







Participant Handbook

Sector Automotive

Sub-Sector Manufacturing

Occupation Welding & Quality

Reference ID: ASC/ Q 3109, Version 1

NSQF Level 3



Welding and Quality Technician

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Automotive Skills Development Council Sector Skill Council Contact Details:

Address: Set Paul Mittal Building, 1/6, Siri Institutional Area,

Khel Gaon, New Delhi Delhi - 110049

E-mail: info@asdc.org.in Phone: 011 4186 8090

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If we have to move India towards
development then Skill Development
should be our mission.

Shri Narendra Modi Prime Minister of India







Certificate

COMPLIANCE TO QUALIFICATION PACK - NATIONAL OCCUPATIONAL **STANDARDS**

is hereby issued by the

AUTOMOTIVE SKILLS DEVELOPMENT COUNCIL

for

SKILLING CONTENT: PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/Qualification Pack: 'Welding and Quality Technician' QP No. 'ASC/Q3109 NSQF Level 3'

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humber Sunil K. Chaturvedi Chief Executive Officer, ASDC

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About this book

Indian Auto Industry is already one of the largest in the world and growing rapidly. As per Automotive Mission Plan 2016-26 the industry is projected to increase its contribution from Current level of ~7% of GDP to ~10% in the next decade. In the process, the sector will create 65 million additional jobs. The Automotive sector offers opportunities for a variety of skills. Employment or self-employment opportunities exist in every nook and corner of the country. Moreover, in line with the technological advancement in this field, there are several exciting options for a candidate to have a fulfilling career.

This book is designed for a candidate to acquire skills in Manufacturing domain for the job role of a Welding and Quality Technician. The skilling content of the handbook is as per industry's requirements and therefore will be helpful in employment and career advancement or self employment.

The content of this book is aligned to the National Occupational Standards (QP/NOS) and conforms to the National Skills Qualifications Framework (NSQF).

The Qualification pack of a Welding and Quality Technician includes the following NOS's which have been covered in the book:

- Understand welding job requirements and related processes
- Prepare the welding machine for the welding process
- Support the welder in the welding process
- Remove the finished goods and store them in the designated place
- Inspect and maintain the product quality
- Conduct quality checks and inspection of the finished metal cast products
- Conduct regular cleaning and maintenance of the equipment
- Maintain a safe and healthy working environment
- Maintain 5S at the work premise

ASDC team wishes best of learning to candidates!

Symbols Used



Key Learning Outcomes



Steps



Time



Tips



Notes



Unit Objectives

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Introduction

Unit 0.1 – Welding: An Introduction

Unit 0.2 – Shielded Metal Arc Welding (SMAW): An Introduction

Unit 0.3 – Gas Metal Arc Welding (GMAW): An Introduction

Unit 0.4 – Resistance Welding Procedures: An Introduction

Unit 0.5 – Basics of Measurement: An Introduction



Key Learning Outcomes



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

- 1. state the different types of joining processes;
- 2. describe the welding process;
- 3. explain the importance of welding;
- 4. describe SMAW Welding;
- 5. describe GMAW Welding;
- 6. describe Electric Resistance Welding (ERW) process;
- 7. describe Spot Welding process;
- 8. describe Seam Welding process;
- 9. identify and recognize basic measurement systems;
- 10. differentiate between various measurement systems;
- 11. list the various measuring tools and its function;
- 12. identify the required measuring tools for a task.

UNIT 0.1: Welding – An Introduction

- Unit Objectives



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

- 1. state the different types of joining processes;
- 2. describe the welding process;
- 3. explain the importance of welding.

0.1.1 Joining Process



There are many types of joining processes:

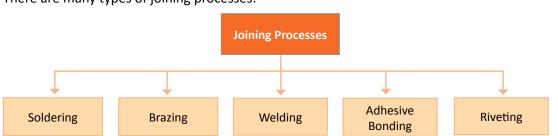


Fig. 0.1.1.1 - Joining Processes

Among these the most widely used joining process is welding.

Welding Process

This flow chart below explains how two metal pieces are joined.

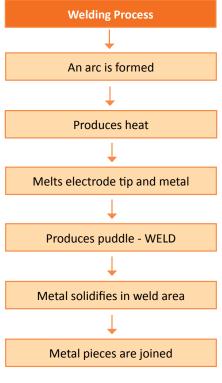


Fig. 0.1.1.2 - Welding Process

• Importance of Welding

Welding is popular because it is:

- Cost effective
- Versatile
- ◆ Permanent
- ◆ Strong
- ◆ Leak proof

UNIT 0.2: Shielded Metal Arc Welding (SMAW) - An Introduction

Unit Objectives



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

1. describe SMAW Welding.

0.2.1 Shielded Metal Arc Welding (SMAW) -

It is an arc welding process where an electric arc is used to produce the heat required for the welding. The electric arc develops when electricity jumps across an air gap between the end of the metallic electrode and the welding job surface. The metallic electrode is generally coated with the flux which is consumable. The arc created due to the ionization of air between the electrode tip and the base metal generates an intense arc heat having a temperature between 3600C-4000 C. The welding current is provided by an AC or DC machine. The forceful heat of the arc melts a small portion (Molten pool) on the job directly under the arc and towards the end of the electrode instantaneously.

The melted electrode fuses in to the molten pool of the welding job and produces a homogeneous weld on cooling. The flux coating on the electrode also melts and provides a gaseous shield around the arc which secures the molten metal from atmospheric contamination. Hence this is called shielded metal arc welding (SMAW).

The welding speed and feed of the electrode is controlled manually by the welder himself. It is also called manual metal arc welding (MMAW). When the weld metal solidifies, the slag (Of flux coating) gets deposited on its surface as it weighs little than the metal and the weld metal is allowed to cool gradually and slowly.

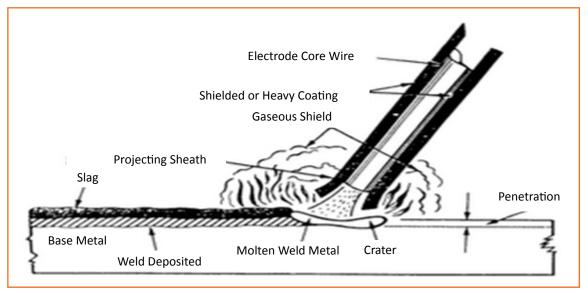


Fig. 0.2.1 - Shielded Metal Arc Welding

UNIT 0.3: Gas Metal Arc Welding (GMAW) - An Introduction

Unit Objectives



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

1. describe GMAW Welding.

0.3.1 Gas Metal Arc Welding (GMAW)-

Gas metal arc welding (GMAW) is also known by its sub types, such as metal inert gas (MIG) welding or metal active gas (MAG) welding. It is a wielding process in which there is a formation of an electric arc between a consumable wire electrode and the work piece metal(s). This electric arc provides heat to the work piece metal(s), leading them to melt and join.

Besides the wire electrode, wielding gun supplies shielding gas, which protects the process from contaminants in the air. The process can be semi-automatic or automatic. A constant voltage, direct current power source is generally used with GMAW; however, constant current systems, as well as alternating current, can be used. There are four main methods of metal transfer in GMAW, such as globular, short-circuting, spray, and pulsed-spray. These methods have different properties from each other but equivalent advantages and limitations.

Originally developed for welding aluminum and other non-ferrous materials in the 1940s, GMAW was soon applied to steel because it provided faster welding time compared to other welding process. After several years, the use of inert gas was restricted in steel unit due to its cost, when the use of semi-inert gases such as carbon dioxide became common. During the 1950s and 1960s, the process was further evolved that made it more adaptable; hence, it became a highly utilized industrial process. At present, GMAW is the most preferred industrial welding process due to its speed and ability to adapt the process of robotic automation. Unlike welding process that do not employ a shielding gas, such as shielded metal arc welding, it is rarely used outdoors or in other areas of air volatility. Flux cored arc welding is an associated process that uses an electrode wire, which is hollow and filled with flux, however, it avoids the use of a shielding gas.

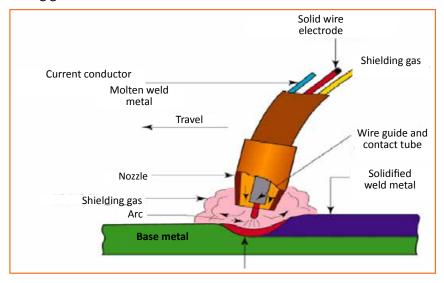


Fig. 0.3.1 - Gas Metal Arc Welding

UNIT 0.4: Resistance Welding Procedures - An Introduction

Unit Objectives



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

- 1. describe Electric Resistance Welding (ERW) process;
- describe Spot Welding process;
- 3. describe Seam Welding process.

0.4.1 Electric Resistance Welding (ERW)

Electric resistance welding (ERW) refers to a group of welding process such as spot and seam welding that produce coalescence of faying surfaces where heat to form the weld is generated by the electrical resistance of material combined with the time and the force used to hold the materials together during welding. Some factors influencing heat or welding temperatures are the proportions of the workpices, the metal coating or the lack of coating, the electrode materials, electrode geometry, electrode pressing force, electrical current and length of welding time. As an electrical current (100-100,000 A) is transferred through the metal, small pools of molten metal are developed at the faying surfaces, which is the point of most electrical resistance. In general, resistance welding methods are efficient and cause little pollution, however, their applications are limited to relatively thin materials and the equipment can be expensive (although in production situations the cost per weld may be low).

0.4.2 Spot Welding

Spot welding, a resistance welding method, is helpful to combine two or more overlapping metal sheet, studs, projections, electrical wiring hangers, some heat exchanger fins, and some tubing. Generally power sources and welding equipment are sized to the specific thickness and material being welded together. The output of the wielding power source restricts the thickness; as a result, the current required for each application causes the variation in the equipment. The contaminants between the faying surfaces are removed with caution. Generally, the metal sheets are held together by two copper electrodes and to transfer current through the sheets. The intense heat is produced when the current is transferred from the electrodes to the sheets. As the heat is collected in the work pieces between the copper electrodes because of the electrical resistance of the material, the increasing temperature affects a rising resistance, and causes a molten pol contained most of the time between the electrodes. The resistance welding time is usually fixed as a quantity of AC cycles of milliseconds, so the heat disappears across the work piece in less than a second. At this moment, the molten or plastic state grows to meet the welding tips. The metal hardens under pressure as the copper tips cool the spot weld.

0.4.3 Seam Welding

A process that generates a weld at the faying or connecting surfaces of two like metals is known as seam welding. The seam may be referred as a butt joint or an overlap joint and is usually an mechanized process. However, seam welding varies from butt welding. The latter typically welds the whole joint at once and the former develops the weld gradually, beginning at one end. Similar to spot welding, seam welding depends on two electrodes, usually made from copper, to apply pressure and current. The electrodes are disc shapped and rotate as the material passes between them. This allows the electrodes to stay in constant contact with the material to make long continuous welds. The electrodes may also move or assist the movement of the material.

Unit 0.5: Basics of Measurement: An Introduction

Unit Objectives



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

- 1. identify and recognize basic measurement systems;
- 2. differentiate between various measurement systems;
- 3. list the various measuring tools and its function;
- 4. identify the required measuring tools for a task.

0.5.1 Units of Measurement

Commonly used systems of measurements are:

- 1. CGS Centimeter Gram Second
- 2. FPS Foot Pound Second
- 3. MKS Meter Kilogram Second

However, now-a-days SI (International System of Units) is used across the globe as a standard system of measurement. It is an extension of MKS system of measurement.

S. No	Unit	Length (L)	Mass (M)	Time (T)
1	CGS	Centimeter (cm)	Gram (gm)	Second (sec)
2	FPS	Foot (ft.)	Pound (lb)	Second (sec)
3	MKS	Meter (m)	Kilogram (Kg)	Second (sec)

Table 0.5.1.1 - Systems of measurement

SI system has 7 fundamental units and 2 supplementary units, while there are a number of derived units.

S. No	Measuring	S I Units
1	Length	Meter
2	Mass	Kilogram
3	Time	Second
4	Intensity of Electric current	Ampere
5	Thermodynamic Temperature	Kelvin or degree Celsius
6	Quantity of substance	Mole
7	Luminous Intensity	candela

Table 0.5.1.2 - 7 fundamental units of SI system

Supplementary Units in SI system

Plane Angle: Radian Solid Angle: Steradian

Few Derived Units in SI System

S. No	Measuring	S I Units
1	Area	Sq. mtr
2	Volume	Cu.mtr
3	Speed	m/sec
4	Acceleration	m/sq sec
5	Density	Kg/cu.m
6	Force	Newton
7	Pressure	Pascal

Table 0.5.1.3 - Supplementary Units in SI system

Additional Information:

A physical quantity can be depicted in different units. Here is a quick run through of Unit Conversion.

Length

- 1 inch [in] = 2.54 cm
- 1 foot [ft] = 12 in = 0.3048 m
- 1 yard [yd.] = 3 ft = 0.9144 m
- 1 mile = 1760 yd. = 1.6093 km

Area

- 1 sq. inch = 6.4516 sq.cm.
- 1 sq. foot = 144 sq.in = 0.0929 sq. m.
- 1 sq. yd. = 9 sq. ft. = 0.8361 sq. m.
- 1 acre = 4840 sq. yd. = 4046.9 sq. m.
- 1 sq. mile = 640 acres = 2.59 sq. km.

0.5.2 Use of Measuring Instruments

Measurement is defined as an activity of obtaining and comparing the physical quantities/ dimensions of components in terms of standard units. For a person working in a machine shop it is imperative to know the method of measurement and know the tools that are required for measurement.

Primarily, measurement is of two types:

- **1. Linear Measurement:** Linear Measurement includes measurement of lengths, diameters, heights, depths, thickness etc.
- **2. Angular Measurement:** Angular Measurement includes measurement of angles, tapers etc.

Some common tools used in measurement are; steel rule, callipers, surface gauge, plug gauge, micrometer, dial gauge etc.

Steel Rule

Steel Rule is a flat and thin linear measurement instrument. It is the most commonly used measuring instrument. Steel rule is manufactured from stainless steel. The edges of the rule are accurately ground to form straight edges. Steel rules are available in different sizes like 150 mm, 300 mm and 600 mm. usually; the reading accuracy is around 0.5 mm.

There are different types of rules available. Few commonly used are:

- Engineer's rule
- Folding rule
- Flexible rule
- Hook rule



Fig. 0.5.2.1 - Steel Rule



Fig. 0.5.2.2 -Engineer's Rule

Calipers

Calipers are measurement devices used to measure distance between two opposite ends of an object. A caliper can be as simple as a drafting compass, with inwards or outward facing points. The tips of the caliper are adjusted to fit across the points to be measured, the caliper is then expelled and the separation between the tips is measured with a measuring device, such as a ruler.

Few common types of calipers are:

• **Inside Calliper:** These calipers are used to measure inside size of an object. The caliper can be manually adjusted or screw-adjusted.

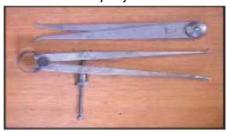


Fig. 0.5.2.3 - Inside Calliper

• **Outside Calliper:** These calipers are used to measure external size of an object. These are commonly used to measure pipe diameters.



Fig. 0.5.2.4 - Outside Calliper

Divider Calliper: In metal working, divider calipers are used for marking work-pieces.
The tips are sharpened to act as scribers, one leg can then be located in the dimple
made by a center or prick punch and the other leg pivoted so that it scribes a line on
the work-piece's surface, thus forming an arc or circle.



Fig. 0.5.2.5 - Divider Calliper

 Odd leg or Jenny Callipers: These calipers have one straight pointed leg and other inward curved leg. These are generally used for marking lines parallel to straight edges and also for transferring dimensions. Odd leg or Jenny callipers are also used to find center of a rod.



Fig. 0.5.2.6 - Odd leg or Jenny Callipers

In certain cases, there is a need of precision while doing measurements. In such cases, regular measuring tool like rules or callipers are not recommended. In these scenarios precision measuring tools are used.

Precision of a measurement system or tool is the degree under which repeated estimations under unaffected conditions display the same result.

Few commonly used precision measuring tools are:

- Micrometer
- Vernier Calliper
- Height Gauge
- Depth Gauge

Micrometer:

Micrometers are precision measurement devices that are used to measure small dimensions. There are two types of micrometers viz. inside and outside.

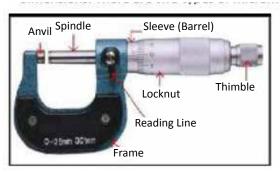


Fig. 0.5.2.7 - Micrometer

Outside or External Micrometer:

Outside micrometers are used to measure shafts, pipe, plate thickness etc.

The parts of an outside micrometer are:

- Frame: Frame of a micrometer is a C-shaped component that clamps the other parts of the micrometer. The frame is usually made of drop-forged steel and is heavy with high thermal mass. The high thermal mass is to prevent heating up and to reduce flexion, expansion and contraction.
- **Anvil:** The projected portion of the frame, which extends to at least 3mm, is known as anvil. It is one of the measuring faces. An anvil is manufactured from alloy steel and in finished to a perfectly flat surface.

- **Spindle:** The spindle of a micrometer grips the job against the anvil. The movement of the thimble causes the spindle to move towards the anvil.
- **Sleeve:** It is also known as barrel or stock. Sleeve is a stationary round part on which datum line and graduations are marked.
- **Thimble:** It is a cylindrical cover attached to the spindle and moves with the spindle. It is has a beveled edge and is divided into 50 equal parts. The divisions are marked as 0, 5, 10, 15...... 45.
- Ratchet Stop: It is an extension to the thimble. Ratchet stop ensures even pressure between the gauging surfaces.
- Lock Lever or Lock Nut: It is used to lock the spindle at a desired position.

Principle of a Micrometer

Micrometers use the principle of a screw to increase small distances (that are too small to measure directly) into large rotations of the screw that are big enough to read from a scale.

The basic operating principles of a micrometer are as follows:

- 1. The measure of rotation of a precisely made screw can be specifically and accurately related to a specific measure of axial movement (and like versa), through the constant known as the scew's pitch. A screw's pitch is the distance it moves forward axially with one complete turn (360.........?).
- 2. With an appropriate pitch and major diameter of the screw, a given amount of axial movement will be increased in the subsequent circumferential development.

Reading a Micrometer

To take a reading from a micrometer, following things need to be observed:



Fig. 0.5.2.8 - Reading a Micrometer

- 1. First note the minimum range of the outside micrometer. For instance, while measuring a 50-75 mm micrometer, the minimum range in 50 mm.
- 2. Now read the sleeve or barrel graduations. The value of the visible lines to the left of the thimble edge is to be read.
- 3. The next step is to read the thimble graduations. The value of thimble graduation in line with sleeve or barrel is to be read,
- 4. The value of the thimble reading is then multiplied by the least count, which is 0.01 mm.
- 5. The final reading is the sum of the minimum range, sleeve reading and the thimble reading.

Inside Micrometer

Inside micrometers are used to obtain measurement of internal sizes like diameters of holes, pipes etc.



Fig. 0.5.2.9 - Inside Micrometer

The principle of an inside micrometer is similar to that of the outside micrometer. Now-a-days, electronic micrometers are being used. The electronic micrometer has a least count of 0.001 mm, thereby higher accuracy.

Vernier Caliper

A Vernier calliper is a measuring unit that precisely measures (read) distances or angle measurement more accurately than a normal scale or rule. It is simply a Vernier scale mounted on a measuring instrument. Vernier Calipers are available in both digital and manual versions. This instrument can be used to measure internal as well as external dimensions. The main components of a Vernier Caliper are:

- Internal Jaws and External Jaws: To measure internal and external dimensions
- Locking Screws: To tighten or loosen the object held in jaws.
- **Scale:**To read the measurement.
- **Depth measuring blade:** To measure depth.

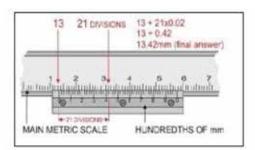


Fig. 0.5.2.10 - Vernier Caliper

Using and Reading a Vernier Calliper

- Loosen the locking screw and move the slider to check if the Vernier scale works properly and ensure that the caliper displays or reads 0 when fully closed. If the reading is not 0, adjust the caliper's jaws until you get a 0 reading. If you can't adjust the caliper to 0, remember to add to subtract the correct offset from your final reading.
- Close the jaws lightly on the item which you want to measure (For example a round steel ball)

- The main metric scale is read first and for example says this shows that there are 13 whole divisions before the 0 on the hundredths scale. Therefore, the first number is 13.
- The 'hundredths of mm' scale is then read. The most ideal to check the quantity of divisions until you get to the division that lines up with the fundamental metric scale. This is 21 divisions on the hundredths scale.
- This 21 is duplicated by 0.02 giving 0.42 as the appropriate response (each division on the hundredths scale is comparable to 0.02mm)
- The 13 and the 0.42 are included to give the last estimation of 13.42mm (the diameter of the piece of round section steel).

> Height Gauge

A digital height gauge is precision measuring device used specifically for measuring height of two points. Advanced electronic (digital) height gauges can be used to carry out different tasks like measuring step heights, internal/external diameters and center-line distances. The electronic height gauge has a precision of up to 0.0254 mm. and claims consistency of ± 0.00254 mm. The conventional height gauges are similar to VernierCalipers, except that the fixed jaw is shaped like a base. The scale is graduated on both sides, one side being graduated for internal measurement. The main scale for external measurement starts at 1 inch. This allows for the combined width of the base and movable jaw, when the jaws are in contact. The gauge can be converted into a form of scribing block (to mark the work piece) by attaching an extension arm, beveled to a sharp edge, to the movable jaw.

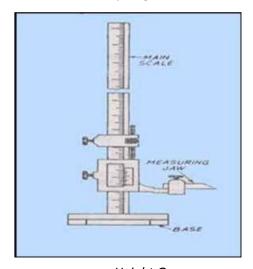


Fig. 0.5.2.11 - Height Gauge

Exercise



1. Choose the correct answer

- a. Which of these are two types of measurement?
 - i. Vertical and Horizontal
 - ii. Long and Short
 - iii. Linear and Angular
 - iv. None of these
- b. What is the least count of a micrometer?
 - i. 0.1 mm
 - ii. 0.01 mm
 - iii. 0.0001 mm
 - iv. None of these
- c. What is the use of locking screw in a Vernier Calliper?
 - i. To read measurement
 - ii. To tighten or loosen object held in the jaw
 - iii. To provide a level surface
 - iv. None of these

2. Fill in the Blanks

- a. Linear measurement includes measurement of lengths, heights, thickness etc., while angular measurement includes measurement of ______ and tapers.
- b. Micrometers use the principle of a ______ to increase small distances (that are too small to measure directly) into large rotations of the screw.
- 3. SI system is an extension of which system of measurement:
 - a. CGS
 - b. FPS
 - c. MKS
 - d. None of these
- 4. Match the unit of Length with their measurement system:

Column A	Column B	
CGS		Foot
FPS		Meter
MKS		Centimeter

- 5. How many Fundamental units are there in SI system?
 - a. 7
 - b. 8
 - c. 6
 - d. 5
 - e. 4

Votes			









Gas Metal Arc Welding (GMAW) – Before Welding

Unit 1.1 - Why GMAW

Unit 1.2 - Parts of a GMAW Machine and Accessories

Unit 1.3 - Setting Up a GMAW Outfit

Unit 1.4 - Operating Parameters of GMAW

Unit 1.5 - Process Parameters of GMAW

Unit 1.6 – Techniques of GMAW Operation

Unit 1.7 - Process Parameters of GMAW



Key Learning Outcomes



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

- 1. list the reasons why GMAW is popular;
- 2. Identify the parts of a GMAW machine;
- 3. state the function of each part;
- 4. set up a GMAW outfit such that it is ready for the welding process;
- 5. implement maintenance of welding equipment;
- 6. list the parameters of a GMAW process;
- 7. identify the part required to set the parameters of a GMAW process;
- 8. list the modes of metal transfer in a GMAW process;
- 9. select the process parameters based on the nature of the job;
- 10. explain the various techniques of GMAW operation;
- 11. explain applications of GMAW in different industries.

UNIT 1.1: Why GMAW

Unit Objectives



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

1. list the reasons why GMAW is popular.

1.1.1 Introduction to GMAW

GMAW or Gas Metal Arc Welding was introduced in the late 1940's and has been the most popular forms of welding till now.

The most important reason for its popularity is that it is a mechanised process. The arc gap, which is the measure for quality is maintained steady with the aid of a mechanised vertical motion. Hence vertical motion is standardised, removing the chance of human error.

Therefore, when compared to other processes, GMAW proves to be more efficient and more reliable in terms of reducing defects and producing a strong weld.

1.1.2 Merits of GMAW



Fig. 1.1.2 - Advantages of GMAW

- Usability: The degree of usability with the GMAW process is very high as compared to
 other processes. The GMAW process can be used to weld all metals with appropriate filler
 metal and gas. These include carbon steel, alloy steels, stainless steel, aluminium, cast
 iron, etc.
- **High Strength:** Strength is defined by the penetration of the weld metal, which in turn is defined by the current density. In the GMAW process, due to the small size of electrode, current density is very high and so is the strength of the weld metal.
- **High Productivity:** Productivity is defined by the rate of metal deposition. Metal deposition is governed by the current density. Since current density is much higher in GMAW process than in SMAW, the productivity is also very high.
- Less Distortion: The main reason for lesser distortion is less heat input. Heat input in GMAW is very less when compared to that in SMAW because of the higher productivity.
- **Savings in Consumables:** The consumable which is used in GMAW is considerably far less than in SMAW, for a job of similar nature.
- **Error Reduction:** The GMAW process is considerably enhanced and improved over other methods of welding. This is done by automation of the process. The welder does not have to concentrate on two different motions as the vertical motion is mechanized and the quality of the weld does not primarily depend on the skill of the welder.
- Ease of Operation: The basic reason for this is fewer starts and stops during welding by the GMAW process. This is because the welder needn't stop the welding process to change the electrode. The electrode is fed automatically. Therefore, the welder has to only concentrate on one motion, thus making it easier for him to operate the GMAW process. Another reason is the exposure to heat for a welder is much less than when compared to SMAW process and so, the welder is much more comfortable working.
- **Single Size of Consumable:** In GMAW process, we use a single size of consumable, by and large, to do welding on thin to thick plates. Thus, the GMAW process, not only saves the need for changing the electrodes, but it also saves on inventory.

1.1.3 Limitations of GMAW Process

The major limitations of GMAW are:

- **1. Shielding Depletion:** A wind flow rate of 4 miles per hour can affect the welding and contaminate the weld and hence, it should be avoided at all stages of welding process.
- 2. Approach for the Torch: In GMAW, the approach for the torch to reach the weld joint should not have any obstruction. If approach is restricted then the weld can't be laid and hence need to do that joint with some other process where in the approach shall not be a problem.

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1.	State	whether	the	following	statements	are	true or	·false.
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- a. The distortion in a SMAW process is less than GMAW process.
- b. The vertical motion in GMAW is mechanised and so it is a better welding process than SMAW.
- c. Strength is defined by penetration of the weld metal.

2. Match the statements in column A with the corresponding options in column B to complete the sentences.

	Column A		Column B
a.	GMAW process can be used to	i.	automated
b.	The rate of metal deposition is called	ii.	heat input
C.	The reason for distortion is	iii.	current density
d.	In GMAW the vertical motion is	iv.	productivity
e.	High strength is due to high	V.	weld all types of metals

3. Fill in the blanks

- a. The air flow of _____ miles per hour can deplete the shield cover of welding process.
- b. We use a _____ size of consumable for GMAW processes.

Notes			

UNIT 1.2: Parts of a GMAW Machine and Accessories

Unit Objectives



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

- 1. identify the parts of a GMAW machine;
- 2. state the function of each part.

1.2.1 Introduction-

The parts of the GMAW machine can be illustrated as follows:

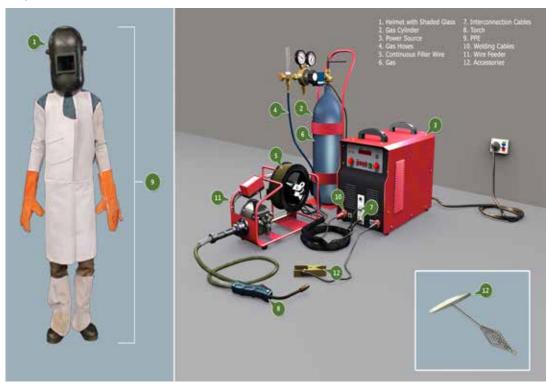


Fig. 1.2.1 - The parts of the GMAW machine

1.2.2 Parts of a GMAW Machine

The various parts of a GMAW machine are given below, along with their functions.

• Gas

The gas shields the weld metal from atmosphere contamination, thus strengthening the weld. The selection of gas has to be made on the basis of material and process requirement.

The commonly used shielding gases for GMAW process are carbon dioxide, argon, helium and their mixtures.

GMAW process is also called as the MIG-MAG process. MIG Process is Metal Inert Gas, where inert gases like argon and helium are used. MAG is Metal Active Gas, where carbon dioxide, which is an active gas, is used.

Carbon dioxide, at arc temperature, breaks down to carbon and oxygen. Just above the arc zone, carbon and oxygen recombine to form carbon dioxide. This chemical reaction is exothermic, which means that it produces additional heat than what is generated by the arc.

Power Source

The power source delivers the power to strike an arc for welding. The power source input supply is 440/220 volts from the Electricity Board.

For welding operation, high current, low voltage is required. The power source converts the input supply of high voltage, low current to low voltage, high current.

All GMAW power sources are constant potential power sources. The arc gap signifies the quality of welding is being maintained steadily by the GMAW welding machine. This is done using a self-corrective mechanism.

Normally, voltage is set on the power source.

The types of power sources are rectifier power source, thyristor rectifier power source and inverter power source.

Wire Feeder

Unlike SMAW process, wherein the welder is a wire feeder, we have a dedicated wire feeding mechanism in this process.

Current is nothing but the wire feed rate, which is set on the wire feeder. The wire feeder is a two-roll/ four-roll/planetary drive mechanism operating on pinch force effect.

Appropriate pressure settings shall ensure smooth uninterrupted delivery of wire through the torch to the arc zone.

Torch

The torch is the business end of the operation. This is because the torch is where all the parameters come into action, allowing it to deliver the power to generate the arc.

Torches are available in gas-cooled and water-cooled, as well as in unitised and non-unitised versions. The appropriate torch is chosen on the basis of the duty cycle of operation.

Torch conveys the wire from the outlet of the wire feeder to the arc zone through a contact tip. The wire is energised only at the contact tip, just before it arcs and gets deposited as weld metal. The torch also conveys the gas to the weld zone to provide a protective shield.

Since the torch is directly in the heat area, certain components of it are classified as consumable spares. These are bound to wear off over a period of usage. Eg., contact tip, nozzle, tip holder, etc.

A torch is not a single unit – it is made up of a variety of different parts. These parts can be categorised as per the diagram below.

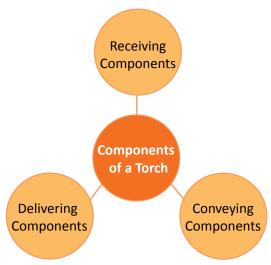


Fig. 1.2.2 - Components of a Torch

Continuous Filler Wire – Welding Consumable

The continuous filler wire draws the current to generate the heat on striking an arc. Welding consumable is selected based on the base material. Normally, for carbon steel, the continuous filler wire is of the grade ER 70S6.

For 308 stainless steel grade material, ER308L grade material filler is used.

• Gas Cylinder with Regulator and Flow Meter

The gas cylinder provides the shielding gas, which is needed to secure the weld metal. The gas is filled in the cylinder under high pressure. A regulator is used to release the gas at operating low pressure range. The flow of the gas is further regulated using a flow meter, which is attached to the outlet of the regulator.

Welding Cables

The welding cable conveys the power from the power source to the torch which is connected to the wire feeder. Correct size of cables as per recommendation, based on the current delivered, has to be used.

Interconnection Cable

The interconnection cable or control cable delivers the power required for the wire feeder from the power source. It delivers the power required for the function of the wire feeder motor. It also delivers the power for the operation of solenoid valve, which controls gas flow. It transmits the control board outputs to ensure sequential operation of the various functions on pressing the torch trigger switch.

Gas Hoses

The gas hoses deliver the gas from the cylinder to the welding area through the wire feeder and torch. There should not be any leakage while delivering the gas from the flow meter to the wire feeder, which is the function of the gas hose.

Helmet with Shaded Glass

The helmet is used to view the arc through the suggested shaded glass as per the recommendation. It facilitates the use of both hands for effectively controlling the weld puddle. Selection of shade of glass shall be as per the recommendation chart based on the current.

Accessories

Welding accessories include the earth clamp with cable, wire brush and chipping hammer. The accessories are used to finish the post operations after welding.

Personal Protective Equipment (PPE)

The PPE protects the welder from the ill-effects of heat and light.

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a. Wearing the PPE is optional. _____

b. The torch is the business end of the GMAW operation.

2. Match the statements in column A with the corresponding options in column B to complete the sentences.

	Column A		Column B
a.	Gas Cylinder	i.	Helps to complete the post-welding operations
b.	Accesories	ii.	Conveys power from the power source to the torch.
c.	Welding Cable	iii.	Releases the gas at low pressure
d.	Regulator	iv.	Stores the gas under high pressure

3. Fill in the blanks.

- a. Voltage is set at the ______.
- b. The appropriate shaded glass for the welding helmet is selected as per the ______.

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UNIT 1.3: Setting Up a GMAW Outfit

Unit Objectives



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

- 1. set up a GMAW outfit such that it is ready for the welding process;
- 2. implement maintenance of welding equipment.

1.3.1 Components of a GMAW Outfit

Components of a GMAW Outfit

Let's take a look at all the different components that are required to set up a GMAW outfit.

Components of a GMAW Outfit

1. Accessories

4. Helmet with **Shaded Glass** 7. Base Plates

10. Work Table

2. Return Cable with Earth Clamp 5. Welding Cables

8. Gas Cylinder

11. Interconnection Cable

3. Torch

6. Wire Feeder

9. Power Source with Input Power 12. PPE

1.3.2 Setting up the Cylinder 💾



First, the gas cylinder needs to be set up. The steps for setting up the cylinder are:

- 1. Attach the cylinder to the stand.
- 2. Flush out some gas to clear the valve of dust.
- 3. Connect the regulator to the outlet valve of the cylinder.
- 4. Open the cylinder slightly so that the regulator registers the cylinder pressure at the inlet gauge.
- 5. Connect the flow meter to the regulator.
- 6. Connect the gas hose to the flow meter and power source or wire feeder.
- 7. Engage the knob in the regulator.

1.3.3 Setting up the Torch



Next, the torch needs to be set up using the following:

- 1. Feed the liner carefully through the bikox cable.
- Connect the contact tip holder, contact tip and nozzle on to the neck.

1.3.4 Setting up the Wire Feeder



Using the following steps, set up the wire feeder.

- 1. Connect the wire feeder to the power source using the interconnection cable.
- 2. Connect the positive terminal of the power source through the welding cable to the wirefeeder.
- 3. Mount the MIG welding wire coil on the wire feeder and pull out the wire through the coil.
- 4. Set the pressure on the rollers.
- 5. Connect the torch to the wire feeder.

1.3.5 Setting up the Power Source



The steps for setting up the power source are as follows.

- 1. Connect the input power cable to the main power supply while the power supply is switched off.
- 2. Ensure that the welding cable from the positive terminal has been connected to the wire feeder without any loose connection.
- 3. Ensure that the control cable or interconnection cable from the wire feeder is joined to the power source rigidly.
- 4. Connect the return earth cable from the negative terminal of the power source using an earth clamp onto the work table.
- 5. Turn on the main switch to enable the power source to be connected with the electricity board supply.
- 6. Set the ON/OFF switch in the 'ON' position to energise the power source.

1.3.6 Preventive or Self Maintenance of Welding-Equipment

Here are five common problems with MIG equipment, along with some reliable solutions that You have learned, if conducted regularly, will keep our good day from going bad.

1. Drive Rolls Not Cleaned or Adjusted Properly: The drive roll groove (and knurls on rolls so configured) can become packed with the drawing compound (used during wire manufacturing to reduce the size of nearly all the solid or flux-cored wire used in the MIG applications), industrial grit from grinding, and smoke from welding. This can cause the tensioning and hold on the wire. Knurled rolls used for FCAW wires are more influenced than Smooth rolls used for solid wire.

Solution: To remove the accumulation of drawings compound, dust and dirt that would cause the pressure and grip the rolls would have on the wire, clean the drive rolls with a wire brush occasionally by removing them. At the same time, examine the drive rolls for wear. They will wear out, especially if knurled.

2. Drive Roll Pressure Too High: It's common, when a feeding problem arises, to tighten the drive rolls in order to grip the wire better, to overcome the problem. This is especially true when using knurled rolls for flux-cored wire. Using drive roll pressure, the flux-cored wire can change its shape from round to oval, which is possible due to its construction. This wire also develops 'teeth' when knurled rolls are used. These teeth will start to wear the liner, guides, and tip like a saw. On the other hand, solid wire cannot be reshaped with knurled drive rolls, however, it will develop 'teeth' and similar wear.

Solution: Occasionally, an air nozzle and shop air pressure to blow out the liner can be used before feeding the wire through the cable/hose assembly. This can be done initially from the torch end and then, if possible, from the feeder end. The amount of small debris blown out of the liner will surprise you. Shavings from the wear and wire has a tendency to pack up the liner at non-contact points and junctions (diffuser/tip.) This will affect the wire to chatter, or stop feeding altogether. It also deteriorate the liner more rapidly.

3. Worn Spring Liner: The spring liner can utilized for almost all cable/hose assemblies since it is detachable and replaceable. Nearly all spring liners have at least two constant bends. One coming out of the feeder, the other in the torch neck. The wire brushes the same spot and wears a groove in the liner. This turns out to be a high-friction area as the groove deepens, and the more bends that are permanent increases the drag on the wire, causing it to "birdnest" at the torch inlet or just stop feeding.

This is also one of causes of the chatter that frustrates welders.

Solution: Occasionally index the liner, remove and inspect it. A kink in the liner will cause a feeding problem. Blow out the liner guide, turn the liner 90°-180° and reinstall it. (You did index it before you pulled it out, didn't you?) This will present a fresh area in the liner to the wear of the moving wire. Eventually you will need to replace the liner, but doing this can extend the service life by three or four times what it normally would be.

4. Diffuser / Tip Problems: The most commonly replaced item in a torch assembly is the tip. Because the tip is at the business end of the torch, it receives the lion's share of the abuse from the heat, spatter, and the operator.

Solution: Aside from normal wear that results in the need for replacement, the tip is rarely the cause of feeding problems. But, it does show the results of the problem. There is a guarantee that the issue is developed in one of the discussed areas if the tip has been supplanted and feeding problems continue.

5. Check Your Ground: A bad ground can introduce itself as a stutter and make the wire execute as if it needs voltage or speed change. A lack of shielding gas coverage, liner or tip grab, or base metal contamination, will cause porosity.

Solution: Intermittently check the ground at the power source, wire feeder, and work clamp. A tip with burn-back and spatter can be abolished by a bad ground.

The utilization of commonly available wire lube and cleaner, good for MIG and FCAW is one of the easiest approaches to keep up feeding characteristics, if everything else is correct. Another good idea for protecting the consumables (nozzle and tip) is nozzle dip. These products won't correct for drive rolls issues, worn liners, or weak grounds, however, when utilized by the manufacturer's suggestions and the previously mentioned tips, they will promote much longer component life, fewer feeding problems, and many more good days than bad ones.

Exercise	0
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1.	State whether	the following	statements	are true	or false.
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- a. The bikox cable is part of the torch. _____
- b. The power source is set up first. _____

2. Given below are the steps for setting up a cylinder. Rearrange them in the correct order.

a.	Flush out some gas to clear the valve of dust.
b.	Connect the regulator to the outlet valve of the cylinder.
C.	Connect the gas hose to the flow meter and power source or wire feeder.
d.	Engage the knob in the regulator.
e.	Connect the flow meter to the regulator.
f.	Attach the cylinder to the stand.
g.	Open the cylinder slightly so that the regulator registers the cylinder pressure at the inlet gauge.

3. Fill in the blanks.

- a. While setting up the GMAW outfit, the power supply should be switched ______.
- b. Some gas needs to be flushed from the cylinder to clear the _____ from dust.

UNIT 1.4: Operating Parameters of GMAW

Unit Objectives



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

- 1. list the parameters of a GMAW process;
- 2. identify the part required to set the parameters of a GMAW process.

1.4.1 Introduction

Let's have a look at the key operating parameters of GMAW process. These are:

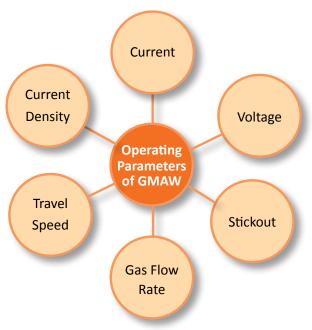


Fig. 1.4.1 - Operating Parameters of GMAW

1.4.2 Current

What is Current

Current is responsible for melting the wire and the base plate.

What Current Does

In GMAW, the current is nothing but the wire feed speed. In other words, the more the wire that comes out of the torch, more current is required to melt the wire and deposit it as a weld metal. More wire requires more current, and less requires less current.

• Where and How to Set the Current

Current is set by the current potentiometer knob, which is usually on the wire feeder. This knob controls the wire feeder motor speed. The knob setting is normally configured in terms of clock setting. The current is at minimum when the knob is at the 7 o'clock position, and the motor hardly rotates. The current is at maximum in the 5 o'clock position, when the motor rotates at full speed.

• How to Calculate the Current

The guideline for calculating current is the welding area thickness of the job.

For example, say you are welding two 10 mm plates edge prepared so as to form a single V joint with an included angle of 60 degrees and with a root face of 2 mm. A fit up for groove welding is made with the above plates with a root gap of 2 mm. The root run is made on the root face so as to bridge the gap with full penetration. Hence, the effective thickness for the root run is 2 mm in spite of the plate thickness being 10 mm. So the welding area thickness for the root run is 2 mm.

The thumb rule for current calculation is 40 A/ mm welding area thickness. So, the required current for root run is 80 amps.

1.4.3 Voltage

What is Voltage

Voltage is the pressure or the force which drives the current.

Let us consider an overhead tank in a building. By virtue of its location at the top of the building, there is a pressure which is pushing the water through the tap when it is open in the ground floor. The pressure is synonymous to voltage, and the flow of water is synonymous to current.

In all forms of welding, voltage digs a pit and current melts the metal to fill the pit. Hence, current and voltage are related to ensure that the pit dug by the voltage is filled with adequate metal by current.

• Where to Set the Voltage

The voltage is set using a potentiometer or multi-position switch on the power source.

How to Calculate the Voltage

Voltage is arrived using an empirical formula from the above calculated current. The empirical formula varies for different shielding gases.

◆ When carbion dioxide (CO₂) shielding gas is used,

$$V = 14 + 0.05I$$

When argon or argon-CO₂ (ACM) shielding gas is used,

$$V = 12 + 0.05I$$

1.4.4 Stickout

• What is Stickout

Stickout is defined as the length of the wire which is protruding outside from the contact tip.

What Stickout Does

The actual operating voltage is the outcome of the set voltage and stickout. If the stickout increases, the actual operating voltage will decrease for a set voltage, and vice versa.

How to Set the Stickout

The actual operating voltage is the outcome of the set voltage and stickout. If the stickout increases, the actual operating voltage will decrease for a set voltage, and vice versa.

What is the Operating Range of Stickout

The normal stickout range tends to vary from 10 to 15 mm. However, larger stickouts, more than 15 mm can also be utilized by bringing in corresponding change in the gas flow rate, if needed.

1.4.5 Gas Flow Rate -

What is Gas Flow Rate

Gas flow rate defines the amount of shielding gas flowing through the nozzle to provide effective shielding for the weld metal from atmospheric contamination.

• How to Set the Gas Flow Rate

The gas flow rate is set on the flow meter which is fitted onto the regulator. The regulator regulates the pressure of the gas from the cylinder to operating pressures. This gas at operating pressure is further controlled to provide the desired flow rate using a flow meter.

What is Operating Gas Flow Rate in GMAW

The normal range of gas flow rate for a stickout of 15 mm shall be around 12 to 15 litres per minute when operating in a closed welding shed.

It should be borne in mind that wind speed of 4 mph is sufficient to wash away the shielding envelope provided by the shielding gas. Exposure of the weld metal to atmosphere leads to porosity, which leads to a weak weld. Hence, utmost precaution has to be taken direct exposure of the welding area to the wind path.

In case of higher stickout, a small increment in gas flow rate is needed to ensure effective shielding.

1.4.5 Travel Speed -

• What is Travel Speed

Travel Speed is defined as the speed at which the welding progresses. Its unit is normally in millimetres per minute (mm/m).

How to Set Travel Speed

The travel speed depends totally on the welder's hand movement, which depends on the metal deposition.

• What is Operating Travel Speed

In GMAW, the operating travel speed is influenced by technique, current, voltage and stickout. Being a high productive process, the normal travel speed for semi-automatic operation shall be in the range of 250 to 300 millimetres per minute.

Exercise



1. State whether the following statements are true or false.

- a. The travel speed is maintained as per the welder's desire.
- b. If the stickout is increased, the gas flow should also increase.

2. Match the columns.

	Column A		Column B
a.	Voltage	i.	250-300 mm/m
b.	Travel Speed	ii.	10-15 mm
C.	Current	iii.	Calculation varies with the shielding gas used
d.	Stickout	iv.	40 amps per mm

3. Fill in the blanks.

- a. Current is at maximum when the knob is in the _____ position.
- b. A wind speed of ______ is enough to blow away the shielding gas and cause porosity in the weld job.

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UNIT 1.5: Process Parameters of GMAW

Unit Objectives



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

- 1. list the modes of metal transfer in a GMAW process;
- 2. select the process parameters based on the nature of the job.

1.5.1 Process Parameters

The process parameters for GMAW are defined with different types of metal transfers. In SMAW, we need to use different sizes of electrodes for different operations. Whereas, in GMAW; we use a single size of electrode, say 1.2 mm, for all operations in the different types of welding processes. In GMAW, the process requirements are met like in SMAW, by varying the operating parameters. This has resulted into various modes of metal transfers.

1.5.2 Modes of Metal Transfers

There are different modes of metal transfers, depending upon the various operating parameters.

Diverse methods of metal transfer:

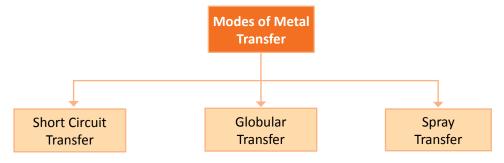


Fig. 1.5.2.1 - Modes of Metal Transfer

• Short Circuit Transfer: In this metal is transferred by literally short circuiting the wire and the base plate. This is also called as 'dip transfer'. This transfer mode is achievable with all shielding gases and operates with low currents and low voltages. This mode of transfer is used to bridge gaps, in sheet metal operations and root runs. Root runs are always done in short circuit mode. For a given size of wire, we can define the range of short circuiting transfer operating parameters. Since the main operating parameters are current and voltage, other parameters can be defined easily with help of these two parameters. The following chart gives a relationship between current, voltage and wire size.

	Wire Size 0.8 mm	Wire Size 1.2 mm
Current	0 –140 amps	0 – 200 amps
Voltage	16 – 22 volts	17 – 23 volts

Table 1.5.1.2 - Short Circuit Transfer

Globular Transfer: In this, the metal is transferred by means of big globules. This is medium
current, medium voltage transfer. Globular transfer is normally used after root welding for
higher productivity. Since metal is transferred in globules, there is possibility of spatter
to occur in this mode of transfer. In globular transfer mode, 100% carbon dioxide is used.
It can be used only in down hand and horizontal positions. The following chart gives a
relationship between current, voltage and wire size.

	Wire Size 0.8 mm	Wire Size 1.2 mm
Current	140 amps and above	200 amps and above
Voltage	23 volts and above	24 volts and above

Table 1.5.2.3 - Globular Transfer

• **Spray Transfer:** In this, the metal is sprayed from the torch to the base plate in the form of fine droplets. This is a high current, high voltage transfer process. Spray transfer is normally used after root welding for high productivity. The gases used are argon and argon gas mixtures, where the percentage of argon is more than 80%. Since it is a high-heat input operation, It is possible to do welding in this mode only in the down hand position. The following chart gives a relationship between current, voltage and wire size.

	Wire Size 0.8 mm	Wire Size 1.2 mm
Current	150 amps and above	240 amps and above
Voltage	25 volts and above	27 volts and above

Table 1.5.2.4 - Spray Transfer

- 1. State whether the following statements are true or false.
 - a. Globular transfer is mainly used for root runs.
 - b. Short circuiting transfer is operating at medium currents and low voltages. _____
 - c. Short circuiting transfer mode is achievable with all shielding gases. ______
- 2. Fill in the blanks.
 - a. Spray transfer is possible only with argon and argon gas mixtures, where the percentage of argon is more than _______.
 - b. The strength of a weld done by GMAW technique is ______ than that of the weld done by SMAW.

3. Match the statements in column A with the corresponding options in column B to complete the sentences.

	Column A		Column B
a.	The short circuiting transfer	i.	short circuit transfer.
b.	Globular transfer	ii.	down hand and horizontal positions.
C.	The mode achievable with all the gases is	iii.	1.2 mm.
d.	The size of the electrode used in GMAW can be	iv.	is also called as 'dip transfer'.
e.	Globular transfer can only be used in	V.	pertains to medium current, medium voltage transfer.

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UNIT 1.6: Techniques of GMAW Operation

Unit Objectives (



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

1. explain the various techniques of GMAW operation.

Running Push Pull Keyhole Weaving Technique Technique Technique Technique Technique Technique

Fig. 1.6.1 - Techniques for GMAW

Exercise



1. Tick the correct answers.

Which of the following are GMAW techniques?

- a. Running a Bead
- b. Running a Parallel Bead
- c. Single Pass Fillet Weld
- d. Pull Technique
- e. Push Technique
- f. Root Run Weld
- g. Weaving Technique
- h. Merging Bead
- i. Keyhole Technique

Notes			

UNIT 1.7: Applications of GMAW

Unit Objectives



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

1. explain applications of GMAW in different industries.

1.7.1 GMAW - Applications

GMAW is popular due to its speed and versatility in various industries.

For example:



Fig. 1.7.1.1 - Alloy Steel



Fig. 1.7.1.2 - Aluminium



Fig. 1.7.1.3 - Carbon Steel



Fig. 1.7.1.4 - Cast Iron



Fig. 1.7.1.5 - Stainless Steel

Exercise



1. Match the column.

	Column A		Column B
a.	Alloy Steel	i.	
b.	Cast Iron	ii.	
C.	Aluminium	iii.	
d.	Carbon Steel	iv.	
e.	Stainless Steel	v.	The state of the s

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2. Shielding Gas

Unit 2.1 – Why Shielding Gas

Unit 2.2 – Shielding Gas Selection



Key Learning Outcomes



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

- 1. describe the functions of shielding gas;
- 2. explain the types of shielding gas;
- 3. list the metals that can be welded;
- 4. select shielding gas for the identified base material (metal).

UNIT 2.1: Why Shielding Gas

Unit Objectives



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

- 1. describe the functions of shielding gas;
- 2. explain the types of shielding gas.

2.1.1 Functions of Shielding Gas

1. Primary function:

• provides shielding for liquid metal from atmosphere.

2. Other Functions:

- Ignition of arc;
- Arc stability;
- Wetting between the solid material and the weld pool;
- Penetration Depth and shape of the weld bead;
- Spatter formation Argon based shielding gases will have less spatter than CO₂ shielding gas.

2.1.2 Types of Shielding Gas

Shielding gas is classified into two types: Active Gas and Inert Gas

1. Active Shielding Gas: e.g.: CO,

Why it is called active?

 ${\rm CO_2}$ gas at arc zone disassociates into carbon monoxides and oxygen, and immediately recombines to form ${\rm CO_2}$ slightly above the arc zone. This reaction produces extra amount of heat (exothermic reaction) which is utilized for welding operations.

Summary: Active gases likes CO₂ contributes heat over and above the heat generated by the arc. Hence, CO₂ gas is called active gas.

2. Inert Shielding Gas: e.g.: Argon, Helium

Inert gases do not participate in the dynamics of arc welding and restrict themselves only to the extent of providing shielding to the liquid metal. They also contribute to the arc stability.

Exercise
1. Fill in the blanks.
afunction of a shielding gas is to provide shielding for liquid metal from
atmosphere.
b. Shielding gas is classified into gas and gas.
c. Active gases likes ${\rm CO_2}$ contributes heat over and above the heat generated by the arc. Hence ${\rm CO_2}$ gas is called as
 d do not participate in the dynamics of arc welding and restrict themselves only to the extent of providing shielding to the liquid metal.
e gas also contribute to arc stability.
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UNIT 2.2: Shielding Gas Selection

- Unit Objectives



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

- 1. list the metals that can be welded;
- 2. select shielding gas for the identified base material (metal).

2.2.1 Types of Metals that Can be Welded by GMAW-

All types of material can be welded provided we have the right type of filler material and gas combinations.

List of shielding gases available are:

- CO₂
- Argon
- Argon CO₂ gas mixer (ACM) in various combinations like: 80/20, 95/5, 90/10 etc.
- Argon oxygen gas mixer 98/2 (Argon -98/Oxygen-2)
- Argon/Helium
- Argon/Helium/Oxygen
- Argon/Helium/CO₂/H₂

2.2.2 Selection of Shielding Gas

Base Material	Ar	Ar / He	Ar/He/CO ₂ /H ₂	Ar/He/CO ₂	Ar/He/O ₂	Ar/CO ₂ /O ₂	CO ₂
Unalloyed and low- alloyed steels						•	•
Austenitic stainless steels	0	0	•	•	•		
Other stainless steels	0	0		•	•		
Aluminium and alloys	•	•					
Copper and alloys	•	•	0				
Nickel and alloys	•	•					
Titanium	•	•					
normally used							
O sometimes also used							

Table 2.2.2 - Selection of Shielding Gas

Exercise



1. Name the shielding gases used for the following base material:

Base Material	Shielding Gas
Unalloyed and low-alloyed steels	
Austenitic stainless steels	
Other stainless steels	
Aluminium and alloys	
Copper and alloys	
Nickel and alloys	
Titanium	

Notes				











3. Safety

Unit 3.1 - Hazards in Welding

Unit 3.2 – Personal Protective Equipment (PPE)

Unit 3.3 – Fire Safety

Unit 3.4 – First Aid for Electric Shock and Burns

Unit 3.5 – 5S



Key Learning Outcomes



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

- 1. identify different kinds of hazards that a welder faces;
- 2. state the ways to avoid these hazards;
- 3. list the different kinds of protective equipment that a welder must use;
- 4. identify the use of each piece of protective equipment;
- 5. identify the causes of fire at the shop floor;
- 6. list the dos and don'ts to prevent fire;
- 7. explain how to deal with a fire accident;
- 8. describe the different safety precautions at workplace;
- 9. describe how to give first aid in case of burns and shocks;
- 10. explain importance of 5S;
- 11. describe 5S activities.

UNIT 3.1: Hazards in Welding

Unit Objectives



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

- 12. identify different kinds of hazards that a welder faces;
- 13. state the ways to avoid these hazards.

3.1.1 Different Types of Hazards

There are different types of hazards that a welder has to face at the work place. These hazards are:

- **Fumes and Gases:** Fumes and gases can be hazardous to your health as they contain various poisonous chemicals.
- **Electric Shock:** An electric shock can kill or cause serious injury.
- **Arc Rays:** Arc rays can injure eyes and burn skin just like the Sun's rays because they are as powerful.
- **Fire and Explosion:** Welding sparks can affect fires and explosions. The height of the sparks can be as much as 35 feet and cause serious damage to yourself and the workplace.
- Noise: Loud noises can damage your hearing.
- Hot Objects: Hot objects can cause severe burns.

3.1.2 Ways to Avoid Hazards

You have to be careful while handling and working with the welding equipments. Below given are the ways to avoid hazards:

- **Fumes and Gases:** To protect yourself from fumes and gases keep your head away from the exhaust. Make sure there is proper ventilation so that the fumes can escape.
- **Electric Shock:** Do not touch any live electrical parts. Protect yourself from the open wires and electrical equipments and follow all the warnings given on the welding equipment.
- **Arc Rays:** Arc rays contain UV rays so you must guard your eyes and skin by wearing the right type of eye and body protection.
- **Fire and Explosion:** To avoid fire and explosion, either remove all materials that burn easily from the welding area or shield them from sparks and spatter. Fire extinguishers should be kept ready at designated places. Check the welding area 30 minutes after welding to see if there is a fire.
- **Noise:** Guard your ears by using appropriate hearing protection, such as ear plugs and ear muffs as and when required.
- **Hot Objects:** Never touch the electrode or other "electrically hot" parts of the welding machine without proper insulation. Any metal object at a welding area can be very hot, so take care before touching.

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1. Create a mind map as seen in the multimedia module in the space given below:

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UNIT 3.2: Personal Protective Equipment (PPE)

Unit Objectives



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

- 14. list the different kinds of protective equipment that a welder must use;
- 15. identify the use of each piece of protective equipment.

3.2.1 Personal Protective Equipment

Let us now look at the different types of personal protective equipment that a welder needs:

- **Welding Helmet:** A welding helmet is worn on the head to protect the welder during welding.
- **Filter Lens:** The filter lens enables the welder to see the weld pool at the same time its dark. The lens protects the welder's eye from extreme bright light.
- **Leather Apron:** Leather is worn to protect the welder from spatters during welding and from arc rays.
- **Leather Gloves:** They protect the welder from sparks, arc rays and spatters during welding. Gloves also protect the welder from hot objects.
- **Leather Sleeves:** Leather sleeves are worn by the welder to protect him from spatter, arc rays and sparks during welding.
- **Leggings:** Leggings are worn over the ankle. They stop hot spatter or sparks from entering the shoe.
- **Safety Shoes:** Safety shoes serve as an insulator. They also save the foot from spatters; arc rays and sparks during welding.

3.2.2 Personal Protective Equipment-Accessories

Apart from welding, a welder has to do some non welding operations like chipping and grinding. For all these operations a welder needs special accessories to protect him.

The accessories are as mentioned below:

- **Safety Helmet:** A safety helmet is worn on the shop floor during grinding etc. to guard the wearer from falling objects or flying splinters.
- **Clear Glass Goggles:** Clear glass goggles are worn during operations like grinding to protect the eyes from flying splinters.
- **Ear Muffs/Plugs:** They protect the welder from high noise levels on the shop floor. They also stop any splinters from entering the ears.
- **Dust Mask:** A dust mask is worn to protect the wearer from fine dust which is made up mainly of fine metal particles.
- **Gas Mask:** A gas mask is a mask put on over the face to protect the welder from inhaling pollutants and toxic gases.

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1. Create a mind map as seen in the multimedia module in the space given below:

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UNIT 3.3: Fire Safety

Unit Objectives



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

- 16. identify the causes of fire at the shop floor;
- 17. list the dos and don'ts to prevent fire;
- 18. explain how to deal with a fire accident;
- 19. describe the different safety precautions at workplace.

3.3.1 Possible Causes of Fire

The welding arc has a temperature of 10,0000 F but the heat does not cause fire. It is the spatter, arc rays and sparks produced during welding that can cause fire if they fall on:

- Combustible materials like petrol, wood, acetylene, hydrogen or oxygen cylinders.
- Electrical fittings or lines

3.3.2 How to Prevent Fire

Fire can be prevented by following these do's and don'ts at the work place:

Dos	Don'ts
Keep welding area clean.	Do not wear inflammable materials like nylon etc.
If empty containers contain flammable materials, fill them with water.	Never weld near electrical lines.
Report any unsafe situation that may cause a fire.	Never weld near combustible materials.
Watch where the sparks and metals are falling from your work.	Never leave any cable without insulation.

Table 3.3.2 - How to Prevent Fire

3.3.3 How to Deal with a Fire Accident

In case a fire breaks out, then

- If it is a small fire it can be put out by using a fire extinguisher.
- If the fire is big, the fire brigade should be called.
- All those on the shop floor should move towards the exit.
- Above all you should stay calm.

3.3.4 Different Safety Precautions

In case a fire breaks out, then

- If it is a small fire it can be put out by using a fire extinguisher.
- If the fire is big, the fire brigade should be called.
- All those on the shop floor should move towards the exit.

Electric Shock

- Above all you should stay calm.
- Make sure the machine is properly grounded.
- Never permit "live" parts of the electric welding machine to touch bare skin or wet clothing.
- Do not cool electrode holders by putting them in water.
- Turn off power supply when the welding machine is not in use.
- Avoid standing on damp areas while welding.
- Wear leather gloves.
- Ensure that the cables are protected and in great condition.
- Ensure that electrode holders are correctly insulated.

Burns

- Guard your eyes and face from flying particles of slag by using safety glasses or face shield.
- Wear adequate protective clothing.
- Always wear leather gloves.
- Wear high top shoes.
- Button collar, shirt pockets, etc.
- Avoid touching the electrode or metal where welding has taken place.
- Hold hot metal with pliers or tongs.
- Keep electrode stubs appropriately arranged off.

Radiant Energy (Ultra Violet Rays etc.)

- Protect your head and eyes with a welding helmet and the right shade lens in great condition.
- Avoid leaving bare skin exposed to the rays of the arc, thus, wear suitable clothing.
- Never strike the arc without protecting the face and eyes. Give warning to others before striking the arc.
- Never look directly at the arc where others are welding without suitable eye protection.

Gases & Fumes

- Work only in well-ventilated areas.
- Be extra careful when working on metals covered with lead or zinc.
- Use respirator or other approved breathing devices if operating in a restricted area.

Combustible Materials

- Keep shop clean in areas where welding is to be done.
- Never weld near inflammable materials of any kind.
- Never weld on shielded containers which may have held inflammable materials without first taking appropriate safety precautions. For example, fill them with water, steam clean or fill it with an inert gas.

Fire Protection

- Get acquainted with location and types of fire extinguishers.
- Report any risky conditions that may begin a fire.
- Never weld near combustible materials.
- Never weld on containers that have held combustible materials.
- Never weld near electrical fittings or lines.

Trips & Falls

- Keep work areas clear of equipment, machines, cables and hoses.
- Always properly maintain and use handrails.
- Always use and maintain safety lines, harnesses and lanyards.
- Continuously ensure that that scaffolds are correctly assembled and used.

3.3.5 Fire Extinguishers

Electrical fires are different from regular fires. They cannot be extinguished with water. Also, using water to put out an electrical fire is very dangerous and could lead to electrocution. To put out an electrical fire, the right type of fire extinguisher must be used.

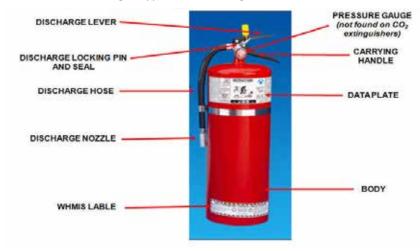


Fig. 3.3.5.1 - Fire Extinguisher Anatomy

There are two types of fire extinguishers that can be used for electrical fires. These are:

- Carbon dioxide (CO2) extinguishers
- Dry chemical extinguishers

Types of Fire Extinguisher Which is relevant to Welding Shop:-



Fig. 3.3.5.2 - Types of Fire Extinguishers

Different types of fire extinguishers are designed to fight different classes of fires.

The three most common types of fire extinguishers are:

Water (Class A)

- Suitable for Class "A" fires only.
- To allow visual capacity check, there is a pressure gauge
- 30-40 ft. maximum effective range.
- Can be started and stopped as necessary.
- Extinguishes by cooling burning material below the ignition point

Carbon Dioxide CO, (Class B, C)

- Suitable for Class "B" or "C" fires.
- 2.5-100 lb. of CO₂ (8-30 seconds discharge time).
- Has NO pressure gauge--capacity verified by weight.
- 3-8 ft. maximum effective range.
- Extinguishes by smothering burning materials.
- Effectiveness decreases as temperature of burning material increases.

 CO_2 extinguishers are specially designed to put out electrical fires. They have a wide nozzle that expels the CO_2 gas. When the extinguisher is sprayed on an electrical fire, the oxygen on the surface of the fire is displaced. This results in the fire dying out. However, it should be noted that the fire can reignite once the CO_2 gas dissipates – this is why it is very important to remove the ignition source in time.

When CO₂ extinguishers are sprayed on electrical equipment, no messy residue is left behind. This makes them perfect for putting out fires on delicate electrical equipment.

Dry Chemical or Powder (Class A,B,C)

- Suitable for Class "A", "B", and "C" fires.
- 2.5-20 lb. dry chemical (ammonium phosphate).
- 8-25 seconds discharge time.
- To allow visual capacity check, it has pressure gauge.

Dry chemical extinguishers are also designed to put out electrical fires. These extinguishers are better than CO_2 extinguishers as they prevent fires from reigniting. This is because they leave a layer of non-flammable material on the area that they have been sprayed over. On the down side, these extinguishers are very messy and they leave behind a fine powder that irritates the throat and lungs.

In case of an electrical fire, the following precautions should be taken:

- Switch off the main switch.
- Throw sand on the fire. This will extinguish an electrical fire.
- Use carbon dioxide extinguishers to put out such fires. Ensure that the extinguisher is not outdated. Remember, never use water to put out a fire if the mainline is live.

3.3.6 How to Use a Fire Extinguisher



How to use fire extinguisher



Step 1: Pull the pin



Step 2: Aim at the base of fire



Step 3: Squeeze the handle



Step 4: Sweep from side to side

Types of Fire



Table 3.3.6.1 - Types of Fire

Colour Code



Table 3.3.6.2 - Colour Code for Selecting Fire Extinguishers

3.3.7 Safety Signages

Take a look at some important safety signs that you should be aware of:

It is important to know the meaning of safety signs. Such signs warn us of danger and allow us to take precautions to keep safe. There are four main types of safety signs:

- Prohibition signs
- Mandatory signs
- Warning signs
- Information signs





Table 3.3.7.1 - Safety Signages

3.3.8 Procedure for Reporting and Responding to Accidents and other Emergencies



One of the essential responsibilities of an individual is reporting hazards for electrical works. He should be aware of:

- the people responsible for health and safety at the work place;
- the name, designation and location of the person responsible to contact at the time of emergency;
- the names and location of the documents that refer to health and safety in the workplace.

Additionally, an individual should also be adept in writing accident report. An accident report needs to include all the essential information about the incident or near-miss. The report-writing process begins with facts and ends with recommendations for preventing future accidents.

Accident report involves four steps:

- 1. Gathering Facts: Collect and note all the facts, including -
- Date, time, and location of accident
- Names, job titles, workers and immediate supervisor involved
- Events leading up to the accident
- Job that a worker was handling at the time of the accident
- Names of workers/supervisor who witnessed the accident
- Surrounding conditions (e.g. greasy floor, insufficient lighting, noise, etc.)
- Circumstances at the time of accident (including tasks, equipment, tools, materials, etc.)
- PPE worn by the worker at the time of the accident
- Injuries that occurred (name of the injured body part and characteristics and extent of injuries)
- Type of treatment for injuries (first aid if given)
- Damage to equipment, materials, and the worker was working on or any other equipment or material around it.
- 2. **Determining the Sequence:** Describe this sequence in events after gathering the facts –
- Events leading up to the accident: Task the worker was performing at the time of accident. For example: bending over, climbing, lifting operating machinery, using a tool, handling hazardous materials, etc.
- Events involved in the accident: Was the employee struck/caught in the machine or caught in the fire? Did the worker fall on the same level or from a height? Did he inhale hazardous fumes or get splashed with a hazardous chemical?
- Events immediately following the accident: What did the employee do: started bleeding? Body caught fire? Complain about back pain? Put a hand over a bleeding wound? Response from other workers/supervisor. Did they call for help, administer first aid, shut down equipment, move the victim to the other place, etc.?

The accident should be described on the report in sufficient detail that any reader can clearly picture what happened. A picture can also be drawn, in a simple and visually effective manner, the sequence of events related to the incident and include this in your incident report. Photos can be clicked by the mobile phone of the accident scene, injury the occurred which may help reader follow the sequence of events.

- 3. Analysing: Analyse of the causes of the accident.
 - Causes include:
- Primary cause (e.g., a slip and fall from a ladder)
- Secondary causes (e.g., employee not wearing appropriate goggles or helmet)
- Other contributing factors (e.g., poor ventilation).
- 4. Recommending: Recommendations for corrective action might include immediate as well as long-term corrective actions such as -
- Training on safe work practices
- Preventive maintenance exercises that keep equipment in great working condition
- Assessment of job techniques with a proposal for changes
- Conducting a job hazard analysis to evaluate the task for any other hazards and then train employees on these hazards
- Engineering changes that make the task safer or administrative changes that might include changing the way the task is performed

3.3.9 Introduction to Mock Drills

Safety is a priority in order to provide a safe working environment. Efforts should be taken to reduce the scale & probability of hazards. However careful, hazards may occur. Effective action has been possible in the emergency situation, In dealing such emergencies effective action is possible due to existence of pre-planned and practiced procedure for dealing such emergencies.

What is a Mock Drill

Mock Drills is a situation in which fake emergency is announced and workmen are asked to follow emergency evacuation plan. This allows the workman to familiarize with the emergency situation and act according to plan. Mock drills for chemical accidents and firefighting drills should be organized at regular intervals at the sites

At the time of emergency evacuation one must:

- Raise the alert by crushing the glass cover of the closest break-glass alarm unit.
- Be calm and composed. Switch off all electrical apparatus except lights.
- If possible, shut doors around the fire area to stop it from spreading.
- Leave the Building/site area immediately. Follow the evacuation queue.
- Give first preference to the physically handicapped, expectant mothers and the elderly
- If it's dark and smoky, get down on your hands and knees and crawl to the nearest exit by counting the number of door. If manageable, cover your nose with a wet towel or handkerchief.
- Be acquainted with the hot exit door and pay attention for the thick smoke in the staircase. In the event that the staircase is free from smoke, follow the directional signs and handrails.
- Gather at the designated assembly point.
- Do not re enter the building until the signal is given
- Max. time for evacuation 2.5 to 3.0 minutes.

Exercise 2 1. Create a mind map as seen in the multimedia module in the space given below:

UNIT 3.4: First Aid for Electric Shock and Burns

Unit Objectives



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

1. describe how to give first aid in case of burns and shocks.

3.4.1 First Aid for Burns

Burns are caused by coming in contact with hot objects accidentally. Burns can be minor or major. Below given is the first aid for minor and major burns.

For Minor Burns

- Pour cold water on the burnt area.
- Apply a paste of baking soda and water or use a wet compress of baking soda solution in water.
- Cover the burnt area with a thin cloth to keep it free of dust.

For Major Burns

- In case a person's clothes are on fire drop him to the ground and roll him over until the fire is put out. He must not run because that will only spread the fire.
- Do not wrap any blanket around him because that will raise the temperature of the burnt area.
- Call the doctor immediately.
- Till the time the doctor arrives, make the victim to lie down in a quiet place but keep the feet slightly raised.

3.4.2 First Aid for Electric Shocks

You can get an electric shock if current passes through your body or hair. When a person gets a severe shock his or her skin turns white or pale blue. The first aid to be given to the victim are as mentioned:

- Turn off the electric supply.
- Pull out the plug if you cannot find the switch.
- Use rubber gloves and stand on paper or wood when you are cutting off the electric supply.
- You should go near the victim, ONLY after the electric supply is cut off, otherwise you may also get a shock especially if the voltage is high.
- Help the victim if he cannot breathe properly.
- If there is a wound apply medicine.
- Call the ambulance or the doctor immediately.

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Exercise 2
1. Create a mind map as seen in the multimedia module in the space given below:
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UNIT 3.5: 5S

Unit Objectives 🧭



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

- 2. explain importance of 5S;
- 3. describe 5S activities.

3.5.1 Why 5S

To attend greater productivity, 5S is designed as a visually-oriented system of cleanliness, organization, and arrangement. It engages all employees and is a foundation for more selfdiscipline on the job for better work and better products. Along with engaging employees, it also builds a strong and positive culture of self-discipline in the workplace for better work and better products.

3.5.2 Benefits of 5S

The Benefits of 5S are:

- Cleaner and safety work Hazard free work area
- Reduced waste of time through more workplace organization Orderly placed tools save
- Organised space Organized workplace requires less floor space
- Improved self-discipline Follows company production standards
- Improved workplace culture Encourages better teamwork and enthusiasm

5S fosters people to work in a well-organized and clean environment. People feel better about themselves and their work. This win-win situation is achieved through self-discipline.

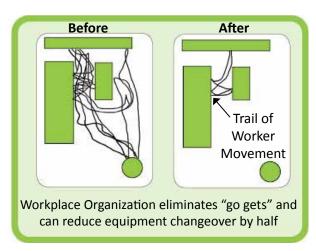


Fig. 3.5.2 - 5S Facilitates greater Productivity, Safety and Quality.

Source:http://reliabilityweb.com/index.php/articles/the 5s method of improvement enhancing safety productivity and culture/

3.5.3 What are the 5S's

5S consist of:

- **Sorting** Sorting and separating tools removes unnecessary items from the work area and keep the place clean.
- Simplifying Tools kept at the appropriate storage area are clean and ready to use.
 Simplifying ensures workplace safety and efficiency. Welding Technician Level 3 65 2011 © IL&FS Skills Development Corporation Limited
- **Systematic Cleaning** Organized daily cleaning and inspection of the workplace and equipment helps to understand its efficiency and determine if corrective action is required.
- **Standardizing** Standardizing makes unusual and out-of-the-ordinary conditions noticeable. It also helps to document agreements to ensure consistency and sustainability.
- **Sustaining** Helps holding the gains and improving. It is aimed to maintain the improvements from the other 5S activities and further improve the workplace.

3.5.4 Importance of Implementing 5S

Benefits of implementing the 5S are:

- It is a visual system;
- It engages employees;
- It requires team effort;
- It results must enable its users to tell in a glance what is right and what is out of place;
- It makes work easier.

The manner to follow 5S is:

- 1. Sorting: Helps manage space better
 - Keep the frequently used tools near the work table
 - Identify the unnecessary tools and move to an appropriate storage area
 - Dispose off the not required items
 - · Clean the work area
 - Once sorting is complete, get the workplace organized.

2. Simplifying: Helps in storing the materials efficiently

- Frequently used items must be close to work area and at proper and safe distance
- Label the items
- Find out how to replace the supplies
- Document layout, equipment, supplies, and agreements for returning items to their places

3. Systematic Cleaning: Makes the job of regular cleaning and supervisions easier

- Recognize points to check for performance
- Define acceptable performance standard
- Mark equipment and controls with visual indicators (e.g., gauges show the correct range)
- Conduct daily cleaning and visual checks

- 4. Standardizing: Helps ensure everyone knows what is expected by them at the workplace. There should be some involvement in establishing the 5S in their work area.
 - A routine check sheet should be set up at the work area. It may act as self-audit.
 - A multi-level audit system ensures that 5S is sustained in the work area and that the 5S system evolves and strengthens.
 - Set up and document standard methods across similar work areas.
 - Document any new standard methods for doing the work.
- 5. Sustaining: Prevents backsliding and fosters continuous improvement
 - Find out the 5S level of achievement the overall grade.
 - Execute worker-led routine 5S checks according to the 5S check list.
 - Detect regressing and new opportunities found during routine checks.
 - Execute scheduled, routine checks by team leads, supervisors or by people from outside of the workgroup.
 - Perform higher-level reviews to assess how well the 5S framework is functioning overall. For instance, are there systemic issues with supporting 5S? Frequently, the company's safety committee is a brilliant body for leading these reviews.

It is through sustaining activities the sustainability of 5S is improved and more importantly, they improve safety, morale, and productivity at the workplace.

3.5.5 Description of 5S Activities

5S establishes a strong framework for achieving operational magnificence. Self-discipline and teamwork built through 5S improves worker-to-worker and worker-to-manager relationship.

Description of 5S Activities pertaining to your workplace:

Keep only the required tools at the workstation. Preserve only the essential spare parts, materials, WIP etc. at the workstation. Keep only the essential equipment at the workstation. Remove all damaged or avoidable equipment from the workplace. Keep only the necessary furniture at the workstation. Remove all damaged or avoidable chairs, shelves, workbenches etc. from the workplace Keep only the required paperwork at the workstation. Keep away all items that may cause accidental injury such as electrical cables, etc. from standing/walking areas.

SIMPLIFYING:

- 1 Keep the containers, boxes, bins, WIP, materials etc. at a clearly defined location and label them properly (part number, quantity, etc.).
- Keep the tool sat a designated storage location so that it is in the reach of the operator. The tools should be labelled for easy identification.
- 3 Label the paperwork with clear visibility for the operators and keep it away from work surfaces.

SIMPLIFYING:

- 4 Mark the equipment that need critical maintenance. Keep the equipment at properly identified location equipment (numbered, named, colour-coded etc.)
- 5 Keep the furniture in a visibly known (numbered, named, colour-coded, etc.) location.
- 6 Label the work areas that require personal protective equipment.
- 7 Keep stop switches and breakers at highly visible locations and easily accessible in case of emergency.
- 8 Display fire hoses, fire extinguishers and other emergency equipment prominently and at unobstructed locations.
- 9 Keep the working conditions ergonomically friendly. Store the tools at appropriate heights; lift assist devices are provided where necessary, etc.
- 10 The workplace layout should accommodate easy exit in case of emergency.
- Keep the walkways and vehicle paths clearly known and unhindered. Label the exits area clearly.

SYSTEMATIC CLEANING:

- 1 Check whether the containers, boxes, bins, etc. are clean, not cracked, torn, or otherwise damaged. Stack them neatly.
- 2 Keep the tools in good working order.
- 3 Ensure that paperwork is not torn, kept clean and protected from dirt. Take care it does not get torn.
- Work surfaces (machines, workbenches, dyes, and other equipment including electrical boxes) are clean and painted for identification.
- Keep the floor free from dirt, debris, oil, spare parts, hardware, empty boxes, packaging material etc. Keep the drains unclogged.
- 6 Walls, partitions, railings etc. are to be painted and kept clean.
- Keep a schedule for cleaning areas of the workplace such as windows, corners, walls, doors, top of cabinets etc. indicating times, frequency and responsibilities.
- 8 Keep the cleaning equipment neatly stored and readily existing when required.
- Keep all personal protective equipment conserved in hygienic and reliable condition. Store them properly and ensure that they are easily reachable and are kept at the labelled location when not in use.
- Ensure that equipment safety concerns are clearly recognized. Safety guards should be painted, in great working condition, and give suitable safety.

STANDARDIZING:

- Store the tools, equipment, paperwork, furniture etc. at the designated areas and should be returned immediately after each use.
- 2 Documents should be labelled clearly as to contents and responsibility for control and revision. The date and revision number should be clearly visible.
- Maintain the equipment's maintenance records and clearly state when the last maintenance check occurred and when the next maintenance is scheduled.

STANDARDIZING:

- 4 Clean and remove the product waste (e.g. shavings, containers, liquids, wrappers etc.) from the workplace at all times.
- Implement preventive measures to make sure the workplace satisfy 5S guidelines (e.g. A system that prohibits waste to accumulate and there are containers to gather product debris from the machines).
- 6 Post the result of the previous audit so that they are clearly visible to the entire team.
- 7 Areas for improvement identified during the previous audit should be completed.
- Work environment will affect the quality of work produced. Lighting (brightness and colour), air quality, temperature etc. will affect the quality of work produced. Better the environment, better the productivity.

SUSTAINING:

- Ensure that a member of management is part of 5S exercise, such as an audit or any other activity within the past 3 audit periods.
- 2 Ensure that acknowledgement is given to teams who are part of 5S exercises.
- Ensure that time and resources are allotted to 5S exercises (e.g. selected daily/ weekly clean-up time, 5S team leader etc.)
- 4 Ensure that all operators, team leaders, supervisors etc. are allocated 5S activities to be accomplished at least once/week.
- Ensure that the team that took the initiative to make improvement to the workplace followed it through. Also ensure that the improvements that were identified in the previous audit were implemented.

3.5.6 Measuring the 5S Level of Achievement

In order to demonstrate the use of the matrix, check the levels from I to V for Simplifying.

Level I is a usual initial level where the work area is a disorganized mess.

Achieving Level II for Simplifying requires that the necessary items are safely stored according to the frequency of use. Frequently used items should be easily accessible from the area of work.

Achieving Level III requires that the correct quantities of those items have a clearly marked storage space. Sometimes, work regions accomplish this level generally rapidly by setting shadowboards (frameworks depicting visually where items belong).

Levels IV and V require additional refinement.

Level IV requires that the number of items in an area is kept at a minimum. This means fewer consumables, fewer files or paperwork, and fewer tools.

Level V requires that anybody, even individuals new to the region, can recover any required thing within 30 seconds and with least movement.

The general 5S level of accomplishment is the least level achieved for any of the S's. 5S is only as good as its weakest link. If a work area has not tended to Standardizing and Sustaining, regardless how high the level accomplished for different S is, the area will in the end return to a non-5S state.

5S Levels of A Level V:	Cleanliness	Needed	Possible	Well-grounded	Root causes are
Continuously Improve	problems are identified and mess prevention actions are in place.	items can be recovered within 30 seconds and need a less number of steps.	problems are recognized and counter measures are recorded.	approaches and standards for housekeeping, routine supervisions and workspace arrangement are shared and are used throughout similar work areas.	removed and improvement actions concentrate on developing precautionary methods.
Level IV: Focus on Reliability	Work area has recorded housekeeping tasks and agendas and the jobs are consistently followed.	Needed items in work area are minimized in number and are well organized for recovery and use.	Inspection occurs during daily cleaning of work areas and equipment and supplies	Dependable procedures and standards for housekeeping, routine supervisions and workplace plan are recorded and abided by all members of the work group.	Sources and recurrence of issues are recorded as a component of routine work. root causes are identified and corrective action plans are developed.
Level III: Make It Visual	Preliminary cleaning has been completed and clutters are recognized and improved.	Needed items are outlined, dedicated locations are properly labeled and required quantities are determined.	Visual controls and identifires are established and marked for the work area, equipment files and supplies.	Work Group has recorded arrangements on visual controls tagging of items and desired amounts of necessary items.	Work group is regularly examining area to sustain 5S agreements.
Level II: Focus on Basics	Essesntial and non-essential items are identified. Those non-essential items are withdrawn from work area.	Essential items are carefully stored and organized as per occurrence of use.	Important work area items to be checked are recognized and adequate performance levels recorded.	Work group has recorded arrangements for essential items, organization and work area controls.	Initial 5S level had been decided, and performance is recorded and displayed in work area.
Level I Just Beginning	Essential and non-essential items are mixed throughout the work area.	Items are located arbitrarily all over the workplace.	Important work area items checked are not recognized and are not marked.	Work techniques are not regularly abided and are unrecorded.	Work area checks are haphazardly executed and there is no visual measurement of 5S.
Place yellow box where each area is on the 5S levels of Achievement	Sorting	Simplifying	Systematic Cleaning	Standardizing	Sustaining

Table 3.5.6 - 5S Levels of Achievement

Source: http://reliabilityweb.com/index.php/articles/the_5s_method_of_improvement_-_enhancing_safety_productivity_and_culture/

Exercise



1. Create a mind map as seen in the multimedia module in the space given below:

Notes











4. Perform First Operation

Unit 4.1 – Types of Weld - Fillet and Groove

Unit 4.2 – Types of Joints

Unit 4.3 – Welding Positions

Unit 4.4 – Material Preparation

Unit 4.5 – Edge Preparation

Unit 4.6 – Fit Up



ASC/N3104 ASC/N3105

Key Learning Outcomes



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

- 1. identify the different types of weld;
- 2. list the different parts of weld;
- 3. Identify the different types of joints;
- 4. describe the different welding positions;
- 5. state the norms of position classification;
- 6. define material preparation;
- 7. describe the different methods of cleaning and cutting metals;
- 8. explain edge preparation;
- 9. state the methods of edge preparation;
- 10. list the types of edges;
- 11. understand purpose and method of fit up;
- 12. to form the component as per the drawing.

UNIT 4.1: Types of Weld – Fillet and Groove

- Unit Objectives



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

- 1. identify the different types of weld;
- 2. list the different parts of weld.

4.1.1 Different Types of Weld

Welds can be broadly classified into 2 types.

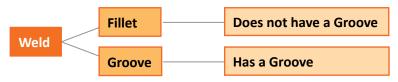


Fig. 4.1.1 - Types of Weld

Let us look at both these types of weld.

- A fillet weld is the one in which the weld beads are deposited on the edge of the two surfaces to be joined. These surfaces do not have any groove. The weld bead is laid on the surface.
- Groove welds are welds made in the groove between two pieces to be joined.

4.1.2 Parts of Weld

Let us see the different parts of a weld.

Fillet Weld

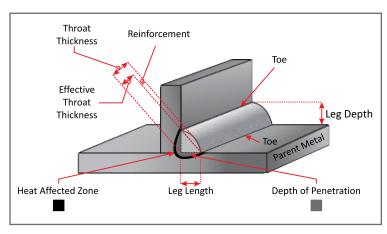


Fig. 4.1.2.1 - Fillet Weld

Groove Weld

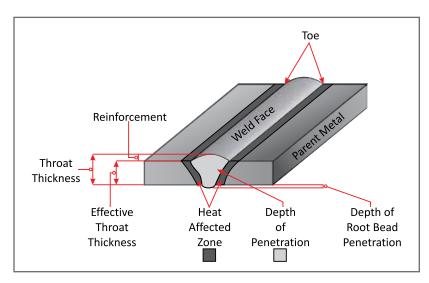


Fig. 4.1.2.2 - Groove Weld

- Base Metal: The metal pieces that are being welded are known as "base metal" or "work piece"
- **Root:** The root is the point at which the backside of the weld intersects the base metal surface.
- **Root Run:** The first run deposited in the root of a joint is the root run.
- **Root Gap:** The distance between the parts to be joined is called the root gap.
- Toe: The point where the weld face and the base metal are connected is called the toe.
- **Leg Length:** The space between the junction of the metals and the point where the weld metal connects the base metal is the leg length.
- **Throat Thickness:** The space between the junction of the metals and the midpoint of the line connecting the two toes is called throat thickness.
- **Heat Affected Zone:** The heat affected zone is the place under the weld or around it which has not welded but the heat of welding has changed its properties.
- **Depth of Penetration:** The depth a weld ranges into a joint from the metal surface is called the depth of penetration.
- **Weld Junction:** The boundary between the fusion zone and the heat affected zone is the weld junction.
- **Weld Face:** The surface of a weld as viewed from the side from which the weld was made is the weld face.

4.1.3 Layers of Multipass Welding

A single run of electrode on a metal during welding is called a pass. When the base metal pieces to be welded are thick, then a single pass is not enough to fill the gap between the two pieces. Therefore multiple passes are required.

Let us look at the different layers in multipass welding.

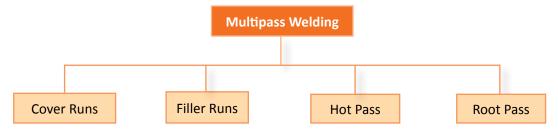


Fig. 4.1.3 - Multipass Welding

- The Root Pass: The first weld run is known as Root Pass or Root Run.
- Hot Pass: The run above the root run is called hot pass.
- **Filler Runs:** All the runs above the hot pass, except the top ones are called filler runs.
- Cover Runs: The top layer runs are known as cover runs.

Exercise 🔀

1. Create a mind map as seen in the multimedia module in the space given below:

- Notes	
L	

UNIT 4.2: Types of Joints

Unit Objectives



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

1. Identify the different types of joints.

4.2.1 Session Overview Corner Joints Types of Joints Cannot be used for Fillet weld Tee Joints Edge Joint Fig. 4.2.1 - Types of Joints

4.2.2 Different Types of Joints

There are five basic types of joints:



Fig. 4.2.2.1 - Butt Joint

Butt Joint

A joint between two members lying almost in the same plane.

Corner Joint

A joint between two members located almost at right angles to each other in the form of an angle.



Fig. 4.2.2.2 - Corner Joint

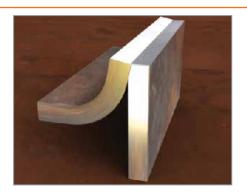


Fig. 4.2.2.3 - Edge Joint

Edge Joint

A joint between two edge of two or more parallel or almost parallel members.

Lap Joint

A joint between two overlapping members.



Fig. 4.2.2.4 - Lap Joint

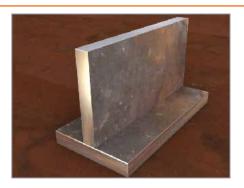


Fig. 4.2.2.5 - Tee Joint

Tee Joint

A joint between two members located almost at right angles to each other in the form of a T.

_				
· F)	KP	rc	is	F



1. Create a mind map as seen in the multimedia module in the space given below:

Notes



UNIT 4.3: Welding Positions

- Unit Objectives



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

- describe the different welding positions;
- 2. state the norms of position classification.

4.3.1 Different Welding Positions

The four positions of welding are:

Down Hand Horizontal Vertical Overhead

Fig. 4.3.1 - Different Welding Positions



4.3.2 Position Classification

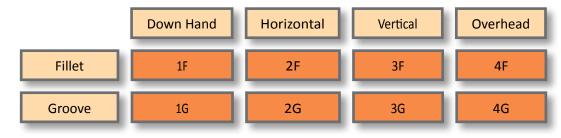
The position classification for welding is done as per following rules:

Position

- If the position is flat or down hand it is numbered 1
- If the position is horizontal the number given is 2.
- If the position is vertical the nomenclature given is 3.
- If the position is overhead the nomenclature is given as 4.

Type of Weld

- If the weld is fillet type it is named F.
- If the weld is groove type it is named G.



4.3.3 Welding Positions and Symbols

The difference between Weld symbol and Welding symbol:

Weld symbol is indicating the type of weld.

Welding symbol is a method of demonstrating the weld on diagrams. It comprises the supplementary information and involves the following 8 elements:

- 1. Reference line
- 2. Arrow
- 3. Basic weld symbol
- 4. Dimension and other data
- 5. Supplementary symbols
- 6. Finish symbols
- 7. Tail
- 8. Specification, Process or other reference

Plate and Pipe Positions to ISO AS/AWS Standards:

- ISO STANDARD 6947
- AUSTRALIAN STANDARD AS 3545
- AMERICAN WELDING SOCIETY AWS A3.0

Plate and Pipe Welding Positions to ISO

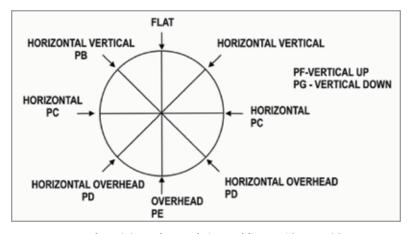


Fig. 4.3.3.1 - Plate and Pipe Welding Positions to ISO

Plate Positions

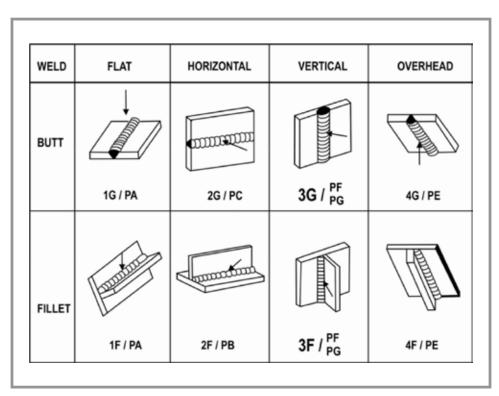


Fig. 4.3.3.2 - Plate Positions

Pipe Positions - Rotated or Rolled

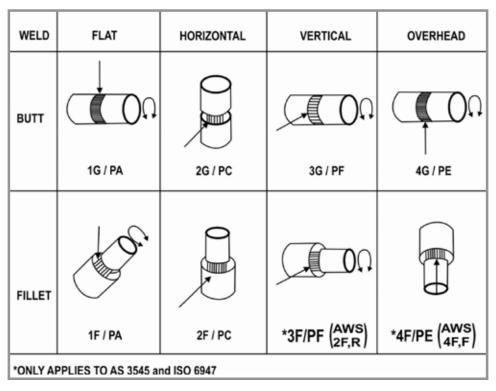


Fig. 4.3.3.3 - Pipe Positions - Rotated or Rolled

Pipe Positions - Fixed Position

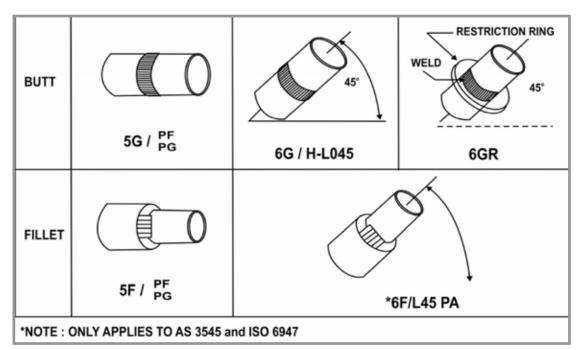


Fig. 4.3.3.4 - Pipe Positions - Fixed Position

Welding Directions or Positions

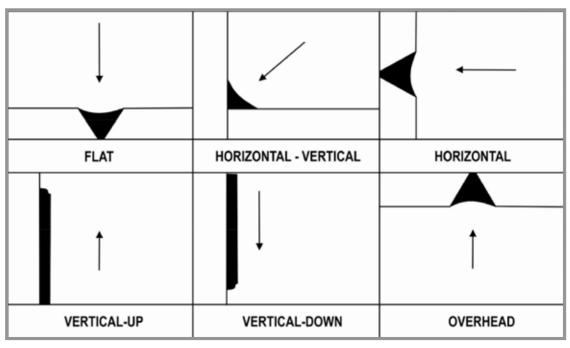


Fig. 4.3.3.5 - Welding Directions or Positions

How Welding Symbols are used:

TYPE OF WELD	SKETCH OF WELD	SYMBOL	INDICATION OF DRAWING
FILLET WELD	₹		
BEAD	{		EDGE SEAL BACKING WELD RUN
BUTT WELDS			
GENERAL BUTT	FULL PENETRATION BUTT WELD BY A WELDING PROCEDURE TO BE AGREED	2	₹1 - -
SQUARE BUTT	- -}	=	₹ <u>1</u>
SINGLE 'V' BUTT	{ \(\)	\	<
SINGLE BEVEL BUTT		V	
SINGLE 'U' BUTT	E	Y	₹
SINGLE 'J' BUTT		h	

Fig. 4.3.3.6 - How Welding Symbols are used

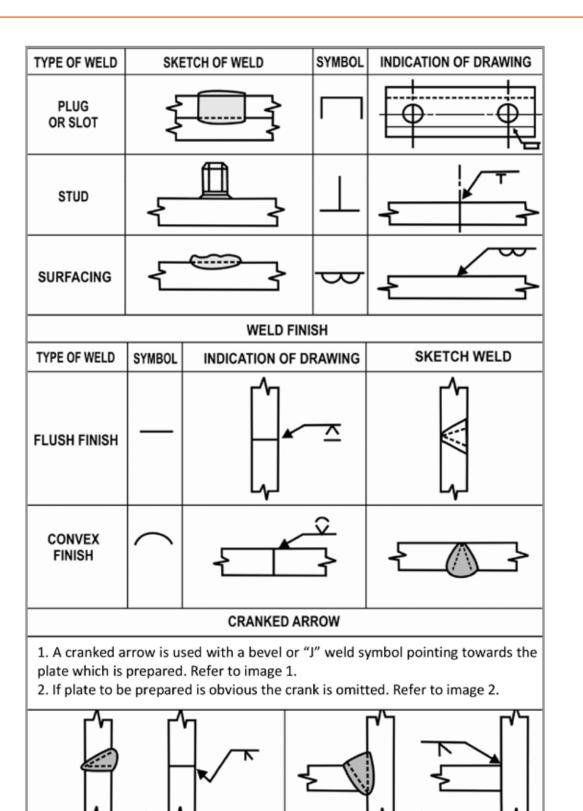


Fig. 4.3.3.6 - How Welding Symbols are used

Basic Weld Symbols:

Basic Weld Symbols

			Groove W	eld Symbol:	5		
Square	Scarf	V	Bevel	u	_1 _	Flare V	Flare bevel
	//		.V	<u>Y</u>	_Ľ_	عد	_1_
	77			_ <u>T</u>	<u>-</u>	75	-17
			Other Wel	d Symbols			
	Plug	Spot		Back	Surfacing	Fla	inge
Fillet	er skat	er Prejection	Seam	or backing	Surfacing	Edge	Corner
<u></u>		Q- -0-	⊕ -		$\overline{\mathbf{w}}$	-77-	_1 <u>_</u>

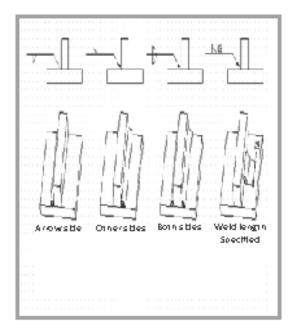


Fig. 4.3.3.7 - Basic Weld Symbols

Other Symbols:

SYMBOL FOR:	ANSI Y14.5
STRAIGHTNESS	
FLATNESS	
CIRCULARITY	0
CYLINDRICITY	\mathcal{O}
PROFILE OF A LINE	
PROFILE OF A SURFACE	
ALL AROUND- PROFILE	P
ANGULARITY	
PERPENDICULARITY	
PARALLELISM	//
POSITION	+
CONCENTRICITY/ COAXIALITY	0
SYMMETRY ‡	None
CIRCULAR RUNOUT	A
TOTAL RUNOUT	2,9
AT MAXIMUM MATERIAL CONDITION	(M)
AT LEAST MATERIAL CONDITION	(L)
REGARDLESS OF FEATURE SIZE	<u>S</u>
PROJECTED TOLERENCE ZONE	P

SYMBOL FOR:	ANSI Y14.5
DIAMETER	Ø
BASIC DIMENSION	50
REFERENCE DIMENSION	(50)
DATUM FEATURE	- A-
DATUM TARGET	Ø1 A1
TARGET POINT	X
DIMENSION ORIGIN	-
CONICAL TAPER	\Rightarrow
SLOPE	
COUNTERBORE/SPOTFACE	
COUNTER SINK	~
DEPTH/DEEP	$\overline{\mathbf{v}}$
SQUARE (SHAPE)	
DIMENSION NOT OT SCALE	<u>15</u>
NUMBER OF TIME/PLACES	8X
ARC LENGTH	105
RADIUS	R
SPHERICAL RADIUS	SR
SPHERICAL DIAMETER	S

Fig. 4.3.3.8 - Other Symbols

F	Y	Δ	r	r	ic	
	Л	L			U	щ



1. Create a mind map as seen in the multimedia module in the space given below:

Notes



UNIT 4.4: Material Preparation

- Unit Objectives



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

- 1. define material preparation;
- 2. describe the different methods of cleaning and cutting metals.

4.4.1 What is Material Preparation

Before welding, the raw material is in the form of metal sheets or blocks and needs to undergo material preparation process. To make components of different sizes and shapes, they need to be cut from the raw sheets or blocks. It also needs to be cleaned. This process of cutting and cleaning is known as material preparation.

4.4.2 Methods of Cutting Metal

There are different methods of cutting metal to bring them into meaningful shapes.

Methods of cutting metal

- Cold Cutting
 - Chisel
 - Hacksaw
 - Shearing
- Gas Cutting
 - Pug Cutting
- Plasma Cutting



Fig. 4.4.2.1 - Hacksaw Cutting



Fig. 4.4.2.2 - Pug Cutting



Fig. 4.4.2.3 - Chisel Cutting



Fig. 4.4.2.4 - Gas Cutting

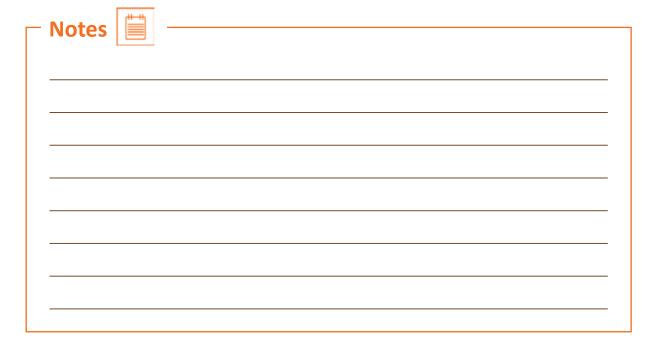
4.4.3 Material Cleaning

Any material must be free of any foreign material like oil, paint, rust, moisture, scale etc before it can be welded. If these impurities are not removed, the weld will have defects and the weld may be porous, brittle or weak. Material cleaning is done by different methods depending on the material and the type of impurity. Cleaning can be done by:

- Wire Brushing
- Grinding
- Rubbing with Emery Paper
- Flaming
- Chemical Cleaning

Exercise 2

1. Create a mind map as seen in the multimedia module in the space given below:



UNIT 4.5: Edge Preparation

Unit Objectives



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

- 1. explain edge preparation;
- 2. state the methods of edge preparation;
- 3. list the types of edges.

4.5.1 What is Edge Preparation

Edges of the metal pieces have to be shaped and prepared for welding.

This is known as edge preparation.

4.5.2 Methods of Edge Preparation

There are many methods of edge preparation. The method that is chosen will depend on:

- The shape of the edge to be prepared
- The thickness of the metal to be welded



Fig. 4.5.2 - Methods of Edge Preparation

The different methods of edge preparation are:

- 1. Gas Cutting
 - Pug Cutting
- 2. Plasma Cutting
- 3. Filing
- 4. Grinding
- 5. Milling Machine



Fig. 4.5.2.1 - Grinding



Fig. 4.5.2.2 - Filing



Fig. 4.5.2.3 - Pug Cutting



Fig. 4.5.2.4 - Gas Cutting



Fig. 4.5.2.5 - Milling

4.5.3 Types of Edges

There are various types of possible edges. Type of edge is determined by the drawing of joint. The choice of edge depends on:

- the thickness of the metal
- the type of joint and
- the type of weld
- requirement of welding strength

The most common types of edge preparation are:

- Square edge
- Bevel edge
- Double Bevel edge
- Chamfer edge
- Groove edge and
- Double J Groove edge

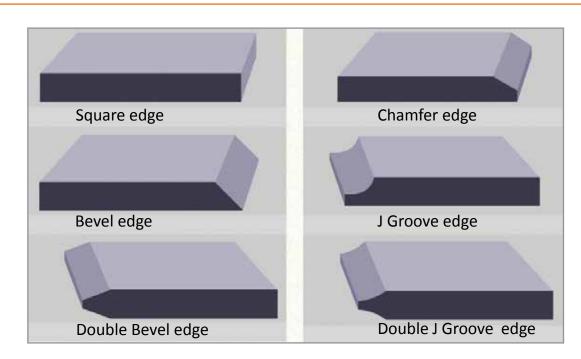


Fig. 4.5.3.1 - Types of Edges

Exercise



1. Create a mind map as seen in the multimedia module in the space given below:

Notes	

UNIT 4.6: Fit Up

Unit Objectives



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

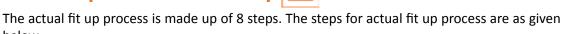
- 1. understand purpose and method of fit up;
- 2. to form the component as per the drawing.

4.6.1 Purpose of Fit Up

A proper fit up is important if a good weld is to be made. Every fit up has edge preparation

- 1. The joint is brought to the required shape and dimension as per the drawing
- 2. Avoids disturbance of alignment of the joint during welding

4.6.2 Steps for Actual Fit Up



below Step 1

To arrange the components that we need.

Step 2

- Components are kept side by side on a levelled surface.
- With a try square the level of the surface is checked.
- The ends are checked to see if they are properly aligned.

Step 3

Next, a bent rod is inserted at the side where the welding will end.

Step 4

The alignment of the front and the back of the metals to be welded, are checked and adjusted accordingly.

Step 5

The bridge plates are tacked.

Step 6

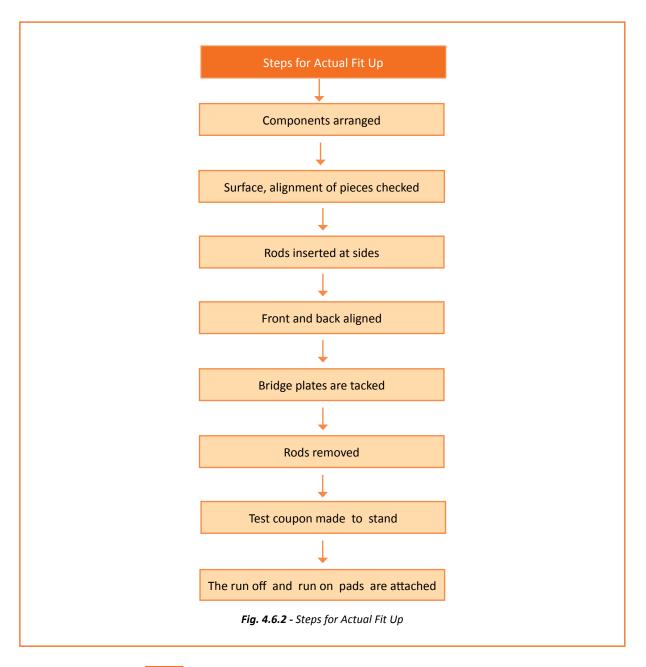
The second bridge plate is also placed and tacked as done for the first bridge plate.

Step 7

The rods are removed and the test coupon is made to stand on the bridge.

Step 8

• The runoff and run on pads are attached.



Exercise



1. Create a mind map as seen in the multimedia module in the space given below:

_	Notes	











5. Flux Cored Arc Welding (FCAW)

Unit 5.1 – Principles of Flux Cored Arc Welding (FCAW)



Key Learning Outcomes



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

- 1. explain why FCAW;
- 2. list the materials required for FCAW;
- 3. name the types of FCAW filler wire;
- 4. list the process parameters for FCAW.

UNIT 5.1: Principles of Flux Cored Arc Welding (FCAW)

- Unit Objectives



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

- 1. explain why FCAW;
- 2. list the materials required for FCAW;
- 3. name the types of FCAW filler wire;
- 4. list the process parameters for FCAW.

5.1.1 Why FCAW

FCAW process is used for various reasons:

- For high strength requirement;
- High productivity;
- Better shielding shielding provided by gas as well as slag;
- Suitable for varieties of materials;
- Can tolerate abuses weld even on rusted plates;
- Hard surfacing applications.

5.1.2 Materials Required for FCAW -

List of material required for FCAW:

- · Helmet with shaded glass;
- Gas cylinder;
- Power source;
- Gas hoses;
- Continuous filler wire flux cored wire;
- Gas;
- Interconnection cables;
- Torch;
- PPE;
- Welding cables;
- Wire feeder;
- Accessories.

5.1.3 Types of FCAW - Filler Wire

Different types of FCAW - filler wire are:

- Self shielding flux cored filler wire;
- Gas shielded flux cored filler wire;
- Hard surfacing flux cored filler wire either self shielding or gas shielding.

Classification of filler wires:

1. AWS classification – E70T1, E70T2, E71T1 etc.

5.1.4 Process Parameters for FCAW-

Process parameters of FCAW:

Globular transfer mode only

Exercise



1. Match the statements in column A with the corresponding options in column B to complete the sentences.

	Column A		Column B
a.	FCAW process can be used for	i.	FCAW - filler wire
b.	AWS classification	ii.	high productivity
C.	Self shielding flux cored filler wire	iii.	E70T1

- 2. Fill in the blanks.
 - a. In FCAW process ______ is used.
 - b. Process parameter for FCAW is _____

- Notes	
-	







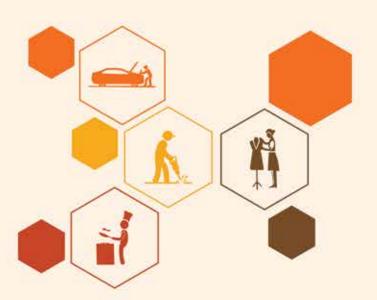




6. Gas Metal Arc Welding (GMAW) – After Welding

Unit 6.1 – Defects: Definition, Causes and Remedy

Unit 6.2 – Methods of Inspection



ASC/N0007 ASC/N0008

Key Learning Outcomes



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

- 1. list the common defects that occur during welding and their causes;
- 2. state the ways to prevent defects;
- 3. know the classification of inspection methods;
- 4. learn about the methods of Non Destructive Examination (NDE).

UNIT 6.1: Defects: Definition, Causes and Remedy

Unit Objectives



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

- 1. list the common defects that occur during welding and their causes;
- 2. state the ways to prevent defects.

6.1.1 Definition of Defect

- A welding defect is a discontinuity which does not allow the finished joint to withstand or carry the required load.
- All defects are discontinuities but all discontinuities shall not be defects.

6.1.2 Common Defects and their Causes in Welding

A defective welded joint will have the following common defects

1. Undercut: A groove at the toe or at the root of the weld on the weld face is called an undercut.

The causes of undercut can be due to:

- · Excessive amperage meaning too high current
- Arc length too long
- Too much weaving of electrode
- Travel speed too high or
- Electrode angle either too big or too small



Fig. 6.1.2.1 - Undercut

2. Overlap: When metal overflows on to the base metal at the toe or at the root of the weld, it is called overlap.

The causes of overlap can be due to:

- · Current too low
- Incorrect travel speed of the electrode
- Electrode size, that is electrode diameter too large or
- 'Angle of approach' not correct

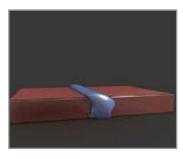


Fig. 6.1.2.2 - Overlap

3. **Slag Inclusion:** When any non-metallic material such as slag or other impurities is left behind in a weld, it is called an inclusion.

The causes of inclusion can be due to:

- Slag from previous run not removed
- Low current
- Wrong electrode angle
- Wrong electrode size or T
- Material not prepared properly

This defect will not appear in TIG welding as there is no slag formation in TIG welding



Fig. 6.1.2.3 - Slag Inclusion

4. **Porosity:** When small cavities or holes are formed from gas pockets in the weld metal, either externally or internally, the defect is called porosity.

The causes of porosity in SMAW can be due to:

- Wet electrodes
- Electrode flux breaking down leading to atmospheric contamination which results in porosity.
- Impurities on the surface of the base metal or too high travel speed.



Fig. 6.1.2.4 - Porosity

Cause of porosity in TIG welding can be due to:

Insufficient shielding due to poor gas coverage

5. **Lack of Fusion:** When the weld metal fails to blend completely with the base metal or a weld bead before it, the defect is called lack of fusion or incomplete fusion.

The causes of lack of fusion in SMAW can be due to:

- Small electrodes used on thick and cold steel
- Not enough heat and so base metal does not melt properly
- Wrong electrode angle and weaving
- Travel speed is too high and there is no enough time for fusion
- Surface of metal not clean



Fig. 6.1.2.5 - Lack of Fusion

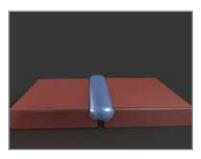
Causes of lack of fusion in TIG welding can be due to:

• Improper technique adopted by the welder

6. Incomplete Penetration: When the weld metal does not penetrate to the root of the joint it is called incomplete penetration.

Causes of incomplete penetration in SMAW can be due

- Current being too low
- Not enough root gap
- Electrode size is too big
- Improper technique, keyhole technique not followed completely



Causes of incomplete penetration in SMAW can be due Fig. 6.1.2.6 - Incomplete Penetration

- Improper technique, keyhole technique not followed completely
- Excessive Penetration: When the weld metal melts through the base metal and hangs underneath the weld, it is a defect and it is called excessive penetration.

The possible causes of excessive penetration in SMAW can be due to:

- Current being too high
- Electrode very big
- Incorrect travel speed

Causes of excessive penetration in TIG welding can be due to:

Incorrect welding technique and travel speed



Fig. 6.1.2.7 - Excessive Penetration

Burn Through: When the weld metal melts completely through the base metal and causes holes such that no metal remains, the defect is known as burn through.

Cause of burn through in SMAW can be due to:

- Low travel speed
- Too much of heat higher current

Causes of excessive penetration in TIG welding can be due to:

- Low travel speed
- Too much heat higher current

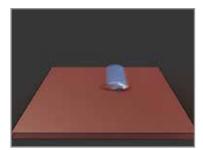


Fig. 6.1.2.8 - Burn Through

9. **Weld Cracking:** In any form of welding discontinuity called as cracks is not accepted. Cracks are fractures or breaks that appear in the weld. Cracks will occur in the weld metal when the stresses are more than the ultimate strength of the metal. Cracks can occur in the base metal or in the weld metal.

Some of the causes can be due to:

- Improper weld termination techniques
- The centre of the weld pool becoming solid before the outside of the weld pool and
- Electrodes may be wet or damp

Causes of excessive penetration in TIG welding can be due to:

Incorrect welding technique and travel speed



Fig. 6.1.2.9 - Weld Cracking

10. **Misalignment:** When the parts being welded are not aligned according to specifications, it is a defect and, is called misalignment.

Causes of misalignment can be:

- The parts to be welded have been assembled badly
- Tack welds inadequate or
- Insufficient damping that results in movement

Causes of burn through in TIG welding can be due to:

- Low travel speed
- Too much heat higher current



Fig. 6.1.2.10 - Misalignment

11. **Distortion:** Distortion cannot be eliminated in any form of welding, though it can be controlled. If the weld metal contracts during welding forcing the base metal to move, it is a defect called distortion.

Possible causes of distortion can be:

- Non uniform heating and cooling of the joint or
- Excessive heat input

Causes of excessive penetration in TIG welding can be due to:

Incorrect welding technique and travel speed

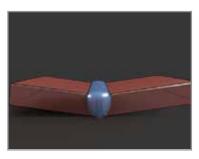


Fig. 6.1.2.11 - Distortion

12. **Excessive Spatter:** When there is a lot of scattering of molten metal particles that cool to solid form, near the weld bead it is called excessive spatter. It is a defect.

Causes of excess spatter can be due to:

- The amperage or current is too high for the electrode
- Arc length is too long or voltage is too high

There is no spatter in TIG welding.

- Low travel speed
- Too much heat higher current

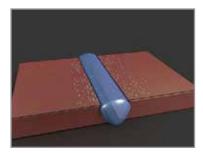


Fig. 6.1.2.12 - Excessive Spatter

- **13. Arc Strike:** If the electrode joins the base metal off from the weld accidentally it is called arc striking.
 - Cause of arc strike:
 - Due to operator error

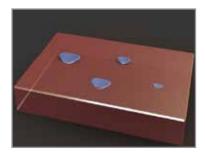


Fig. 6.1.2.13 - Arc Strike

14. **Tungsten Inclusion:** Tungsten inclusion is a defect which is due to tungsten melting and contaminating the base metal.

This occurs due to:

- Polarity change which leads to melting of the tungsten electrode
- Excessive current for the given diameter of the electrode

6.1.3 Results of Defect and Ways to Prevent Defects-

Sr. No.	Defects	Result of Defects	Ways to Prevent Defects
1	Undercut	The site will be weak and will not be able to take stress or load.	In most cases, the resultant groove with a smaller size electrode can be welded up to fix undercut.
2	Overlap	The metal does not fuse properly and notch formation takes place which results in stress concentration point thus the site cannot take tress.	The overlap can be repaired by grinding off excess weld metal and surface grinding the base metal to smoothen it.

Sr. No.	Defects	Result of Defects	Ways to Prevent Defects	
3	Slag Inclusion	Slag inclusions make the weld area weak and the joint can crack easily.	Inclusions can only be repaired by grinding down and re-welding.	
4	Porosity	Porosity reduces strength of the joint and metal corrodes easily.	 Dry the electrodes; reduce the arc length and remove all grease, dirt etc. Weld at slower speed to allow gases to escape Porosity can be repaired by grinding down and rewelding. 	
5	Lack of Fusion	Lack of fusion results in weak welded joints and these joints cannot take load or stress.	Use larger size electrodes, increase amperage, and follow correct welding techniques.	
6	Incomplete Penetration	The result of incomplete penetration is a weakened weld site and it cannot take load or stress.	The joint preparation and design must be such that the groove can be reached. Increase the current and select proper electrode size.	
7	Excessive Penetration	The result of excessive penetration is the joint will become weak.	The defect can be avoided by keeping the current low, using a smaller electrode and by adjusting the travel speed.	
8	Burn Through	The joint has holes and becomes weak.	To avoid burn through, the heat must be kept low. Thus a lower current setting should be chosen. The electrode should be smaller and travel speed should be increased.	
9	Weld Cracking	A crack, by its nature, is sharp at its extremities and thus acts as a weak point. When under stress, a crack can increase in size.	opened till its depth and filled up A crack can be stopped	
10	Misalignment	Result of misalignment will be that both edges of the root will not melt. It will make the joint weak and it will bend easily.	Remedial action will be to ensure that all parts are aligned in the correct position before welding begins.	

Sr. No.	Defects	Result of Defects	Ways to Prevent Defects
		As a result of distortion the welded joint will not get the shape as desired	Weld shrinkage cannot be prevented, but it can be controlled. Here are some tips • Avoid over welding - The bigger the weld, the greater the shrinkage.
			 Use a clamp to hold base metal in position. Weld in small segments to distribute the heat uniformly over the plates.
12	Excessive Spatter	Excessive spatter results in poor weld appearance, wastes electrode and makes it difficult to see the weld puddle.	 For remedial action decrease amperage or select larger electrode and Reduce arc length or voltage.
13	Arc Strike	A small bit of base material melts where the arc is struck. The heat spreads through the plate and it may cause craters and cracks.	The operator has to be careful and not touch the electrode on the metal plate at unintended places when the machine is on.

Table 6.1.3 - Results of Defect and Ways to Prevent Defects

Exercise 📝

1. Create a Mind map as seen in the multimedia session in the space given below:

Notes			

UNIT 6.2: Methods of Inspection

Unit Objectives



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

- 1. know the classification of inspection methods;
- 2. learn about the methods of Non Destructive Examination (NDE).

6.2.1 Classification of Inspection

Methods of inspection can be classified into destructive and non destructive examination. But first let us see destructive examination

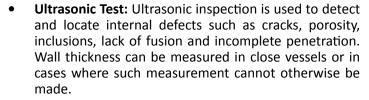
Destructive Examination

Destructive tests are costlier because they damage or break the weld. However they give accurate results regarding the strength of a weld, quality of weld metal and the operator's skill. Destructive testing is carried out on test specimens or on a specimen taken as a representative of several similar ones.

6.2.2 Non-Destructive Examination

In non–destructive testing the weld is not broken or damaged and is therefore a cheaper method of testing. Non destructive examination can be done by different methods depending on the requirement. The tests are given as below

- Visual Inspection: In visual inspection the finished weld should be examined for defects such as undercut, overlap, surface irregularities, cracks, porosity. Visual inspection should not be overlooked because it gives us a lot of information about the weld.
- Dye Penetrant Test: In dye penetrant test the weld is inspected for cracks, porosity or any other surface defect



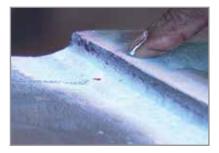


Fig. 6.2.2.1 - Visual Inspection



Fig. 6.2.2.2 - Ultrasonic Test

X-ray Test: X-rays are used to view a cross sectional area of a weld and locate defects. This process is called radiography. Radiographs are used to assess the quality of welded joints

Note

All the above test results are interpreted by certified quality inspectors.

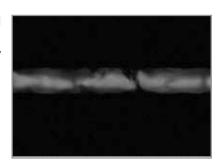


Fig. 6.2.2.3 - X-ray Test





1. Create a Mind map as seen in the multimedia session in the space given below:

- Notes	
L	











7. Demonstration

Unit 7.1 – Run a Bead in 1F Position (Short Circuit Mode of Transfer)

Unit 7.2 – Run a Bead in 1F position (Globular Transfer Mode)

Unit 7.3 – Run a Bead in 1F Position (Spray Transfer Mode)

Unit 7.4 – Fillet Weld in 2F Position (Spray Transfer Mode)

Unit 7.5 – Running a Parallel Bead in 1F Position (Short Circuit Mode of Transfer)

Unit 7.6 – Merging a Bead in 1F Position (Short Circuit Mode of Transfer)

Unit 7.7 – Root Run in 1G Position (Short Circuit Mode of Transfer)

Unit 7.8 – Lap Joint in Inclined Position (Short Circuit Mode of Transfer)

Unit 7.9 – FCAW - Butt Weld on 8 mm Plate in 2G Position

Unit 7.10 - FCAW - Fillet Weld on 8 mm Plate in 2F Position



ASC/N3104 ASC/N3105

Key Learning Outcomes



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

- 1. run a bead along a pre-defined path in 1F position in short circuit mode of transfer;
- 2. run a bead along a pre-defined path in 1F position in globular transfer mode;
- 3. run a bead along a pre-defined path in 1F position in spray transfer mode;
- 4. practice fillet weld on 8 mm plate in 2F position using 1.2 mm wire using spray transfer mode:
- 5. run a parallel bead in 1F position in short circuit mode of transfer;
- 6. Merge a bead in 1F position in short circuit mode of transfer;
- 7. lay a root run on a 3 mm plate in 1G position in short circuit mode of transfer;
- 8. practice lap joint on 3 mm plate in inclined position using short circuit mode of transfer;
- 9. practice butt weld on 8 mm plate in 2G position using 1.2 mm E 70-T1 flux cored wire and CO₂;
- 10. practice fillet weld on 8 mm plate in 2F position using 1.2 mm E 70-T1 flux cored wire and CO₂.

UNIT 7.1: Run a Bead in 1F Position (Short Circuit Mode of Transfer)

Unit Objectives



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

1. run a bead along a pre-defined path in 1F position in short circuit mode of transfer.

7.1.1 Materials Needed

The materials and equipments required to run a bead along a pre-defined path is:

- Mild Steel Plate
- MIG wire
- Chipping hammer
- Work table connected to earth
- Bucket of water
- Ruler
- Complete MIG welding outfit
- Earth cable with clamp
- Helmet with shaded glass
- Carbon dioxide (CO₂)
- Regulator
- Flow meter
- Personal Protective Equipment

7.1.2 Procedure to Run a Bead



The steps to run a bead are:

1 Wear the PPE.



2 Set the machine for striking a GMAW arc.



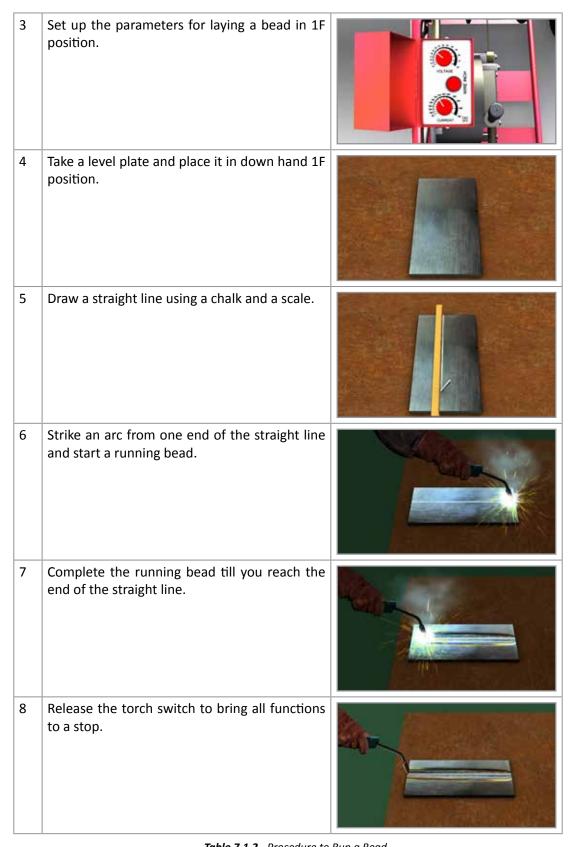


Table 7.1.2 - Procedure to Run a Bead

7.1.3 Parameters for Short Circuit Mode of Transfer

For short circuit mode of transfer parameters are:

Filler wire	0.8 mm
Gas	CO ₂
Current	160 amps
Wire feed speed	320 inches/min (8.13 meters)
Voltage	20 volts
Gas flow rate	16 litres /minute
Stick-out	12 to 15 mm
Welding /Travel speed	250 mm/min
Joint position	1F
Torch (angle and technique)	Push or Pull technique
Torch weaving	Yes/No
Base material	3 mm MS Plate

Exercise 🕝



- 1. State whether the following statements are true or false.
 - a. MIG welding is a production-oriented process _____
 - b. In GMAW, an arc is struck between a non-consumable electrode and base metal
- 2. Match the statements in column A with the corresponding options in column B to complete the sentences.

	Column A		Column B
а	For running a bead the plate should be put in	i	is required for running a bead.
b	Regulator is used to	ii	to release the gas at operating low pressure range.
С	The bead that is formed by melting the plate and the filler material is shielded from the atmosphere by	iii	down hand position.
d	Chipping hammer	iv	shielding gas.

3. Fill in the parameters required to run a bead on chalk line using short circuit mode of transfer.

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Base material	

Notes			
ı			

UNIT 7.2: Run a Bead in 1F position (Globular Transfer Mode)

Unit Objectives



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

1. run a bead along a pre-defined path in 1F position in globular transfer mode.

7.2.1 Materials Needed

- Mild Steel Plate
- MIG wire
- Chipping hammer
- Work table connected to earth
- Bucket of water
- Ruler
- Complete MIG welding outfit
- Earth cable with clamp
- Helmet with shaded glass
- Carbon dioxide (CO₂)
- Regulator
- Flow meter
- Personal Protective Equipment

7.2.2 Procedure to Run a Bead 💾



The steps to run a bead are:

Wear the PPE.



Set the machine for striking a GMAW arc.



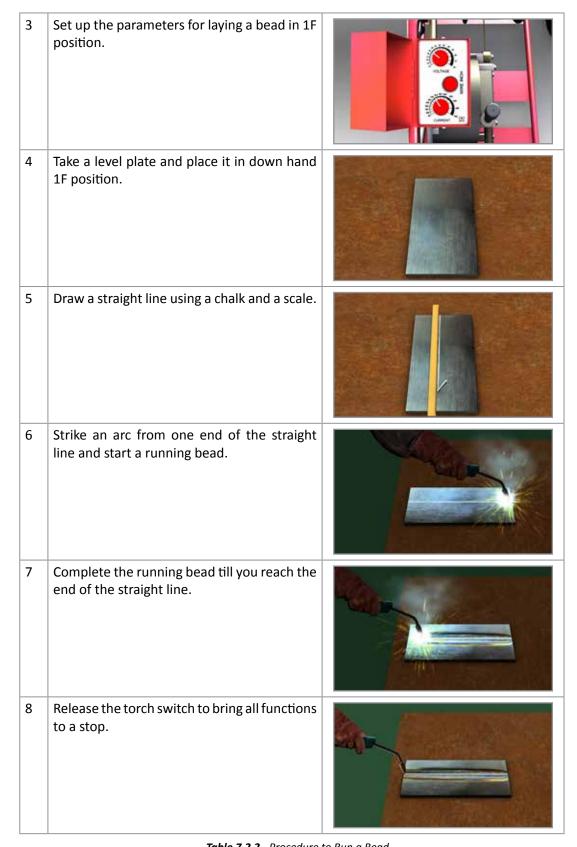


Table 7.2.2 - Procedure to Run a Bead

7.2.3 Parameters for Globular Mode of Transfer -

For globular mode of transfer parameters are:

Filler wire	1.2 mm			
Gas	CO ₂			
Current	230 amps			
Wire feed speed	230 inches/min (5.85 meters)			
Voltage	25 volts			
Gas flow rate	16 litres /minute			
Stick-out	12 to 15 mm			
Welding /Travel speed	250-300 mm/min			
Joint position	1F			
Torch (angle and technique)	Push or Pull technique			
Torch weaving	Yes/No			
Wire consumable	ER 70S6 diameter 1.2 mm			
Base material	8 mm – 10 mm MS Plate			

Exercise



1. Fill in the parameters required to run a bead on chalk line using globular transfer mode.

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Notes	

UNIT 7.3: Run a Bead in 1F Position (Spray Transfer Mode)

Unit Objectives



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

1. run a bead along a pre-defined path in 1F position in spray transfer mode.

7.3.1 Materials Needed -

- Mild Steel Plate
- MIG wire
- Chipping hammer
- Work table connected to earth
- Bucket of water
- Ruler
- Complete MIG welding outfit
- Earth cable with clamp
- Helmet with shaded glass
- Argon CO, mixed gas
- Regulator
- Flow meter
- Personal Protective Equipment

7.3.2 Procedure to Run a Bead



The steps to run a bead are:

1 Wear the PPE.



2 Set the machine for striking a GMAW arc.



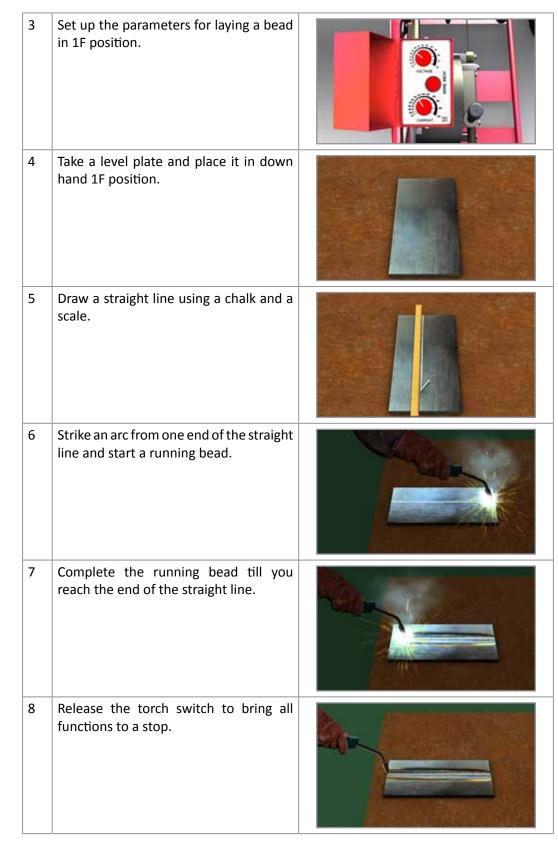


Table 7.3.2 - Procedure to Run a Bead

7.3.3 Parameters for Spray Transfer Mode -

For spray mode of transfer parameters are:

Filler wire	1.2 mm		
Gas	80/20, Argon CO ₂ mixed gas		
Current 260 amps			
Wire feed speed 260 inches/min (6.6 meters)			
Voltage	27 volts		
Gas flow rate	16 litres /minute		
Stick-out	15 to 18 mm		
Welding /Travel speed	250-300 mm/min		
Joint position	1F		
Torch (angle and technique)	Push or Pull technique		
Torch weaving	Yes/No		
Wire consumable	ER 70S6 diameter 1.2 mm		
Base material	8 mm – 10 mm MS Plate		

Exercise



1. Fill in the parameters required to run a bead on chalk line using spray transfer mode:

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Notes	

UNIT 7.4: Fillet Weld in 2F Position (Spray Transfer Mode)

Unit Objectives



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

 practice fillet weld on 8 mm plate in 2F position using 1.2 mm wire using spray transfer mode.

7.4.1 Materials Needed -

To weld a single pass fillet in 2F position you will require the following tools and equipments:

- Mild Steel Plate
- A MIG Filler rod
- Chipping hammer
- Work table connected to earth
- Bucket of water
- Ruler
- Complete MIG welding outfit
- Earth cable with clamp
- · Helmet with shaded glass
- Argon CO₂ mixed gas
- Regulator
- Flow meter
- Personal Protective Equipment (PPE)

7.4.2 Procedure to do a Single Pass Fillet Weld in 2F Position



The steps to run a single pass fillet weld in 2F position are:

- 1. Wear the PPE.
- 2. Set the machine for striking a GMAW arc.
- 3. Set the parameters for striking a GMAW arc in 2F position.
- 4. Using a chalk, draw a line parallel to the length of a plate at 25 mm from the sides.

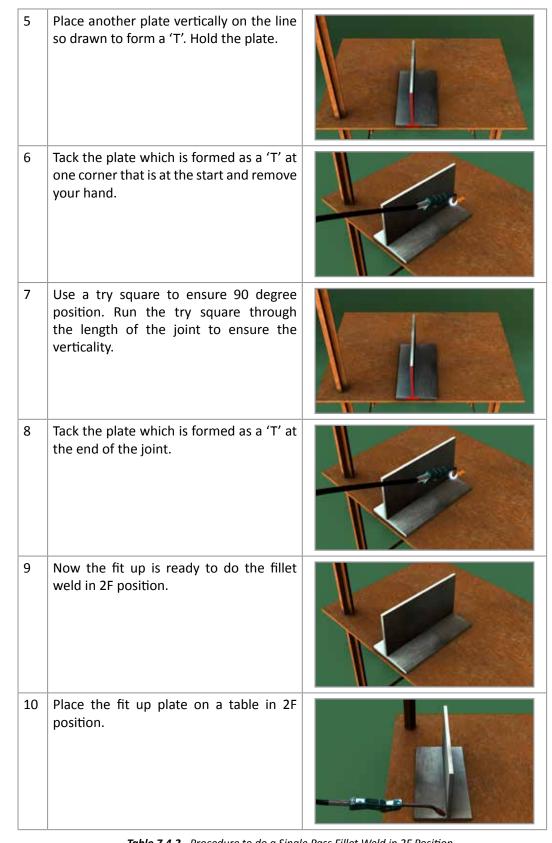


Table 7.4.2 - Procedure to do a Single Pass Fillet Weld in 2F Position

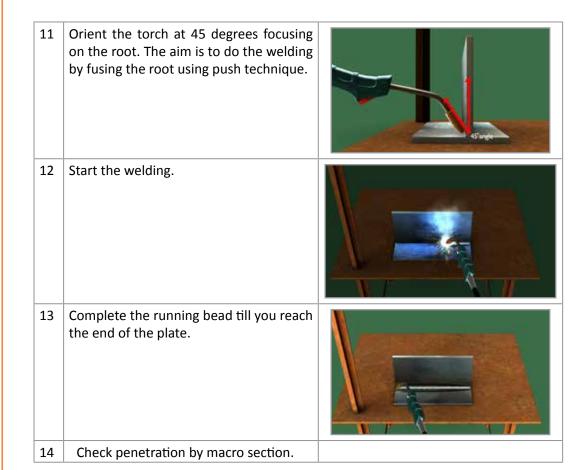


Table 7.4.2 - Procedure to do a Single Pass Fillet Weld in 2F Position

7.4.3 Parameters for Spray Transfer Mode

For spray transfer mode parameters are:

Filler wire	1.2 mm		
Gas	80/20, Argon CO ₂ mixed gas		
Current 260 amps			
Wire feed speed 260 inches/min (6.6 meters)			
Voltage 27 volts			
Gas flow rate	16 litres /minute		
Stick-out 15 to 18 mm			
Welding /Travel speed	250-300 mm/min		
Joint position	2F		
Torch (angle and technique)	Push or Pull technique		
Torch weaving	Yes/No		
Wire consumable	ER 70S6 diameter 1.2 mm		
Base material	8 mm – 10 mm MS Plate		



Wire consumable Base material

— г.		1:19 .			
E	kercise	:0			
1.			_	nts are true or false.	
	a. Flow m	neter is u	sed to regulate the	e flow of weld metal	·
	b. All fille	t welds a	are defined by spec	cified leg lengths.	.
2.	Following a Write dowr		•	eld a single pass fillet weld	in 2F position.
	1. Wear t	he PPE.			
	2.				
	3. Set the4.	parame	ters for striking a G	GMAW arc in 2F position.	
		nother	olate vertically on t	he line so drawn to form a '	T'. Hold the plate.
		e plate	•	a 'T' at one corner that is	•
	7.				
	8. Tack th	e plate v	which is formed as	a 'T' at the end of the joint.	
	9.				
	10. Place the	he fit up	plate on a table in	2F position.	
	11.				
	12. Start t	he weld	ng.		
	13. Comple	ete the r	unning bead till yo	u reach the end of the plate	!.
	14. Check	penetrat	tion by macro section	on.	
3.	Fill in the b	lanks.			
	a		joints are used to f	illet joints.	
	b. Torch o		•	let weld should be	degrees focusing
4.	-		ers required to fille ansfer mode.	et weld on 8 mm plate in 2F	position using 1.2 mm
	Filler wire				
	Gas				
	Current				
	Wire feed	speed			
	Voltage				
	Gas flow ra	ate			
	Stick-out				
	Welding /1	Travel sp	eed		
	Joint posit	ion			
	Torch (ang	le and te	chnique)		
	Torch wear	ving		I	

Notes	

UNIT 7.5: Running a Parallel Bead in 1F Position (Short Circuit Mode of Transfer)

Unit Objectives



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

1. run a parallel bead in 1F position in short circuit mode of transfer.

7.5.1 Materials Needed

You will require the following tools and equipments:

- Mild Steel Plate
- MIG wire
- Chipping hammer
- Work table connected to earth
- **Bucket of water**
- Ruler
- Complete MIG welding outfit
- Earth cable with clamp
- Helmet with shaded glass
- Carbon dioxide (CO₂)
- Regulator
- Flow meter
- Personal Protective Equipment (PPE)

7.5.2 Procedure to Run a Parallel Bead 🖆



Following are steps to run a parallel bead in 1F position:

- 1. Wear the PPE.
- 2. Set the machine for striking a GMAW arc.
- 3. Set up the parameters for striking a GMAW arc.
- 4. Take a level plate and place it in down hand 1F position.
- 5. Draw a straight line using a chalk and a scale.
- 6. Strike an arc from one end of the straight line and start a running bead.
- 7. Complete the running bead till you reach the end of the straight line.
- 8. Release the torch switch to bring all functions to a stop.
- Position the torch, say, 10 milli-meters from the start of the earlier bead. Use the earlier bead as a guide to run another bead parallel to the first.



Fig. 7.5.2 - Procedure to Run a Parallel Bead

7.5.3 Important Tips and Points to Remember

Always remember the following points while running a parallel bead.

- The width of the running bead on both runs should be uniform from start to finish. This signifies that your hand is steady.
- The 2nd run should be absolutely parallel to the first run. This signifies that you are able to bring out the output exactly the way you visualised.
- The height or reinforcement of the bead should be uniform from start to finish. This signifies good hand-eye coordination and synchronisation of feeding of filler material.

7.5.4 Parameters for Short Circuit Mode of Transfer

For short circuit mode of transfer parameters are:

Filler wire	0.8 mm			
Gas	CO ₂			
Current 160 amps				
Wire feed speed 320 inches/min (8.13 meters)				
/oltage 20 volts				
Gas flow rate 16 litres /minute				
Stick-out 12 to 15 mm				
Welding /Travel speed	250 mm/min			
Joint position	1F			
Torch (angle and technique)	Push or Pull technique			
Torch weaving	Yes/No			
Wire consumable	ER 70S6 diameter 1.2 mm			
Base material	3 mm MS Plate			

Exercise | 🗹



1. State whether the following statements are true or false.

- a. The uniform width of both the parallel beads signifies a steady hand. _
- b. In GMAW process, the torch is connected to the negative terminal of a DC power
- MIG welding can be used for joining all types of metals by choosing the appropriate shielding gas. __
- d. Helmet is paired with non-coloured glasses to protect the welder from heat and spatter. ___

2. Fill in the blanks.

- a. Straight polarity means that the torch is connected to the ______ terminal of DC power source.
- b. The maximum distance between two parallel beads is ____

3. Fill in the parameters required to run a parallel bead in 1F position using short circuit mode of transfer.

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Notes			

UNIT 7.6: Merging a Bead in 1F Position (Short Circuit Mode of Transfer)

Unit Objectives



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

1. Merge a bead in 1F position in short circuit mode of transfer.

7.6.1 Types of Weld -

Weld is classified into Fillet Weld and Groove Weld.

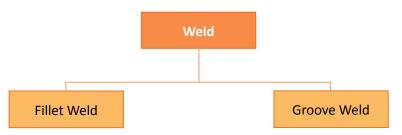


Fig. 7.6.1 - Types of Weld

The various parts of weld are:

- **Face**: The face represents the insides of the weld. If the face is good, the weld can be expected to be sound.
- **Toe**: Toe of the weld takes the entire load of the weld. A well done toe doesn't have any undercuts.
- Throat: The throat, also called penetration, is normally defined by the leg length.
- **Reinforcement:** The height to which the bead is protruding from the surface of the plate is the reinforcement.
- **Leg Length:** The distance from the root to the toe of the fillet weld. Leg length determines the size of fillet weld. The leg length should be uniform.

7.6.2 Materials Required

The materials and tools required to merge a bead is:

- Mild Steel Plate
- MIG wire
- Chipping hammer
- Work table connected to earth
- · Bucket of water
- Ruler

- Complete MIG welding outfit
- Earth cable with clamp
- Helmet with shaded glass
- Carbon dioxide (CO₂)
- Regulator
- Flow meter
- Personal Protective Equipment (PPE)

7.6.3 Procedure to Merge a Bead



The steps to merge a bead are:

- 1. Wear the PPE.
- 2. Set the machine for striking a GMAW arc.
- 3. Set up the parameters for laying a bead in 1F position.
- 4. Take a level plate and place it in downhand 1F position.
- 5. Draw a straight line using a chalk and a scale.
- 6. Strike an arc from one end of the straight line and start a running bead.
- 7. Complete the running bead till you reach the end of the straight line.
- 8. Release the torch switch to bring all functions to a stop.
- 9. Start the second run. Focus the arc on the toe of the 1st run. Form a bead in such a way that 50% of it is over the 1st bead and rest 50% is on the base plate.

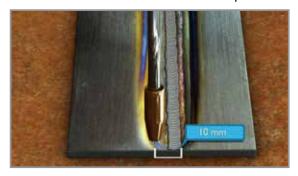


Fig. 7.6.3.9 - Procedure to Merge a Bead

10. Continue in the same way till you complete the pad of defined size.

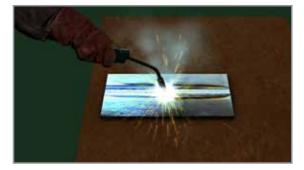


Fig. 7.6.3.10 - Procedure to Merge a Bead

7.6.4 Things to Remember

Always remember the following while merging a bead.

- The merged pad should have a uniform height of deposit of weld metal.
- There should not be any deep grooves. To find this out, run a sharp tool on the beads. If the tool is stuck in the beads, it means the groove is deep, which is not preferable.
- Voids are under filled pockets. There should not be any voids.

7.6.5 Parameters for Short Circuit Mode of Transfer

For short circuit mode of transfer parameters are:

Filler wire	0.8 mm
Gas	CO ₂
Current	160 amps
Wire feed speed	320 inches/min (8.13 meters)
Voltage	20 volts
Gas flow rate	16 litres /minute
Stick-out	12 to 15 mm
Welding /Travel speed	250 mm/min
Joint position	1F
Torch (angle and technique)	Push or Pull technique
Torch weaving	Yes/No
Wire consumable	ER 70S6 diameter 1.2 mm
Base material	3 mm MS Plate

Exercise



- 1. State whether the following statements are true or false.
 - a. The merged pad should have a uniform height of deposit of weld metal. _______
 - b. Presence of voids is desirable in the final product. ______.
- 2. Match the statements in column A with the corresponding options in column B to complete the sentences.

	Column A		Column B
a.	The presence of deep grooves is checked by	i.	Penetration.
b.	The strength of the weld is determined by	ii.	Running a sharp tool on the surface of the weld.
c.	The throat is also called	iii.	Down hand position.
d.	For merging the bead, the plate is to be put in	iv.	Face of the weld.

Fill in the blanks. a. The leg length should be	
	otruding from the surface of the plate is the
	otracing from the surface of the plate is the
Fill in the parameters required to mer	ge a bead in 1F position using short circuit mode
transfer.	50 a 200a 2. Postuon asB successiveness
Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

UNIT 7.7: Root Run in 1G Position (Short Circuit Mode of Transfer)

Unit Objectives



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

1. lay a root run on a 3 mm plate in 1G position in short circuit mode of transfer.

7.7.1 Material Required

Following are the tools and accessories required for a root run:

- Mild Steel Plates (2 numbers)
- MS rod
- Chipping hammer
- Chipping hammer
- Work table connected to earth
- Bucket of water
- Ruler
- Complete MIG welding outfit
- Earth cable with clamp
- Helmet with shaded glass
- Carbon dioxide (CO₂)
- Regulator
- Flow meter
- Personal Protective Equipment (PPE)

7.7.2 Procedure to Run a Bead 💾



The steps to run a bead are:

- 1. Wear the PPE.
- Set the machine for striking a GMAW arc.

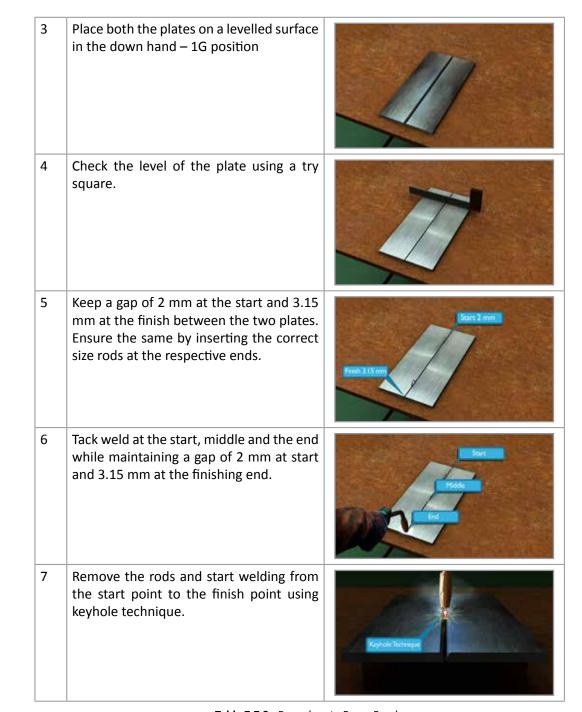


Table 7.7.2 - Procedure to Run a Bead

7.7.3 Parameters for Short Circuit Mode of Transfer

For short circuit mode of transfer parameters are:

Filler wire	0.8 mm
Gas	CO ₂
Current	160 amps
Wire feed speed	320 inches/min (8.13 meters)
Voltage	20 volts
Gas flow rate	16 litres /minute
Stick-out	12 to 15 mm
Welding /Travel speed	250 mm/min
Joint position	1G
Torch (angle and technique)	Push or Pull technique
Torch weaving	Yes/No
Wire consumable	ER 70S6 diameter 1.2 mm
Base material	3 mm MS Plate

Exercise



- 1. State whether the following statements are true or false.
 - a. Inspection of full plate is done for completeness of the weld and not for full penetration.
 - b. Insufficient shielding gas coverage leads to porosity. ______.
- 2. Following are a few steps from the procedure of laying a root run in 1G position. Tick the step which doesn't belong to the procedure.
 - 1. Wear the PPE.
 - 2. Set up the machine for striking a GMAW arc.
 - 3. Place the fit up plate on a table in 1F position.
 - 4. Check the level of the plate using a try square.
 - 5. Keep a gap of 2 mm at the start and 3.15 mm at the finish between the two plates. Ensure the same by inserting the correct size rods at the respective ends.
 - 6. Tack weld at the start, middle and the end while maintaining a gap of 2 mm at start and 3.15 mm at the finishing end.
 - 7. Remove the rods and start welding from the start point to the finish point using keyhole technique.

3. Fill in the parameters required to root run in 1G position using short circuit mode of transfer.

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Notes		

UNIT 7.8: Lap Joint in Inclined Position (Short Circuit Mode of Transfer)

Unit Objectives



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

1. practice lap joint on 3 mm plate in inclined position using short circuit mode of transfer.

7.8.1 Materials Needed

- Mild steel plate of size
- A MIG filler wire
- Chipping hammer
- Work table connected to the ground
- · Bucket of water
- Ruler
- · Complete MIG welding outfit
- Earth cable with clamp
- Helmet with shaded glass
- Gas cylinder
- Regulator
- Flow meter
- Personal Protective Equipment (PPE)

7.8.2 Procedure to Lap Joint on 3 mm Plate in Inclined Position



- 1. The procedure for making this weld is similar to that used for making fillet welds in T joints.
- 2. The electrode should be held to form an angle approximately 30° from the vertical and tilted 15° in the direction of welding.
- 3. The position of the electrode in relation to the plates is shown in the given figure.

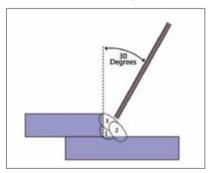


Fig. 7.8.2.3 - Position of the Electrode

- 4. The aim is to do the welding by using push or pull technique.
- 5. Start the welding.
- 6. Complete the running bead till you reach the end of the plate.
- 7. Repeat the same exercise by keeping the plates in an inclined position.

7.8.3 Parameters for Short Circuit Mode of Transfer

For short circuit mode of transfer parameters are:

Filler wire	0.8 mm
Gas	CO ₂
Current	160 amps
Wire feed speed	320 inches/min (8.13 meters)
Voltage	20 volts
Gas flow rate	16 litres /minute
Stick-out	12 to 15 mm
Welding /Travel speed	250 mm/min
Joint position	Inclined
Torch (angle and technique)	Push or Pull technique
Torch weaving	Yes/No
Wire consumable	ER 70S6 diameter 1.2 mm
Base material	3 mm MS Plate

Exercise



1. Fill in the parameters required to lap joint in inclined position in short circuit mode of transfer.

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

- Notes	

UNIT 7.9: FCAW - Butt Weld on 8 mm Plate in 2G Position

Unit Objectives



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

1. practice butt weld on 8 mm plate in 2G position using 1.2 mm E 70-T1 flux cored wire and CO₃.

7.9.1 Tools and Materials Required

The materials and tools required are:

- Mild steel plates of size 8 mm X 50 mm X 200 mm
- Flux cored filler wire of size 1.2 mm specification E 70 T1
- MS rod of size 2.5 and 3.15 mm
- · Chipping hammer
- Tri-square
- table connected to the ground
- Bucket of wate
- Chalk piece
- Ruler
- FCAW welding outfit
- Earth cable with clamp
- Head shield with shaded glass
- Gas cylinder
- Regulator
- Flow metre
- Personal Protective Equipment (PPE)

7.9.2 Procedure to Do Butt Weld on 8 mm Plate in 2G Position



- 1. Wear the PPE.
- 2. Set the machine for striking a FCAW arc.
- 3. Set the parameters for striking a FCAW arc in 2G position.

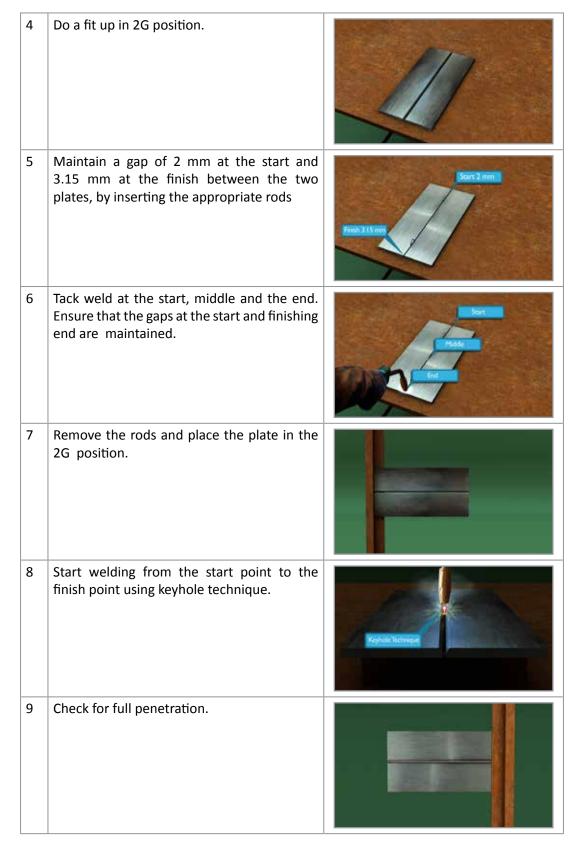


Table 7.9.2 - Procedure to Do Butt Weld on 8 mm Plate in 2G Position

7.9.3 Typical operating parameters for FCAW E 70 – T1 – wire size 1.2 mm

- Filler wire (1.2 mm)
- Gas CO₂
- Current 250-260 amps, Wire feed speed 320-340 inches/min (8.12 8. 64 meters)
- Voltage 28-30 volts
- Gas flow rate 16-18 litres /minute
- Stick-out 22 to 25 mm
- Welding/Travel Speed 280-300 mm/min
- Joint position 2G
- Torch (angle and technique) Push or Pull technique
- Torch weaving No
- Wire consumable E 70 T-1 diameter 1.2 mm
- Base material 8 mm MS plate

Exercise



- 1. State whether the following statements are true or false.
 - a. The gap at the finishing point in a root run is approx 3mm.
 - b. The rods need to be removed before laying the root run. _____
- 2. Tick the incorrect step from the process.

a.	Do a fit up in 1G position.	
b.	Remove the rods and place the plate in the 2G position.	
c.	Place the fit up plate on a table in 1F position.	
d.	Check for full penetration.	

3. Fill in the blanks.

- a. ______ is not the most economical shielding gas.
- b. _____ welding technique is used for laying a root run weld in 2G positions.

UNIT 7.10: FCAW - Fillet Weld on 8 mm Plate in 2F Position

Unit Objectives



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

1. practice fillet weld on 8 mm plate in 2F position using 1.2 mm E 70-T1 flux cored wire and CO₃.

7.10.1 Tools and Materials Required

The materials and tools required are:

- Mild steel plates of size 8 mm X 50 mm X 200 mm
- Flux cored filler wire of size 1.2 mm specification E 70 T1
- MS rod of size 2.5 and 3.15 mm
- Chipping hammer
- Tri-square
- Work table connected to the ground
- Bucket of water
- Chalk piece
- Ruler
- FCAW welding outfit
- Earth cable with clamp
- Head shield with shaded glass
- Gas cylinder
- Regulator
- Flow metre
- Personal Protective Equipment (PPE)

7.10.2 Procedure to Fillet Weld on 8 mm Plate in 2F Position



To do fillet weld on 8 mm plate in 2F position, you should follow the following steps:

- 1. Wear the PPE.
- 2. Set the machine for striking a FCAW arc.
- 3. Set the parameters for striking a FCAW arc in 2F position.
- 4. Using a chalk, draw a line parallel to the length of a plate at 25 mm from the sides.

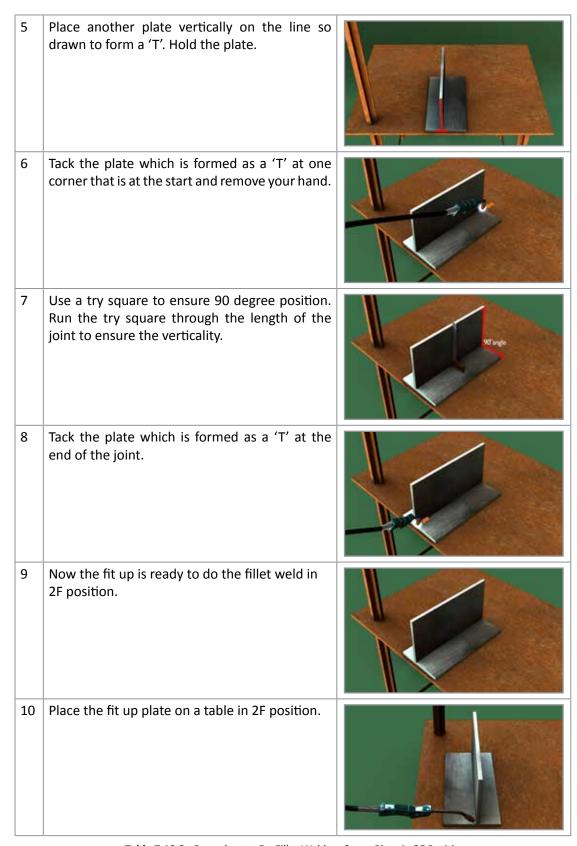
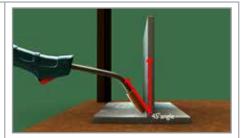


Table 7.10.2 - Procedure to Do Fillet Weld on 8 mm Plate in 2F Position

Orient the torch at 45 degrees focusing on the root. The aim is to do the welding by fusing the root using push technique.



12 Start the welding.



13 Complete the running bead till you reach the end of the plate.

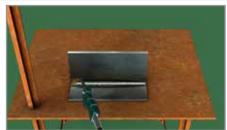


Table 7.10.2 - Procedure to Do Fillet Weld on 8 mm Plate in 2F Position

7.10.3 Typical operating parameters for FCAW E70 – T1 wire size 1.2 mm:

- Filler wire (1.2 mm)
- Gas CO,
- Current 250-260 amps, Wire feed speed 320-340 inches/min (8.12 8. 64 meters)
- Voltage 28-30 volts
- Gas flow rate 16-18 litres /minute
- Stick-out 22 to 25 mm
- Welding/Travel Speed 280-300 mm/min
- Joint position 2G
- Torch (angle and technique) Push or Pull technique
- Torch weaving No
- Wire consumable E 70 T-1 diameter 1.2 mm
- Base material 8 mm MS plate

Exercise



	1.	Fill	in the	blanks.
--	----	------	--------	---------

- a. _____ gas is used for FCAWE 70 T1 wire size 1.2 mm.
- b. Wire feed speed should be ______ for FCAWE 70 T1 wire size 1.2 mm.
- c. Gas flow for FCAWE 70 T1 wire size 1.2 mm should be ______.
- d. Voltage range for FCAWE 70 T1 wire size 1.2 mm should be ______.

lotes			











8. Practical

Unit 8.1 – Practical I – Short Circuit Mode of Transfer in 1F Position

Unit 8.2 – Practical II – Short Circuit Mode of Transfer in 1G Position

Unit 8.3 – Practical III – Lap Joint in Inclined Position (Short Circuit Mode of Transfer)

Unit 8.4 – Practical IV – Spray Transfer Mode in 1G Position

Unit 8.5 – Practical V – Spray Transfer Mode in 2F Position

Unit 8.6 – Practical VI – Test Plate Welding (Lap and Square Butt) 3 mm plate , 0.8 mm wire and ${\rm CO_2}$ in Inclined Position Using Short Circuit Mode of Transfer

Unit 8.7 – Practical VII – Test Plate Welding in 2F Position Using Spray
Transfer Mode



ASC/N3106 ASC/N0007 ASC/N0008

Key Learning Outcomes



- 1. practice to run a bead on plate in 1F position in short circuit mode of transfer;
- 2. practice to run a parallel bead on plate in 1F position in short circuit mode of transfer;
- 3. practice to merge a bead on plate in 1F position in short circuit mode of transfer;
- 4. practice to lay a root run on plate in 1F position in short circuit mode of transfer;
- 5. practice to run a bead on plate in 1G position in short circuit mode of transfer;
- 6. practice to run a parallel bead on plate in 1G position in short circuit mode of transfer;
- 7. practice to merge a bead on plate in 1G position in short circuit mode of transfer;
- 8. practice to lay a root run on plate in 1G position in short circuit mode of transfer;
- 9. practice lap joint on 3 mm plate in inclined position using open arc, 0.8 mm wire and CO₃;
- 10. practice to run a bead on plate in 1G position in spray transfer mode;
- 11. practice to run a parallel bead on plate in 1G position in spray transfer mode;
- 12. practice to merge a bead on plate in 1G position in spray transfer mode;
- 13. practice to lay a root run on plate in 1G position in spray transfer mode;
- 14. practice fillet weld on 8 mm plate in 2F position using 1.2 mm wire using spray transfer mode;
- 15. practice lap joints on 3 mm plate in inclined position using an open arc, 0.8 mm wire and CO₂ using short circuit mode of transfer;
- 16. prepare a square butt joint on 3 mm sheet using short circuit mode of transfer with 0.8 mm wire and CO₃;
- 17. perform fillet weld on 8 mm plate in 2F position using 1.2 mm wire with spray transfer mode.

UNIT 8.1 : Practical I – Short Circuit Mode of Transfer in 1F Position

Unit Objectives



- 1. practice to run a bead on plate in 1F position in short circuit mode of transfer;
- 2. practice to run a parallel bead on plate in 1F position in short circuit mode of transfer;
- 3. practice to merge a bead on plate in 1F position in short circuit mode of transfer;
- 4. practice to lay a root run on plate in 1F position in short circuit mode of transfer.

31	ort Circuit Mode of Transfer	Position in -
Note the materials required:		
-4- 4b		
ote the pro	ocedure:	

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Note the parameters for short circuit mode of transfer:

Competencies to be Tested

- Participants should move the torch from right to left i.e. they should use the leftward technique/forward technique/push technique along the chalk line to form a continuous, smooth, reinforced, liquid bead of uniform height and width exhibiting a smooth ripple.
- Perform the activity to complete 25 metres.

Note to the Trainer:

- Trainer needs to explain the philosophy of making the welder do bead on chalk line to form path and make him follow the chalk line.
- Ensure that the participants are given every facility for performing the practical well. For example, the shaded glasses which are attached to their helmets should be checked and replaced time after time so that the stains do not obscure the participant's vision.
- The participant themselves should be conditioned to consider these minute details and make sure everything is in place.

Evaluation Parameter	Marks Per Line	Marks Obtained
Straightness of the bead for each	h line	
No deviation	2	
Deviation present	0	
Uniformity of width of the bead	for each line	
Uniform width (within - 2 mm in size)	2	
Not uniform	0	

0-1 stop and restart (smooth finish) 2 or 3 stops and restart (smooth finish) More than 3 stops and restarts 0 Defects: Undercut and overlap for each line Up to 2 defects 2 3 or 4 defects 1 More than 4 0 Total 10	Evaluation Parameter	Marks Per Line	Marks Obtained
in size) Not uniform O Stops and restart quality for each line 0-1 stop and restart (smooth finish) 2 or 3 stops and restart (smooth finish) More than 3 stops and restarts O Defects: Undercut and overlap for each line Up to 2 defects 3 or 4 defects More than 4 O Total	Uniformity of height of the beac	d for each line	
Stops and restart quality for each line 0-1 stop and restart (smooth finish) 2 or 3 stops and restart		2	
finish) 2 or 3 stops and restart (smooth finish) More than 3 stops and restarts 0 Defects: Undercut and overlap for each line Up to 2 defects 2 3 or 4 defects 1 More than 4 0 Total 10		0	
finish) 2 or 3 stops and restart (smooth finish) More than 3 stops and restarts 0 Defects: Undercut and overlap for each line Up to 2 defects 2 3 or 4 defects 1 More than 4 0 Total 1 1 1 1 1 1 1 1 1 1 1 1 1	Stops and restart quality for eac	h line	
(smooth finish) More than 3 stops and restarts Defects: Undercut and overlap for each line Up to 2 defects 3 or 4 defects More than 4 0 Total 10		2	
Defects: Undercut and overlap for each line Up to 2 defects 2 3 or 4 defects 1 More than 4 0 Total 10		1	
Defects: Undercut and overlap for each line Up to 2 defects 2 3 or 4 defects 1 More than 4 0 Total 10		0	
Up to 2 defects 2 3 or 4 defects 1 More than 4 0 Total 10		or each line	
3 or 4 defects 1 More than 4 0			
Total 10		1	
	More than 4	0	
	Fotal	10	
	rainer's Comments:		

3.1.2 Practice to Run a Parallel Bead on Plate in 1F Position in Short Circuit Mode of Transfer Note the materials required:			er		
te the ma	erials require	ed:			
e the pro	cedure:				
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Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

- Participants should move the torch along the chalk line using the push technique along the chalk line to form a continuous, smooth, reinforced, liquid bead of uniform height and width exhibiting a smooth ripple.
- The beads need to be laid keeping a spacing of 5 to 10 mm in such a way that the second bead shall run parallel to the first one.
- Participants should complete 25 metres.

Evaluation Parameter	Marks/Parameter	Marks Obtained
Follow the chalk line without an	y deviation	
No deviation	2	
Deviation present	0	
Parallelism of the second run wi	ith respect to the first run	
More than 2 inconsistencies	0	
0-2 inconsistencies	1	
Missed 0 to 2 steps	2	
Uniformity of the bead width		
Uniform width (within - 2mm in size)	2	
Not uniform	0	

Evaluation Parameter	Marks/Parameter	Marks Obtained
Uniformity of the height of the b	ead	
Uniform height (within - 2mm	2	
Not uniform	0	
Defects: Undercut and overlap for	or each line	
More than 4	0	
3 or 4 defects	1	
Up to 2 defects	2	
Total	10	

	Short Circuit Mo		
ote the ma	erials required:		
	•		
ote the pro	cedure:		
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Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch(angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Competencies to be tested and evaluation parameters:

- Participants should use push technique along the chalk line to form a continuous, smooth, reinforced, liquid bead of uniform height and width exhibiting a smooth ripple.
 They should focus on the toe of the first bead to have a smooth overlap/merging of bead.
- Perform the activity to complete 25 metres.

Evaluation Parameter	Marks/Parameter
Follow the chalk line in the first run without any deviation	
No deviation	2
Deviation present	0
Uniformity of the bead merging with the previous bead void of dunder-fil.	efects like undercut and
More than 2 inconsistencies	0
0-2 inconsistencies	1
Missed 0 to 2 steps	2
Uniformity of the height of the bead	
More than 2 inconsistencies	0
0-2 inconsistencies	1
Missed 0 to 2 steps	2

Evaluation Parameter	Marks/Parameter
Note: Variation should be checked using a flat scale or tri-square	and within 2mm
Defects: Undercut and overlap for each line	
Defects: Undercut and overlap for each line	
More than 4	0
3 or 4 defects	1
Up to 2 defects	2
Start and stops for the weld pad	
More than 3 stops and restarts	0
2-3 stops and restarts (smooth finish)	1
0-1 stop and restart (smooth finish)	2
Total	10

Circuit Mode of Transfer					
ote the mat	erials required	:			
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				
ote the pro	cedure:				

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch(angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Competencies to be tested and evaluation parameters:

- 1. Fit-up. This consists of the following procedure:
 - i. Take the two base plates.
 - ii. Have a gap of 2.5 mm at the start and 3.15 mm at the end by inserting suitable inserts.
 - iii. Make a bridge using the filler material at the start and at the end between the two individual plates to be joined.
 - iv. Place a bridge after every inch so that the plate remains in position for the activity to be performed.
- 2. Follow keyhole technique to lay a running bead using filler material to have a full penetration weld.
- 3. Perform the activity to complete a minimum of 25 metres.

Evaluation Parameter	Marks/Parameter	Marks Obtained
Setting Up the Parameters		
1 or more mistakes	0	
No mistakes	2	
Fit-up		
1 and more inconsistencies	0	
No inconsistencies	2	

Evaluation Parameter	Marks/Parameter	Marks Obtained
Uniform root bead ensuring full per be sighted from beneath after weld		individual plates to
2 and more inconsistencies	0	
1 inconsistency	1	
Full penetration	2	
Uniformity of the width and the hei	ght of the bead along the run	
2 or more inconsistencies	0	
Less than inconsistencies	1	
No inconsistencies	2	
Note: Variation of width and height	of the top side of the bead withir	n 2 mm
Defects like under-fil and undercut.		
More than 2	0	
Up to 2 defects	1	
0 defects	2	
Total rainer's Comments:	10	

UNIT 8.2 : Practical II – Short Circuit Mode of Transfer in 1G Position

Unit Objectives



- 1. practice to run a bead on plate in 1G position in short circuit mode of transfer;
- 2. practice to run a parallel bead on plate in 1G position in short circuit mode of transfer;
- 3. practice to merge a bead on plate in 1G position in short circuit mode of transfer;
- 4. practice to lay a root run on plate in 1G position in short circuit mode of transfer.

	ractice to Run hort Circuit M		Position III –
Note the r	naterials required:		
Note the p	rocedure:		

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Note the parameters for short circuit mode of transfer:

Competencies to be Tested

- Participants should move the torch from right to left i.e. they should use the leftward technique/forward technique/push technique along the chalk line to form a continuous, smooth, reinforced, liquid bead of uniform height and width exhibiting a smooth ripple.
- Perform the activity to complete 25 metres.

Note to the Trainer:

- Trainer needs to explain the philosophy of making the welder do bead on chalk line to form path and make him follow the chalk line.
- Ensure that the participants are given every facility for performing the practical well. For example, the shaded glasses which are attached to their helmets should be checked and replaced time after time so that the stains do not obscure the participant's vision.
- The participant themselves should be conditioned to consider these minute details and make sure everything is in place.

Evaluation Parameter	Marks Per Line	Marks Obtained
Straightness of the bead for each	h line	
No deviation	2	
Deviation present	0	
Uniformity of width of the bead	for each line	
Uniform width (within - 2 mm in size)	2	
Not uniform	0	

Evaluation Parameter	Marks Per Line	Marks Obtained
Uniformity of height of the beac	for each line	
Uniform height (within - 2 mm n size)	2	
Not uniform	0	
Stops and restart quality for eac	h line	
0-1 stop and restart (smooth finish)	2	
2 or 3 stops and restart (smooth finish)	1	
More than 3 stops and restarts	0	
Defects: Undercut and overlap for	or each line	
Up to 2 defects	2	
3 or 4 defects	1	
More than 4	0	
Total	10	

	osition in Short Circuit	t Mode of Transfer	
	terials required:		
te the ma	eriais required.		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
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te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		
te the pro	cedure:		

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch(angle and technique)	
Torch weaving	
Wire consumable	
Base material	

- Participants should move the torch along the chalk line using the push technique along the chalk line to form a continuous, smooth, reinforced, liquid bead of uniform height and width exhibiting a smooth ripple.
- The beads need to be laid keeping a spacing of 5 to 10 mm in such a way that the second bead shall run parallel to the first one.
- Participants should complete 25 metres.

Evaluation Parameter	Marks/Parameter	Marks Obtained
Follow the chalk line without an	y deviation	
No deviation	2	
Deviation present	0	
Parallelism of the second run wi	th respect to the first run	
More than 2 inconsistencies	0	
0-2 inconsistencies	1	
Missed 0 to 2 steps	2	
Uniformity of the bead width		
Uniform width (within - 2mm in size)	2	
Not uniform	0	

Evaluation Parameter	Marks/Parameter	Marks Obtained
Uniformity of the height of the l	bead	
Uniform height (within - 2mm in size)	2	
Not uniform	0	
Defects: Undercut and overlap f	for each line	
More than 4	0	
3 or 4 defects	1	
Up to 2 defects	2	
Total	10	

	in Short Circuit Mode of Transfer			
Note the materials required:				
•				
ote the pro	cedure:			

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch(angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Competencies to be tested and evaluation parameters:

- Participants should use push technique along the chalk line to form a continuous, smooth, reinforced, liquid bead of uniform height and width exhibiting a smooth ripple.
 They should focus on the toe of the first bead to have a smooth overlap/merging of bead.
- Perform the activity to complete 25 metres.

Evaluation Parameter	Marks/Parameter
Follow the chalk line in the first run without any deviation	
No deviation	2
Deviation present	0
Uniformity of the bead merging with the previous bead void of dunder-fil.	efects like undercut and
More than 2 inconsistencies	0
0-2 inconsistencies	1
Missed 0 to 2 steps	2
Uniformity of the height of the bead	
More than 2 inconsistencies	0
0-2 inconsistencies	1
Missed 0 to 2 steps	2

Evaluation Parameter	Marks/Paramete
Note: Variation should be checked using a flat scale or tri-squ	uare and within 2mm
Defects: Undercut and overlap for each line	
Defects: Undercut and overlap for each line	
More than 4	0
3 or 4 defects	1
Up to 2 defects	2
Start and stops for the weld pad	
More than 3 stops and restarts	0
2-3 stops and restarts (smooth finish)	1
0-1 stop and restart (smooth finish)	2
Total	10

Circuit Mode of Transfer			
lote the materials required:			
te the proce	dure:		
te the proce	dure:		
te the proce	dure:		
te the proce	dure:		
te the proce	dure:		
te the proce	dure:		
te the proce	dure:		
te the proce	dure:		
te the proce	dure:		
te the proce	dure:		
te the proce	dure:		
ete the proce	dure:		
ote the proce	dure:		
ete the proce	dure:		
ote the proce	dure:		
ete the proce	dure:		
ete the proce	dure:		

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Competencies to be tested and evaluation parameters:

- 1. Fit-up. This consists of the following procedure:
 - i. Take the two base plates.
 - ii. Have a gap of 2.5 mm at the start and 3.15 mm at the end by inserting suitable inserts.
 - iii. Make a bridge using the filler material at the start and at the end between the two individual plates to be joined.
 - iv. Place a bridge after every inch so that the plate remains in position for the activity to be performed.
- 2. Follow keyhole technique to lay a running bead using filler material to have a full penetration weld.
- 3. Perform the activity to complete a minimum of 25 metres.

Evaluation Parameter	Marks/Parameter	Marks Obtained
Setting Up the Parameters		
1 or more mistakes	0	
No mistakes	2	
Fit-up		
1 and more inconsistencies	0	
No inconsistencies	2	

Evaluation Parameter	Marks/Parameter	Marks Obtained
Uniform root bead ensuring full pene		e individual plates to
2 and more inconsistencies	0	
1 inconsistency	1	
Full penetration	2	
Uniformity of the width and the heig	ht of the bead along the run	
2 or more inconsistencies	0	
Less than inconsistencies	1	
No inconsistencies	2	
Note: Variation of width and height of	f the top side of the bead withi	n 2 mm
Defects like under-fil and undercut.		
More than 2	0	
Up to 2 defects	1	
0 defects	2	
Total	10	

UNIT 8.3: Practical III – Lap Joint in Inclined Position (Short Circuit Mode of Transfer)

Unit Objectives



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

1. practice lap joint on 3 mm plate in inclined position using open arc, 0.8 mm wire and CO₂.

	Position Using Open Arc, 0.8 mm Wire and	CO ₂		
lote the materials required:				
ote the	procedure:			
ote the	procedure:			
ote the	procedure:			
ote the	procedure:			
ote the	procedure:			
ote the	procedure:			
ote the	procedure:			
ote the	procedure:			
ote the	procedure:			
ote the	procedure:			
ote the	procedure:			
ote the	procedure:			

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Note the parameters for short circuit mode of transfer:

- 1. Fit-up This consists of the following procedure:
 - i. Take the two base plates.
 - ii. Have a gap of 2.5 mm at the start and 3.15 mm at the end by inserting suitable inserts.
 - iii. Make a bridge using the filler material at the start and at the end between the two individual plates to be joined.
 - iv. Place a bridge after every inch so that the plate shall be in position for the activity to be performed.
- 2. Follow keyhole technique to lay a running bead using filler material to have a full penetration weld.
- 3. Perform the activity to complete a minimum of 25 metres.

	Marks Per Line	Marks Obtained
Uniform leg length		
More than 2 inconsistencies	0	
1-2 inconsistencies	3	
No inconsistencies	6	
Note: Variation of leg length wit	thin 2 mm	
Defects		
2 or more defects	0	
Less than two defects	1	
No defects	2	
Smooth uniform bead with fine	e ripples	
More than 2 inconsistencies	0	
1-2 inconsistencies	1	
No inconsistencies	2	
Total	10	

UNIT 8.4: Practical IV- Spray Transfer Mode in 1G Position

- Unit Objectives



- 1. practice to run a bead on plate in 1G position in spray transfer mode;
- 2. practice to run a parallel bead on plate in 1G position in spray transfer mode;
- 3. practice to merge a bead on plate in 1G position in spray transfer mode;
- 4. practice to lay a root run on plate in 1G position in spray transfer mode.

aterials required:				
rocedure:				
	procedure:	procedure:	procedure:	procedure:

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Note the parameters for short circuit mode of transfer:

Competencies to be Tested

- Participants should move the torch from right to left i.e. they should use the leftward technique/forward technique/push technique along the chalk line to form continuous smooth reinforced liquid bead of uniform height and width exhibiting a smooth ripple.
- Perform the activity to complete 25 metres.

Note to the Trainer:

• Trainer needs to explain the philosophy of making the welder do bead on chalk line – to form path and make him follow the chalk line. Ensure that the students are given every facility for performing the practical well. For example, the shaded glasses which are attached to their helmets should be checked and replaced time after time so that the stains do not obscure the student's vision. The participantsthemselves should be conditioned to consider these minute details and make sure everything is in place.

Evaluation Parameter	Marks Per Line	Marks Obtained
Straightness of the bead for each line		
No deviation	2	
Deviation present	0	
Uniformity of the width of the bead for each I	ine	
Uniform width (within - 2 mm in size)	2	
Not uniform	0	
Uniformity of the height of the bead for each	line	
Uniform height (within - 2 mm in size)	2	

Evaluation Parameter	Marks Per Line	Marks Obtained
Not uniform	0	
Stops and restart quality for each line	'	
0-1 stop and restart (smooth finish)	2	
2 or 3 stops and restart (smooth finish)	1	
More than 3 stops and restarts	0	
Defects: Undercut and overlap for each line		
Up to 2 defects	2	
3 or 4 defects	1	
More than 4	0	
Total	10	

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Note the parameters for short circuit mode of transfer:

- Participants should move the torch along the chalk line using the push technique along the chalk line to form continuous smooth reinforced liquid bead of uniform height and width, exhibiting a smooth ripple.
- The beads need to be laid keeping a spacing of 5 to 10 mm in such a way that the second bead shall run parallel to the first one.
- The students should complete 25 metres.

Evaluation Parameter	Marks Per Line	Marks Obtained
Follow the chalk line without any deviation		
No deviation	2	
Deviation present	0	
Parallelism of the second run with respect to	the first run	
More than 2 inconsistencies	0	
0-2 inconsistencies	1	
Missed 0 to 2 steps	2	

Evaluation Parameter	Marks Per Line	Marks Obtained
Uniformity of the bead width		,
Uniform width (within - 2mm in size)	2	
Not uniform	0	
Uniformity of the height of the bead		
Uniform height (within - 2mm in size)	2	
Not uniform	0	
Defects: Undercut and overlap for each line		
Up to 2 defects	2	
3 or 4 defects	1	
More than 4	0	
Total	10	

Position Using Spray Transfer Mode					
			~,a		
lote the materials required:					
ote the pro	cedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	cedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				
ote the pro	ocedure:				

Note the parameters for short circuit mode of transfer:

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Note the parameters for short circuit mode of transfer:

- Participants should use push technique along the chalk line to form continuous smooth reinforced liquid bead of uniform height and width exhibiting a smooth ripple. They should focus on the toe of the first bead to have a smooth overlap/merging of bead.
- Perform the activity to complete 25 metres.

Evaluation Parameter	Marks/Parameter	Marks Obtained
Follow the chalk line in the first ru		
No deviation	2	
Deviation present	0	
Uniformity of the bead merging w defects like undercut and under-fil	· · · · · · · · · · · · · · · · · · ·	
More than 2 inconsistencies	0	
0-2 inconsistencies	1	
Missed 0 to 2 steps	2	

More than 2 inconsistencies D-2 inconsistencies 1 Missed 0 to 2 steps 2 Note: Variation should be checked using a flat scale or tri-square and within 2mm Defects: Undercut and overlap for each line More than 4 0 3 or 4 defects 1 Up to 2 defects 2 Start and Stops for the weld pad More than 3 stops and restarts 0 2-3 stops and restarts (smooth inish) D-1 stop and restart (smooth inish) Otal	Evaluation Parameter	Marks/Parameter	Marks Obtained		
Missed 0 to 2 steps Note: Variation should be checked using a flat scale or tri-square and within 2mm Defects: Undercut and overlap for each line More than 4 S or 4 defects Up to 2 defects Start and Stops for the weld pad More than 3 stops and restarts O 1-3 stops and restarts (smooth inish) O-1 stop and restart (smooth inish)	Uniformity of the height of the bead				
Note: Variation should be checked using a flat scale or tri-square and within 2mm Defects: Undercut and overlap for each line More than 4 3 or 4 defects Up to 2 defects 2 Start and Stops for the weld pad Wore than 3 stops and restarts 2-3 stops and restarts (smooth finish) 0-1 stop and restart (smooth finish) Total	More than 2 inconsistencies	0			
Note: Variation should be checked using a flat scale or tri-square and within 2mm Defects: Undercut and overlap for each line More than 4 0 3 or 4 defects 1 Up to 2 defects 2 Start and Stops for the weld pad More than 3 stops and restarts 0 2-3 stops and restarts (smooth finish) 0-1 stop and restart (smooth finish) Total 10	0-2 inconsistencies	1			
3 or 4 defects Up to 2 defects 2 Start and Stops for the weld pad More than 3 stops and restarts 0 2-3 stops and restarts (smooth finish) 0-1 stop and restart (smooth finish) Total	Missed 0 to 2 steps	2			
More than 4 0 3 or 4 defects 1 Up to 2 defects 2 Start and Stops for the weld pad More than 3 stops and restarts 0 2-3 stops and restarts (smooth finish) 2 0-1 stop and restart (smooth finish) 1 Total 10		using a flat scale or tri-square			
3 or 4 defects Up to 2 defects 2 Start and Stops for the weld pad More than 3 stops and restarts 0 2-3 stops and restarts (smooth finish) 0-1 stop and restart (smooth finish) Total	Defects: Undercut and overlap for	each line			
Up to 2 defects 2 Start and Stops for the weld pad More than 3 stops and restarts 2-3 stops and restarts (smooth finish) 0-1 stop and restart (smooth finish) Total 10	More than 4	0			
Start and Stops for the weld pad More than 3 stops and restarts 2-3 stops and restarts (smooth finish) 0-1 stop and restart (smooth finish) Total 10	3 or 4 defects	1			
More than 3 stops and restarts 0 2-3 stops and restarts (smooth finish) 0-1 stop and restart (smooth finish) Total 10	Up to 2 defects	2			
2-3 stops and restarts (smooth finish) 0-1 stop and restart (smooth finish) Total 10	Start and Stops for the weld pad				
finish) 0-1 stop and restart (smooth ginish) Total 10	More than 3 stops and restarts	0			
finish) Total 10		1			
Total 10 Trainer's Comments:		2			
rainer's Comments:					
		10			

Transfer Mode						
ote the ma	terials required	ł:				
oto the pro	coduro					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					
ote the pro	cedure:					

Note the parameters for short circuit mode of transfer:

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Note the parameters for short circuit mode of transfer:

- 1. Fit-up. This consists of the following procedure:
 - i. Take the two base plates.
 - ii. Have a gap of 2.5 mm at the start and 3.15 mm at the end by inserting suitable inserts.
 - iii. Make a bridge using the filler material at the start and at the end between the two individual plates to be joined.
 - iv. Place a bridge after every inch so that the plate shall be in position for the activity to be performed.
- 2. Follow keyhole technique to lay a running bead using filler material so as to have a full penetration weld.
- 3. Perform the activity to complete a minimum of 25 metres.

Evaluation Parameter	Marks/Parameter	Marks Obtained
Setting Up the Parameters		
1 or more mistakes	0	
No mistakes	2	
Fit-up		
1 and more inconsistencies	0	
No inconsistencies	2	

Evaluation Parameter	Marks/Parameter	Marks Obtained
2 and more inconsistencies	0	
1 inconsistency	1	
Full penetration	2	
Uniformity of the width and height of the be	ead along the run	
2 or more inconsistencies	0	
Less than inconsistencies	1	
No inconsistencies	2	
Note: Variation of width and height of the to 2 mm	p side of the bead within	
Defects like under-fill and undercut.		
More than 2	0	
Up to 2 defects	1	
0 defects	2	
Total rainer's Comments:	10	

UNIT 8.5: Practical V – Spray Transfer Mode in 2F Position

Unit Objectives



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

1. practice fillet weld on 8 mm plate in 2F position using 1.2 mm wire using spray transfer mode.

8.5.1 Practice Fillet Weld on 8 mm Plate in 2F Position Using 1.2 mm Wire

	ls required:			
ote the procedu	ıre:			
ote the procedu	ıre:			
ote the procedu	ıre:			
ote the procedu	ire:			
ote the procedu	ıre:			
ote the procedu	ire:			
ote the procedu	ire:			
ote the procedu	ıre:			
ote the procedu	ire:			
ote the procedu	ire:			
ote the procedu	ire:			

Note the parameters for short circuit mode of transfer:

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Note the parameters for short circuit mode of transfer:

- 1. Striking the GMAW arc.
- 2. Preparation of the fit up.
 - i. Take a base plate of size 8 mm and draw a line in the centre.
 - ii. Take the other base plate and place it vertically over the line ensuring the perpendicular position.
 - iii. Hold it in the above position and place a tack weld at the intersection at one end of the plate and run a tri-square to ensure the perpendicular position. Ensure no gap between the two plates.
 - iv. Place a tack weld on the other end of the plate intersection.
- 3. Place the plate in 2F position horizontal position.
- 4. Locate the torch so that it focuses the root of the T joint making an angle of 45 degrees either to the base plate or the vertical plate.
- 5. Orient the torch at 45 degrees focusing on the root. The aim is to do the welding by fusing the root using the leftward technique, forward technique or push technique. Alignment of the torch is complete.
- 6. Strike a GMAW arc and form weld bead so that it has equal leg length and progress the bead all through the length of the joint.
- 7. Check penetration by macro section.

Evaluation Parameter Uniform leg length More than 2 inconsistencies		Marks Obtained
	Marks Per Line	
	0	
1-2 inconsistencies	3	
No inconsistencies	6	
Note: Variation of leg length within 2 mm		l
Defects		
2 or more defects	0	
Less than two defects	1	
No defects	2	
Smooth uniform bead with fine ripples		
More than 2 inconsistencies	0	
1-2 inconsistencies	1	
No inconsistencies	2	
Total	10	

UNIT 8.6: Practical VI – Test Plate Welding (Lap and Square Butt) 3 mm plate, 0.8 mm wire and CO₂ in Inclined Position Using Short Circuit Mode of Transfer

Unit Objectives



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

- 1. practice lap joints on 3 mm plate in inclined position using an open arc, 0.8 mm wire and CO₂ using short circuit mode of transfer;
- 2. prepare a square butt joint on 3 mm sheet using short circuit mode of transfer with 0.8 mm wire and CO_3 .

8.6.1 Test Plate Welding – Lap Joint in Inclined Position – Using an Open Arc, 0.8 mm Wire and CO₂Using Short Circuit Mode of Transfer

Practice lap joints on 3 mm plate in inclined position using an open arc, 0.8 mm wire and CO₂ using short circuit mode of transfer.

materials required:

procedure:

Parameters for short circuit mode of transfer:

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Competencies to be tested and evaluation parameters:

- 1. Striking the GMAW arc.
- 2. Preparation of the fit up.
- 3. Place the plate in inclined position.
- 4. Locate the torch so that it focuses the root of the joint making an angle of 30 degrees from the vertical and tilted 15 degrees in the direction of welding. The aim is to do the welding by fusing the root using the push or pull technique.
- 5. Strike a arc and form weld bead so that it has equal leg length and progress the bead all through the length of the joint.

Evaluation Parameter	Marks/Parameter
Uniform leg length	
More than 2 inconsistencies	0
1-2 inconsistencies	3
No inconsistencies	6
Note: Variation of leg length within 2 mm	
Defects	
2 or more defects	0
Less than two defects	1
No defects	2

larks/Parameter
10
_

prepare a square butt joint on 3 mm sheet using short circuit mode of transfer with 0.8 m wire and CO ₂ and check the penetration at the back side. materials required: procedure:	გ. ხ.∠	Test Plate Welding – Square Butt Joint on 3 mm – Sheet Using Short Circuit Mode of Transfer with 0.8 mm Wire and CO ₂
	wire an	d CO ₂ and check the penetration at the back side.
procedure:		ais required.
procedure:		
orocedure:		
procedure:		
orocedure:		
procedure:		
	proced	ure:

Parameters for short circuit mode of transfer:

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Evaluation parameters to be tested:

Evaluation Parameter	Marks/Parameter	Marks Obtained
Setting Up the Parameters		
1 or more mistakes	0	
No mistakes	2	
Fit-up		
1 and more inconsistencies	0	
No inconsistencies	2	
Uniform root bead ensuring sighted from beneath after	full penetration. No visible edge welding.	es of the individual plates to be
2 and more inconsistencies	0	
1 inconsistency	1	
Full penetration	2	
Uniformity of the width and	I height of the bead along the ru	ın
2 or more inconsistencies	0	
Less than inconsistencies	1	
No inconsistencies	2	
Note: Variation of width and	height of the top side of the bea	ad within 2 mm
Defects like under-fill and u	ndercut.	
More than 2	0	
Up to 2 defects	1	
0 defects	2	
Total	10	

rainer's Commen	its:		

UNIT 8.7: Practical VII – Test Plate Welding in 2F Position Using Spray Transfer Mode

Unit Objectives



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

1. perform fillet weld on 8 mm plate in 2F position using 1.2 mm wire with spray transfer mode.

	F Position Using 1.2 mm Wire with Spray Trans Iode	fe
	et weld on 8 mm plate in 2F position using 1.2 mmwire with spray transfer mo	ode
procedure		
		—

Parameters for spray transfer mode:

Filler wire	
Gas	
Current	
Wire feed speed	
Voltage	
Gas flow rate	
Stick-out	
Welding /Travel speed	
Joint position	
Torch (angle and technique)	
Torch weaving	
Wire consumable	
Base material	

Competencies to be tested and evaluation parameters:

- 1. Striking the GMAW arc.
- 2. Preparation of the fit up.
 - i. Take a base plate of size 8 mm and draw a line in the centre.
 - ii. Take the other base plate and place it vertically over the line ensuring the perpendicular position.
 - iii. Hold it in the above position and place a tack weld at the intersection at one end of the plate and run a tri-square to ensure the perpendicular position. Ensure no gap between the two plates.
 - iv. Place a tack weld on the other end of the plate intersection.
- 3. Place the plate in 2F position horizontal position.
- 4. Locate the torch so that it focuses the root of the T-joint making an angle of 45 degrees either to the base plate or the vertical plate.
- 5. Orient the torch at 45 degrees focusing on the root. The aim is to do the welding by fusing the root using the leftward technique or forward technique or push technique. Orientation of the torch is complete.
- 6. Strike a GMAW arc and form weld bead so that it has equal leg length and progress the bead all through the length of the joint.
- 7. Check penetration by macro section.

Evaluation Parameter	Marks/Parameter	Marks Obtained
Uniform leg length		
More than 2 inconsistencies		
1-2 inconsistencies		
No inconsistencies		
Note: Variation of leg length within 2 mm		
Defects		
2 or more defects		
Less than two defects		
No defects		
Smooth uniform bead with fine ripples		
More than 2 inconsistencies		
1-2 inconsistencies		
No inconsistencies		
Total		
Trainer's Comments:		











9. TIG Welding

Unit 9.1 – Introduction



Key Learning Outcomes



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

- 1. understand TIG welding principle, application and about Shielding Gas;
- 2. understand GTAW electrode, welding torch and advantage and limitations of GTAW.

UNIT 9.1: Introduction

Unit Objectives



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

- 1. understand TIG welding principle, application and about Shielding Gas;
- 2. understand GTAW electrode, welding torch and advantage and limitations of GTAW.

9.1.1 TIG Welding: An Introduction-

GAS-TUNGSTEN ARC WELDING (GTAW), also known as HeliArc and tungsten inert gas (TIG). In the late 1930s, TIG welding process was created when necessity to weld magnesium became obvious. Its old name is Tungsten Inert Gas welding (TIG). The process now known as gas tungsten arc welding GTAW and the new name became popular in the technical books.

9.1.2 TIG Welding Principle

Principle In the **Gas Tungsten Arc Welding (GTAW)** metal are intertwined by warming them by an electric arc built up between a non-consumable (does not dissolve) tungsten electrode and the workpiece. A filler metal may not be utilized relying upon the plan of the joint. The molten metal, tungsten electrode and dle welding zone are protected from the climate (the air around it) by a surge of inert gas through the welding torch. The subsequent welds have an identical chemical integrity as the first base metal.

GTAW **TIG Welding** should be possible in any welding position and in manual, semiautomatic and automatic modes; the technique utilized rely upon the available hardware and the application.

The melting temperature important to weld materials in manual, semiautomatic and (GTAW) process is acquired by maintaining an arc between a tungsten alloy electrode and the workpiece (Fig. 1). Weld pool temperatures can approach 2500°C (4530°F). An inert gas maintains the arc and shields the molten metal from atmospheric pollution. The inert gas is ordinarily argon, helium, or mixture of helium and argon.

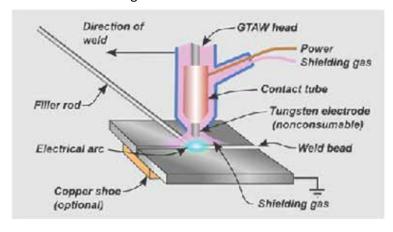


Fig. 9.1.2 - GTWA Principle

9.1.3 Applications

The **TIG Welding** or GTAW process can be utilized to weld almost all metals and metal alloys being used today. It is an essentially productive and cost-effective way for welding light gague metals (under 3mm thickness) and for welding metals that are challenging to weld with the standard welding process. Such metals include the following:

- Aluminum and aluminum alloys
- Copper and copper alloys
- Nickel and nickel alloys
- Magnesium and magnesium alloys
- Low alloy steel and carbon steels
- Volatile materials (for example, titanium and tantalum)
- Combining carbon and alloy steels

Gas Tungsten Arc Welding (GTAW) is used in industries, such as aerospace industry. It is one of the key consumers of gas tungsten arc welding, the production of metal furniture, sheet metal works and in automotive body works.

9.1.4 Shielding Gas-

To guard the welding area from atmospheric gases, for example, nitrogen and oxygen, which cause deficiencies, shielding gases are essential in **Gas Tungsten Arc Welding (GTAW)**. Likewise, the gas also transmits heat from the tungsten electrode to the metal, and it helps start and keep up a stable arc.

A shielding gas can be selected on the following basis:

- · the form of material being welded
- joint design
- required final weld presence

Argon:

Argon is the most commonly used gas for gas tungsten arc welding. Air is lighter than argon while helium is 10 times lighter. The argon provides a superior protecting cover than helium at lesser flow rates as it has low tendency to float away or be blown out from the welding area. Argon is less expensive than helium and can be supplied in cylinders as gas or liquid. The smooth, calm arc given by Argon can be utilized at a lesser arc voltage, thus, argon can be utilized for welding thin metals. Argon has special qualities when utilized with alternating current which is especially imperative for welding aluminum, therefore argon is almost used for aluminium welding. The utilization of argon brings in high weld quality and great appearance.

Helium:

Helium can be utilized alone or in mix with argon. Helium needs a higher arc voltage than argon. To give necessary gas protection to the weld area, helium needs higher flow rates 2 to 3 times more than argon since helium is lighter than argon. Helium is utilized for welding thick metals and opponent welding metals with high degree heat conductivity as they lose heat rabidly. Such metals require higher arc voltages with helium.

9.1.5 GTAW Electrodes

Electrodes for gas tungsten arc welding can be either pure tungsten alloys; they are typically shading coded. The pure tungsten electrode is green in color. The alloyed tungsten electrodes can be brown, yellow, red or blue relying upon the alloying elements.

9.1.6 Welding Torch

GTAW torches are available in various sizes, shapes, amperage and volumes. **Gas Tungsten Arc Welding (GTAW)** torches gives a means for holding and changing the tungsten electrode that conducts the current to the arc and carry shielding gas, electricity and cooling water. The key components of a typical welding torch are shown in Fig There are two main types of GTAW torches; the gas cooled welding torches used for welding thin metals at currents under 200 amperes, and the water cooled torches used for welding medium and thick metals.

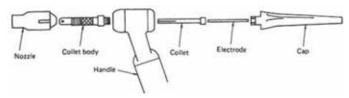


Fig. 9.1.6 - Schematic Showing Exploded View of Key Components Comprising a Gtaw Manual Torch

9.1.7 Advantages and Limitations

Advantages of GTAW

- Generate superior-quality, less-distortion welds
- Free of the spatter related with different strategies
- Can be utilized with or without filler wire
- Can be utilized with a scope of energy supplies
- Welds almost all metals, including disparate ones
- Provide exact control of welding heat

The **Gas Tungsten Arc Welding (GTAW)** process is appropriate when the superior weld quality is needed. It can be used to weld almost all types of metals. The operator has incredible control of heat input, and vision is not constrained by fumes or smoke from the process.

Limitations of GTAW

- Generates lesser deposition rates than consumable electrode arc welding methods.
- Needs a little more deftness and welder organization than gas metal arc welding (gmaw) or shielded metal arc welding (smaw) for manual welding
- Difficult in draughty surroundings due to trouble in shielding the weld zone correctly
- Tungsten inclusions if the electrode is allowed to contact the weld pool
- Adulteration of the weld metal, if appropriate shielding of the filler metal by the gas stream is not kept
- Little acceptance for impurities on filler or base metals
- Adulteration or porosity, affected by coolant leakage from water-cooled torches
- Arc blow or arc deflection, as with other methods











1 0.Inspect and Maintain Product Quality

Unit 10.1 Introduction to Quality Control

Unit 10.2 Inspections

Unit 10.3 Inspections of the final product

Unit 10.4 CAPA and its implementation

Unit 10.5 PPAP - PSW

Unit 10.6 ISO/TS 16949

Unit 10.7 8ds

Unit 10.8 FMEA

Unit 10.9 The 5 Whys



UNIT 10.1: Introduction to Quality Control

Unit Objectives



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

- 1. Understand Quality Control & Pre-delivery (PDI)
- 2. Understand the importance of Pre-delivery (PDI)

10.1.1 Introduction to Quality Control

Description

The term "inspection" generally refers to the activity of checking products, whereas "audit" applies to analysing a manufacturing organization. The ISO 2859 standard (derived from MIL -STD 105 E) defines an inspection as an "activity such as measuring, examining, testing or gauging one or more characteristics of a product or service, and comparing the results with requirements as per need for establishing whether compliance is achieved for each characteristic". The inspected products can be the components used for production, work -inprocess inventory, or finished goods. Quality control in the automobile industry is an imperative aspect of the overall production, as the complexity of the mechanical parts involved in synch plus the overall need for their lending themselves to synchronized assembly with other parts of engine. Various tools and techniques work together in the QA process and physical and automated QA methodologies can have a place in the quality control done on the production of automobiles, starting at the level of the component parts.

10.1.2 This is an example only for PDI -

A pre-delivery inspection is a standard procedure carried out by a vehicle sales and workshop team. In a xPDI, a vehicle is checked to make sure that everything is working safely and as intended. There is a checklist that is used. The items there may have such things as the exterior of the vehicle (inspected for its condition and the installation of panels and attachments) and any defects are identified and noted. Simple repairs may be done there and then. The interior is also inspected in a PDI. Inspection covers the condition of interiors and installation if any included. Defects are noted within the check list. Simple repairs can be undertaken there and then. Further in pre-delivery inspection, the engine will also be checked for leakage and stiffness. Simple adjustments are made and any minor defects undertaken. Fluid levels are also checked.

The engine is also started and brought up to normal operating temperature, and again checks are carried out on fluid levels, leaks and tightness of the engine components. Simple adjustments can be made according to vehicle manufacturer's specifications. During a pre-delivery inspection, the vehicle will be taken for a run and operated in compliance with the Road Code to test its operation. This will include the car running at speeds up to and including the open road limit. After completing the predelivery inspection all the simple problems will have been noted and fixed. The more complex problems will also have been noted, but will then be handed over to a specialist mechanic to fix. A pre-delivery inspection ensures that any work that has to be done on the vehicle is carried out prior to the vehicle reaching the customer. The motor vehicle should then be functioning perfectly when the vehicle is sold to the customer.

10.1.3 The importance of the pre-delivery inspection

Almost all items go through a pre delivery inspection - for any product that is manufactured or bought it is important to check it's quality before it reaches customer or market. A pre-delivery inspection should also be carried out. The pre-delivery inspection is the last chance to make sure that the quality is as per the specs that have been followed. The inspector can also make sure any accessories, manuals, cables and other goods are included as required.

10.1.4 Pre-delivery inspections are important for the below reasons.

- a. Most goods are shipped to long distances and travel via various modes of transport. It costs exponentially more if a good is returned over tat distance for any quality or other related matters. This will also help to address issues in your supply chain.
- b. To make sure the goods have been packed properly for transport especially the fragile items or products that break if enough care is not taken to pack and ship properly. PDI inspector can do various checks and tests to ensure the shipping conditions are suitable for the goods in question, reducing the chance of breakage or spoilage during shipment.
- c. To check that all paperwork and documentations are complete and correct

UNIT 10.2 Inspections

Unit Objectives



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

- 1. Explain Objectives & Purpose of Inspection.
- 2. Carry out Inspection of final product.

10.2.1 Introduction -

Inspection is the most common method of attaining standardisation, uniformity and quality of workmanship. It is the cost of controlling the product quality after comparison with the established standards and specifications. It is the function of quality control. If the item does not conform to the standards as expected it will be rejected. Inspection is an indispensable tool of modern manufacturing process. It helps to control quality, manage manufacturing costs or losses and find assignable causes of defective work.

10.2.2 Objectives of Inspection

- (1) Gather information for product performance against standards for the use of purchase, QA & production etc.
- (2) Manage inadequate quality of product and for maintenance of standards.
- (3) Have increased reputation by avoiding faulty product delivery to customers.
- (4) Find source of weakness or failure in the final product.

10.2.3 Purpose of Inspection

- (1) Differentiate between good and bad product batches
- (2) To know good pieces from bad ones.
- (3) To know change in the process.
- (4) To determine if the process is approaching the specification limits.
- (5) To rate quality of product.
- (6) To rate accuracy of inspectors.
- (7) To measure the precision of the measuring instrument.
- (8) To secure products design information.
- (9) To measure process capability.

10.2.4 Stages of Inspection

- (1) Inspection of material inward.
- (2) Inspection of processing of material (production).
- (3) Inspection of goods produced.

Inspection of incoming materials

It is also called receipt/ inward inspection. Process starts with inspecting and checking of raw materials and that will eventually be used in further manufacturing. Inspection takes place either at vendor's or at manufacturer's outward goods area. Where the cost of transportation is high, inspection is done at the origin

Inspection of production process

Inspection is done when the goods are under process and at various critical production points that have already been identified for a check. This can track defects at the start as it costs a lot more once the defective part reaches the assembly. The 3 ways are:

Inspection of finished goods

It is the last stage when finished goods are inspected and carried out before entering the market.

Inspection Procedures

There are three ways of doing inspection- Floor, Centralised and combined inspection.

Floor Inspection

It is done by inspectors that move around the factory floor when the production is going on. Skilled inspectors carry the process out and this method of inspection makes sure that the production is not hampered.

Advantages of floor inspection

- (1) Encourage working between inspector and foreman.
- (2) Random checking may be more successful than batch checking.
- (3) Does not delay in production.
- (4) Saves time and expense of having to more batches of work for inspection.
- (5) Inspectors may see and be able to report on reason of faculty work.

Disadvantages of floor inspection

(1) Difficult in inspection due to vibration.

- (2) May be there is based inspection because of relation with worker.
- (3) There may be pressure to say favourable things on inspector.
- (4) The cost is high as many skilled inspectors are needed.

Suitability of floor inspection

- (1) Production of heavy products.
- (2) Different work centres are integrated in continuous line layout.

Centralised Inspection

Materials in process may be inspected and checked at centralise d inspection centre which are located at one or more places in the manufacturing industry.

Advantages of centralised inspection

- (1) Better quality check-up.
- (2) Closed supervision.
- (3) Absence of workers pressure.
- (4) Systematic flow of production and inspection cost is low.

Disadvantages

- (1) Extra handling of material.
- (2) Wastage of time for delay in inspection room.
- (3) Work of production control increases.
- (4) Due to non-detection of machining errors in time, there may be more spoilage of work.

Suitability

- (1) Incoming materials inspection.
- (2) Finished product inspection.
- (3) Inspection by particular department.
- (4) Products of high precision or delicate products.
- (5) Small and less expensive products.

Combined Inspection

Floor or central inspection method can be combined. The main outcome of increased compliance should be kept in mind.

Methods of Inspection

There are two methods of inspection. They are 100% inspection and Sampling inspection.

100% Inspection

This is quite details and non-destructive test of every piece is carried out. It is a costly method as more and more inspectors are needed. Hence complete accuracy of influence is seldom attained and no sampling error is factored in because 100% inspection has been carried out. It is suitable for example: Jet engines, Aircraft, Medical and Scientific equipment.

Sampling Inspection

Random samples are taken from various and if the sample proved defective, the whole lot is tested. There may be some errors but they are reduced if the process is duly followed. More and more inspections of this type have now been taken over by machines.

Example: Electrical bulbs, radio bulbs, washing machine etc.

Destructive tests are conducted for items where the strength may be of importance, like beams.

Example: Flexible strength, resistance capacity, compressibility etc.

Drawbacks of Inspection

- (1) Inspection adds to the cost of the product but not for its value.
- (2) It is partially subjective, often the inspector has to judge whether a product passes or not. Example: Inspector discovering a slight burnish on a surface must decide whether it is bad enough to justify rejection even with micrometres a tight or loose fit change measurement by say 0.0006 inches. The inspectors design is important as he enforces quality standards.
- (3) Fatigue and Monotony may affect any inspection judgement.
- (4) Inspection merely separates good and bad items. It is no way to prevent the production of bad items.

UNIT 10.3 Inspections of the final product

Unit Objectives



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

Understand different types of Inspection methods (Dimensional / Layout Inspection)
 &Inspection Tools (Micrometer, Vernier Calipers & Height Gauge).

10.3.1 Dimensional Inspection -

Dimensional is performed to compare the actual condition of a manufactured part or component to the nominal condition as de fined by engineering drawings and blueprints, metal or film templates (decreasingly), digital files and 3D CAD models (increasingly), or even a master tool or part.

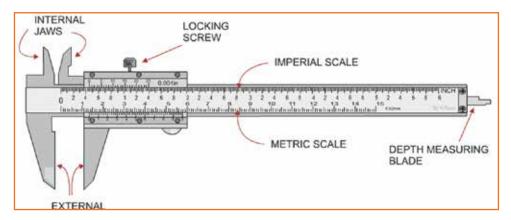
10.3.2 Layout Inspection

As name suggests, the Layout Inspection is the measurement of all dimensions of an item. This is compared to the design record for accuracy and anomalies reported. A pre-determined frequency is agreed with the customer and the results are available for customer review upon request.

10.3.3 Inspection Tools

Vernier Calipers

The Vernier Caliper is a precision instrument that can be used to measure internal and external distances extremely accurately. The example shown below is a manual caliper. Measurements are interpreted from the scale by the user. Digital Vernier calipers are available which have a LCD digital display for display of readings. Manually Vernier is much cheaper as compared to the digital counterpart hence is popular.



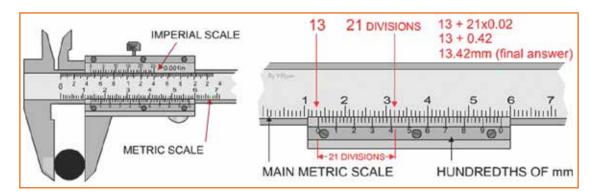
Reading the measurement on a Vernier Calipers

Mathematical method:

- A. The main metric scale is read first and this shows that there are 13 whole divisions before the 0 on the hundredths scale. Therefore, the first number is 13.
- B. The' hundredths of mm' scale is then read. You can count the divisions till you get to the division that lines up with the main scale. This is 21 divisions.
- C. This 21 is multiplied by 0.02 giving 0.42 as the answer (each division on the hundredths scale is equivalent to 0.02mm).
- D. The 13 and the 0.42 are added together to give the final measurement of 13.42mm (the diameter of the piece of round section steel)

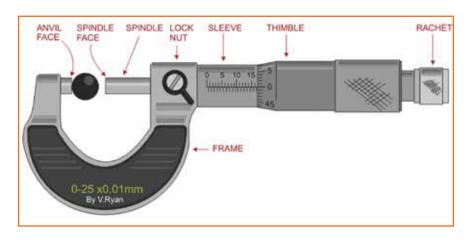
Common Method:

Alternatively, it is just as easy to read the 13 on the main scale and 42 on the hundredths scale. The correct measurement being 13.42mm



10.3.4 Micrometer

The micrometer is a precision measuring instrument. Each ratchet revolution moves the spindle face 0.5mm into the face of anvil. The object t is placed between the anvil and the spindle. The ratchet is turned till the object is 'held' between the two points and a click sound of ratchet is heard - this indicates that it is tight enough and the measurement can be read.

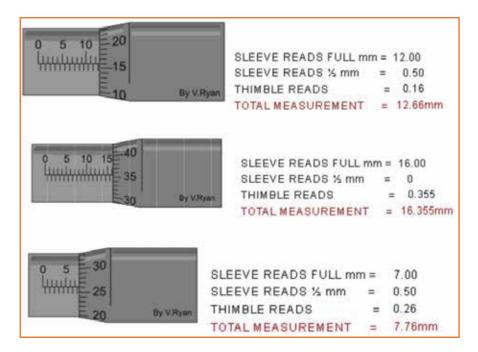


Reading measurements on the micrometer

Using the first example seen below:

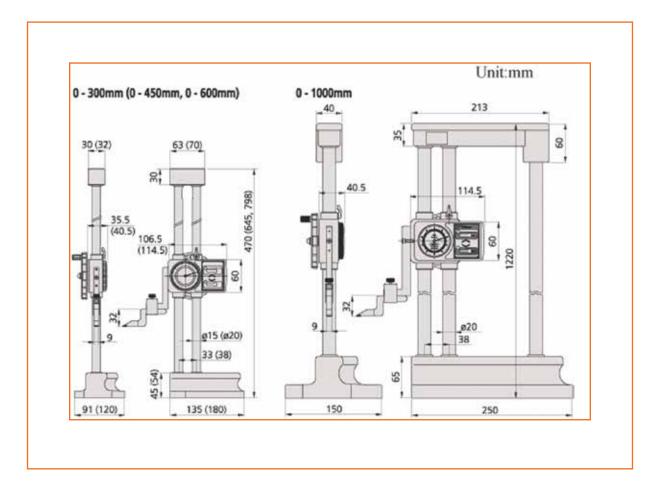
- 1. Read the scale on the sleeve. The example clearly shows 12 mm divisions.
- 2. Still reading the scale on the sleeve, further 0.5 mm readings can be seen on the bottom of the scale. The measurement now reads 12.5mm.
- 3. Finally, the thimble scale shows 16 full divisions (these are hundredths of a mm).

The final measurement is 12.5mm + 0.16mm = 12.66



Height Gauge

A height gauge is a measuring device used either for determining the height of objects, or for marking of items to be worked on. These measuring tools are used in metalworking or metrology to either set or measure vertical distances; the pointer is sharpened to allow it to act as a scriber and assist in marking out work pieces. Devices similar in concept, with lower resolutions, are used in health care settings (health clinics, surgeries) to find the height of people, in which context they are called stadiometers. Height gauges may also be used to measure the height of an object by using the underside of the scriber as the datum. The datum may be permanently fixed or the height gauge may have provision to adjust the scale, this is done by sliding the scale vertically along the body of the height gauge by turning a fine feed screw at the top of the gauge; then with the scriber set to the same level as the base, the scale can be matched to it. This adjustment allows different scribers or probes to be used, as well as adjusting for any errors in a damaged or re -sharpened probe. In the tool room, the distinction between a height gauge and a surface gauge is that a height gauge has a measuring head (whether Vernier, fine rack and pinion with dial, or linear encoder with digital display), whereas a surface gauge has only a scriber point. Both are typically used on a surface plate and have a heavy base with an accurately flat, smooth underside.



UNIT 10.4 CAPA and its implementa

Unit Objectives



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

- Understand CAPA.
- 2. Coordinate with R&D / Quality Manager CAPA C1.

10.4 CAPA and its implementation

Description

Corrective and preventive actions (CAPA, also called corrective action / preventive action, or simply corrective action) are improvements to an organization's processes taken to eliminate causes of nonconformities or other undesirable situations. CAPA is one of the items related to Good manufacturing practice (GMP) plus various ISO business standards. It focuses on methodical investigating the root causes of problems or risks that have been identified, to prevent and eliminate them. This is also called preventative or corrective action.

Corrective actions are implemented in response to customer complaints, unacceptable levels of product non-conformance, issues identified during an internal audit, or adverse or unstable trends in product and process monitoring such as would be identified by statistical process control (SPC). Preventive actions are implemented in response to the identification of potential sources of nonconformity.

To ensure that corrective and preventive actions are effective, the systematic investigation of the root causes of failure is pivotal. CAPA is part of the overall quality management system (QMS). Elements of an Effective CAPA Process

10.3.2 Layout Inspection

ons (CAPA, also called corrective action / preventive action, or simply corrective action) are improvements to an organization's processes taken to eliminate causes of Inputs such as Complaints, Quality Records, Servicing, Nonconforming Product Supply Chain, Process Monitoring, Audits and Concessions (Deviations) give specific information to design and deploy CAPA actions.

- Risk assessment and prioritization Risks associated with the above identified inputs are analysed and prioritized as per the SOP/requirement of the organization
- Investigation disciplines A detailed investigation of the risks are then conducted through various inspection methods
- Verification / validation The results of the above investigations are validated against desired outcomes and verified for conformity of standards
- Well defined action plan A CAPA action plan is prepared where all the action items and modifications are defined to the last element

- Disseminate information Information is then disseminated to the various departments which come under the scope of the CAPA
- Documentation rules All the standard rules of documenting the CAPA process is carried out as an ongoing activity and checked for conformity.
- Effectiveness checks Complete? Effective? Timely The CAPA which is set in motion will be checked for its completeness, effectiveness and confirmation to the set timelines.
- Management escalation The problems identified, if any, after determining their severity, are escalated to the management for review

UNIT 10.5 PPAP - PSW

Unit Objectives



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

1. Understand the objectives of PPAP-PSW

'PPAP Package' contains the summary of Parts Summary Package (PSW). It includes the following details:

1) Part Information

Part Name

- The part name is the parts official name for example Pedal Box or Bonnet Locking Platform. It benefits the supplier and manufacturer as there is a unique name for each part and its variation there within. For example calling the part QNCA0001450002N could easily be mixed up if multiple PPAPs were being discussed.

Part Name on Drawing

- The part name on the drawing is the part ID written or stamped onto the drawing for example QNCA0001450002N.
- Will be specified by the manufacturer and could include any manufacturing change such as tool modifications

Engineering Change Date

- The date of these changes Additional Engineering Changes
- Specified by the manufacturer which could include any manufacturing change such as engineering or tooling changes.

Additional Engineering Changes Date

- The date of these changes

Safety and/or Government Regulation

If there are changes to regulations for safety or government and if the supplier and the manufacturer need to be aware of it. These should be listed and relevant documents included or referred.

Checking Aid Number

- ID of any special tools used while completing the PPAP Checking Aid Engineering Change Level
- Understand the level of check and the instrument used.

Checking Aid Engineering Change Date

- Date of the Checking Aid Customer Part Number
- The number the customer uses on their system to identify the part. This is very helpful to know when speaking to different department in the manufacturers company as not everyone will know the suppliers part number.

Organization Part Number

- The number the organization uses on their system to identify the part. Purchase Order Number
- The ID of the manufacturers purchase order

Weight

Weight of the material ordered

2) Suppliers Contact Information

Supplier Name and/or Vendor Code

Vendor/ Suppliers Address

3) The Customers Contact Information

Customers Name and Division

Any buyer code

4) Materials Reporting

Substance of Concern Information

- May need to be submitted, Could be COSH data sheets IMDS format
- What is the format that you will use for submission of IMDS / IMDS type information?

IMDS ID

- Specify the IMDS number

5) Reason for Submission

There can be many reasons why it is necessary to conduct a PPAP:

- I. Initial Submission
- ii. Engineering Changes
- iii. Tooling: Replace, Transfer, Add or Refurbish
- iv. Fix any discrepancy issues
- v. Tool Inactive > 1 Year
- vi. Change to Optional Construction or Material
- vii. Supplier or Material Source Change
- viii. Variate process of changes to part
- ix. Parts Produced at Additional Location
- x. Other (Specify)

6) Requested Submission Level

There are different levels of PPAP submission

- Level 1 Warrant only for customer
- Level 2 Warrant with product samples and low data to support it
- Level 3 Warrant with product samples and supporting data is available to support it.
- Level 4 Warrant as defined by customer
- Level 5 Warrant with product samples and complete supporting data reviewed at supplier's location.

7) Submission Results

Include results for below points:

I.	Dimensional measurements						
ii.	Material and function tests						
iii.	Appearance Criteria						
iv.	Statistical process package						
	Do all the results meet all the design requirements with any concerns noted Mold / Cavity / Production Process ID						
8) [Declaration						
9) Explanations or Comments							
	Comments / Explanations						
	Customer tool tags						
	Signature						
	Date						
	Printed name						
	Phone Number						
	Fax Number						
	Job Title						
	Email						
10)	Status						
Sigi	n off by customer						

UNIT 10.6 ISO/TS 16949

Unit Objectives



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

1. Understand the importance of ISO/TS 16949

10.6 ISO/TS 16949 —

ISO/TS 16949 was prepared by the International Automotive Task Force (IATF), with support from ISO/TC 176, Quality management and quality assurance. This third edition of ISO/TS 16949 cancels and replaces the second edition (ISO/TS 16949:2002), which has been technically amended according to ISO 9001:2008. ISO/TS 16949 specifies the requirements of ISO 9001 for automotive production. Born out of the need for a globally harmonized quality management system requirements document, ISO/TS 16949 was developed by the International Automotive Task Force (IATF) and the ISO technical committee. This technical specification combines all previous and published national automotive quality standards such as QS-9000, VDA 6.1, EAQF 94, and AVSQ.

Why is ISO/TS 16949 important?

Obtaining the ISO/TS 16949 certification is a way of showing that the company follows the quality management system (QMS) requirements to follow of creates a process of continuous improvement with a focus on defect prevention and reduction of variation and waste in the supply chain. The technical specification is followed after implementation at all the departments or areas in an organization. Areas like heat treatment, galvanizing or customers such as the constituent parts of vehicles. The certification for this standard is desirable and recognized at all the major leading automotive manufacturers and OEMs. Major manufacturers only engage with organizations with a valid ISO/TS 16949 as they know the supplier will have an understanding of the strict specifications that have been laid out in the standard and following would lead to good practice being followed.

What are the key benefits?

- A higher advantage nationally and internationally at negotiation.
- Understand defect prevention, continual improvement, and reduction of waste and variations in the process.
- Less customer specific certification audits which leads to cost savings

UNIT 10.7 8ds

Unit Objectives



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

1. Understand the discipline 8ds.

10.7 8ds —

Eight Disciplines (8Ds) Problem Solving is a method developed at Ford used to approach and to resolve problems, employed by engineers or other professionals. The focus is on product and process improvement, and the main reason to employ this is to identify, fix, and get rid of problems that are occurring again and again. Statistical analysis of the problem is carried out and the decision for improvement and the action is based on it. Problem is tracked to its origin by finding out the root causes. From 8 stages that it had originally, it was changed by an initial planning stage. 8D follows the logic of the PDCA cycle. The disciplines are:

D0: Plan: determine what will be needed for the process and forma team.

D1: Use a Team: professionals with product/process knowledge come together.

D2: Specify the Problem: who, what, where, when, why, how, and how many

D3: Develop tactical plan and containment Plan: Finalize containment actions to isolate the problem from customer.

D4: Specify and recheck Root Causes and Escape Points: Identify all causes and why the problem was not noticed before. All causes are then checked again. We can use 5- whys or fish diagrams to map causes and the possible effect.

D5: recheck the recommended changes (also called Permanent Corrections (PCs)). It is recommended to use pre-production programs to show that the selected correction will resolve the problem.

D6: Define and Implement Corrective Actions:

D7: Prevent the Recurrence: make changes to current management, operation, practices, and procedures systems to make sure that there is no recurrence of a similar problem.

D8: Congratulate Your Team: Need to formally thank and recognize the efforts of the team and some of the shining stars who have gone above and beyond their work.

In automotive industry, now 8Ds has become a standard for structured problem solving process using a team approach.

UNIT 10.8 FMEA

Unit Objectives



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

- 1. Explain what is FMEA.
- 2. Understand the relation between 8D & FMEA.

10.8 FMEA -

Also called: potential failure modes and effects analysis; failure modes, effects and criticality analysis (FMECA).

Failure modes and effects analysis (FMEA) - it is an approach for identifying all possible failures in a step by step manner. It can be used in design, a manufacturing or assembly process, or a product or service industry environment. Any errors or defects are called 'Failures' especially ones that affect the customer be it purely potential or actual. The study of consequences of those failures is called the "Effects analysis" .Consequences and frequency determines the rating. FMEA is used to eliminate or reduce failures. We start by taking on the highest-priority FMEA also touches current actions or understanding about the risks of occurrence of failures. It is actually designed to prevent failure, to control, before and during an operation. FMEA starts at the design and continues for the life of the product or service.

It was started in the 1940s by the U.S. military, FMEA was then developed by the then US based aerospace and automotive industries. Several industries maintain formal FMEA standards.

When to Use FMEA

- If you want to change a process for new
- · When control plans are being developed
- When improvement goals are planned for an existing process, product or service
- At analysing failures of existing, product or service
- Throughout the process of any mentioned product or service

FMEA Procedure

(This is a general procedure. Specific details may vary with standards of the organization or industry.)

 Assemble a cross-functional team of people with diverse knowledge about the process, product or service and customer needs. Functions often included are: design, manufacturing,

- quality, testing, reliability, maintenance, purchasing (and suppliers), sales, marketing (and customers) and customer service.
- Identify the scope of the FMEA. Is it for concept, system, design, process or service? What are the boundaries? How detailed should we be? Use flowcharts to identify the scope and to make sure every team member understands it in detail. (From here on, we'll use the word "scope" to mean the system, design, process or service that is the subject of your FMEA.)
- Fill in the identifying information at the top of your FMEA form. Figure 1 shows a typical format. The remaining steps ask for information that will go into the columns of the form.
- Identify the functions of your scope. Ask, "What is the purpose of this system, design, process or service? What do our customers expect it to do?" Name it with a verb followed by a noun. Usually you will break the scope into separate subsystems, items, parts, assemblies or process steps and identify the function of each.
- For each function, identify all the ways failure could happen. These are potential failure modes. If necessary, go back and rewrite the function with more detail to be sure the failure modes show a loss of that function.
- For each failure mode, identify all the consequences on the system, related systems, process, related processes, product, service, customer or regulations. These are potential effects of failure. Ask, "What does the customer experience because of this failure? What happens when this failure occurs?"
- Determine how serious each effect is. This is the severity rating, or S. Severity is usually rated on a scale from 1 to 10, where 1 is insignificant and 10 is catastrophic. If a failure mode has more than one effect, write on the FMEA table only the highest severity rating for that failure mode.
- For each failure mode, determine all the potential root causes. Use tools classified as cause analysis tool, as well as the best knowledge and experience of the team. List all possible causes for each failure mode on the FMEA form.
- For each cause, determine the occurrence rating, or O. This rating estimates the probability of failure occurring for that reason during the lifetime of your scope. Occurrence is usually rated on a scale from 1 to 10, where 1 is extremely unlikely and 10 is inevitable. On the FMEA table, list the occurrence rating for each cause.
- For each cause, identify current process controls. These are tests, procedures or mechanisms that you now have in place to keep failures from reaching the customer. These controls might prevent the cause from happening, reduce the likelihood that it will happen or detect failure after the cause has already happened but before the customer is affected. For each control, determine the detection rating, or D. This rating estimates how well the controls can detect either the cause or its failure mode after they have happened but before the customer is affected. Detection is usually rated on a scale from 1 to 10, where 1 means the control is absolutely certain to detect the problem and 10 means the control is certain not to detect the problem (or no control exists). On the FMEA table, list the detection rating for each cause.

- (Optional for most industries) Is this failure mode associated with a critical characteristic?
 (Critical characteristics are measurements or indicators that reflect safety or compliance with government regulations and need special controls.) If so, a column labelled "Classification" receives a Y or N to show whether special controls are needed. Usually, critical characteristics have a severity of 9 or 10 and occurrence and detection ratings above 3.
- Calculate the risk priority number, or RPN, which equals S × O × D. Also calculate Criticality by multiplying severity by occurrence, S × O. These numbers provide guidance for ranking potential failures in the order they should be addressed.
- Identify recommended actions. These actions may be design or process changes to lower severity or occurrence. They may be additional controls to improve detection. Also note who is responsible for the actions and target completion dates.
- As actions are completed, note results and the date on the FMEA form. Also, note new S, O
 or D ratings and new RPNs.

What is the Relationship Between 8D and FMEA?

- FMEA is a tool used in the planning of product or process design. The Failure Modes in a FMEA are equivalent to the problem statement or description in an 8D. Causes in a FMEA are equivalent to potential causes in an 8D. Effects of failure in a FMEA are problem symptoms in an 8D. The relationships between 8D and FMEA are outlined below:
- The problem statements and descriptions can be linked between both documents. An 8D can be completed faster by utilizing easy to locate, pre-brainstormed information from a FMEA to solve problems.
- Possible causes in a FMEA can immediately be used to jump start 8D Fishbone or Ishikawa diagrams. Brainstorming information that is already known is not a good use of time or resources.
- Data and brainstorming collected during an 8D can be placed into a FMEA for future planning of new product or process quality. This allows a FMEA to consider actual failures, occurring as failure modes and causes, becoming more effective and complete.
- The design or process controls in a FMEA can be used in verifying the root cause and permanent Corrective Action in an 8D.
- The FMEA and 8D should reconcile each failure and cause by cross documenting failure modes, problem statements and possible causes. Each FMEA can be used as a database of possible causes of failure as an 8D is developed.

UNIT 10.9 The 5 Whys

Unit Objectives



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

1. Explain what is 5 Whys.

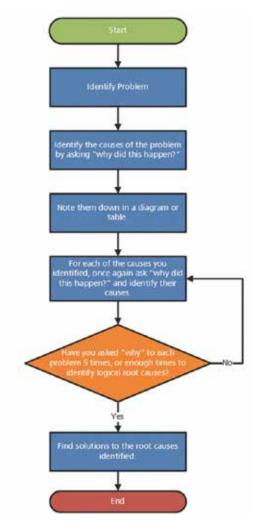
10.9 The 5 Whys

It is just as it sounds: A discussion of the unexpected event or challenge that follows one train of thought to its logical conclusion by asking "Why?" five times to get to the root of what happened. But it is also a lot deeper than that, too. Let us take a look at the origin and history of this unique process.

The 5 Whys technique was developed and fine-tuned within the Toyota Motor Corporation as a critical component of its problem-solving training.

The 5 Why process

5-Whys Process Flowchart



- Invite anyone affected by the issue: As soon as the problem or situation is identified (and all immediate concerns are dealt with), invite anyone at all on the team who was affected or noticed the issue to be involved in a 5 whys meeting.
- Select a 5 Whys master for the discussion or meeting: The master will start and carry on the discussion and ask the group for the questions and possible solutions. The rest of those involved will answer those questions and discuss.
- Ask "why" 5 times: Each possible answer is delved into 5 times with a WHY so a root cause can be found.
- Assign responsibility for solutions Pair each answer with their likes and try to form a trend to see the biggest area of focus.
- Share the results: Write answers in plain language with technical jargon. This should be written in a way that anyone can understand.







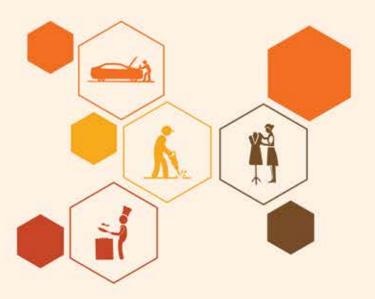


11. Maintaining a safe, Clean and secure working envi ronment

Unit 11.1 Health Safety and Security procedure

Unit 11.2 PPE of Workers

Unit 11.3 Hazards



UNIT 11.1 Health Safety and Security procedure

Unit Objectives



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

1. Understand Health Safety and Security procedure

11.1 Health Safety and Security procedure

Health, safety and security procedures refer to the guidelines and rules that make sure that people in the workplace, whether they are employers, employees or other visitors are safe and secure. These procedures tell employees or employers how they should carry out their tasks around the workplace in a way that ensures a minimization in accidents, incidents, contraction of diseases and security breaches.

These sorts of preventative procedures may include:

- Educating staff on manual handling, i.e.: how to lift and move objects properly to avoid an injury
- Educating staff on how to minimize back and neck pain by using ergonomic furniture in an ppropriate fashion
- Giving detailed instructions on how to use equipment
- Educating staff on the importance of wearing appropriate protective gear to handle certain pieces of equipment
- Instructing staff on how to keep the workplace secure, by teaching them about the security systems in place and how to use them so that cash, equipment and people are safe and secure
- · Educating staff on potential hazards at the workplace
- Health, safety and security procedures also refer to what you should do when accidents or incidents do occur.

UNIT 11.2 PPE of Workers

Unit Objectives



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

1. Identify the Safety Equipment required

11.2 PPE of Workers



PPE refers to the equipment worn by staff to reduce the exposure to hazards. PPE include such items as:

Gloves - You should wear gloves when you are working with any sharp tools, knives or materials. You should also wear gloves when working with some cleaning agents, glues, etc. Foot protection (safety boots) - Safety boots are necessary if you are working in a building site or in an area where heavy objects can fall on you.

Body protection – aprons, gowns - Additional protective clothing may be necessary when cleaning duties require the use of various chemicals and/or disinfectants.

Hearing protection — ear muffs, ear plugs - Ear muffs should be used when working in an environment to protect your ears if there is regular noise or occasional sounds that are louder.

Face masks – Use face masks to get the protection from gases, poisonous fumes, dust, vapours etc. Face mask protect our self from flying particles and Harmful radiation. Head protection – hard hats - If you are working in an area where tradesmen are working above you, you should wear a hard hat

Eye protection – goggles, glasses. - When working outside you should wear protection glasses to protect you from the sun ultra -violet rays.

There are two things to consider in regards to PPE:

PPE protects only the wearer, whereas measures controlling the risk at source can protect everyone in the workplace.

The specified level of protection in reality may not be achieved with PPE and the actual level of protection provided is difficult to assess.

UNIT 11.3 Hazards

Unit Objectives



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

- 1. Identify activities causing potential Hazards.
- 2. Explain Safe Practises for avoiding Hazards.

11.3 Hazards -

A hazard is a situation that poses a level of threat to life, health, property, or environment. The main hazards can happen during work are:

- Fire that may be caused by sparks, molten metal or heat or direct contact with the flame/ fire
- Explosion at the time of undertaking repair of tanks which contains flammable materials (even if residual)
- By flashback and gas leaks
- · Fumes during flame cutting
- Fire/burns resulting from misuse of oxygen
- Skin burns
- Injuries form handling and transporting cylinders
- To assure a high degree of safety, no machine-tool is to be used unless the risk management process as outlined below is understood and applied by the user:
- 1) The machine tool can generate. Hazard-Identify the potential hazard(s)
- 2) Understand severity and the probability and make a Risk Assessment Matrix. Risk acceptance decision authority for the risk levels is as follows:
- a. Extremely high
- b. High
- c. Moderate and low

- 3) Determine the actions that will be taken. Also follow the risk control measures that will finally eliminate risk before and during operation of the machine tool.
- 4) Supervise and evaluate the process by enforcing the standards and risk control measures. Evaluate effectiveness and update as and when necessary.

Probability of hazard

- Frequent Individual worker/item Occurs often in the career/equipment service life. All workers or item inventory exposed Continuously experienced during operation.
- Likely Individual worker/item Occurs several times in career/equipment service life.
- All workers or item inventory exposed. Occurs frequently during operation.
- Occasional Individual worker/item. Occurs sometimes in career/equipment service life.
 All workers or item inventory exposed. Occurs periodically or several times in inventory service or operations.
- Remote Individual worker/item Possible to occur in career/equipment service life. All
 workers or item inventory exposed, Remote chance of occurrence Expected to occur
 sometime in inventory service life or operation.
- Unlikely Individual worker/item Can assume will not occur in career/ equipment/ service life. All workers or item inventory exposed Possible, but improbable; occurs only very rarely during operation.

Severity of hazard

- Catastrophic There may be permanent and or total disability and or death and or major damage to the property.
- Critical -, If there is a major system da mage or permanent partial disability, temporary total disability in excess of 3 months
- Marginal -Minor system damage or minor property damage, minor injury, lost workday accident with compensable loss.
- Negligible First aid or minor treatment needed.

Risk levels

- Extremely high Loss of ability to accomplish mission
- High Significantly degrades mission capabilities in terms of required mission standards
- Moderate Degrades mission capabilities in terms of required mission's standards
- Low Little or no impact on accomplishment of mission

How to control problems:

Elimination	Control the hazard at the source. Completely remove the hazard.		
Substitution	Replace the hazard with something that serves the same purpose but is		
	less harmful.		
Engineering	Installing guards, fume hoods, emergency stop buttons, etc.		
Administrative	Provide adequate training, use Safe Work Procedures, MSDS's, safety		
	signage		
PPE	Wear eye protection, gloves, apron, safety toe boots, hard hat, face		
	shield, ear plugs etc.		

Remedial action procedure:

- 1. If you find any problem or hazard situation, remedial action should be completed as soon as possible. Apply these guidelines to expedite correction of the hazardous conditions.
- 2. Give remedial action priority to hazards with more severe loss potential.
- 3. Obtain target dates for correction. Use hazard classification to motivate correction.
- 4. Write a detailed explanation of the hazard and its potential loss severity as justification for any action requiring a major expenditure and forward it to the person most responsible for corrective action.
- 5. Encourage responsible persons to take permanent corrective action (repetitive remedy is costly).
- 6. Make sure intermediate (temporary) safety measures are taken whenever permanent or complete remedy will require additional time.
- 7. At a reasonable time after the inspection is conducted and necessary action is submitted, do a follow-up walk through to ensure that the corrective action has been completed.
- 8. Make sure all reports are properly filed and maintained for record purposes.

Safety Procedures While Working With Hazards

While working in workplace you have to follow personal safety procedures when dealing with tools and equipment. You have to follow Standard Operating Procedures (SOP's) must be maintained for each piece of machinery in the shop. SOP's when written must be made keeping in mind the manufacturer's recommendation and should take into account the hazards for the safety of users of machines and others that may be affected. SOP's must be available around the user of the machine or made available on request when someone needs it.

The Hazardous Material can be:

- Flammable
- Reactive

- Toxic
- Corrosive

Some Examples of Hazardous Material:	
Material	Type of Hazard
Solvents / Mixed Solvent Paint	Flammable, Toxic
Acid Cleaning Solutions	Corrosive, Possibly Toxic
Cleaning Solutions	Toxic, Corrosive
Used antifreeze	Toxic

Hazardous work practices:

- Hot Work: Hot work is defined as any work producing an arc, flame, or spark. The only
 exception to this are those areas specifically designed and or built for welding, cutting or
 brazing.
- Confined Space Entry: Entry to confined spaces is very dangerous and requires special precautions in addition to a permit issued by a supervisor. Confined spaces are defined as tanks, vessels, sewers, pits, boilers, manholes, etc.
- Lockout: Everyone who works on or is endangered by equipment that is powered by an energizing source, such as electricity, steam, hydraulics, or pneumatic power shall shut it off and lock it out prior to performing any maintenance work.
- High Voltage Electricity: Only specially trained maintenance employees/electricians are permitted to work with high voltage equipment.

The main hazards in machining works are:

- Fire caused by heat, sparks, molten metal or direct contact with the flame.
- Explosion when cutting up or repairing tanks or drums which contain or may have contained flammable materials
- Fire/explosion caused by gas leaks, backfires and flashbacks
- · Fumes created during flame cutting
- Fire/burns resulting from misuse of oxygen
- Burns from contact with the flame or hot metal

Safe practices for avoiding general shop hazards:

- Never use compressed air to blow chips away from a machine
- Keep the floor clear of stock and tools, and clean spilled oils or coolants
- Know where the fire extinguisher is kept and how to use it
- Always keep machines turned off when making adjustments to them

Safe practices for avoiding machine hazards

Before using a machine, think about what you are going to do before doing it. Go over the following

safety checklist before operating a machine:

- Am I familiar with the operation of this machine?
- Are the procedures that I am following, at all safe?
- Am I doing something that I probably should not do?
- I have made adjustments and tightened all locking mechanisms?
- The work piece is properly secured
- Any potential hazards with the use of the machine
- Are all safety guards in place and I have proper safety equipment?
- Do I know how to turn off the machine quickly if necessary- Do I think about safety in everything I do?

Notes	











12. Soft Skill

Unit 12.1 - Problem Solving Skills

Unit 12.2 - Motivation



Key Learning Outcomes



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

- 1. Explain what are problem solving skills;
- 2. Solve your problems efficiently;
- 3. List ways to motivate yourself and others.

UNIT 12.1 Problem Solving Skills

Unit Objectives



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

- 1. Explain what are problem solving skills;
- 2. Solve your problems efficiently.

12.1.1 What is Problem Solving-

"Most people spend more time and energy going around problems than in trying to solve them."

- Henry Ford

Problems seldom are predictable. How a person sees a problem speaks a lot about his or her personality Most of us are too concerned about the magnitude of the problem and intensity of its consequences. Hence solving the problem doesn't get the focus it needs. A good problem solver needs skills that might not come naturally. These skills need to be acquired and nurtured. Problem solving is a process by which a person uses his or her skills, knowledge and understanding to face a situation that's not pleasant or familiar. It's an essential trait that everybody should have to prevent anxiety and depression in life.

12.1.2 Why are Problem Solving Skills Required at Work

Welding is a professional where like life, problems com when you ae least prepared. How you handle the problem and find the right solution can affect the success of your work. Let's take an example of a welder who had a really bad day. When he starts from home, he misses the bus. As he had to wait for the next bus. he is late for work. His manager is angry at him for being late and gives him a feedback in front of everybody. he is really sad and embarrassed. After some time the machine stops working whil he was working on it. The entire day is wasted and he is blamed for it. So what should he do now/ should he cry, crib and feel miserable? Or find a way to learn from the problems and prevent further losses?

A person that becomes negative when faced with problems will affect everyone around him. it's really important to be rational and mature to stay happy and prevent loss for the organization Thus, problem solving skills need to be acquired to be successful in any profession.

12.1.3 How to Solve problems

The best way to solve a problem is to prevent it by being careful and analytical. This way the solution to the problem is found before it can affect you.

For example: Imaging that you have a measuring chain that is in a bad condition. Instead of waiting for the chain to stop functioning, raise the issue immediately. let the supervisor know and make sure you get a new chain. This way you prevent a problems later. So, try your best to solve problems before they occure.

But there will always be problems that you were not prepared for. here's how you can solve them:

- Recognize the problem: use the following tips:
- · Identify what is wrong.
- List the problem.
- Speak about it to others.
- **Analyze it:** Ask the right questions:
- What is the issue?
- Why did it happen?
- When did it get noticed?
- Who is going to get affected by it?
- Where will the affect be?
- How significant is the problem? How major would be the consequences?
- Set Goals: Again, ask the right questions:
- What do I want?
- What is the current state and what is the desired state?
- What are the steps that I should take to resolve the issue?
- Are the steps being finished on time set by you?
- What is getting in my way of reaching the desired outcome?
- Evaluate Potential Solutions: Follow the following tips:
- Find the different options that will solve the problem.
- Think about the positives and negative of each options.

- List all the pros and cons for each option to fine out what solution is the best for that situation.
- The best solution is one which has more positives than negative.
- Refine that best solution and apply it:
- Find the best solutions and see if the negative can be changed.
- Apply the best solution.
- **Evaluate the applied solutions:** Ask the right questions:
- Was my solution the best one?
- Did I have a better way of solving the issue?
- Did I judge the problem correctly?
- Could I stop the loss?
- Can I apply this solution next time for a similar problem?

12.1.4. personality Traits of a Problem Solver

You can be a good problem solver only if you have these personality traits:

Good communication skills

Good analyzing skills

Wisdom and knowledge about the problem

Good interpersonal skills

Be positive and don't let the problem affect you personally

Willingness to go that extra mile and try new ways to solve problems

Know the value of time

Be a quick learner

Be risk takeers at times and follow unconventional ways

Be a quick learner

Be risk takers at time and follow unconventional ways

Respect other's point f view

Use your own judgement and not get influenced by other always

Be confident

Think and act!

Exercise



Your manager has assigned some tasks to you. You have utillised your resources to do the tasks. Unexpectedly some more tasks are assigned to you which are likely to fetch huge revenue for your company. You ask for a priority and are told that all have equal priority. What will you do?

- a. Put up your hands and say you cannot do so much
- b. Work overtime to deliver
- c. Source for more people and get the job done
- d. Say that it does not fit into your plan and continue with your existing projects and tasks

Notes = -		

12.2- Motivation

Unit Objectives



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

- 1. Explain what are problem solving skills;
- 2. Solve your problems efficiently.

12.2.1 Types of Motivation

Motivation is necessary to achieve anything. Broadly speaking, there are two types of motivation:

- 1. External Motivation
- 2. Internal Motivation

External Motivation

This type of motivation is driven by a desire to avoid the negative consequences of acting in a specific way or solely to gain reward. We often see external motivation present in institutions like schools, universities and offices. for examples, "I have to study Civics to pass my exams" or "I have to complete this project by Frieday otherwise I will not pass the exam". External motivation is extermely efective in the short term. However, to achieve long-term targets, external motivation is rarely enough.

Internal Motivation

This type of motivation comes from within people and is less dependent on the reward or netative consequences. It comes from a person's true passion to fulfil a dream. It is the type of motivation you might observe in professional sportsmen or creative professionals such as artists, designers and writhers. For example, "I will wake up early every morning for cricket practice ce" or "I will train myself on the finer aspects of industrial design to become a good engineer".

Internal Motivation is more powerful than external motivation and leads to excellence and success. This type of motivation is necessary to achieve long-term goals.

12.2.2 Ways to Get Motivated

Since you now understand how crucial motivation is for achievement and success, we will explore some pointers on how to build your motivation:

• Set Goals: Having a goal lends direction to your life. A goal serves as a reference point for you when it comes to taking decisions and becomes the basis for your motivation. Without goals, it becomes difficult to get motivated to do anything.

Goals need to be defined clearly. A good way to do this is to set S.M.A.R.T. goals. This means your gosl should be:

- Specifice
- measureable
- Attainable
- Reevant
- Time-bound

For example, a S.M.A.R. goal for a marathon runner would be-" I will run a half-marathon in less than 1.5 hours by the end of the year."

An example of an unclear goal for the same marathon runner would be-" I want to become a faster runner." While it is well-intentined, the goal is too vague to be able to motivate the runner to achieve specific milestones.

- **Stay Focused:** Focus is another essential ingredient to stay motivated. Why is that so few of us achieve those New Year resolutions we wet for ourselves? Often, we are motivated for the first week or two, and then the motivation tends to die down. To achieve any meaningful goals, you must set your goals intelligently and be tenacious in working towards their fulfilment. Remind yourself of your goals, envision yourself achieving them and enforce some self-discipline to keep moving in the right direction.
- **Be Persistent:** When you are pursuing a goal, there are likely to be moments when the situation appears difficult or even impossible. At times like thse, find the strength to keep typing. Learn from your mistakes and push yourself harder. After all, there no failures in life, only lessons.
- Identify your Strengths and Weaknesses: As you set out on your journey to achieve your goals, introspect a little bit to understand yourself better. Recognize your strengths and weaknesses and play to your strengths while working to minimize the effect of your weaknesses.

A good way to identify your strengths and weaknesses is by performing a SWOT (Strength, Weakness, Opportunities and Threat) Analysis. Once you have understood yourself better, you will find it easier to navigate any obstacles in your path towards success.

• **Enjoy the Journcy:** While your objective may be to achieve goals, it is important to be able to enjoy the journey towards your goals. In the pursuit of any goal, there are bound to be tasks that you will not like. However, if you don't learn to find satisfaction in the work that you're doing, the process of realizing your dreams can become a painful journey.

Take the example of a law student. If he or she doesn't find law and its application in legal cases interesting, there is a low chance that the student will be either happy and/or successful while studying and practicing to become a lawyer.

Similaryl, if you are unable to find fulfilment in your journey over a longer period of time, you might want to reassess your choice of goals.

• **Surround Yourself with Positive Messages:** A great way to get motivated is to read inspiring stories, listen to uplifting music, watch inspiring movies and keep the company of positive people.

Doing this will help you to stay positive and generate the energy you need to achieve your goals.

• **Start Now:** The biggest mistake that a lot of us make when beginning the pursuit of our goals is to put off the action. There is no better time than now and no better place than here to start your journey towards your goals. The longer you delay action, the less likely you are to make any real and meaningful progress.

The mantra for getting and staying motivated is to act when inspired. Once you lose that moment of inspiration, it becomes hard to recapture the feeling and the drive to act again.

As You have read, there are various practices that you can follow to get motivated. The rest is now up to you!

Exercise



- 1. Classify the following as examples of external motivation and internal motivation.
- a. I will get a bonus if I sell more than 20 washing machines.
- b. I will learn how to become a pilot because I enjoy the thrill of flying and being in control.
- c. I will go to cooking classes so that I can serve my family a healthy and tasty meals every day.
- d. I Must study for my exams if want to get admission to engineering college.
- e. I must work on controlling my anger to improve my behavior.
- f. I will do an internship this summer to earn money for my new mobile phone.
- 2. To develop powerful motivation, you must set S.M.A.R.T. goals. What does S.M.A.R.T. stand for?
- a. Salient, maningul, Accessible, Reachable, Time-bound
- b. Specific, Meaningful, Accessible, Reachable Truthful
- c. Specific, measurable, Attainable, Relevant. Time-bound
- d. Short, Measurable, Attainable, Realistic, Truthful
- e. Salient, measurable, Attainable, Realistic, Time-bound

Notes			









13. Employability & Entrepreneurship Skills

Unit 13.1 – Personal Strengths & Value Systems

Unit 13.2 - Digital Literacy: A Recap

Unit 13.3 – Money Matters

Unit 13.4 – Preparing for Employment & Self Employment

Unit 13.5 – Understanding Entrepreneurship

Unit 13.6 – Preparing to be an Entrepreneur



Key Learning Outcomes



At the end of this unit, 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. Understand 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. Understand 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 basic computer terminology

- 36. Recall the functions of basic computer keys
- 37. Discuss the main applications of MS Office
- 38. Discuss the benefits of Microsoft Outlook
- 39. Discuss the different types of e-commerce
- 40. List the benefits of e-commerce for retailers and customers
- 41. Discuss how the Digital India campaign will help boost e-commerce in India
- Describe Explain how you will sell a product or service on an e-commerce platform
- 43. Discuss the importance of saving money
- 44. Discuss the benefits of saving money
- 45. Discuss the main types of bank accounts
- 46. Describe the process of opening a bank account
- 47. Differentiate between fixed and variable costs
- 48. Describe the main types of investment options
- 49. Describe the different types of insurance products
- 50. Describe the different types of taxes
- 51. Discuss the uses of online banking
- 52. Discuss the main types of electronic funds transfers
- 53. Discuss the steps to prepare for an interview
- 54. Discuss the steps to create an effective Resume
- 55. Discuss the most frequently asked interview questions
- 56. Discuss how to answer the most frequently asked interview questions
- 57. Discuss basic workplace terminology
- 58. Discuss the concept of entrepreneurship
- 59. Discuss the importance of entrepreneurship
- 60. Describe the characteristics of an entrepreneur
- Describe the different types of enterprises
- 62. List the qualities of an effective leader
- 63. Discuss the benefits of effective leadership
- 64. List the traits of an effective team
- _{65.} Discuss the importance of listening effectively
- 66. Discuss how to listen effectively
- _{67.} Discuss the importance of speaking effectively
- _{68.} Discuss how to speak effectively
- 69. Discuss how to solve problems
- 70. List important problem solving traits

- 71. Discuss ways to assess problem solving skills
- 72. Discuss the importance of negotiation
- 73. Discuss how to negotiate
- 74. Discuss how to identify new business opportunities
- 75. Discuss how to identify business opportunities within your business
- 76. Understand the meaning of entrepreneur
- 77. Describe the different types of entrepreneurs
- 78. List the characteristics of entrepreneurs
- 79. Recall entrepreneur success stories
- 80. Discuss the entrepreneurial process
- 81. Describe the entrepreneurship ecosystem
- 82. Discuss the government's role in the entrepreneurship ecosystem
- 83. Discuss the current entrepreneurship ecosystem in India
- 84. Understand the purpose of the Make in India campaign
- 85. Discuss the relationship between entrepreneurship and risk appetite
- 86. Discuss the relationship between entrepreneurship and resilience
- 87. Describe the characteristics of a resilient entrepreneur
- 88. Discuss how to deal with failure
- 89. Discuss how market research is carried out
- 90. Describe the 4 Ps of marketing
- 91. Discuss the importance of idea generation
- 92. Recall basic business terminology
- 93. Discuss the need for CRM
- 94. Discuss the benefits of CRM
- 95. Discuss the need for networking
- 96. Discuss the benefits of networking
- 97. Understand the importance of setting goals
- 98. Differentiate between short-term, medium-term and long-term goals
- 99. Discuss how to write a business plan
- 100. Explain the financial planning process
- 101. Discuss ways to manage your risk
- $_{\mbox{\scriptsize 102.}}$ $\,$ Describe the procedure and formalities for applying for bank finance
- 103. Discuss how to manage your own enterprise
- List important questions that every entrepreneur should ask before starting an enterprise

UNIT 13.1: Personal Strengths & Value Systems

- Unit Objectives



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

- · Explain the meaning of health
- List common health issues
- Discuss tips to prevent common health issues
- Explain the meaning of hygiene
- Understand the purpose of Swacch Bharat Abhiyan
- Explain the meaning of habit
- Discuss ways to set up a safe work environment
- Discuss critical safety habits to be followed by employees
- Explain the importance of self-analysis
- Understand motivation with the help of Maslow's Hierarchy of Needs
- Discuss the meaning of achievement motivation
- List the characteristics of entrepreneurs with achievement motivation
- List the different factors that motivate you
- Discuss the role of attitude in self-analysis
- Discuss how to maintain a positive attitude
- List your strengths and weaknesses
- Discuss the qualities of honest people
- Describe the importance of honesty in entrepreneurs
- Discuss the elements of a strong work ethic
- Discuss how to foster a good work ethic
- List the characteristics of highly creative people
- List the characteristics of highly innovative people
- Discuss the benefits of time management
- List the traits of effective time managers
- Describe effective time management technique
- Discuss the importance of anger management
- Describe anger management strategies
- Discuss tips for anger management
- Discuss the causes of stress
- Discuss the symptoms of stress
- Discuss tips for stress management

13.1.1 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.

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Some common health issues are:

- Allergies
- Asthma
- Skin Disorders
- Depression and Anxiety
- Diabetes
- · Cough, Cold, Sore Throat
- Difficulty Sleeping
- Obesity

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 meditatio

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 checkups.			
9.	Exercise for 30 minutes at least 5 days a week.			
10.	Avoid consuming lots of aerated beverages.			
⊢ W	/hat is Hygiene?			
As he en	s per the World Health Organization (WHO), "Hygiene refers to conditions and practices elp to maintain health and prevent the spread of diseases." In other words, hygiene masuring that you do whatever is required to keep your surroundings clean, so that you receive chances of spreading germs and diseases.	neans		
kit ov	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.			
Ho	ow 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.			
	e how healthy and hygienic you are, by giving yourself 1 point for every ticked stater en take a look at what your score means.	ment!		
Yo	our Score			
	7/20: You need to work a lot harder to stay fit and fine! Make it a point to practice bits daily and see how much better you feel!	good		
	14/20: Not bad, but there is scope for improvement! Try and add a few more good habour daily routine.	oits to		
14	-20/20: Great job! Keep up the good work! Your body and mind thank you!			

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!

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



- 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!

13.1.2: 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

Non-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



- Be aware of what emergency number to call at the time of a workplace emergency
- Practice evacuation drills regularly to avoid chaotic evacuations

1.1.3 Self Analysis – Attitude, Achievement Motivation: What is Self-Analysis

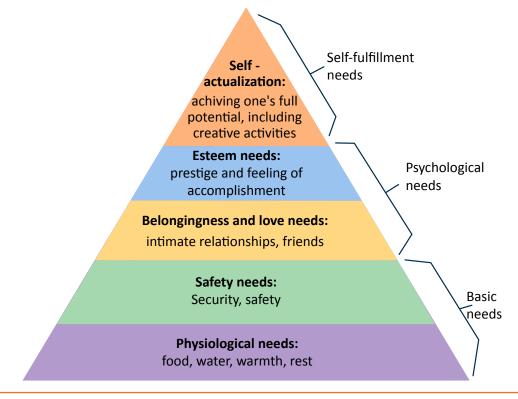
To truly achieve your full potential, you need to take a deep look inside yourself and find out what kind of person you really are. This attempt to understand your personality is known as self-analysis. Assessing yourself in this manner will help you grow, and will also help you to identify areas within 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.

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.

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.



As you can see from the pyramid, the lowest level depicts the most basic needs. Maslow believed that our behaviour is motivated by our basic needs, until those needs are met. 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.

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?

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

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.

What Are Your Strengths and Weaknesses?

Another way to analyze 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



- Achievement motivation can be learned.
- Don't be afraid to make mistakes.
- Train yourself to finish what you start.
- Dream big.

13.1.4 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.

Qualities of Honest People

Honest individuals have certain distinct characteristics. Some common qualities among honest people are:

- 1. 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.
- 2. 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.
- 3. They are think skinned. This means they are not affected by others judging them harshly for their honest opinions.
- 4. 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.

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.

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.

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.

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, etc.
- **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.



- 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.

13.1.5 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



- 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.

13.1.6 Time Management: What is 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
- Better professional reputation
- Higher chances for career advancement
- Higher efficiency
- Reduced stress
- Greater opportunities to achieve goals

Not managing time effectively can result in undesirable consequences like:

- Missing deadlines
- Substandard work quality
- Stalled career

- Inefficient work output
- Poor professional reputation
- Increase in stress and anxiety

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

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. Analyze 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.



- 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.

13.1.7 Anger Management: What is 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.

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.

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.



- Try to forgive those who anger you, rather than hold a grudge against them.
- Avoid using sarcasm and hurling insults. Instead, try and explain the reason for your frustration in a polite and mature manner.

13.1.8 Stress Management: What is Stress

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
- **External causes of stress**
- Major life changes
- Difficulties with relationships
- Having too much to do

- Pessimism
- Negative self-talk
- All in or all out attitude
- Difficulties at work or in school
- Financial difficulties
- Worrying about one's children and/or family

Symptoms of Stress

Stress can manifest itself in numerous ways. Take a look at the cognitive, emotional, physical and behavioral symptoms of stress.

Cognitive Symptoms	Emotional Symptoms
Memory problems	• Depression
Concentration issues	Agitation
Lack of judgement	Irritability
Pessimism	• Loneliness
Anxiety	 Anxiety
Constant worrying	Anger

Physical Symptoms	Behavioral Symptoms		
Aches and pain	Increase or decrease in appetite		
Diarrhea or constipation	Over sleeping or not sleeping enough		
Nausea	Withdrawing socially		
Dizziness	 Ignoring responsibilities 		
Chest pain and/or rapid heartbeat	Consumption of alcohol or cigarettes		
Frequent cold or flu like feelings	Nervous habits like nail biting, pacing etc.		

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.



- Force yourself to smile even if you feel stressed. Smiling makes us feel relaxed and happy.
- Stop yourself from feeling and thinking like a victim. Change your attitude and focus on being proactive.

13.2. Digital Literacy: A Recap

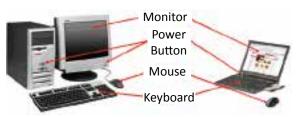
Unit Objectives



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 basic computer terminology
- 5. Recall the functions of basic computer keys
- 6. Discuss the main applications of MS Office
- 7. Discuss the benefits of Microsoft Outlook
- 8. Discuss the different types of e-commerce
- 9. List the benefits of e-commerce for retailers and customers
- 10. Discuss how the Digital India campaign will help boost e-commerce in India
- 11. DescribeExplain how you will sell a product or service on an e-commerce platform

13.2.1 Computer and Internet basics:Basic Parts of a Computer



Basic Parts of a Keyboard



Shift Space Enter Arrow Keys

Basic Parts of a Computer

- **Central Processing Unit (CPU)**: The brain of the computer. It interprets and carries out program instructions.
- Hard Drive: A device that stores large amounts of data.
- Monitor: The device that contains the computer screen where the information is visually displayed.
- **Desktop**: The first screen displayed after the operating system loads.
- **Background**: The image that fills the background of the desktop.

Basic Parts of a Computer

- Mouse: A hand-held device used to point to items on the monitor.
- **Speakers**: Devices that enable you to hear sound from the computer.
- **Printer**: A device that converts output from a computer into printed paper documents.
- **Icon**: A small picture or image that visually represents something on your computer.
- **Cursor**: An arrow which indicates where you are positioned on the screen.
- **Program Menu**: A list of programs on your computer that can be accessed from the Start menu.
- **Taskbar**: The horizontal bar at the bottom of the computer screen that lists applications that are currently in use.
- **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.



- 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.

13.2.2 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 OneNote and...your phone!
- Offline access to email: No Internet? No problem! Write emails offline and send them when you're connected again.



- 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.

13.2.3 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 individuals and public administration.

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

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.



- Before launching your e-commerce platform, test everything.
- Pay close and personal attention to your social media.

13.3: Money Matters

Unit Objectives | 6



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

- Discuss the importance of saving money
- 2. Discuss the benefits of saving money
- 3. Discuss the main types of bank accounts
- Describe the process of opening a bank account
- Differentiate between fixed and variable costs 5.
- Describe the main types of investment options 6.
- 7. Describe the different types of insurance products
- Describe the different types of taxes
- Discuss the uses of online banking
- 10. Discuss the main types of electronic funds transfers

13.3.1 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
- 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.



- 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.

13.3.2 Types of Bank Accounts, Opening a Bank Account: Types of Bank Accounts

In India, banks offer four main types of bank accounts. These are:

- Current Accounts
- Savings Accounts
- Recurring Deposit Accounts
- 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.

Savings 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.

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 needs 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 (Aadhaar) 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!



- 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.

13.3.3 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 output changes.
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, tax etc.	Material consumed, wages, commission on sales, packing expenses, etc.

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.

13.3.4 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 Non-Life or General Insurance.

Life Insurance

Life Insurance deals with all insurance covering human life.

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, cargo etc. against loss or damage during transit by rail, road, sea and/or air.

Taxes

There are two types of taxes – Direct Taxes and 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.



- 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.

13.3.5 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 to:

- Transfer funds into your own accounts of the same bank.
- Transfer funds into different accounts of the same bank.
- Transfer funds into accounts in different banks, using NEFT.
- Transfer funds into other bank accounts using RTGS.
- Transfer funds into various accounts using 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 bank address
- Beneficiary's account number
- Beneficiary's 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, the 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.

For the beneficiary to receive the transferred money, he must:

- 1. Link his mobile number with his respective account
- 2. Receive the MMID from the bank

In order to initiate a money transfer through IMPS, you will need to enter the following information:

- 1. The beneficiary's mobile number
- 2. The beneficiary's MMID

3. The transfer amount

4. 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.

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	Upto 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	Upto 10,000 – `5 above 10,000 – 1 lac – `5 above 1 – 2 lacs – `15



- 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.

13.4. 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

13.4.1 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 analyze the job description.
- Make a note of the knowledge, skills and abilities required to fulfill 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, behavioral 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:
 - o What do you consider the most important criteria for success in this job?
 - o How will my performance be evaluated?
 - o What are the opportunities for advancement?
 - O What are the next steps in the hiring process?
- Remember, never ask for information that is easily available on the company website.



- 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.

13.4.2 Preparing an Effective Resume: How to Create 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

- Organization
- Platform used

- Contribution
- Description

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

Gender & marital status

Nationality

• Languages known

Example:

Personal Details

Date of birth: 25th May, 1981
 Gender & marital status: Female, Single

Nationality: Indian

• Languages known: English, Hindi, Tamil, French



- 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.

13.4.3 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.



- Be honest and confident while answering.
- Use examples of your past experiences wherever possible to make your answers more impactful.

13.4.4 Work Readiness – Terms & Terminologies: Basic Workplace Terminology

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 services 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 background, work experience, skills and strengths.
- **Declining Letter:** A letter sent by an employee to an employer, turning down the job offer made by the 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 and pitches 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 intern, to work at the employer's company for a fixed, limited time period.
- **Interview**: A conversation between a potential employee and a representative of an employer, in 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, address, contact 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.
- 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 of 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 employee terminates it.
- **Overqualified**: A person who is not suited for a particular job because he or she has too many years of work experience, or a level of education that is much higher than required for 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/Headhunters/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.

13.5. Understanding Entrepreneurship

· Unit Objectives | 🌀



- 1. At the end of this unit, you will be able to:
- Discuss the concept of entrepreneurship
- 3. Discuss the importance of entrepreneurship
- 4. Describe the characteristics of an entrepreneur
- 5. Describe the different types of enterprises
- 6. List the qualities of an effective leader
- Discuss the benefits of effective leadership
- List the traits of an effective team 8.
- 9. Discuss the importance of listening effectively
- 10. Discuss how to listen effectively
- 11. Discuss the importance of speaking effectively
- 12. Discuss how to speak effectively
- 13. Discuss how to solve problems
- 14. List important problem solving traits
- 15. Discuss ways to assess problem solving skills
- 16. Discuss the importance of negotiation
- 17. Discuss how to negotiate
- 18. Discuss how to identify new business opportunities
- 19. Discuss how to identify business opportunities within your business
- 20. Understand the meaning of entrepreneur
- 21. Describe the different types of entrepreneurs
- 22. List the characteristics of entrepreneurs
- 23. Recall entrepreneur success stories
- 24. Discuss the entrepreneurial process
- 25. Describe the entrepreneurship ecosystem
- 26. Discuss the government's role in the entrepreneurship ecosystem
- 27. Discuss the current entrepreneurship ecosystem in India
- 28. Understand the purpose of the Make in India campaign
- 29. Discuss the relationship between entrepreneurship and risk appetite
- 30. Discuss the relationship between entrepreneurship and resilience
- 31. Describe the characteristics of a resilient entrepreneur
- 32. Discuss how to deal with failure

13.5.1 Concept Introduction, (Characteristic of an Entrepreneur, types of firms / types of enterprises): Entrepreneurs and Entrepreneurship

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.

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

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

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)

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.



- 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.

13.5.2 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.

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.

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

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.

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 problem 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.



- 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.

13.5.3 Communication Skills: Listening & Speaking: The Importance of Listening Effectively

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.

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

How to Listen 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.

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.



- 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.

13.5.4 Problem Solving & Negotiation skills: What is a Problem?

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.

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 problemStep 2: Study the problem in detailStep 3: List all possible solutionsStep 4: Select the best solution

Step 5: Implement the chosen solution Step 6: Check that the problem has really been solved

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

Being proactive

Having a positive attitude

Asking the right questions

Not panicking

Focusing on the right problem

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.
- 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.

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 startup. 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 alternate solutions to reach an outcome where both parties 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



- 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

13.5.5 Business Opportunities Identification: Entrepreneurs and Opportunities

"The entrepreneur always searches for change, responds to it and exploits it as an opportunity."

Peter Drucker

The ability to identify business opportunities is an essential 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 means a good or favourable change available to run a specific 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

1. Identify Market Inefficiencies

When looking at a market, consider what inefficiencies are present in the market. Think about ways to correct these inefficiencies.

2. Remove Key Hassles

Rather than create a new product or service, you can innovatively improve a product, service or process.

3. Create Something New

Think about how you can create a new experience for customers, based on existing business models.

4. 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.

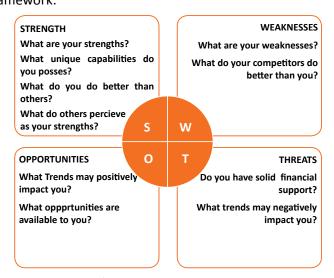
5. Think About Product Differentiation

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:



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 and position yourself as different from your competitors. Identify why customers should buy from you and promote that reason.

Opportunity Analysis

Once you have identified an opportunity, you need to analyze it.

To analyze 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



- Remember, opportunities are situational.
- Look for a proven track record.
- Avoid the latest craze.
- Love your idea.

13.5.6 Entrepreneurship Support Eco - System: What is an Entrepreneur?

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

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.

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.

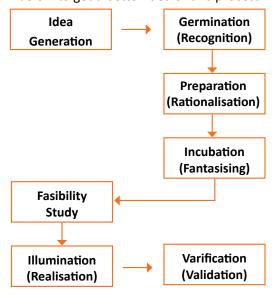
Stage 4: Incubation or Fantasizing. This stage involves creative thinking for the purpose of coming up with more ideas. Less thought is given to the problem areas.

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.



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.

Early Customers

- Early adopters for proof-of-concept
 - Expertise in productizing
 - Reference customer First reviews
- Distribution channels

Leadership

- Unequivocal support
 - Social legitimacy
- Open door for advocate
- **Entrepreneurship strategy**

e.g. for R&D, jump start funds

Financial support

Regulatory framework

e.g. Tax benifits

Policy

incentives

e.g. Investment, support

Government

Institutions

urgency, crisis and challenge

- Research institutes
- Venture-friendly legislation
- property rights, and labour contract enforcement, e.g. Bankruptcy,

Networks

- Entrepreneure's networks
- Diaspora networks
- Multinational corporations

Financial Capital

Micro-loans

Venture capital funds

Private equity

friends and family Angel investors,

Finance

Market

Public capital markets Debt Zero-stage venture capital

Labour

- Skilled and unskilled
- Serial entrepreneures

Entrepreneurship

Later generation family

Educational Institutions

- General degrees (professional and academic)
- Specific entrepreneurship training

Success Stories

Visible successes

Culture

Human

Capital

- Wealth generation for founders
 - International reputation

Societal norms

Supports

- Tolerance of risk, mistakes, failure
- Innovation, creativity, experimentation
 - Social status of entrepreneur
- Wealth creation
- Ambition, drive, hunger

Support Professions

Zones, incubation centers, clusters

Transportation & logistics

Energy

Telecommunications

nfrastructure

- Legal
- Accounting
- Investment bankers

Entrepreneur-

Non-Government Institution

Conferences

- Entrepreneurship promotion in non-profits
- **Business plan** contests

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 sustainability of the environment.

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 that favour existing, dominant firms over entrepreneurial ventures, restrict competition and obstruct entry for new companies.
- Instead of developing policies conceptually intended to correct market failures, policymakers should interact with entrepreneurs and understand the challenges faced by them. The feedback should be used to develop policies that incite idea exploration, product development and increased rates of deal flow.
- Entrepreneurial supporters should create a database that enables identifying who the
 participants in the ecosystem are and how they are connected. These ecosystem maps are
 useful tools in developing engagement strategies.
- 4. Disruptions are unavoidable in economic and 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.

The need for effective strategies to enable local entrepreneurship support ecosystems is a practical one. Better understanding of the actual ecosystems provides a framework within which policy makers can ask relevant questions, envisage more efficient approaches, and assess ensuing outcomes.

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.

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



- 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.

13.5.7 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) have to evaluate all potential alternatives and select 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 startup with a revolutionary concept will have a very high risk appetite. The startup 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 tradeoff 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
- Strong social connections
- Skill to learn from setbacks
- Ability to look at the bigger picture
- Ability to diversify and expand
- Survivor attitude
- Cash-flow conscious habits
- Attention to detail



- 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 the 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.

13.5.8 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 startup. 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!



- Remember that nothing is impossible.
- Identify your mission and your purpose before you start.
- Plan your next steps don't make decisions hastily.

13.6: 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. Understand 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

13.6.1 Market Study / The 4 Ps of Marketing / Importance of an IDEA: Understanding Market Research

Market research is the process of gathering, analyzing 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 research is the more expensive than conducting exploratory research.

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.

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:

A tangible good

An intangible 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 does the customer want from 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 questions to ask yourself are:

- 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



- 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.

13.6.2 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.

13.6.3 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 enhances customer satisfaction and retention
- It improves profitability by identifying and focusing on the most profitable customers

6.3.4 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.

6.3.5 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



- Use social media interactions to identify needs and gather feedback.
- When networking, ask open-ended questions rather than yes/no type questions.

13.6.4 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 3-5 year 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.

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 businesslike 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
- The incentives that you offer

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 fulfill 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 longterm 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.



- 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.

13.6.5 Procedure and Formalities for Bank Finance: The Need for Bank Finance

For entrepreneurs, one of the most difficult challenges faced involves securing funds for startups. 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 startups, offering funding to thousands of startups every year.

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.

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.

- 1. Submit your application form and all other required documents to the bank.
- The bank will carefully assess your credit worthiness and assign ratings by analyzing your business information with respect to parameters like management, financial, operational and industry information as well as past loan performance.
- 3. The bank will make a decision as to whether or not you should be given funding.



- 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.

13.6.6 Enterprise Management - An Overview: How to Manage Your Enterprise

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.

Use all your skills and the skills of your employees to market your enterprise in an effective manner. You can 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!



- 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.

13.6.7. 20 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 mentor 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 insurance 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.
- There are two types of insurance life insurance and general insurance. Life insurance covers human life while general insurance covers assets like animals, goods, cars etc.

Notes			