Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

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IPSC

Participant Handbook

Sector
Plumbing

Sub-Sector
Contractors

Occupation
Plumbing

Reference ID: **PSC/Q0104, NSQF Level 3, Version 0.1**

Plumber General

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

Shri Narendra Modi
Prime Minister of India


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Prof.(Dr.) Virendra Kumar Paul
(Indian Plumbing Skills Council)

Acknowledgements

Indian Plumbing Skills Council (IPSC) is a company incorporated under Section 25 of the Indian Companies Act 1956. The Plumbing Industry faces the mammoth challenge of huge gap between the supply of skilled labour and the demand of skilled labor. A very small percentage of the plumbing workforce is actually skilled in India.

Plumbing Industry since a long time has been awaiting an opportunity to skill its workforce, and through the mandate of the National Skills Development Corporation (NSDC) has got an excellent opportunity to train its workforce with the latest skills and technology and best practices in the Industry. IPSC has been formed as the official Plumbing Sector Skills Council (SSC) under the National Skill Development Corporation (NSDC), an umbrella organization created under Ministry of Skill Development and Entrepreneurship. NSDC is an initiative of the Govt. of India and the Vision of our Prime Minister Shri Narendra Modi to transform India as a hub of skilled manpower not only for India but for the World.

The IPSC acts as an accreditation and certifying body; and will work to fill the gap of skilled and unskilled labor in India. For this purpose we are partnering associations and organizations who share same vision, and work to upgrade the skills in deficit in the plumbing industry.

This Participant book has been developed for Plumber General Level 3 to drive competency based training for this role which specify the standard of performance an individual must achieve when carrying out a functions for execution of installation, repair and maintenance activities in Plumbing together with the knowledge and understanding of communications and discussions of work flow and reporting to senior about process flows.

In addition, the purpose of completion of this Qualification Pack is progress to Level 4.

This handbook will lead to successful roll out the skill development initiatives, helping greatly our stakeholders particularly trainees, trainers and assessors etc.

We acknowledge the support from Plumbing Industry in compiling this Handbook; it won't be possible without their contribution.

It is expected that this publication would meet the complete requirements of QP/NOS based training delivery, we welcome the suggestions from users, Industry experts and other stakeholders for any improvement in future.

16thth September 2016
New Delhi

R.K.Somany
Chairman, Governing Body
Indian Plumbing Skills Council (IPSC)

About this Book

This manual has been developed by IPSC to assist the trainee as a reference guide while undergoing the course Plumber General

The course is designed for participants who want to start a career in plumbing and is aligned to the :

- PSC/ N 0101 (Installation of basic sanitary fixtures, fittings, related piping and accessories)
- PSC/ N 0102 (Repair of basic plumbing systems)
- PSC/ N 0108 (Coordinate with the senior and other working team)
- PSC/ N 0109 (Maintain a healthy, safe and secure working environment)

Indian Plumbing Skill Council's qualification pack number PSC/Q 0102. It will help a fresher to learn the basics of plumbing and qualify as a certified Plumber General equivalent to Level -3 of the NVEQF/NVQF/NSQF. This 25-day course aims to develop a participant into a Plumber General, who is “responsible for preliminary installation and minor repair work of basic plumbing systems in domestic, commercial and institutional setups.”

Symbols Used

Key Learning Outcomes

Setps

Time

Tips

Notes

Unit Objectives

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1. Introduction

Unit 1.1 - Overview of the program

Unit 1.2 - Opportunity in plumbing

Unit 1.3 - Safety, maintenance and housekeeping

Key Learning Outcomes

At the end of this lesson, students should be able to demonstrate appropriate knowledge, and show an understanding of the following:

1. Identify what will be discussed in the training program
2. Discuss the plumbing sector in India, and its sub-sectors
3. Identifying and developing component shapes for a plumbing activity.
4. Identify your Roles and responsibilities
5. Establish skills required for the job (behavioural, professional, technical and communication)
6. Maintain a safe, hygienic and secure working environment
7. Demonstrate how maintenance and housekeeping can be performed

Unit 1 - Introduction

Unit Obejectives

At the end of this lesson, students should be able to define & understand :

1. Identify the program topics
2. Knowing one and all
3. List expectations from the training
4. Identify and understand opportunities in plumbing
5. An understanding of basic tasks and theories within the plumbing industry
6. Understand the Job description and attributes of a Plumber General
7. Identify various skills required to perform the role of a Plumber General

Unit 1.1 - Overview Of Program

This training program will cover topics as per following National Occupational Standards:

1. **Installation of basic sanitary fixtures (PSC/ N 0101)** - This unit is about installation of pipes and sanitary fixtures in housing, commercial and institutional setups.
2. **Repair of basic plumbing systems (PSC/ N 0102)** - This unit is about repair of pipes and sanitary fixtures in housing, commercial and institutional setups.
3. **Maintenance and servicing of plumbing systems (PSC/ N 0112)** - This units about maintenance and servicing of plumbing systems in housing, commercial and institutional setups.
4. **Coordinating with the senior and other working team (PSC/N0108)** - This unit is about communicating with colleagues and seniors in order to achieve smooth and hazard free work flow.
5. **Maintaining a healthy, safe and secure working environment (PSC/N0109)** – This unit is about monitoring your working environment and making sure it meets requirements for health and safety.

1.1.1 Knowing Each Other

Let's Know Each Other:

1. Your Name
2. Your Location
3. Your favourite movies

Fig-PG-001 Representative Image

1.1.2 Expectation Mapping

My expectations from the training program are:

Unit 1.2 - Opportunity in Plumbing

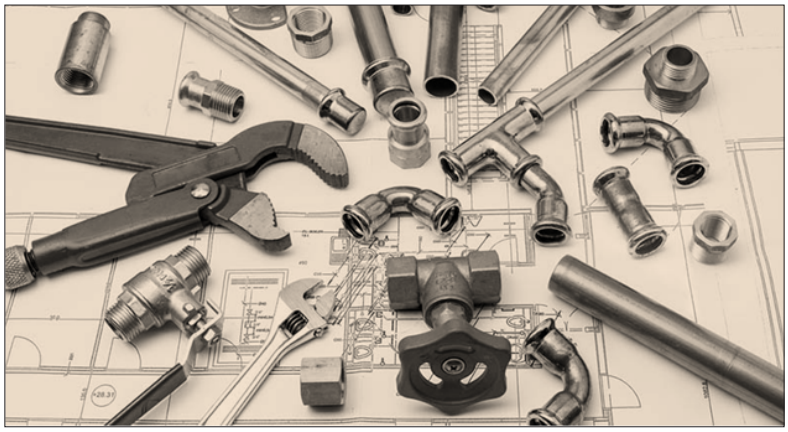

Fig-PG-002 Representative Image

1. The Plumbing Industry faces big challenge of skill gap between the availability and demand of skilled workforce.
2. India is among the few providential nations of the world where the working population is in far excess of the dependent (World Bank, 2011). Census (2011) placed a 430 million i.e. 35% of the population in the age group of 15-34 hereby have a working age population far exceeding its dependent. Plumbing industry has a market size of 23,300 Croress
3. Other than construction, the services of plumbers are required in the following sectors: Fire Fighting, Air- conditioning, Industrial Waste Management, Gas Supply, Sewage and drainage, Water Supply and Water Treatment
4. Orissa's Kendrapada district is home to more than 70% Plumbers
5. Only 10 % are organized, 90% of the total Plumbers are from the unorganized sector.
6. Most of the Plumbers learn their work on the job (unorganized OJT), they do not get any formal training
7. There are three main divisions in the Plumbing Industry – plumbing consultants, manufacturers of plumbing related products, contractors and plumbers in the construction industry
8. Number of jobs in plumbing is 14,05,000 (Contractors & Plumbers – 9,00,000; Plumbing Products Manufacturing – 5,00,000; Plumbing Consultants 5,000)
9. Manpower to be certified in 10 yrs 14,05,000
10. Number of Trainers to be trained 11,000
11. Number of Training Institutes to be certified 220
12. Number of Trades for which skill development has to be carried out is 50

1.2.1 Job Description and Attributes

Plumber (General) is an important job role in installation and repair of plumbing fittings and fixtures in 'contractors' segment. A Plumber (General) is responsible for installation, minor repair maintenance and servicing of pipes and sanitary fixtures in housing, commercial and institutional setups. The person should be able to work independently on the assignment. The person should be comfortable in performing laborious work, should be a good listener, good at taking and following instructions, a good team player and result oriented with positive attitude.

1.2.2 Skills

To perform the job successfully, an individual should demonstrate the following Competencies:

1. Problem Solving-Identifies and resolves problems in a timely manner
2. Group-Works well in group problem solving situations.
3. Technical Skills-Assesses own strengths and weaknesses; Pursues training and development opportunities; Strives to continuously build knowledge and skills.
4. Interpersonal-Remains open to others' ideas and tries new things.
5. Oral Communication-Listens and gets clarification; Responds well to questions.
6. Team Work-Balances team and individual responsibilities
    - Contributes to building a positive team spirit.
    - Team spirit and cooperativeness
    - Patience and tolerance
    - Planned and systematic work
    - Use of appropriate tools and materials
    - Neatness and cleanliness in work
    - Positive attitude
    - Devotion and honest effort in work o Perseverance and zeal for perfection o Self-effort and problem solving spirit
    - Workmanship and skill in the performance of work
    - Imagination and creativity
7. Ethics-Treats people with respect; Keeps commitments; Inspires the trust of others; Works with integrity and ethically; Upholds organizational values.
8. Organizational Support-Follows policies and procedures; Supports affirmative action and respects diversity.
9. Adaptability-Adapts to changes in the work environment; Able to deal with frequent change, delays, or unexpected events.
10. Attendance/Punctuality-At work and on time.

11. Dependability-Follows instructions, responds to management direction; Takes responsibility for own actions.
12. Initiative-Volunteers readily; Seeks increased responsibilities; Asks for and offers help when needed.
13. Innovation-Meets challenges with resourcefulness; Generates suggestions for improving work.
14. Judgment-Exhibits sound and accurate judgment; Supports and explains reasoning for decisions.
15. Motivation-Measures self against standard of excellence.
16. Professionalism-Approaches others in a tactful manner; Treats others with respect and consideration regardless of their status or position; Accepts responsibility for own actions.
17. Quality-Demonstrates accuracy and thoroughness; Looks for ways to improve and promote quality.
18. Quantity-Completes work in timely manner; Strives to increase productivity.
19. Safety and Security-Observes safety and security procedures; Reports potentially unsafe conditions; Uses equipment and materials properly.
20. Qualifications-To perform this job successfully, an individual must be able to perform each essential duty satisfactorily.
21. Reasoning Ability-Ability to apply common sense understanding to carry out detailed but uninvolved written or oral instructions. Ability to deal with problems involving a few concrete variables in standardized situations

Unit 1.3 - Safety, Maintenance and Housekeeping

Unit Obejectives

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

1.Demonstrate how maintenance and housekeeping can be performed

2.Workers responsibility

Fig-PG-003 Housekeeping

1.3.1 Safety, Maintenance and Housekeeping

Housekeeping refers to day-to-day cleanliness, tidiness and good order in all parts of the site. Good housekeeping provides a clean and pleasant working environment. It also helps prevent accidents in the workplace and aids the efficient operation of the site. Good housekeeping can usually be achieved by routine cleaning of the premises, proper storage of materials, periodic disposal of rubbish, regular maintenance of facilities and full staff co-operation.

Good Practises

- Keep tools and equipment, and their safety features, in good working order and in place.
- Keep cutting equipment sharp so they will work properly. Cut away from worker face and body to avoid cuts and punctures.
- Keep work areas clear of clutter and equipment. Place, stack, or store materials and equipment so they will not cause injury to self or other workers.
- Follow good housekeeping procedures – empty waste containers often; clean up spills quickly; discard oily rags and other flammable waste materials safely and time to time.

Fig-PG-004 Health & Safety

1.3.2 Workers Responsibility

- As a worker, worker responsibilities are to: Know and follow health and safety requirements affecting worker job.
- If you don't know how to do something safely, ask for training before you begin work.
- Wear appropriate safety gear and encourage others to also wear, so as to avoid accidents.
- Immediately report unsafe working conditions to worker supervisor.
- Immediately report any injury to a first aid attendant or supervisor
- Keep all the tools in an organized manner so as to avoid accidents

1.3.3 Risk Assessment

The following checklist is designed to help you assess the health risks in the workplace. Answer all the questions and if the answer(s) is the same as that indicating "potential hazards", there are deficiencies in the safety system or there are situations that can cause health hazards/ accidents

General Cleanliness

1. Are there daily cleaning activities in the site?
2. Are all litter-bins emptied daily?
3. Is spillage or litter generally found on the floor?
4. Is decayed food or plant material left in the site?
5. Are insects and pests often found in the site?
6. Is a visible dust layer found on furniture, walls, windows or lighting fixtures?
7. Is there any mould growing on walls or furniture?
8. Is the storage room cleaned at least once a year?

Storage

9. Is there a designated storage area for documents, machinery and goods?
10. Are documents, machinery and goods placed at locations that are easily accessible and without causing obstruction to the staff?
11. Are there any documents, machinery or goods placed in a way that are difficult to handle?

Space Occupancy

15. Is the working area overcrowded?

Maintenance

13. Does the company have a schedule to dispose of obsolete or waste materials?
14. Is there any defective machinery or furniture that has not been attended to for more than a year?
15. Are there any people who have clear responsibilities for housekeeping and maintenance of the site?

General Overview

1. Regular inspections of the complete system.
2. Keep accurate records regarding the number of times a basin has been cleaned.
3. Record amount of waste collected.
4. Store wastes from cleaning activities in appropriate containers and store in a manner that does not allow discharge back into the system or to receiving waterways.
5. Identify and monitor known problem areas.
6. Develop a regular schedule for cleaning system components.
7. Catch basins and inlets Sumps should be cleaned prior to 40% fill.
8. Inlet covers should be free of debris and sediment build-up.
9. Dewater wastes with outflow in to the sanitary sewer if allowed (however, water should be filtered prior to discharge into the sanitary sewer).
10. If dewatering to sanitary sewers is not allowed, water should be pumped or vacuumed to a tank and properly disposed of.
11. Remove sediment, debris, litter, etc.
12. Remove sediment, debris and trash build-up.
13. Observe for hydraulic functionality. Consider modifications to improve hydraulics or increase ability for pollutant removals.
14. Develop a flushing schedule for identified problem areas with repeated excessive buildup.
15. Collect flushed effluent and pump to sanitary sewer or dispose properly.
16. Inspect for functionality and structural integrity.
17. Clean pump station storm drains regularly to remove silt and trash.
18. Clean outlet structures as necessary.

Tips

a. Select equipment according to type of cleaning to be done

b. Check all equipment if clean and in safe working condition prior to use

c. Select and prepare suitable dry and wet cleaning agents and chemicals in accordance with manufacturer's and relevant occupational health and safety requirements

d. Select and use protective clothing where necessary

e. Assess use furniture, fixtures, ceilings and walling materials

f. Select appropriate cleaning equipment and chemicals in accordance with the type of material used

g. Apply appropriate procedures in accordance with the technique

h. Clean and store equipment and chemicals properly in accordance with manufacturer's specifications and requirements

I. Prepare wet and dry areas for cleaning and hazards are identified and assessed

j. Barricade or warning signs place in the work area as appropriate, to reduce risk to colleagues and customers

k. Select and apply cleaning agents or chemicals on specific areas in accordance with manufacturer's recommendations, safety procedures and establishment policies and procedures

l. Use safe equipment in accordance with manufacturer's recommendations

Tips

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2. Installation Of Basic Sanitary Fixtures

Unit 2.1 - Tools, equipment and materials (pre-installation activity)

Unit 2.2 - Measurement (pre-installation activity)

Unit 2.3 - Pipes – fitting, cutting, bending, joining and testing of pipelines etc. (pre-installation and installation activities)

Unit 2.4 - Plumbing and sanitary fixtures and their installation

Unit 2.5 - Pumps and their installation

Unit 2.6 - Water meters

Unit 2.7 - Assessment

PSC/ N 0101

Key Learning Outcomes

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

1. Identify, understand and demonstrate the different types of tools
2. Identify and understand different measuring systems
3. Repair of various types of fitting and fixtures
4. Different types of pipes, fitting, cutting, bending, joining and testing of pipelines
5. Install Tap/Faucets, Washbasins, water closets, urinals, bidet, shower and other accessories.
6. Cutting opening structure, chasing, masonry tool, mortar preparation and filling etc.
7. Pumps and their types, installation and water meters etc.

Unit 2.1 - Tools, Equipment And Materials

Unit Objectives

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

1. Understand and demonstrate the use of holding devices
2. Understand and demonstrate the use of fitting tools
3. Understand and demonstrate cutting tools
4. Understand and demonstrate pi pe threading and bending tools
5. Understand and demonstrate miscellaneous tools – screw drivers, file, chisels and hammersSealing materials, drill machines etc.

2.1.1. Holding Devices (Bench Vice)

(a) Bench Vice is a holding device that is bolted to a work bench.

(b) It opens and closes by turning a handle that is attached to a spindle. This allows for control over how tight something is held.

(c) It has one moveable jaw and one fixed jaw.

(d) Bench vices are used to hold objects allowing use of other tools to complete a task.

(e) Filing edges on a block is a perfect example. Focus can be placed on filing evenly as opposed to holding an object and trying to properly file.

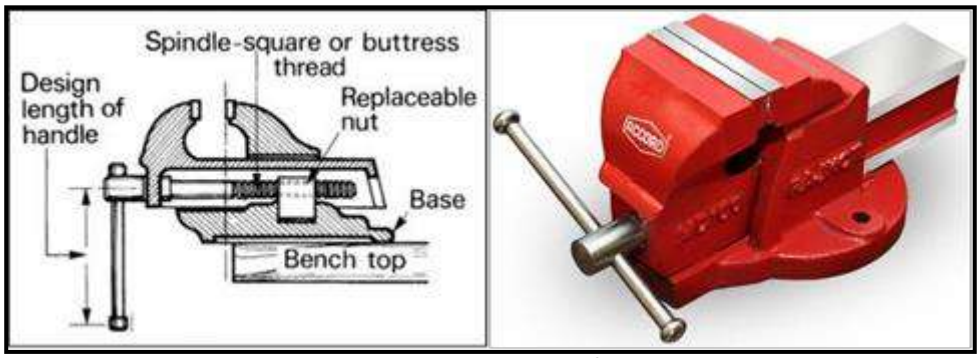

Fig-PG-005 Bench vice

2.1.2. Holding Devices (Pipe Vice)

Pipe Vice is an apparatus which enables a pipe to be held tightly.

(a) Often a feature of a common bench vice, the addition of a pipe vice makes the bench vice an all-purpose tool capable of performing many more tasks.

(b) Complete with two half-circle jaws, the pipe vice can be tightened to grip a pipe and hold it securely while it is being worked on.

(c) The teeth of a pipe vice are critical in the gripping success of the tool, as rounded or dull teeth allow the pipe to slip and roll even though the pipe vice is tightened.

Fig-PG-006 Pipe Vice

2.1.3. Fitting Tool (Pipe Wrench)

(a) Pipe Wrench is a slide wrench used for turning soft iron pipes and fittings with a rounded surface.

(b) The design of the slide jaw allows it to rock in the frame, such that any forward pressure on the handle tends to pull the jaws tighter together.

(c) Teeth angled in the direction of turn dig into the soft pipe.

(d) They are usually made of cast steel

(e) Pipe wrenches are usually sold in the following sizes (by length of handle): 10, 14, 18, 24, 36, and 48 inches, although smaller and larger sizes are available as well.

Fig-PG-007 Pipe Wrench

2.1.4. Fitting Tool (Slide Wrench)

(a) Slide Wrench is a wrench with a "jaw" of slide width, allowing it to be used with different sizes of fastener head (nut, bolt, etc.) rather than just one fastener, as with a conventional fixed spanner.

Fig-PG-008 Slide Wrench

2.1.5. Parrot Pliers

(a) Parrot Pliers are a type of slip-joint pliers.

(b) Parrot pliers are commonly used for turning and holding nuts and bolts, gripping irregularly shaped objects, and clamping materials.

(c) They have serrated jaws generally set 45– to 60-degrees from the handles.

(d) The lower jaw can be moved to a number of positions by sliding along a tracking section under the upper jaw.

(e) An advantage of this design is that the pliers can adjust to a number of sizes without the distance in the handle growing wider.

Fig-PG-009 Parrot Pliers

Fig-PG-0010 Parrot Pliers

2.1.6. Spanners

(a) Spanners are used mostly for plumbing to unscrew water pipes Tap/Faucets and other plumbing pipes.

(b) They are a form of open head wrench for use with special fittings whose character is such as to preclude the use of the ordinary type of wrench.

(c) These can be bought in different sizes to accommodate most plumbing jobs.

Fig-PG-0011 Spanners

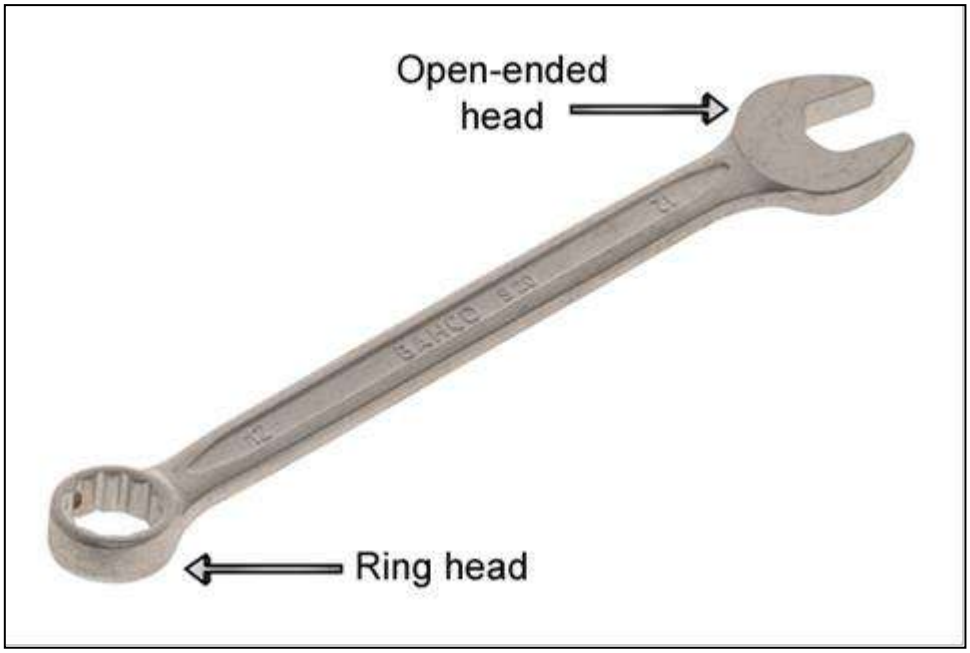

Fig-PG-0012 Open & Close Head Wrench

2.1.7. Blow-Torch

A blow-torch or blow-lamp is a fuel-burning tool used for applying flame and heat to various applications, usually metalworking. The blowlamp is commonly used where a (wide spread) high temperature naked flame heat is required but not so hot as to cause combustion or welding. It is used for soldering, brazing, softening paint for removal, melting roof tar, or pre-heating large castings before welding such as for repairing

Fig-PG-0013 Blow-Torch

Fig-PG-0014 Blow-Torch

2.1.8.Chisel

Chisel-They are used to cut through concrete. The diamond point chisel is sometimes used to give grooves a pointed bottom.

Fig-PG-0015 Flat chisel

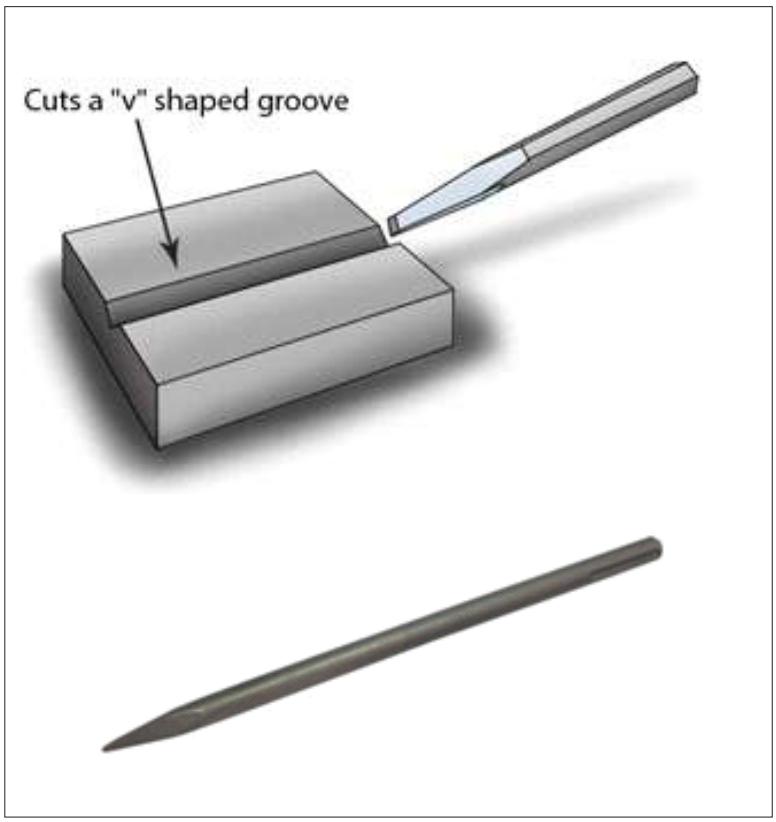

Fig-PG-0016 Point Chisel

2.1.9. Punch

A punch is a hard metal rod with a shaped tip at one end and a blunt butt end at the other, which is usually struck by a hammer.

a. Flat punch
b. Point Punch

Fig-PG-0017 Flat & Point Punch

2.1.10. Chain Wrench

Chain wrench-A self-tightening wrench with either a chain or strap of metal, leather, or rubber attached to a handle, used to grip and turn smooth cylindrical objects. It is similar to a pipe wrench, but uses a chain The links of the chain have extended pegs which fit into grooves in the front of the handle, with one end of the chain attached permanently to the handle. This is used in situations where pipe wrenches cannot maintain a proper grip on an object such as a wet or oily pipe.

Fig-PG-0017 Chain Wrench

2.1.11. Rowel Jumper is used to make hole on wall to fix pipe

Fig-PG-0018 Rowel Jumper

Fig-PG-0019 Rowel Jumper

A **Pocker** is a tool, manual or powered, for turning (**driving** or removing) **screws**. A typical simple **pocker** has a handle and a shaft, and a tip that the user inserts into the **screw** head to turn it. The shaft is usually made of tough steel to resist bending or twisting

2.1.12. Pocker

A Pocker is a tool, manual or powered, for turning (driving or removing) screws. A typical simple pocker has a handle and a shaft, and a tip that the user inserts into the screw head to turn it. The shaft is usually made of tough steel to resist bending or twisting

Fig-PG-0020 Pocker

2.1.13.Trowel

2.1.13. Trowel is a small handheld tool with a flat, pointed blade, used to apply and spread mortar or plaster.

Fig-PG-0021 Small trowel

Big Trowel

Fig-PG-0022 Big Trowel

2.1.14. Pipe Cutter

(a) Pipe Cutter is a type of tool used by plumbers to cut pipe.
(b) These are used by rotating it around the pipe and repeatedly tightening it until it cuts all of the way through.
(c) There are two types of pipe cutters.
(d) Plastic tubing cutters, which really look much like a pair of pruning shears, may be used for thinner pipes and tubes, such as sprinkler pipe.
(e) For use on thicker pipes, there is a pipe cutter with a sharp wheel and adjustable jaw grips.
(f) Besides producing a clean cut, the tool is often a faster, cleaner, and more convenient way of cutting pipe than using a hacksaw, although this depends on the metal of the pipe.

Fig-PG-0023 Pipe Cutter

2.1.15. Hack Saw

(a) Hack Saw is used for cutting materials such as metal or plastics.
(b) It is a fine-tooth hand saw with a blade held under tension in a frame.
(c) Blades are available in standardized lengths, usually 10 or 12 inches for a standard hand hacksaw.
(d) Powered hacksaws may use large blades in a range of sizes, or small machines may use the same hand blades.

Fig-PG-0024 Hack Saw

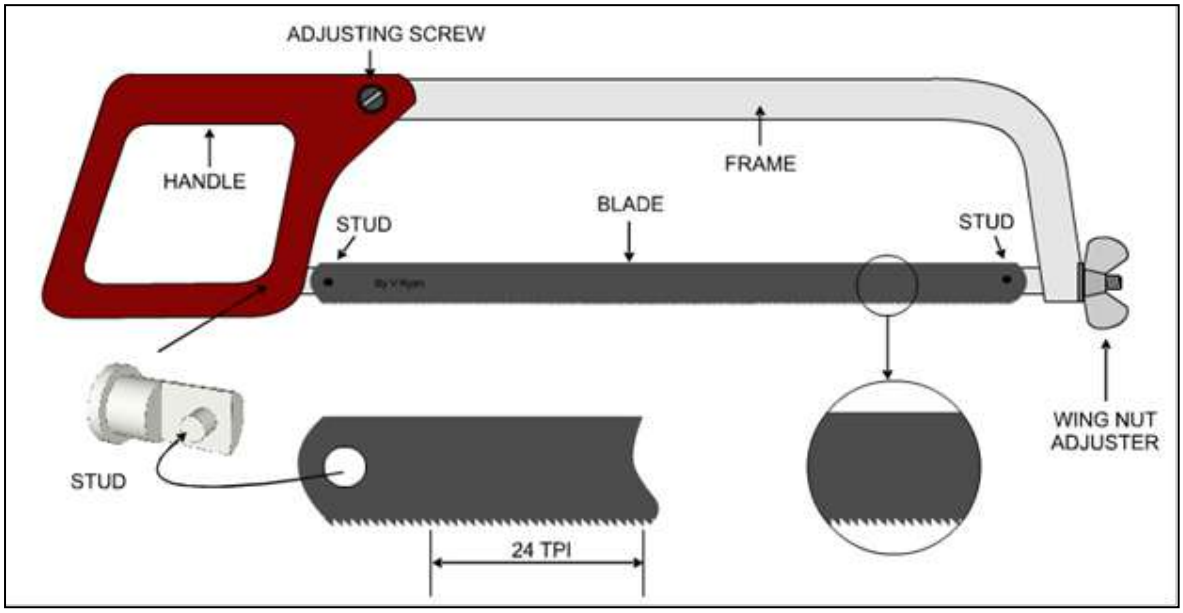

Fig-PG-0025 Hack Saw

2.1.16. Pipe Threader

(a) Pipe Threader allows plumbers or builders to fasten a length of pipe securely to a coupling or connector.

(b) It is used to cut grooves or threads into the end of a metal pipe. These grooves are similar to those found on a traditional screw, and serve the same basic function.

(c) The threads on the pipe fit into a pattern of threads in the connector, allowing users to screw the two components together by hand.

(d) Before threading the pipe, plumbers use a pipe-cutting tool to cut the pipe to the desired length.

(e) The end of the pipe is then inserted into the pipe threader.

(f) Special cutting tools, or dies, within the threader can be used to create the proper thread profile and depth.

Fig-PG-0026 Pipe Threader

Steps For Threading A Pipe

(a) Inspect the pipe threader before beginning .Worn or damaged dies can result in poor thread quality.

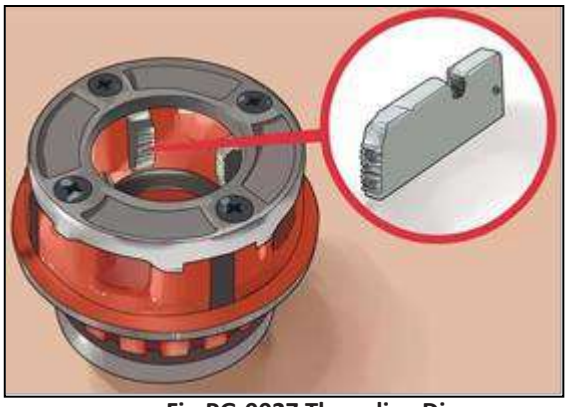

Fig-PG-0027 Threading Diy

(b) Mount your pipe firmly in the pipe vice by placing it in the vice and then tightening until it is held tightly.

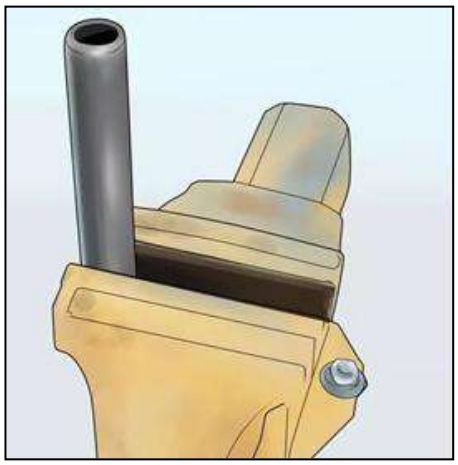

Fig-PG-0027 Pipe Mounted on Threader

(c) Cut the end of the pipe cleanly and squarely by using a pipe cutter.

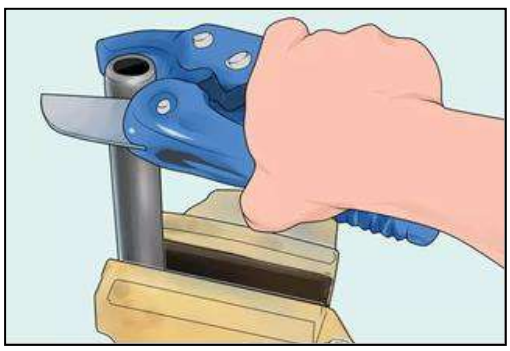

Fig-PG-0028 Pipe Mounted on Threader

(d) Ream the cut end of the pipe to remove any burrs from the cut using a reamer, which is a cylinder-shaped rotary cutting tool that you run smoothly across the freshly cut edges of the pipe to remove rough edges.

Fig-PG-0029 Reaming The Cut

(e) Select your die head according to the size and type of pipe you are threading and the thread form you require. Die heads come in different shapes and sizes that include different threads for pipes that have different diameters.

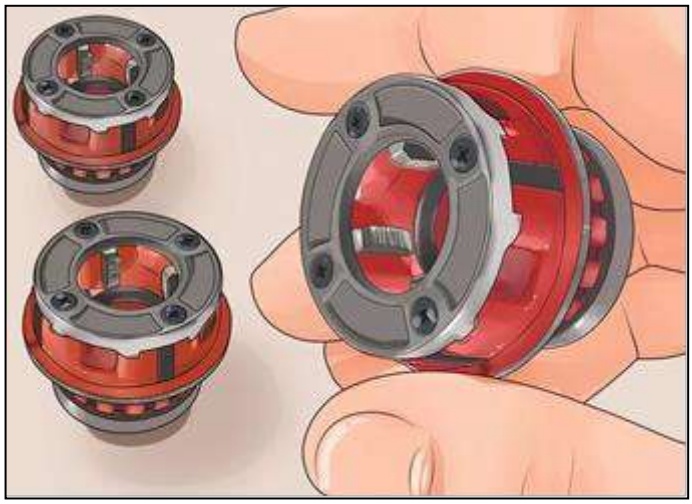

Fig-PG-0029 Die Selection

(f) Place the die head over the pipe on the threader.

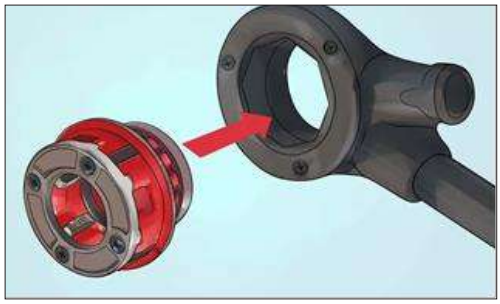

Fig-PG-0030 Die Header Placement

(g) Press steadily on the front of the die head, while simultaneously pushing the handle down to start the threader. Before placing too much pressure on the handle, check to be sure the ratchet pawl is engaged

Fig-PG-0031 Die Head Press

(h) Use your weight as leverage to apply pressure on the handle, while holding it firmly. Be sure to maintain proper footing and balance for maximum control. This can be dangerous and could result in injury.

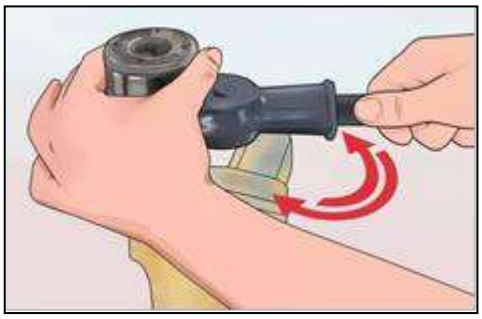

Fig-PG-0032 Applying Pressure

(I) Apply threading oil generously while threading. Using oil too thin as a substitute for threading oil can result in sub-standard threading.

Fig-PG-0033 Applying Threading Oil

(j) Reverse the ratchet mechanism and turn the die head in the opposite direction. Be careful to maintain control of the threader as the dies are removed. Threads can become damaged when the die head is being removed if you don't maintain control and move the piece smoothly.

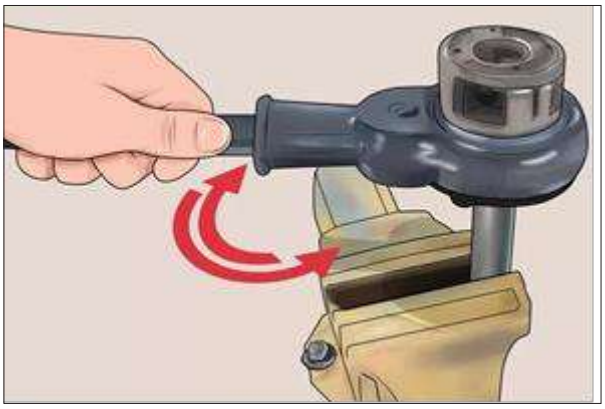

Fig-PG-0034 Reverse Ratchet Movement

(h) Clean the pipe with a cloth, removing any oil. Be careful, the threads will be very sharp. Seal the threading with Teflon Tap/Faucete or a pipe thread compound when attaching the pipe to the connector.

Fig-PG-0035 Cleaning The Pipe

2.1.17. Pipe Threading Tools (Pipe Benders)

(a) Pipe Bending Machine is designed for bending pipe or conduit.
(b) The tube is bent over a former which is curved to the radius of the required bend and shaped to support half the wall of the tube.
(c) A separate guide block supports the upper half of the tube as it is bent.
(d) Long handles provide the necessary leverage.
(e) Pipe benders are produced in a variety of sizes, from small domestic tools to large scale hydraulic benders for the trade.
(f) Pipe bending machines are similar to bending presses except that special dies are used to suit the size of pipe being bent the tube bender supports the walls of a tube locally while it is bent, but does it in a different way

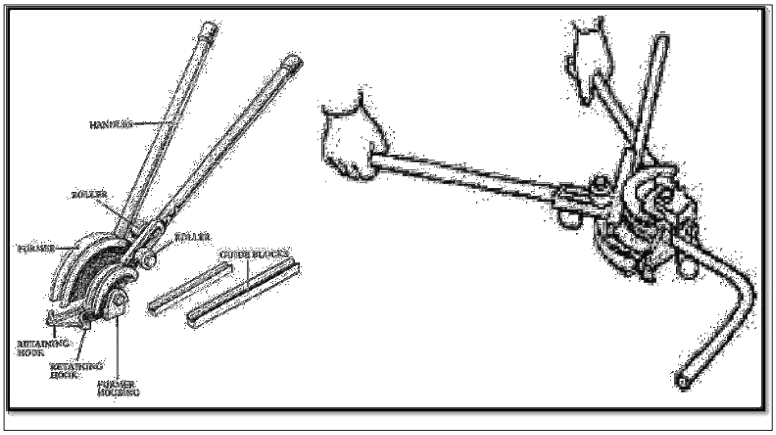

Fig-PG-0036 Pipe Bending Tool and Its Working

2.1.18. Screw Drivers

(a) Screw Driver is a hand-tool for turning (driving) screws (and sometimes bolts or other machine elements with a mating drive system).

(b) A typical screwdriver comprises of an approximately cylindrical handle of a size and shape to be held by a human hand, an axial shaft embedded in, and protruding from, the handle and a tip found at the end of the shaft, opposite the handle.

(c) The handle and shaft allow the screwdriver to be positioned and supported and, by rotating the handle, torque is applied to the tip via the screwdriver's shaft.

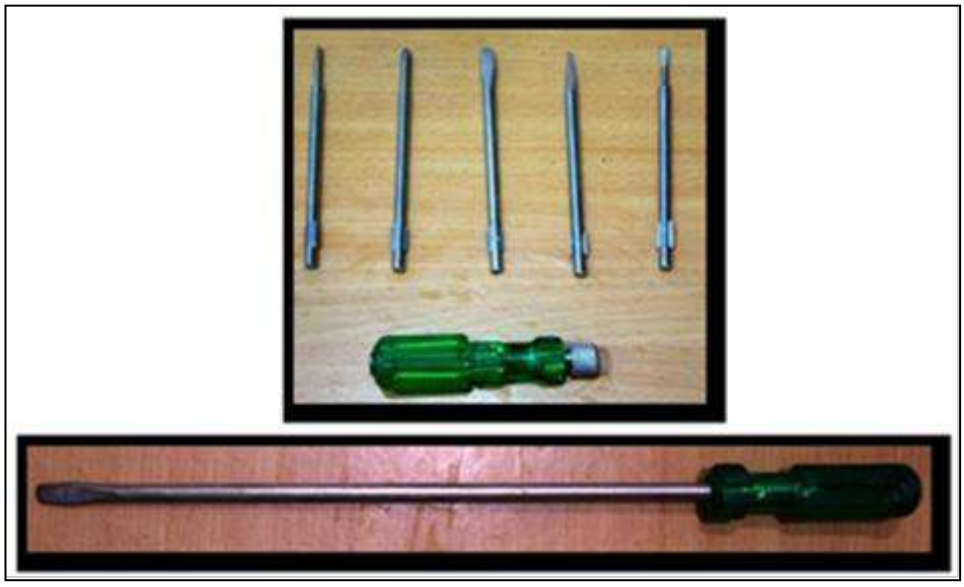

Fig-PG-0037 Screw Driver

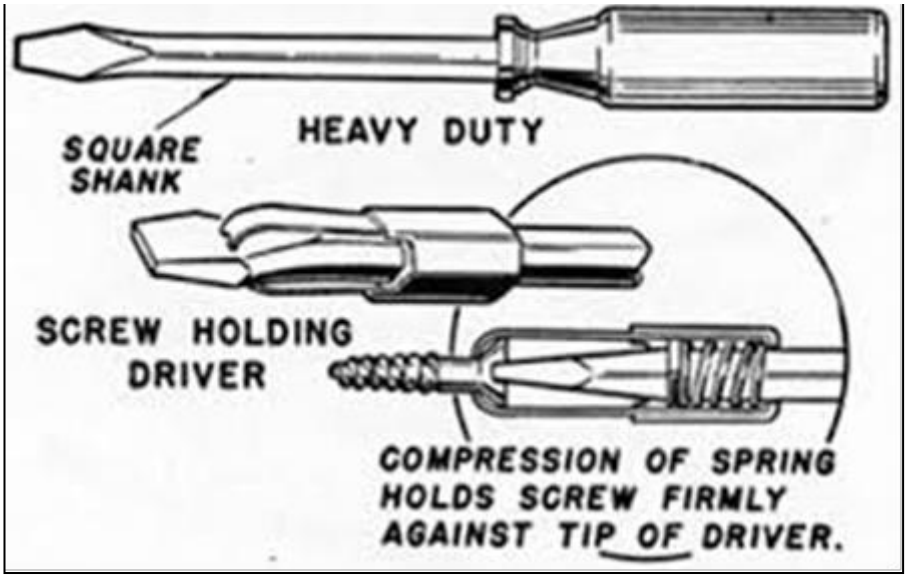

Fig-PG-0038 Screw Driver Components

2.1.19. Chisels

(a) Chisels are a tool with a characteristically shaped cutting edge.

(b) Handle and blade of a few chisels are made of metal or wood with a sharp edge in it.

(c) Chisels are forced into the material to cut it.

(d) The driving force may be manually applied or applied using a mallet or hammer

Fig-PG-0039 Chisel

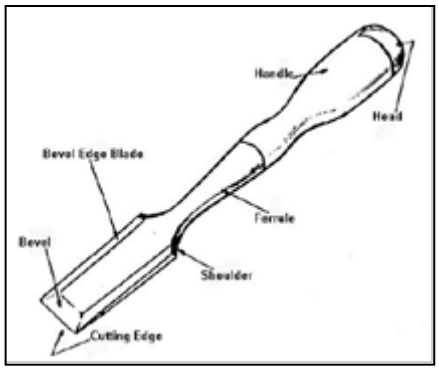

Fig-PG-0040 Chisel

2.1.20. Hammers

(a) Hammer is used to drive nails, fit parts, forge metal and break apart objects.

(b) It gives an impact to an object.

Fig-PG-0041 Hammer

2.1.21. Files

(a) Files are used to smoothen the edges and to rub the surfaces.

(b) It is a roughened surface typically made of steel.

Fig-PG-0042 Files

2.1.22. Caulking Tools

(a) Caulking is one of several different processes to seal joints or seams in various structures and piping.

Fig-PG-0043 Caulking Tools

2.1.23. Thread Seal Tap/Faucete

(a) Thread Seal Tap/Faucete can be used in many ways, the most common of which is to seal pipe threads.

(b) It is a poly tetrafluoroethylene (PTFE) film cut to specified widths for use in sealing threads.

(c) It is commonly used commercially in pressurized water systems, such as central heating systems, as well as in air compression equipment and thread joints with coarse threads.

(d) The Tap/Faucete is wrapped around the exposed threads of a pipe before it is screwed into place.

Fig-PG-0044 Thread Seal Tap/Faucete

2.1.24. Plumber's Putty

(a) Plumber's Putty is a type of putty used as a sealant in plumbing.
(b) It is a pliable substance used to create watertight seals around Tap/Faucets and drains.
(c) The putty is a basic component of a plumber's toolkit and is often used when replacing plumbing fixtures

Fig-PG-0045 Plumber's Putty

2.1.25. Drills and Drill Machine

(a) Plumber's Putty is a type of putty used as a sealant in plumbing.
(b) It is a pliable substance used to create watertight seals around Tap/Faucets and drains.
(c) The putty is a basic component of a plumber's toolkit and is often used when replacing plumbing fixtures

Fig-PG-0046 Drill Machine

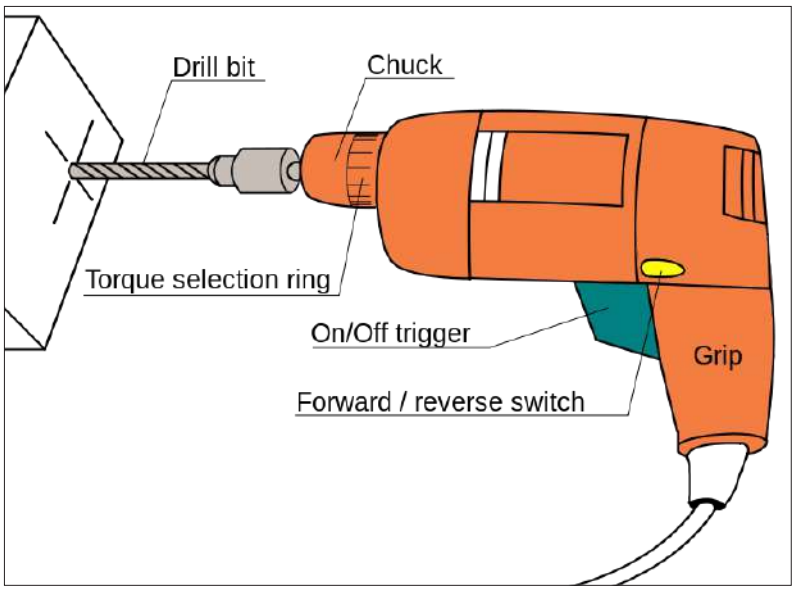

Fig-PG-0047 Drill Machine Components

2.1.26. Hammer Drill Machine

A hammer drill, also known as a "rotary hammer", "roto-drill" or "hammering drill", (see also rotary drill) is a rotary drill with a hammering action. The hammering action provides a short, rapid hammer thrust to pulverize relatively brittle material and provide quicker drilling with less effort.

Fig-PG-0048 Hammer Drill Machine

2.1.27 Hangers

Pipe Hanger is used to support a pipe or group of pipes from a slab, beam, ceiling, or other structural element.

This category contains many clamps, hangers and straps including Beam Clamps, C Clamps, Band Irons, Clevis Hangers, Copper Clevis Hangers, Copper Straps, Galvanized Straps, Stud Brackets.

Fig-PG-0049 Hangers

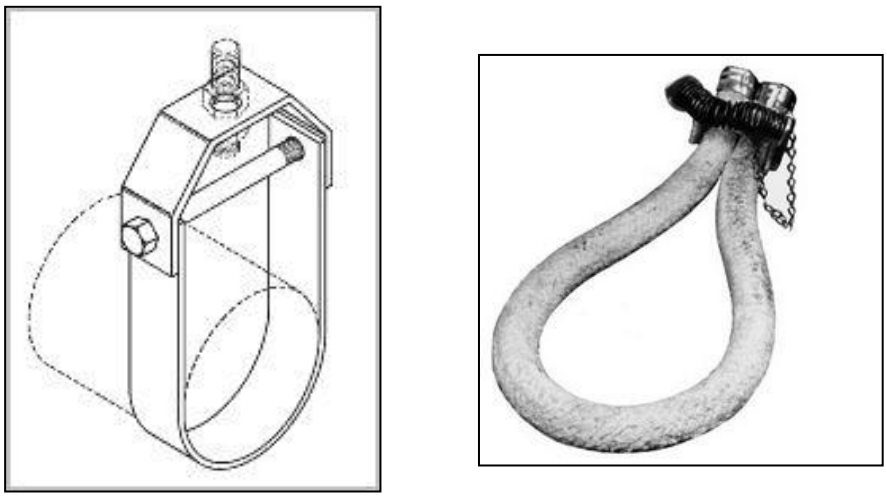

Fig-PG-0050 Clamps

2.1.28. Measuring Tap/Faucete

Measuring Tap/Faucete is used to measure length breadth and height.

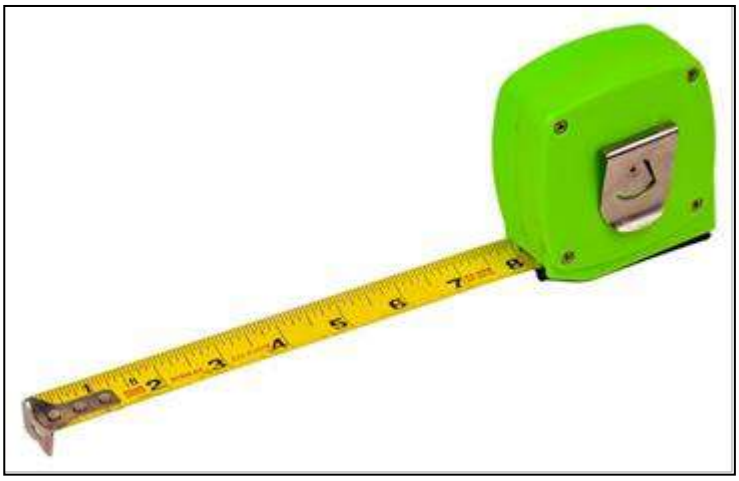

Fig-PG-0051 Measuring Tap/Faucete

2.1.29. Spirit Level

Spirit Level or bubble level is an instrument designed to indicate whether a surface is horizontal (level) or vertical (plumb).

Fig-PG-0052 Spirit Level

2.1.30. Masonry Tools

(a) Spade: Spade is used for earth work excavation, mixing --mortar and mixing concrete. It is manufactured out from toot steel. It consists of flate form with eye hole to hold handle. Wooden handle is fixed with help of a wedge at an inclination in the eye hole. Size is designated by its width and length.

Fig-PG-0053 Spade

(b) Shovel: Shovel is used for mixing concrete and also for carrying concrete to mortar pans. Shovels are made of tool steel sheets. The size is designates by its lengths and widths.

Fig-PG-0054 Shovel

(c) Pickaxe is used to excavate hard soils. It is manufactured from tool steel. One end of the Pickaxe is flat and the other end is sharp. It helps for two different operations. The size is denoted by its lengths.

Fig-PG-0055 Pickaxe

(d) Mortar pan: Mortar pan is used to carry the excavated —material, cement mortar, concrete etc. It should never be -4ed as a measure for mixing cement mortar etc. It is Manufactured out from mild steel sheet. The size is designated by its radius at top.

Fig-PG-0056 Mortar Pan

(e) Masons' square (Tri-square) -Masons' square (Tri-square) is used to check whether the external and internal corners are at right angle one side of the L is 60cm and the other side is 30cm. It is marked on the both sides either in inch or centimeter. It is made of carbon steel sheet.

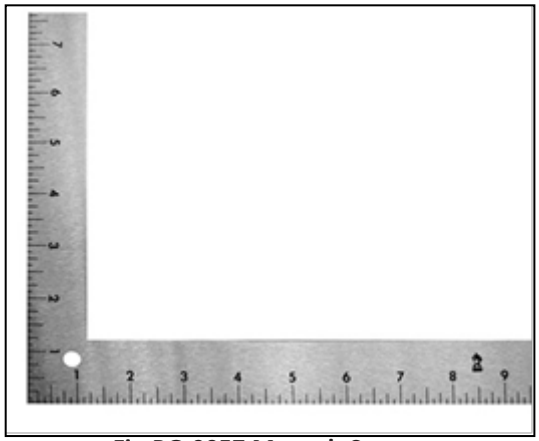

Fig-PG-0057 Mason's Square

(f) Plumb rule -It consists of a wooden plank thread and weight. There will be a marking on the centre of the plank. The thread is fixed at the centre of plank at one end and other end is tied to the weight Keep one side of the plank close to the surface to be checked, if the surface is vertical the thread will rest exactly over the line.

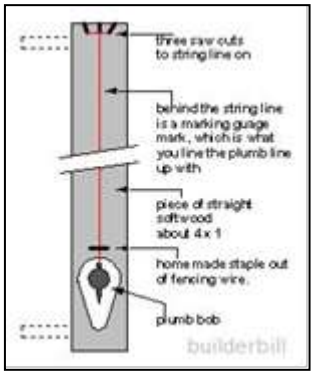

Fig-PG-0058 Plumb rule

(g) Water level -It is based on the principle that water remain in one level when it is connected. polythene tubes of varying dia from 10 to 15mm and lengths varying according to requirement are used. It is used to check levels, transfer levels etc. water is poured inside tube at the time of use.

Fig-PG-0059 Water Level

(h) Plumbing Bob - Plumb-Bob or plummet is a weight, usually with a pointed tip on the bottom that is suspended from a string and used as a vertical reference line, or plumb-line. It is essentially the y-axis equivalent of a "water level".

Fig-PG-0060 Plumbing Bob

Unit 2.2 - Measurement

Unit Objectives

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

1.Understand the different measurement systems used for plumbing purpose.
2.Demonstrate and explain calculation methods
3.Understand the different symbols for plumbing purpose in drawings

2.2.1 Measurement of length

Plumber uses the metallic Tap/Faucetes, cloth Tap/Faucetes, scale, and foot rule for measuring. Metallic Tap/Faucete should be used for accuracy in the measurement. Meter and its divisions are printed on measuring Tap/Faucetes.
The symbol of feet is (') and symbol of inch is (").

For example the meaning of 4'-9" is 4 feet 9 inches.

Both the systems i.e. metric system and F.P.S. are used in plumbing.

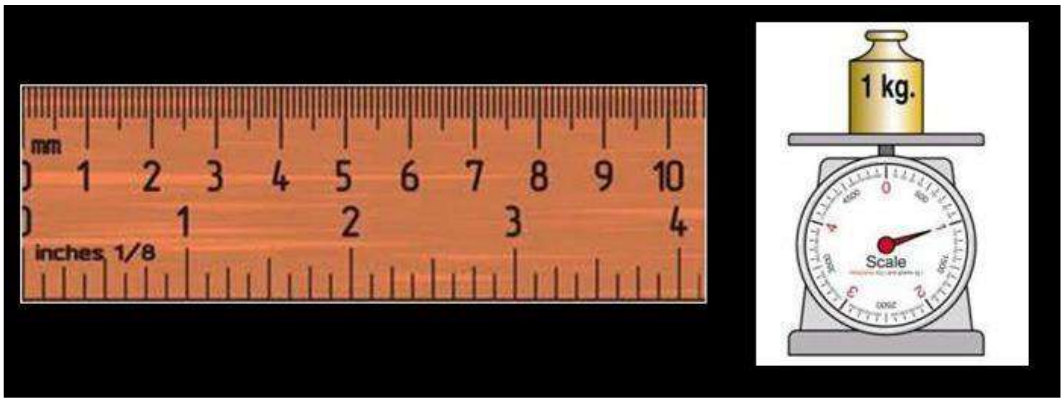

Fig-PG-0061 Scale & Measuring Equipment

(a) **In metric systems**

1 meter = 10 decimeter (dm)

1 meter = 100 centimetre (cm)

1 meter = 1000millimetre (mm)

The same can be more simplified

10 millimetre = 1 centimetre (cm)

10 centimetre = 1 decimeter (dm)

10 decimeter = 1 meter (m.)

(b) **In the F.P.S. system**

1 feet = 12 inches

3 feet = 1 yard

Inter-relation of Metric and F.P.S. System Both type of measuring systems can be interrelated, for taking length, in the following manner :

1 meter = 39.37 inches = 1.09 yard

2.2.2 Measurement of Weight

Weight measurement, using hboth the systems, is done in the following:

Conversion Tables Weight

1 kilogram	=	10 hectograms
1 kilogram	=	100 decagram
1 kilogram	=	1000 gram
100 kilogram	=	1 Quintal
1000 kilogram	=	1 metric ton
1 kilogram	=	2.2046 pounds

2.2.3. Measurement of Length

Length conversion is depicted in the following:

1 millimetre (mm)	=	0.03937079 in., or about 1/25 in		
10 millimetre	=	1 centimetre (cm.)	=	0.3937079 in
10 centimetres	=	1 decimetre (dm.)	=	3.937079 in
10 decimetres	=	1 meter (m.)	=	39.37079 in., 3.2808992 ft.,
or1.09361 yd				
10 meters	=	1 decametre (Dm.)	=	32.808992 ft
10 decametres	=	1 hectometres (Hm.)	=	19.927817 rods
10 hectometres	=	1 kilometre (Km.)	=	1093.61 yd., or 0.621377 mt
1 inch	=	2.54cm.1 foot	=	0.3048 m.
1 yard	=	0.9144 m		
1 rod	=	0.5029 Dm.1 mile	=	1.6093 Km

Conversion Table Length

Length conversion is depicted in the following:

1 millimeter (mm)	= 0.03937079 in., or about 1/25 in	
10 millimeter	= 1 centimeter (cm.)	= 0.3937079 in
10 centimeters	= 1 decimeter (dm.)	= 3.937079 in
10 decimeters	= 1 meter (m.)	= 39.37079 in., 3.2808992 ft., or 1.09361 yd
10 meters	= 1 decameter (Dm.)	= 32.808992 ft
10 decameters	= 1 hectometers (Hm.)	= 19.927817 rods
10 hectometers	= 1 kilometer (Km.)	= 1093.61 yd., or 0.621377 mit
10 kilometers	= 1 myriameter (Mn.)	= 6.21377 ml
1 inch	= 2.54cm.	1 foot = 0.3048 m., 1 yard = 0.9144 m
1 rod	= 0.5029 Dm.	1 mile = 1.6093 Km

2.2.4 Measurement of Capacity

Capacity conversion, is depicted in the following table:

1 liter (l.) = 1 cubic decimeter = 61.0270515 cu.in. or 0.03531 cu. ft. or 1.0567 liquid qtr. 0.908 dry qt.

10 liters	=	1 deciliter (Dl.)	=	2.6417 gal., or 1.135 pk.
10 deciliters	=	1 hectoliter (Hl.)	=	2.8375 bu.
10 hectoliters	=	1 kiloliter (Kl.)	=	61027.0515 cu.in. or 28.375 bu.
1 cubic foot	=	28.317		
1 gallon, Amer	=	3.785 l.		
1 gallon, Brit	=	4.543 l.		
1 gallon	=	4.546 liter		

2.2.5. Measurement of Density

Density conversion is depicted in the following table:

1 lb./ft3	=	16.018 kg/m3
1 kg./m3	=	0.0624 lb./ft3
1 lb./cu.inch	=	27.68 gms/cu.cm.

2.2.6. Measurement of Pressure

Pressure conversion is depicted in the following table:

1 lb. /ft2	=	4.8824 kg/m3	=	1lb/meter2	=	6.895 Kg.Newton/M2
1 lb./inch2	=	0.0703 kg/cm3				

2.2.7 Comprehensive Conversion Table

Millimeters	= 25.400	x inches
Meters	x 3.2809	= feet
Meters	= 0.3048	x feet
Kilometers	x 0.621377	= miles
Kilometers	= 1.6093	x miles
Square centimeters	x 0.15500	= square inches
Square centimeters	= 6.4515	x square inches
Square meters	x 10.76410	= square feet
Square meters	= 0.09290	x square feet
Square kilometers	x 247.1098	= acres
Square kilometers	= 0.00405	x acres
Hectares	x 2.471	= acres
Hectares	0.4047	x acres

Cubic centimeters	x 0.061025	= cubic inches
Cubic centimeters	= 16.3266	x cubic inches
Cubic meters	x 35.3156	= cubic feet
Cubic meters	= 0.02832	x cubic feet
Cubic meters	x 1.308	= cubic yard
Cubic meters	= 0.765	x cubic yard
Liters	x 61.023	= cubic inches
Liters	= 0.01639	x cubic inches
Liters	x 0.26418	= U.S.gallons
Liters	= 3.7854	x U.S.gallons
Grams	x 15.4324	= grains
Grams	= 0.0648	x grains
Grams	x 0.03527	ounces, avoirdupois
Grams	= 28.3495	x ounces, avoirdupois
Kilograms	x 2.2046	= pounds
Kilograms	= 0.4536	x pounds

Kilograms per sq.cm.	x 14.2231	= lb. Per. sq.in.
Kilograms per sq.cm.	= 0.0703	x lb.per.sq.in
Kilogram per cubic meter	x 0.06243	= lb.per.cu.ft.
Kilogram per cubic meter	= 16.01890	xlb.per.cu.ft.
Metric tons (1000 kilograms)	x 1.1023	x tons(2000 lb.)
Metric tons (1000 kilograms)	= 0.9072	x tons (2000 lb.)
Kilowatts	x 1.3405	= horsepower
Kilowatts	= 0.746	x horsepower
Calories	x 3.9683	= B.t.u.
Calories	= 0.2520	x B.t.u.
Francs	x 0.193	= dollars
Francs	= 5.18	x dollars

Tips

(a) To find the circumference of a circle, multiply the diameter by 3.1416.

(b) To find the diameter of a circle, multiply the circumference by .31831.

(c) To find the area of a circle, multiply the square of the diameter by .7854.

(d) The radius of a circle x6.283185 = the circumference.

(e) The square of the circumference of a circle x .07958 = the area.

(f) Half the circumference of a circle x half its diameter = the area.

(g) The circumference of a circle x .159155 = the radius.

(h) The square root of the area of a circle x .56419 = the radius.

(i) The square root of the area of a circle x 1.12838 = the diameter.
(j) To find the diameter of a circle equal in area to a given square, multiply a side of the square by 12838.
(k) To find the side of a square equal in area to a given circle, multiply the diameter by .8862.
(l) To find the side of a square inscribed in a circle, multiply the diameter by .7071.
(m) To find the side of a hexagon inscribed in a circle, multiply the diameter of a circle by .500.
(n) To find the diameter of a circle inscribed in a hexagon, multiply a side of the hexagon by 1.7321.
(o) To find the side of an equilateral triangle inscribed in a circle, multiply the diameter of a circle by .866
(p) To find the diameter of a circle inscribed in an equilateral triangle, multiply a side of the triangle by .57735.
(q) To find the area of the surface of a ball (sphere), multiply the square of the diameter by 3.1416.
(r) To find the volume of a ball (sphere), multiply the cube of the diameter by .5236.
(s) Doubling the diameter of a pipe increases its capacity four times.
(t) To find the pressure in pounds per square inch at the base of a column of water, multiply the height of the column in feet by .433.
(u) A gallon of water (U.S. standard) weighs 8.336 pounds and contains 231 cube inches. A cubic foot of water contains 7½ gallons, 1728
(v) Cubic inches and weighs 62.425 pounds at a temperature of about 39ºF. These weights change slightly and below this temperature.

2.2.8. Measuring Instruments

Fig-PG-0062 Measuring Tap/Faucete

Fig-PG-0063 Pressure Gauge

Fig-PG-0064 Callipers

Fig-PG-0065 Flow Meter

2.2.9 Plumbing symbols

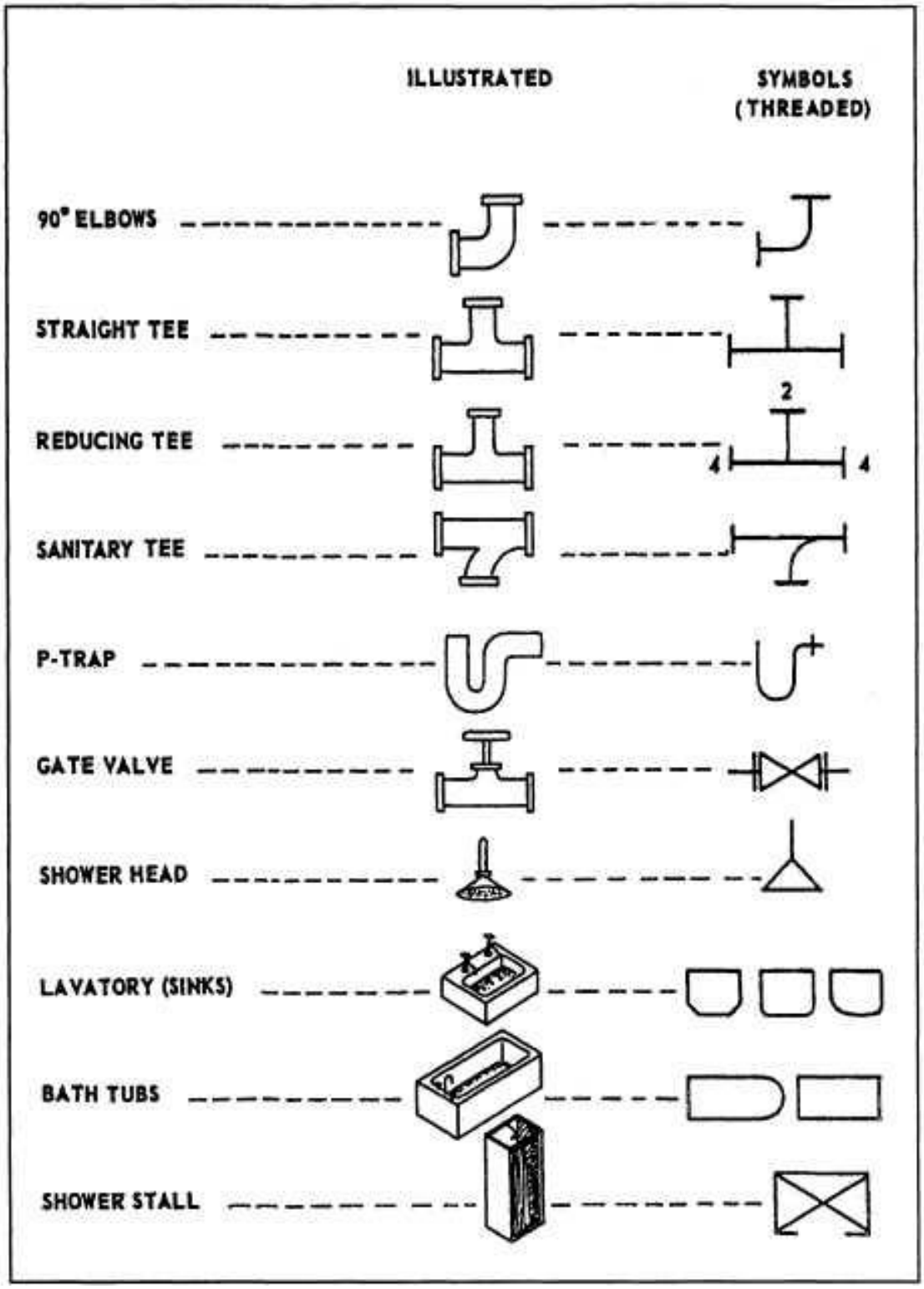

Fig-PG-0066 Plumbing symbols

ITEM	SYMBOL	SAMPLE APPLICATION (S)	ILLUSTRATION
PIPE	SINGLE LINE IN SHAPE OF PIPE- USUALLY WITH NOMINAL SIZE NOTED		
JOINT- FLANGED	DOUBLE LINE		
SCREWED	SINGLE LINE		
BELL AND SPIGOT	CURVED LINE		
OUTLET TURNED UP	CIRCLE AND DOT		
OUTLET TURNED DOWN	SEMICIRCLE		
REDUCING OR ENLARGING FITTING	NORMAL SIZE NOTED AT JOINT		
REDUCER CONCENTRIC	TRIANGLE		
ECCENTRIC	TRIANGLE		
UNION SCREWED	LINE		
FLANGED	LINE		

Fig-PG-0067 Plumbing symbols

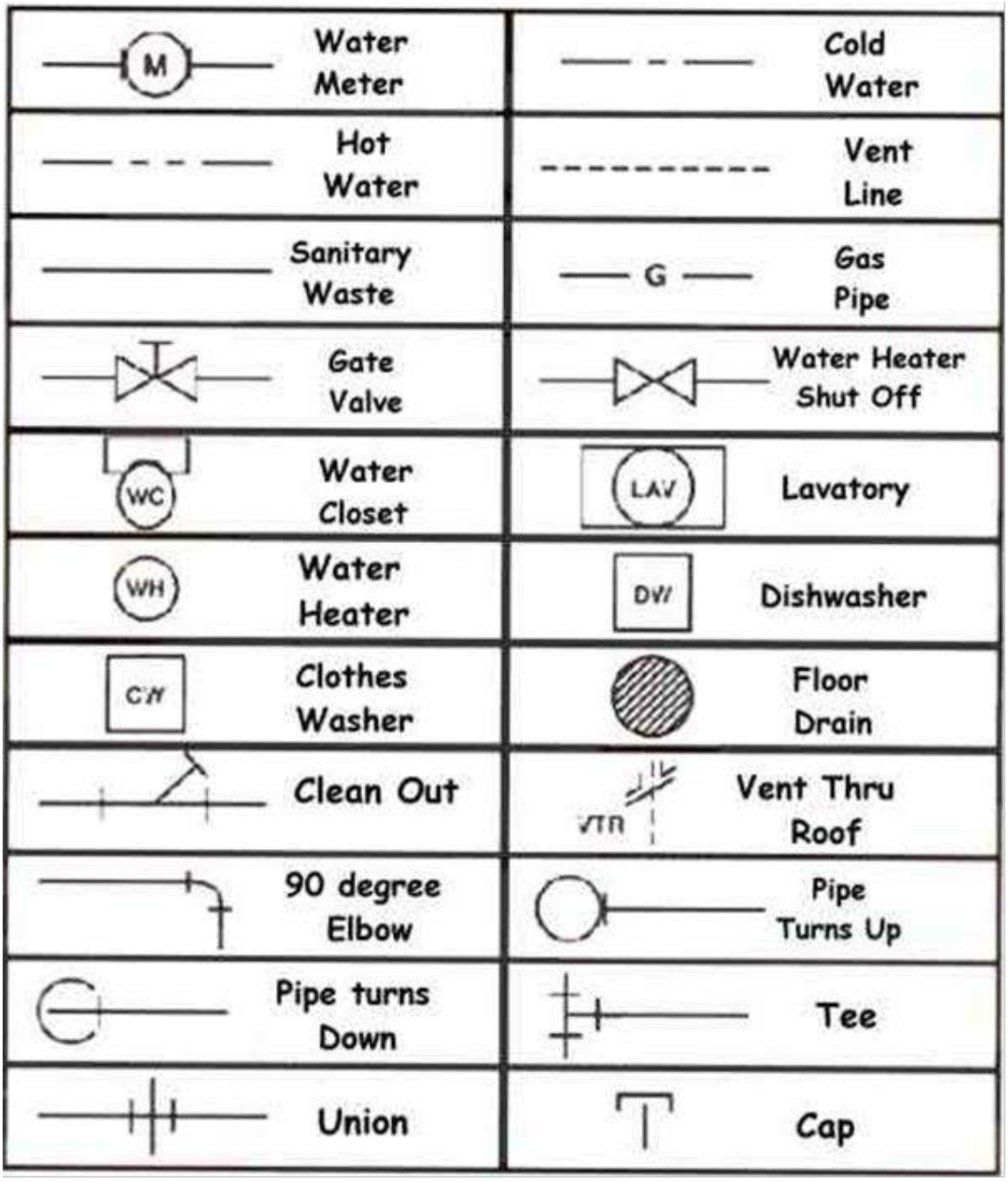

Fig-PG-0068 Plumbing symbols

2.3 PIPES - Fitting, Cutting, Bending, Joining And Testing Of Pipelines

Unit Objectives

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

1. Identify and understand different types of pipes
2. Identify and understand allied fitting of pipes
3. Understand and demonstrate bending, threading and joining of pipe
4. Testing of pipe lines

2.3.1 Types of Pipes

There are various types of pipes that are used in plumbing industry, you will study about them further in chapter.

2.3.1.1. Metallic Pipes

(a) Cast Iron- It is used as a pressure pipe for transmission of water, gas and sewage, and as a water drainage pipe. These are available with flanged ends or one end with socket & other with spigot.

Fig-PG-0069 Cast Iron Pipes

(b) Ductile Iron –It is commonly used for potable water transmission and distribution. It is made of ductile iron. These pipes are improved version of Cast Iron Pipes.

Fig-PG-0070 Ductile Iron Pipes

(c) Copper-It is made up of copper. It is most often used in - supply of hot and cold Tap/Faucet water, as refrigerant line in HVAC systems Copper offers a high level of resistance to corrosion however, it is becoming very costly.

Fig-PG-0071 Copper Pipes

(d) Stainless Steel –It is used in marine environments where salt water would erode other metal pipe. These pipes are strong and highly resistant to corrosion. However, even more expensive than copper pipes.

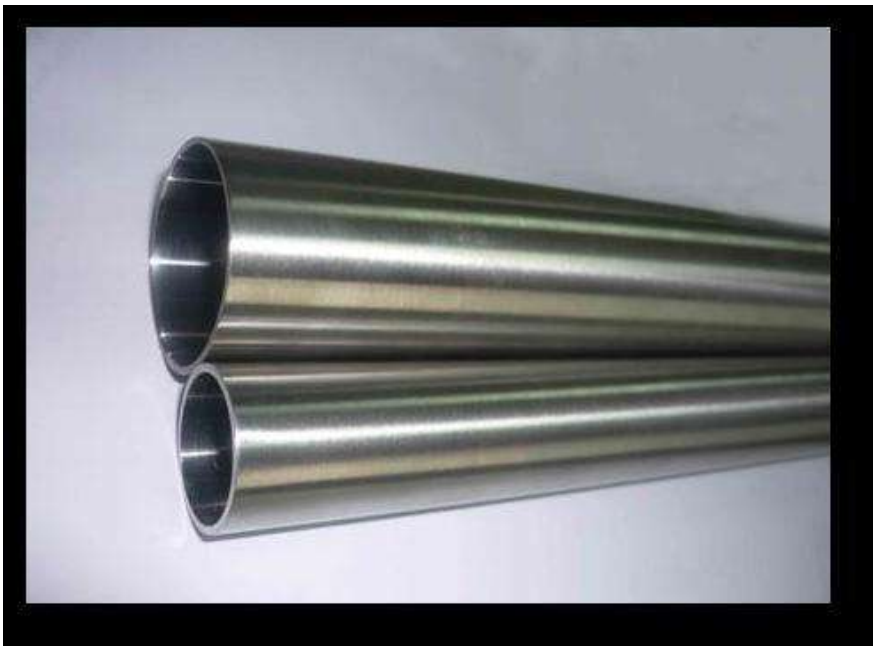

Fig-PG-0072 Stainless Steel Pipes

(e) Galvanized Iron Pipe is mainly used in water supply distribution. These pipes are made of different grade i.e. Light, Medium and Heavy depending upon the thickness of pipe used. These are colour coded for identification - light – yellow band, medium – blue band and heavy – red band Pipes with diameters in size from 15 mm to 150 mm are used in distribution.

Fig-PG-00 73 Galvanized Iron Pipes

2.3.1.2. Non-Metallic Pipes

(a) CPVC -Chlorinated Polyvinyl Chloride (CPVC) Pipe is primarily used for supplying hot and cold potable water. It is also used in industrial liquid applications Chlorinated polyvinyl chloride is a thermoplastic pipe material.

Fig-PG-00 74 CPVC Pipes

(b) PEX or XLPE- It is a form of polyethylene with cross-links, formed into tubing. PEX Pipe is primarily used in - building services, pipe work systems, domestic water piping, natural gas and offshore oil applications, chemical transportation and transportation of sewage and slurries.

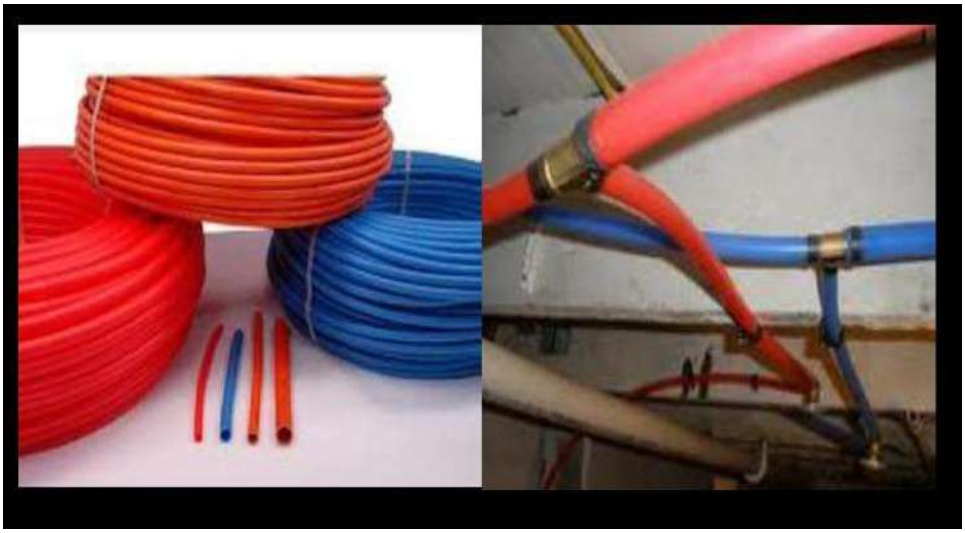

Fig-PG-0075 PEX or XLPE

(c) Polypropylene -These are made of polypropylene "random copolymer". Polypropylene Pipe is primarily used for - inner hot water and cold water supply conduits, industrial pipe-lines

Fig-PG-0076 Polypropylene Pipe

(d) Stone Ware- These are made of clay. They are primarily used in - sewerage systems for underground drainage, industrial drainage, irrigation, chemical industry for transporting the highly corrosive chemical etc.

Fig-PG- 0077 Stone Ware

(e) Un-Plasticized

Un-plasticized Polyvinyl (UPVC) Pipe is primarily used in - ventilation pipe work, rain water applications, soil and waste water discharge system

Fig-PG- 0078 Un-Plasticized

(f) High Density Polyethylene (HDPE) water is used as pressure pipe for municipal and industrial water transmission systems. Polyethylene density is divided into three main groups according to their crystalline structure percent.

- Low density polyethylene raw material (LDPE)
- Medium density polyethylene raw materials (MDPE)
- High density polyethylene raw materials (HDPE)

The properties of HDPE pipes are

(a) HDPE Pipe is resistant to weather conditions

(b) HDPE Pipe High resistance to tearing and pressure

(c) HDPE Pipes are non toxic.

(d) HDPE Pipe is suitable for radioactive waste

Fig-PG-0079 HDPE Pipe

(g) PPR Pipes- PPR pipe can be used as a cold water pipe and hot water pipes.

Advantage: moderate price, stable performance, heat insulation, corrosion resistance, smooth inner wall, safe and reliable, does not penetrate, life up to 50 years.

Disadvantages: It needs to use special tools and professionals to undertake construction in order to ensure system safety.

Fig-PG- 0080 PPR Pipes

2.3.2. Allied Fittings for Pipe

Various types of fitting used in plumbing systems to connect pipe or tubing sections as per layout requirements.

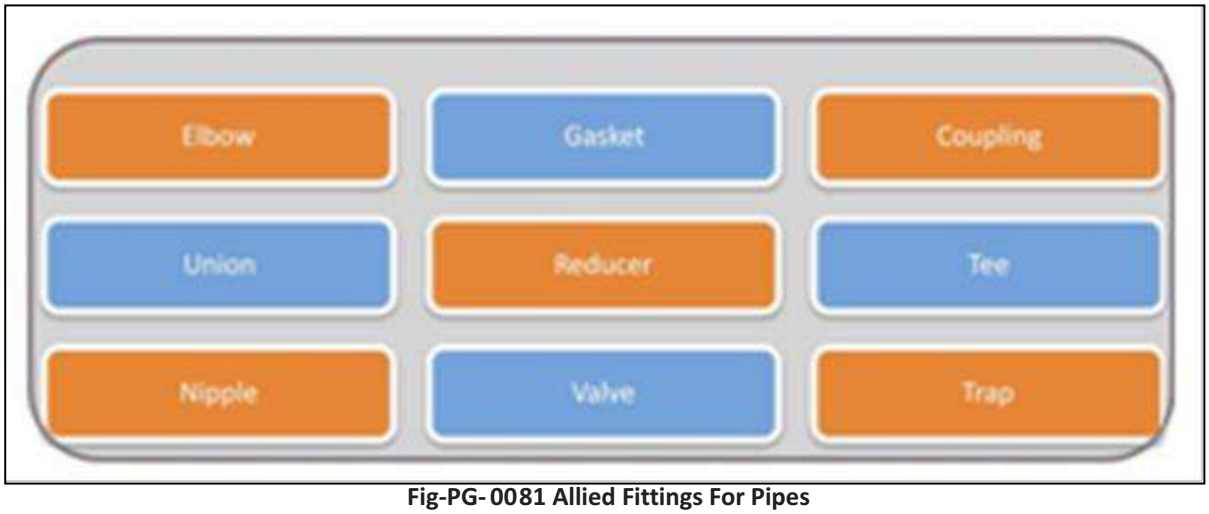

Fig-PG- 0081 Allied Fittings For Pipes

2.3.2.1 Elbow

An elbow is a pipe fitting installed between two lengths of pipe or tubing to allow a change of direction, usually a 90° or 45° angle.The ends may be machined for butt welding, threaded (usually female), or socketed, etc. When the two ends differ in size, the fitting is called a reducing elbow or reducer elbow.

Elbows are categorized based as below:

Long Radius (LR) Elbows–radius is 1.5 times the pipe diameter

Short Radius (LR) Elbows–radius is 1.o times the pipe diameter.

90° Elbow–where change in direction required is 90°

45° Elbow–where change in direction required is 45°

Elbows are categorized based as below:

Bend 45^0




Fig-PG- 0082 Bend 45 Degree Bend

Bends 90^o




Fig-PG- 0083 Bend 90 Degree Bend

Fig-PG- 0084 Bend 90 Degree Bend

Tee - Joints



Fig-PG- 0085 Tee-Joints

Y-T joint


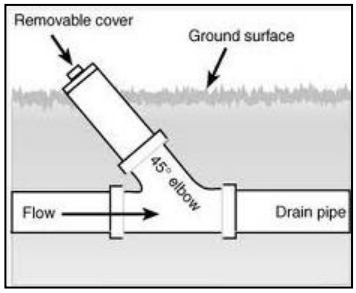

Fig-PG- 0086 Y-T Joint

Double Y-T joint

Fig-PG- 0087 Double Y-T Joint

Fig-PG- 0088 T Trap

Fig-PG- 0089 Coupler Reducer

2.3.2.2 Gaskets

Gaskets are used for sealing of flange joints. Various types of gaskets are available depending upon their construction, materials, and features. The following are the type of gaskets commonly used:

(a) Non-Metallic Gaskets

(b) Spiral-Wound Gaskets

(c) Ring Joint Gaskets

Fig-PG- 0090 Gaskets

2.3.2.3 Coupling

A coupling connects two pipes to each other. If the size of the pipe is not the same, the fitting may be called a reducing coupling or reducer, or an adapter. By convention, the term "expander" is not generally used for a couple that increases pipe size; instead the term "reducer" is used.

Fig-PG- 0091 Coupling

Fig-PG- 0092 Expander

2.3.2.4 Union

A union is similar to a coupling, except it is designed to allow quick and convenient disconnection of pipes for maintenance or fixture replacement. While a coupling would require solvent welding, soldering or being able to rotate with all the pipes adjacent as with a threaded coupling, a union provides a simple transition, allowing easy connection or disconnection at any future time. A standard union pipe is made in three parts consisting of a nut, a female end, and a male end. When the female and male ends are joined, the nuts then provide the necessary pressure to seal the joint. Since the mating ends of the union are interchangeable, changing of a valve or other device can be achieved with a minimum loss of time. Pipe unions are essentially a type of flange connector, as discussed further below.

Fig-PG- 0093 Union

2.3.2.5 Reducer

A reducer allows for a change in pipe size to meet hydraulic flow requirements of the system, or to adapt to existing piping of a different size. Reducers are usually concentric but eccentric reducers are used when required to maintain the same top- or bottom-of-pipe level.

Fig-PG- 0093 Reducer

2.3.2.6 Tee

A tee is the most common pipe fitting. It is available with all female thread sockets, all solvent weld sockets, or with opposed solvent weld sockets and a side outlet with female threads. It is used to either combine or split a fluid flow. It is a type of pipe fitting which is T-shaped having two outlets, at 90° to the connection to the main line. It is a short piece of pipe with a lateral outlet. A tee is used for connecting pipes of different diameters or for changing the direction of pipe runs. They are made of various materials and available in various sizes and finishes. They are extensively used in pipeline networks to transport two-phase fluid mixtures.

Single 'TEE' with door

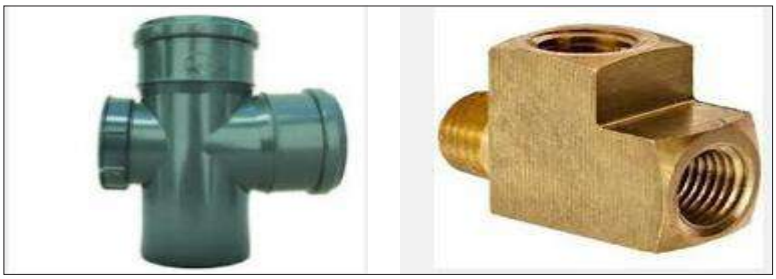

Fig-PG- 0094 Single TEE with Door

Double 'TEE'

Fig-PG- 0095 Double TEE

Double 'TEE' with door

Fig-PG- 0096 Double TEE with Door

2.3.2.7 Nipple

A short stub of pipe, usually threaded steel, brass, chlorinated polyvinyl chloride (CPVC) or copper; occasionally just bare copper. A nipple is defined as being a short stub of pipe which has external male pipe threads at each end, for connecting two other fittings. Nipples are commonly used for plumbing and hoses, and second as valves for funnels and pipes

2.3.3. Types of Pipe Joints

Connecting two or more pipe together is called fitting. Different pipe joints are for different pipes. These joints are as followed:-

2.3.3.1.Butt - welded Joints

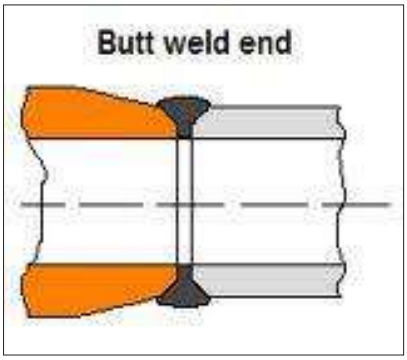

Fig-PG- 0097 Butt-welding

- Butt-welding is the most common method of joining piping used in large commercial, institutional, and industrial piping systems. Material costs are low, but labor costs are moderate to high due to the need for specialized welders and fitters.
- Long term leakage integrity is extremely good, as is structural and mechanical strength.
- The interior surface of a butt-welded piping system is smooth and continuous which results in low pressure drop.
- The system can be assembled with internal weld backing rings to reduce fit-up and welding costs, but backing rings create internal crevices, which can trap corrosion products.

- In the case of nuclear piping systems, these crevices can cause a concentration of radioactive solids at the joints, which can lead to operating and maintenance problems.
- Backing rings can also lead to stress concentration effects, which may promote fatigue cracks under vibratory or other cyclic loading conditions.

2.3.3.2. Socket - welded Joints

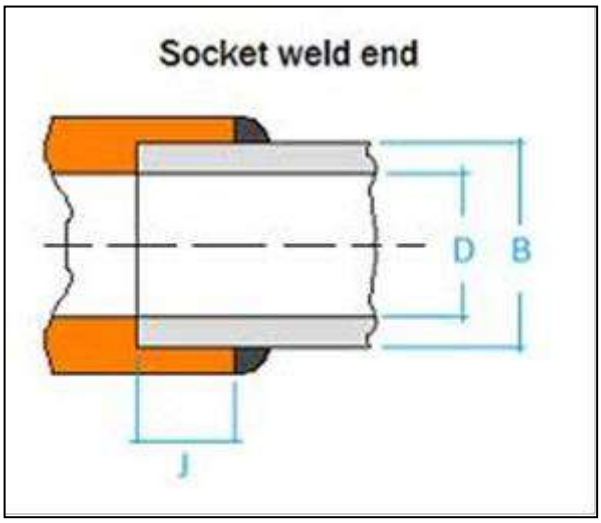

Fig-PG- 0098 Socket Welded Joint

- Socket welded construction is a good choice wherever the benefits of high leakage integrity and great structural strength are important design considerations.
- Construction costs are somewhat lower than with butt welded joints due to the lack of exacting fit up requirements and elimination of special machining for butt weld end preparation.
- The internal crevices left in socket welded systems make them less suitable for corrosive or radioactive applications where solids build up at the joints may cause operating or maintenance problems.
- Fatigue resistance is lower than that in butt welded construction due to the use of fillet welds and abrupt fitting geometry, but it is still better than that of most mechanical joining me thods.
- Aesthetic appeal is good.

2.3.3.3. Brazed and Soldered Joints

- Brazing and soldering are most often used to join copper and copper alloy piping system, although brazing of steel and aluminium pipe and tubing is possible.
- Brazing and soldering both involve the addition of molten filler metal to a close fitting annular joint.
- The molten metal is drawn into the joint by capillary action and solidifies to fuse the parts together. The parent metal does not melt in brazed or soldered construction.

Fig-PG- 0099 Molten Mettle

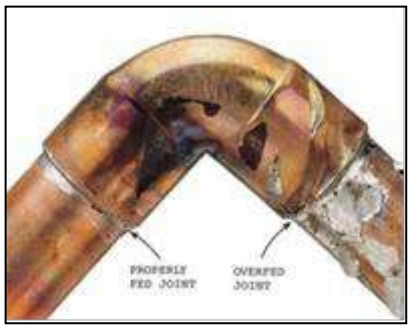

Fig-PG- 0100 Molten Mettle

The advantages of these joining methods are high leakage integrity and installation productivity.

2.3.3.4. Threaded or Screwed Piping

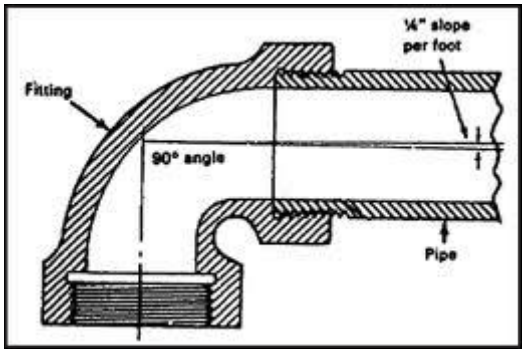

Fig-PG- 0101 Threaded or Screwed Piping

Fig-PG- 0102 Threaded or Screwed Piping

(a) Threaded or screwed piping is commonly used in low-cost, noncritical applications such as domestic water, fire protection, and industrial cooling water systems.

(b) Installation productivity is moderately high, and specialized installation skill requirements are not extensive

(c) Leakage integrity is good for low-pressure, low-temperature installations where vibration is not encountered.

(d) Rapid temperature changes may lead to leaks due to differential thermal expansion between the pipe and fittings.

(e) Vibration can result in fatigue failures of screwed pipe joints due to the high stress intensification

(f) Effects caused by the sharp notches at the base of the threads. Screwed fittings are normally made of cast gray or malleable iron, cast brass or bronze, or forged alloy and carbon steel.

(g) Screwed piping systems are useful where dis assembly and reassembly are ne

(h) Threaded or screwed joints must be used within the limitations imposed by the rules and requirements of the applicable code.

2.3.3.5. Grooved Joints

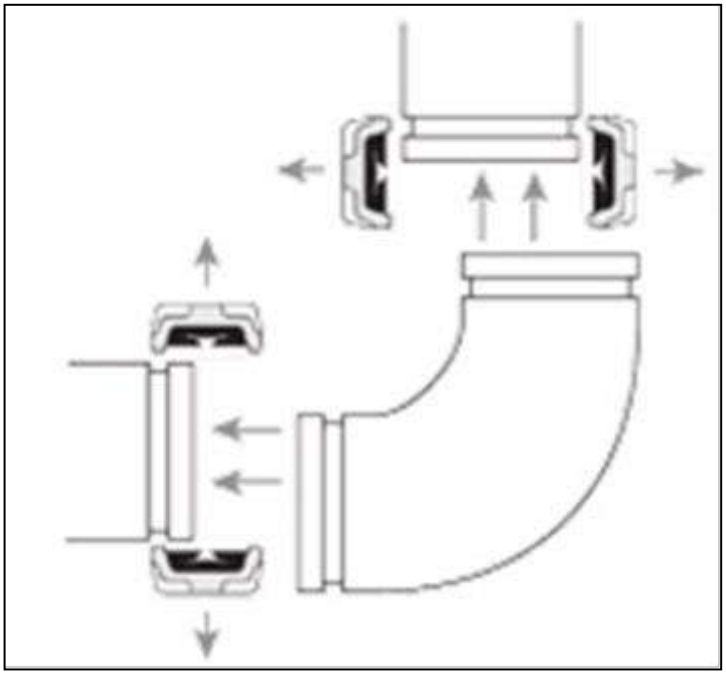

Fig-PG- 0103 Grooved Joints

Fig-PG- 0104 Grooved Joints

(a) The main advantages of the grooved joints are their ease of assembly, which results in low labor cost, and generally good leakage integrity.

(b) They allow a moderate amount of axial movement due to thermal expansion, and they can accommodate some axial misalignment. While typical applications involve machining the groove in standard wall pipe, light wall pipe with rolled-in grooves may also be used.

(c) Grooved joints are used extensively for fire protection, ambient temperature service water, and low pressure drainage applications such as floor and equipment drain systems and roof drainage conductors.

(d) They are a good choice where the piping system must be disassembled and reassembled frequently for maintenance or process changes.

2.3.3.6. Flanged Joints

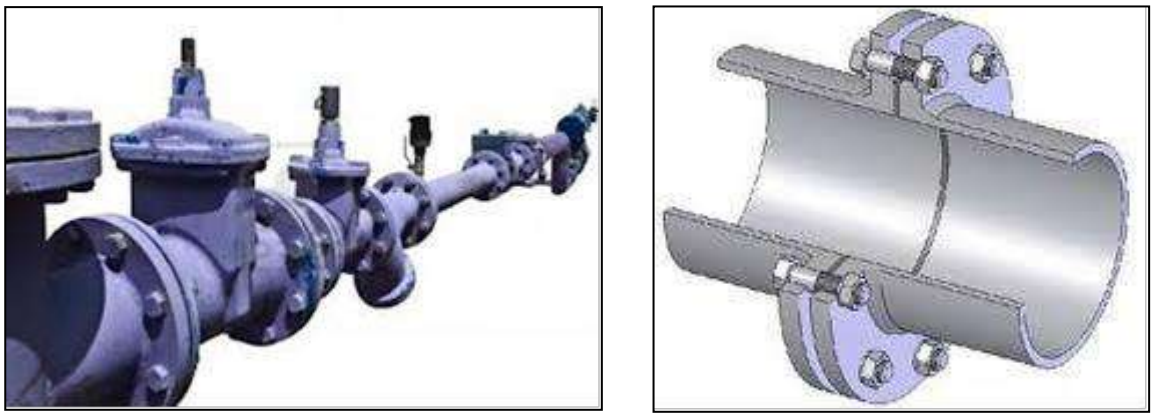

Fig-PG- 0105 Flanged Joints

(a) Flanged connections are used extensively in modern piping systems due to their ease of assembly and disassembly; however, they are costly.

(b) Contributing to the high cost are the material costs of the flanges themselves and the labor costs for attaching the flanges to the pipe and then bolting the flanges to each other.

(.c) Flanges are normally attached to the pipe by threading or welding, although in some special cases a flange-type joint known as a lap joint may be made by forging and machining the pipe end.

(d) Flanged joints are prone to leakage in services that experience rapid temperature fluctuations.

2.3.3.7. Compression Joints

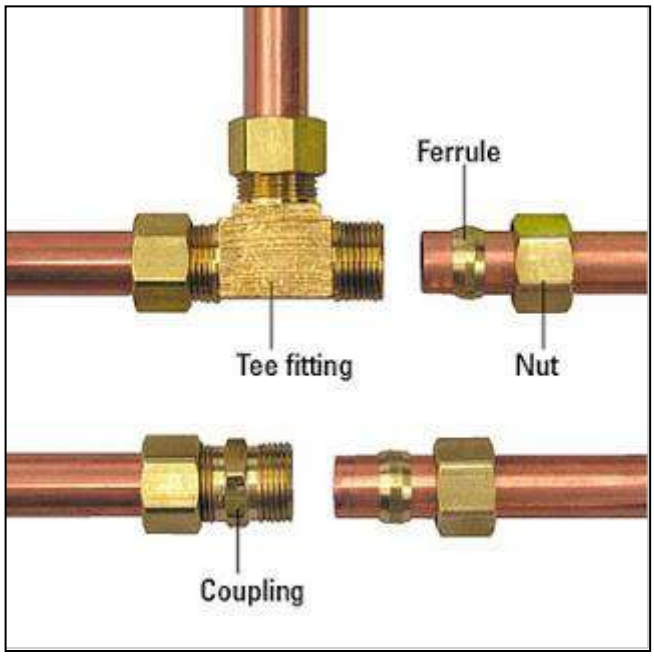

Fig-PG- 0106 Compression Joints

Compression sleeve-type joints are used to join plain end pipe without special end preparations. These joints require very little installation labor and as such result in an economical overall installation .

Advantages include the ability to absorb a limited amount of thermal expansion and angular misalignment and the ability to join dissimilar piping materials, even if their outside diameters are slightly different.

2.3.4. Valves

They are equipment designed to stop or regulate flow of any fluid (liquid, gas, condensate, stem, slurry, etc.) in its path. Valves are categorized depending on their applications like isolation, throttling, and non-return. Various type of valves are available depending upon the type of construction as follows:

(a) Check Valve- It is used for preventing reverse flow (non-return) A check valve, clack valve, non-return valve or one-way valve is a valve that normally allows fluid (liquid or gas) to flow through it in only one direction. Check valves are two-port valves, meaning they have two openings in the body, one for fluid to enter and the other for fluid to leave.

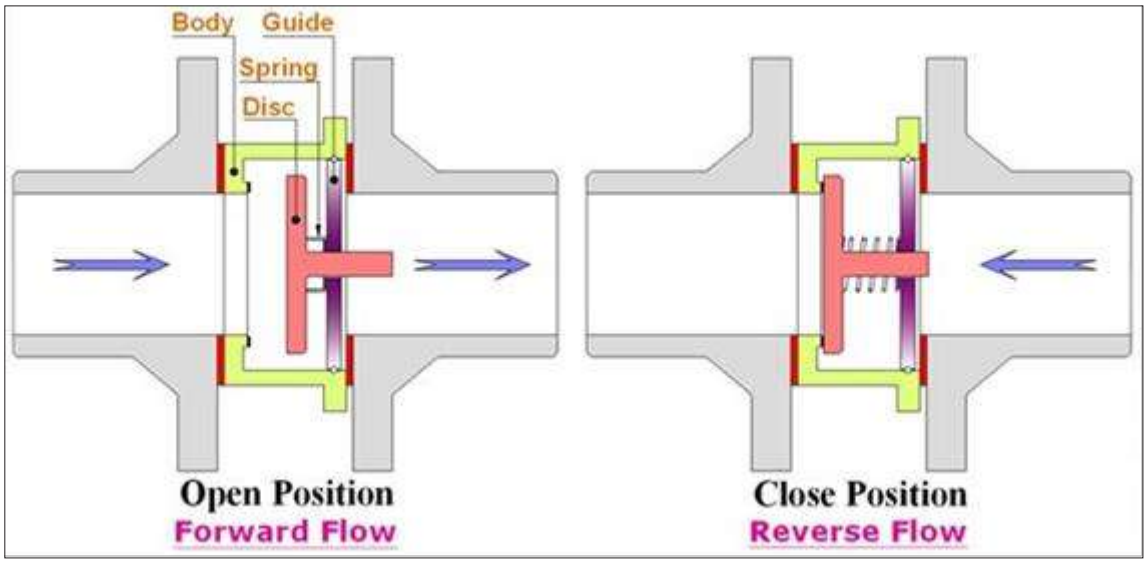

Fig-PG- 0107 Check Valve

(b) Globe Valve- It is used for throttling. A globe valve is a type of valve used for regulating flow in pipeline, consisting of a movable disk-type element and a stationary ring seat in a generally spherical body.

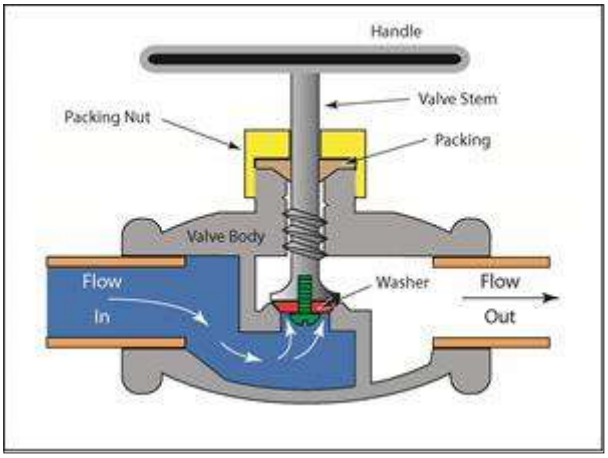

Fig-PG- 0108 Globe Valve

(c) Sluice valve- gate valve or sluice valve, is a valve which opens by lifting a round or rectangular gate/wedge out of the path of the fluid.

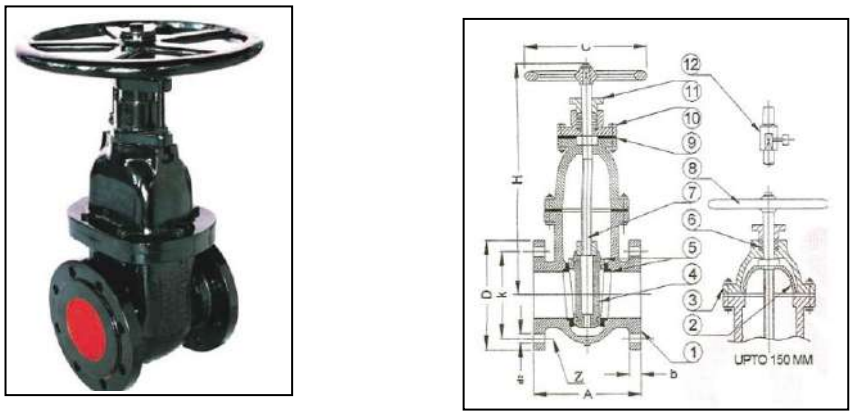

Fig-PG- 0109 Sluice valve- gate valve or sluice valve

(d) Foot Valve- A foot valve works as a one way valve, that allows water to be sucked through the valve with a pump and when the water flow stops the seal stops the backflow of the water. The foot valve has a s trainer on the outside which prevents obstructions and a check valve that closes when pump stops pumping.

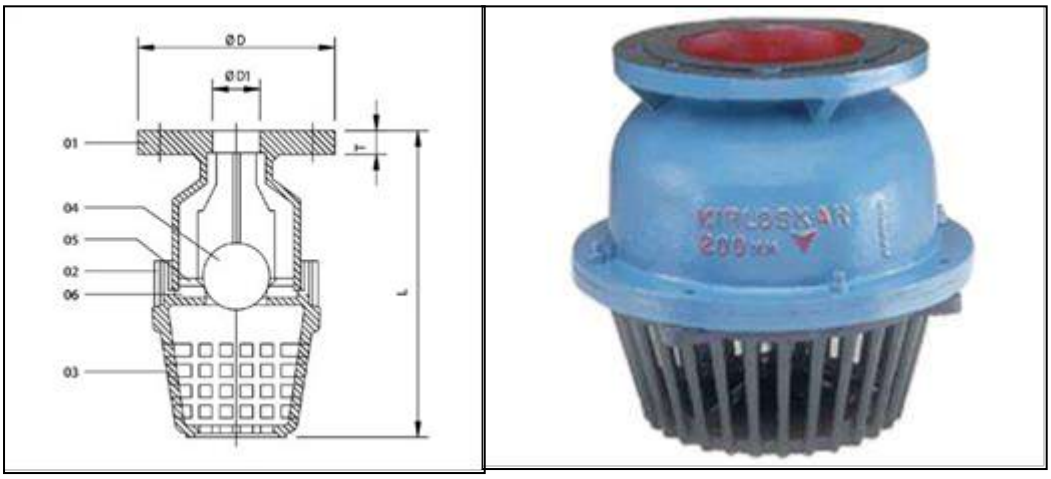

Fig-PG- 0110 Foot Valve

(e) Air release Valve: - In pipeline systems serve two primary functions. The first is the release of accumulated air that comes out of solution within a pressurized pipeline. This air will result in bubble formation, which will gather at localized high points along the pipeline profile. This air accumulation will occur when the bubble's buoyancy is greater than the energy to convey the bubble with the liquid. The air valve used to release this free air is known as an air release valve.

The second function of an air valve is to admit air into the system when the internal pressure of the pipeline drops below atmospheric pressures. By admitting air into the pipeline as the internal vacuum condition develops, the magnitude of the vacuum pressure can be reduced and as a result help prevent the pipeline from experiencing excessive deflection and/or collapse as well as help prevent the formation of a full vacuum condition in which vapor cavities may form from the fluid vaporizing. The air valve used in this situation is an air & vacuum valve. The air & vacuum valve is also used to discharge large volumes of air from the pipeline system when the pipeline is initially filled and after water column separation.

Fig-PG-0111 Air release Valve

(f) Needle Valve- A needle valve is a type of valve having a small port and a threaded, needle-shaped plunger. It allows precise regulation of flow, although it is generally only capable of relatively low flow rates. These valves are usually made up of plastic.

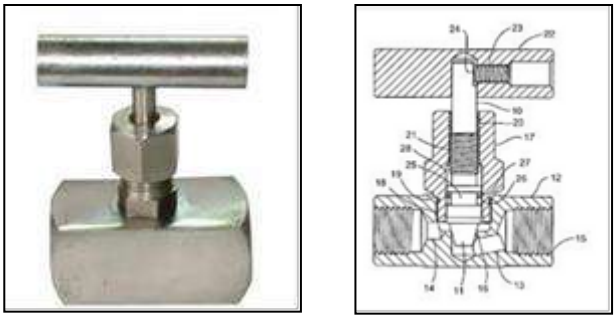

Fig-PG-0112 Needle Valve

(g) Stop Valve: - A valve that can be closed or opened at will, as by hand, for preventing or regulating flow, as of a liquid in a pipe; - in distinction from a valve which is operated by the action of the fluid it restrains.

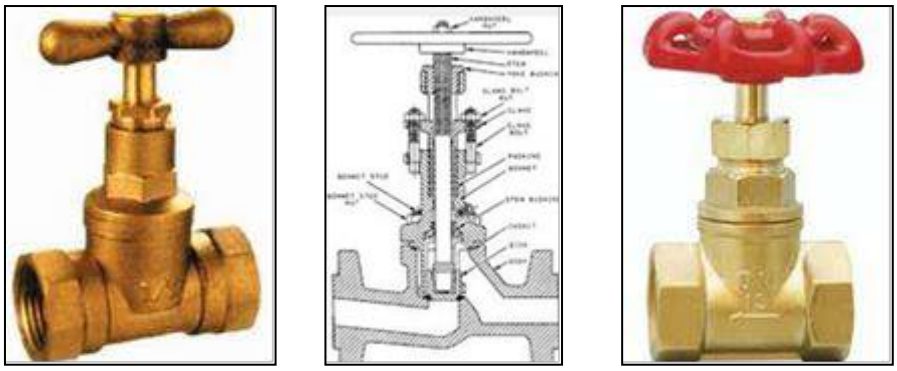

Fig-PG- 0113 Stop Valve

(h) Pressure reducing Valves: - The reducing valve (RV) is a type of valve used to control or limit the pressure in a system or vessel which can build up by a process upset, instrument or equipment failure, or fire. The pressure is relieved by allowing the pressurized fluid to flow from an auxiliary passage out of the system.

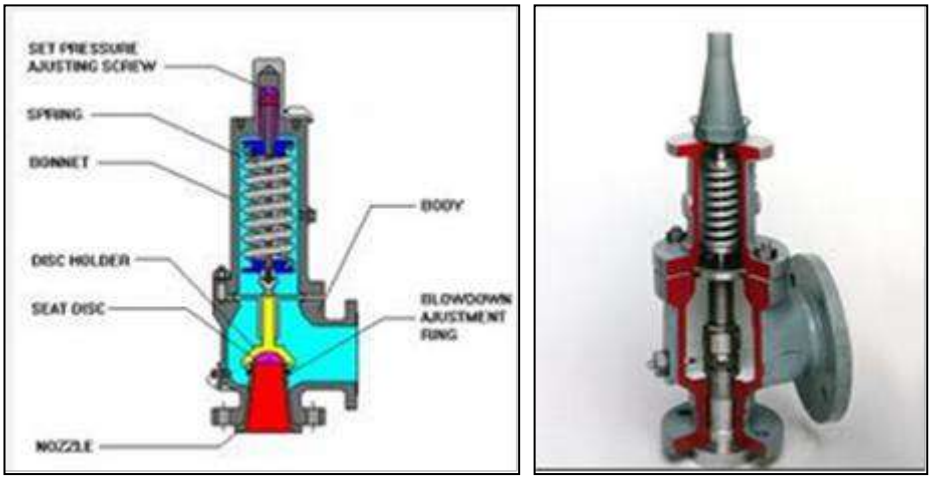

Fig-PG- 0114 Pressure reducing Valves

(I) Safety Valve:- A safety valve is a valve mechanism which automatically releases a substance from a boiler, pressure vessel, or other system

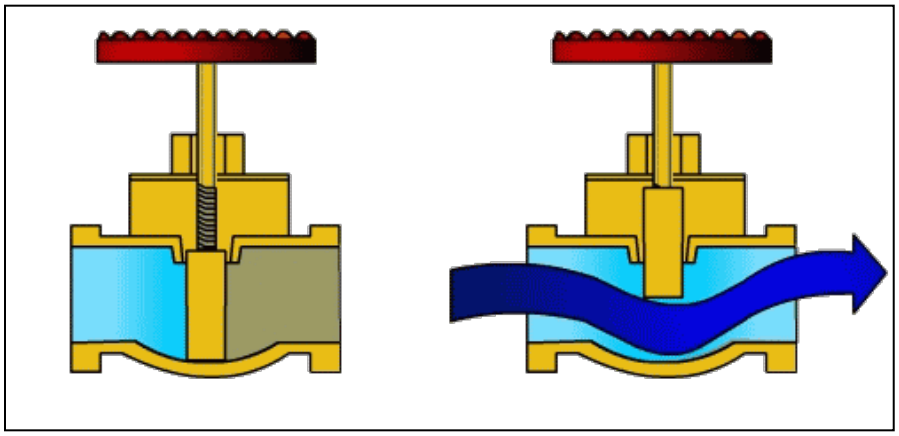

Fig-PG- 0115 Safety Valves

(j) Plug valve –It is used for isolation only

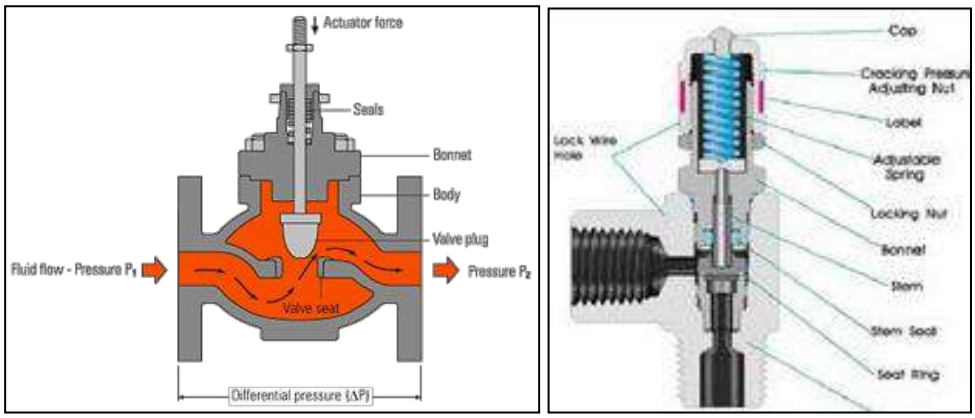

Fig-PG- 0116 Plug Valves

(k) Butterfly valve - It is used for isolation as well as throttling

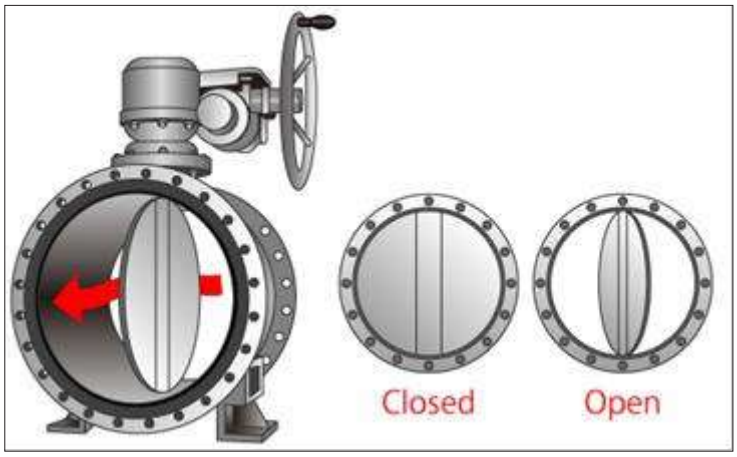

Fig-PG- 0117 Butterfly Valve

(l) Diaphragm valve - It is used for isolation as well as throttling

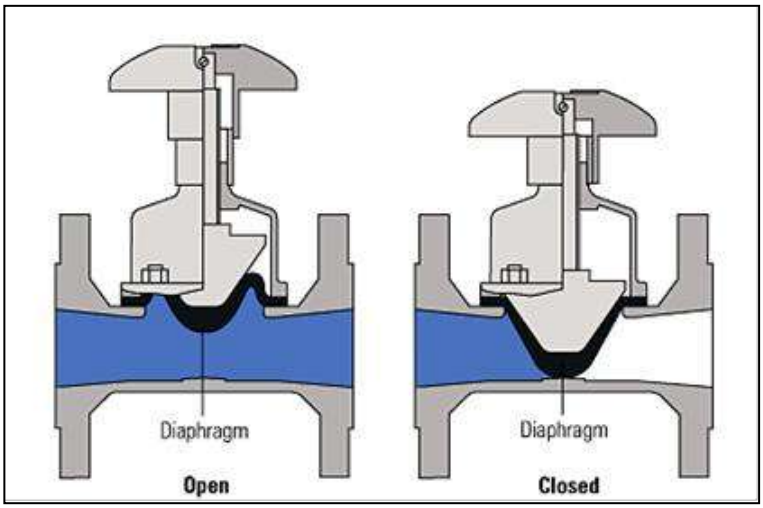

Fig-PG- 0118 Diaphragm Valve

(m) Ball valve - It is used for isolation only

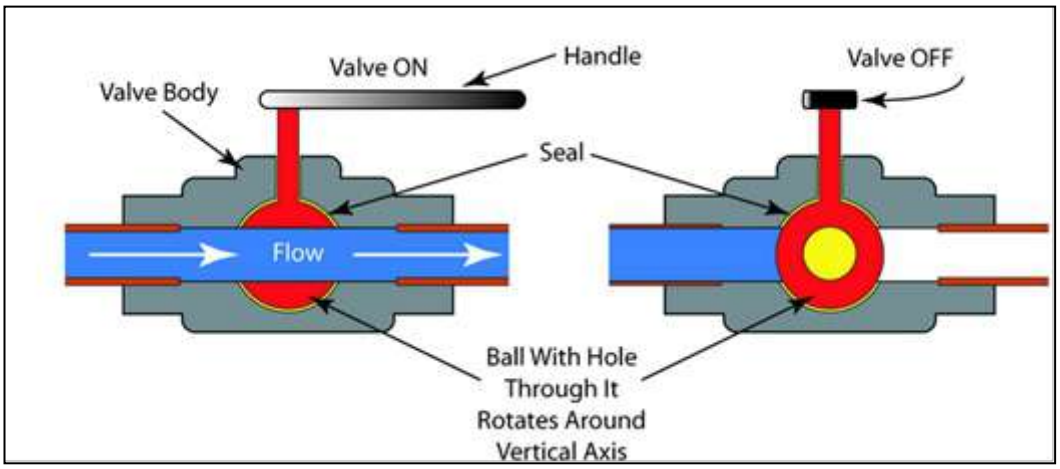

Fig-PG- 0119 Ball Valve

(n) Float valve - A float valve is a mechanism or machine for filling water tanks, such as those found in flush toilets, while avoiding overflow and (in the event of low water pressure) backflow

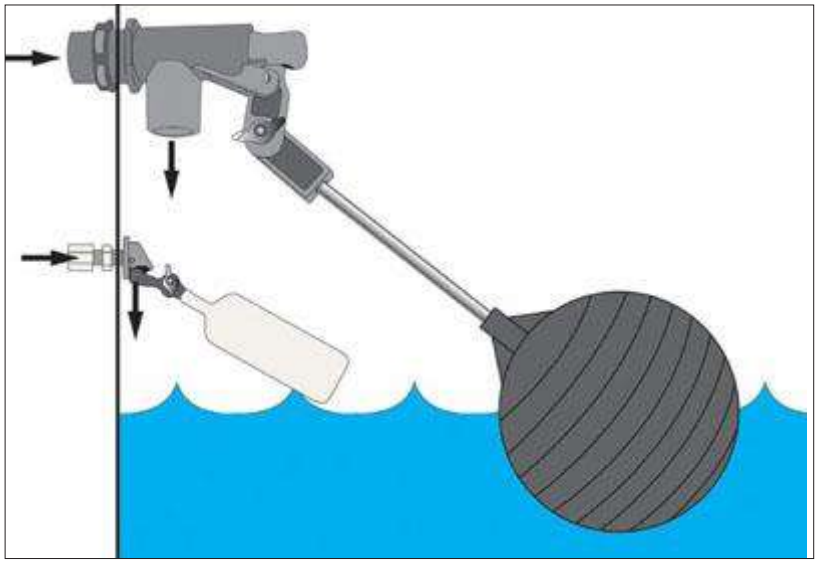

Fig-PG- 0120 Float Valve

2.3.5. Traps

(a) In plumbing, a trap is a U-, S-, or J-shaped pipe located below or within a fixture. The bend is used to prevent sewer gases from entering buildings. There are various types of traps:

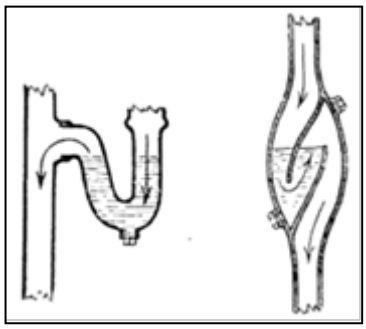

Fig-PG-0121Traps

(b) A p-trap is comprised of a tailpiece, the curved trap piece, and a drain elbow. The drain elbow for a p-trap fits into the drain pipe which goes directly into the wall. It has a water seal along the curve of the trap. The seal prevents noxious air or gases to backflow from the sewer line, but the original waste can still exit into the sewage system. If the gases were allowed back into the home, not only would they smell, but they could cause illnesses and have even been known to explode.

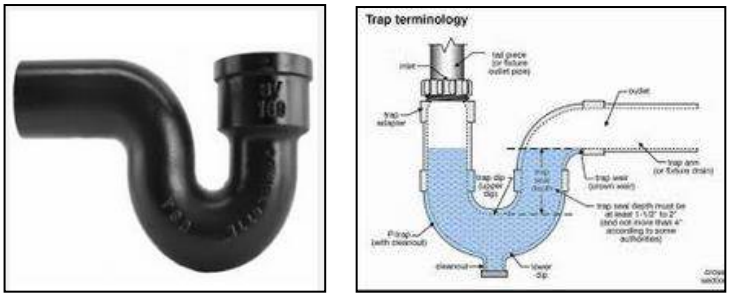

Fig-PG-0122 P-Traps

(c) **Q-**TRAP

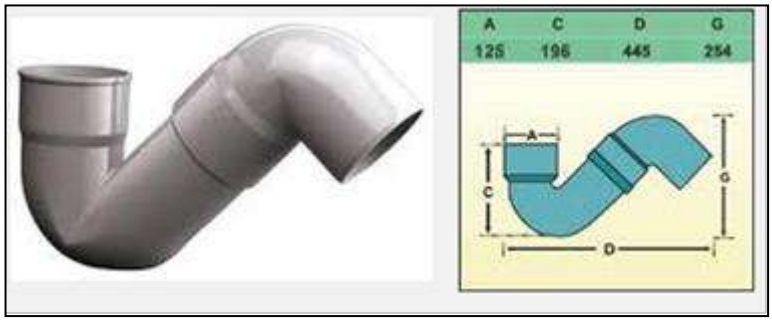

Fig-PG-0123 Q-Traps

(d) S- traps

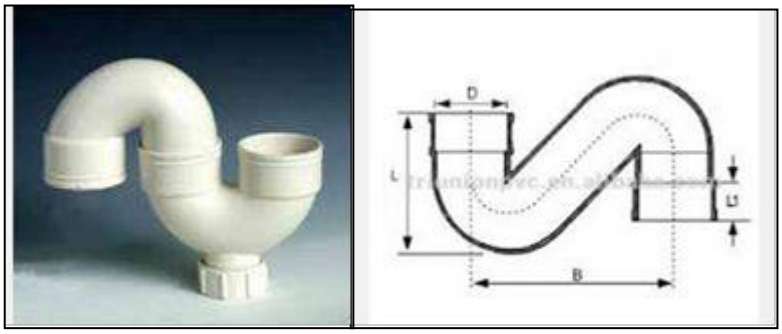

Fig-PG- 0124 S-Traps

2.3.6.Cutting of Pipes

Various methods used for pipe cutting include:

(a) Using plastic tubing cutters- It is used for thinner pipes and tubes, such as sprinkler pipe.

(b) Using wheel cutters - for use on thicker pipes, there is a pipe cutter with a sharp wheel and adjustable jaw grips.

(c) It is used for work in areas where a complete turn is not possible.

Fig-PG- 0125 Pipe Cutting Tool

(d) These are used by rotating it around the pipe and repeatedly tighten ing it until it cuts all of the way through.

(e) The cut can leave a burr around the inside of the tube.

(f) This burr should be cleaned or reamed.

(g) Using hacksaws - hacksaws can cut nearly any size pipe made out of metals and plastics.

Fig-PG- 0126 Cutting pipe with Hexa

Fig-PG- 0127 Pipe cutting with wheel cutters

Fig-PG- 0128 Pipe cutting using Hacksaws

Steps: It is the process of creating screw thread. A common method of threading is with Tap/Faucets and dies. Tap/Faucets and dies are cutting tools used to create screw threads, which is called threading.

(a) A Tap/Faucet is used to cut the female portion of the mating pair (e.g., a nut).

(b) A die is used to cut the male portion of the mating pair (e.g., a screw).

(c) The process of cutting threads using a Tap/Faucet is called Tap/Faucetping, whereas the process using a die is called threading.

(d) Both tools can be used to clean up a thread, which is called chasing.

(e) A Tap/Faucet cuts a thread on the inside surface of a hole, creating a female suface which functions like a nut.

(f) The die cuts a thread on a preformed cylindrical rod, which creates a male threaded piece which functions like a bolt.

(g) Unlike drill bits, hand Tap/Faucets do not automatically remove the chips they create.

Fig-PG- 0129 Tap/Faucets and dies

Fig-PG- 0130 Pipe Threading Using Pipe Threading Machine

Fig-PG-0131 Pipe Threading Using Pipe Threading Machine

Pipe threading using machine

Bending: The pipes are manufactured straight in factories but we need to provide the bends at various positions as per the requirement.

2.3.7.Joining

The method of joining non metallic, plastic pipes does not require threading of ends. CPVC pipes are joined using solvent cementing technique.

(a) CPVC Solvent Cementing

I. Basic principle of CPVC solvent cementing is to make consistently good joints; the following points should be clearly understood.

II. The joining surfaces must be softened and made semi fluid.

III. Sufficient cement must be applied to fill gap between pipe and fitting.

IV. Assembly of pipe and fittings must be made while the surfaces are still wet and cement is still fluid.

V. Joint strength develops as the cement dries. In the tight part of the joint the surfaces will tend to fuse together; in the loose part, the cement will bond to both surfaces. These areas must besoftened and penetrated.

Fig-PG-0132 Pipe Joining

2.3.8. Methods of Testing Pipelines

Testing of pipe line is necessary after installation. There are four different testing methods of pipe line.

(a) Smoke Test: This test is done in case of leakage in C.I. Pip e.

I. Smoke is released from the bottom side of the pipe.

II. Smoke can be detected from the leaked portion, if any.

III. Smoke testing refers to physical tests made to closed systems of pipes to detect cracks or breaks.

IV. In plumbing a smoke test forces non-toxic, artificially created smoke through waste and drain pipes under a slight pressure to find leaks.

V. Plumes of smoke form where there are defects.

VI. This test can be performed when the plumbing is brand new, but more often it is used to find sewer gas leaks that may plague a building or an area.

VII. Any sign of smoke escaping can be considered a possible site for sewer gas to escape.

Plumbing smoke tests are also used to find places where pipes will spill fluid, and to check sanitary sewer systems for places where ground water and storm runoff can enter.

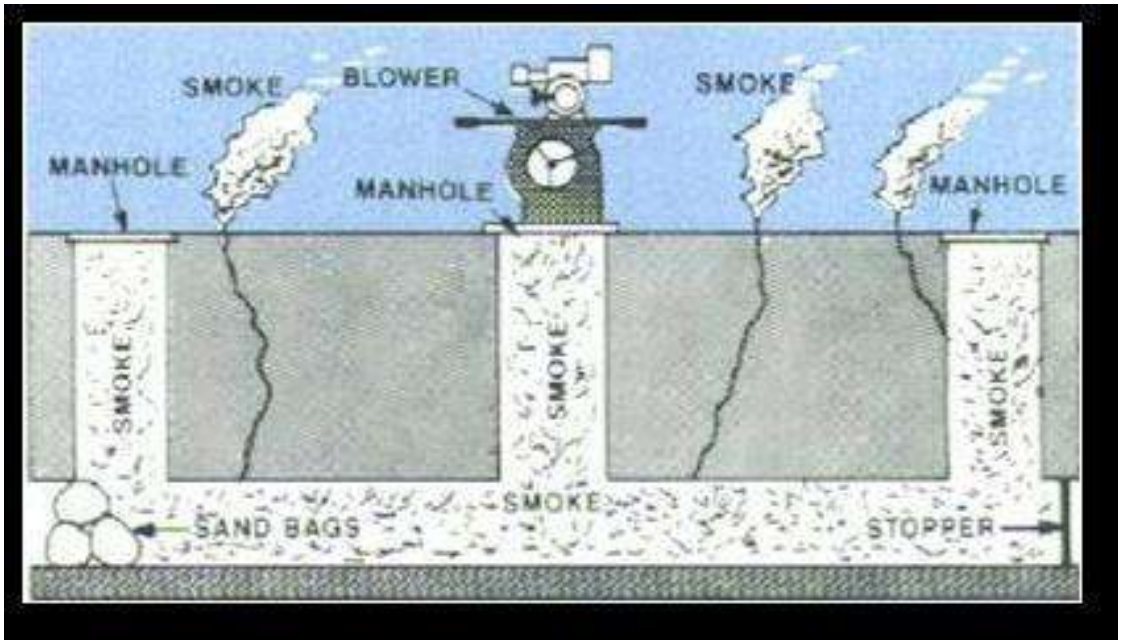

Fig-PG-0133 Smoke Test

(b) Pressure Hydraulic Test

I. Pressure Test: Open the ball valve on the pressure tester and then connect a garden hose to the tester.

II. Turn hose on and allow the pressure in the pipes to reach 30psi. This usually takes several minutes.

III. When it reaches 30psi on the gauge, close the ball valve on the pressure tester assembly and then turn off the hose. You can now disconnect the hose from the pressure tester assembly.

IV. The pressure should stay at 30psi.

V. Leave at this pressure for several hours to make sure you do not have a small leak.

VI. If the gauge does begin to drop slowly, check the plumbing for leaking water.

Fig-PG-0134 Pressure Hydraulic Test

Unit 2.4: Plumbing And Sanitary Fixtures And Their Installation

Unit Objectives

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

1. Understand and demonstrate various ty pes of Tap/Faucets and showers
2. Understand and demonstrate various types of Was hbasins and their installation
3. Understand and demonstrate various types of water clos ets, urinals and their working
4. Understand and demonstrate bidets, bath shower trays and geysers
5. Identify and understand standard height of sanitary fixtures
6. Identify and understand basic building construction, cutting / opening in structures, mason tools, preparing mortar and filling etc.

2.4.1 Types of Plumbing and Sanitary Fixtures

2.4.1.1. Tap/Faucets

(a) Tap/Faucet is a valve controlling release of liquids or gas. There are a variety of options for the simple act of turning a Tap/Faucet on or off.

Fig-PG-0135 Tap/Faucet

(b) Single Lever Mixer It is to control the water and temperature. Lever Handle Tap/Faucet is easy to grip and turn. These are available in many decorative styles.

Fig-PG-0136 Single Lever Mixer

(c) Joystick -It is similar to lever handle Tap/Faucet, yet with a different look and different range of motion.

Fig-PG-0137 Joystick

(d) Push Tap/Faucet -It turns the water on with a push instead of turning a handle or knob. It is used for predetermined flow of water.

Fig-PG-0138 Push Button Tap/Faucet

(e) Sensor Tap/Faucet-It don't require handles or knobs at all. Most automatic Tap/Faucets are battery powered and incorporate a passive infrared sensor to detect hand motion. Automatic Tap/Faucets are common in public washrooms, particularly in airports and hotels, where they help reduce - water consumption and transmission of disease causing microbes

Fig-PG-0139 Sensor Tap/Faucet

2.4.1.2 Shower

The modern shower comes with configurable temperature and spray pressure settings, along with adjustable showerhead nozzle settings.

Fig-PG-0140 Shower

2.4.1.3 Washbasin

Washbasin is a bowl-shaped fixture used for washing hands, for dishwashing or other purposes. The most significant difference between the major Washbasin types is the manner in which they are installed.

(a) Wall Mounted

Wall-mounted Washbasin hangs directly from the wall, taking up little space and offering easy access to plumbing hook-ups. These are ideal options for half baths and small bathrooms.

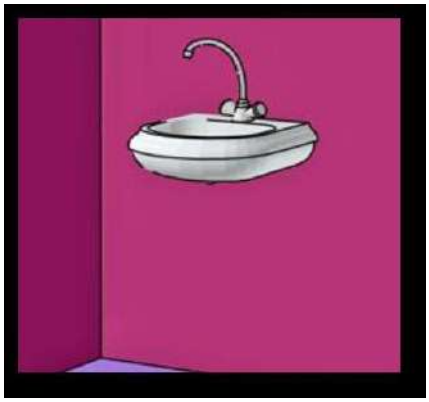

Fig-PG-0141 Wall Mounted Washbasin

(b) Pedestal

Pedestal Washbasin is also a wall-mounted Washbasin that rests on a pedestal that may or may not provide actual support to the Washbasin bowl. Usually the pedestal conceals plumbing. The drawback of this type is the lack of storage space under the Washbasin bowl.

Fig-PG-0142 Pedestal Washbasin

(c) Console-Console Washbasin is also a wall-mounted Washbasin that rests on legs. The legs support the front two corners while an apron often masks the plumbing hook-ups. A small storage space can be created underneath simple by placing a basket or a shelving unit.

Fig-PG-0143 Console Washbasin

(d) Self Riming -Self-rimming Washbasin drops into a cut-out in the countertop and usually are secured with mounting clips from below. The rim overlaps the cut-out edges.

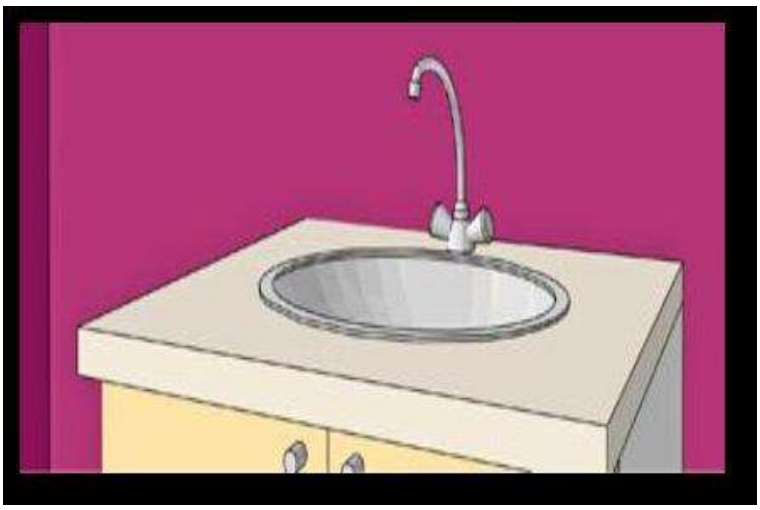

Fig-PG-0144 Self Riming Washbasin

(e) Integral-Integral Washbasin is usually made of solid surface material like corian and acrylic. The bowl and the countertop are one piece and are easy to clean and maintain.

Fig-PG-0145 Integral Washbasin

Standard dimensions for Installation

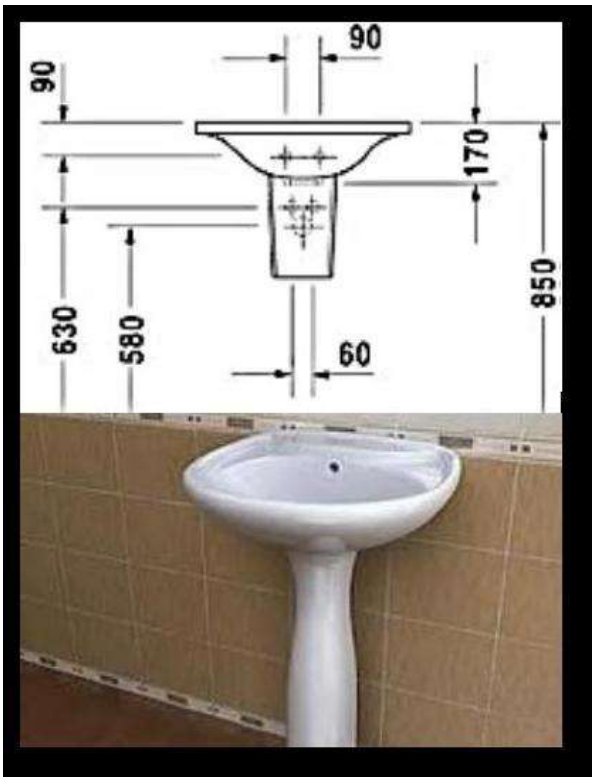

Fig-PG-0146 Installing Pedestal Wash Basin

2.4.2 Water Closets

Water Closet is a fixture for the toilets used to carry out the human excreta

2.4.2.1. Indian

Indian Water Closet is commonly used in eastern part of the world from India, Bangladesh including, Pakistan, Sri Lanka, Nepal, and Bhutan. It is shaped in a way that one has to sit by foot on it. Its basin has inverted slop towards the back side of the closet where a trap excludes the sewer pipe (drain) from it.

Fig-PG-0146 Indian Water Closet

2.4.2.2. Western

Western Water Closet is very popular and commonly used in western part of the world. It is shaped like a chair and is used in the same manner. It is sloped towards the backside and also connects with the house drain through a trap. It has two types according to the structure - one piece water closet with a basin and the trap are manufactured together and then two piece water closet is manufactured in a way that the basin and trap are manufactured separately.

Fig-PG-0147 Western Water Closet

Fig-PG-0148 Western Water Closet

2.4.3. Flushing Cistern

Flushing Cistern is used for storage and discharge of water for flushing of contents from a water closet (W.C.) and urinals. Flushing cistern is also known as water waste preventer. It stops wastage of water. These are used to throw water with pressure after the use of W.C. and urinals.

Fig-PG-0149 Flushing Cistern

Flush Tank: is a tank which holds fluid in reserve for flushing. It is the tank attached to a toilet. Today's toilets are typically a two pie ce (tank and bowl) plumbing fixture made out of vitreous china. The mechanical components, which are located inside the tank, work together as a system to perform a gravity flush.

2.4.3.1. Bell flushing Cistern

I. Bell flushing cistern is only suitable for high level cistern.

II. These are made of cast-iron with a capacity of 5 to 15 litres

III. This type of flushing cistern is now virtually outdated and their origins may still be founding old factories, schools and similar established buildings

IV. It consists of a bell connected to flushing chain through a lever

V. When the chain is pulled, the bell is lifted up and the water in the tank rushes through the flushing pipe by siphon action

VI. The float valve now allows the water from the inlet into the cistern.

VII. Once the water starts down the pipe, it starts a siphon effect drawing the rest of water from the cistern until air is drawn under the bottom of the bell.

VIII. The emptying action takes only a few seconds causing powerful flush in the water closet below.

IX. The chain should be released immediately after being pulled to force the water out of flush pipe.

X. This cistern is supplied with water through a ball valve arrangement so that the water inlet gets closed when the cistern is full with water up to water line and gets open when it is empty, permitting entry of water.

XI. It is also provided with an over flow pipe to drain out excess incoming water if the ball cock gets out of order so as to avoid spilling of water over the cistern in the toilet.

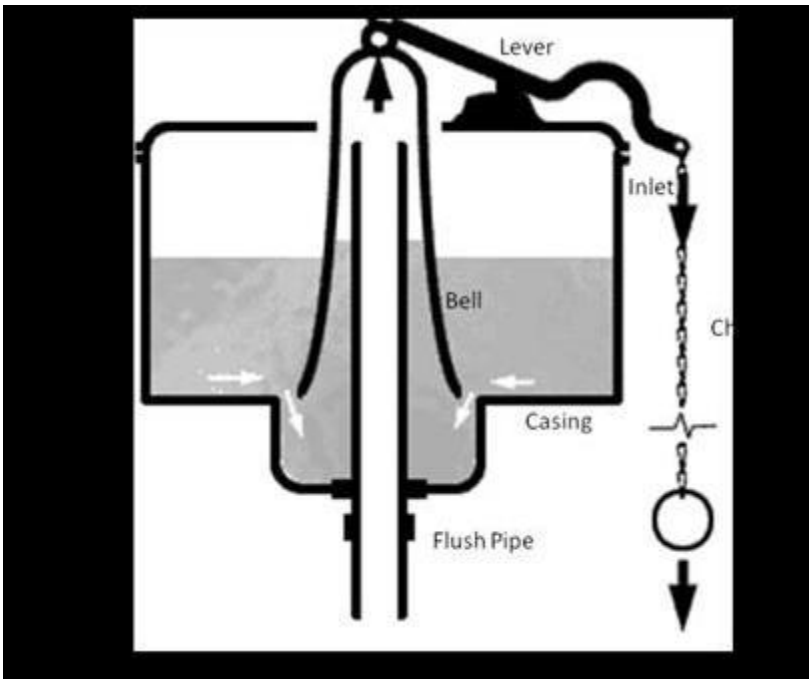

Fig-PG-0150 Flushing Cistern

2.4.3.2. Flat Type

I. It is placed at a height of 3ft. above the floor
II. These cisterns are now using in modern time
III. This cistern is generally composed of plastic
IV. It has a flat valve inside
V. It stops the water after the tank gets fully filled and starts after the tank get va cant
VI. It flushes out by pressing a button

2.4.3.3. Automatic Cistern

I. It is used in urinals.
II. Nowadays these cisterns are mainly used.
III. I.These cisterns are mainly used in public places for example bus stand, railway station, offices etc.
IV. Lot of water used in these cisterns.

2.4.4. Urinals

2.4.4.1. Manual Handles

Each urinal is equipped with a button or short lever to activate the flush, with users expected to operate it as they leave. Such a directly controlled system is the most efficient, provided that patrons remember to use it.

2.4.4.2 Timed Flush

A constant drip feed of water slowly fills the cistern, until a tipping point is reached, the valve opens (or a siphon begins to drain the cistern), and all the urinals in the group are flushed. Electronic controllers performing the same function are also used.

2.4.4.3 Automatic Flush

Electronic automatic flushes solve the problems of both previous approaches, and are common in new installations.

Passive infrared sensors identify when the urinal has been used (or when someone has stood in front of it and moved away), and activate the flush.

Thus the urinal is cleaned, where with a manual flush it might not have been, but water is not wasted when the toilet is not used.

2.4.4.4 Waterless Urinals

In this a trap insert filled with a sealant liquid instead of water.

The lighter-than-water sealant floats on top of the urine collected in the U-bend, preventing odors from being released into the air.

The cartridge and sealant must be periodically replaced.

Fig-PG-0151 Urinal

2.4.5 Bidets

Bidets are primarily used to wash and clean. They may also be used to clean any other part of the body such as feet.

Despite appearing similar to a toilet, it would be more accurate to compare it to the washbasin or bathtub.

Fig-PG-0151 Bidet

2.4.6. Bath Tub

Bathtub is large containers for holding water in which a person may bath Tubs is manufactured from many different materials.

Fig-PG-0152 Bath Tub

The most common materials used are:

(a) Acrylic

I. It can be moulded into just about any shape and size.

II. The colour runs through the entire substance rather than just in the surface coat, making it less likely to show scratches or to fade.

(b) Enamelled Steel

I. Enamelled steel tubes are pressed from sheets of steel and coated with baked-on enamel.

II. The enamel layer is usually thin, though susceptible to chipping.

III. In addition, enamelled steel doesn't retain heat.

(c) Cast Iron enamelled Bath tub-Cast iron moulded into a bathtub shape and finished with enamel. Generally thicker than other materials.

I. They are durable and solid

II. Available in a range of colours

III. Retain heat well

IV. Excellent soundproofing

V. They may require structural reinforcement

2.4.7 Standard Height of Sanitary Fixtures

Wet room installations are largely standardized and sanitary ware is supplied in a range of fixed dimensions. The graphic representation shows the typical heights of the most common sanitary ware and accessories.

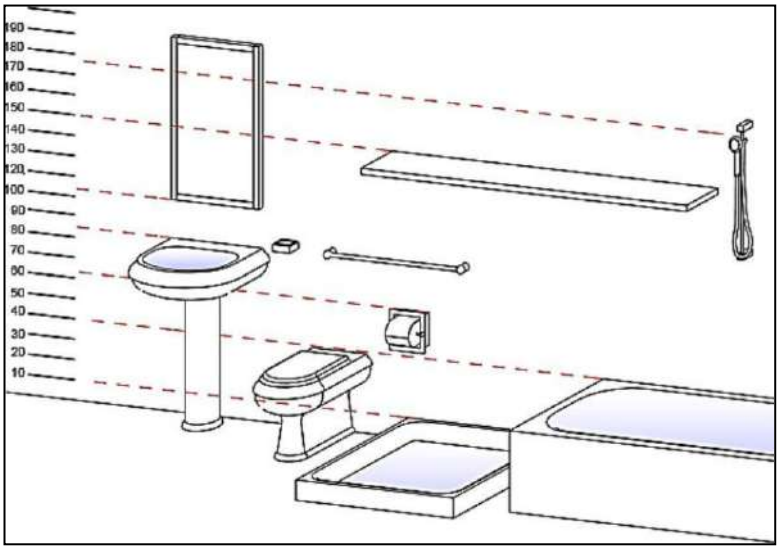

Fig-PG-0153 In centimetres

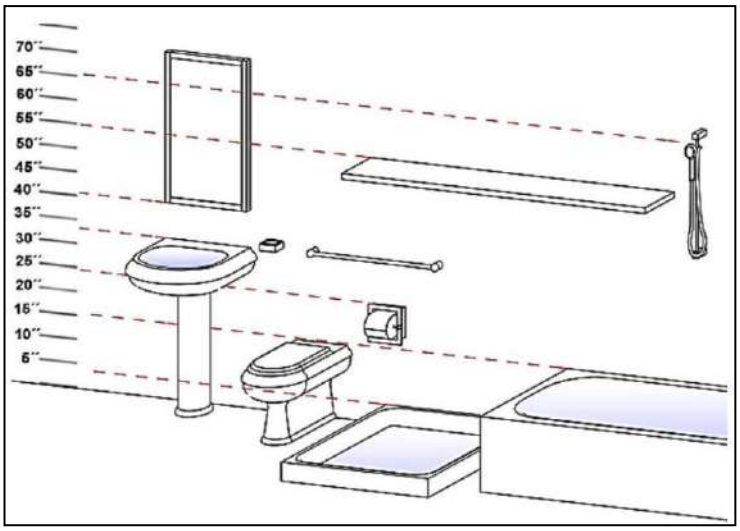

Fig-PG-0154 In inches

2.4.8. Basic Building Construction

The illustration shown below represents the essential elements of a modern Building.

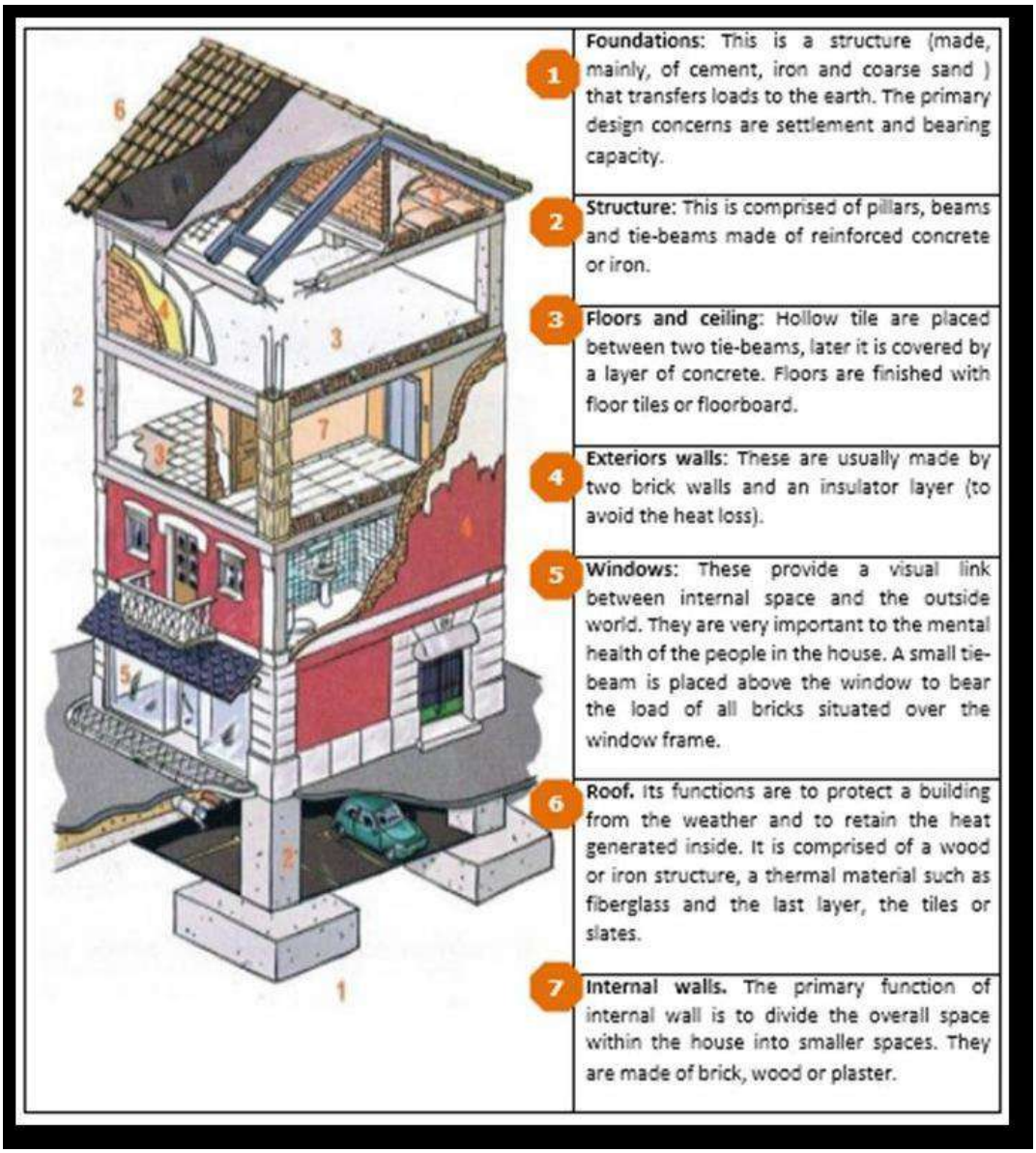

Fig-PG-0155 Building Structure illustration

2.4.8.1 Cutting Opening in Structures

(a) Drilling

Drills are very powerful and potentially dangerous tools. They can just as easily put holes in your walls or holes. However we have to be mindful of the following:

I. Always check for any electricity cables running through the wall before start drilling.

II. Catching a live cable when drilling is potentially fatal so it's worth taking the extra time to check.

III. Never wear loose clothing or dangling jewellery which could catch in the drill as one lean over it.

IV. The drill bit will become hot with use so keep hands off it.

V. Make sure you use the correct drill bit for the type of wall you are drilling into.

VI. If you are drilling into tiles use a specialist tile drill bit and stick a little piece of masking Tap/Faucete over the area to stop the drill from wandering.

VII. If drilling into plasterboard, Tap/Fauce t the wall to find where it is not hollow as this will be where the wooden joist is - aim to drill only into this.

VIII. Always use a proper purpose made extension cord if one need a longer wire for drill and never pick the drill up by its flex.

Fig-PG-0156 Drilling

(b) Nailing-It is done to fasten to a surface or to something else with a nail and a hammer.

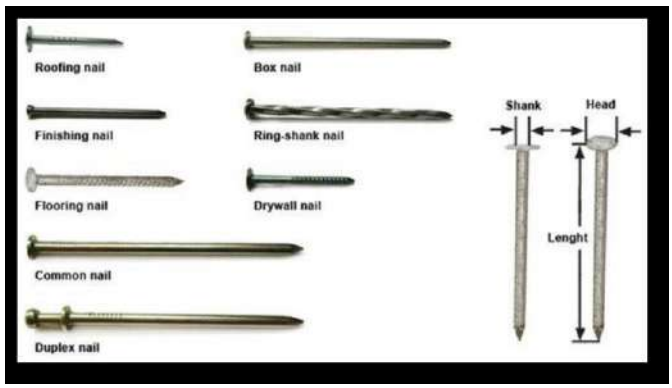

Fig-PG-0157 Nailing

(c) Chase / Core -It is to bury (or, in builders terms, chase) running cables or pipes up (or along) a masonry wall.

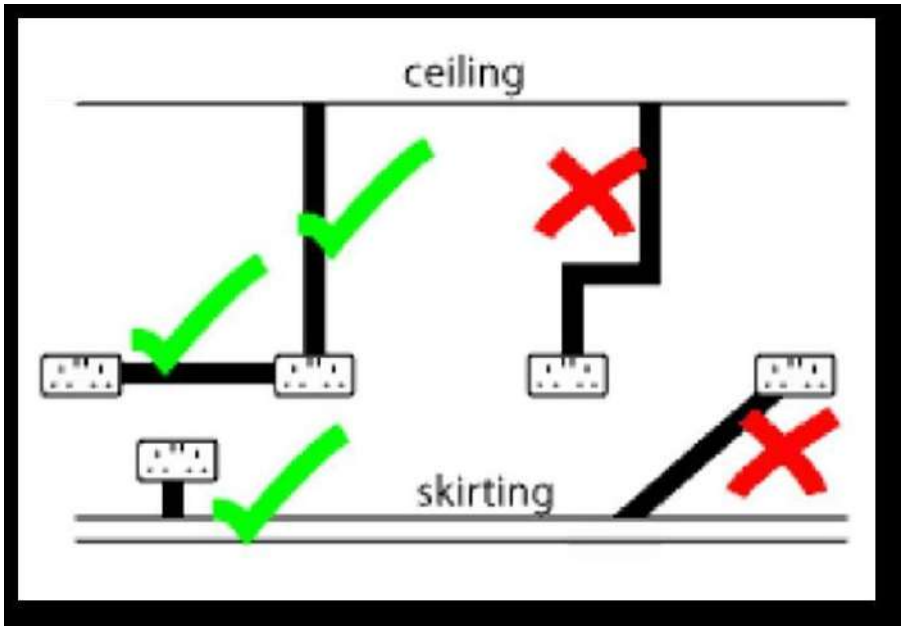

Fig-PG-0158 Chase/Core

I. Chase cut-outs should always be vertical or horizontal between start and finish on the wall never cut a chase at an angle between these two, nor step the channel.

II. Vertical chases should be no deeper than one third of the wall thickness – with standard 100mm bricks and blocks, that going to be 33mm, which is quite deep anyway – that's not allowing for

any plaster coating which could be 10mm so the maximum depth then works out at 36mm from the front face of the plaster.

III. Horizontal chases should be no deeper than one sixth of the wall thickness - with standard 100mm blocks, that going to be 16mm which is usually quite sufficient – that's not allowing for any plaster coating.

IV. Chases on opposite sides of a wall should not be in line, i.e. 'back to back'.

V. If chasing in a cable, it should be noted that any new wiring circuit falls under Part P of the Building Regulations

Fig-PG-0159 Measurement for vertical chasing

Fig-PG-0160 Chase Marking & Cutting

2.4.8.2 Basic Mason's Tools

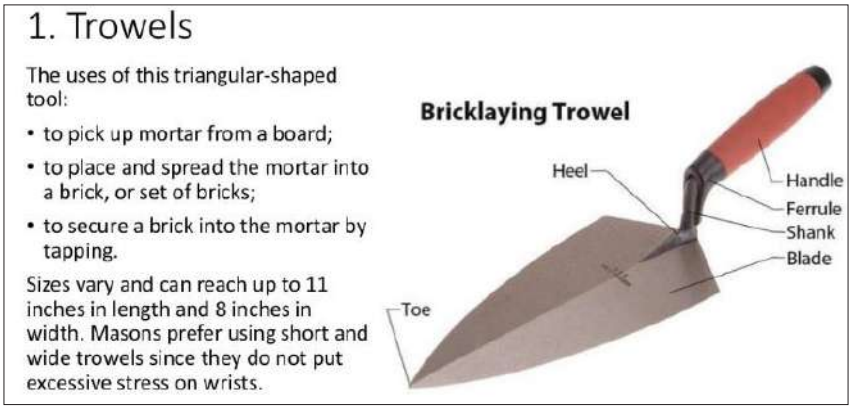

Fig-PG-0161 Trovel

Fig-PG-0162 Chisels

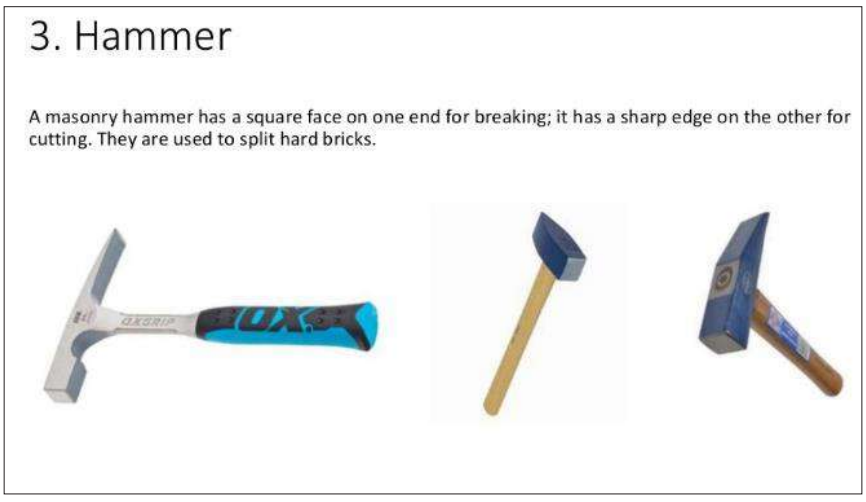

Fig-PG-0163 Hammer

2.4.8.3 Preparation of Building Material / Cement Mortar

Mortar is a workable paste used to bind construction blocks together and fill the gaps between them. Mortar may be used to bind masonry blocks of stone, brick, cinder blocks, etc. Mortar becomes hard when it sets, resulting in a rigid aggregate structure.

Modern mortars are typically made from a mixture of sand, a binder such as cement or lime, and water. Mortar can also be used to fix, or point, masonry when the original mortar has washed away. Mortar is mixed by hand in a mortar box. It should be as watertight as possible.

Preparation Method

I. Determine the type of cement will work best for the project.

II. Take fine sand and coarse sand. Take 1part cement, 2 parts sand, and 3 parts coarse sand into the wheelbarrow.

III. Mix the ingredients thoroughly with spade to ensure they are well combined. Pour a small amount of water and make paste.

Fig-PG-0164 Preparation of Mortar

2.4.8.4. Mortar Filling

Filling mortars can be used for a variety of projects and repairs.

Mortar is a necessary filling component to adhere some home-building components together, such as bricks; but it can also be used to patch holes and cracks in basements and foundations, hold a patio together or secure fence posts and mailboxes.

A mixture of concrete, lime and sand, most mortars are easy to mix and use, in small and large batches Good mortar is necessary for good workmanship andgood masonry service because it must bond the masonry units into a strong well-knit structure.

Unit 2.5: Pumps and Their Installation

Unit Objectives

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

1. Identify and understand the types of pumps
2. Its advantages and dis-advantages

2.5.1 Types of Pumps

Pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action.

(a) Air Lift Deep Well Pumps

I. These pumps are very reliable and durable.
II. Air lift pumps are often used in deep dirty well where the nature of sand is Acid and Alkali.
III. It is also used where simple pumps do not work.
IV. These are used to collect more water than simple pumps.
V. The compressed air enters at the bottom level of pump and water lifts above the well.

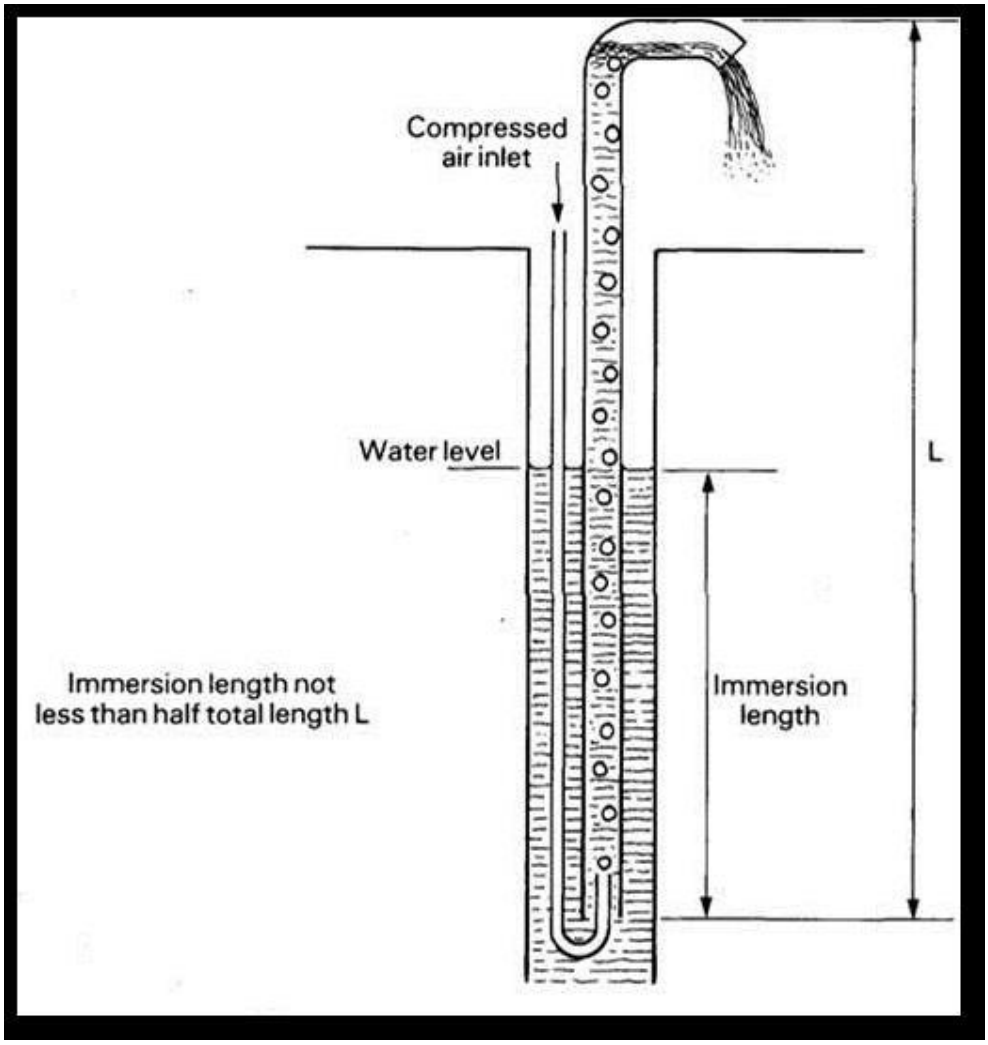

Fig-PG-0165 Pump Structure

(b) Centrifugal Pump

I. These pumps are more useful than other pumps.

II. This pump works on the principle of centrifugal force.

III. These pumps are used to take water and other liquid at higher level.

IV. Where less space is available these pumps are placed.

V. Initial cost and operational cost is low.

VI. Efficiency is satisfactory.

VII. These pumps are easy to operate and placed.

VIII. These pumps are available in many range and capacity.

IX. It does not have any discharging sound.

X. The usage of these pumps is as follows:

XI. These pumps are available in singe stage and multi stage.

XII. It has no valve.

XIII. It is casted out in iron and has steel shaft, bronze sleeves, cast iron impeller or cast iron vanes. Sometimes impeller and vanes are in bronze.

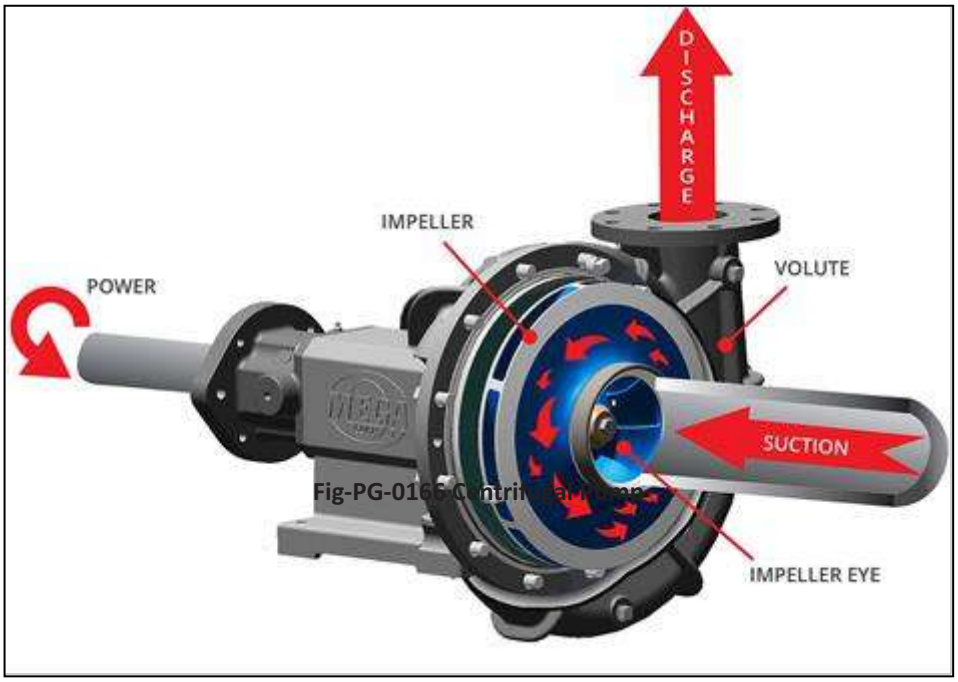

Fig-PG-0166 Centrifugal Pump

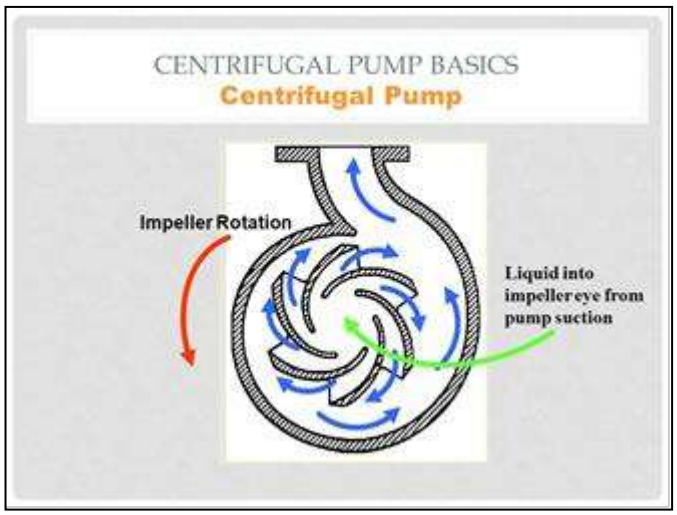

Fig-PG-0167 Centrifugal Pump

(c) Reciprocating Pump

I. It is called hand pump.

II. These pumps are mainly used for domestic works. It is often used where relatively small quantity of liquid is to handled and where delivery pressure is quite large.

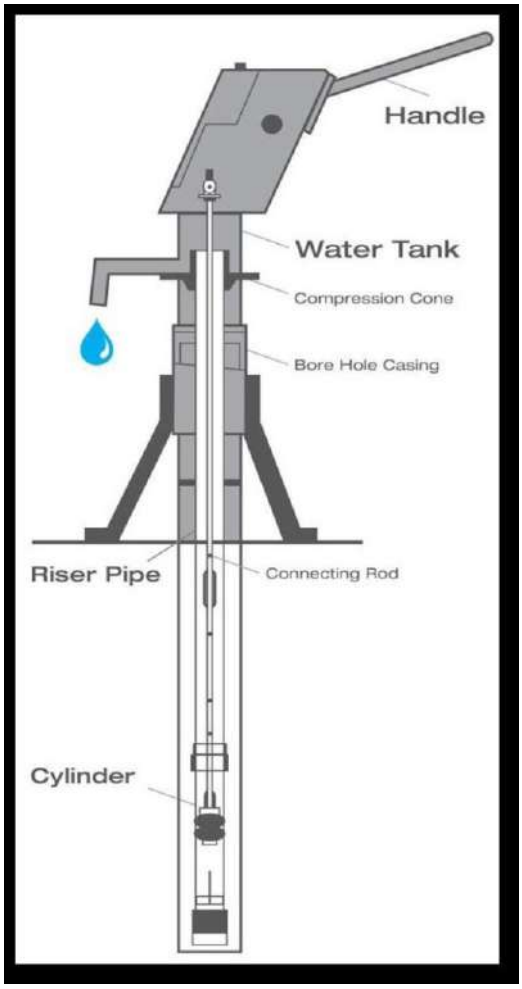

Fig-PG-0168 Reciprocating Pump

(d) Jet Well Pumps-Jet Well Pumps circulates water in loop systems and is available in several Horsepower (HP) options for different pumping performance rates.Jet well pumps are mainly used in low capacity installation. It delivers water and water pressure to a household, cottage or small sprinkler systems.

I. Shallow Well Jet Pumps

It is used when the pump is located above the water source, drawing water from 25' depth to water or less vertically.

It uses a single suction pipe to draw from wells or surface water.

II. Deep Well Jet Pumps

They are used when the pump is located above the water source, drawing wat er from 25' to 110' depth to water vertically.

III. Convertible Jet Pumps

They are used for Deep Wells when installed with a jet assembly, built -in or attached to the pump.

They are used when the pump is located above the water source, drawing water from 110' depth to water or less vertically. It uses two pipes on the suction side to draw from wells.

They are mainly used for household water supply from a well, driven point system, or open water source. Pumps should be used with standard or pre -charged pressure tank.

These pumps are mainly used to take lot of water, oil or liquids

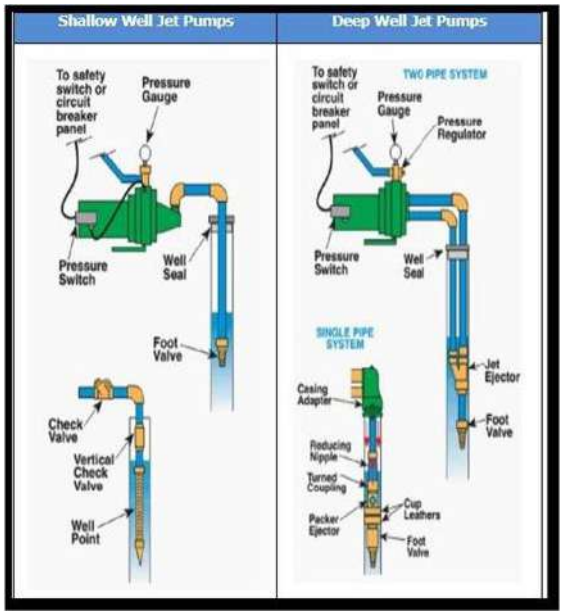

Fig-PG-0169 Jet Pump

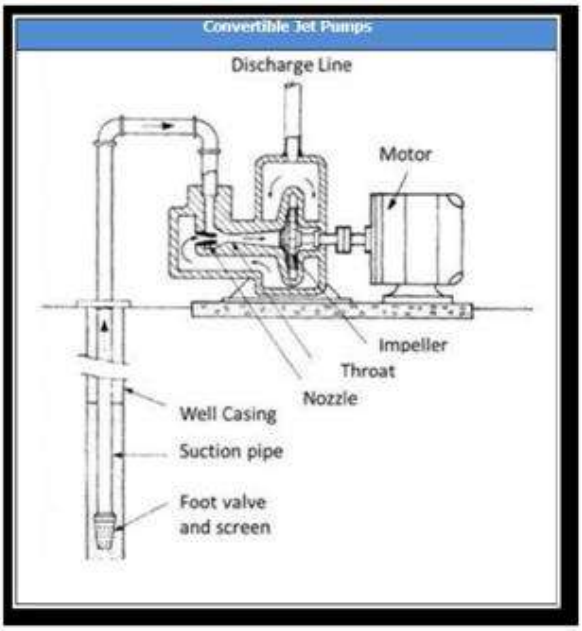

Fig-PG-0170 Jet Pump

(e) Rotary Pumps-In rotary pumps two gear are placed. These gears are rotate on center. It does not have valve and it does not lift water where sand, silt are mixed in water. It capac ity to pump water totally depends on the tightening of its body. It pumps water without any obstruction but low maintenance cost. Work capacity is 60 to 80% of these types of pumps.

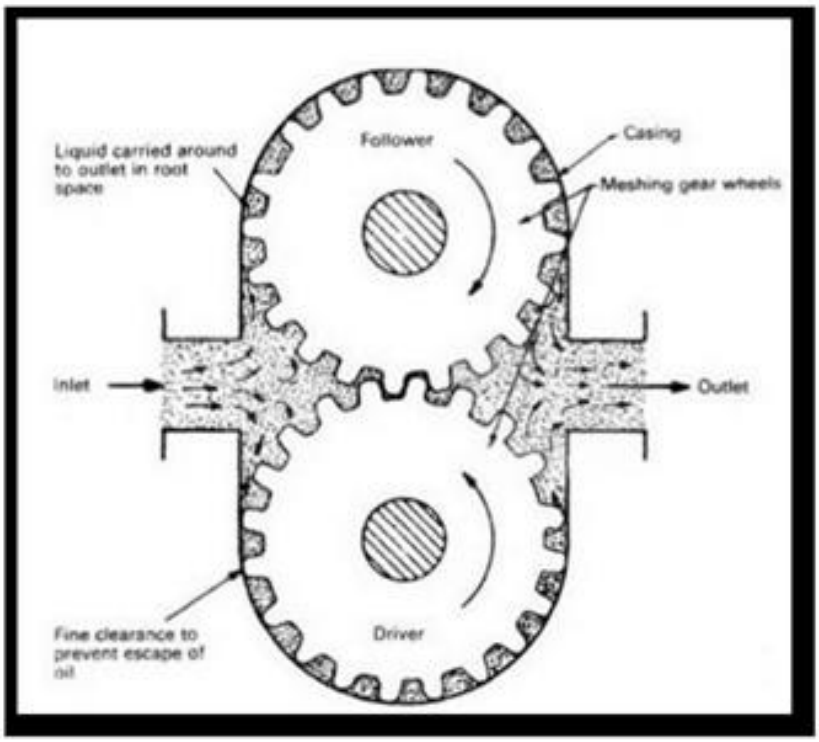

Fig-PG-0170 Rotary Pump

Unit 2.6 Water Meter

Water metering is the process of measuring water use. The purpose of meter is to measure the quantity of water consumed by the building.There is different types of meters to measure the different quantities of water.

For example 15mm size meter measures 2000 liter of water per hour while the 50mm size of water meter can measure 15000 liter water per hour.

1 kilo liter = 1000 liter o 1 gallon = 4.546 liter

Fig-PG-0171 Water Meter

Advantages - Water Meter

(a) This quantifies the amount of water consumed by the people.

(b) In conjunction with volumetric pricing it provides an incentive for water conservation.

(c) It helps to detect water leaks in the distribution network, thus providing a basis for the reduction of Non-revenue water.

(d) It is a precondition for quantity-targeting of water subsidies to the poor.

(e) By quantity consumed is generally regarded as the fairest way to pay

(f) Provides a stronger signal to users to manage water consumption and reduce wastage.

(g) Helps to detect leakage

Disadvantages

(a) Uncertainty over the extent to which meters do actually reduce consumption. The evidence for optional metering in particular is inconclusive and metered customers may be less likely to reduce consumption during times of drought .

(b) Potential impacts on affordability, since less well-off customers may limit their use to save money with a consequent risk to health or hygiene. There is therefore a tension between pricing to encourage customers to use water wisely and making water affordable for all.

(c) The difficulty of individually metering some properties, such as those with a shared supply.

(d) The historic cross subsidy, where the costs of metering have been shared amongst non-metered customers, is gradually unwound, leaving a smaller proportion of remaining unmetered customers paying a higher cost.

2.6.1 Type Of Water Meters

(a) Displacement water meters measure how much water occupies a given space over a preset time. The water flow displaces the measuring device according to the volume of water in either gallons or cubic feet that passes through the meter. A piston or a mutating disk controls the movement of a magnet that activates the water volume register.

(b) Positive displacement meters or PD meters are the most common water meters for homes and small businesses. They can measure small volumes of water at low flow rates to a high degree of accuracy. These meters can also be installed in separate units of a condominium or apartment to track individual water usage.

(c) Velocity Meters-The speed at which the water moves is measured by velocity water meters. The velocity through the meter's specific volume is measured and converted to units of volume, either gallons or cubic feet. These meters can be calibrated to adjust the accuracy of their measurement.

2.7 Assessment

Multiple Choice Questions

Questions 1. What fitting is required to join copper with galvanized pipe?

A. Adaptor
B. Coupling
C. Dielectric Union
D. Solder Joint
E. None of the above

Questions 2. What is the diameter of a lavatory tailpiece?

A. 1 1/4"
B. 1 1/2"
C. 1 3/4"
D. 2"
E. None of the above

Questions 3. What size of P-Trap is required for a kitchen Washbasin?

A. 1"
B. 1 1/4"
C. 1 1/2"
D. 1 3/4"
E. None of the above

Questions 4. What is the name of the fitting that connects the P-Trap to the drain?

A. Union
B. Coupling
C. Trap Adaptor
D. Clamp
E. None of the above

Questions 5. Name the trap assembly used when the drain is centered under one bowl of the kitchen Washbasin.

A. Center Outlet Continuous Waste
B. End Outlet Continuous Waste
C. Under-the- Washbasin Assembly
D. Single Trap Assembly
E. None of the above

Questions 6. What prevents gases from entering a home or building?

A. Back Flow Preventer
B. Anti-Syphon Valve
C. P-Trap
D. Atmospheric Pressure
E. None of the above

Questions 7. What is the minimum size drain for a water closet?

A. 1 1/2"
B. 2"
C. 3"
D. 4"
E. None of the above

Questions 8. What size of drain is required for a combination tub/shower?

A. 1 1/2"
B. 2"
C. 3"
D. 4"
E. None of the above

Questions 10. What size of drain is required for a washing machine?

A. 1 1/2"

B. 2 "

C. 3"

D. 4"

E. None of the above

Questions 11. All pipe used in plumbing applications will have all of the following markings except

a. Pressure rating in psi

b. Nominal pipe size

c. Length of pipe

d. Manufacturer's brand name

Questions 12. What is the likely height of a handicap toilet?

a. 13 inches

b. 15 inches

c. 18 inches

d. 22 inches

Questions 13. 6.What is the minimum unobstructed opening of egress when a shower door is installed for a typical shower?

a. 22 inches

b. 24 inches

c. 28 inches

d. 30 inches

Questions 14. Which of the following is considered to be the best method for connecting an indirect waste to a sanitary drainage system?

a. Air gap

b. Air break

c. Both a and b are equal

d. None of the above

Questions 15. The minimum vertical distance from the bottom of an indirect drain line to its receptor's flood rim is _____.

a. 1"

b. ¾"

c. ½"

d. 2"

Questions 16. Which of the following types of fixtures can be served by a combination-waste-and-vent system?

a. Urinals

b. Toilets

c. Washbasins

d. Bidets

Questions 17. One trap arm may serve a total of how many P-traps?

a. 3

b. 1

c. 2

d. 4

Questions 18. Flexible water connections are required to be _____.

a. Readily accessible

b. Accessible

c. Limited to first-floor installations

d. Supported

Questions 19. Water heaters, hose bibs and sill cocks are normally protected from backflow

a. An air gap

b. An air break

c. A vacuum breaker

d. A reduced-pressure backflow preventer

Questions 20. What is the typical amount of grade required per liner foot on a household drainage pipe?

a. 1/8 inch

b. 1/4 inch

c. 3/4 inch

d. 1 inch

Questions 21. What will result when a 4 inch pipe is reduced in size in the direction of the flow?

a. The waste will travel faster which will allow for better cleaning of the pipe.

b. This could cause blockage to build up at the reduction point.

c. This could cause slugging in the waste system.

d. This will have no affect on the drainage system.

Questions 22. In Med Gas systems, the exhaust from vacuum pumps must be discharged into the following:

a. Designated receptor

b. Indirect drain

c. Outdoors

d. Reducing vent

Questions 23. Flux can only be used in the brazing process when:

a. Brazing copper to brass

b. Brazing copper to copper

c. Not allowed

d. Both a and b

Questions 24. Where is the maximum allowable working pressure of a storage tank and water heater required to be shown?

a. In the installation guide

b. Stamped in the metal

c. On a permanently attached plate

d. Either b or c

Questions 25. The minimum depth thickness for a water heater drip pan is

a. 1"

b. 1.5"

c. 3/4"

d. 2"

Questions 26. Gray water that enters a collection reservoir must be _____.

a. Measured

b. Flow controlled

c. Filtered

d. Monitored

Questions 27. What is the maximum amount of time that gray water is allowed to be retained for use to flush a toilet or urinal?

a. 24 hours

b. 48 hours

c. 72 hours

d. 96 hours

Questions 28. Gas piping installed in a laundry chute _____.

a. Must be secured at maximum intervals of 6 feet

b. Must be protected from damage in the normal course of use of the chute

c. Is required to be installed with only vertical pipe sections

d. Is a code violation

Questions 29. When flow controls are installed on gas piping, they _____.

a. Must be accessible

b. Must not contain sediment traps

c. Must be equipped with a leak-limiting device

d. Are used to keep operating pressure lower than the supply pressure

Questions 30. What is the angle made when you offset a sewer with a 1/8 bend?

a. 45°

b. 60°

c. 72°

d. 90°

Questions 31. What is the total force in pounds on a 6 inch diameter test plug with a water head of 15 feet?

a. 3.00 psi

b. 4.25 psi

c. 6.51 psi

d. 7.20 psi

Questions 32. What steps are followed to join bell and spigot plastic pipe in a drainage system?

A. Cut pipe square, lubricate outside of pipe and inside of fitting and push pipe together using a push bar or shovel.

B. Cut pipe square apply solvent and primer to outside of pipe and inside of fitting and push pipe together using a push bar or shovel

C. Cut pipe square, ream inside and outside surfaces of pipe, apply solvent and primer to outside of pipe and inside of fitting and push pipe together using a push bar or shovel.

D. Cut pipe square, ream inside and outside surfaces of pipe, lubricate outside of pipe and inside of fitting and push pipe together using a push bar or shovel.

Questions 33. What safe work procedures should be followed when wor king with PVC solvent cements and primers inside an enclosed building?

A. Wear leather palmed gloves and only cut a small hole in the lid of the containers large enough for the brush required to dispense materials.

B. Wear cotton gloves, cut a small hole in the lid of the containers large enough for the brush required to dispense materials and ventilate area as needed.

C. Keep containers tightly closed when not in use, open only when brush is to be used to dispense primer or solvent cement and ventilate area.

D. Wear approved gloves, keep containers tightly closed when not in use, open only when brush is to be used to dispense primer or solvent cement and ventilate area.

Questions 34. To protect drainage piping in a trench, what is the minimum cover to be placed and tamped?

A. 150 mm above pipe.

B. 300 mm above pipe.

C. 150 mm below finished grade

D. 300 mm below finished grade.

Questions 35. What is the purpose of installing a screen around an effluent pump in a septic tank?

A. Prevents the pump from plugging.

B. Prevents solids from entering the gravity distri bution.

C. Prevents solids from entering the pressure distribution.

D. Prevents solids from entering the effluent chamber

Questions 36. When the building drain (BD) is located below the level of the adjoining street, which device is installed inside the building?

A. A backflow preventer on the service.

B. A normally closed backwater valve on the BD.

C. A normally open backwater valve on the BD.

D. A normally open backwater valve on the weeping tile.

Questions 37. !n !ngle and Plumb is used for ///.

Horizontal Levelling

Measurement of Vertical Angle

Vertical Reference Line

Measurement of Height

Questions 38. Which of the following is not a material for manufacturing pipes?

Tempered Glass

Alloy Steel

Carbon Steel

Aluminium

Questions 39. In the colour coding of Galvanized Iron Pipes, what does Blue Band indicate?

Heavy Weight

Medium Grade

Medium Density

Medium Weight

Questions 40. What does PEX or XLPE stand for?

A. Polypropylene

B. Cross-linked polyethylene

C. Chlorinated polyvinylchloride

D. Plasticized polyvinyl chloride

Questions 41. Find the incorrect pairing

A. Cross-linked polyethylene &sewage and slurries.

B. Polypropylene &coldwater supply conduits

C. Chlorinated polyvinylchloride &ventilation pipe work

D. Plasticized polyvinyl chloride &industrial liquid applications

Questions 42. Which piping material is used for marine environments in salt waters?

A. Copper pipes

B. Stoneware pipes

C. Stainless steel pipes

D. Polypropylene

Questions 43. Which of the following pipes is generally used for as refrigerant line in HVAC systems?

a)

b)

c)

d)

Questions 44. What is a Short Radius (SR) Elbow?

A. radius of fitting is 0.5 times the pipe diameter

B. radius of fitting is 1.0 times the pipe diameter

C. radius of fitting 1.5 times the pipe diameter

D. radius of fitting is 2.0 times the pipe diameter

Questions 45. Identify the following in the sequence of display;

a. 

b. 

c. 

d. 

A. Tee-Joint, Bends 90°, Reducer elbow,

B. Tee-Joint, Y-Joint, Bends 45°

C. Tee-Joint, Y-Joint, Bends 90°

D. Tee-Joint, Double Y-T Joint, Reducer elbow

Questions 46. Which of the following is the incorrect match?

Coupler Reducer

Gasket

Union

Coupling

Questions 47. When sizing a water service and distribution system, which variable will have the greatest effect on the available water pressure to a plumbing fixture?

A. The length of the building.

B. The height of the building.

C. The total Fixture Unit load.

D. The size of the water service.

Questions 48. When setting a wall hung water closet, which installation procedure ensures a water tight seal on the waste connection?

A. Chair carrier is positioned close to the finished wall.

B. Back up nuts and washers are set 1/16" past wall.

C. Adjustable nipple is set for compression of gasket.

D. Horn wax seal is positioned and compressed by adjustable nipple.

Questions 49. Which procedure is used to lengthen the flush time of a typical diaphragm Style flush meter valve?

A. Turn the bypass screw counter clockwise.

A. Open the control stop fully.

B. Install a new vacuum breaker.

C. Turn the flush meter bonnet screw counter clockwise.

Questions 50. What must be done prior to connecting the dishwasher waste line to a garbage grinder attached to a kitchen Washbasin?

A. Increase the continuous waste one pipe size.

B. Remove the garbage grinder knock out plug.

C. Install a vacuum breaker on the cold water line.

D. Install the garbage grinder downstream of the fixture trap.

Questions 51. What is the hand held shower piping connected to on a roman tub?

A. Pressure balanced control.

B. Thermostatic mixing valve.

C. Diverter valve.

D. Hot/cold mixing valve.

Questions 52. When installing a cultured marble plumbing fixture, what is the manufacturers' recommendation for installation of the patented overflow (PO)?

!. Use plumber's putty.

B. Use silicon on the fixture.

C. Apply plumbers grease to threaded parts.

D. Apply pipe joint lubricant to threaded parts.

Questions 53. What must be considered for a commercial dishwasher when discharging into an interceptor?

A. The flow rating of the interceptor.

B. The discharge rate from the dishwasher.

C. Copper drainage piping is installed before the interceptor.

D. Copper drainage piping installed within 1.2 meters of the interceptor.

Questions 54. What protective plumbing connection must a commercial kitchen combi-oven use?

A. Atmospheric vacuum breaker on hot and cold water supply .

B. Exhaust vent to kitchen canopy with proving switch

C. Indirect waste connection to drainage system.

D. Air gap connection on waste line

Questions 55. What are the requirements for nuts, washers, bolts and screws for attaching a floor flange and water closet to a floor?

A. Corrosion resistant.

B. Zinc coated steel.

C. Nickel plated iron.

D. Brass plated steel.

Questions 56. Which chemical is approved for disinfecting surface water used as a potable supply?

A. Sodium hypchlorite.

B. Potassium chloride.

C. Sodium carbonate.

D. Potassium permanganate.

Questions 57. Which water treatment device is used to remove taste and odour found in water supplies?

A. Sand filter.

B. Water softener.

C. Activated carbon filter.

D. Iron filter.

Questions 58. . Which piping arrangement must be used when terminating the regeneration discharge line serving a water softener?

A. Directly to the bypass valve around softener head.

B. Indirectly to approved drainage termination.

C. Indirectly to a dual check valve on the softener head.

D. Directly to approved drainage termination.

Questions 59. Where would the chlorinator be installed when used with a sand filter, water softener and activated carbon filter?

A. Between the sand filter and the activated carbon filter.

B. Between the activated carbon filter and the water softener.

C. Before the sand filter, activated carbon filter and softener.

D. After the water softener and the activated carbon filter.

Questions 60. Which piping connection protects the water treatment equipment water supply from sewage contamination?

A. Check valve on back wash line.

B. Air break termination.

C. Stand pipe off floor drain.

D. Air gap termination.

Questions 61. What is a gasket? List three main types of gasket.

Questions 62. List five common tools used in plumbing.

Questions 63. What is a valve? List five different types of valves and their uses.

Questions 64. Is the following statement true or false?

Questions 65. While preparing the layout for cold water supply, the communication pipe must be laid 3/2 meter below the floor level and soil is filled around it. (True / False)

Questions 66. Name three types of water closet.

Questions 67. What are the different parts of a flushing cistern and their functioning? Explain with the help of a diagram.

Questions 68. List four safety measures to be taken while using a drilling machine

Questions 69. What is meant by double-vial level? Why are they preferred over single-vial levels?

Questions 70. Describe the method for installation of a pedestal Washbasin in brief.

Questions 71. Differentiate between shallow well jet pumps and deep well jet pumps.

Questions 72. How do we identify the direction of water flow on a water meter?

Questions 73. Why is water seal required in Gully Trap?

Questions 74. List three advantages and three disadvantages of installing a water meter.

Tips

Notes

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3. Repairing of Basic Plumbing Systems

Unit 3.1 - Repairing of various types of fitting and fixtures

PSC/ N 0102

UNIT - 3: Repairing of basic plumbing systems

Unit Objectives

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

1. Diagnosis and Repair activities which includes the understanding of the installed system, basic inspection and identification of the fault therein. Repair and replacement with minimal damage to other systems
2. Diagnosis of problems and/or failures in plumbing system and undertaking activities necessary to maintain the system
3. Maintenance and servicing of pipes and sanitary fixtures in housing, commercial and institutional setups

3.1 Repair Of Various Types Of Fittings And Fixtures

3.1.1 Causes of damage to the pipe line and plumbing system

(a) Defective jointing material.

(b) Direct strike on the body of the pipe with any sharp edge, while jointing.

(c) Slipping of jointing material like rubber ring or lead etc.

(d) Corrosive nature of soil causing damage to the external surface of the pipe.

(e) Loss of support or anchorage (horizontal or vertical), both in case of pipes embedded and those laid above ground level.

(f) Movement of soil due to filled soil, mining.

(g) Movement of soil while work of laying pipes or other activities like laying of cables etc. is taken up.

(h) Changes in soil moisture or water table conditions.

(I) Expansion: severe compression, end crushing.

(j) Contraction: pull out or separation of joint.

(k) Pipe blockages and splits.

(l) Excessive test pressure.

(m) Pressure surge, water separation, vacuum.

(n) Extending pipe connections without proper precautions.

(o) Damage to the internal surface of pipe as well the lining material.

Following procedure to be followed for repair of pipes:

1. Location and demarcation
2. Repair planning
3. Repair work: Selection of most appropriate method for repair.
4. Testing of 'dry' repair.
5. Restoration

Steps For Repair

1. Inspect site and ascertain the nature of the failure.
2. Assess any possible damage or dispute that may arise and take steps to face such situations.
3. Investigate the access to the site so as to plan the arrangement of plant and equipment.
4. Locate isolating valves for proper control of requisite activities required for repair work.

3.1.2. Type Of Repair

A 'wet' repair is defined as a repair which can be achieved while maintaining a nominal pressure in the pipeline. Split collars or identical fittings can be installed in this way if the conditions are favourable.

A 'dry' repair is defined as one in which the main is completely isolated and drained out. 'Cut out 'repairs necessitating the removal of a section of the pipe and/or joints will require 'dry' main on which to work and the pipeline should be drained out.

3.1.2.1. Repair of Small, Local Defects - 'Wet Repair'

For small local defects such as pinholes a single split collar or wraparound clamp may be all that is required. The repair can be carried out at as a 'wet' or 'dry' operation. In case of 'wet' repair care should be taken to maintain a steady, gentle flow so as not to dislodge the sealing elements.

3.1.2.2. Cut Out - 'Dry Repair'

For a more extensive damage e.g. a longitudinal fracture, a section of pipe is cut out and replaced by the use of two appropriate couplers. If full extent of the fracture is not clearly defined cuts should be made at least 300mm beyond each end of the visible crack or defect and in case of any doubt the full length of damaged pipe should be replaced. This necessitates cutting out the joint at both ends of the affected pipe, thus the repair normally requires two replacement pipe sections and three couplers.

3.1.2.3. Replacement Repairs

- Carryout correct measurements and give allowance for expansion;
- All cuts should be made clean and square;
- In A.C. pipes, cuttings should be avoided;
- All cut edges should be prepared to the manufacturer's recommendations.
- Both exposed ends of the existing pipe should be similarly treated;
- Couplers should have their sealing rings lubricated if recommended;
- Correct expansion gaps should be allowed;
- Good alignment is essential particularly if narrow couplers are used;
- All couplers and collars should be centralized;
- Tighten all bolts evenly;
- Do not over tighten bolts or compression joints;

- Restore any damaged coatings on the parent pipe;
- Ensure full protection to the bolts and any exposed bare metal before burial.

3.1.3. Site Management

(a) Record of repair

While the repair is still visible the details of repair should be recorded.

(b) Site cleanliness

During the repair work the area should be kept as clean as possible. All debris and contaminants should be removed from the site and the contamination of the trench from plant, equipment or any other potentially hazardous materials must be avoided.

(c) Prevention of contamination during repair work

Clean and spray with disinfectant, on all surfaces that come into contact with potable water including the broken main, repair fittings and replacement pipe. Ensure that the contaminants do not enter the main where it is cut for repair. After completing the repair, flush the main at the nearest hydrant to remove any dirt etc.

(d) Disinfection procedure

For small repairs which do not require the main to be cut, the fracture should be cleaned and

this along with the repair collar should be sprayed with disinfectant. For more major repairs requiring cut out, every care must be taken to prevent contamination.

(e) Clear site

On completion of the work all materials and protective barriers should be removed from site and the working area left clean and tidy. All records should be completed and submitted.

3.1.4. Types Of Repairs And Problems In Plumbing System

(a) Bibcock

Bibcock is commonly referred as Tap/Faucet and it is the most frequently used water supply fitting. There are Tap/Faucets of many designs available in th e market. It is advisable to read the manufacturers' instructions also while repairing the Tap/Faucets.

The defects commonly encountered during the functioning of Tap/Faucets, their causes and remedial measures to be taken are listed below.

- Defect
    i. Water flows/drips from the Tap/Faucet even when the Tap/Faucet is firmly closed
    ii. Water flows from around the spindle or stuffing box
    iii. Difficulty to turn on or tune off the Tap/Faucet
    iv. Spindle continuously slipping when the Tap/Faucet is turned and Tap/Faucet does not shut off
    v. There is lot of noise in the Tap/Faucet when Tap/Faucet is turned on
- Causes
    i. Worn out defective washer Accumulation of grit, dust or other foreign matter Defective seating
    ii. Gland nut is loose The packing in the stuffing box is defective
    iii. Stuffing box packing is dry Spindle bent
    iv. Spindle thread worn out

(b) Stopcock

It is similar in construction to a bibcock except that it is placed in the pipeline instead of the outlet. The defects commonly encountered during the functioning of stopcock, their causes and remedial measures to be taken are listed below.

- Defect
    i. Water drippings from the stopcock even after it is firmly closed
    ii. Water flows from around the spindle or stuffing box screw

iii. It is difficult to turn on or tune off the cock
iv. Spindle slips down continuously when the cock is turned and Tap/Faucet does not close

- Causes

i. Worn out defective washer Accumulation of grit, dust, or other foreign matter Defective stopcock seat
ii. Gland nut is loose The packing in the stuffing box is defective
iii. Stuffing box packing is dry Spindle bent
iv. Spindle thread worn out badly

(c) Water supply fitting-Gate valve

Gate valve is one of the most common valves used in the main supply lines of a water supply system and pump-lines. The commonly encountered defects during the operation of gate valves, their causes and remedial measures to be taken are listed below.

- Defect
  i. Water flow from around the stuffing box screw
  ii. Valve is hard to turn on or turn off
  iii. Spindle rotates continuously and the gate valve does not close

- Causes

i. Gland nut is loose Tighten the packing in the gland nut stuffing box is renew packing defective with asbestos hemp and water pump grease
ii. Stuffing box packing Tighten the is dry gland nut Spindle is bent replace the spindle
iii. Spindle thread is worn replace the out badly worn-out part

(d) Cistern and float valve

To clean out a floor drain, remove the strainer or grating which covers the drain box. The dirt and grease can then be dug out with a spoon or a stick. After a hooked wire or coil spring-steel auger will clean out the bend or trap. The floor drain should be checked regularly, especially one that is not often used, since water in the trap may evaporate. This would allow sewer gases to enter the room.

(g) Water Closets

Most water closets are made of vitreous china which might crack if exposed to extremely hot water. A plunger will normally handle simple toilet clogs. Another method of cleaning a water closet trap or toilet is the use of an auger with an adjustable, crank-type handle. Known to plumbers as a "snake," the spring-steel coil is easily worked past the trap and down the pipe. A three foot auger is inexpensive and will quickly drill through most clogs. Use the auger carefully. Careless handling may crack the toilet.

(h) Toilet Tanks

- If water continues to run into the closet bowl after the toilet is flushed, it is obvious that some part of the mechanism is out of order. When the tank has refilled, if water continues to seep into the bowl or if there is a low humming noise, this indicates leakage from the tank. This leakage can occur from either the supply valve or the improper seating of the rubber tank ball or (flapper) on the discharge opening.
- If the collar or seat of the discharge opening is corroded or grit-covered, it should be scraped and sand-papered until it is smooth and forms a uniform bearing for the stopper.
- Straighten or replace bent lift wires so that the ball drops squarely into the hollowed seat.
- A leaky, waterlogged float ball holds the supply valve open and does not completely shut off the water. If the rod which connects the tank float to the supply valve has become bent, it may prevent the float from reaching its full height, thus leaving the valve open and allowing leakage. This rod

should be straightened and a little oil applied to the lever joints to insure smooth action.

- Sometimes the tank will not fill sufficiently or will fill to overflowing. These difficulties may be corrected without disturbing the supply valve by bending the rod attached to the tank float upward or downward. If the rod is bent upward, the water will rise higher in the tank, and if downward, the water level will be lowered.
- An overflow tube or pipe is provided in the closet tank to take care of the water in case it should rise above its accustomed level which should be at least 3/4 of an inch below the top of the overflow. While there is not much danger of its becoming stopped up, it might be well to examine it occasionally to see that it is in working order.
- If water rises to the top of the overflow pipe an adjustment or new fill-valve assembly is necessary. Consult your plumber if in doubt.

(I) Fittings

- Fittings (Tap/Faucets and valves) are used more often than any other part of the plumbing system. They get plenty of use but are built to take it, under normal conditions. The best modern fittings are all chrome plated brass and will last a lifetime under everyday use. They clean easily with soap and warm water.
- Caution: The metal chromium is easily dissolved in hydrochloric acid and sulphuric acid. Muriatic acid has for years been considered a good tile cleaner, but only where there are nickel plated plumbing fittings. Where chrome plating is present, clean bathroom tile with warm oxalic acid never with muriatic or sulphuric acids. Even covering the chromium surfaces with cloths will not prevent the acid fumes from inflicting permanent damage.
- Gaining in popularity are polished brass fittings and trim. These will hold up well, as long as certain precautions are observed. NEVER use any abrasive cleaner on polished brass. This can scratch the protective coating

on the brass finish resulting in deterioration or pitting of the brass plating. Also avoid use of solvent based cleaners because they can be deleterious to the polished brass finish.

- Check the manufacturer's guidelines before any repair for warranty of the product

(j) Tap/Faucets

- Washer less Tap/Faucets-Washer less Tap/Faucets can be either single handle or the two handle type. In washer less Tap/Faucets, the control of the water flow is done by a replaceable cartridge or arrangement of seals that allow water flow when the holes or ports are lined up in the proper configuration. Giving the handle an extra hard twist to stop water flow will be ineffective. This type of Tap/Faucet does not use compression strength to stop water flow.
- However, when removing the stem, always check the seat inside the Tap/Faucet body – the brass ring that the washer grinds against. The Tap/Faucet seat can be worn or grooved, making the washer replacement ineffective within days. The washer and seat are the two parts of a compression type Tap/Faucet that receives the greatest amount of wear.
- Pad a smooth jawed wrench with a cloth, then, using the padded wrench, unscrew the large packing nut and turn out the Tap/Faucet stem. Then, with a screw driver that fits the screw slot closely, remove the screw from the bottom of the stem and pry out the worn washer.
- Next, clean out the washer seat or compartment. When this is done, insert the new washer of the correct size and composition for hot or cold water.
- Some of the newer, soft neoprene washers are for both hot and cold water and have a long life. The washer should fit snugly without having to be forced into position. After inserting, replace the screw and tighten.
- It is usually just as expensive to renew a seat as it is to buy a new Tap/Faucet, unless it has been made with a renewable seat. Check with your plumber about a badly worn Tap/Faucet.

- With cloth over finger, clean the valve seat inside the Tap/Faucet. The edge should be smooth and free from deep nicks. If you find it badly worn, you will probably need to replace the seat or have the entire Tap/Faucet replaced by the plumber. Otherwise, it will leak again.
- Next, replace the Tap/Faucet stem and turn it in. Tighten the packing nut. Be careful not to tighten the nut more than necessary to stop seepage around the Tap/Faucet stem.

(k) Sink

Sink bowls come in many different materials. Although enamelled cast iron remains an attractive and durable product, many people today are choosing bowls made of stainless steel, and other solid surface materials for their added durability and stain resistance. The important thing to remember is to follow the manufacturer's instructions pertaining to the material of bowl is constructed.

- Use a non-abrasive cleaner. Constant use of abrasive cleaners can eventually wear the finish down, making it much more porous and susceptible to stains. This can also happen with enamelled, cast iron tubs over a long period.

(l) **Washbasin**

Clogs in washbasins can be removed with block remover. The clogging can be removed by closet auger also, force cup and plungers.

- Plunger is the simplest way to open a clogged drain without undoing any pipes. The general idea is to break up the clog and force it on down the drain

Fig-PG-0172 Plunger

- Plumbing snakes are lengths of tightly wound wire that are highly flexible so they can go around those sharp 90-degree bends in drain lines .

Fig-PG-0173 Plumbing Snake

(m) Noises in the Plumbing System

There are three general types of noises found in some of the older plumbing systems. These are water hammer, whistling and chattering.

- Water hammer is the thump in the piping heard when Tap/Faucets or valves are turned off abruptly. It can usually be eliminated by the installation of an air chamber or short length of pipe in the wall where each supply pipe enters a plumbing fixture.
- Chattering in the piping may be caused by loose pipes, by pipes rubbing against a metal projection, by worn Tap/Faucet washers or looseness of other inside parts.
- Whistling is caused by the speed of water flowing through piping which is usually too small. A pressure reducing valve will help as will a general straightening out of the plumbing system. Whistling is most common at bends and tees in the pipe.

(n) Odours in the Plumbing System

The well-designed and correctly installed plumbing system is odourless. Odours are most likely to arise from leaks in the waste or vent piping or from traps which have lost their water seal. In an incorrectly installed system, there are, of course, many opportunities for odours to result from defects in the system, particularly if it is not properly vented.

(o) Repair of different type of pipes

Some of the methods of repair for different types of pipes are given in the following tables.

MATERIAL	CAST IRON	
Burst	**Action**	**Repair**
Joint failure	Enclose joint Two couplers	Special joint clamp Two couplers and new section
Brittle failure	Remove section/joint Enclose failure	Two couplers and new section Repair collar or clamp
Corrosion	Remove section/joint Rehabilitation technique Enclose failure	Two couplers and new section Sliplining etc. Repair collar or clamp

MATERIAL	DUCTILE IRON	
Burst	**Action**	**Repair**
Joint failure	Enclose joint Remove section/joint	Special joint clamp Two couplers and new section
Extensive pinholing	Rehabilitation technique Remove section/joint	Sliplining etc. Two couplers and new section
Ductile failure	Remove section/joint Enclose burst	Two couplers and new section Repair collar or clamp
Localised pinholing	Enclose burst	Repair collar or clamp

MATERIAL	STEEL	
Burst	**Action**	**Repair**
Extensive pin holing	Rehabilitation Technique Remove section/joint	Slip lining etc. Two couplers and new section
Joint failure	Remove section/joint Enclose joint	Two couplers and new section Special joint clamp
Isolated pin holing	Enclose burst	Patch and weld Repair collar or clamp

MATERIAL	PRESTRESSED CONCRETE	
Burst	**Action**	**Repair**
Surface softening	Remove complete length/joint or cracking	Two couplers and new pipe section
Joint failure	Remove complete length/joint Enclose joint	Two couplers and new pipe section Special joint clamp

MATERIAL	POLYETHYLENE/P.V.C.	
Burst	**Action**	**Repair**
Fast crack propagation	Remove damaged section	Two couplers and new section
Brittle failure	Remove damaged section Enclose burst	Two couplers and new section Repair collar or clamp
Joint failure	Cut out joint	Two couplers and new section

3.1.5. Plan and Schedule Routine Maintenance, Repairs and Modifications

(a) Assess or confirm the need for replacement or repair

(b) Check existing warranties and service agreements to establish if any identified maintenance requirement is covered by such documents

(c) Provide an estimate and quote where required, detailing work to be carried out and costs

(d) Receive approval for work in writing from appropriate personnel

(e) Organize and confirm details relating to access to site and specific site requirements with relevant personnel

(f) Identify labor, tools and equipment required for the job

(g) Check relevant skills, qualifications and licenses of labor to ensure job requirements are fulfilled

(h) Schedule labor to be available when required for work

(l) Check equipment/fixture required for job to ensure availability and order in advance needs, where required

(j) Check tools and equipment required for job to ensure availability, organize and order in advance needs, where required

(k) Communicate and organize details of job with concerned departments where required

(l) Prepare work schedule to maximize productivity and meet company requirements

(m) Plan time for installation to minimize disruption of operation

(n) Identify, assess and incorporate weather condition and other contingency in work schedule

(o) State clearly detail of schedule and job and resource requirement in work order

(p) Complete promptly work order and provide report to relevant personnel

Tips

Notes

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4. Maintenance and Servicing of Plumbing Systems

Unit 4.1 - Source of water
Unit 4.2 - Water treatment system
Unit 4.3 - Water supply system
Unit 4.4 - Drainage system
Unit 4.5 - Common terms in plumbing

PSC/ N 0112

Unit 4- Maintainnce and Servicing of Plumbing Systems

4.1 Source Of Water And Supply System

Rainwater

- Rooftop rainwater harvesting
- Catchment and storage dams

Groundwater

- spring water collection
- dug well
- drilled wells
- subsurface harvesting systems

Surface water

- river-bottom intake
- floating intake
- Sump intake

4.1.1 Rooftop Rainwater Harvesting

Rooftop catchment systems gather rain-water from the roofs of houses, schools, etc., using gutters and downpipes (made of local wood, bamboo, galvanized iron or PVC), and lead it to storage containers that range from simple pots to large tanks.

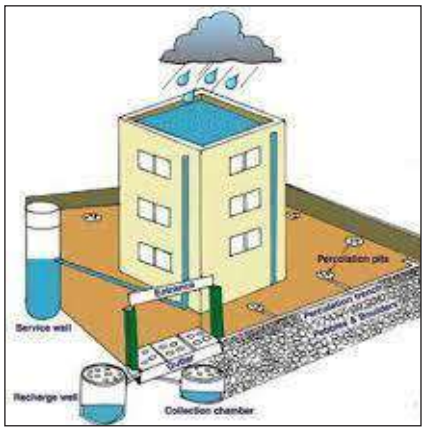

Fig-PG-0174 Rain Water Harvesting

4.1.2. Catchment and Storage Dams

Water can be made available by damming a natural rainwater catchment

area, such as a valley, and storing the water in the reservoir formed by the dam, or diverting it to another reservoir. Important parameters in the planning of dams are: the annual rainfall and evaporation pattern; the present use and runoff coefficient of the catchment area; water demand; and the geology and geography of the catchment area and building site.

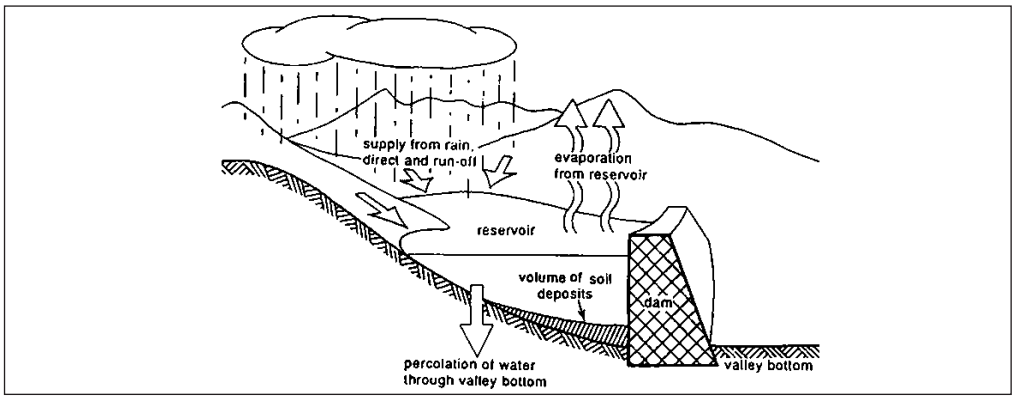

Fig-PG-0175 Rain Water Harvesting

4.1.3. Spring Water Collection

Spring water is groundwater that surfaces naturally. Where solid or clay layers block the underground flow of groundwater, it is forced upward and can come to the surface. Spring water may emerge either in the open as a spring, or invisibly as an outflow into a river, stream, lake or the sea.

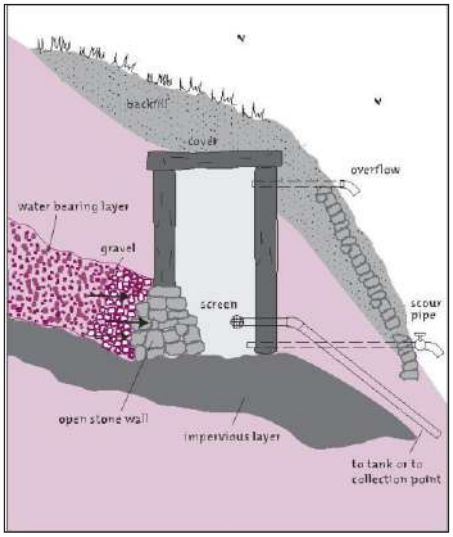

Fig-PG-0176 Spring Water Collection

4.1.4. Dug Well

A dug well gives access to a groundwater aquifer and facilitates its abstraction. Dug wells can be entered for cleaning or deepening, and they will rarely be less than 0.8 m in diameter.

- dug wells can often be constructed with locally-available tools, materials and skills;
- if the water-lifting system breaks down and cannot be repaired, a dug well can still work with a rope and bucket;
- dug wells can be deepened further if the groundwater table drops;
- dug wells have a greater storage capacity;
- dug wells can be repaired and de-silted by the community;
- dug wells can be constructed in formations where hand or mechanical drilling is difficult or impossible.

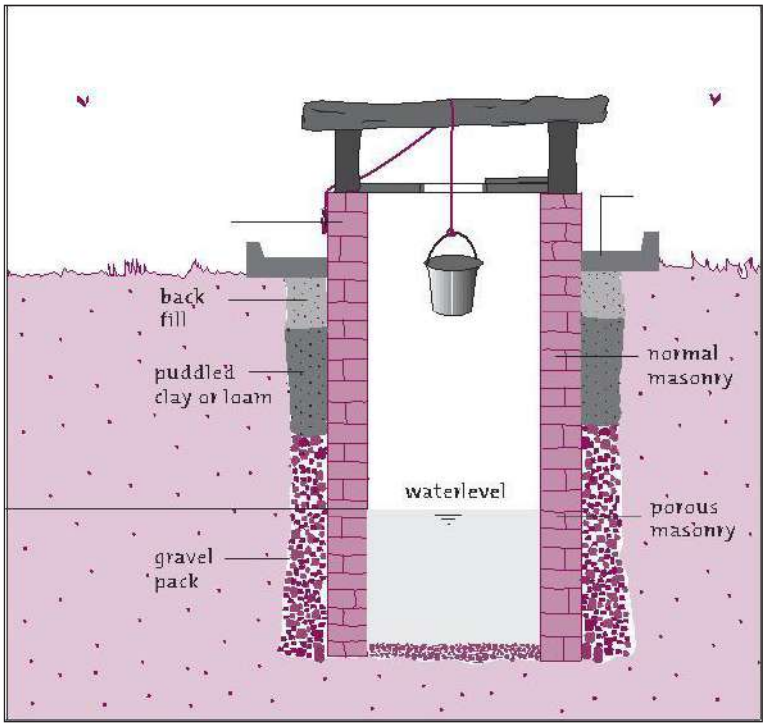

Fig-PG-0177 A Dug Well

4.1.5. Drilled Wells

Drilled wells, tube wells or boreholes give access to ground-water aquifers and facilitate abstraction of the water. They differ from dug wells in that the diameter is generally smaller, between 0.10–0.25 m for the casing. This does not allow a person

to enter for cleaning or deepening. The well is usually the most expensive part of a hand-pump.

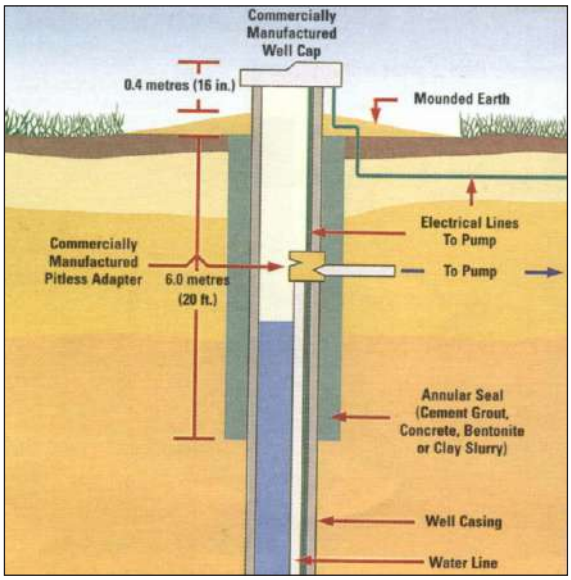

Fig-PG-0178 A Drilled Well

4.1.6. Subsurface Harvesting Systems

Subsurface harvesting systems retain groundwater flows and facilitate their abstraction. There are two main systems:

(a) Subsurface dams: an impermeable dam is built across a surface aquifer, such as the bed of a seasonal sand-filled river, and based on top of an impermeable layer..

(b) Raised-sand dams: an impermeable dam is built across the bed of a seasonal sand-filled river, with the crest reaching a few decimetres above the upstream river bed. Each time the upstream part of the river fills with sand, the crest is raised a little more to build up a groundwater reservoir.

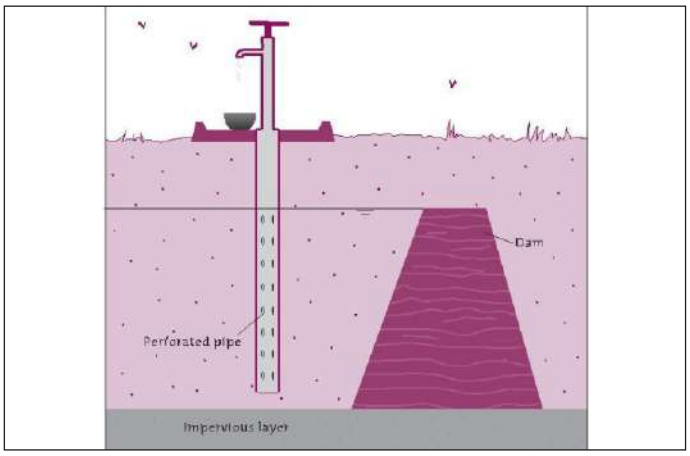

Fig-PG-0179 Surface Harvesting

4.1.7. Protected Side Intake

A protected side intake provides a stable place in the bank of a river or lake, from where water can flow into a channel or enter the suction pipe of a pump. It is built to withstand damage by floods and to minimize problems caused by sediment. Side intakes are sturdy structures, usually made of reinforced concrete, and may have valves or sluices to flush any sediment that might settle.

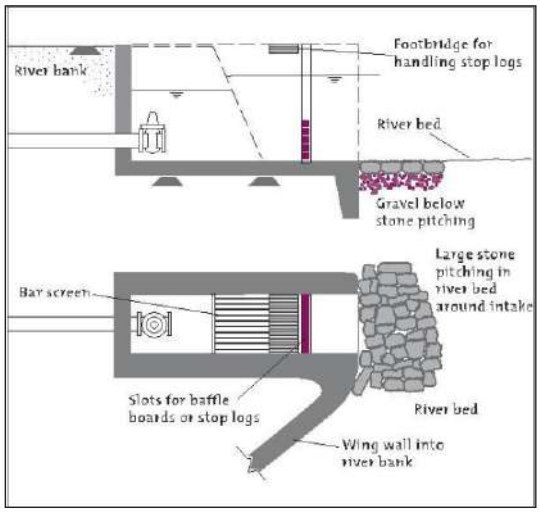

Fig-PG-0180 Protected Side Intake

4.1.8.River-bottom Intake

River-bottom or Tyrolean intakes for drinking-water systems are usually used in small rivers and streams where the sediment content and bed load transport are low. The water is abstracted through a screen over a canal (usually made of concrete and built into the river bed). The bars of the screen are laid in the direction of the current and sloping downwards, so that coarse material can-not enter. From the canal, water enters a sand trap and then may pass a valve and flow by gravity, or be pumped into the rest of the system.

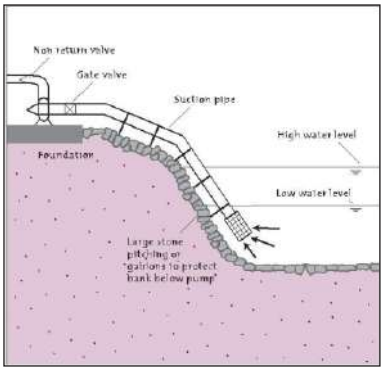

Fig-PG-0181 River Bottom Intake

4.1.9 Floating intake

Floating intakes for drinking-water systems allow water to be abstracted from near the surface of a river or lake, thus avoiding the heavier silt loads that are transported closer to the bottom during floods. The inlet pipe of a suction pump is connected just under the water level to a floating pontoon that is moored to the bank or bottom of the lake or river.

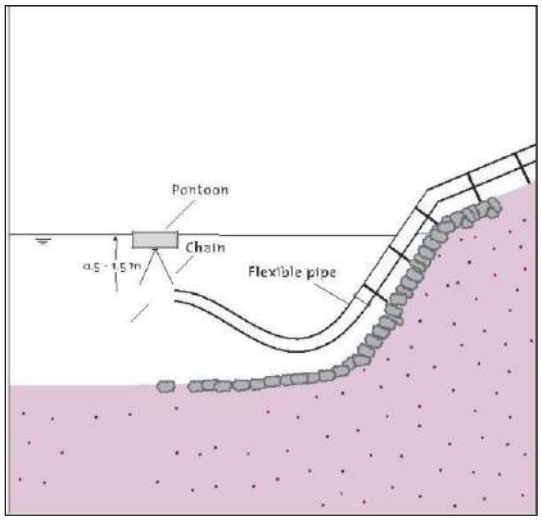

Fig-PG-0182 Floating Intake

4.1.10. Sump Intake

In a sump intake, water from a river or lake flows through an underwater pipe to a well or sump from where it is lifted, usually into the initial purification stages of a drinking-water system. The inflow opening of the underwater pipe is located below the low-water level and is screened. A well provides a place for sedimentation to settle and protects the pump against damage by floating objects. To facilitate cleaning, two sump intakes are sometimes built for one pump.

Unit 4.2- Treatment of Water

The water may contain organic and inorganic impurities in the form of suspended and dissolved states. Harmful living organisms like bacteria may also be present. Therefore the water is to be treated according to the use for which it is supplied.

The raw water is treated in a number of ways. The water for drinking purposes is treated in the various steps listed below.

(a) Screening
(b) Plain sedimentation
(c) Sedimentation with coagulation
(d) Filtration
(e) Aeration and chemical treatment
(f) Disinfection

All the above steps may not be necessary and different treatments are given depending upon quality of water taken from different sources.

Type of treatment process will depend on the quality of raw water and standard of water quality required after treatment. The following treatment processes are used for removing various types of impurities.

- Floating matters like leaves, dead animals –Screening
- Suspended impurities like silt, clay, sand etc. Plain sedimentation
- Fine suspended matter- Sedimentation with coagulation
- Micro organisms and colloidal matters- Filtration
- Dissolved gases tastes and odours- Aeration and chemical treatment
- Pathogenic bacteria- Disinfection

Treatment for drinking water production involves the removal of contaminants from raw water to produce water that is pure enough for human consumption without any short term or long term risk of any adverse health effect. Substances that are removed during the process of drinking water treatment include suspended solids, bacteria, algae, viruses,

fungi, and minerals such as iron and manganese. The processes involved in removing the contaminants include physical processes such as settling and filtration, chemical processes such as disinfection and coagulation and biological processes such as slow sand filtration.

1. Wastewater treatment is the process that removes the majority of the contaminants from wastewater or sewage and produces both a liquid effluent suitable for disposal to the natural environment and sludge. Biological processes can be employed in the treatment of wastewater and these processes may include, for example, aerated lagoons, activated sludge or slow sand filters.
2. Industrial water and wastewater treatment-Two of the main processes of industrial water treatment are boiler water treatment and cooling water treatment. A lack of proper water treatment can lead to the reaction of solids and bacteria within pipe work and boiler housing.
3. Domestic water treatment-Water supplied to domestic properties may be further treated before use, often using an in-line treatment process. Such treatments can include water softening or ion exchange. Many propriety systems also claim to remove residual disinfectants and heavy metal ions. Saline water can be treated to yield fresh water. Two main processes are used, reverse osmosis or distillation. Both methods require high energy inputs and are usually only used where fresh water is difficult to source.
4. Portable water purification-Living away from drinking water supplies often requires some form of portable water treatment process. These can vary in complexity from the simple addition of a disinfectant tablet in a hiker's water bottle through to complex multi-stage processes carried by boat or plane to disaster areas.

Important Points

- It is impossible to boil water in water works. Disinfection with iodine and bromine are costly, hence not used in water works.
- The method of use of ozone can be used only if electricity is easily and cheaply available at the water works.
- Disinfection by potassium permanganate is commonly used in rural areas for treating individual well water.

- Plain chlorination is used where good surface water is available. When water is to be treated in large water works gaseous chlorine is use. It should not be applied directly. It is applied through chlorinator specially designed for this purpose.
- Application of liquid chlorine is most effective in disinfection. The rate of application can be controlled manually, automatically or mechanically liquid chlorinators are used for this application.
- Bleaching powders are not used in the water works for chlorination as gaseous and liquid chlorine are available in market and they are more effective.

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Unit 4.3- Types of Water Supply Systems

1. Continuous In the continuous supply system, water is available to consumers throughout the days.
2. In the intermittent supply system, water is supplied during fixed hours and for the remaining period the supply is shut off. Intermittent supply has many disadvantages
   (a) Water has to be stored for non supply hours
   (b) Water will not be available for fire extinguishing if fire breaks out during non supply hours.
   (c) The sizes of the pipes are required to be larger.
   (d) There is chance of wastage of water as the Tap/Faucets may be left open during non-supply hours.
   (e) The only advantage is that water can be supplied to high level areas also with adequate pressure as different areas of the town may be supplied with water in different hours.
3. The water supply distribution systems are laid in the following forms.
   (a) Tree or dead end system-Tree or dead end system: In this system the main line is laid along the main road and goes on diminishing in size. Branch lines are taken in many places along the road and there are many dead ends in the system. This system is suitable for towns growing irregularly. The dead ends

cause stagnation of water. Also in case of any repair, the area beyond that point will not get water. However this system requires less number of valves and design of pipe sizes is easy.

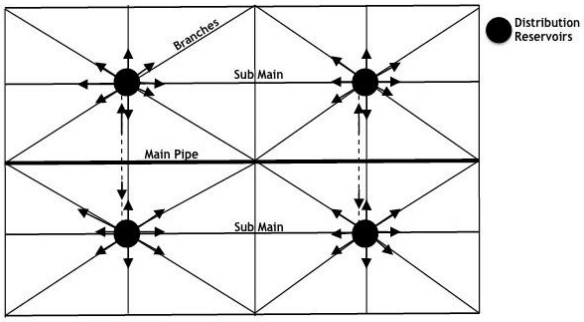

Fig-PG-0183 Tree Or Dead End System

(b) Circular or ring system -In this system each locality of a town is divided into square or circular blocks and water lines are laid around the circumference of the square or circle. The branches, sub mains are laid along the inner roads. At the sub main and branches are interconnected end cross point gets supply from two directions. This system is suitable for towns having well planned roads. This system involves many valves and more pipe length but the design of pipe is easier.

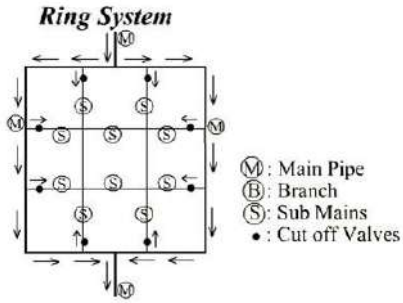

Fig-PG-0184 Ring System

(c) Grid iron system-In this system water mains and branches are laid in rectangles. The lines are so interconnected so that in case of repair at any point, the water is available from other direction. There are no dead ends and water is kept in good circulation. In case of fire, water is available from all directions. This system involves large number of valves and exact design of pipes is difficult. It is the most widely used system and is best suited for planned cities with road of rectangular pattern.

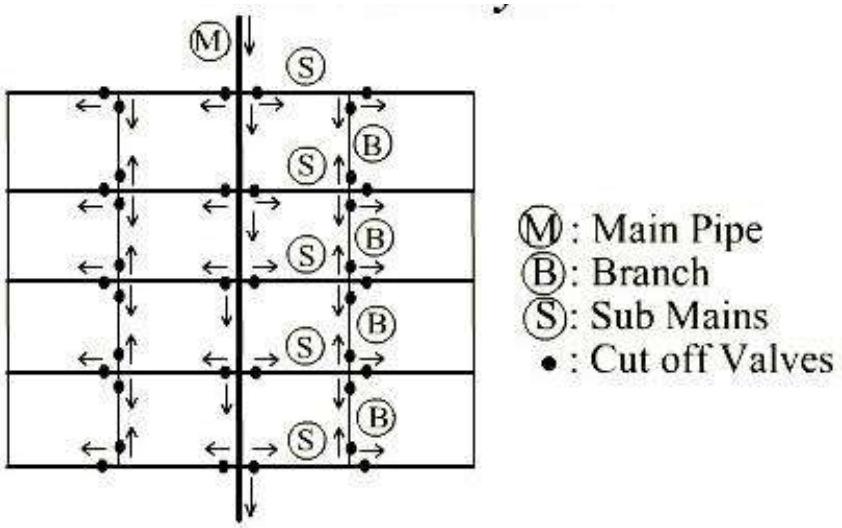

Fig-PG-0185 Grid Iron System

(d) Radialsystem-In this system the supply lines are laid radially from the middle of the each zone boundary of the area to be served. It gives quick service. This system is suitable for towns with a radial layout. The design of pipe sizes is also easy.

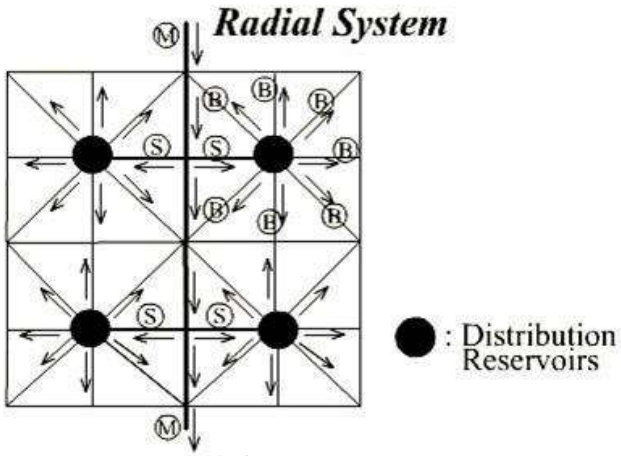

Fig-PG-0186 Radial System

4.3.1. On The Basis Of Pumping Ways The Water Distribution Is Classified As

- Gravity system
- Pumping system
- Dual systems
- Gravity system: In this system the source of supply is at higher level than the town. The water flows in the main due to gravity. In this method no pumping is required.

- Pumping system: In this system, the water is pumped direct to mains from the treatment plant. Because of direct pumping, required pressure is maintained in this system.
- Dual system: This system is also known as combined gravity and pumping system. In this system, the pump is connected to the main as well as to an elevated tank. This system is more economical and reliable. The water from the source is carried to the treatment plants through open earthen channels, masonry or concrete chambers, cast iron/steel/galvanised iron/concrete/R.C.C./PVC pipes.

4.3.2. Types of water

1. Non-potable water: water that is not of drinking water quality.

2. Soft water-Soft water is water which has relatively low concentration of calcium carbonate and other ions. The water that lathers with soap easily is called soft water. It describes type of water that contain few or no minerals like calcium (Ca) or magnesium (Mg) ions

3. Hard Water -This is saturated with calcium, iron, magnesium, and many other inorganic minerals. All water in lakes, rivers, on the ground, in deep wells, is classified as hard water.

4. Raw Water- This has not been boiled. Raw water may be hard (as calcium hardened water) or soft as rain water. It contains millions of germs and viruses.

5. Rain Water. This has been condensed from the clouds. The first drop is distilled water. But when it falls as rain, it picks up germs, dust, smo ke, minerals, strontium 90, lead and many other atmospheric chemicals. By the time rain water reaches the earth it is so saturated with dust and pollutants it may be yellowish in color.

6. Filtered Water. This water has passed through a fine strainer, calle d a filter. Some calcium and other solid substances are kept in the filter; there is no filter made which can prevent germs from passing through its fine meshes. Each pore of the finest filter is large enough for a million viruses to seep through in a few moments.

7. De-ionized Water. A process of exchanging "hard" ions for "soft." The total ions are still present. The end result is the same. But the water has the appearance of being distilled.

8. Distilled Water. This is water that has first been turned into steam so that all of its impurities are left behind. Then through condensation, it is turned back into pure water. It is the only pure water. The only water free from all contamination. Distilled water may well be considered the only pure water on earth.

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Unit 4.4- Drainage Systems

1. The systems adopted in plumbing of drainage work in a building:

- Pipe Systems —The design to be adopted will depend on the type and planning of thE buildings to which it is to be installed and will be one of the following:

(a) The two-pipe system

(b) The one-pipe system

(c) The single stack system

- Choice of Plumbing System

I. Where the sullage from baths and kitchens can be dealt with separately for use in gardening or any other such purposes, the two pipe system is advantageous.

II. The one-pipe system is more economical and has application where all types of waste waters are taken in a common sewer line to the place of disposal or treatment. Both these systems are fully ventilated by a system of ventilating pipe. However, these days the single-stack system without any vent pipe system, where the stack itself is made to serve the vent requirements also by restricting the flow in the stack, is being used. This system is recommended with 100 mm diameter stack for up to 5 storey buildings. Not more than two toilet units can discharge to the single stack at each floor level.

III. In high-rise buildings, a partially ventilated one-pipe system is being used where the vent stack is connected to the drainage stack or the WCs at each or alternate floors. The fully ventilated system does not demand any special safeguards.

4.4.1. Typical Design Guidelines

I. Branches and stacks which receive discharges from WC pans should not be less than 100 mm, except where the outlet from the siphonic water closet is 80 mm in which case a branch pipe of 80 mm may be used; for outlet of floor traps 75 mm diameter pipes may be used.

II. The gradient of a horizontal branch should not be flatter than 1 in 50 and not steeper than 1 in 10.

III. Layout of Pipes—Pipe work and appliances should be so arranged as to allow close grouping of connections preferably with a water closet near to the main soil pipe. The level of the trap outlet of an appliance shall be studied in relation to the level of the floor and the branch pipe.

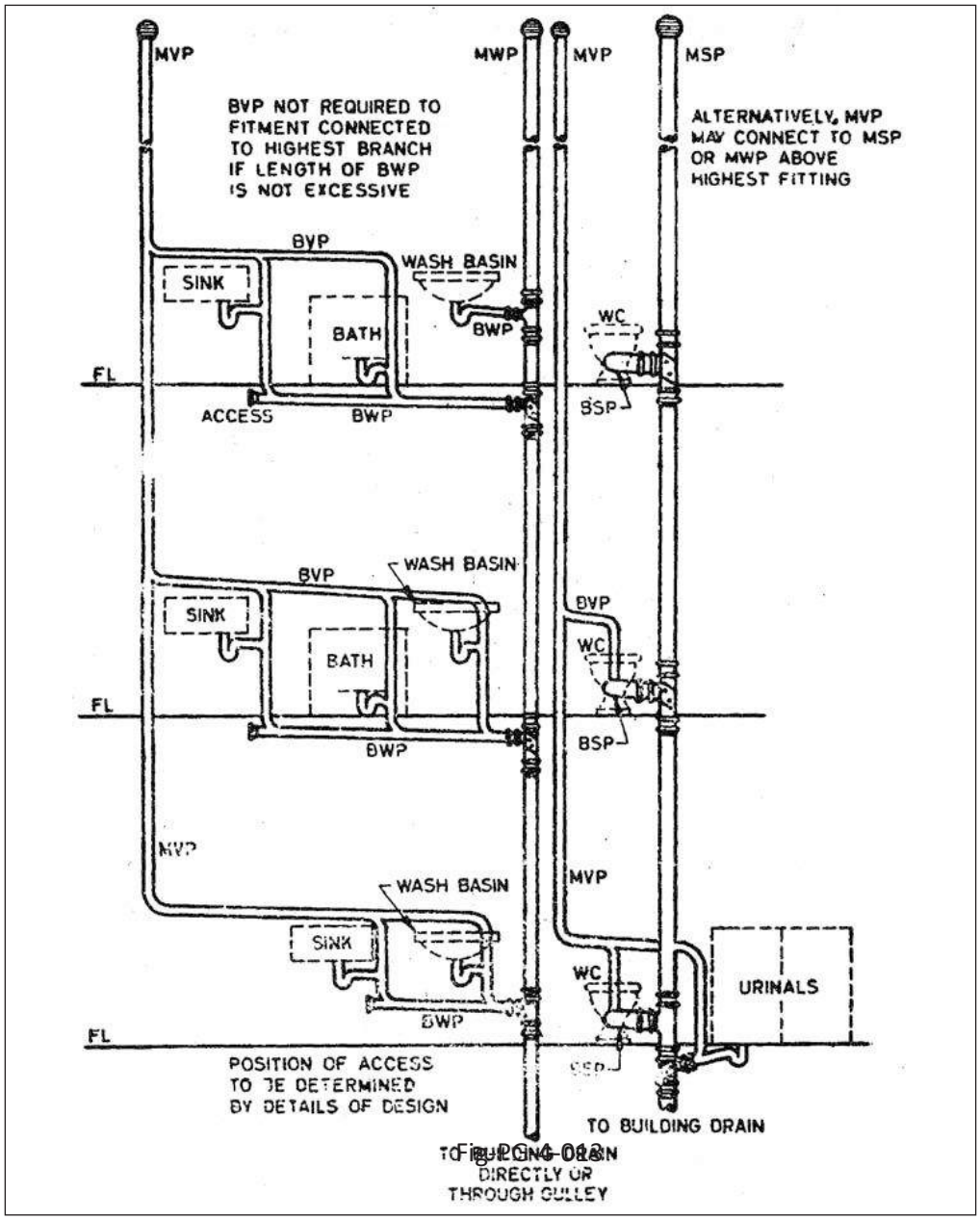

Fig-PG-0187 Design Guidelines

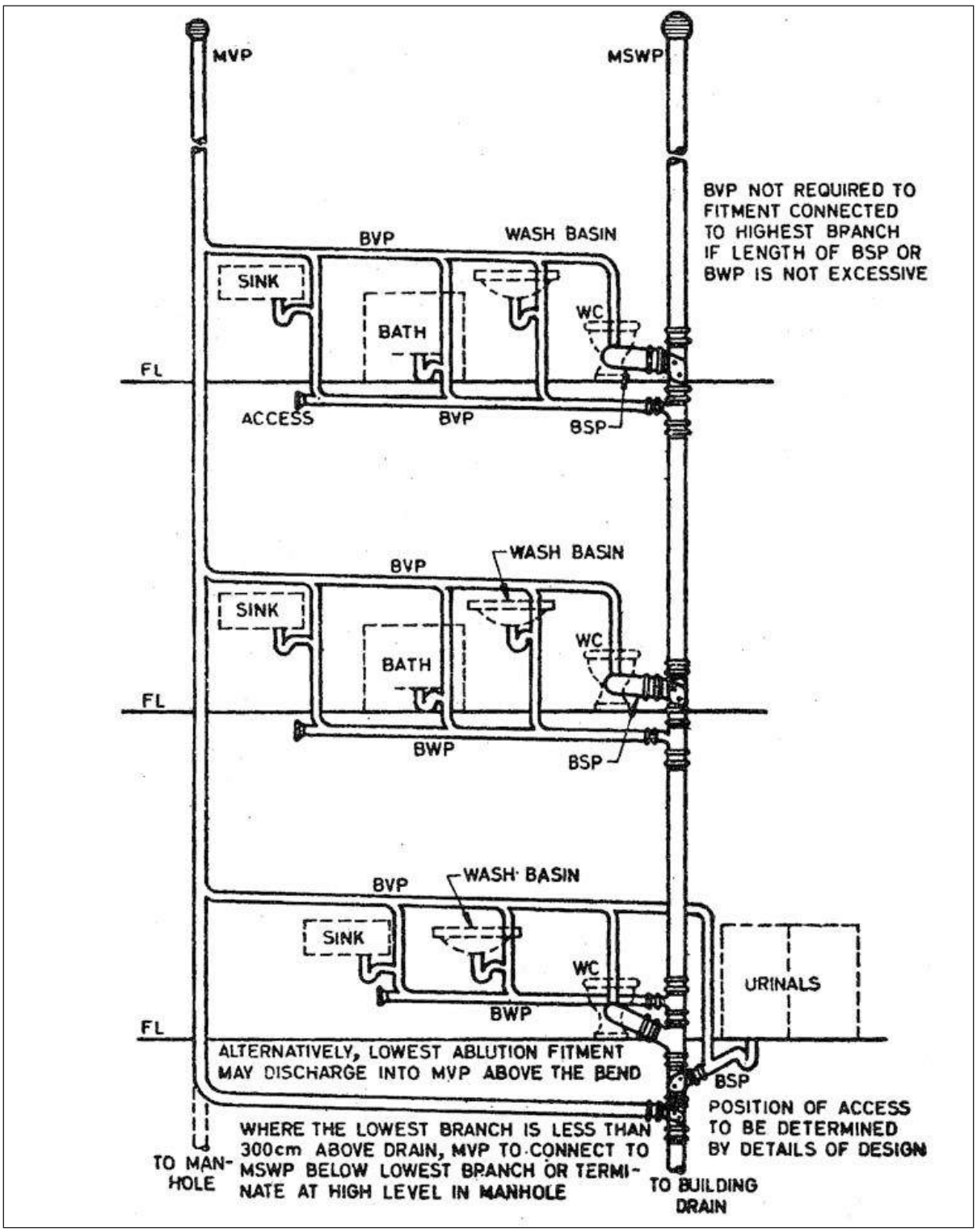

Fig-PG-0188 Diagram of One-Pipe System

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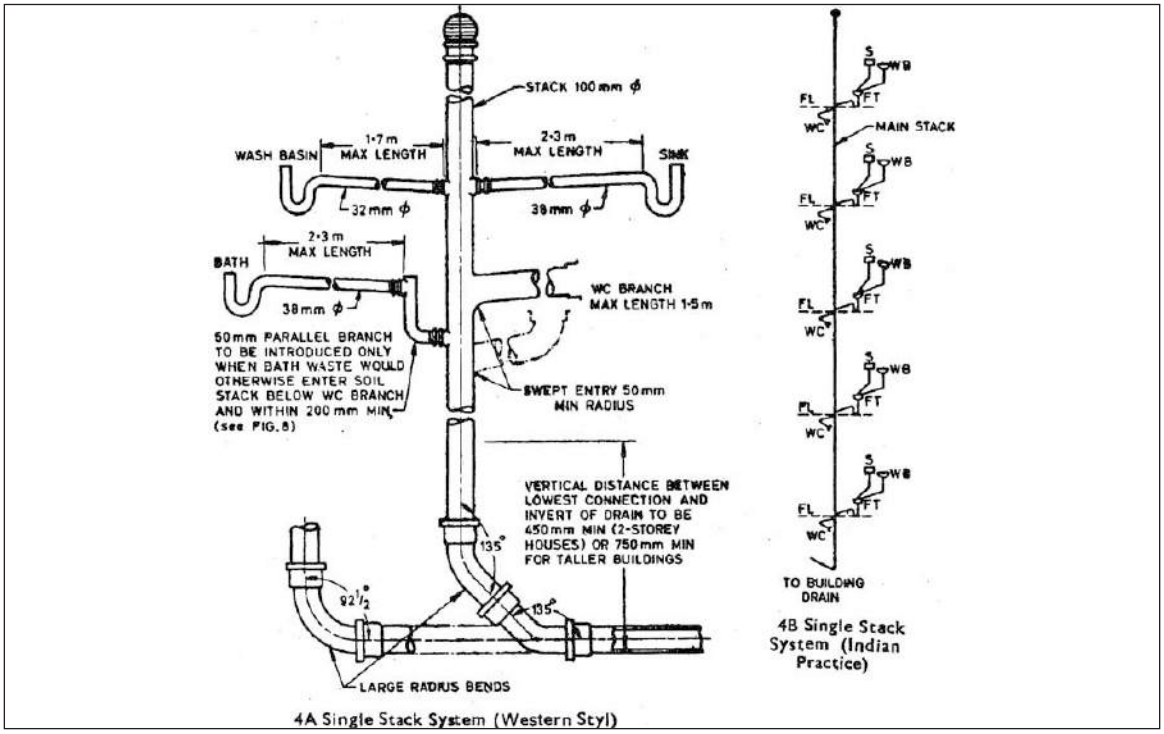

Fig-PG-0189 Main Features of Design of Single Stack system

4.4.2 We Use Following Types Of Drainage Pipes In Residential Building

1. Soil Pipe-A soil pipe conveying to a drain any solid or liquid filth shall be circular and shall have a minimum diameter of 100 mm.

   I. The soil pipe shall be situated outside the building or in suitably designed pipe shafts and shall be continued upwards without diminution of its diameter, and (except where it is unavoidable) without any bend or angle, to such a height and position as to afford by means of its open end a safe outlet for foul air.

II. Where pipe shafts are provided the cross-sectional area shall be such as to allow free and unhampered access to the pipes to be installed in the shaft and in no case shall the cross section be less than a square of 1 metre side.

III. All pipe shafts shall be provided with an access door at ground level and facilities for ventilation.

IV. Soil pipes shall preferably be of cast iron. Asbestos cement building pipes may also be used as soil pipes only above ground level.

2. Waste Pipe-Every pipe in a building for earring off the waste or overflow water from every bath, wash basin or Washbasin to a drain shall be of 32 to 50 mm diameter, and shall be trapped immediately beneath such wash basin or Washbasin by an efficient siphon trap with adequate means for inspection and cleaning. Such traps shall be ventilated into the external air whenever such ventilation is necessary to preserve the seal of the trap.

I. Waste pipes, traps, etc, shall be constructed of iron, head, brass, stoneware, asbestos cement or other approved material. The overflow pipe from wash basins, Washbasins, etc, shall be connected with the waste pipe immediately above the trap. Vertical pipes carrying off waste water shall have a minimum diameter of 75 mm.

II. The waste pipe shall be finally attached to the wall at least 5 cm clear of it, if the waste pipe is of cast iron, the pipe shall be secured to the walls properly fixed holder bats or equally suitable and efficient means.

3. Storm water pipe-A storm pipe in drainage system is designed to drain excess rain and ground water from impervious surfaces.Pipes can come in many different cross-sectional shapes. Pipes made of different materials can also be used, such as brick, concrete, high-density polyethylene or galvanized steel.

4. Ventilating Pipe-Ventilating pipes should be so installed that water cannot be retained in them. They should be fixed vertically. Whenever possible horizontal runs should be avoided. Ventilating pipe shall be carried to such a height and in such a position as to afford by means of the open end of such pipe or vent shaft, a safe outlet for foul air with the least possible nuisance.

   I. Branch ventilating pipes should be connected to the top of the BSP and BWP between 75 mm and 450 mm from the crown of the trap.

II. The ventilating pipe shall always be taken to a point 150 cm above the level of the eaves or flat roof or terrace parapet whichever is higher or the top of any window within a horizontal distance of 3 m. The least dimension shall be taken as a minimum and local conditions shall be taken into account. The upper end of every ventilating pipe shall be protected by means of a cowl.

III. In case the adjoining building is taller, the ventilating pipe shall be carried higher than the roof of the adjacent building, wherever it is possible.

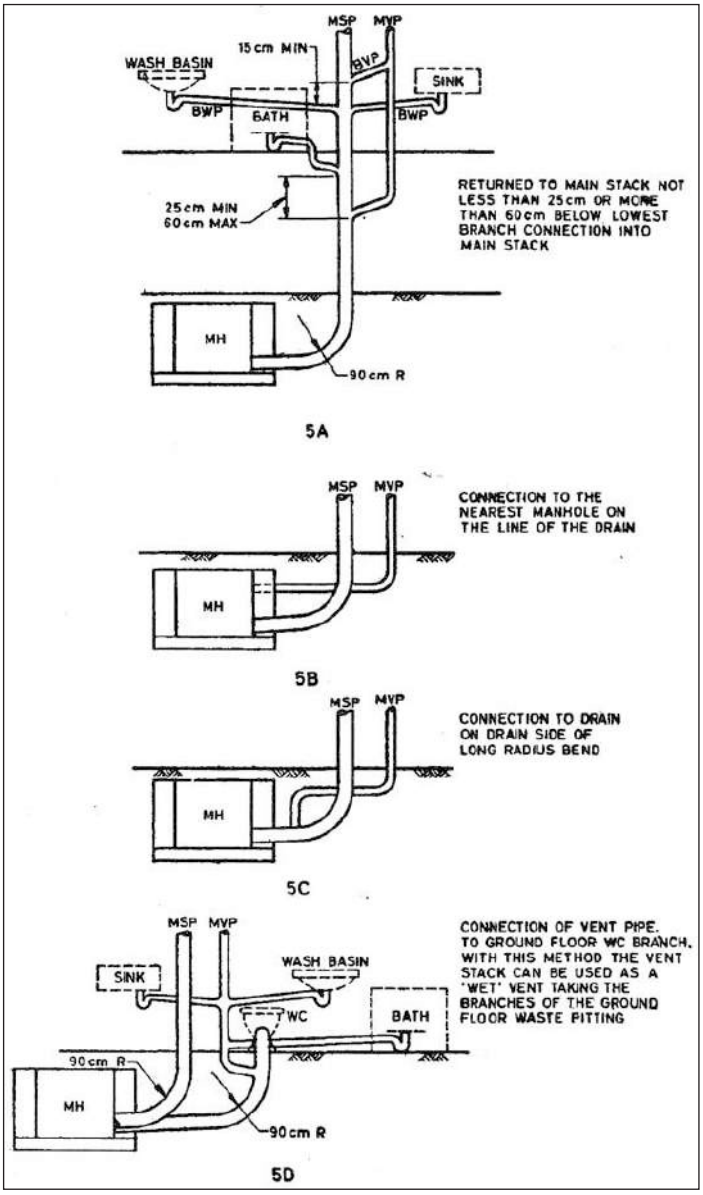

Fig-PG-0190 End Connections of Vent Pipe

4.4.3. Sewerage Plans of Buildings and Designs of Sewer Pipes

(a) Quantity of Flow: The flow in the drainage pipes of a house sewerage system is irregular in nature and is not continuous. The quantity is also small. The average rate of flow is usually based on a water supply of 135 litres per capita per day for average Indian conditions. The maximum flow may be taken as three times this average.

(b) Waste pipes: Every pipe for carrying water or overflow water from every bath, wash basin or Washbasin to a drain shall be of 32 to 50mm diameter. Waste stacks shall have a minimum dia of 75mm.

(c) Ventilating pipes: The building drain ventilating pipe should be not less than 75mm in diameter when, however, it is used as main soil pipe or main waste pipe (MSP or MWP). The upper portion, which does not carry discharges, should not be of lesser diameter than the remaining portion. The diameter of the main ventilating pipe should not be less than 50mm. A branch ventilating pipe on a waste pipe in both one and two pipe systems should be of not less than two-thirds, the diameters of the branch waste ventilated pipe subject to a minimum of 25mm. A branch ventilating pipe on a soil pipe should be not less than 32m in diameter.

(d) Anti Siphonage pipes: Water seals of traps in multi-storied buildings or houses may sometimes get broken due to siphonic action

4.4.4. Installation of Drains

Where any drain is constructed adjacent to or under or through a structural part of any building, adequate measures must be taken to ensure that the trench in which such drain is laid in no way impairs the stability of such building or the stability of any other building or interferes with or affects any existing services.

- Any drain shall be of such strength, having regard to the manner in which it is bedded or supported, so that the maximum loads and forces to which it may normally be subjected will be sustained by it and it shall where necessary be protected against damage.
- The following requirements shall be satisfied

i. The minimum cover over the outside of the drain is not less than 300 mm or

ii. Precast or cast-in-situ concrete slabs are placed over the drain, isolated from the crown of the pipe by a soil cushion not less than 100 mm thick and such slabs are wide enough and strong enough to prevent excessive superimposed loads being transferred directly to the pipes.

- Any drain shall;-

i. Be laid in a straight line between any points where changes of direction or gradients occur.

ii. Be laid with approved flexible joints which will permit joint movement to take place throughout the life of the drainage installation.

iii. Withstand root penetration and not deteriorate when in contact with sewage or water, and will not cause any obstruction in the interior of such drain.

- Be laid at a minimum gradient of 1:60 for 100 Ø and 1:100 for 150 Ø pipes. However the Project Manager may in his discretion permit gradients less than those specified above.
- Where the gradient exceeds 1:5 it must be provided with anchor blocks which must securely fix such drain in place.

4.4.4.1.The Various Parts Of Drainage Systems Are As Following.

I. INSPECTION EYE (IE)

(a) Inspection eyes should be provided:

i. at all junctions (except those of vent pipes) and bends in the drainage system;

ii. within 0,5m downstream of each cleaning eye;

iii. c above and below each vertical or sloping ramp and above each ramp to an inspection chamber.

II. CLEANING EYE (CE)

Cleaning eyes should be provided:

a. above ground at each junction and bend of all soil and waste pipes;

b. underground at not more than 25m for a 100mm drain;

c. at the head of each branch drain longer than 3m;

d. at a distance of 1,2m within the boundary of a single house andat each ramp.

III. OPEN INLETS

No open inlets to drains, such as gulley's, are permitted within a building or beneath any roofed area.

IV. VENT AND ANTI-SIPHON PIPES (VP AND ASP)

A vent pipe the same size as the drain pipe which it ventilates must be provided.

a. at the head of every drain or branch drain into which 2 or more fittings discharge;

b. at each vertical waste water pipe longer than 3,5m and

c. an additional vent must be provided where 8 or more WC's are connected in a row, for example at schools.

V. SEPTIC AND CONSERVANCY TANKS

A septic tank is a key component of a septic system, a small-scale sewage treatment system common in areas that lack connection to main sewage pipes provided by local governments or private corporations .Septic and conservancy tanks must be located at least 3m from any building. French drains, soakage pits

or agricultural drains at least 5m from any building. Care should be taken that underground water supplies are not polluted; where effluent flows away from any underground water supply the distance should be at least 50m. If effluent flows towards an underground water supply, the distance should be considerably greater and will depend on such conditions as depth of water supply, water table and soil or rock formations.The term "septic" refers to the anaerobic bacterial environment that develops in the tank which decomposes or mineralizes the waste discharged into the tank.

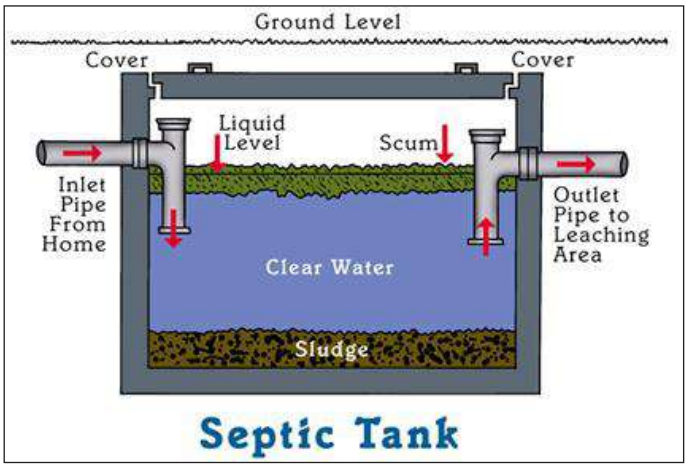

Fig-PG-0191 Septic Tank

VI. GREASE TRAPS

Grease traps should be provided at all large kitchens and also at residences where the kitchen waste is connected to a trench drain.

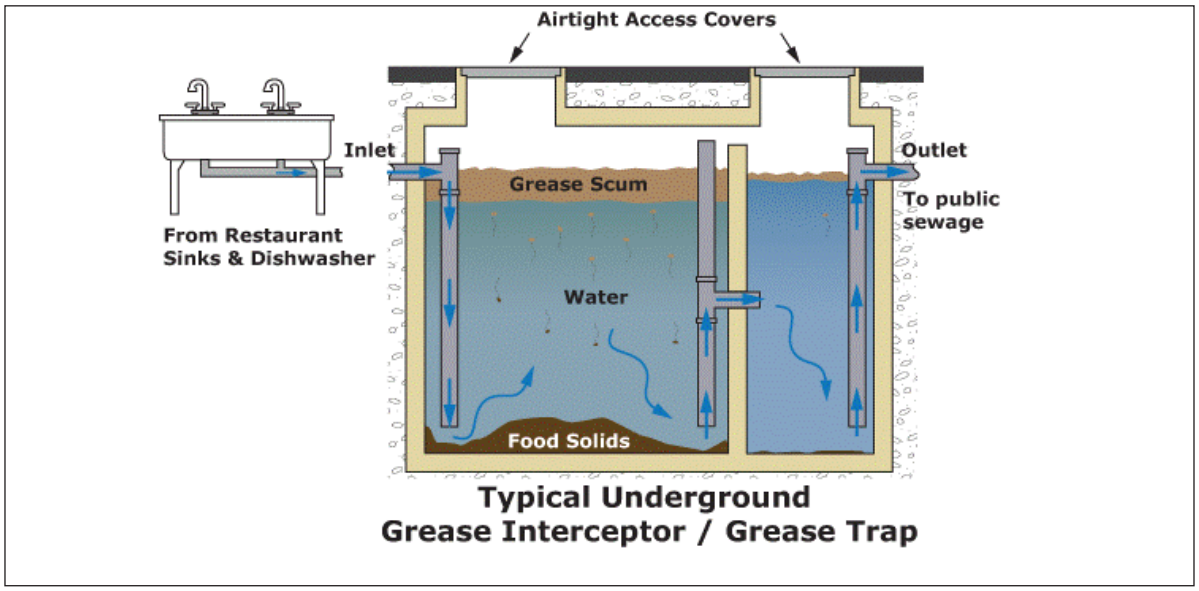

Fig-PG-0192 Grease Trap

VII. STORM WATER DRAINAGE

Storm water is normally conveyed by means of shallow brick or concrete channels, flumes or concrete pipes. No pipes of less than 200 mm diameter should be used. Pipes draining roads should not be less than 300 mm.The size of the concrete storm water pipe depends on: .

- the surface of the area e.g. roof or tar surface; rocky,clay, or sandy ground; grassed surface etc;
- gradient of the ground;
- gradient of the pipe and
- region (inland, Cape coastal area, etc.)

It should be noted that:

- No storm water is allowed to flow into the drainage system;
- Where storm water pipes run under a building they are to have a minimum diameter of 300 mm and must be fitted with catchpits on both sides of the building.

- Storm water from paved areas, roads and sport fields must be efficiently disposed of;
- All ground levels, invert levels, sizes and grades of pipes and channels must be shown on the drawing pad.
- The final disposal of storm water from a site must be clearly defined and must be designed in consultation with the Local Authority where necessary.

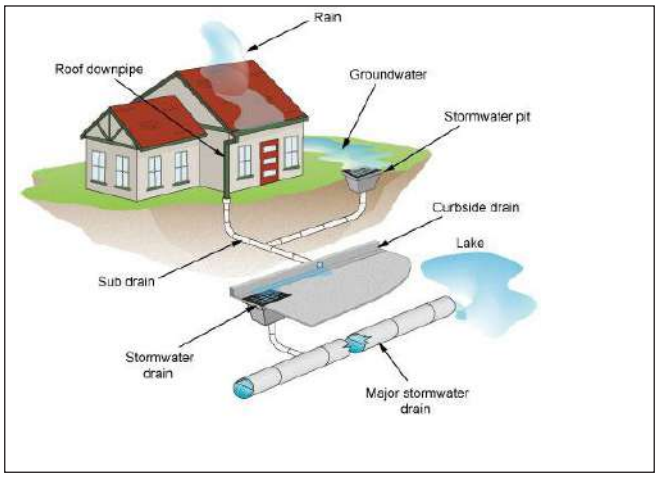

Fig-PG-0193 Building

II. Design Points of a drainage system

- There are some points to note when designing any drainage scheme, these are:
- Foul water is soil water from toilets and waste water from basins, baths, showers, etc.
- The one-pipe system is favoured over the two-pipe system because there are fewer pipes and it is more hygienic.
- The two-pipe system uses a separate vent from each sanitary appliance, which are then joined into a combined vent stack, whereas the single-stack system is simplified.
- All systems are vented and trapped to exclude smells and foul air.
- Traps are devices, which contain a water-seal of about 50mm to 75mm to prevent gases escaping into sanitary fittings like wash basins, water closets, Washbasins, baths, showers, etc.
- Foul water pipes exceeding 6.4 metres long are usually required to be vented.

- If the waste pipe from a wash basin is at too steep a gradient, self-siphonage may occur. This is where the contents of the trap are sucked out into the waste pipe because the water flows away too quickly thus emptying the trap.

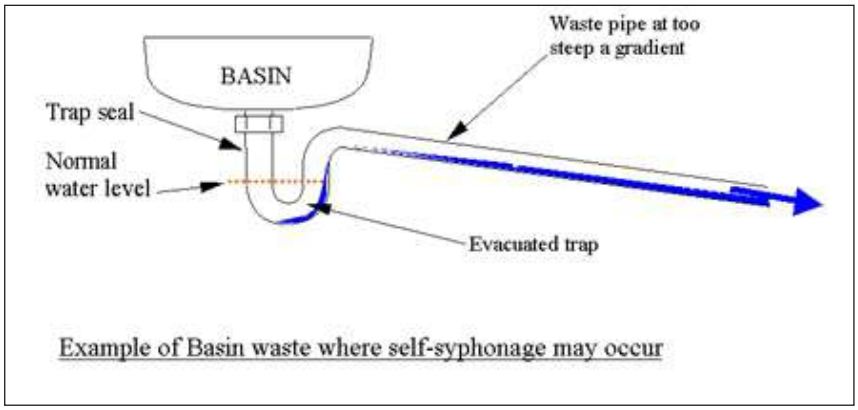

Fig-PG-0194 Basin Waste

- Induced siphonage can occur if a suction pressure develops in the drainage system. A suction pressure of 500 N/m2 (50mm water gauge) will reduce the water level in a basin trap by 25mm.

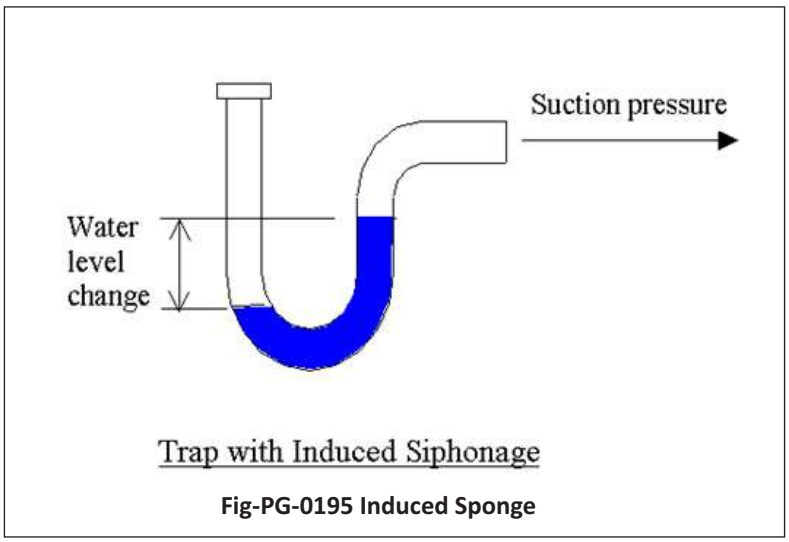

Fig-PG-0195 Induced Sponge

- In badly designed systems backpressure can also occur which is sufficient to remove water from a trap.

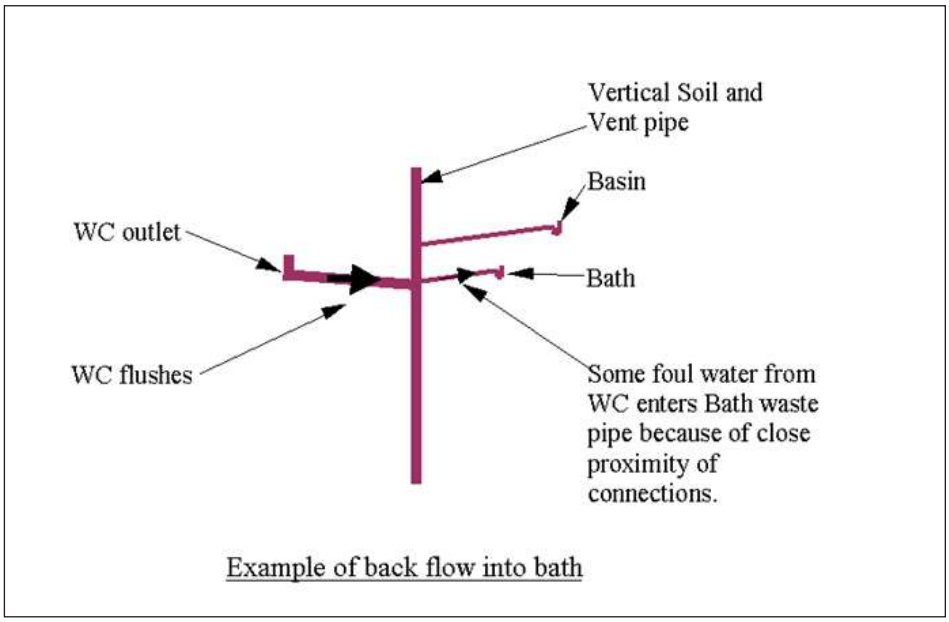

Fig-PG-0196 Back Flow

- Waste pipes from appliances which discharge into larger pipes avoids siphonage problems because the larger pipes do not normally run full.
- Waste pipes from appliances which discharge into pipes of the same diameter have limitations on lengths, number of bends and gradients to minimise siphonage problems.

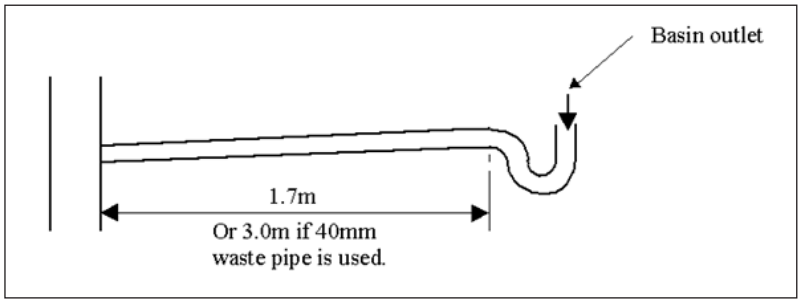

Fig-PG-0197 Waste Pipe

- Self-Siphonage is not normally a problem for Washbasins, baths and showers because of the near flat base of each appliance allowing the trap to re-fill should it empty.
- Soil and Vent stacks should have no waste branch close to the connection of the WC.

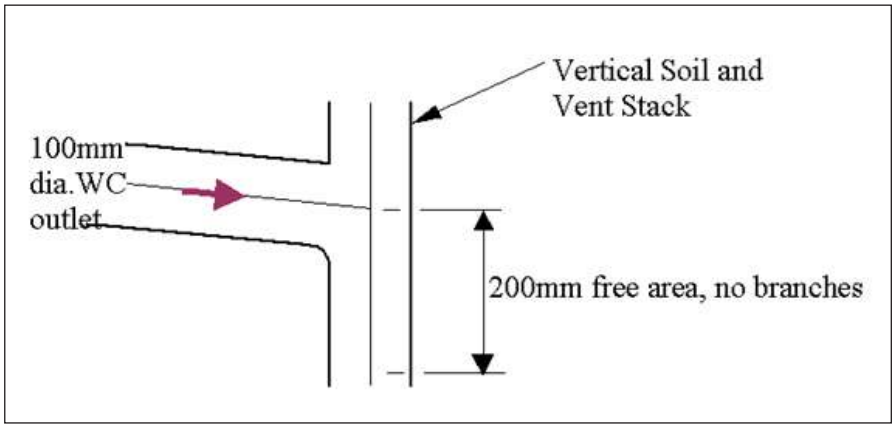

Fig-PG-0198 Soil and Vent Stacks

- Sometimes it is not possible to prevent pressure fluctuations in pipe-work in which case separate vent pipes should be installed. It may not be possible to limit the length of branches or provide reasonable gradients in some installations.
- A velocity of flow of 0.6 to 0.75 m/s should prevent stranding of solid matter in horizontal pipes.
- Gradients from 1 in 40 to 1 in 110 will normally give adequate flow velocities.
- It is normal practice to connect a ground floor water closet straight into a manhole. Self-Siphonage and induced Siphonage will not occur because of the large pipe from a W.C. diameter (100mm) and because the drain is vented.

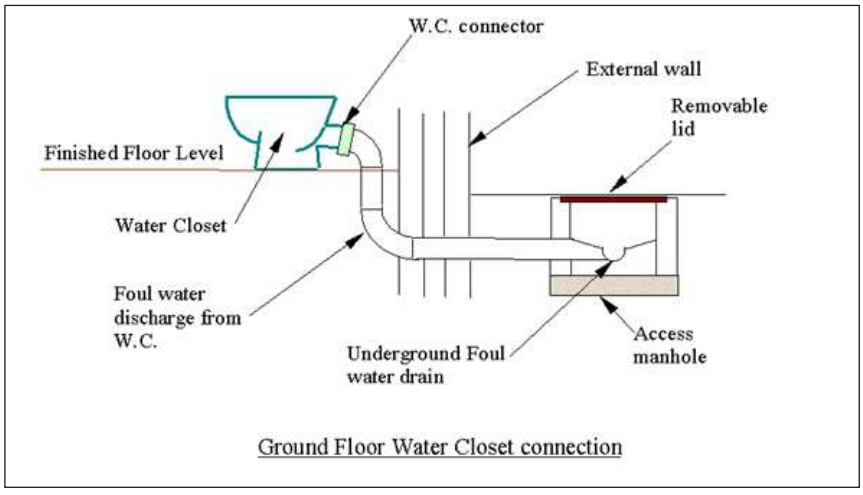

Fig-PG-0199 Water Closet Connection

- Access points should be sited:

  (a) At a bend or change indirection

  (b) At a junction, unless each run can be cleared from an access point.

  (c) On or near the head of each drain run.

  (d) On long runs

  (e) At a change of pipe size.

- The soil & vent stack or branch to which at least one WC is connected must have an internal diameter of at least 100mm.Outlets from wash basins have a 32mm minimum diameter branch pipe and Washbasins and baths have branch discharge pipes of 40mm diameter.
- For large drainage installations pipe can be sized using discharge units and appropriate graphs.
- Drains should be laid at a depth of 900mm (minimum) under roads and at least 600mm below fields and gardens.

4.4.5 Traps-The Entry Of Foul Air To The Building Should Be Prevented By Suitable Traps, Properly Sited.

I. Traps should always be of a self-cleansing pattern. A trap which is not an integral part of an appliance should be directly attached to its outlet, and the pipe bore should be uniform throughout and have a smooth surface.

II. Traps for use in domestic waste installations and all other traps should be conveniently accessbile and provided with cleaning eyes, or other means of cleaning.

III. Traps for Various Purposes

MINIMUM INTERNAL DIAMETERS FOR WASTE APPLIANCES	
ITEM	DIAMETER mm
Drinking fountains	25

Wash basins	30
BidetsRECOMMENDATIONS FOR DESIGN OF SINGLE STACK SYSTEM	30
Domestic Washbasins and baths	40
Shower bath trays	40
Domestic bath tubs	50
Hotel and canteen Washbasins	50
Urinals Stall urinals (with not more than 1-20 m of channel drainage)	50
Floor traps (outlet diameter)	65

DEPTH OF SEALS FOR DIFFERENT PLUMBING SYSTEM				
SL NO	ITEM	TWO-PIPE mm	ONE-PIPE mm	SINGLE STACK mm
I	Water closets	50	50	50
ii	Floor traps	50	50	50
iii	Other fixtures, directly connected to the stack:			
	a) Where attached to branch waste pipes of dia 75 mm or more	40	40	40
	b) Where, attached to branch waste pipe of less than 75 mm dia	40	40	75
Note—When connection is made through floor trap, no separate seals are required for individual fixtures.				

SL NO.	COMPONENT	ACTION TO BE GUARDED AGAINST	DESIGN RECOMMENDATIONS
(1)	(2)	(3)	(4)
I	Wash basin waste	Self-siphonage	75 mm seal P-trap to be used. The maximum slope of a 40 mm waste pipe to be determined according to the length of the waste pipe. Any bends to be not less than 75 mm radius to centre line. Waste pipes longer than the recommended maximum length of 165 cm should be vented, or a larger diameter waste pipe or approved resealing trap should be used
ii	Bath and Washbasin wastes 38 mm trap and 38 mm waste pipe	Self-siphonage	75 mm seal traps to be used. Self-siphonage not important. Length and slope of waste branch not critical, but long waste pipes may be troubled by sedimentation and access for cleaning should be provided
		Backing up of discharge from W.C. branch into bath branch	Position of entry of bath waste into stack to be as the bath waste pipes may be connected to the stack so that its centre line meets the centre line of the stack at or above the point where the centre line of the WC branch meet the centre line of the stack, or at least 20 cm below it21
iii	Soil branch connection to stack	Induced siphonage lower in the stack when W.C. is discharged	W.C. connections should be swept in the direction of flow. Fittings should have a minimum sweep of at least 5 cm radius
iv	Bend at foot of stack	Back pressure at lowest branch. Build-	Bend to be of large radius or two 135° bends to be used. Vertical distance between lowest branch connection and invert of drain to be at least 750

		up of detergent foam	mm (450 mm for 2 storied houses with 100 mm stack)
v	Offsets in stacks	Back pressure above offset	There should be no offsets in stacks below the topmost appliances unless venting is provided to relieve any back pressure. Offsets above the topmost appliances are of no significance.
vi	Floor traps and 75 mm branch pipe	Induced Siphonage	50-mm seal trap to the used. Slops of the branch pipe may vary from 1 in 50 to 1 in 10
Note—The recommendations apply to systems with swept-inlet WC branches. With straight inlet branches a 100 mm stack with no vents has been found satisfactory for up to four storeys, a 150 mm stack with no vents has been found satisfactory for up to 15 storeys.			

Source of Tables (IS: Code of practise for Plumbing and Water supply)

Unit 4.5- Common Terms In Plumbing

Common terms in Plumbing (IS: Code of practise for Plumbing and Water supply)

1. Air Gap—The distance between the lowest point of a water inlet or feed pipe to an appliance and the spill-over level (or the overflowing level) of the appliance.

2. Appliance—A receptacle or apparatus in which water is heated, treated or measured, or in which it is utilized before passing to waste.

3. Approved—Accepted or acceptable under an applicable specification stated or cited in this code or accepted as suitable for the proposed use under the bye-laws or regulations of the Authority.

4. Area of a Floor or Floor Area of a Building—The area of a horizontal section taken at the plinth or floor level of any storey of a building inclusive of all projecting and overhanging parts of the external walls and of such portions of the partition walls as belong to the building.

5. Available Head—The head of water available at the point of consideration due to main's pressure or overhead tank or any other source of pressure.

6. Authority Having Jurisdiction—The authority which has been created by a statute and which for the purpose of administering the code may authorise a committee or an official to act on its behalf; hereinafter called the 'Authority'

7. Backflow—The flow of water or other liquids, mixtures or substances into the distributing pipes of a potable supply of water system from any source or sources other than its intended source .

8. Backflow Prevention Device—Any approved measure or fitting or combination of fittings specifically designed to prevent backflow or back-Siphonage in a water service.

9. Back Siphonage—The flowing back of used contaminated or polluted water from a plumbing fixture or vessel into a water supply pipe due to a reduced pressure in such pipe .

10. Branch—Any part of the piping system other than a main.

11. Building—Any permanent or temporary structure built for the support, shelter or enclosure for persons, animals, chattels or property of any kind, and includes a house, out-house, stable, shed, hut and every other such structure, whether of masonry, bricks, wood, mud, metal or any other material but does not include a watchman's booth, a mandap or other similar kinds of temporary structures erected on ceremonial occasions.

12. Branch Ventilating Pipe (B.V.P.) — A pipe, one end of which is connected to the system adjacent to the trap of an appliance and the other to a main ventilating pipe or a drain-ventilating pipe. It is fitted to prevent loss of water seal from a trap owing to partial vacuum back pressure, or surging caused by air movement within the pipe system. It also provides ventilation for the branch waste pipe.

13. Branch Soil Pipe (B.S.P.) — A pipe connecting one or more soil appliances to the main soil pipe.

14. Branch Waste Pipe (B.W.P) A pipe connecting one or more waste appliances to the main waste pipe.

15. Branch Soil Waste Pipe (B.S.W.P.) — A pipe connecting one or more soil and/or waste appliances to the main soil waste pipe (one-pipe system).

16. Building Drain The building (house) drain is the part of the lowest horizontal piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building (house) sewer beginning one metre outside the building wall.

17. Building Sewer - The building (house) sewer is the part of the horizontal piping of a drainage system which extend from the end of the building drain and which receives the discharge of the building drain and conveys it to a public sewer, private sewer, individual sewage-disposal system, or other point of disposal.

18. Cleaning Eye— An access opening in a pipe or pipe fitting arranged to facilitate the clearing of obstructions and fitted with removable cover.

19. Crown of Trap— The topmost point of the inside of a trap outlet.

20. Diameter— The nominal diameter of pipes fittings.

21. Drain— Any pipe which conveys discharges from sanitary appliances in a drainage system.

22. Drain Ventilating Pipe (D.V.P.) — A pipe installed to provide flow of air to or from a drain to prevent undue concentration of foul air in drain. Main soil pipe or main waste pipe may serve as drain ventilating pipe wherever their upper portions, which do not receive discharges, are extended to the roof level and let open to air.

23. Diameter—Unless specifically stated, the nominal (internal) diameter of the pipe.

24. Direct Tap/Faucet—A Tap/Faucet which is connected to a supply pipe and subject to pressure from the water main.

25. Domestic Purposes—All purposes incidental to the occupation of a dwelling.

26. DowntakeTap/Faucet—A Tap/Faucet connected to a system of piping not subject to water pressure from the water main.

27. Dwelling—A building used or constructed or adapted for use wholly or principally for human habitation. It may include garages, other outhouses appurtenant thereto.

28. Fitting—Coupling, flange, branch, bend tees, elbows, unions, waste with plug, P or S trap with vent, stop ferrule, stop valve, bib Tap/Faucet, pillar Tap/Faucet, globe Tap/Faucet, ball valve, cistern storage tank, baths water-closets, boiler gyser, pumping set, with motor and accessories, meter, hydrant valve and any other article used in connection with water supply and sanitation.

29. Float Operated Valve—Ball valves or ball Tap/Faucets and equilibrium by valves operated by means of a float.

30. Flushing Cistern—A cistern provided with a device for rapidly discharging the contained water and used in connection with a sanitary appliance for the purpose of cleansing the appliance and carrying away its contents into a drain.

31. Fixture Unit—A quantity in terms of which the load producing effects on the plumbing system of different kind of plumbing fixtures are expressed on some arbitrarily chosen scale

32. General Washing Place—A washing place provided with necessary sanitary arrangement and common to more than one tenement.

33. Horizontal Pipe—Any pipe or fitting which makes an angle of more than 45° with the vertical.

34. Insanitary—Contrary to sanitary principles or injurious to health.

35. Induced Siphonage— The extraction of water from a trap by Siphonage set up by reduction of pressure at the outlet of the trap.

36. Main Soil Pipe (M.S.P.) — A pipe connecting one or more branch waste pipes to the drain.

37. Main Ventilating Pipe (M.V.P.) — A pipe which receives a number of branch ventilating pipes.

38. Main Waste Pipe (M.W.P.) — A pipe connecting one or more branch waste pipes to the drain.

39. Main Soil Waste Pipe (M.S.W.P.) — A pipe connecting one more branch soil waste pipes to the drain.

40. Period of Supply—The period of the day or night during which water supply is made available to the consumer.

41. Pipe Work—Any installation of piping with its fitting.

42. Plinth—The portion of a structure between the surface of the surrounding ground and surface of the floor, immediately above the ground.

43. Plumbing—(a) The pipes, fixtures and other apparatus inside a building for bringing in the water supply and removing the liquid and water borne wastes; (b) The installation of the foregoing pipes, fixtures and other apparatus.

44. Plumbing System—The plumbing system shall include the water supply and distribution pipes; plumbing fittings and traps; soil, waste, vent pipes and anti-siphonage pipes; building drains and building sewers including their respective connections, devices and appurtenances within the property lines of the premises, and water-treating or water-using equipment.

45. Potable Water—Water which is satisfactory for drinking, culinary and domestic purposes and meets the requirements of the Authority.

46. Premises—Premises shall include passages, buildings and lands of any tenure, whether open or enclosed, whether built on or not, and whether public or private in

respect of which a water rate or charge is payable to the Authority or for which an application is made for supply of water.

47. Public Building—A building used or intended to be used either ordinarily or occasionally as a church, chapal, temple, mosque or any place of public worship, DHARAMSHALA, college, school, theatre, cinema, public concert room, public hall, public bath, hospital, hotel, restaurent, lecture room or any other place of public assembly.

48. Pipe Ears— Two wings cast integrally with the pipe socket provided with holes to take fixing nails or screws.

49. Pipe Systems— The system to be adopted will depend on the type and planning of the building in which it is to be installed and will be one of the following:

a. Two Pipe System -A discharge pipe system comprising two independent discharge pipes one of which conveys soil directly to the drain, the other conveying waste water to the drain through a trapped gully. The system may also require ventilating pipes.

b. One Pipe System -The plumbing system in which the waste connection from Washbasins, baths and wash basins and the soil pipe branches are all collected into one main pipe which is connected directly to the drainage system. Gully traps and waste pipes are completely dispensed with but all the traps of water closets, basin, etc, are completely ventilated to preserve water seal.

c. Single Stack System -One pipe system without trap ventilation pipe work.

50. Self Siphonage— The extraction of water from a trap by siphonage setup by the momentum of the discharge from the sanitary appliance to which the trap is attached.

51. Stack— A main vertical discharge or ventilating pipe.

52. Service Pipe—Pipe that runs between the distribution main in the street and the riser in the case of a multistoreyed building or the water in the case of an individual house and is subjected to water pressure from such main.

53. Stopcock—A cock fitting in a pipeline for controlling the flow of water.

54. Stop Tap/Faucet—Stop Tap/Faucet includes stop cock, stop valve or any other devices for stopping the flow of water in a line or system of pipe at will.

55. Storage Cistern—A cistern for storing water.

56. Supply Pipe—So much of any service pipe as is not a communication pipe.

57. Supports—Supports, hangers and anchors or devices for supporting and securing pipe and fittings to walls, ceilings, floors or structural members.

58. Trap— A fitting or device so designed and constructed as to provide, when properly vented, a liquid seal which will prevent the back passage of air without materially affecting the flow of sewage or water through.

59. Water Seal—The water in a trap which acts as a barrier to the passage of air through the trap.

60. Vertical Pipe—Any pipe which is installed in a vertical position or which makes an angle of not more than 45° with the vertical.

61. Warning Pipe—An overflow pipe so fixed that its outlet, whether inside or outside a building, is in a conspicuous position where the discharge of any water therefrom can be readily seen.

62. Washout Valve—A device located at the bottom of the tank for the purpose of draining a tank for cleaning, maintenance, etc.

63. Water Line—A line marked inside a cistern to indicate the highest water level at which the supply valve should be adjusted to shut off.

64. Water Main (Street Main)—A pipe laid by the water undertakers for the purpose of giving a general supply of water as distinct from a supply to individual consumers and includes any apparatus used in connection with such a pipe.

65. Water Outlet—A water outlet, as used in connection with the water distributing system, is the discharge opening for the water (a) to a fitting, (b) to atmospheric pressure (except into an open tank which is part of the water supply), and (c) to any water-operated device or equipment requiring water to operate.

66. Water Supply System—Water supply system of a building or premises consists of the water service pipe, the water-distribution pipes, and the necessary connecting pipes, fittings, control valves, and all appurtenances in or adjacent to the building or premises.

67. Waterworks—Waterworks for public water supply include a lake, river, spring, well, pump with or without motor and accessories, reservoir, cistern, tank, duct whether covered or open, sluice, water main, pipe

Tips

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5. Coordinating with Seniors and Working with Team

Unit 5.1 - Team building and its management

Unit 5.2 - Resolving conflicts

Unit 5.3 - Team working skills

Unit 5.4 - Interact with colleagues and seniors within and outside the team

Unit 5.5 - Diaries and log reports

Unit 5.6 - Assessment

PSC/ N 0108

Key Learning Outcomes

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

1. Work as a team with colleagues and share work as per the work load and skills
2. Work with colleagues of other teams
3. Receive work instructions and raw materials from reporting senior
4. Communicate to senior about task status, repairs and maintenance of tools and equipment as required
5. Communicate any potential hazards and expected process disruptions
6. Handover completed task to reporting senior
7. Receive feedback from senior
8. Report any anticipated reasons for delays Interact with colleagues within and outside the team
9. Communicate and discuss work flow related difficulties in order to find solution with mutual agreement Taking instructions from the reporting senior
10. Work as a team with colleagues and share work as per the work load and skills
11. Work with colleagues of other teams
12. Report problem/incident etc.
13. Put team over individual goals
14. Resolve conflicts

Unit 5.1 - Team Management – Meaning and Concept

There are some tasks which can't be done alone. Individuals need to come together, discuss things among themselves and work together towards the realization of a common goal. The individuals forming a team should ideally think more or less on the same lines and should have similar interests and objective.

Fig-PG-0200 Representative Image

5.1.1. What is Team Management?

Team management refers to the various activities which bind a team together by bringing the team members closer to achieve the set targets .

5.1.2. Characteristics of a Good/Effective Team

- **A clear, elevating goal:** This is a goal which has been communicated to all.
- **A results-driven structure:** The goal has been jointly decided by all the team members. They are fully committed towards achieving it.
- **Competent members:** Each team member has the required skill set in order to achieve the team objectives.
- **Unified commitment:** There is nothing happening in silos. With the total commitment from team members, achieving organizational goals becomes easier.
- **A collaborative climate:** Commitment from team members and a good leadership leads to a collaborative team with a productive work environment.
- **Standards of excellence:** Quality orientation is vital to the success of any organization.

5.1.3. What is Team Work?

The sum of the efforts undertaken by each team member for the achievement of the team's objective is called team work. In other words, team work is the backbone of any team.

I. **Think about your team first –**
II. Never underestimate your team member
III. **Discuss –** Before implementing any new idea, it must be discussed with each and every member on an open platform.
IV. **Avoid criticism –** Stay away from criticism and making fun of your team members. Help each other and be a good team player.
V. **Transparency must be maintained and healthy interaction must be promoted among the team members**.

VI. **The team leader must take the responsibility of encouraging the team members** to give their level best and should intervene immediately in cases of conflicts.

VII. **Avoid conflicts in your team**. Don't fight over petty issues and find faults in others. One should be a little adjusting with each other and try to find an alternative best suited to all the team members.

VIII. **Rewards and Recognition –** Healthy competition must be encouraged among the team members.

5.1.4. Resolving Disputes

There are two ways of solving a dispute:

(a) Consensual process: Collaborative Law, Conciliation or Negotiation-It is a dialogue between two or more people or parties intended to reach a beneficial outcome.

(b) Litigation: Litigation or arbitration is the most costly and time-consuming way to resolve a dispute. Each party is represented by an attorney while witnesses and evidence are presented. Once all information is provided on the issue, the arbitrator makes a ruling which provides the final decision. The arbitrator provides the final decision on what must be done and it is a binding agreement between each of the disputing parties.

5.2 Conflict-Everyone, rich or poor, young or old, at workplace or even at home, if is in contact with others, faces one kind or the other type of conflict at many points of time. Conflict is a situation in which one person or a group perceives that its interests are being opposed or negatively affected by another person or group.

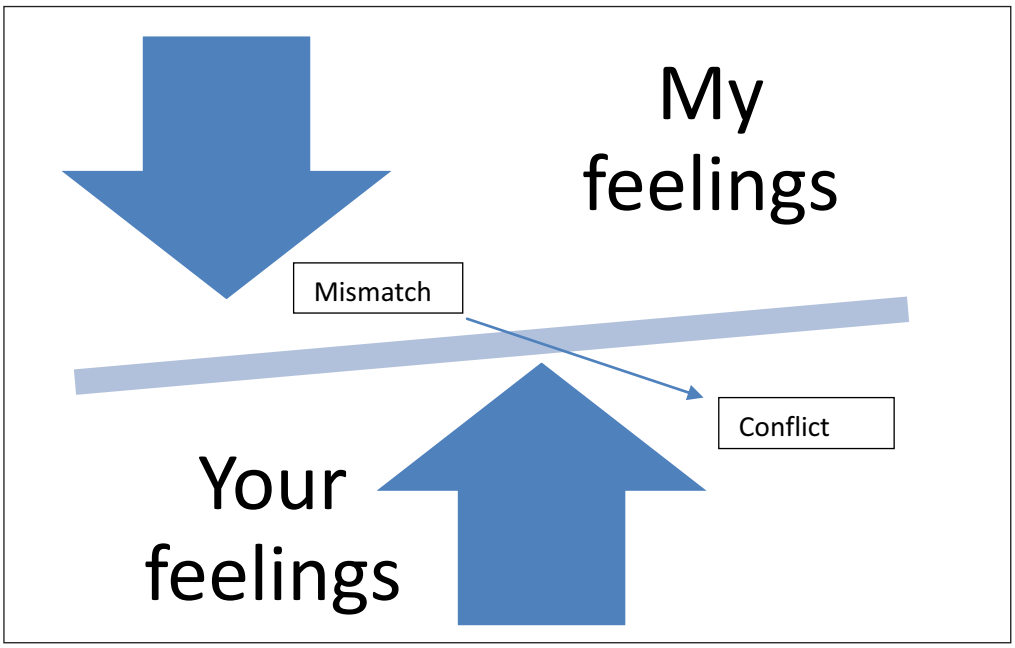

Fig-PG-0201 Conflict

Basically it is a mismatch in the concerns of people involved in a particular activity.

5.1.5. How You Can Avoid Conflict

No one wants to be in a conflict situation. By adopting some minor attitudinal changes one can easily avoid conflicts. These are:

(a) Focus on solution than problem - Rather than dwelling on the past happenings and events, talk about how you want things to be.

(b) Avoid blaming and criticising others by using words – 'You should…., You make me feel……'

(c) Instead of talking about your beliefs base your talk on observation.

(d) Never give any personal comments. If you do not like at any given point of time any action or reaction of any of your colleagues, do not comment on the person, just talk about the behaviour not about the person.

(e) Offer support and collaboration and make it obvious that you are a part of the solution.

(f) Recognize the positive intention.

Unit 5.2 - Resolving Conflict

When a team oversteps the mark of healthy difference of opinion, resolving conflict requires respect and patience.

There are the following ways of solving a conflict:

(a) Negotiation

(b) Mediation

(c) Arbitration

(d) Litigation

5.2.1. Preventing Conflict

(a) Dealing with conflict immediately – avoid the temptation to ignore it.

(b) Being open – if people have issues, they need to be expressed immediately and not allowed to fester.

(c) Practicing clear communication – articulate thoughts and ideas clearly.

(d) Practicing active listening – paraphrasing, clarifying, questioning.

(e) Practicing identifying assumptions – asking yourself "why" on a regular basis.

(f) Not letting conflict get personal – stick to facts and issues, not personalities.

(g) Focusing on actionable solutions – don't belabor what can't be changed.

(h) Encouraging different points of view – insist on honest dialogue and expressing feelings.

(i) Not looking for blame – encourage ownership of the problem and solution.

(j) Demonstrating respect – if the situation escalates, take a break and wait for emotions to subside.

(k) Keeping team issues within the team – talking outside allows conflict to build and fester, without being dealt with directly.

(l) To explore the process of conflict resolution in more depth, take our Bite-Sized Training session on Dealing with Conflict.

Unit 5.3 - Team Working Skills

Team work is important because it helps us synergize, it complements our individual weaknesses, it does help in productivity and it helps one build new and better skills.

Team work is an important part of a working culture. Good team works enhance effective and efficient achievement of an organization's work. Members of a team are more committed to work on goals that they helped to create.

The most important thing about team work is that it enables individuals in the team to focus on one main objective. Team work is also important since everyone contributes their unique abilities, which make the result of their objective more diverse. Team work is generally important because it gives everyone a sense of belonging.

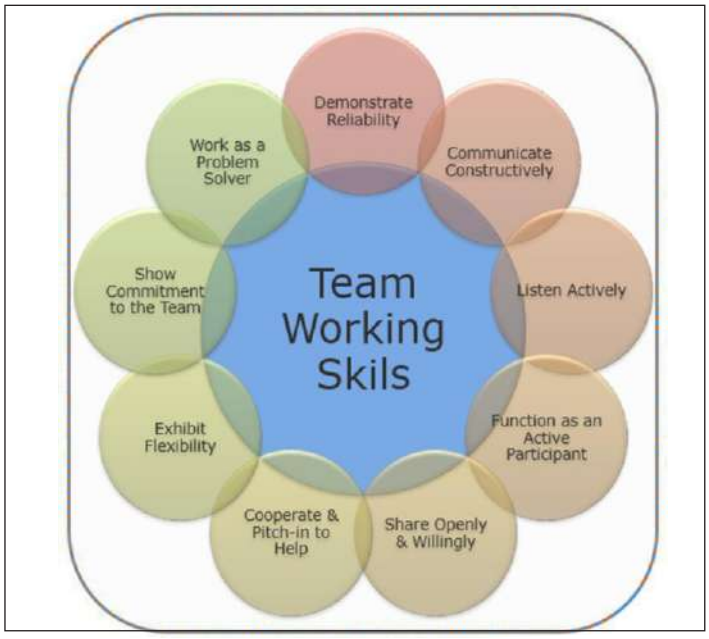

Fig-PG-0202 Team Working Skills

5.3.1. Demonstrates Reliability

(a) A reliable team member who gets work done and does his fair share to work hard and meet commitments.

(b) He or she follows through on assignments. Consistency is key.

5.3.2. Communicates Constructively

(a) Teams need people who speak up and express their thoughts and ideas clearly, directly, honestly, and with respect for others and for the work of the team. That's what it means to communicate constructively.

(b) Such a team member does not shy away from making a point but makes it in the best way possible — in a positive, confident, and respectful manner.

5.3.3. Listens Actively

(a) Good listeners are essential for teams to function effectively.

(b) Teams need team players who can absorb, understand, and consider ideas and points of view from other people without debating and arguing every point.

(c) Such a team member also can receive criticism without reacting defensively.

(d) Most important, for effective communication and problem solving, team members need the discipline to listen first and speak second so that meaningful dialogue results.

5.3.4. Functions as an Active Participant

(a) Good team players are active participants. They come prepared for team meetings and listen and speak up in discussions.

(b) They're fully engaged in the work of the team and do not sit passively on the sidelines. Team members who function as active participants take the initiative to help make things happen, and they volunteer for assignments.

5.3.5. Shares Openly and Willingly

(a) Good team players share. They're willing to share information, knowledge, and experience.

(b) They take the initiative to keep other team members informed. Much of the communication within teams takes place informally.

(c) Beyond discussion at organized meetings, team members need to feel comfortable talking with one another and passing along important news and information day-to-day. Good team players are active in this informal sharing.

(d) They keep other team members in the loop with information and expertise that helps get the job done and prevents surprises.

5.3.6. Cooperates and Pitches in to-Help

(a) Cooperation is the act of working with others and acting together to accomplish a job.

(b) Effective team players work this way by second nature.

(c) Good team players, despite differences they may have with other team members concerning style and perspective, figure out ways to work together to solve problems and get work done.

(d) They respond to requests for assistance and take the initiative to offer help.

5.3.7. Exhibits Flexibility

(a) Teams often deal with changing conditions — and often create changes themselves.

(b) Good team players roll with the punches; they adapt to ever-changing situations.

(c) They don't complain or get stressed out because something new is being tried or some new direction is being set.

(d) In addition, a flexible team member can consider different points of views and compromise when needed. He or she doesn't hold rigidly to a point of view and argue it to death, especially when the team needs to move forward to make a decision or get something done.

(e) Strong team players are firm in their thoughts yet open to what others have to offer — flexibility at its best.

5.3.8. Shows Commitment to the Team

(a) Strong team players care about their work, the team, and the team's work.

(b) They show up every day with this care and commitment up front.

(c) They want to give a good effort, and they want other team members to do the same.

5.3.9. Works as a Problem Solver

(a) Teams, of course, deal with problems. Sometimes, it appears, that's the whole reason why a team is created — to address problems.

(b) Good team players are willing to deal with all kinds of problems in a solutions-oriented manner.

(c) They're problem-solvers, not problem-dwellers, problem-blamers, or problem-avoiders.

(d) They don't simply rehash a problem the way problem-dwellers do.

(e) They don't look for others to fault, as the blamers do. And they don't put off dealing with issues, the way avoiders do.

(f) Team players get problems out in the open for discussion and then collaborate with others to find solutions and form action plans.

Unit 5.4 - Interact With Colleagues And Seniors Within And Outside The Team

Interaction with seniors is extremely essential and should be done with lot of care. Seniors by virtue of a prolonged experience will offer guidance and support, which will also help to improve your skills. Interaction with seniors should be based on the principles of mutual respect and should not confrontational in nature.

Good relationships are also often necessary if we hope to develop our careers. After all, if your boss doesn't trust you, it's unlikely that he or she will consider you when a new position opens up. Overall, we all want to work with people we're on good terms with.

5.4.1. Good Relationship

There are several characteristics that make up good, healthy working relationships:

(a) Trust – This is the foundation of every good relationship. If you trust the people you work with, you can be open and honest in your thoughts and actions, and you don't have to waste time and energy "watching your back."

(b) Mutual Respect – When you respect the people that you work with, you value their input and ideas, and they value yours. Working together, you can develop solutions based on your collective insight, wisdom and creativity.

(c) Mindfulness – This means taking responsibility for your words and actions. Those who are mindful are careful and attend to what they say, and they don't let their own negative emotions impact the people around them.

(d) Welcoming Diversity – People with good relationships not only accept diverse people and opinions, but they welcome them. For instance, when your friends and colleagues offer different opinions from yours, you take the time to consider what they have to say, and factor their insights into your decision-making.

(e) Open Communication – We communicate all day, whether we're sending emails and IMs, or meeting face-to-face. The better and more effectively you communicate with those around you, the richer your relationships will be. All good relationships depend on open, honest communication.

5.4.2. Where to Build Good Relationships

Although we should try to build and maintain good working relationships with everyone, there are certain relationships that deserve extra attention.

5.4.2.1. How to Build Good Work Relationships?

(a) Develop Your People Skills
(b) Good relationships start with good people skills.
(c) Schedule Time to Build Relationships
(d) Appreciate Others
(e) Be Positive
(f) Avoid Gossiping
(g) Listen Actively

Unit 5.5 - Diaries and Log Report

5.5.1. Importance of Log Reports

A supervisor is the crew leader on a construction jobsite. It's up to him to plan, organize, and direct work in a safe, and timely, manner. All supervisors will experience conflict at some point, as well as safety violations and workplace injuries. By keeping a daily record of all activities, your construction site supervisor can protect your business from arbitration and/or litigation.

5.5.2. What is a Daily Log?

The daily log is a book, or software program, into which a supervisor records the day's activities. Record keeping helps ensure project organization, as well as keeps tabs on day-to-day employee happenings. The daily log is essential because it keeps a consistent record, which could be useful if you're ever sued, and need to prove that your workers performed a safety inspection, or conflict was handled immediately and efficiently.

Daily log sectionsinclude:

- Date
- Times of incidents
- Work performed
- Safety topics
- Problems and delays

- Employee conflict
- Equipment usage
- Materials purchased
- General management

5.5.3. What is an Incident Report?

In order to understand the incident report, you'll first need to understand what constitutes an incident. There are two types of events that are considered "incidents."

(a) An event that resulted in an injury. For example: An employee is handling materials and suffers a cut to the finger.

(b) An event that resulted in a near-miss, otherwise known as an event that almost resulted in injury or damage. For example: An employee is handling materials and almost suffers a cut to the finger.

5.5.4. Importance of Site Diaries

(a) Diaries: Each member of the project team is expected to keep a project diary. The diary contains summaries of the day's events in the member's own words. While interacting with seniors note down the information, expectation as communicated by the seniors.They are used to keep track of any daily work activity, conversations, observations, or any other relevant information regarding the construction activities. Diaries can be referred to when disputes arise and a diary happens to contain information connected with the disagreement. Handwritten diaries can be used as evidence in court.

(b) Logs: Logs keep track of the regular activities on the job site such as phone logs, transmittal logs, delivery logs, and RFI (Request for Information) logs.

5.5.5. Daily Field Reports

Daily field reports are a more formal way of recording information on the job site. They contain information that includes the day's activities, temperature and weather conditions, delivered equipment or materials, visitors on the site, and equipment used that day. We should share these reports with our seniors on a daily basis.

(a) The diaries and daily or other reports are meant to supplement each other and do not need to contain identical information.
(b) The diaries and other reports are public record and may be used in case of litigation
(c) Include only factual information in them.
(d) Minimize personal remarks, which may not be factual, about operations or personnel of the Contractor, Agency, or other organization. Such remarks may be used to demonstrate the inspector was hostile and did not behave in a manner consistent with good faith.
(e) All entries should be clear, neat, and most importantly, legible.
(f) Summarize key points of any discussion of work activities with the Contractor.
(g) Be specific.

Unit 5.6 - Assessments

Answer the following questions

1. A mutually respectable interaction with seniors results in:

a. Progress

b. No confrontation

c. Accomplishment of tasks

d. All of above

2. Logs keep track of the regular activities on the job site such as :

a. phone logs

b. transmittal logs

c. delivery logs

d. and RFI (Request for Information)

e. All of above

3. Good communication skills are necessary for effective team working :

a. True

b. False

Answer /explain the following

1. A flexible team member can consider different points of views and when needed.
2. Ability to listen hampers the collective progress of the team.
3. Team work is an important part of culture explain in five lines – why?

4. What is a conflict and how can you avoid it?
5. What is a conflict and how can you avoid it?
6. How can you transform a conflict?
7. Resolution of conflicts improves efficiency explain how?
8. What are the methods of resolving a conflict?
9. What considerations you will keep in mind while resolving a conflict?
10. How Good Are Your Management Skills?

Tips

Notes

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6. Maintaining a Healthy, Safe & Secure Work Environment

Unit 6.1. - Type of hazards
Unit 6.2 - Hazard analysis
Unit 6.3. - Hazard communication and responsibilities
Unit 6.4. - Safety gears and first aid
Unit 6.5. - Safety guidelines
Unit 6.6. - Assessment

PSC/ N 0109

Key Learning Outcomes

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

1. Avoid accidents related to use of sharp tools and equipment
2. Attend and actively participate in the health and safety campaigns organized by the company or any other authority State importance of taking precautions while working
3. Use or wear safety gear (helmet, gloves, goggles, safety shoes, ear plugs, etc.) as per the rules of the company
4. Attend fire drills or any other safety drills organized by the company or any other authority
5. Learn first-aid procedure
6. Use insect repellents and safe drinking water
7. Use site toilets and follow other hygienic practices
8. Understand the evacuation and emergency procedures z

Unit 6.1 - Hazards

Construction
The fatal injury rate for the construction industry is higher than the national average in this category for all industries. There are common hazards in the plumbing industry. It is important to learn about these hazards and how they can be controlled so people at work are not exposed to risk.

- Powered Tools
- Hand Tools
- Prevention of Falls
- Manual Handling
- Hazardous Substances
- Biological Hazards
- Electricity
- Burns
- Trenches and Confined Spaces
- Sunburn and Heat Stress

Within the plumbing industry, plumber may be involved in a range of work activities such as:

- installing hot water and gas services
- replacing guttering and downpipes
- laying and connecting water and sewage pipes
- fixing Washbasin or sewage blockage

6.1.1Powered Tools

Powered tools are used to carry out everyday tasks in the plumbing industry. Powered tools present serious risks if not used and maintained correctly. The most common injuries are to hands and fingers, which could be cut, broken or crushed. Eye injuries are often caused by pieces of material flying off while being cut or ground by powered tools. Such injuries can lead to long periods away from work and sometimes result in permanent disability.

6.1.2. Hand Tools

Hand tools can also be dangerous if they are not used correctly. A common cause of accidents with hand tools is using the wrong tool for the job. When hazards cannot be eliminated or sufficiently reduced by engineering controls or safe working procedures alone, the person may need to wear (PPE) to improve protection. Personal protective equipment may include safety glasses or goggles, earplugs or earmuffs, protective gloves, overalls or other close fitting clothing. Safety shoes or boots with reinforced toe-caps will protect feet if any heavy or sharp items are dropped.

6.1.3. Prevention of Fall

Prevention of fall Many plumbing tasks are carried out at heights: these include work on roofs, installing or repairing gutters and downpipes, accessing roof cavities through manholes. Safe work methods must be established before a worker is required to access the task. The options for work at height (in their preferred order) are:

(a) Use fall protection devices (such as temporary work platforms or scaffolding)

(b) Use a work positioning system (such as a rope access system to position and support the worker for the duration of the task)

(c) Use a fall injury prevention system (such as an industrial safety net or a safety harness)

(d) Use a ladder, as long as it can be employed safely for the duration of the task – this will require procedures and training for the workers who will use it

6.1.4. Manual Handling

Manual Handling - Plumbers' work often involves significant manual handling hazards. Handling heavy and awkward objects, often in uncomfortable postures because of lack of space to move freely, creates a risk of traumatic injury such as back strain. The need for continuous repetitive movements can lead to ‘overuse' injuries, affecting neck, back, hand and arms over a period of time. Work should be arranged and monitored to minimize the risk of overuse injuries.

6.1.5. Hazardous Substances

Hazardous Substances and Dangerous Goods Hazardous substances are chemicals used to carry out work, or present in the work environment. All of these may create hazards for plumbers if their use in the workplace is not managed with care:

- Oxy-acetylene
- Fluxes (solder)
- lead
- Hydrochloric acid
- Degreasers and solvents
- Adhesives
- Caulking compounds

6.1.6. Biological Hazards

Biological Hazards -Health effects of exposure to sewage include tetanus (caused by a toxin produced by bacteria common in soil and sewage), leptospirosis (caused by a parasitic worm), hepatitis A, and parasites such as giardia and cryptosporum. The degree of the harm that can result depends on the microbes present, and the extent and duration of exposure. Microbes in raw sewage can enter the body through the nose or mouth, particularly if a person drinks contaminated water or by hand-to-mouth transmission.

(a) Assume anything touched by sewage is contaminated

(b) Do not eat or drink in any sewage handling area

(c) Wash hands well with soap and clean (preferably hot) water before eating or drinking, and after touching any surface or object that may be contaminated by sewage

(d) Immediately wash and disinfect any wound that comes into contact with sewage

(e) Change out of work clothes before leaving the work site (soiled work clothes should be bagged and laundered separately from other clothing)

(f) Wear appropriate protection: this will include rubber boots and gloves, overalls and eye protection (wear goggles if a hose will be used, as safety glasses will not protect against splashing)

6.1.7. Electricity

Electricity -Electric leads must be kept away from water. Because plumbers use powered tools in proximity to water supply, and out of doors in all weather conditions, there is always the possibility of electrocution if work practices do not take into account the presence of electrical hazard. Insulated hot water pipes with 240-volt heat trace cables are used to maintain water temperature in many modern apartments. If power to the heat trace cable is not isolated, there is potential for electrocution when a plumber unknowingly cuts through the insulated pipe. Simply turning off the water supply valve will NOT shut down the power to the cable.

6.1.8. Burns

Burns -Hot water services store water at high temperatures. Maintenance and repair work must be carried out carefully to avoid scalds and steam burns. The unexpected release of hot water or steam could result in serious injury and permanent disfigurement.

6.1.9. Trenches and Confined Spaces

Plumbers working in trenches, pits, tanks, beneath houses and in roof cavities must understand and plan for the significant hazards of confined spaces. In sewage systems, the release of toxic gases can cause collapse, unconsciousness and death. Lack of oxygen is also potentially fatal. Before any worker begins a job in a confined space (such as a pit or tunnel) where gases could be present or oxygen may be deficient, there must be a full assessment of the worksite and the safeguards required.

6.1.10. Sunburn and Heat Stress

Heat stress, sunburn and skin cancer can all result from prolonged exposure to ultraviolet radiation from the sun. The longer the skin is exposed, the greater the risk – regardless of tan or skin pigment.

6.1.11Potential Hazards for Workers in Construction Include:

(a) Scaffolding

Hazard: When scaffolds are not erected or used properly, fall hazards can occur. About 2.3 million construction workers frequently work on scaffolds. Protecting these workers from scaffold-related accidents would prevent an estimated 4,500 injuries and 50 fatalities each year.

Solutions:

i. Scaffold must be sound, rigid and sufficient to carry its own weight plus four times the maximum intended load without settling or displacement. It must be erected on solid footing.

ii. Unstable objects, such as barrels, boxes, loose bricks or concrete blocks must not be used to support scaffolds or planks.

iii. Scaffold must not be erected, moved, dismantled or altered except under the supervision of a competent person.

iv. Scaffold must be equipped with guardrails, midrails and toeboards.

v. Scaffold accessories such as braces, brackets, trusses, screw legs or ladders that are damaged or weakened from any cause must be immediately repaired or replaced.

vi. Scaffold platforms must be tightly planked with scaffold plank grade material or equivalent.

vii. Synthetic and natural rope used in suspension scaffolding must be protected from heat-producing sources.

viii. Scaffold can be accessed by using ladders and stairwells.

ix. Scaffolds must be at least 10 feet from electric power lines at all times.

(b) Fall protection

Hazard: Each year, falls consistently account for the greatest number of fatalities in the construction industry. A number of factors are often involved in falls, including unstable working surfaces, misuse or failure to use fall protection equipment and human error. Studies have shown that using guardrails, fall arrest systems, safety nets, covers and restraint systems can prevent many deaths and injuries from falls.

Solutions:

i. Consider using aerial lifts or elevated platforms to provide safer elevated working surfaces;

ii. Erect guardrail systems with toe boards and warning lines or install control line systems to protect workers near the edges of floors and roofs;

iii. Cover floor holes; and/orUse safety net systems or personal fall arrest systems (body harnesses).

(C) Ladders

Hazard: Ladders and stairways are another source of injuries and fatalities among construction workers.

Solutions:

i. Use the correct ladder for the task.

ii. Make sure that ladders are long enough to safely reach the work area.

iii. Mark or tag ("Do Not Use") damaged or defective ladders for repair or replacement, or destroy them immediately.

iv. Never load ladders beyond the maximum intended load or beyond the manufacturer's rated capacity.

v. Be sure the load rating can support the weight of the user, including materials and tools.

vi. Avoid using ladders with metallic components near electrical work and overhead power lines.

(d) Stairways

Hazard: Slips, trips and falls on stairways are a major source of injuries and fatalities among construction workers.

Solutions:

i. Stairway treads and walkways must be free of dangerous objects, debris and materials.

ii. Slippery conditions on stairways and walkways must be corrected immediately.

iii. Make sure that treads cover the entire step and landing.

iv. Stairways having four or more risers or rising more than 30 inches must have at least one handrail.

(e) Trenching

Hazard: Trench collapses cause dozens of fatalities and hundreds of injuries each year.

Solutions:

i. Never enter an unprotected trench.

ii. Always use a protective system for trenches feet deep or greater.

iii. Employ a registered professional engineer to design a protective system for trenches 20 feet deep or greater.

iv. Protective Systems:

- Shoring to protect workers by installing supports to prevent soil movement for trenches that do not exceed 20 feet in depth.
- Shielding to protect workers by using trench boxes or other types of supports to prevent soil cave-ins.

v. Always provide a way to exit a trench--such as a ladder, stairway or ramp--no more than 25 feet of lateral travel for employees in the trench.

vi. Keep spoils at least two feet back from the edge of a trench.

vii. Make sure that trenches are inspected by a competent person prior to entry and after any hazard-increasing event such as a rainstorm, vibrations or excessive surcharge loads.

(f) Cranes

Hazard: Significant and serious injuries may occur if cranes are not inspected before use and if they are not used properly. Often these injuries occur when a worker is struck by an overhead load or caught within the crane's swing radius. Many crane

fatalities occur when the boom of a crane or its load line contact an overhead power line.

Solutions:

i. Check all crane controls to insure proper operation before use.
ii. Inspect wire rope, chains and hook for any damage.
iii. Know the weight of the load that the crane is to lift.
iv. Ensure that the load does not exceed the crane's rated capacity.
v. Raise the load a few inches to verify balance and the effectiveness of the brake system.
vi. Check all rigging prior to use; do not wrap hoist ropes or chains around the load.
vii. Barricade accessible areas within the crane's swing radius.

(g) Forklifts

Hazard: Approximately 100 employees are fatally injured and approximat ely 95,000 employees are injured every year while operating powered industrial trucks. Forklift turnover accounts for a significant number of these fatalities.

Solutions:

i. Properly maintain haulage equipment, including tires.
ii. Do not modify or make attachments that affect the capacity and safe operation of the forklift without written approval from the forklift's manufacturer.
iii. Examine forklift truck for defects before using.
iv. Follow safe operating procedures for picking up, moving, putting down and stacking loads.
v. Drive safely--never exceed 5 mph and slow down in congested or slippery surface areas.

(h) Head Protection

Hazard: Serious head injuries can result from blows to the head.

Solution:

i. Be sure that workers wear hard hats where there is a potential for objects falling from above, bumps to their heads from fixed objects, or accidental head contact with electrical hazards.

Unit 6.2 - Hazard Analysis

(a) Chemicals (Pouring/Handling)

Task	Hazard	Cause	Prevention
General Use	Eye Injury	Splash, fumes	Goggles
	Contact irritation, burn or absorption	Splash, skin contact	Gloves (appropriate type for chemical), apron (if necessary), long sleeves
	Ingestion	Breathing fumes	Wear respirator if needed
	Face	Splash	Wear Face Shield (if necessary)

PPE Required:

i. Goggles
ii. Gloves protective Clothing (apron)
iii. Respirator (as needed)
iv. Face shield (if necessary)

(b) Cleaning (Sweeping/Mopping/Buffing)

Task	Hazard	Cause	Prevention
General Use	Trauma	Projectiles, impact, chemical contact	Situational awareness, gloves, protective clothing
	Foot Injury	Dropped object on foot	Wear safety shoes
	Ingestion	Chemicals, dust	Wear respirator or dust mask if needed

PPE Required:

i. Safety Shoes/boots

ii. Gloves (optional) protective Clothing (long pants recommended to prevent chemical splash on skin)

iii. Respirator or dust mask (as needed)

(c) Trenching

Task	Hazard	Cause	Prevention
Routine Maintenance/Repair	Hand Injury	Confined work areas, sharp edges/objects, rotating parts	Gloves, situational awareness
	Foot Injury	Equipment rolls over foot, object drops on foot	Wear safety shoes
	Trauma	Rotating parts	Situational awareness, appropriate clothing
	Eye Injury	Flying particles	Safety glasses
	Noise	Equipment Operation	Use hearing protection

Routine Operation	Noise	Equipment Operation	Use hearing protection
	Head Injury	Bump head, objects fall on head	Wear hard hat (as necessary)
	Foot Injury	Equipment rolls over foot, object drops on foot	Wear safety shoes
	Hand Injury	Sharp edges/objects	Wear Gloves

PPE Required:

Protective Clothing

i. Safety Shoes/Boots
ii. Safety Glasses
iii. Hard Gloves and Hearing Protection

(d) Drill Bit Sharpener

Task	Hazard	Cause	Prevention
General Use	Eye Injury	Projectiles, filings	Safety glasses with side shield or appropriate safety goggles
	Hand Injury	Point of operation, ingoing nip points, rotating parts, flying chips and sparks	Situational awareness
	Electrical Shock	Improper grounding, improper operations and maintenance	Proper grounding of frame, manufacturer's instructions strictly followed

PPE Required:

i. Safety Glasses w/side shield

ii. Protective Clothing

iii. Safety Shoes/Boots

iv. Hearing Protection

(e) Hand Held Portable Power Tools

Task	Hazard	Cause	Prevention
General Use	Inhalation	Dust/particles generated during machine operation	Appropriate natural ventilation, disposable respirators (if necessary), automatic vacuum machine
	Eye Injury	Projectiles	Safety glasses with side shield or appropriate safety goggles
	Foot Injury	Drop object on foot	Wear safety shoes
	Hand Injury	Point of operation, ingoing nip points, rotating parts, flying chips & sparks	Machine guards, situational awareness
	Head Protection	Projectiles	Face Shield
	Fire	Sparks	Appropriate placed fire extinguisher, remove all combustibles and fire hazards from machine area
	Noise	Machine operation	Hearing protection
	Electrical Shock	Improper grounding, improper operations and maintenance	Proper grounding of frame, manufacturer's instructions strictly followed

PPE Required:

i. Protective Clothing

ii. Safety Shoes/Boots

iii. Safety Glasses

iv. Hard Gloves

v. Hearing Protection

(f) Lifting/Carrying Objects/working on Loft/Mezzanine/Roofing Operations

Task	Hazard	Cause	Prevention
General Use	Trauma	Impact	Situational awareness, gloves, back brace/belt (optional)
	Foot Injury	Dropped object on foot	Wear safety shoes/boots
	Trauma	Impact, falls	Situational awareness, gloves, fall protection (restraint)

PPE Required:

i. Safety Shoes/Boots

ii. Gloves

iii. Back brace/belt (optional)

(g) Pipe Threading and Cutting

Task	Hazard	Cause	Prevention
General Use	Foot Injury	Drop object on foot	Safety Shoes
	Electric Shock	Improper operation and maintenance, improper grounding	Manufactures instructions strictly followed, proper grounding
	Hand Injury	Point of operation, rotating parts	Gloves, situational awareness
	Eye	Flying particles	Safety glasses w/side shields

	Injury		
	Noise	Running equipment	Hearing protection for noise in excess of 85db

PPE Required:

i. Safety Glasses w/side shields
ii. Safety Shoes/Boots
iii. Gloves
iv. Back brace/belt (optional)
v. Hearing Protection

(h) Portable Arc Welder, Gasoline Powered

Task	Hazard	Cause	Prevention
General Use	Inhalation	Hazardous fumes, gases, dusts	Appropriate ventilation, respirator as required
	Eye Injury	Projectiles, fumes, dusts, flashes	Helmets, goggles/safety glasses, appropriate noncombustible or flameproof screens
	Trauma	Projectiles, burns	Situational awareness, PPE, protective clothing, switch guards
	Foot Injury	Drop object on foot	Wear safety shoes
	Fire	Heat, sparks, slag	Appropriate placed fire extinguisher, remove all combustibles and fire hazards from machine area
	Electrical Shock	Improper grounding, improper operations and maintenance, improper switching	Lockout/tagout, proper grounding of secondary and case portable welding transformers, manufacturer's instructions strictly

		device	followed, proper switching for shutting down machine

PPE Required:

i. Safety Shield/Helmet with Filter Lens
ii. Fire resistant gauntlet gloves
iii. Safety shoes/boots
iv. Respirator
v. Safety glasses w/side shields or Goggles
vi. Protective
vii. Clothing (Full sleeves, no front pockets, no cuffs, Shirt left outside of trousers, made of clean fire-resistant materials)

(i) Valves (Operating)

Task	Hazard	Cause	Prevention
General Use	Eye Injury	Projectiles, fumes, dusts	Safety glasses w/side shields or goggles (for chemical piping), face shield (if needed)
	Trauma	Projectiles, impact, burns	Situational awareness, gloves, protective clothing (long sleeves/pants)
	Foot Injury	Dropped object on foot	Wear safety shoes

PPE Required:

i. Safety Shield/Helmet with Filter Lens
ii. Safety shoes/boots
iii. Safety glasses w/side shields or Goggles
iv. Protective Clothing (long sleeves/pants)

(j) Vice

Task	Hazard	Cause	Prevention

General Use	Eye Injury	Projectiles	Safety glasses with side shield or appropriate safety goggles
	Foot Injury	Drop object on foot	Wear safety shoes
	Hand Injury	Impact, penetration, compression	Gloves, situational awareness

PPE Required:

i. Safety Shield/Helmet with Filter Lens
ii. Safety shoes/boots
iii. Safety glasses w/side shields or Goggles
iv. Protective Clothing (long sleeves/pants)

(k) Power Hacksaw

Task	Hazard	Cause	Prevention
General Use	Inhalation	Dust/particles generated during machine operation, exhaust fumes	Appropriate natural ventilation, respirators when needed
	Eye Injury	Projectiles, burns	Safety glasses with side shield or appropriate safety goggles
	Head Protection	Projectiles	Face shield (as necessary)
	Trauma	Projectiles, point of operation, flying chips & sparks, improper use and operation	Situational awareness, PPE, protective clothing, machine guards, manufacturer's instructions strictly followed
	Foot Injury	Drop object on foot	Safety shoes
	Hand Injury	Point of operation, in-going nip points, rotating parts, flying chips and sparks	Machine guards, situational awareness

	Fire	Sparks	Appropriate placed fire extinguisher, remo ve all combustibles and fire hazards from machine area

PPE Required:

i. Safety Shield/Helmet with Filter Lens
ii. Safety shoes/boots
iii. Safety glasses w/side shields or Goggles
iv. Protective Clothing (long sleeves/pants)
v. Respirators

Unit 6.3 - Hazard Communication and Responsibilities

(a) Maintain a Material Safety Data Sheet (MSDS) for each chemical in the facility.
(b) Make this information accessible to employees at all times in a language or formats that are clearly understood by all affected personnel.
(c) Train employees on how to read and use the MSDS.
(d) Follow manufacturer's MSDS instructions for handling hazardous chemicals.
(e) Train employees about the risks of each hazardous chemical being used.
(f) Provide spill clean-up kits in areas where chemicals are stored.
(g) Have a written spill control plan.
(h) Train employees to clean up spills, protect themselves and properly dispose of used materials.
(i) Provide proper personal protective equipment and enforce its use.
(j) Store chemicals safely and securely.
(k) Hazard Communication
(l) Safety Checklists
(m) The following checklists may help you take steps to avoid hazards that cause injuries, illnesses and fatalities. As always, be cautious and seek help if you are concerned about a potential hazard.

6.3.1. Employee Responsibility

Main employee responsibilities under the are:

(a) Do not intentionally or recklessly interfere with or misuse anything
(b) Co-operation with employer on health and safety matters
(C) Inform employees of the risk and train them in the effective application of the control measures and periodically review the risk assessments

6.3.2. Types of Safety Controls Used by Firms

There are a variety of control systems that can be used by plumbing companies:

- Risk assessments – an identification of the work activities carried out by the plumbing firm that could cause harm to staff or others.
- In undertaking the risk assessment, safety control measures are then identified that will minimize the risk to the lowest practicable level.

6.3.3. Precautions at Work Places

The generally ensuring a safe place of work.

(a) Precautions against falls from height or into excavations

(b) Protection against falling objects

(c) Protection against structural collapse (while work is taking place), i.e. The building falling down

(d) Safeguards when working in excavations

(e) Prevention of drowning (falling into water)

(f) Provision of safe traffic routes (on sites)

(g) Prevention and control of emergencies (site emergency evacuation procedures, etc.)

(h) Provision of welfare facilities – wcs, washing facilities, canteens/rest areas, shower facilities (if required)

(I) Provision of site-wide issues – clean and tidy sites, adequate lighting, constant and fresh air supply, etc.

(j) Training, inspection and reports – proper training of staff, use of properly trained staff to do the work, proper supervision of staff and monitoring the work carried out by staff to ensure it is carried out in a safe manner.

6.3.4. Reporting of Injuries, Diseases and Danger

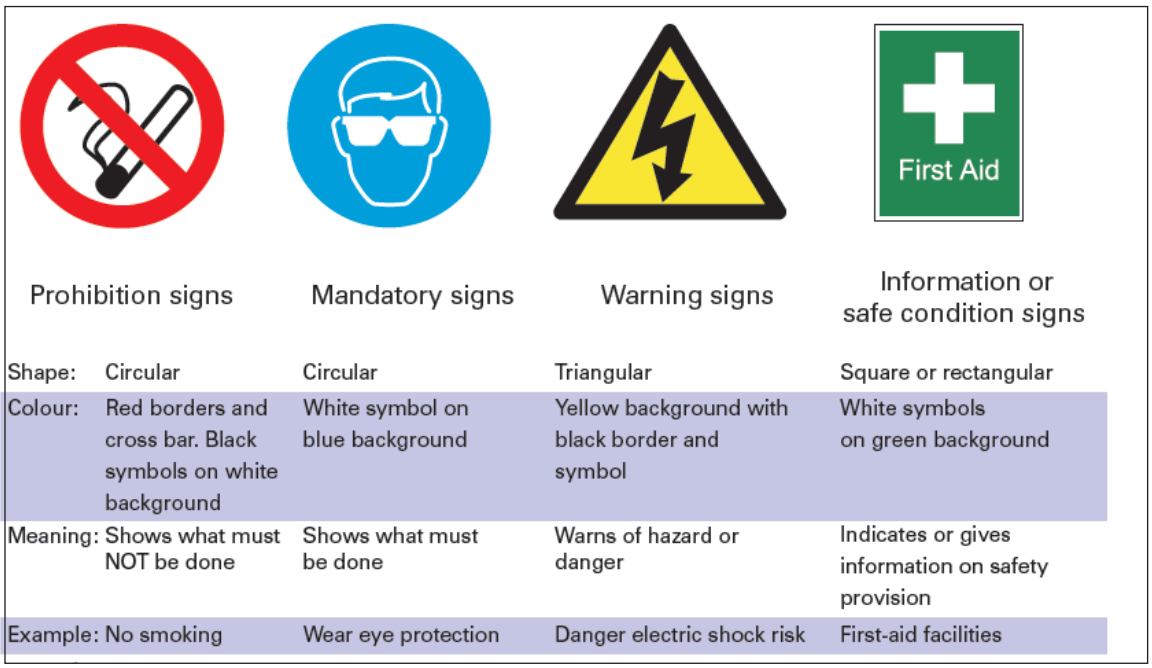
(a) Injuries – fatalities (including members of the public) or injuries

(b) Diseases – if a doctor advises that an employee is suffering from a work related disease

(c) Dangerous occurrences – something that happened that could have resulted in a reportable injury, e.g. The collapse of an excavation

(d) Maintaining Accident book – a document where detail of all accidents is recorded, no matter how minor.

6.3.5. Signs and symbols at site



	Prohibition signs	Mandatory signs	Warning signs	Information or safe condition signs
Shape:	Circular	Circular	Triangular	Square or rectangular
Colour:	Red borders and cross bar. Black symbols on white background	White symbol on blue background	Yellow background with black border and symbol	White symbols on green background
Meaning:	Shows what must NOT be done	Shows what must be done	Warns of hazard or danger	Indicates or gives information on safety provision
Example:	No smoking	Wear eye protection	Danger electric shock risk	First-aid facilities

Fig-PG-0203 Precaution Signs

6.3.6. The Personal Protective Equipment at Work (PPE)

The Personal Protective Equipment at Work (PPE) PPE is defined as equipment (including clothing affording protection against the weather) which is intended to be worn or held by a person at work and which protects him against one or more risks to his health.

(a) **Eye protection** It comes in the form of

i. Safety glasses – a typical application could be lead welding

ii. Safety goggles – these provide a higher level of protection than safety glasses, as they should fit closely to the face

iii. Welding goggles – these include specialist colored lenses.

Fig-PG-0204 Goggles

(b) Hand protection Hand protection that is normally used in plumbing includes:

- General-purpose gloves – these help protect against cutting or puncture, wounds; an example of their use could be lifting concrete blocks or lifting steel tube
- Specialist gloves – these are typically used to deal with hazardous substances such as dry ice used in pipe-freezing applications
- Rubber gloves – these help protect against contact with used soil and waste systems and sanitary appliances. Gloves also provide protection against a disease known as dermatitis, which is caused by the hands coming into contact with materials class as irritants.

Fig-PG-0205 Hand Gloves

(c) Head protection- It is a mandatory requirement to wear a safety helmet on new-build and major construction sites. In addition a safety helmet will need to be worn when work is taking place at heights or above the point where people are working – that could be in a trench. A safety helmet must:

i. Be properly adjusted to fit

ii. Be replaced if it becomes defective or damaged.

Fig-PG-0206 Hard Hat

(d) Foot protection It is important to wear adequate foot protection for the majority of plumbing installation work carried out, owing to the weight of the components used. Adequate foot protection (which can be in the form of a safety shoe) usually includes:

Fig-PG-0207 Foot Protection

(e) Ear protection Ear protection should be worn when working in noisy areas or with equipment that generates high levels of noise. Ear protection is usually in the form of:

i. Ear defenders

ii. Ear plugs.

The need to wear ear protection may be indicated by safety signs or through risk assessments carried out by construction or plumbing companies.

(f) Respiratory protection There are many forms of respiratory protection:

i. Simple dust mask – an example of its use could be working with loft insulation

ii. Cartridge-type respirator – these can guard against a range of substances such as high levels of dust or fumes; different disposable cartridges are required to protect against different types of substances

iii. Full breathing apparatus – usually used in specialist work in confined spaces such as drains or sewers.The top of the ladder should project 1m above a working platform or roof access point.

6.3.7. Classes of Fire

1. Fires are classed into groups according to the fuel type:

I. Class A – fires involving solid materials, extinguished by water

II. Class B – fires involving flammable liquids, extinguished by foam or carbon dioxide

III. Class C – fires involving flammable gases, extinguished by dry powder

IV. Class D – fires involving flammable metals, extinguished by dry powder.

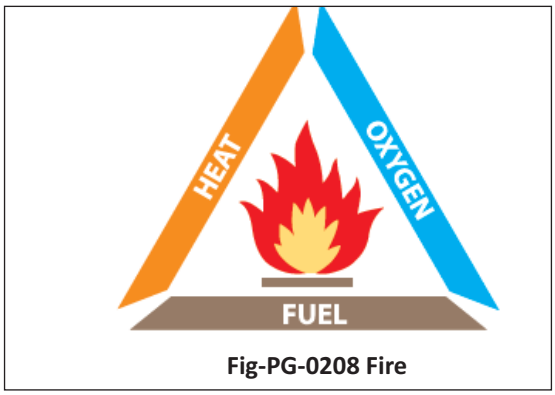


Fig-PG-0208 Fire

2. **Fire-fighting** equipment- Thereare a variety of different types of fire-fighting equipment. In undertaking plumbing work you are more likely to come across the fire extinguisher as the main source of protection; here are some points to its use:

I. An extinguisher should be kept in the immediate work area when hot working, e.g. Using lpg gas heating equipment

II. A fire extinguisher should only be used when it is safe to do so, personal safety must come before attempts to contain a fire

III. Fire extinguishers should only be used by those trained in their use

IV. The following shows the color coding for extinguishers for dealing with the different types of fire.

Type of extinguisher	Colour code	Main use
Water	Red	Wood, paper or fabrics
Foam	Cream	Petrol, oil, fats and paints
Carbon dioxide	Black	Electrical equipment
Dry powder	Blue	Liquids, gases, electrical equipment

Fig-PG-0209 Different types of Fire

Unit 6.4 - Safety Gears and First Aid

1. These procedures apply to a range of different type of emergencies including fire:

I. Find a telephone in a safe environment, well away from the emergency

II. Dial the emergency service number

Fire 102 Police 100 Ambulance 101

III. First-aid arrangements- The following shows the typical contents of a first aid kit.

-

(a) Plasters

(b) Sterile dressings

(c) Triangular bandage

(d) (sling) Safety pins

(e) Disposable gloves

(f) Crepe bandages

(g) Scissors, Tweezers

(h) Cotton wool Tap/Faucete

(I) Alcohol-free antiseptic wipes

(j) Sterile pads

Fig-PG-02010 First Aid Kit items

2. Summoning the emergency services

(a) Minimise the time taken for the emergency services to reach you

(b) Minimise the risk to operators if there is an emergency

(c) Include environmental and other emergencies in your plan.

(d. Employers and the self-employed need to assess the first aid requirements of their work.

(e) Make sure there are enough trained first aiders and facilities to help casualties of illness or injury immediately, and that an ambulance or other professional help can be summoned without delay.

3. First aid as essment should take account of:

(a) The nature of the work

(b) The history and consequences of injuries

(c) The nature and distribution of the workforce

(d) The remoteness of the site from the emergency services, including location, terrain and weather conditions

(e) Working on shared or multi-occupied sites

(f) Holidays and other absences of first aiders

(g) The presence of trainees and the public

(h) The possibility of medical conditions or allergies.

4. Emergency procedures

For any emergency procedures to work well, all operators and managers must aware of the procedures and have the opportunity to test them. You should test, evaluate and modify your procedures to ensure they are working. Ensure you know your location. Be able to provide OS grid references or GPS coordinates, and access points from the main road into the forest or woodland.

The following questions can assist you to review first aid and assess whether improvement is needed: „

(a) Do the first aid kits and modules suit the hazards at your workplace?

(b) Are more first aid kits required?

(c) Are first aid kits accessible to workers?

(d) Are first aid kits well maintained and identifiable to workers?

(e) Is a first aid room or health centre required?

(f) Are first aid facilities well maintained?

(g) Do first-aiders have the skills and competencies required of them and are their skills up-to-date?

(h) Do workers know how to access first aiders?

(I) Are more first aiders needed?

(j) Do workers have access to first aiders at all times?

(k) Do workers and other people know what to in an emergency situation?

(l) Is there easy access for emergency services, such as parking for an ambulance?

Unit 6.5 - Safety Guidelines

Setps

Step 1 Identify potential causes of workplace injury and illness

i. Does the nature of the work being carried out pose a hazard to people's health and safety? „

ii. Have these hazards been identified in work that is being carried out?

iii. Has incident and injury data been reviewed? „

iv. Has consultation with workers and their health and safety representatives occurred? „

v. Is specialist or external assistance required?

Step 2 – Assess the risk of workplace injury and illness „

i. How often does a hazard have the potential to cause harm? „

ii. What type of injuries would the hazards cause? „

iii. How serious are the injuries? „

iv. Does the number and composition of workers and other people affect how first aid should be provided? „

v. Could the size and location of the workplace affect how first aid is provided?

Step 3 – What first aid is required?

(a) First aiders

i. How many first aid helpers are needed?

ii. What competencies do they require?

iii. What training do they need?

(b) First aid kits & procedures

i. What kits/modules are needed and where should they be located?

ii. Is other first aid equipment needed?

iii. Who is responsible for maintaining the kits?

iv. What procedures are needed for my workplace?

(c) First aid facilities

i. Is a first aid room or health centre required?

Step 4 Review first aid to ensure effectiveness

Unit 6.6 - Assessment

1. Why it is important to comply with health and safety at site
2. What general hygienic practices must be adhered to in own work environment.
3. Why the correct clothing, footwear and headgear should be worn at all times.
4. Why it is important to maintain good personal hygiene.
5. What the possible causes are of fire in the working environment.
6. What preventative actions can be taken to minimise risk of fire.
7. What organisational procedures should be followed in the event of fire?
8. Why a fire should never be approached unless it is safe to do so.
9. Why suspicious items and packages should be reported.
10. What basic first aid should be applied in the event of an accident?
11. What action should be taken to ensure the safety of the injured and uninjured?
12. What the potential hazards are within own working environment.
13. Why it is important to use correct lifting techniques.
14. What the employee's responsibility is in relation to health and safety regulations?

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7. Employability & Entrepreneurship Skills

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 how to maintain a positive attitude
15. Discuss the role of attitude in self-analysis
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
42. 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
61. 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
102. Describe the procedure and formalities for applying for bank finance
103. Discuss how to manage your own enterprise
104. List important questions that every entrepreneur should ask before starting an enterprise

UNIT 7.1: Personal Strengths & Value Systems

Unit Objectives

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
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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

7.1.1 Health, Habits, Hygiene: What is Health

As per the World Health Organization (WHO), health is a "State of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity." This means being healthy does not simply mean not being unhealthy – it also means you need to be at peace emotionally, and feel fit physically. For example, you cannot say you are healthy simply because you do not have any physical ailments like a cold or cough. You also need to think about whether you are feeling calm, relaxed and happy.

Common Health Issues

Some common health issues are:

- Allergies
- Asthma
- Skin Disorders
- Depression and Anxiety
- Diabetes
- Cough, Cold, Sore Throat
- Difficulty Sleeping
- Obesity

Tips to Prevent Health Issues

Taking measures to prevent ill health is always better than curing a disease or sickness. You can stay healthy by:

- Eating healthy foods like fruits, vegetables and nuts
- Cutting back on unhealthy and sugary foods
- Drinking enough water everyday
- Not smoking or drinking alcohol
- Exercising for at least 30 minutes a day, 4-5 times a week
- Taking vaccinations when required
- Practicing yoga exercises and meditation

How many of these health standards do you follow? Tick the ones that apply to you.

1. Get minimum 7-8 hours of sleep every night. ☐
2. Avoid checking email first thing in the morning and right before you go to bed at night. ☐
3. Don't skip meals – eat regular meals at correct meal times. ☐
4. Read a little bit every single day. ☐
5. Eat more home cooked food than junk food. ☐

6. Stand more than you sit. ☐
7. Drink a glass of water first thing in the morning and have at least 8 glasses of water through the day. ☐
8. Go to the doctor and dentist for regular checkups. ☐
9. Exercise for 30 minutes at least 5 days a week. ☐
10. Avoid consuming lots of aerated beverages. ☐

What is Hygiene?

As per the World Health Organization (WHO), "Hygiene refers to conditions and practices that help to maintain health and prevent the spread of diseases." In other words, hygiene means ensuring that you do whatever is required to keep your surroundings clean, so that you reduce the chances of spreading germs and diseases.

For instance, think about the kitchen in your home. Good hygiene means ensuring that the kitchen is always spick and span, the food is put away, dishes are washed and dustbins are not overflowing with garbage. Doing all this will reduce the chances of attracting pests like rats or cockroaches, and prevent the growth of fungus and other bacteria, which could spread disease.

How many of these health standards do you follow? Tick the ones that apply to you.

1. Have a bath or shower every day with soap – and wash your hair with shampoo 2-3 times a week. ☐
2. Wear a fresh pair of clean undergarments every day. ☐
3. Brush your teeth in the morning and before going to bed. ☐
4. Cut your fingernails and toenails regularly. ☐
5. Wash your hands with soap after going to the toilet. ☐
6. Use an anti-perspirant deodorant on your underarms if you sweat a lot. ☐
7. Wash your hands with soap before cooking or eating. ☐
8. Stay home when you are sick, so other people don't catch what you have. ☐
9. Wash dirty clothes with laundry soap before wearing them again. ☐
10. Cover your nose with a tissue/your hand when coughing or sneezing. ☐

See how healthy and hygienic you are, by giving yourself 1 point for every ticked statement!

Then take a look at what your score means.

Your Score

0-7/20: You need to work a lot harder to stay fit and fine! Make it a point to practice good habits daily and see how much better you feel!

7-14/20: Not bad, but there is scope for improvement! Try and add a few more good habits to your daily routine.

14-20/20: Great job! Keep up the good work! Your body and mind thank you!

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

Tips

- Following healthy and hygienic practices every day will make you feel good mentally and physically.
- Hygiene is two-thirds of health – so good hygiene will help you stay strong and healthy!

7.1.2: 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

Tips

- Be aware of what emergency number to call at the time of a workplace emergency
- Practice evacuation drills regularly to avoid chaotic evacuations

7.1.3 Self Analysis – Attitude, Achievement Motivation: What is Self-Analysis

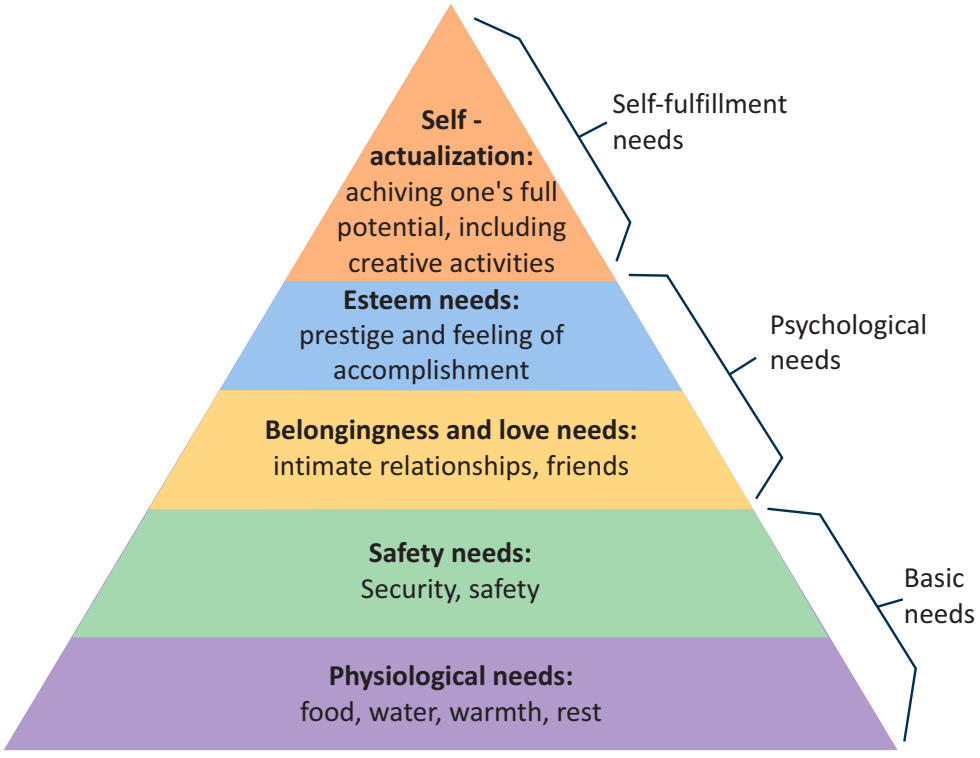
To truly achieve your full potential, you need to take a deep look inside yourself and find out what kind of person you really are. This attempt to understand your personality is known as self-analysis. Assessing yourself in this manner will help you grow, and will also help you to identify areas within 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

Tips

- Achievement motivation can be learned.
- Don’t be afraid to make mistakes.
- Train yourself to finish what you start.
- Dream big.

7.1.4 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.

Tips 

- Don't get angry when someone tells you the truth and you don't like what you hear.
- Always be willing to accept responsibility for your mistakes.

7.1.5 Creativity & Innovation : What is Creativity

Creativity means thinking outside the box. It means viewing things in new ways or from different perspectives, and then converting these ideas into reality. Creativity involves two parts: thinking and producing. Simply having an idea makes you imaginative, not creative. However, having an idea and acting on it makes you creative.

Characteristics of Highly Creative People

Some characteristics of creative people are:

- They are imaginative and playful
- They see issues from different angles
- They notice small details
- They have very little tolerance for boredom
- They detest rules and routine
- They love to daydream
- They are very curious

What is Innovation?

There are many different definitions of innovation. In simple terms, innovation means turning an idea into a solution that adds value. It can also mean adding value by implementing a new product, service or process, or significantly improving on an existing product, service or process.

Characteristics of Highly Innovative People

Some characteristics of highly innovative people are:

- They embrace doing things differently
- They don't believe in taking shortcuts
- They are not afraid to be unconventional
- They are highly proactive and persistent
- They are organized, cautious and risk-averse

Tips

- Take regular breaks from your creative work to recharge yourself and gain fresh perspective.
- Build prototypes frequently, test them out, get feedback, and make the required changes.

7.1.6 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.

Tips 

- Always complete the most important tasks first.
- Get at least 7 – 8 hours of sleep every day.
- Start your day early.
- Don’t waste too much time on small, unimportant details.
- Set a time limit for every task that you will undertake.
- Give yourself some time to unwind between tasks.

7.1.7 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.

Tips

- 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.

7.1.8 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
- Pessimism
- Negative self-talk
- All in or all out attitude

External causes of stress

- Major life changes
- Difficulties with relationships
- Having too much to do
- Difficulties at work or in school
- Financial difficulties
- Worrying about one's children and/or family

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.

Tips 

- 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 attiude and focus on being proactive.

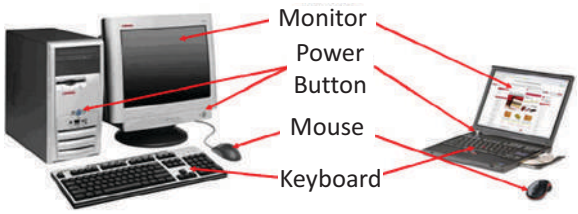
7.2. Digital Literacy: A Recap

Unit Objectives

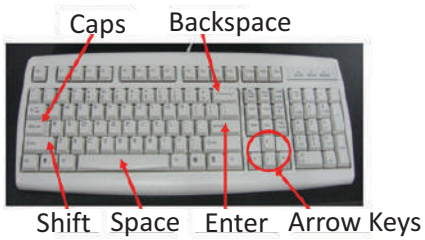
At the end of this unit, you will be able to:

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. Describe how you will sell a product or service on an e-commerce platform

7.2.1 Computer and Internet basics: Basic Parts of a Computer



Basic Parts of a Keyboard



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.

Tips 

- When visiting a .com address, there no need to type http:// or even www. Just type the name of the website and then press Ctrl + Enter. (Example: Type 'apple' and press Ctrl + Enter to go to www.apple.com)
- Press the Ctrl key and press the + or - to increase and decrease the size of text.
- Press F5 or Ctrl + R to refresh or reload a web page.

7.2.2 MS Office and Email: About MS Office

MS Office or Microsoft Office is a suite of computer programs developed by Microsoft. Although meant for all users, it offers different versions that cater specifically to students, home users and business users. All the programs are compatible with both, Windows and Macintosh.

Most Popular Office Products

Some of the most popular and universally used MS Office applications are:

- **Microsoft Word**: Allows users to type text and add images to a document.
- **Microsoft Excel**: Allows users to enter data into a spreadsheet and create calculations and graphs.
- **Microsoft PowerPoint**: Allows users to add text, pictures and media and create slideshows and presentations.
- **Microsoft Outlook**: Allows users to send and receive email.
- **Microsoft OneNote**: Allows users to make drawings and notes with the feel of a pen on paper.
- **Microsoft Access**: Allows users to store data over many tables.

Why Choose Microsoft Outlook

A popular email management choice especially in the workplace, Microsoft Outlook also includes an address book, notebook, web browser and calendar. Some major benefits of this program are:

- **Integrated search function**: You can use keywords to search for data across all Outlook programs.
- **Enhanced security**: Your email is safe from hackers, junk mail and phishing website email.
- **Email syncing**: Sync your mail with your calendar, contact list, notes in One Note and…your phone!
- **Offline access to email**: No Internet? No problem! Write emails offline and send them when you're connected again.

Tips

- Press Ctrl+R as a shortcut method to reply to email.
- Set your desktop notifications only for very important emails.
- Flag messages quickly by selecting messages and hitting the Insert key.
- Save frequently sent emails as a template to reuse again and again.
- Conveniently save important emails as files.

7.2.3 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.

Tips

- Before launching your e-commerce platform, test everything.
- Pay close and personal attention to your social media.

7.3: Money Matters

Unit Objectives

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

1. Discuss the importance of saving money
2. Discuss the benefits of saving money
3. Discuss the main types of bank accounts
4. Describe the process of opening a bank account
5. Differentiate between fixed and variable costs
6. Describe the main types of investment options
7. Describe the different types of insurance products
8. Describe the different types of taxes
9. Discuss the uses of online banking
10. Discuss the main types of electronic funds transfers

7.3.1 Personal Finance – Why to Save: Importance of Saving

We all know that the future is unpredictable. You never know what will happen tomorrow, next week or next year. That's why saving money steadily through the years is so important. Saving money will help improve your financial situation over time. But more importantly, knowing that you have money stashed away for an emergency will give you peace of mind. Saving money also opens the door to many more options and possibilities.

Benefits of Saving

Inculcating the habit of saving leads to a vast number of benefits. Saving helps you:

- **Become financially independent**: When you have enough money saved up to feel secure you can start making your choices, from taking a vacation whenever you want, to switching careers or starting your own business.
- **Invest in yourself through education**: Through saving, you can earn enough to pay up for courses that will add to your professional experience and ultimately result in higher paying jobs.
- **Get out of debt**: Once you have saved enough as a reserve fund, you can use your savings to pay off debts like loans or bills that have accumulated over time.
- **Be prepared for surprise expenses** : Having money saved enables you to pay for unforeseen expenses like sudden car or house repairs, without feeling financially stressed.
- **Pay for emergencies**: Saving helps you deal with emergencies like sudden health issues or emergency trips without feeling financially burdened.

- **Afford large purchases and achieve major goals:** Saving diligently makes it possible to place down payments towards major purchases and goals, like buying a home or a car.
- **Retire**: The money you have saved over the years will keep you comfortable when you no longer have the income you would get from your job.

Tips 

- Break your spending habit. Try not spending on one expensive item per week, and put the money that you would have spent into your savings.
- Decide that you will not buy anything on certain days or weeks and stick to your word.

7.3.2 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!

Tips

- Select the right type of account.
- Fill in complete nomination details.
- Ask about fees.
- Understand the rules.
- Check for online banking – it's convenient!
- Keep an eye on your bank balance.

7.3.3 Costs: Fixed vs Variable: What are Fixed and Variable Costs

Fixed costs and variable costs together make up a company's total cost. These are the two types of costs that companies have to bear when producing goods and services.

A fixed cost does not change with the volume of goods or services a company produces. It always remains the same.

A variable cost, on the other hand, increases and decreases depending on the volume of goods and services produced. In other words, it varies with the amount produced.

Differences Between Fixed and Variable Costs

Let's take a look at some of the main differences between fixed and variable costs:

Criteria	Fixed Costs	Variable Costs
Meaning	A cost that stays the same, regardless of the output produced.	A cost that changes when the
Nature	Time related.	Volume related.
Incurred	Incurred irrespective of units being produced.	Incurred only when units are produced.
Unit cost	Inversely proportional to the number of units produced.	Remains the same, per unit.
Examples	Depreciation, rent, salary, insurance, 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.

7.3.4 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.

Tips

- Think about how quickly you need your money back and pick an investment option accordingly.
- Ensure that you are buying the right type of insurance policy for yourself.
- Remember, not paying taxes can result in penalties ranging from fines to imprisonment.

7.3.5 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

- Recipient's name
- Recipient's account number
- Recipient's bank's name
- Recipient's bank's IFSC code

RTGS

RTGS stands for Real Time Gross Settlement. This is a real time funds transfer system which enables you to transfer funds from one bank to another, in real time or on a gross basis. The transferred amount is immediately deducted from the account of one bank, and instantly credited to the other bank's account. The RTGS payment gateway is maintained by the Reserve Bank of India. The transactions between banks are made electronically.

RTGS can be used by individuals, companies and firms to transfer large sums of money. Before remitting funds through RTGS, you will need to add the beneficiary and his bank account details via your online banking account. In order to complete this registration, you will require the following information:

- Name of the beneficiary
- Beneficiary's account number
- Beneficiary's bank address
- 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

Tips

- Never click on any links in any e-mail message to access your online banking website.
- You will never be asked for your credit or debit card details while using online banking.
- Change your online banking password regularly.

7.4. 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

7.4.1 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:
     - What do you consider the most important criteria for success in this job?
     - How will my performance be evaluated?
     - What are the opportunities for advancement?
     - What are the next steps in the hiring process?
   - Remember, never ask for information that is easily available on the company website.

Tips

- Ask insightful and probing questions.
- When communicating, use effective forms of body language like smiling, making eye contact, and actively listening and nodding. Don't slouch, play with nearby items, fidget, chew gum, or mumble.

7.4.2 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
- Nationality
- Gender & marital status
- Languages known

Example:

Personal Details

- Date of birth: 25th May, 1981
- Gender & marital status: Female, Single
- Nationality: Indian
- Languages known: English, Hindi, Tamil, French

Tips

- Keep your resume file name short, simple and informational.
- Make sure the resume is neat and free from typing errors.
- Always create your resume on plain white paper.

7.4.3 Interview FAQs

Take a look at some of the most frequently asked interview questions, and some helpful tips on how to answer them.

Q1. Can you tell me a little about yourself?

Tips to answer:

- Don't provide your full employment or personal history.
- Offer 2-3 specific experiences that you feel are most valuable and relevant.
- Conclude with how those experiences have made you perfect for this specific role.

Q2. How did you hear about the position?

Tips to answer:

- Tell the interviewer how you heard about the job – whether it was through a friend (name the friend), event or article (name them) or a job portal (say which one).
- Explain what excites you about the position and what in particular caught your eye about this role.

Q3. What do you know about the company?

Tips to answer:

- Don't recite the company's About Us page.
- Show that you understand and care about the company's goals.
- Explain why you believe in the company's mission and values.

Q4. Why do you want this job?

Tips to answer:

- Show that you are passionate about the job.
- Identify why the role is a great fit for you.
- Explain why you love the company.

Q5. Why should we hire you?

Tips to answer:

- Prove through your words that you can not only do the work, but can definitely deliver excellent results.
- Explain why you would be a great fit with the team and work culture.
- Explain why you should be chosen over any other candidate.

Q6. What are your greatest professional strengths?

Tips to answer:

- Be honest – share some of your real strengths, rather than give answers that you think sound good.
- Offer examples of specific strengths that are relevant to the position you are applying for.
- Provide examples of how you've demonstrated these strengths.

Q7. What do you consider to be your weaknesses?

Tips to answer:

- The purpose of this question is to gauge your self-awareness and honesty.
- Give an example of a trait that you struggle with, but that you're working on to improve.

Q8. What are your salary requirements?

Tips to answer:

- Do your research beforehand and find out the typical salary range for the job you are applying for.
- Figure out where you lie on the pay scale based on your experience, education, and skills.
- Be flexible. Tell the interviewer that you know your skills are valuable, but that you want the job and are willing to negotiate.

Q9. What do you like to do outside of work?

Tips to answer:

- The purpose of this question is to see if you will fit in with the company culture.
- Be honest – open up and share activities and hobbies that interest and excite you.

Q10. If you were an animal, which one would you want to be?

Tips to answer:

- The purpose of this question is to see if you are able to think on your feet.
- There's no wrong answer – but to make a great impression try to bring out your strengths or personality traits through your answer.

Q11: What do you think we could do better or differently?

Tips to answer:

- The purpose of this question is to see if you have done your research on the company, and to test whether you can think critically and come up with new ideas.
- Suggest new ideas. Show how your interests and expertise would help you execute these ideas.

Q12: Do you have any questions for us?

Tips to answer:

- Do not ask questions to which the answers can be easily found on the company website or through a quick online search.
- Ask intelligent questions that show your ability to think critically.

Tips

- Be honest and confident while answering.
- Use examples of your past experiences wherever possible to make your answers more impactful.

7.4.4 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.

7.5. Understanding Entrepreneurship

Unit Objectives

1. At the end of this unit, you will be able to:
2. 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
7. Discuss the benefits of effective leadership
8. List the traits of an effective team
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

7.5.1 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.

Tips

- Learn from others' failures.
- Be certain that this is what you want.
- Search for a problem to solve, rather than look for a problem to attach to your idea.

7.5.2 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 admittng 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.

Tips

- Don’t get too attached to your original idea. Allow it to evolve and change.
- Be aware of your weaknesses and build a team that will complement your shortfalls.
- Hiring the right people is not enough. You need to promote or incentivize your most talented people to keep them motivated.
- Earn your team’s respect.

7.5.3 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.

Tips

- If you're finding it difficult to focus on what someone is saying, try repeating their words in your head.
- Always maintain eye contact with the person that you are communicating with, when speaking as well as listening. This conveys and also encourages interest in the conversation.

7.5.4 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 problem

Step 2: Study the problem in detail

Step 3: List all possible solutions

Step 4: Select the best solution

Step 5: Implement the chosen solution

Step 6: Check that the problem has really been solved

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.
3. **Interviews**: Create hypothetical problematic situations or raise ethical questions and see how the candidates respond.
4. **Technical questions**: Give candidates examples of real life problems and evaluate their thought process.

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

Tips

- Know exactly what you want before you work towards getting it
- Give more importance to listening and thinking, than speaking
- Focus on building a relationship rather than winning
- Remember that your people skills will affect the outcome
- Know when to walk away – sometimes reaching an agreement may not be possible

7.5.5 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.

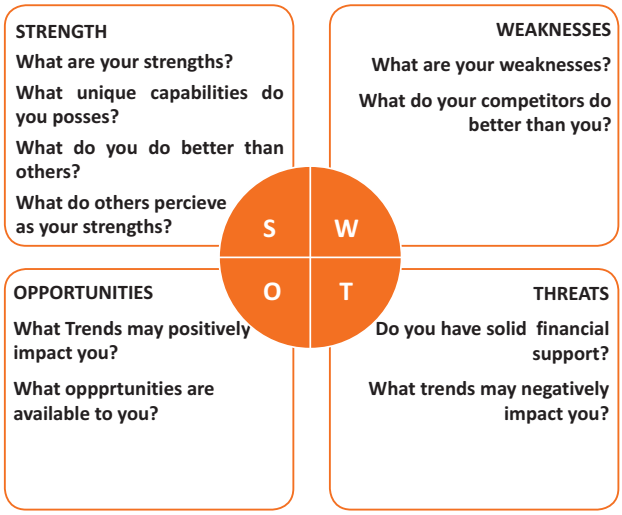
5. Think About Product Differentiation

   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

Tips 

- Remember, opportunities are situational.
- Look for a proven track record.
- Avoid the latest craze.
- Love your idea.

7.5.6 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.

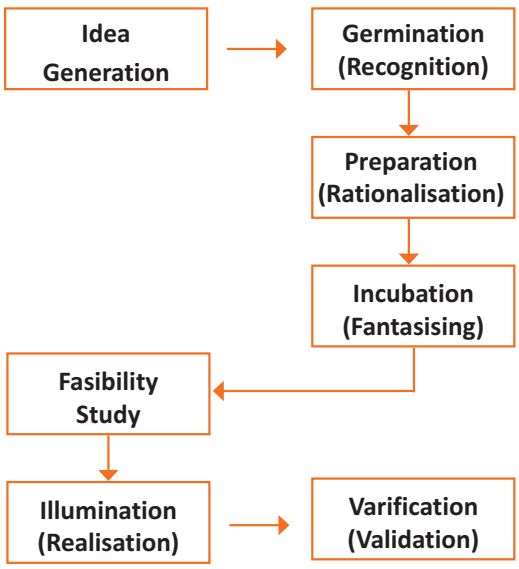
Stage 4: Incubation or Fantasizing. This stage involves creative thinking for the purpose of coming up with more ideas. Less thought is given to the problem areas.

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

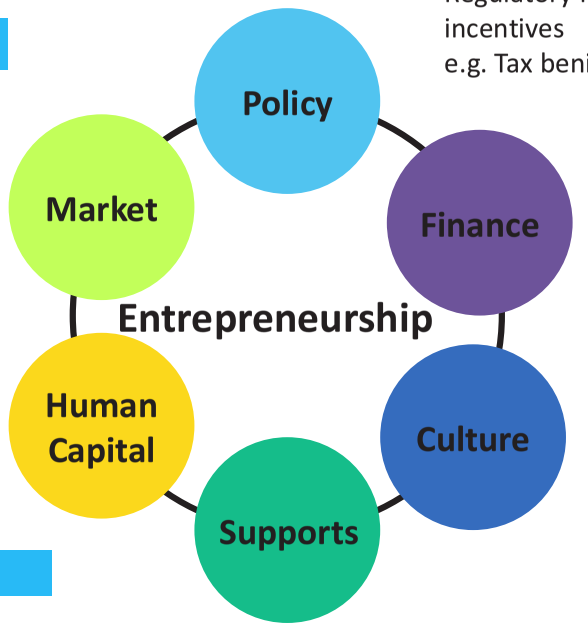
- Unequivocal support
- Social legitimacy
- Open door for advocate
- Entrepreneurship strategy
- urgency, crisis and challenge

Government

- Institutions
  e.g. Investment, support
- Financial support
  e.g. for R&D, jump start funds
  Regulatory framework
  incentives
  e.g. Tax benifits
- Research institutes
- Venture-friendly legislation
- e.g. Bankruptcy, contract enforcement, property rights, and labour

Networks

- Entrepreneure's networks
- Diaspora networks
- Multinational corporations



Financial Capital

- Micro-loans
- Angel investors, friends and family
- Zero-stage venture capital
- Venture capital funds
- Private equity
- Public capital markets
- Debt

Labour

- Skilled and unskilled
- Serial entrepreneures
- Later generation family

Success Stories

- Visible successes
- Wealth generation for founders
- International reputation

Educational Institutions

- General degrees (professional and academic)
- Specific entrepreneurship training

Societal norms

- Tolerance of risk, mistakes, failure
- Innovation, creativity, experimentation
- Social status of entrepreneur
- Wealth creation
- Ambition, drive, hunger

Infrastructure

- Telecommunications
- Transportation & logistics
- Energy
- Zones, incubation centers, clusters

Non-Government Institution

- Entrepreneurship promotion in non-profits
- Conferences
- Business plan contests
- Entrepreneur- friendly association

Support Professions

- Legal
- Accounting
- Investment bankers

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.

1. 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.
2. 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.
3. 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

Tips

- Research the existing market, network with other entrepreneurs, venture capitalists, angel investors, and thoroughly review the policies in place to enable your entrepreneurship.
- Failure is a stepping stone and not the end of the road. Review yours and your peers' errors and correct them in your future venture.
- Be proactive in your ecosystem. Identify the key features of your ecosystem and enrich them to ensure self-sustainability of your entrepreneurship support ecosystem.

7.5.7 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

Tips

- Cultivate a great network of clients, suppliers, peers, friends and family. This will not only help you promote your business, but will also help you learn, identify new opportunities and stay tuned to changes in the market.
- Don’t dwell on setbacks. Focus on what 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.

7.5.8 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!

Tips

- Remember that nothing is impossible.
- Identify your mission and your purpose before you start.
- Plan your next steps – don't make decisions hastily.

7.6: 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

7.6.1 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

Tips 

- Keep in mind that good ideas do not always have to be unique.
- Remember that timing plays a huge role in determining the success of your idea.
- Situations and circumstances will always change, so be flexible and adapt your idea accordingly.

7.6.2 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.

7.6.3 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

7.6.4 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.

7.6.5 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

Tips

- Use social media interactions to identify needs and gather feedback.
- When networking, ask open-ended questions rather than yes/no type questions.

7.6.6 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 long-term goals.
- The type of funding you want and how you plan to use it. Do you want funding that can be used only for a specific purpose, or funding that can be used for any kind of requirement?
- Strategic plans for the future. This will involve detailing out your long-term plans – what these plans are and how much money you will require to put these plans in motions.
- Historical and prospective financial information. This can be done by creating and maintaining all your financial records, right from the moment your enterprise started, to the present day. Documents required for this are your balance sheet which contains details of your company's assets and liabilities, your income statement which lists your company's revenues, expenses and net income for the year, your tax returns (usually for the last three years) and your cash flow budget which lists the cash that came in, the cash that went out and states whether you had a cash deficit (negative balance) or surplus (positive balance) at the end of each month.

Financial Planning

Before you begin building your enterprise, you need to plan your finances. Take a look at the steps for financial planning:

Step 1: Create a financial plan. This should include your goals, strategies and timelines for accomplishing these goals.

Step 2: Organize all your important financial documents. Maintain a file to hold your investment details, bank statements, tax papers, credit card bills, insurance papers and any other financial records.

Step 3: Calculate your net worth. This means figure out what you own (assets like your house, bank accounts, investments etc.), and then subtract what you owe (liabilities like loans, pending credit card amounts etc.) the amount you are left with is your net worth.

Step 4: Make a spending plan. This means write down in detail where your money will come from, and where it will go.

Step 5: Build an emergency fund. A good emergency fund contains enough money to cover at least 6 months' worth of expenses.

Step 6: Set up your insurance. Insurance provides long term financial security and protects you against risk.

Risk Management

As an entrepreneur, it is critical that you evaluate the risks involved with the type of enterprise that you want to start, before you begin setting up your company. Once you have identified potential risks, you can take steps to reduce them. Some ways to manage risks are:

- Research similar business and find out about their risks and how they were minimized.
- Evaluate current market trends and find out if similar products or services that launched a while ago are still being well received by the public.
- Think about whether you really have the required expertise to launch your product or service.
- Examine your finances and see if you have enough income to start your enterprise.
- Be aware of the current state of the economy, consider how the economy may change over time, and think about how your enterprise will be affected by any of those changes.
- Create a detailed business plan.

Tips

- Ensure all the important elements are covered in your plan.
- Scrutinize the numbers thoroughly.
- Be concise and realistic.
- Be conservative in your approach and your projections.
- Use visuals like charts, graphs and images wherever possible.

7.6.7 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.
2. 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.

Tips 

- Get advice on funding options from experienced bankers.
- Be cautious and avoid borrowing more than you need, for longer than you need, at an interest rate that is higher than you are comfortable with.

7.6.8 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!

Tips

- Get advice on funding options from experienced bankers.
- Be cautious and avoid borrowing more than you need, for longer than you need, at an interest rate that is higher than you are comfortable with.

7.6.9. 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[1] or industry expert that I can call on?
5. Who is my ideal customer[2]?
6. Who are my competitors[3]?
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 SWOT[4] 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 product[5] 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 even[6] or make a profit?
16. How will those who invest in my idea make a profit?
17. How should I set up the legal structure[7] of my business?
18. What taxes[8] will I need to pay?
19. What kind of insurance[9] will I need?
20. Have I reached out to potential customers for feedback?

Tips

- It is very important to validate your business ideas before you invest significant time, money and resources into it.
- The more questions you ask yourself, the more prepared you will be to handle to highs and lows of starting an enterprise.

Footnotes:

1. A mentor is a trusted and experienced person who is willing to coach and guide you.
2. A customer is someone who buys goods and/or services.
3. A competitor is a person or company that sells products and/or services similar to your products and/or services.
4. SWOT stands for Strengths, Weaknesses, Opportunities and Threats. To conduct a SWOT analysis of your company, you need to list down all the strengths and weaknesses of your company, the opportunities that are present for your company and the threats faced by your company.

5. A minimum viable product is a product that has the fewest possible features, that can be sold to customers, for the purpose of getting feedback from customers on the product.
6. A company is said to break even when the profits of the company are equal to the costs.
7. The legal structure could be a sole proprietorship, partnership or limited liability partnership.
8. There are two types of taxes – direct taxes payable by a person or a company, or indirect taxes charged on goods and/or services.
9. There are two types of insurance – life insurance and general insurance. Life insurance covers human life while general insurance covers assets like animals, goods, cars etc.

Tips

Notes

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