Platform used: Articulate

Contribution: Content writing and graphic visualization

Description: Development of storyboards for corporate induction & training programs

Step 6: List Your Strengths

This is where you list all your major strengths. This section should be in the form of a bulleted list.

Example:

Strengths

- Excellent oral, written and presentation skills
- Action-oriented and result-focused
- Great time management skills

Step 7: List Your Extracurricular Activities

It is very important to show that you have diverse interests and that your life consists of more than academics. Including your extracurricular activities can give you an added edge over other candidates who have similar academic scores and project experiences. This section should be in the form of a bulleted list.

Example:

Extracurricular Activities

- Member of the Debate Club
- Played tennis at a national level
- Won first prize in the All India Camel Contest, 2010

Step 8: Write Your Personal Details

The last section of your résumé must include the following personal information:

- Date of birth
- Nationality
- Gender & marital status
- Languages known

Example:

Personal Details

- Date of birth: 25th May, 1981
- Gender & marital status: Female, Single
- Nationality: Indian
- Languages known: English, Hindi, Tamil, French

Tips

- Keep your resume file name short, simple and informational.
- Make sure the resume is neat and free from typing errors.
- Always create your resume on plain white paper.

9.4.3 Interview FAQs

Take a look at some of the most frequently asked interview questions, and some helpful tips on how to answer them.

Q1. Can you tell me a little about yourself?

Tips to answer:

- Don't provide your full employment or personal history.
- Offer 2-3 specific experiences that you feel are most valuable and relevant.
- Conclude with how those experiences have made you perfect for this specific role.

Q2. How did you hear about the position?

Tips to answer:

- Tell the interviewer how you heard about the job – whether it was through a friend (name the friend), event or article (name them) or a job portal (say which one).
- Explain what excites you about the position and what in particular caught your eye about this role.

Q3. What do you know about the company?

Tips to answer:

- Don't recite the company's About Us page.
- Show that you understand and care about the company's goals.
- Explain why you believe in the company's mission and values.

Q4. Why do you want this job?

Tips to answer:

- Show that you are passionate about the job.
- Identify why the role is a great fit for you.
- Explain why you love the company.

Q5. Why should we hire you?

Tips to answer:

- Prove through your words that you can not only do the work, but can definitely deliver excellent results.
- Explain why you would be a great fit with the team and work culture.
- Explain why you should be chosen over any other candidate.

Q6. What are your greatest professional strengths?

Tips to answer:

- Be honest – share some of your real strengths, rather than give answers that you think sound good.
- Offer examples of specific strengths that are relevant to the position you are applying for.
- Provide examples of how you've demonstrated these strengths.

Q7. What do you consider to be your weaknesses?

Tips to answer:

- The purpose of this question is to gauge your self-awareness and honesty.
- Give an example of a trait that you struggle with, but that you're working on to improve.

Q8. What are your salary requirements?

Tips to answer:

- Do your research beforehand and find out the typical salary range for the job you are applying for.
- Figure out where you lie on the pay scale based on your experience, education, and skills.
- Be flexible. Tell the interviewer that you know your skills are valuable, but that you want the job and are willing to negotiate.

Q9. What do you like to do outside of work?

Tips to answer:

- The purpose of this question is to see if you will fit in with the company culture.
- Be honest – open up and share activities and hobbies that interest and excite you.

Q10. If you were an animal, which one would you want to be?

Tips to answer:

- The purpose of this question is to see if you are able to think on your feet.
- There's no wrong answer – but to make a great impression try to bring out your strengths or personality traits through your answer.

Q11: What do you think we could do better or differently?

Tips to answer:

- The purpose of this question is to see if you have done your research on the company, and to test whether you can think critically and come up with new ideas.
- Suggest new ideas. Show how your interests and expertise would help you execute these ideas.

Q12: Do you have any questions for us?

Tips to answer:

- Do not ask questions to which the answers can be easily found on the company website or through a quick online search.
- Ask intelligent questions that show your ability to think critically.

Tips

- Be honest and confident while answering.
- Use examples of your past experiences wherever possible to make your answers more impactful.

9.4.4 Work Readiness – Terms & Terminologies

Every employee should be well versed in the following terms:

- **Annual leave:** Paid vacation leave given by employers to employees.
- **Background Check:** A method used by employers to verify the accuracy of the information provided by potential candidates.
- **Benefits:** A part of an employee's compensation package.
- **Breaks:** Short periods of rest taken by employees during working hours.
- **Compensation Package:** The combination of salary and benefits that an employer provides to his/her employees.
- **Compensatory Time (Comp Time):** Time off in lieu of pay.
- **Contract Employee:** An employee who works for one organization that sells said employee's service to another company, either on a project or time basis.
- **Contract of Employment:** When an employee is offered work in exchange for wages or salary, and accepts the offer made by the employer, a contract of employment exists.
- **Corporate Culture:** The beliefs and values shared by all the members of a company, and imparted from one generation of employees to another.
- **Counter Offer/Counter Proposal:** A negotiation technique used by potential candidates to increase the amount of salary offered by a company.
- **Cover Letter:** A letter that accompanies a candidate's resume. It emphasizes the important points in the candidate's resume and provides real examples that prove the candidate's ability to perform the expected job role.
- **Curriculum Vitae (CV)/Resume:** A summary of a candidate's achievements, educational work experience, skills and strengths.
- **Declining Letter:** A letter sent by an employee to an employer, turning down the job offer employer to the employee.
- **Deductions:** Amounts subtracted from an employee's pay and listed on the employee's pay slip.
- **Discrimination:** The act of treating one person not as favourably as another person.
- **Employee:** A person who works for another person in exchange for payment.
- **Employee Training:** A workshop or in-house training that an employee is asked to attend by his or her superior, for the benefit of the employer.
- **Employment Gaps:** Periods of unemployed time between jobs.
- **Fixed-Term Contract:** A contract of employment which gets terminated on an agreed-upon date.
- **Follow-Up:** The act of contacting a potential employer after a candidate has submitted his or her resume.
- **Freelancer/Consultant/Independent Contractor:** A person who works for him or herself for temporary jobs and projects with different employers.
- **Holiday**: Paid time-off from work.
- **Hourly Rate**: The amount of salary or wages paid for 60 minutes of work.

- **Internship**: A job opportunity offered by an employer to a potential employee, called an at the employer's company for a fixed, limited time period.
- **Interview**: A conversation between a potential employee and a representative of an order to determine if the potential employee should be hired.
- **Job Application**: A form which asks for a candidate's information like the candidate's name, details and work experience. The purpose of a candidate submitting a job application, is to show that candidate's interest in working for a particular company.
- **Job Offer**: An offer of employment made by an employer to a potential employee.
- **Job Search Agent**: A program that enables candidates to search for employment opportunities by selecting criteria listed in the program, for job vacancies. background, made by the and pitches intern, to work employer, in address, contact
- **Lay Off**: A lay off occurs when an employee is temporarily let go from his or her job, due to the employer not having any work for that employee.
- **Leave**: Formal permission given to an employee, by his or her employer, to take a leave of absence from work.
- **Letter of Acceptance**: A letter given by an employer to an employee, confirming the offer of employment made by the employer, as well as the conditions of the offer.
- **Letter of Agreement**: A letter that outlines the terms of employment.
- **Letter of Recommendation**: A letter written for the purpose of validating the work skills o f a person.
- **Maternity Leave**: Leave taken from work by women who are pregnant, or who have just given birth.
- **Mentor**: A person who is employed at a higher level than you, who offers you advice and guides you in your career.
- **Minimum wage**: The minimum wage amount paid on an hourly basis.
- **Notice**: An announcement made by an employee or an employer, stating that the employment contract will end on a particular date.
- **Offer of Employment**: An offer made by an employer to a prospective employee that contains important information pertaining to the job being offered, like the starting date, salary, working conditions etc.
- **Open-Ended Contract**: A contract of employment that continues till the employer or terminates it.
- **Overqualified**: A person who is not suited for a particular job because he or she has too m any years of work experience, or a level of education that is much higher than required f or the job, or is currently or was previously too highly paid.
- **Part-Time Worker**: An employee who works for fewer hours than the standard number of hours normally worked.
- **Paternity Leave**: Leave granted to a man who has recently become a father.
- **Recruiters/Head-hunters/Executive Search Firms**: Professionals who are paid by employers to search for people to fill particular positions.
- **Resigning/Resignations**: When an employee formally informs his or her employer that he or she is quitting his or her job.

- **Self-Employed**: A person who has his or her own business and does not work in the capacity of an employee.
- **Time Sheet**: A form that is submitted to an employer, by an employee, that contains the number of hours worked every day by the employee.

UNIT 8.5: Understanding Entrepreneurship

Unit Objectives

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

1. Discuss the concept of entrepreneurship
2. Discuss the importance of entrepreneurship
3. Describe the characteristics of an entrepreneur
4. Describe the different types of enterprises
5. List the qualities of an effective leader
6. Discuss the benefits of effective leadership
7. List the traits of an effective team
8. Discuss the importance of listening effectively
9. Discuss how to listen effectively
10. Discuss the importance of speaking effectively
11. Discuss how to speak effectively
12. Discuss how to solve problems
13. List important problem solving traits
14. Discuss ways to assess problem solving skills
15. Discuss the importance of negotiation
16. Discuss how to negotiate
17. Discuss how to identify new business opportunities
18. Discuss how to identify business opportunities within your business
19. Understand the meaning of entrepreneur
20. Describe the different types of entrepreneurs
21. List the characteristics of entrepreneurs
22. Recall entrepreneur success stories
23. Discuss the entrepreneurial process
24. Describe the entrepreneurship ecosystem
25. Discuss the government's role in the entrepreneurship ecosystem
26. Discuss the current entrepreneurship ecosystem in India
27. Understand the purpose of the Make in India campaign
28. Discuss the relationship between entrepreneurship and risk appetite
29. Discuss the relationship between entrepreneurship and resilience
30. Describe the characteristics of a resilient entrepreneur
31. Discuss how to deal with failure

9.5.1 Concept Introduction

Anyone who is determined to start a business, no matter what the risk, is an entrepreneur. Entrepreneurs run their own start-up, take responsibility for the financial risks and use creativity, innovation and vast reserves of self-motivation to achieve success. They dream big and are determined to do whatever it takes to turn their idea into a viable offering. The aim of an entrepreneur is to create an enterprise. The process of creating this enterprise is known as entrepreneurship.

9.5.1.1 Importance of Entrepreneurship

Entrepreneurship is very important for the following reasons:

1. It results in the creation of new organizations
2. It brings creativity into the marketplace
3. It leads to improved standards of living
4. It helps develop the economy of a country

9.5.1.2 Characteristics of Entrepreneurs

All successful entrepreneurs have certain characteristics in common.

They are all:

- Extremely passionate about their work
- Confident in themselves
- Disciplined and dedicated
- Motivated and driven
- Highly creative
- Visionaries
- Open-minded
- Decisive

Entrepreneurs also have a tendency to:

- Have a high-risk tolerance
- Thoroughly plan everything
- Manage their money wisely
- Make their customers their priority
- Understand their offering and their market in detail
- Ask for advice from experts when required
- Know when to cut their losses

9.5.1.3 Examples of Famous Entrepreneurs

Some famous entrepreneurs are:

- Bill Gates (Founder of Microsoft)
- Steve Jobs (Co-founder of Apple)
- Mark Zuckerberg (Founder of Facebook)
- Pierre Omidyar (Founder of eBay)

9.5.1.4 Types of Enterprises

As an entrepreneur in India, you can own and run any of the following types of enterprises:

Sole Proprietorship

In a sole proprietorship, a single individual owns, manages and controls the enterprise. This type of business is the easiest to form with respect to legal formalities. The business and the owner have no separate legal existence. All profit belongs to the proprietor, as do all the losses the liability of the entrepreneur is unlimited.

Partnership

A partnership firm is formed by two or more people. The owners of the enterprise are called partners. A partnership deed must be signed by all the partners. The firm and its partners have no separate legal existence. The profits are shared by the partners. With respect to losses, the liability of the partners is unlimited. A firm has a limited life span and must be dissolved when any one of the partners dies, retires, claims bankruptcy or goes insane.

Limited Liability Partnership (LLP)

In a Limited Liability Partnership or LLP, the partners of the firm enjoy perpetual existence as well as the advantage of limited liability. Each partner's liability is limited to their agreed contribution to the LLP. The partnership and its partners have a separate legal existence.

Tips 

- Learn from others' failures.
- Be certain that this is what you want.
- Search for a problem to solve, rather than look for a problem to attach to your idea.

9.5.2 Leadership & Teamwork: Leadership and Leaders

Leadership means setting an example for others to follow. Setting a good example means not asking someone to do something that you wouldn't willingly want to do yourself. Leadership is about figuring out what to do in order to win as a team, and as a company.

Leaders believe in doing the right things. They also believe in helping others to do the right things. An effective leader is someone who:

- Creates an inspiring vision of the future.
- Motivates and inspires his team to pursue that vision.

9.5.2.1 Leadership Qualities That All Entrepreneurs Need

Building a successful enterprise is only possible if the entrepreneur in charge possesses excellent leadership qualities. Some critical leadership skills that every entrepreneur must have are:

1. **Pragmatism:** This means having the ability to highlight all obstacles and challenges, in order to resolve issues and reduce risks.
2. **Humility:** This means admitting to mistakes often and early, and being quick to take responsibility for your actions. Mistakes should be viewed as challenges to overcome, not opportunities to point blame.
3. **Flexibility:** It is critical for a good leader to be very flexible and quickly adapt to change. It is equally critical to know when to adapt and when not to.
4. **Authenticity:** This means showing both, your strengths and your weaknesses. It means being human and showing others that you are human.
5. **Reinvention:** This means refreshing or changing your leadership style when necessary. To do this, it's important to learn where your leadership gaps lie and find out what resources are required to close them.
6. **Awareness:** This means taking the time to recognize how others view you. It means understanding how your presence affects those around you.

9.5.2.2 Benefits of Effective Leadership

Effective leadership results in numerous benefits. Great leadership leads to the leader successfully:

- Gaining the loyalty and commitment of the team members
- Motivating the team to work towards achieving the company's goals and objectives
- Building morale and instilling confidence in the team members
- Fostering mutual understanding and team-spirit among team members
- Convincing team members about the need to change when a situation requires adaptability

9.5.2.3 Teamwork and Teams

Teamwork occurs when the people in a workplace combine their individual skills to pursue a common goal. Effective teams are made up of individuals who work together to achieve this common goal. A great team is one who holds themselves accountable for the end result.

9.5.2.4 Importance of Teamwork in Entrepreneurial Success

For an entrepreneurial leader, building an effective team is critical to the success of a venture. An entrepreneur must ensure that the team he builds possesses certain crucial qualities, traits and characteristics. An effective team is one which has:

1. **Unity of purpose:** All the team members should clearly understand and be equally committed to the purpose, vision and goals of the team.
2. **Great communication skills:** Team members should have the ability to express their concerns, ask questions and use diagrams, and charts to convey complex information.
3. **The ability to collaborate:** Every member should feel entitled to provide regular feedback on new ideas.
4. **Initiative:** The team should consist of proactive individuals. The members should have the enthusiasm to come up with new ideas, improve existing ideas, and conduct their own research.
5. **Visionary members:** The team should have the ability to anticipate problems and act on these potential problems before they turn into real problems.
6. **Great adaptability skills:** The team must believe that change is a positive force. Change should be seen as the chance to improve and try new things.
7. **Excellent organizational skills:** The team should have the ability to develop standard work processes, balance responsibilities, properly plan projects, and set in place methods to measure progress and ROI.

Tips

- Don’t get too attached to your original idea. Allow it to evolve and change.
- Be aware of your weaknesses and build a team that will complement your shortfalls.
- Hiring the right people is not enough. You need to promote or incentivize your most talented people to keep them motivated.
- Earn your team’s respect.

9.5.3 Communication Skills

Listening is the ability to correctly receive and understand messages during the process of communication. Listening is critical for effective communication. Without effective listening skills, messages can easily be misunderstood. This results in a communication breakdown and can lead to the sender and the receiver of the message becoming frustrated or irritated.

It’s very important to note that listening is not the same as hearing. Hearing just refers to sounds that you hear. Listening is a whole lot more than that. To listen, one requires focus. It means not only paying attention to the story, but also focusing on how the story is relayed, the way language and voice is used, and even how the speaker uses their body language. The ability to listen depends on how effectively one can perceive and understand both, verbal and non-verbal cues.

9.5.3.1 How to Listen Effectively?

To listen effectively you should:

- Stop talking
- Stop interrupting
- Focus completely on what is being said
- Nod and use encouraging words and gestures
- Be open-minded
- Think about the speaker's perspective
- Be very, very patient
- Pay attention to the tone that is being used
- Pay attention to the speaker's gestures, facial expressions and eye movements
- Not try and rush the person
- Not let the speaker's mannerisms or habits irritate or distract you

9.5.3.2 The Importance of Speaking Effectively

How successfully a message gets conveyed depends entirely on how effectively you are able to get it through. An effective speaker is one who enunciates properly, pronounces words correctly, chooses the right words and speaks at a pace that is easily understandable. Besides this, the words spoken out loud need to match the gestures, tone and body language used.

What you say, and the tone in which you say it, results in numerous perceptions being formed. A person who speaks hesitantly may be perceived as having low self-esteem or lacking in knowledge of the discussed topic. Those with a quiet voice may very well be labelled as shy. And those who speak in commanding tones with high levels of clarity, are usually considered to be extremely confident. This makes speaking a very critical communication skill.

9.5.3.3 How to Speak Effectively?

To speak effectively you should:

- Incorporate body language in your speech like eye contact, smiling, nodding, gesturing etc.
- Build a draft of your speech before actually making your speech.
- Ensure that all your emotions and feelings are under control.
- Pronounce your words distinctly with the correct pitch and intensity. Your speech should be crystal clear at all times. Use a pleasant and natural tone when speaking. Your audience should not feel like you are putting on an accent or being unnatural in any way.
- Use precise and specific words to drive your message home. Ambiguity should be avoided at all costs.
- Ensure that your speech has a logical flow.

- Be brief. Don't add any unnecessary information.
- Make a conscious effort to avoid irritating mannerisms like fidgeting, twitching etc.
- Choose your words carefully and use simple words that the majority of the audience will have no difficulty understanding.
- Use visual aids like slides or a whiteboard.
- Speak slowly so that your audience can easily understand what you're saying. However, be careful not to speak too slowly because this can come across as stiff, unprepared or even condescending.
- Remember to pause at the right moments.

Tips

- If you're finding it difficult to focus on what someone is saying, try repeating their words in your head.
- Always maintain eye contact with the person that you are communicating with, when speaking as well as listening. This conveys and also encourages interest in the conversation.

9.5.4 Problem Solving & Negotiation Skills

As per The Concise Oxford Dictionary (1995), a problem is, "A doubtful or difficult matter requiring a solution"

All problems contain two elements:

1. Goals
2. Obstacles

The aim of problem solving is to recognize the obstacles and remove them in order to achieve the goals.

9.5.4.1 How to Solve Problems?

Solving a problem requires a level of rational thinking. Here are some logical steps to follow when faced with an issue:

- **Step 1:** Identify the problem
- **Step 2:** Study the problem in detail
- **Step 3:** List all possible solutions
- **Step 4:** Select the best solution
- **Step 5:** Implement the chosen solution
- **Step 6:** Check that the problem has really been solved

9.5.4.2 Important Traits for Problem Solving

Highly developed problem-solving skills are critical for both, business owners and their employees. The following personality traits play a big role in how effectively problems are solved:

- Being open minded
- Asking the right questions
- Being proactive
- Not panicking
- Having a positive attitude
- Focusing on the right problem

9.5.4.3 How to Assess for Problem Solving Skills?

As an entrepreneur, it would be a good idea to assess the level of problem solving skills of potential candidates before hiring them. Some ways to assess this skill are through:

1. **Application forms:** Ask for proof of the candidate's problem solving skills in the application form.
2. **Psychometric tests:** Give potential candidates logical reasoning and critical thinking tests and see how they fare.
3. **Interviews:** Create hypothetical problematic situations or raise ethical questions and see how the candidates respond.
4. **Technical questions:** Give candidates examples of real life problems and evaluate their thought process.

9.5.4.4 What is Negotiation?

Negotiation is a method used to settle differences. The aim of negotiation is to resolve differences through a compromise or agreement while avoiding disputes. Without negotiation, conflicts are likely to lead to resentment between people. Good negotiation skills help satisfy both parties and go a long way towards developing strong relationships.

Why Negotiate?

Starting a business requires many, many negotiations. Some negotiations are small while others are critical enough to make or break a start-up. Negotiation also plays a big role inside the workplace. As an entrepreneur, you need to know not only know how to negotiate yourself, but also how to train employees in the art of negotiation.

How to Negotiate?

Take a look at some steps to help you negotiate:

- **Step 1:** Pre-Negotiation Preparation: Agree on where to meet to discuss the problem, decide who all will be present and set a time limit for the discussion.
- **Step 2:** Discuss the problem: This involves asking questions, listening to the other side, putting your views forward and clarifying doubts.
- **Step 3:** Clarify the Objective: Ensure that both parties want to solve the same problem and reach the same goal.
- **Step 4:** Aim for a Win-Win Outcome: Try your best to be open minded when negotiating. Compromise and offer substitute solutions to arrive at an outcome where both win.
- **Step 5:** Clearly Define the Agreement: When an agreement has been reached, the details of the agreement should be crystal clear to both sides, with no scope for misunderstandings.
- **Step 6:** Implement the Agreed Upon Solution: Agree on a course of action to set the solution in motion.

Tips

- Know exactly what you want before you work towards getting it
- Give more importance to listening and thinking, than speaking
- Focus on building a relationship rather than winning
- Remember that your people skills will affect the outcome
- Know when to walk away – sometimes reaching an agreement may not be possible

9.5.5 Business Opportunities Identification

"The entrepreneur always searches for change, responds to it and exploits it as an opportunity."

Peter Drucker

The ability to find good business opportunities is an important characteristic of an entrepreneur.

What is an Opportunity?

The word opportunity suggests a good chance or a favourable situation to do something offered by circumstances.

A business opportunity is typically a good/favourable change that can be used to run a business in a given environment, at a given point of time.

Common Questions Faced by Entrepreneurs

A critical question that all entrepreneurs face is how to go about finding the business opportunity that is right for them.

Some common questions that entrepreneurs constantly think about are:

- Should the new enterprise introduce a new product or service based on an unmet need?
- Should the new enterprise select an existing product or service from one market and offer it in another where it may not be available?
- Should the enterprise be based on a tried and tested formula that has worked elsewhere?

It is therefore extremely important that entrepreneurs must learn how to identify new and existing business opportunities and evaluate their chances of success.

When is an Idea an Opportunity?

An idea is an opportunity when:

- It creates or adds value to a customer
- It solves a significant problem, removes a pain point or meets a demand
- Has a robust market and profit margin
- Is a good fit with the founder and management team at the right time and place

Factors to Consider When Looking for Opportunities

Consider the following when looking for business opportunities:

- Economic trends
- Changes in funding
- Changing relationships between vendors, partners and suppliers
- Market trends
- Changes in political support
- Shift in target audience

Ways to Identify New Business Opportunities

- **Identify Market Inefficiencies:** When looking at a market, consider what inefficiencies are present in the market. Think about ways to correct these inefficiencies.
- **Remove Key Hassles:** Rather than create a new product or service, you can innovatively improve a product, service or process.
- **Create Something New:** Think about how you can create a new experience for customers, based on existing business models.
- **Pick a Growing Sector/Industry:** Research and find out which sectors or industries are growing and think about what opportunities you can tap in the same.
- **Think About Product Differentiation:** If you already have a product in mind, think about ways to set it apart from the existing ones.

Ways to Identify Business Opportunities within Your Business

1. **SWOT Analysis**

An excellent way to identify opportunities inside your business is by creating a SWOT analysis. The acronym SWOT stands for strengths, weaknesses, opportunities, and threats. SWOT analysis framework:

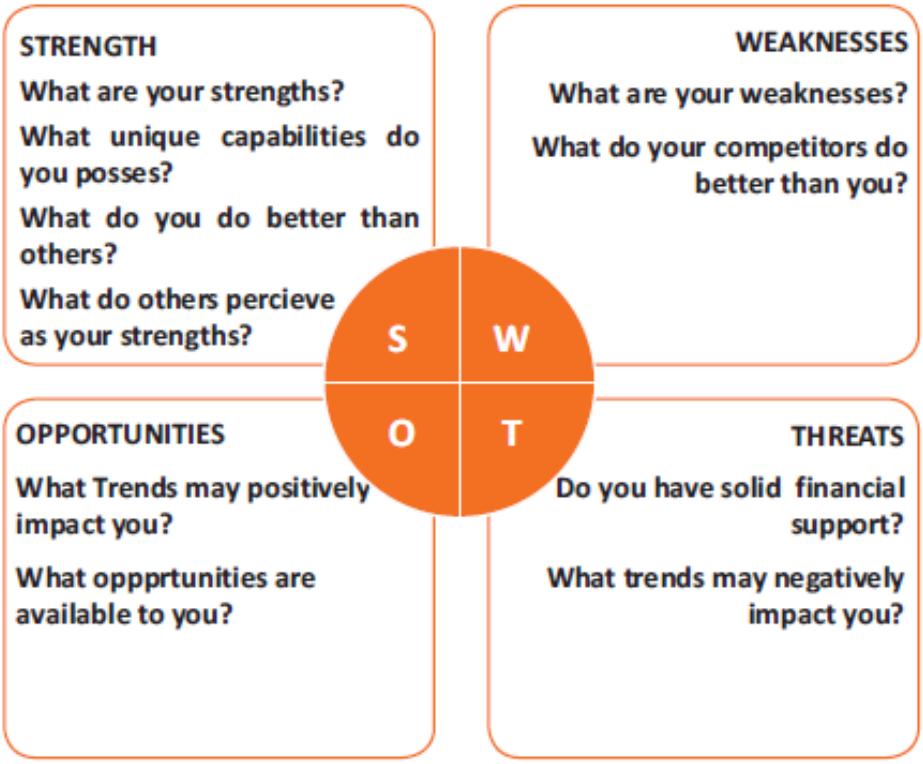

Fig.9.5.1. SWOT Analysis

Consider the following when looking for business opportunities:

By looking at yourself and your competitors using the SWOT framework, you can uncover opportunities that you can exploit, as well as manage and eliminate threats that could derail your success.

2. **Establishing Your USP**

Establish your USP in such a way that positions you differently from your competitors. Identify the uniqueness about your product that will motivate customers to buy from you and then promote that reason.

Opportunity Analysis

Once you have identified an opportunity, you need to analyse it. To analyse an opportunity, you must:

- Focus on the idea
- Focus on the market of the idea
- Talk to industry leaders in the same space as the idea
- Talk to players in the same space as the idea

Tips

- Remember, opportunities are situational.
- Look for a proven track record.
- Avoid the latest craze.
- Love your idea.

9.5.6 Entrepreneurship Support Eco-System

An entrepreneur is a person who:

- Does not work for an employee
- Runs a small enterprise
- Assumes all the risks and rewards of the enterprise, idea, good or service

Types of Entrepreneurs

There are four main types of entrepreneurs:

1. **The Traditional Entrepreneur:** This type of entrepreneur usually has some kind of skill – they can be a carpenter, mechanic, cook etc. They have businesses that have been around for numerous years like restaurants, shops and carpenters. Typically, they gain plenty of experience in a particular industry before they begin their own business in a similar field.
2. **The Growth Potential Entrepreneur:** The desire of this type of entrepreneur is to start an enterprise that will grow, win many customers and make lots of money. Their ultimate aim is to eventually sell their enterprise for a nice profit. Such entrepreneurs usually have a science or technical background.
3. **The Project-Oriented Entrepreneur:** This type of entrepreneur generally has a background in the Arts or psychology. Their enterprises tend to be focus on something that they are very passionate about.
4. **The Lifestyle Entrepreneur:** This type of entrepreneur has usually worked as a teacher or a secretary. They are more interested in selling something that people will enjoy, rather than making lots of money.

Characteristics of an Entrepreneur

Successful entrepreneurs have the following characteristics:

- They are highly motivated
- They are creative and persuasive
- They are mentally prepared to handle each and every task
- They have excellent business skills – they know how to evaluate their cash flow, sales and revenue

- They are willing to take great risks
- They are very proactive – this means they are willing to do the work themselves, rather than wait for someone else to do it
- They have a vision – they are able to see the big picture
- They are flexible and open-minded
- They are good at making decisions

9.5.6.1 Entrepreneur Success Stories

Dhiru Bhai Ambani

Dhirubhai Ambani began his entrepreneurial career by selling "bhajias" to pilgrims in Mount Girnar on weekends. At 16, he moved to Yemen where he worked as a gas-station attendant, and as a clerk in an oil company. He returned to India with Rs. 50,000 and started a textile trading company. Reliance went on to become the first Indian company to raise money in global markets and the first Indian company to feature in Forbes 500 list.

Dr. Karsanbhai Patel

Karsanbhai Patel made detergent powder in the backyard of his house. He sold his product door-to door and offered a money back guarantee with every pack that was sold. He charged Rs.3 per kg when the cheapest detergent at that time was Rs.13 per kg. Dr. Patel eventually started Nirma which became a whole new segment in the Indian domestic detergent market.

9.5.6.2 The Entrepreneurial Process

Let's take a look at the stages of the entrepreneurial process.

- **Stage 1:** Idea Generation. The entrepreneurial process begins with an idea that has been thought of by the entrepreneur. The idea is a problem that has the potential to be solved.
- **Stage 2:** Germination or Recognition. In this stage a possible solution to the identified problem is thought of.
- **Stage 3:** Preparation or Rationalization. The problem is studied further and research is done to find out how others have tried to solve the same problem.
- **Stage 4:** Incubation or Fantasizing. This stage involves creative thinking for the purpose of coming up with more ideas. Less thought is given to the problem areas.
- **Stage 5:** Feasibility Study: The next step is the creation of a feasibility study to determine if the idea will make a profit and if it should be seen through.
- **Stage 6:** Illumination or Realization. This is when all uncertain areas suddenly become clear. The entrepreneur feels confident that his idea has merit.
- **Stage 7:** Verification or Validation. In this final stage, the idea is verified to see if it works and if it is useful.

Take a look at the diagram below to get a better idea of this process.

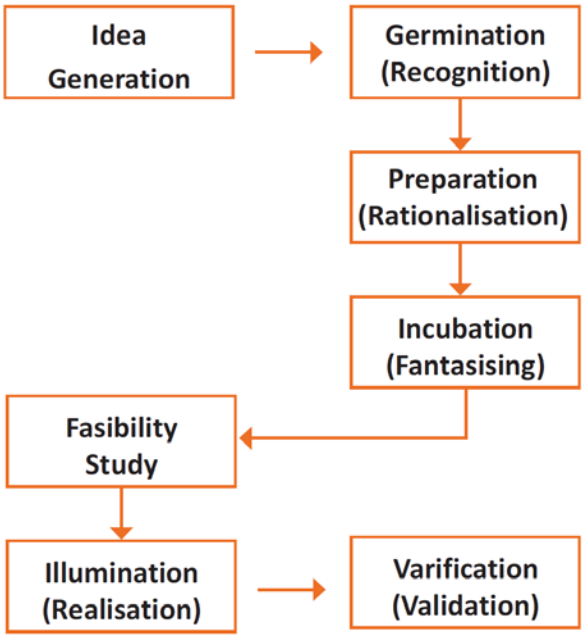

Fig.7.5.2: Stages of the entrepreneurial process

9.5.6.3 What is an Entrepreneur?

The entrepreneurship support ecosystem signifies the collective and complete nature of entrepreneurship. New companies emerge and flourish not only because of the courageous, visionary entrepreneurs who launch them, but they thrive as they are set in an environment or 'ecosystem' made of private and public participants. These players nurture and sustain the new ventures, facilitating the entrepreneurs' efforts. An entrepreneurship ecosystem comprises of the following six domains:

1. **Favourable Culture:** This includes elements such as tolerance of risk and errors, valuable networking and positive social standing of the entrepreneur.
2. **Facilitating Policies & Leadership:** This includes regulatory framework incentives and existence of public research institutes.
3. **Financing Options:** Angel financing, venture capitalists and micro loans would be good examples of this.
4. **Human Capital:** This refers to trained and untrained labour, entrepreneurs and entrepreneurship training programmes, etc.
5. **Conducive Markets for Products & Services:** This refers to an existence or scope of existence of a market for the product/service.
6. **Institutional & Infrastructural Support:** This includes legal and financing advisers, telecommunications, digital and transportation infrastructure, and entrepreneurship networking programmes.

These domains indicate whether there is a strong entrepreneurship support ecosystem and what actions should the government put in place to further encourage this ecosystem.

The six domains and their various elements have been graphically depicted.

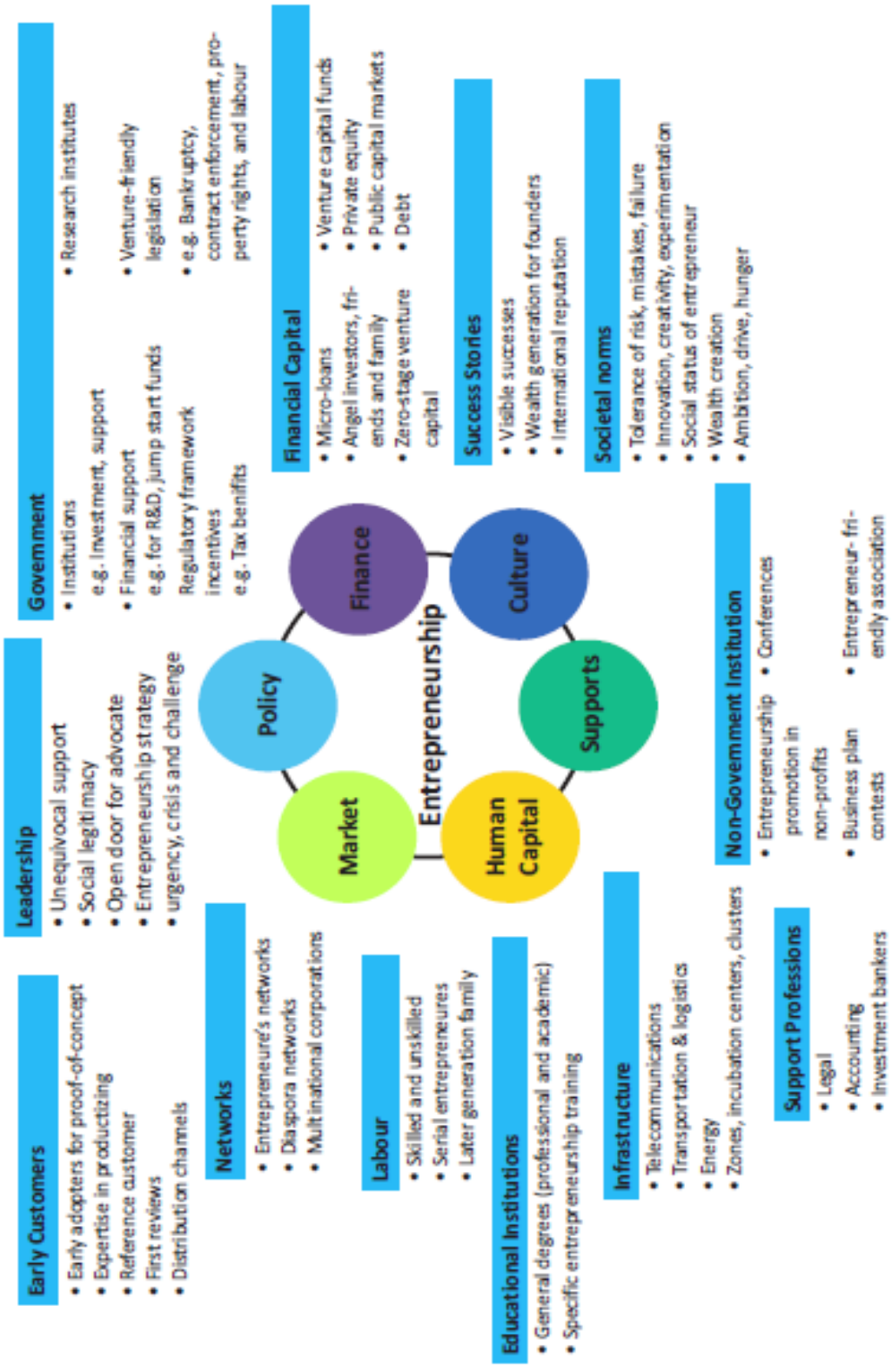

Fig.9.5.3. Entrepreneurship at a Glance

Every entrepreneurship support ecosystem is unique and all the elements of the ecosystem are interdependent. Although every region's entrepreneurship ecosystem can be broadly described by the above features, each ecosystem is the result of the hundred elements interacting in highly complex and particular ways.

Entrepreneurship ecosystems eventually become (largely) self-sustaining. When the six domains are resilient enough, they are mutually beneficial. At this point, government involvement can and should be significantly minimized. Public leaders do not need to invest a lot to sustain the ecosystem. It is imperative that the entrepreneurship ecosystem incentives are formulated to be self-liquidating, hence focusing on sustain ability of the environment.

9.5.6.4 Government's Role in the Entrepreneurship Ecosystem

Encouraging new ventures is a major focus for policymakers. Governments across the world are recognizing that new businesses flourish in distinctive types of supportive environments. Policymakers should study the scenario and take into account the following points whilst they formulate policies and regulations that enable successful entrepreneurship support ecosystems.

- Policymakers should avoid regulations that discourage new entrants and work towards building efficient methods for business startups. Policies and regulations which help existing, leading firms over entrepreneurial ventures, limit competition and obstruct growth/formation of new companies.
- Therefore, in place of developing policies that are intended to improve market failures, policymakers should interact with entrepreneurs and understand the challenges faced by them. The feedback is used to develop policies which encourage exploring ideas, developing new products and increase the rates of deal flow.
- Entrepreneurial supporters ideally need to create a database that enables identifying who the members in the ecosystem are and how they are connected. The ecosystem database are useful tools in developing engagement strategies.
- Disruptions are inevitable in economic as well as social life. However, it's important to note that economic disruption gives rise to entrepreneurial opportunities. Architects of the entrepreneurship ecosystems (entrepreneurs, mentors, policymakers and consumers,) should anticipate these dips, thus capitalizing on the opportunities they create.

9.5.6.5 Snapshot of the Entrepreneurship Ecosystem in India

Entrepreneurship has earned a newfound respect in India. Many Indians, with exposure to the world of business, who traditionally would have opted for a job, are setting up their own ventures. Many elements of the entrepreneurship ecosystem are beginning to come together. For example, increase in venture capitalists, government schemes and incubators, academia industry linkages, and emerging clusters and support to rural economy.

All these initiatives are effective but there is a need to scale up and enrich the ecosystem further in the following ways:

1. We need to review our attitude towards failures and accept them as learning experiences.
2. We must encourage the educated to become entrepreneurs and provide students in schools and colleges with entrepreneurship skills.
3. Universities, research labs and the government need to play the role of enablers in the entrepreneurship support ecosystem.
4. Policymakers need to focus on reducing the obstacles such as corruption, red tape and bureaucracy.
5. We need to improve our legal systems and court international venture capital firms and bring them to India.
6. We must devise policies and methods to reach the secondary and tertiary towns in India, where people do not have access to the same resources available in the cities.

Today, there is a huge opportunity in this country to introduce innovative solutions that are capable of scaling up, and collaborating within the ecosystem as well as enriching it.

9.5.6.6 Make in India Campaign

Every entrepreneur has certain needs. Some of their important needs are:

- To easily get loans
- To easily find investors
- To get tax exemptions
- To easily access resources and good infrastructure
- To enjoy a procedure that is free of hassles and is quick
- To be able to easily partner with other firms

The Make in India campaign, launched by Prime Minister Modi aims to satisfy all these needs of young, aspiring entrepreneurs. Its objective is to:

- Make investment easy
- Support new ideas
- Enhance skill development
- Safeguard the ideas of entrepreneurs
- Create state-of-the-art facilities for manufacturing goods

Tips

- Research the existing market, network with other entrepreneurs, venture capitalists, angel investors, and thoroughly review the policies in place to enable your entrepreneurship.
- Failure is a stepping stone and not the end of the road. Review yours and your peers' errors and correct them in your future venture.
- Be proactive in your ecosystem. Identify the key features of your ecosystem and enrich them to ensure self-sustainability of your entrepreneurship support ecosystem.

9.5.7 Risk Appetite & Resilience

Entrepreneurship and Risk

Entrepreneurs are inherently risk takers. They are path-makers not path-takers. Unlike a normal, cautious person, an entrepreneur would not think twice about quitting his job (his sole income) and taking a risk on himself and his idea.

An entrepreneur is aware that while pursuing his dreams, assumptions can be proven wrong and unforeseen events may arise. He knows that after dealing with numerous problems, success is still not guaranteed. Entrepreneurship is synonymous with the ability to take risks. This ability, called risk-appetite, is an entrepreneurial trait that is partly genetic and partly acquired.

What is Risk Appetite?

Risk appetite is defined as the extent to which a company is equipped to take risk, in order to achieve its objectives. Essentially, it refers to the balance, struck by the company, between possible profits and the hazards caused by changes in the environment (economic ecosystem, policies, etc.). Taking on more risk may lead to higher rewards but have a high probability of losses as well. However, being too conservative may go against the company as it can miss out on good opportunities to grow and reach their objectives.

The levels of risk appetite can be broadly categorized as “low”, “medium” and “high.” The company’s entrepreneur(s) need to assess all possible alternatives and choose the option most likely to succeed. Companies have varying levels of risk appetites for different objectives. The levels depend on:

- The type of industry
- Market pressures
- Company objectives

For example, a start-up with a revolutionary concept will have a very high risk appetite. The start-up can afford short term failures before it achieves longer term success. This type of appetite will not remain constant and will be adjusted to account for the present circumstances of the company.

Risk Appetite Statement

Companies have to define and articulate their risk appetite in sync with decisions made about their objectives and opportunities. The point of having a risk appetite statement is to have a framework that clearly states the acceptance and management of risk in business. It sets risk taking limits within the company. The risk appetite statement should convey the following:

- The nature of risks the business faces.
- Which risks the company is comfortable taking on and which risks are unacceptable.
- How much risk to accept in all the risk categories.
- The desired trade-off between risk and reward.
- Measures of risk and methods of examining and regulating risk exposures.

Entrepreneurship and Resilience

Entrepreneurs are characterized by a set of qualities known as resilience. These qualities play an especially large role in the early stages of developing an enterprise. Risk resilience is an extremely valuable characteristic as it is believed to protect entrepreneurs against the threat of challenges and changes in the business environment.

What is Entrepreneurial Resilience?

Resilience is used to describe individuals who have the ability to overcome setbacks related to their life and career aspirations. A resilient person is someone who is capable of easily and quickly recovering from setbacks. For the entrepreneur, resilience is a critical trait. Entrepreneurial resilience can be enhanced in the following ways:

- By developing a professional network of coaches and mentors
- By accepting that change is a part of life
- By viewing obstacles as something that can be overcome

Characteristics of a Resilient Entrepreneur

The characteristics required to make an entrepreneur resilient enough to go the whole way in their business enterprise are:

- A strong internal sense of control
- Ability to diversify and expand
- Strong social connections
- Survivor attitude
- Skill to learn from setbacks
- Cash-flow conscious habits
- Ability to look at the bigger picture
- Attention to detail

Tips

- Cultivate a great network of clients, suppliers, peers, friends and family. This will not only help you promote your business, but will also help you learn, identify new opportunities and stay tuned to changes in the market.
- Don’t dwell on setbacks. Focus on what you need to do next to get moving again.
- While you should try, and curtail expenses, ensure that it is not at the cost of your growth.

9.5.8 Success & Failures

Understanding Successes and Failures in Entrepreneurship

Shyam is a famous entrepreneur, known for his success story. But what most people don't know, is that Shyam failed numerous times before his enterprise became a success. Read his interview to get an idea of what entrepreneurship is really about, straight from an entrepreneur who has both, failed and succeeded.

Interviewer: Shyam, I have heard that entrepreneurs are great risk-takers who are never afraid of failing. Is this true?

Shyam: Ha ha, no of course it's not true! Most people believe that entrepreneurs need to be fearlessly enthusiastic. But the truth is, fear is a very normal and valid human reaction, especially when you are planning to start your own business! In fact, my biggest fear was the fear of failing. The reality is, entrepreneurs fail as much as they succeed. The trick is to not allow the fear of failing to stop you from going ahead with your plans. Remember, failures are lessons for future success!

Interviewer: What, according to you, is the reason that entrepreneurs fail?

Shyam: Well, there is no one single reason why entrepreneurs fail. An entrepreneur can fail due to numerous reasons. You could fail because you have allowed your fear of failure to defeat you. You could fail because you are unwilling to delegate (distribute) work. As the saying goes, "You can do anything, but not everything!" You could fail because you gave up too easily – maybe you were not persistent enough. You could fail because you were focusing your energy on small, insignificant tasks and ignoring the tasks that were most important. Other reasons for failing are partnering with the wrong people, not being able to sell your product to the right customers at the right time at the right price… and many more reasons!

Interviewer: As an entrepreneur, how do you feel failure should be looked at?

Shyam: I believe we should all look at failure as an asset, rather than as something negative. The way I see it, if you have an idea, you should try to make it work, even if there is a chance that you will fail. That's because not trying is failure right there, anyway! And failure is not the worst thing that can happen. I think having regrets because of not trying, and wondering 'what if' is far worse than trying and actually failing.

Interviewer: How did you feel when you failed for the first time?

Shyam: I was completely heartbroken! It was a very painful experience. But the good news is, you do recover from the failure. And with every subsequent failure, the recovery process gets a lot easier. That's because you start to see each failure more as a lesson that will eventually help you succeed, rather than as an obstacle that you cannot overcome. You will start to realize that failure has many benefits.

Interviewer: Can you tell us about some of the benefits of failing?

Shyam: One of the benefits that I have experienced personally from failing is that the failure made me see things in a new light. It gave me answers that I didn't have before. Failure can make you a lot stronger. It also helps keep your ego in control.

Interviewer: What advice would you give entrepreneurs who are about to start their own enterprises?

Shyam: I would tell them to do their research and ensure that their product is something that is actually wanted by customers. I'd tell them to pick their partners and employees very wisely and cautiously. I'd tell them that it's very important to be aggressive – push and market your product as aggressively as possible. I would warn them that starting an enterprise is very expensive and that they should be prepared for a situation where they run out of money. I would tell them to create long term goals and put a plan in action to achieve that goal. I would tell them to build a product that is truly unique. Be very careful and ensure that you are not copying another start-up. Lastly, I'd tell them that it's very important that they find the right investors.

Interviewer: That's some really helpful advice, Shyam! I'm sure this will help all entrepreneurs to be more prepared before they begin their journey! Thank you for all your insight!

Tips

- Remember that nothing is impossible.
- Identify your mission and your purpose before you start.
- Plan your next steps – don't make decisions hastily.

UNIT 9.6: Preparing to be an Entrepreneur

Unit Objectives

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

1. Discuss how market research is carried out
2. Describe the 4 Ps of marketing
3. Discuss the importance of idea generation
4. Recall basic business terminology
5. Discuss the need for CRM
6. Discuss the benefits of CRM
7. Discuss the need for networking
8. Discuss the benefits of networking
9. Discuss the importance of setting goals
10. Differentiate between short-term, medium-term and long-term goals
11. Discuss how to write a business plan
12. Explain the financial planning process
13. Discuss ways to manage your risk
14. Describe the procedure and formalities for applying for bank finance
15. Discuss how to manage your own enterprise
16. List important questions that every entrepreneur should ask before starting an enterprise

9.6.1 Market Study/The 4 Ps of Marketing/Importance of an IDEA

Understanding Market Research

Market research is the process of gathering, analysing and interpreting market information on a product or service that is being sold in that market. It also includes information on:

- Past, present and prospective customers
- Customer characteristics and spending habits
- The location and needs of the target market
- The overall industry
- Relevant competitors

Market research involves two types of data:

- **Primary information.** This is research collected by yourself or by someone hired by you.
- **Secondary information.** This is research that already exists and is out there for you to find and use.

Primary research

Primary research can be of two types:

- **Exploratory:** This is open-ended and usually involves detailed, unstructured interviews.
- **Specific:** This is precise and involves structured, formal interviews. Conducting specific

Secondary research

Secondary research uses outside information. Some common secondary sources are:

- **Public sources:** These are usually free and have a lot of good information. Examples are government departments, business departments of public libraries etc.
- **Commercial sources:** These offer valuable information but usually require a fee to be paid. Examples are research and trade associations, banks and other financial institutions etc.
- **Educational institutions:** These offer a wealth of information. Examples are colleges, universities, technical institutes etc.

9.6.1.1 The 4 Ps of Marketing

The 4 Ps of marketing are Product, Price, Promotion and Place.

Let's look at each of these 4 Ps in detail.

Product

A product can be tangible, like a good or intangible, like a service.

Whatever your product is, it is critical that you have a clear understanding of what you are offering, and what its unique characteristics are, before you begin with the marketing process.

Some questions to ask yourself are:

- What need does the customer have for the product/service?
- What needs does it satisfy?
- Are there any more features that can be added?
- Does it have any expensive and unnecessary features?
- How will customers use it?
- What should it be called?
- How is it different from similar products?
- How much will it cost to produce?
- Can it be sold at a profit?

Price

Once all the elements of Product have been established, the Price factor needs to be considered. The Price of a Product will depend on several factors such as profit margins, supply, demand and the marketing strategy.

Some typical questions to ask yourself include:

- What is the value of the product/service to customers?
- Do local products/services have established price points?
- Is the customer price sensitive?
- Should discounts be offered?
- How is your price compared to that of your competitors?

Promotion

Once you are certain about your Product and your Price, the next step is to look at ways to promote it. Some key elements of promotion are advertising, public relations, social media marketing, email marketing, search engine marketing, video marketing and more.

Some questions to ask yourself are:

- Where should you promote your product or service?
- What is the best medium to use to reach your target audience
- When would be the best time to promote your product?
- How are your competitors promoting their products?

Place

According to most marketers, the basis of marketing is about offering the right product, at the right price, at the right place, at the right time. For this reason, selecting the best possible location is critical for converting prospective clients into actual clients.

Some questions to ask yourself are:

- Will your product or service be looked for in a physical store, online or both?
- What should you do to access the most appropriate distribution channels?
- Will you require a sales force?
- Where are your competitors offering their products or services?
- Should you follow in your competitors' footsteps?
- Should you do something different from your competitors?

Importance of an IDEA

Ideas are the foundation of progress. An idea can be small or ground-breaking, easy to accomplish or extremely complicated to implement. Whatever the case, the fact that it is an idea gives it merit. Without ideas, nothing is possible. Most people are afraid to speak out their ideas, out for fear of being ridiculed. However, if are an entrepreneur and want to remain competitive and innovative, you need to bring your ideas out into the light.

Some ways to do this are by:

- Establishing a culture of brainstorming where you invite all interested parties to contribute
- Discussing ideas out loud so that people can add their ideas, views, opinions to them

- Being open minded and not limiting your ideas, even if the idea who have seems ridiculous
- Not discarding ideas that you don't work on immediately, but instead making a note of them and shelving them so they can be revisited at a later date.

Tips

- Keep in mind that good ideas do not always have to be unique.
- Remember that timing plays a huge role in determining the success of your idea.
- Situations and circumstances will always change, so be flexible and adapt your idea accordingly.

9.6.2 Business Entity Concepts: Basic Business Terminology

If your aim is to start and run a business, it is crucial that you have a good understanding of basic business terms. Every entrepreneur should be well versed in the following terms:

- **Accounting:** A systematic method of recording and reporting financial transactions.
- **Accounts payable:** Money owed by a company to its creditors.
- **Accounts Receivable:** The amount a company is owed by its clients.
- **Assets:** The value of everything a company owns and uses to conduct its business.
- **Balance Sheet:** A snapshot of a company's assets, liabilities and owner's equity at a given moment.
- **Bottom Line:** The total amount a business has earned or lost at the end of a month.
- **Business:** An organization that operates with the aim of making a profit.
- **Business to Business (B2B):** A business that sells goods or services to another business.
- **Business to Consumer (B2C):** A business that sells goods or services directly to the end user.
- **Capital:** The money a business has in its accounts, assets and investments. The two main types of capital are debt and equity.
- **Cash Flow:** The overall movement of funds through a business each month, including income and expenses.
- **Cash Flow Statement:** A statement showing the money that entered and exited a business during a specific period of time.
- **Contract:** A formal agreement to do work for pay.
- **Depreciation:** The degrading value of an asset over time.
- **Expense:** The costs that a business incurs through its operations.
- **Finance:** The management and allocation of money and other assets.
- **Financial Report:** A comprehensive account of a business' transactions and expenses.
- **Fixed Cost:** A one-time expense.

- **Income Statement (Profit and Loss Statement):** Shows the profitability of a business during a period of time.
- **Liabilities:** The value of what a business owes to someone else.
- **Marketing:** The process of promoting, selling and distributing a product or service.
- **Net Income/Profit:** Revenues minus expenses.
- **Net Worth:** The total value of a business.
- **Payback Period:** The amount of time it takes to recover the initial investment of a business.
- **Profit Margin:** The ratio of profit, divided by revenue, displayed as a percentage.
- **Return on Investment (ROI):** The amount of money a business gets as return from an investment.
- **Revenue:** The total amount of income before expenses are subtracted.
- **Sales Prospect:** A potential customer.
- **Supplier:** A provider of supplies to a business.
- **Target Market:** A specific group of customers at which a company's products and services are aimed.
- **Valuation:** An estimate of the overall worth of the business.
- **Variable Cost:** Expenses that change in proportion to the activity of a business.
- **Working Capital:** Calculated as current assets minus current liabilities.

9.6.3 CRM & Networking

What is CRM?

CRM stands for Customer Relationship Management. Originally the expression Customer Relationship Management meant managing one's relationship with customers. However, today it refers to IT systems and software designed to help companies manage their relationships.

The Need for CRM

The better a company can manage its relationships with its customers, the higher the chances of the company's success. For any entrepreneur, the ability to successfully retain existing customers and expand the enterprise is paramount. This is why IT systems that focus on addressing the problems of dealing with customers on a daily basis are becoming more and more in demand.

Customer needs change over time, and technology can make it easier to understand what customers really want. This insight helps companies to be more responsive to the needs of their customers. It enables them to modify their business operations when required, so that their customers are always served in the best manner possible. Simply put, CRM helps companies recognize the value of their clients and enables them to capitalize on improved customer relations.

Benefits of CRM

CRM has a number of important benefits:

- It helps improve relations with existing customers which can lead to:
  - Increased sales
  - Identification of customer needs
  - Cross-selling of products
- It results in better marketing of one's products or services
- It results in better marketing of one's products or services
- It enhances customer satisfaction and retention
- It improves profitability by identifying and focusing on the most profitable customers

9.6.3.1 What is Networking?

In business, networking means leveraging your business and personal connections in order to bring in a regular supply of new business. This marketing method is effective as well as low cost. It is a great way to develop sales opportunities and contacts. Networking can be based on referrals and introductions, or can take place via phone, email, and social and business networking websites.

The Need for Networking

Networking is an essential personal skill for business people, but it is even more important for entrepreneurs. The process of networking has its roots in relationship building. Networking results in greater communication and a stronger presence in the entrepreneurial ecosystem. This helps build strong relationships with other entrepreneurs.

Business networking events held across the globe play a huge role in connecting like-minded entrepreneurs who share the same fundamental beliefs in communication, exchanging ideas and converting ideas into realities. Such networking events also play a crucial role in connecting entrepreneurs with potential investors. Entrepreneurs may have vastly different experiences and backgrounds but they all have a common goal in mind – they all seek connection, inspiration, advice, opportunities and mentors. Networking offers them a platform to do just that.

Benefits of Networking

Networking offers numerous benefits for entrepreneurs. Some of the major benefits are:

- Getting high quality leads
- Increased business opportunities
- Good source of relevant connections
- Advice from like-minded entrepreneurs
- Gaining visibility and raising your profile
- Meeting positive and enthusiastic people

- Increased self-confidence
- Satisfaction from helping others
- Building strong and lasting friendships

Tips

- Use social media interactions to identify needs and gather feedback.
- When networking, ask open-ended questions rather than yes/no type questions.

9.6.4 Business Plan: Why Set Goals?

Setting goals is important because it gives you long-term vision and short-term motivation. Goals can be short term, medium term and long term.

Short-Term Goals

- These are specific goals for the immediate future.

Example: Repairing a machine that has failed.

Medium-Term Goals

- These goals are built on your short-term goals.
- They do not need to be as specific as your short-term goals.

Example: Arranging for a service contract to ensure that your machines don't fail again.

Long-Term Goals

These goals require time and planning.

They usually take a year or more to achieve.

Example: Planning your expenses so you can buy new machinery

Why Create a Business Plan?

A business plan is a tool for understanding how your business is put together. It can be used to monitor progress, foster accountable and control the fate of the business. It usually offers a 3-5year projection and outlines the plan that the company intends to follow to grow its revenues. A business plan is also a very important tool for getting the interest of key employees or future investors.

A business plan typically comprises of eight elements.

9.6.4.1 Elements of a Business Plan

Executive Summary

The executive summary follows the title page. The summary should clearly state your desires as the business owner in a short and business like way. It is an overview of your business and your plans. Ideally this should not be more than 1-2 pages.

Your Executive Summary should include:

- **The Mission Statement:** Explain what your business is all about.

  Example: Nike's Mission Statement

  Nike's mission statement is "To bring inspiration and innovation to every athlete in the world."
- **Company Information:** Provide information like when your business was formed, the names and roles of the founders, the number of employees, your business location(s) etc.
- **Growth Highlights:** Mention examples of company growth. Use graphs and charts where possible.
- **Your Products/Services:** Describe the products or services provided.
- **Financial Information:** Provide details on current bank and investors.
- **Summarize future plans:** Describe where you see your business in the future.

Business Description

The second section of your business plan needs to provide a detailed review of the different elements of your business. This will help potential investors to correctly understand your business goal and the uniqueness of your offering.

Your Business Description should include:

- A description of the nature of your business
- The market needs that you are aiming to satisfy
- The ways in which your products and services meet these needs
- The specific consumers and organizations that you intend to serve
- Your specific competitive advantages

Market Analysis

The market analysis section usually follows the business description. The aim of this section is to showcase your industry and market knowledge. This is also the section where you should lay down your research findings and conclusions.

Your Market Analysis should include:

- Your industry description and outlook
- Information on your target market
- The needs and demographics of your target audience
- The size of your target market

- The amount of market share you want to capture
- Your pricing structure
- Your competitive analysis
- Any regulatory requirements

Organization & Management

This section should come immediately after the Market Analysis. Your Organization & Management section should include:

- Your company's organizational structure
- Details of your company's ownership
- Details of your management team
- Qualifications of your board of directors
- Detailed descriptions of each division/department and its function
- The salary and benefits package that you offer your people

Service or Product Line

The next section is the service or product line section. This is where you describe your service or product, and stress on their benefits to potential and current customers. Explain in detail why your product of choice will fulfil the needs of your target audience.

Your Service or Product Line section should include:

- A description of your product/service
- A description of your product or service's life cycle
- A list of any copyright or patent filings
- A description of any R&D activities that you are involved in or planning

Marketing & Sales

Once the Service or Product Line section of your plan has been completed, you should start on the description of the marketing and sales management strategy for your business.

Your Marketing section should include the following strategies:

- **Market penetration strategy:** This strategy focuses on selling your existing products or services in existing markets, in order to increase your market share.
- **Growth strategy:** This strategy focuses on increasing the amount of market share, even if it reduces earnings in the short-term.
- **Channels of distribution strategy:** These can be wholesalers, retailers, distributers and even the internet.
- **Communication strategy:** These can be written strategies (e-mail, text, chat), oral strategies (phone calls, video chats, face-to-face conversations), non-verbal strategies (body language, facial expressions, tone of voice) and visual strategies (signs, webpages, illustrations).

Your Sales section should include the following information:

- **A salesforce strategy:** This strategy focuses on increasing the revenue of the enterprise.
- **A breakdown of your sales activities:** This means detailing out how you intend to sell your products or services – will you sell it offline or online, how many units do you intend to sell, what price do you plan to sell each unit at, etc.

Funding Request

This section is specifically for those who require funding for their venture. The Funding Request section should include the following information:

- How much funding you currently require.
- How much funding you will require over the next five years. This will depend on your long-term goals.
- The type of funding you want and how you plan to use it. Do you want funding that can be used only for a specific purpose, or funding that can be used for any kind of requirement?
- Strategic plans for the future. This will involve detailing out your long-term plans – what these plans are and how much money you will require to put these plans in motions.
- Historical and prospective financial information. This can be done by creating and maintaining all your financial records, right from the moment your enterprise started, to the present day. Documents required for this are your balance sheet which contains details of your company's assets and liabilities, your income statement which lists your company's revenues, expenses and net income for the year, your tax returns (usually for the last three years) and your cash flow budget which lists the cash that came in, the cash that went out and states whether you had a cash deficit (negative balance) or surplus (positive balance) at the end of each month.

Financial Planning

Before you begin building your enterprise, you need to plan your finances. Take a look at the steps for financial planning:

- **Step 1:** Create a financial plan. This should include your goals, strategies and timelines for accomplishing these goals.
- **Step 2:** Organize all your important financial documents. Maintain a file to hold your investment details, bank statements, tax papers, credit card bills, insurance papers and any other financial records.
- **Step 3:** Calculate your net worth. This means figure out what you own (assets like your house, bank accounts, investments etc.), and then subtract what you owe (liabilities like loans, pending credit card amounts etc.) the amount you are left with is your net worth.
- **Step 4:** Make a spending plan. This means write down in detail where your money will come from, and where it will go.
- **Step 5:** Build an emergency fund. A good emergency fund contains enough money to cover at least 6 months' worth of expenses.
- **Step 6:** Set up your insurance. Insurance provides long term financial security and protects you against risk.

Risk Management

As an entrepreneur, it is critical that you evaluate the risks involved with the type of enterprise that you want to start, before you begin setting up your company. Once you have identified potential risks, you can take steps to reduce them. Some ways to manage risks are:

- Research similar business and find out about their risks and how they were minimized.
- Evaluate current market trends and find out if similar products or services that launched a while ago are still being well received by the public.
- Think about whether you really have the required expertise to launch your product or service.
- Examine your finances and see if you have enough income to start your enterprise.
- Be aware of the current state of the economy, consider how the economy may change over time, and think about how your enterprise will be affected by any of those changes.
- Create a detailed business plan.

Tips

- Ensure all the important elements are covered in your plan.
- Scrutinize the numbers thoroughly.
- Be concise and realistic.
- Be conservative in your approach and your projections.
- Use visuals like charts, graphs and images wherever possible.

9.6.5 Procedure and Formalities for Bank Finance

The Need for Bank Finance

For entrepreneurs, one of the most difficult challenges faced involves securing funds for start-ups. With numerous funding options available, entrepreneurs need to take a close look at which funding methodology works best for them. In India, banks are one of the largest funders of start-ups, offering funding to thousands of start-ups every year.

9.6.5.1 What Information Should Entrepreneurs Offer Banks for Funding?

When approaching a bank, entrepreneurs must have a clear idea of the different criteria that banks use to screen, rate and process loan applications. Entrepreneurs must also be aware of the importance of providing banks with accurate and correct information. It is now easier than ever for financial institutions to track any default behaviour of loan applicants. Entrepreneurs looking for funding from banks must provide banks with information relating to their general credentials, financial situation and guarantees or collaterals that can be offered.

General Credentials

This is where you, as an entrepreneur, provide the bank with background information on yourself. Such information includes:

- **Letter(s) of Introduction:** This letter should be written by a respected business person who knows you well enough to introduce you. The aim of this letter is set across your achievements and vouch for your character and integrity.
- **Your Profile:** This is basically your resume. You need to give the bank a good idea of your educational achievements, professional training, qualifications, employment record and achievements.
- **Business Brochure:** A business brochure typically provides information on company products, clients, how long the business has been running for etc.
- **Bank and Other References:** If you have an account with another bank, providing those bank references is a good idea.
- **Proof of Company Ownership or Registration:** In some cases, you may need to provide the bank with proof of company ownership and registration. A list of assets and liabilities may also be required.

Financial Situation

Banks will expect current financial information on your enterprise. The standard financial reports you should be prepared with are:

- Balance Sheet
- Cash-Flow Statement
- Business Plan
- Profit-and-Loss Account
- Projected Sales and Revenues
- Feasibility Study

Guarantees or Collaterals

Usually banks will refuse to grant you a loan without security. You can offer assets which the bank can seize and sell off if you do not repay the loan. Fixed assets like machinery, equipment, vehicles etc. are also considered to be security for loans.

9.6.5.2 The Lending Criteria of Banks

Your request for funding will have a higher chance of success if you can satisfy the following lending criteria:

- Good cash flow
- Adequate shareholders' funds
- Adequate security
- Experience in business
- Good reputation

The Procedure

To apply for funding the following procedure will need to be followed.

- Submit your application form and all other required documents to the bank.
- The bank will carefully assess your credit worthiness and assign ratings by analysing your business information with respect to parameters like management, financial, operational and industry information as well as past loan performance.
- The bank will make a decision as to whether or not you should be given funding.

Tips

- Get advice on funding options from experienced bankers.
- Be cautious and avoid borrowing more than you need, for longer than you need, at an interest rate that is higher than you are comfortable with.

9.6.6 Enterprise Management - An Overview

To manage your enterprise effectively you need to look at many different aspects, right from managing the day-to-day activities to figuring out how to handle a large-scale event. Let's take a look at some simple steps to manage your company effectively.

Step 1: Use your leadership skills and ask for advice when required.

Let's take the example of Ramu, an entrepreneur who has recently started his own enterprise. Ramu has good leadership skills – he is honest, communicates well, knows how to delegate work etc. These leadership skills definitely help Ramu in the management of his enterprise. However, sometimes Ramu comes across situations that he is unsure how to handle. What should Ramu do in this case? One solution is for him to find a more experienced manager who is willing to mentor him. Another solution is for Ramu to use his networking skills so that he can connect with managers from other organizations, who can give him advice on how to handle such situations.

Step 2: Divide your work amongst others – realize that you cannot handle everything yourself.

Even the most skilled manager in the world will not be able to manage every single task that an enterprise will demand of him. A smart manager needs to realize that the key to managing his enterprise lies in his dividing all his work between those around him. This is known as delegation. However, delegating is not enough. A manager must delegate effectively if he wants to see results. This is important because delegating, when done incorrectly, can result in you creating even more work for yourself. To delegate effectively, you can start by making two lists. One list should contain the things that you know you need to handle yourself. The second list should contain the things that you are confident can be given to others to manage and handle.

Besides incorrect delegation, another issue that may arise is over-delegation. This means giving away too many of your tasks to others. The problem with this is, the more tasks you delegate, the more time you will spend tracking and monitoring the work progress of those you have handed the tasks to. This will leave you with very little time to finish your own work.

Step 3: Hire the right people for the job.

Hiring the right people goes a long way towards effectively managing your enterprise. To hire the best people suited for the job, you need to be very careful with your interview process. You should ask potential candidates the right questions and evaluate their answers carefully. Carrying out background checks is always a good practice. Running a credit check is also a good idea, especially if the people you are planning to hire will be handling your money. Create a detailed job description for each role that you want filled and ensure that all candidates have a clear and correct understanding of the job description. You should also have an employee manual in place, where you put down every expectation that you have from your employees. All these actions will help ensure that the right people are approached for running your enterprise.

Step 4: Motivate your employees and train them well.

Your enterprise can only be managed effectively if your employees are motivated to work hard for your enterprise. Part of being motivated involves your employees believing in the vision and mission of your enterprise and genuinely wanting to make efforts towards pursuing the same. You can motivate your employees with recognition, bonuses and rewards for achievements. You can also motivate them by telling them about how their efforts have led to the company's success. This will help them feel pride and give them a sense of responsibility that will increase their motivation. Besides motivating your people, your employees should be constantly trained in new practices and technologies. Remember, training is not a one-time effort. It is a consistent effort that needs to be carried out regularly.

Step 5: Train your people to handle your customers well.

Your employees need to be well-versed in the art of customer management. This means they should be able to understand what their customers want, and also know how to satisfy their needs. For them to truly understand this, they need to see how you deal effectively with customers.

This is called leading by example. Show them how you sincerely listen to your clients and the efforts that you put into understand their requirements. Let them listen to the type of questions that you ask your clients so they understand which questions are appropriate.

Step 6: Market your enterprise effectively.

Also, hire a marketing agency if you feel you need help in this area. Now that you know what is required to run your enterprise effectively, put these steps into play, and see how much easier managing your enterprise becomes!

Tips

- Get advice on funding options from experienced bankers.
- Be cautious and avoid borrowing more than you need, for longer than you need, at an interest rate that is higher than you are comfortable with.

9.6.7 Considering Entrepreneurship

Questions to ask yourself before considering entrepreneurship.

1. Why am I starting a business?
2. What problem am I solving?
3. Have others attempted to solve this problem before? Did they succeed or fail?
4. Do I have a mentor1 or industry expert that I can call on?
5. Who is my ideal customer2?
6. Who are my competitors3?
7. What makes my business idea different from other business ideas?
8. What are the key features of my product or service?
9. Have I done a SWOT4 analysis?
10. What is the size of the market that will buy my product or service?
11. What would it take to build a minimum viable product5 to test the market?
12. How much money do I need to get started?
13. Will I need to get a loan?
14. How soon will my products or services be available?
15. When will I break even6 or make a profit?
16. How will those who invest in my idea make a profit?
17. How should I set up the legal structure7 of my business?
18. What taxes8 will I need to pay?
19. What kind of insurance9 will I need?
20. Have I reached out to potential customers for feedback

Tips

- It is very important to validate your business ideas before you invest significant time, money and resources into it.
- The more questions you ask yourself, the more prepared you will be to handle to highs and lows of starting an enterprise.

Footnotes:

1. A mentor is a trusted and experienced person who is willing to coach and guide you.
2. A customer is someone who buys goods and/or services.
3. A competitor is a person or company that sells products and/or services similar to your products and/or services.
4. SWOT stands for Strengths, Weaknesses, Opportunities and Threats. To conduct a SWOT analysis of your company, you need to list down all the strengths and weaknesses of your company, the opportunities that are present for your company and the threats faced by your company.
5. A minimum viable product is a product that has the fewest possible features, that can be sold to customers, for the purpose of getting feedback from customers on the product.
6. A company is said to break even when the profits of the company are equal to the costs.
7. The legal structure could be a sole proprietorship, partnership or limited liability partnership.
8. There are two types of taxes – direct taxes payable by a person or a company, or indirect taxes charged on goods and/or services.
9. There are two types of insurance – life insurance and general insurance. Life insurance overs human life while general insurance covers assets like animals, goods, cars etc.