Plumbing Installation Work

LEVEL II

Learning Guide # 45

Unit of Competence: Install, Service and maintain Water supply Systems and Components

Module Title: Install, Service and maintain water supply Systems and Components

LG Code: EISPLI2 **M11 Lo1- LG 45**

TTLM Code: EISPLI2**TTL**M**11 0919** v1

LO 1: Plan and prepare

Instruction Sheet	Learning Guide #45

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Reading and interpreting plan/working drawings
- Applying OH&S requirements
- Identifying Quality assurance requirements
- Planning & sequencing Tasks
- Selecting and checking tools and equipment

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Read and interpreting plan/working drawings
- Apply OH&S requirements
- Identify Quality assurance requirements
- Plan & sequencing Tasks
- Select tools and equipment, including personal safety equipment

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, and Sheet 4 and Sheet 5”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 , Self-check 4 and Self-check 5” **in page -9, 18, 21,24 and34** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page -37.**
6. Do the “LAP test” **in page – 38** (if you are ready).

operation sheet 1	**Reading and interpreting plan/working drawings**

1.1 Reading and interpreting plan/working drawings

Introduction

Plumbing plans are used to show the location of the water supply, vent, and drain lines but may also include storm water drains and gas lines. Note the difference in the line types. Color has been used here to better differentiate between the various lines; however, most plumbing plans will be black and white. The line style is used to differentiate the various types of pipe. Be sure to record the line style and color of each pipe.

The Plumbing Plan is a plan view that shows the complete plumbing system. The plumbing plan shows the location, size, and type of all plumbing equipment.

A plumbing system consists of all of the elements that provide water or convey water or wastewater within the building as well as those elements that vent the wastewater system. Often gas and storm water drain pipes are also installed and are considered part of the plumbing system.

The plumbing plan should include:

1. Waste lines and vent stacks.
2. Drain and plumbing fixture locations.
3. Size and type of pipe to be used.
4. A plumbing fixture schedule.
5. Symbols Legend.
6. General notes

Drawing Plumbing Plans for Supply System

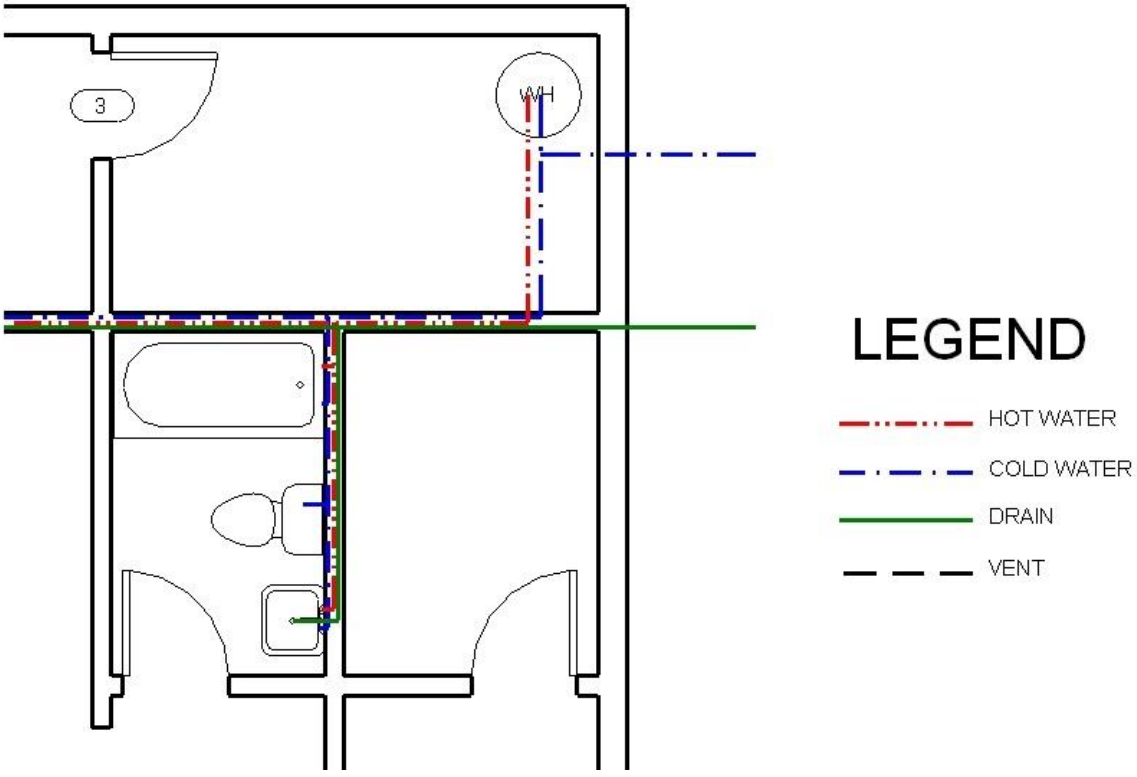
Steps to draw the Plumbing Plan (for supply system)\

1) Trace the floor plan showing only the exterior and interior walls door and window, and features, which are related to plumbing plan.
2) Draw the symbols for all fixtures that are to be connected to the house plumbing system.
3) Check the code to determine clearance dimension and minimum space requirement for fixture.

4) Locate and draw the building main for the water supply system connects the water supply piping to hose bibs and water tanker. 5
5) Draw the cold and hot water main including shut off valves where they are required.
6) Draw the cold and hot water branch pipe parallel where possible
7) Indicate the size of each cold and hot water supply pipes to accommodate the capacity of water needed.
8) Show the location of water heater and identify it.
9) Include a plumbing fixture schedule, symbols and notes

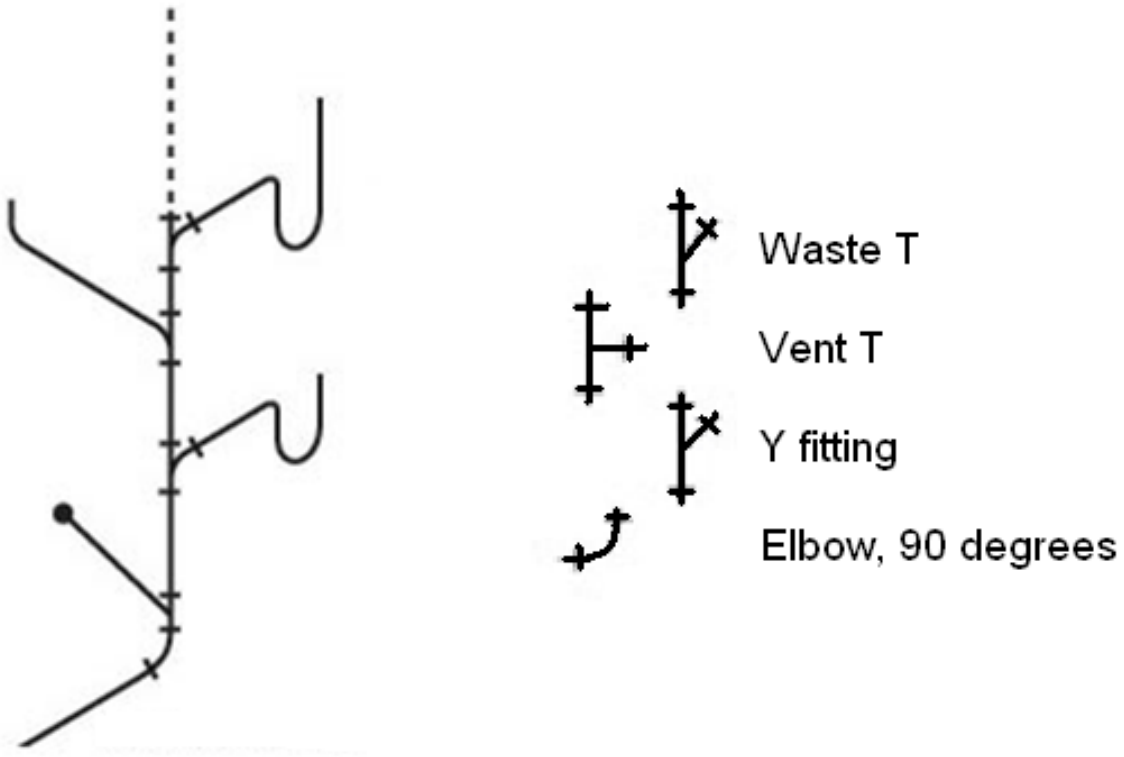
The plan shows water supply lines, waste disposal lines and fixtures, especially this plan shows

a) The size and types of all piping and fittings used in the system. .
b) The location of plumbing equipment to be used.
c) The location of bathroom, toilet, floor drains, roof drains and the like

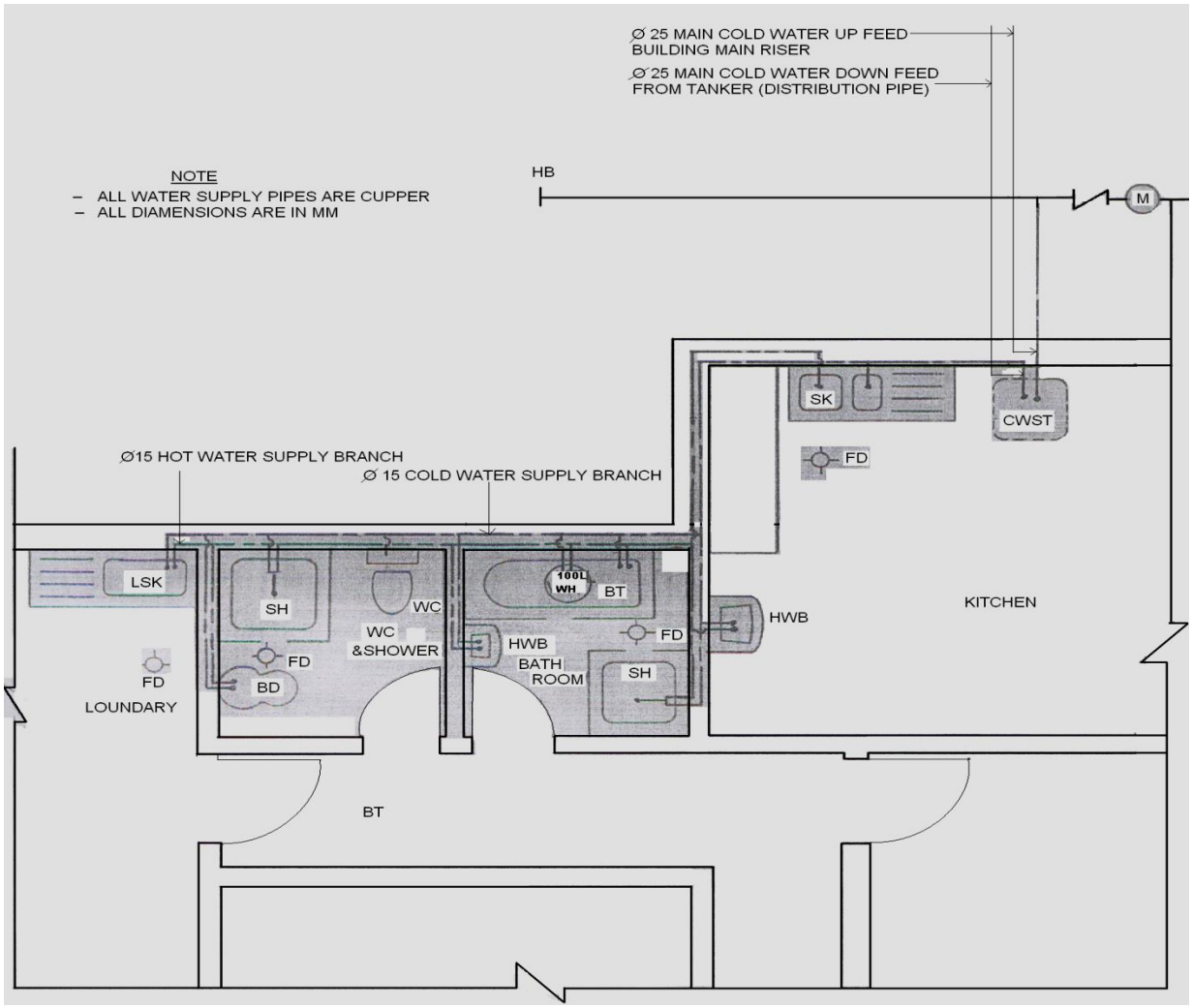


(Figure 1.1) Plumbing Plans

Plumbing Plans – Isometric

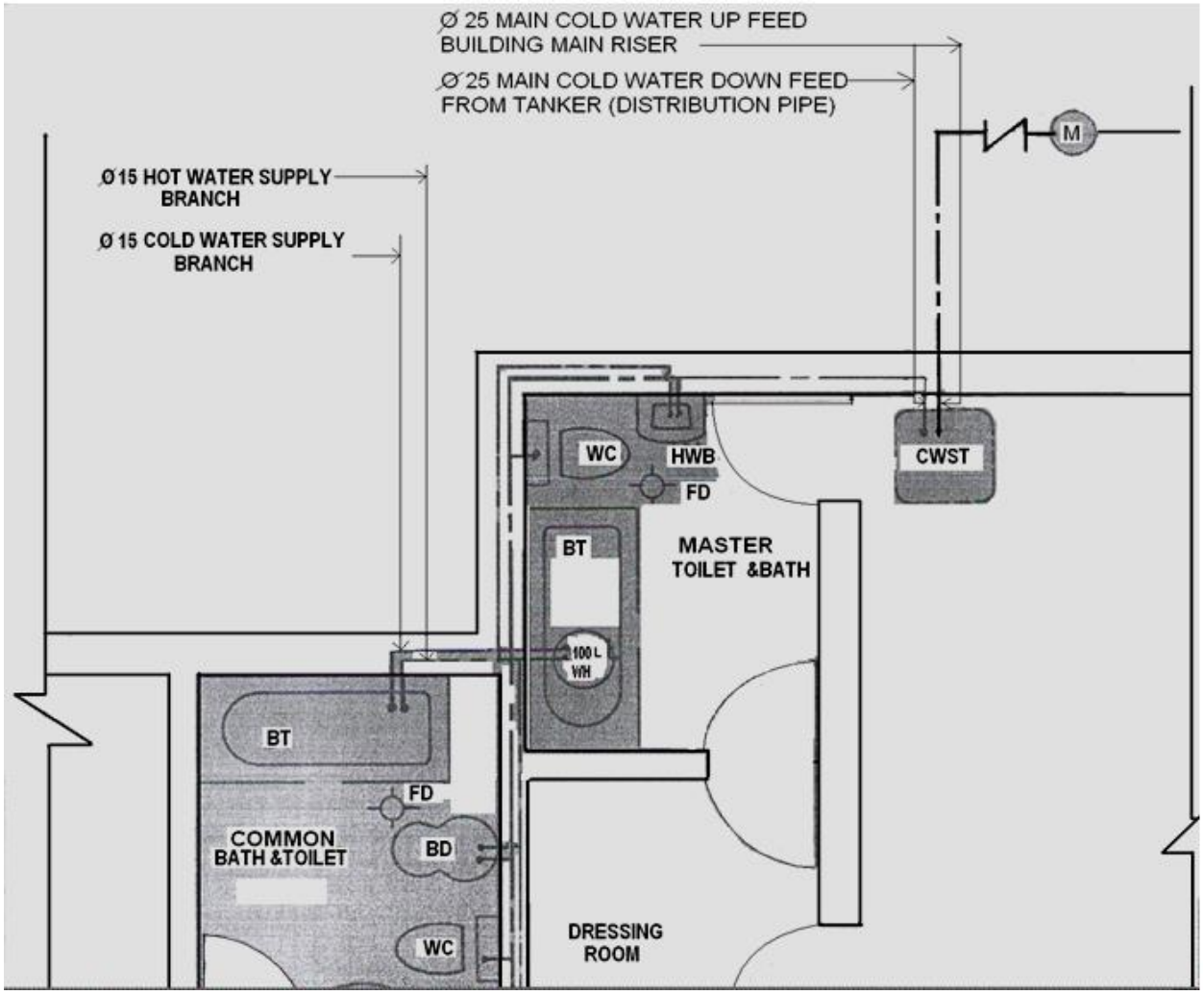


(Figure 1.2**)**Plumbing Plans – Isometric



(Figure 1.3)

Plumbing plan for a given ground floor (supply system)



(Figure 1.4)

Plumbing plan for a given upper floor (system

1.2 READING THE PLUMBING PLANS

The floor plan shows the location of the plumbing fixtures, and the fixtures are numbered 9 to correspond to the numbers in the Plumbing Fixture Schedule. The schedule has the name of the fixtures, the manufacturer and model number of each fixture, and the connection size for all the piping connected to the fixture. There is a space for notes that pertain to the fixtures.

1.1.2 PREPARING PIPING DRAWING

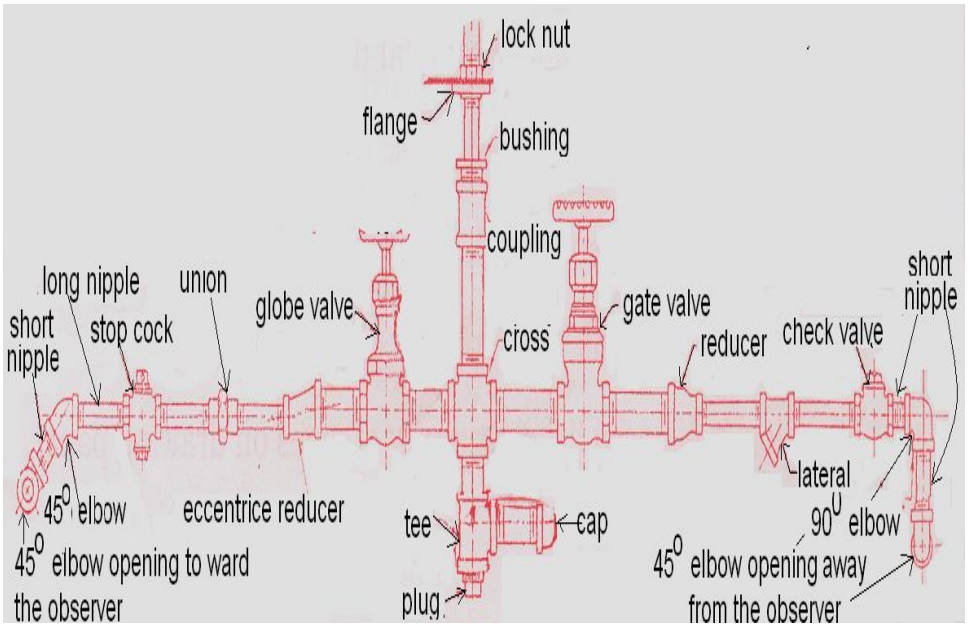
- ✓ Pipe drawing:-is 2-D representation of piping system.
- ✓ Pipes will be symbolized with a single line [diagrammatic layout] or double line [Scale layout] in drawing.
- ✓ These pipe symbols are applied to represent orthographic plan, elevation & pictorial [isometric] view of pipes or: drawing paper.
- ✓ To save time standard graphic symbols are very commonly
- ✓ To save time standard graphic symbols are very commonly used to \ represents pipes, pipe fitting, valves & pipe components.

1.1.3 (Single line (Diaphragmatic) lay out

1. This is used on small scale drawings such as architectural plans, plant layouts etc, or on sketches.
2. - All fittings & run of pipes are shown by a single line regardless of the pipe diameter.
3. OR- these drawings simplify the creation of piping drawings by representing the center lines of pipes as thick solid lines
4. - Also symbols used to represent various components and drawn as thick lines.

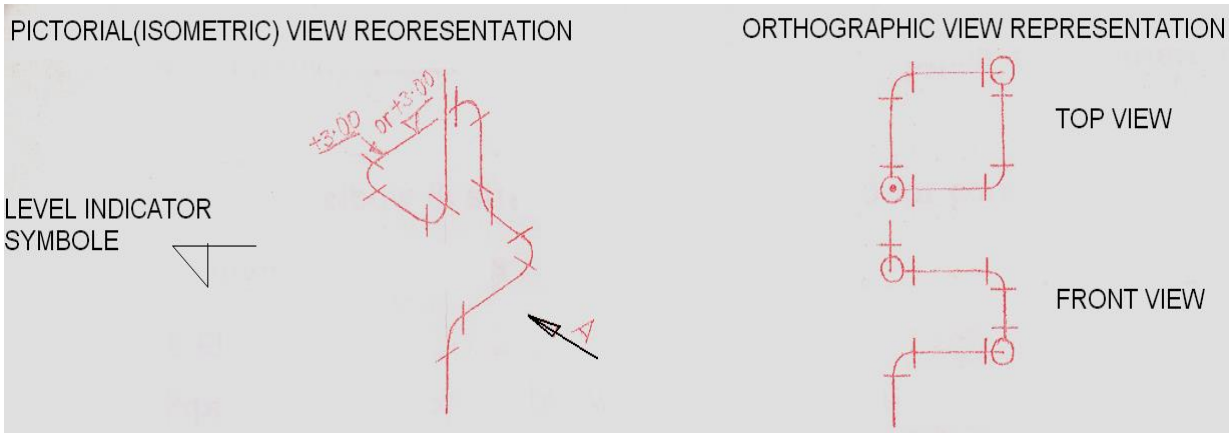
1.1.4 Double line (scale layout)

1. This is used principally for large pipes as in power plant & boiler work where lengths are critical & pipe is not cut. OR- represents pipes as two parallel solid black lines. 10
2. -This drawing takes more time but is much more realistic looking than single line drawing.



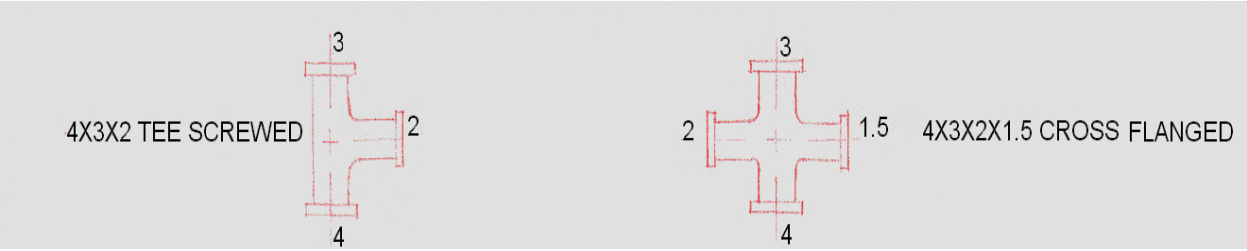
(Figure 1.5) Double line (scale layout)

3. Double line drawings are us piping systems illustration & presentation drawings.
4. Any type of pipe drawing [single line or double line] may be made as multi view, axonometric & oblique projection.
5. Pictorial projection is used for all pipe bent in more than one plane &fur assembly layout. [It shows the piping layout in space & reveals the change in direction & the difference in level.]



(Figure 1.6)

6. Pipe fitting: - are used to connect lengths of pipes, change direction, create branching & change pipe size. 11
7. - Tees & cross are used for branching.
8. - 45^0 &90^0 elbows & bends are used to change direction.
9. - The return bend is used to make an 180^0 turn.
10. - Tee, cross, elbow are used to connect different sizes of pipes so they are called reducing fittings.
11. - Pipe fitting will be designated by the nominal pipe size. the name of I fitting & the material.
12. - For the fitting having both or all ends same nominal size will be described as e.g. 2“screwed Tee.
13. - For reducing fitting-the largest opening is given 1 st. opposite end 2nd and out let 3rd. [The run precedes the branch & the larger does the
14. Smaller.



(Figure 1.7)

Self-Check -1	Written Test

Directions: Answer all the questions listed below.

1. are used to connect lengths of pipes, change direction, create branching & change pipe size.(3point)

   A. Plan C specification

   B .Pipe fitting D. all

2. shows the location of the plumbing fixtures(2point)

   A. Plan

   C specification

   B. Pipe fitting

   D. floor plan

Note: **Satisfactory rating - 3 and 5 points Unsatisfactory - below 3 and points**

You can ask you teacher for the copy of the correct answers.

Information Sheet- 2	applying OH&S requirements

1.2 Applying OH &S requirements

Occupational health and safety (OH&S) play an important role within the plumbing and services sector .Using hand and power tools can be dangerous and must be used safely so as to prevent injury. Having an understanding of your state's OH&S requirements will help you to understand how you can ensure a safe work environment. Quality Assurance is used to ensure that the work performed in the sector is of a consistently high quality. While some quality assurance standards apply across the world, many are determined by company policies and procedures. This section looks at some of the OH&S requirements that you need to understand to ensure a safe working environment. It focuses on the use of personal protective equipment (PPE), the safe use of tools and equipment, the safe handling of materials and hazard control. Safety equipment and its use are also discussed. It also looks at quality assurance and some of the QA requirements you may need to meet this.

1.2.1 Personal protective equipment

Personal protective equipment is an important defense against certain types of injury.
Injuries from falling and flying objects, for instance, can be reduced by wearing hard hats and eye protection. Everyone on when we do install and maintain the water supply work must wear PPE.

It is mandatory for everyone on a construction project to wear head protection in the form of a hard hat that complies with the current Construction Regulation.

Eye protection is strongly recommended to prevent injuries from construction operations such as chipping and drilling and site conditions such as dust.

Personnel exposed for long periods to noisy equipment should wear hearing protection.

Work in confined spaces such as manholes and valve chambers may require respiratory protection against hazardous atmospheres. Before any PPE is used it should be inspected to ensure:

- A good fit on the user
- Is being used correctly

- Is appropriate and effective to protect the wearer from the hazards it is intended to control 14
- Does not introduce any new hazards for the task to be performed

The following are types of PPE requires in construction works.

Body & Skin Protection shall be worn when there is remaining risks in the environment. Overall protects the normal clothes from dust, grease and other spilling materials. Types of body and skin protection include:

- Protective Clothing
- Sunscreen & insect repellent
- High visibility vests working at or near roadways or near moving traffic or moving plant
- Laboratory coats, heat resistant clothing, waterproof jackets.

Head protection shall be worn whenever there is a danger of falling objects, projectile objects or impacts to the head, people striking their heads on objects in the environment or require protection from UV rays. Types of head protection include:

- safety helmets & caps
- hats & hoods
- Helmet

Figure 1.1

Ear protection

It protects the carrier from damages of the ears. Continuously working in a very noisy Environment harms the eardrums forever. Once the eardrums are damaged there is no Way of restoring the sense of hearing again. Types of hearing protection include:

- Ear plugs
- Ear muffs

Ear protection

Figure 1.2

Hand Protection shall be worn to protect the operator from contact with hazardous substances. Types of hand protection include:

- Special gloves - wrist or elbow length
- Cotton, rubber
- PVC & leather
- Stainless steel mesh

Figure 1.3

Eye protection

Eye protection includes safety glasses, safety goggles and welding helmets. These are made from safety material to ensure your eyes are protected from flying objects, sparks or strong light. Choose eye protection that conforms to Eye protection for industrial applications. Don't use sunglasses instead of safety glasses, as they do not protect your eyes from the impact of flying objects.

Figure 1.4

Foot protection shall be worn wear there is a risk of objects dropping onto feet, or slip hazards present. Types of foot protection include: 16

- Steel capped boots
- Non slip shoes
- Waterproof boots

Figure 1.5

Safety boots

Respiratory protection shall be used when exposure to the work atmosphere may be injurious to health. Used during working in confined space such as manhole and valve chamber. Types of respiratory protection include:

- Face masks
- Half face respirators
- Air filter units
- Self-contained breathing apparatus

Figure 1.6

Fall Protection shall be used where a risk of falling is present. Types of fall protection include: 17

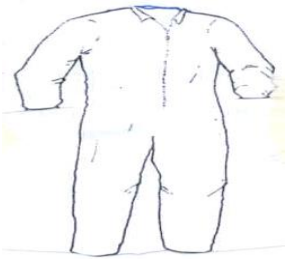
- Helmets
- Belts & harnesses
- Lanyards & pole straps


Safety belt

Figure 1.7

Overall:-Protects the normal clothes from dust, grease and other spilling materials

Always wear firm fitting clothes as loose sleeves and belts can be easily caught in power tools. Wear overalls rather than shorts, because they protect you from sharp objects and the sun. Wear long sleeves, as these will protect you from the sun, and from scratches and burns that may happen when handling material



Overall clothes Figure 1.8

Glove:-Protects the workers from oils, chemicals, and dust and other dangerous material that affect the skin.

Glove

Figure 1.9

Goggle: - Protects eyes of the workers during welding of metal works and when placing reinforcement in the form work.

Figure 1.10

Safe work environment

A safe work environment ensures that accidents are avoided. You can help keep your work environment safe by:

- Locking away dangerous tools at the end of the day.
- putting warning signs or temporary fencing around unfilled holes or opening in the floor
- Removing all rubbish from walkways and areas where people are working.

If you are required to move heavy objects follow correct lifting and moving procedures so that you reduce the incidence of strains, sprains and breaks.

Figure1.11

You should always:

- ✓ bend your knees when lifting anything heavy
- ✓ check that the path you are using is not slippery
- ✓ check there are no obstacles in your way
- ✓ Keep your back as straight as possible when pushing a heavy load.

Hand and power tools can be extremely dangerous, especially if the wrong tool is selected for the job. It is important that all tools are kept in good condition and that they are safely stored when you are not using them. 19

Make sure you:

- ✓ Disengage cutters form work before switching off machines
- ✓ disconnect the tool from the power supply before making any adjustments
- ✓ keep your fingers and hands away from the cutters and blades
- ✓ keep the leads and hoses away from the tool and free of tangles

Don't:

- ✓ Overreach, otherwise you may lose control of the tool.
- ✓ Force the tool – let the tool do the work and your hands do the guiding.
- ✓ lift or lower power tools by their power leads.
- ✓ Operate a power tool while standing in or touching water.

HANDLING MATERIALS

A key part of a safe work environment is handling materials safely and according to applicable safety procedures. Some materials such as oxyacetylene will have Material Safety Data Sheets (MSDS) or hazard tags. These provide details precautions to be taken and any first aid that should be administered should something go wrong. Hazards are a part of every workplace and they have the potential to cause serious and minor injuries and illness. Each job has its own unique set of hazards for example receiving cuts or lacerations from hand and power tools.

Hazards are either:

- ✓ Acute – they happen suddenly and without warning such as falling off a ladder.
- ✓ Chronic – where the effects are not seen for some time such as gradual hearing loss caused by exposure to excessive noise. It is important to know about hazards so you can properly address the safety requirements of your job.

Hazards can be:

Physical	Burned by welding equipment or cut using a hacksaw.
Chemical	Inhaling or swallowing toxic chemicals.
Ergonomic	Lifting something heavy without bending your knees.
Radiological	Exposure to sunlight or power lines.
Psychological	Stress or personal threat.

Self-Check -2	Written Test

Directions: Answer all the questions listed below.

1._____ protects the workers from oils, chemicals, and dust and other dangerous material that affect the skin (**3 points**)

A head protection C. hand protection

B. Eye protection D Glove.

2. ----Protects the normal clothes from dust, grease and other spilling materials.(**2 points**)

A Overall C. hand protection

B. Eye protection D Glove.

Note: **Satisfactory rating – 3 and 4 points** **Unsatisfactory - below 3 and 4 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-3	identifying Quality assurance requirements

1.3 Identifying Quality assurance requirements

Introduction

Quality assurance (QA) is any systematic process of determining whether an install service and maintaining water supply meets specified requirements.

Quality assurance requirements.

1. Public water suppliers are obliged to provide a supply of wholesome water which is suitable and safe for drinking and culinary purposes.

Potable Water·

2. Potable water is water which is satisfactory for drinking, culinary and domestic purposes. Water quality standards may be set by regional, national or international bodies. Guidelines for drinking water quality have been established by the World Health Organization (WHO) as shown in Table 3.1.

Non-Potable Water

3. .Non-potable water may be used for flushing water closets and urinals and other appliances not requiring potable water, provided such water shall not be accessible for drinking or culinary purposes

PRESERVATION OF WATER QUALITY

Water supply installations shall be constructed so that delivered water is not liable to become contaminated to the extent that it is hazardous to health or is unfit for its intended use. 22

(2) The installation in (1) above, in particular, shall not adversely affect drinking water in any of

The following ways:

(a) By materials in contact with water being unsuitable for the purpose (see Clause 3.5.2). (b) By cross connection between pipes conveying water supplied by the water undertaker with pipes conveying water from some other source: (c) By stagnation particularly at high temperatures. (d) As a result of backflow of

Parameter	Unit	Guideline value
Microbiological Quality		
Faecal coliforms	number/100ml	Zero*
Coliform organisms	number/100ml	Zero*
Inorganic Constituents		
Arsenic	mg/l	0.05
Cadmium	mg/l	0.005
Chromium	mg/l	0.05
Cyanide	mg/l	0.1
Fluoride	mg/l	1.5
Lead	mg/l	0.05
Mercury	mg/l	0.001
Nitrate	mg/l(N)	10
Selenium	mg/l	0.01
Aesthetic Quality		
Aluminum	mg/l	0.2
Chloride	mg/1	250
Colour	True colour unit (TCU)	15
Copper	mg/l	1.0
Hardness	mg/l(as $CaCo_3$)	500
Iron	mg/l	0.8
Manganese	mg/l	0.3
pH		6.5 to 8.5
Sodium	mg/l	200
Total dissolved solids	mg/l	1000
Sulphate	mg/l	400
Taste and odour		Inoffensive to most consumers
Turbidity	NTU	5

Self-Check -3	Written Test

Directions: Answer all the questions listed below.

1._____ systematic process of determining whether or water supply installation service meets specified requirements (**3 points**)

A. Identify plans C. Quality assurance

B. Specification D foundation

Note: **Satisfactory rating – 3 and 4 points** **Unsatisfactory - below 3 and 4 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-4	Planning & sequencing Tasks

1.4 Installing water piping systems measurement.

Introduction: Measurement is the first and important part before the operation starts. Therefore knowing how to measure the needed pipe can save time and labored.

Identifying types of pipe

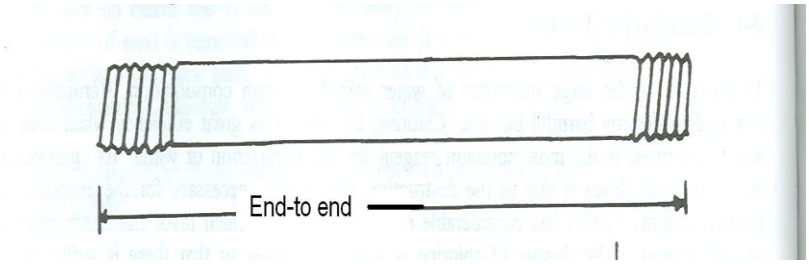
1.4.1 Tasks are planned and sequencing of task in conjunction.

1. Identify types of fitting and there function
2. Follows Safety precautions, supply conditions, or other special requirements
3. Aspects of taking correct measure
4. Provide instructions for completing the skills phase of the job
5. Identify tools, instruments and equipment required
6. Required measurement of complete job
7. Step by step procedure
8. 8 Dimensions and/or specification

We have three methods to measure pipes, they are

END TO END MEASUREMENT

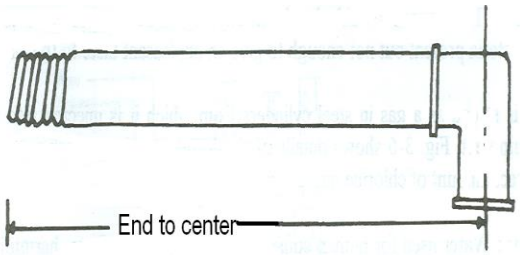
- It is the measurement of a pipe without any fittings.
- It is also known as installation lengths
- It is made by tightening a fitting on the threaded end of a pipe, placing the end of the rule exactly at the end.



END TO CENTER MEASUREMENT

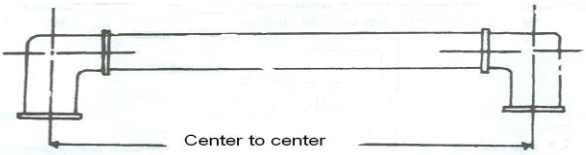
It is a measurement, which is taken from the center of an elbow or a fitting screwed on one end o the opposite end of the pipe.

It is also known as installation lengths, and made by tightening a fitting on the threaded end of a pipe, placing the end of the rule exactly at the center of the fitting measuring along the pipe and making the proper distance. 26



CENTER TO CENTER MEASUREMENT

- -It is a distance between the centers of two fitting in a pipeline.
- -It is also called construction lengths.



1.4.2 Preparing Work areas

1. All excess material should not be wasted, but used or safely removed from site according to appropriate legislation.
2. Identify the waste types that are likely to be produced and aim to reduce the amount of waste as much as possible, through identifying routes to reuse or recycle materials.
3. -Control access to storage areas to minimize risk of theft or damage.
4. .-Store any materials away from sensitive locations in fenced off areas.
5. -Label all waste storage and skips, detailing the type of waste.
6. -Employ a just-in-time policy to deliver materials in order to reduce the storage time on site.
7. Safety at all times should be positive. You must know what to do, what to use, what to prevent & what guards in the work area.
8. Keep work area free from un necessary item, that cause slipping hazards

Self-Check -4	Written Test

Directions: Answer all the questions listed below.

1. ------the measurement of a pipe without any fittings

A. center to center measurement C. center to end measurement

B .end to end measurement D. all

2. ---It is a distance between two fitting in a pipeline

.A. center to center measurement C. center to end measurement

B .end to end measurement D. all

Note: **Satisfactory rating – 3 and 4 points Unsatisfactory - below 3 and 4 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-5	Selecting and checking tools and equipment	8

1.5 importances of tools and equipment

You will use a range of hand tools regularly in your job. So it's important that you know the functions of these tools and how they should be used. This section looks at some of the safety hazards that are associated with using hand tools in the workplace. It looks at some of the things you can do to reduce the impact of these hazards. It discusses the importance of regularly checking and maintaining the hand tools you used. This section also identifies the functions and uses of some of the common hand tools used in plumbing. The safe use of individual tools, and maintenance and storage are also discussed. This section has two parts.

1.51 Safety and serviceability of tools.

Whenever you use hand tools in the workplace you should ensure that you use them safely. You should also ensure that you check the serviceability of the tool before using it. The use of hand tools on plumbing worksites introduces a separate set of potential OH&S hazards. To reduce the impact of these hazards you must ensure that you select the correct tool for the job, and use it appropriately and safely.

1.5.2 Workplace disorders and hand tools

Using hand tools in your workplace can increase your risk of workplace disorders such as repetitive strain injuries and shoulder and back injuries. Using tools correctly can help reduce these risks.

1.5.3Causes of workplace disorders

- ✓ Forceful muscular exertions, such as holding or guiding a tool using a very firm grip, or having your wrist bent when using the tool
- ✓ Heavy loading of the shoulder while you are holding tools.
- ✓ This is more common when your arm is held out from your body. Repetition by making the same movements over and over again, for example sawing tubes.
- ✓ _ Shocks to the hand and wrist.

- ✓ _ Wide grip span caused by badly designed handles or triggers that have to be activated by one finger or only the finger tips. This can cause an injury known as trigger finger.

1.5.4 Reducing the risks of workplace disorders

- ✓ Wherever possible, select tools that are specifically designed for the job you are doing.
- ✓ Use tools that have a good gripping surface on handles.
- ✓ Try not to grip tool handles more tightly than you have to.
- ✓ Have a grip span of about 600 mm and not more than 900 mm.
- ✓ Wherever possible, use a vice or a clamp to hold the item such as tubes hat you are Sawing.
- ✓ Ensure triggers can be easily activated by either hand.
- ✓ Take regular breaks or alternate the way you are doing the tasks.
- ✓ Maintain tools on a regular basis

hand and power tools,

Apart from the hand tools we have looked at, a plumber needs certain power tools to help with the installation process.

Drills and cordless drills can be divided into three different types and these are shown in the table below. Power saws are also included as this play a very important part in the installation process of plumbing and heating systems.

Rotary hammer drills – This type of drill has a standard chuck so accessories such as metal drills and whole saws can be used. The chuck should be kept well oiled to prevent breakdown

(Figure 1.1) Drills and cordless drills

Circular saws – A very useful tool for lifting floorboards and notching joists. Care should be taken to ensure that the blade guard is in place and that the blade is securely fastened

Circular saws – A very useful tool for lifting floorboards and notching joists. Care should be taken to ensure that the blade guard is in place and that the blade is securely fastened

(Figure 1.2) Circular saws

Hacksaw – Used to cut copper tubes, plastic waste pipes, gutters, soil pipes and low carbon steel pipes. Not suitable for cutting wood. Always ensure that the correct type of blade is fitted, that the teeth are facing forward and the tension of the blade is not loose.

(Figure 1.3) Hacksaw

Junior hacksaw – An essential saw for the plumber's toolbox. This small saw is used to cut small copper tubes and plastic pipes. Excellent for cutting tubes in position in tight situations where access is difficult. When replacing the blade, always ensure that the teeth of the blade face forward

(Figure 1.4) Junior hacksaw

Still son – Used when installing low carbon steel pipe. They are available in many sizes ranging from 10in to 36in

, (Figure 1.5) Still son

cutting and threading and bending equipment

Bending copper tube using a bending machine Bending copper tubes using a bending machine is an economical method of installation, especially where lots of bends or changes of direction are required. There are many types of bending machine available for copper tubes up to 42mm diameter, all of which are worked by hand. For larger diameters, ratchet-action machines are required. The most useful type of machine for 15 and 22mm tube is the portable type or scissor bender (see page 215), which is light in weight and requires no adjustment before use.

The advantages of machine bending over spring bending can be summarized as follows:

- ✓ bends can be formed quickly
- ✓ multiple bends can be formed easily
- ✓ bends can be formed close to the end of the tube
- ✓ Bend radius, quality and accuracy are consistent.

Producing accurately positioned bends depends on determining the bending point and the position of the tube in the machine

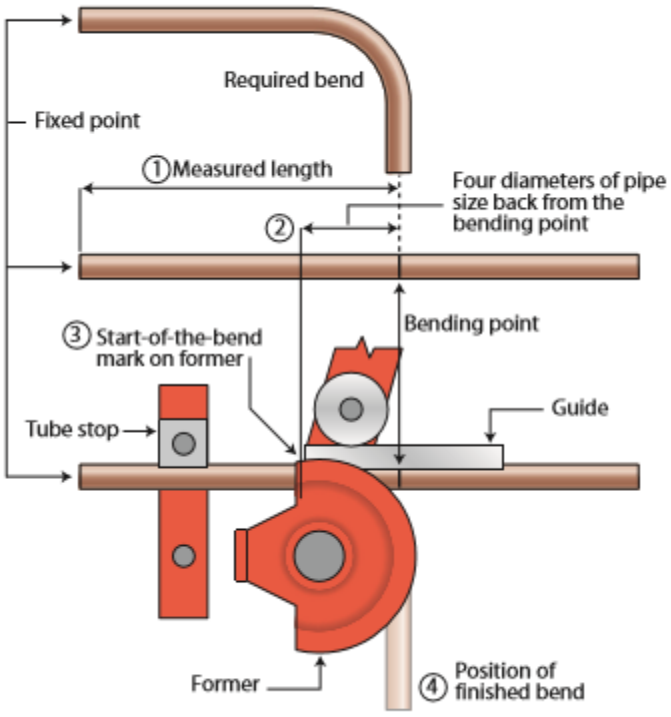
90° bends method 1

1 Measure the distance required and marks it on the tube.

2 Measure back from that mark four diameters of the tube size being used, ie if 15mm tube is being used, measure back 60mm and mark the tube.

3 Place the 4d mark on the ‘start-of-the-bend’ mark on the bending machine.

4 Bend the tube to 90° and check the measurement using a set-square and a rule



(Figure 1.6) cutting and threading and bending equipment

Plastic pipe cutters – Can be used to cut all forms of plastic pipe. They give a clean cut, which is essential when jointing push-fit pressure plastic pipe

(Figure 1.7) Plastic pipe cutters

Scissor bending machines – These bending machines, also known as hand benders, are excellent for precision bending of copper tube. They are light in weight and portable. These are used for bending copper tube in sizes 15mm and 22mm

(Figure 1.8) Scissor bending machines

Tripod bending machines – Static bending machines for bending copper tubes, in sizes ranging from 15mm up to 42mm. Particular attention should be paid to the bending roller to prevent excessive rippling of the tube, which can occur when the roller is not tight against the bending guide. If the roller is too tight, then trotting of the copper tube will occur

(Figure 1.9) Tripod bending machines

Hydraulic low carbon steel bending machines – These use pressure from hydraulic oil to bend steel pipe. The oil level should be checked periodically and topped up as necessary.

(Figure 1.10) Hydraulic low carbon steel bending machines

Ratchet stocks and dies – Used for on-site threading of BSP low carbon steel pipes, whether in situ or mounted in a pipe vice. 34

(Figure 1.11) Ratchet stocks and dies

Pipe threading machines – Used on-site, these electric floor mounted tools will cut, debar and thread LCS pipe easily and quickly. They do, however, need regular maintenance.

(Figure 1.12) Pipe threading machines

motors and fittings

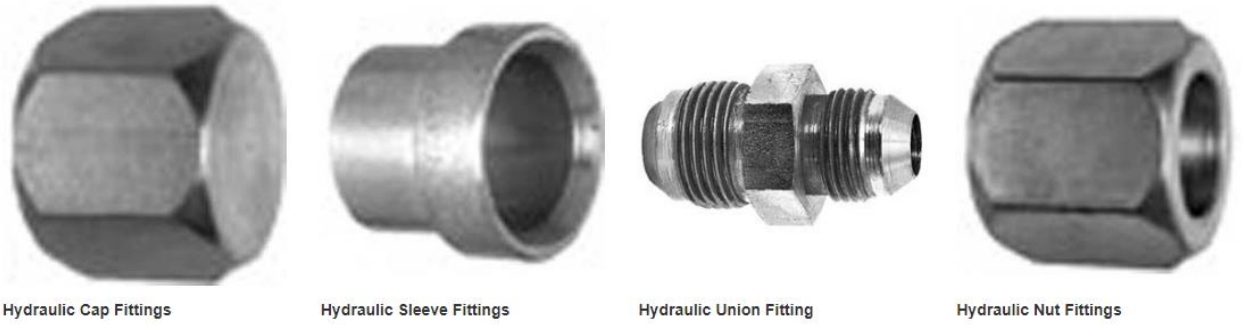
Water is pumped from the tank through a piping system into the water heater and then to the withdrawal points in the vehicle. A water pump ensures that water flows through the pipes. In the camping area, two different types of pump have become established.

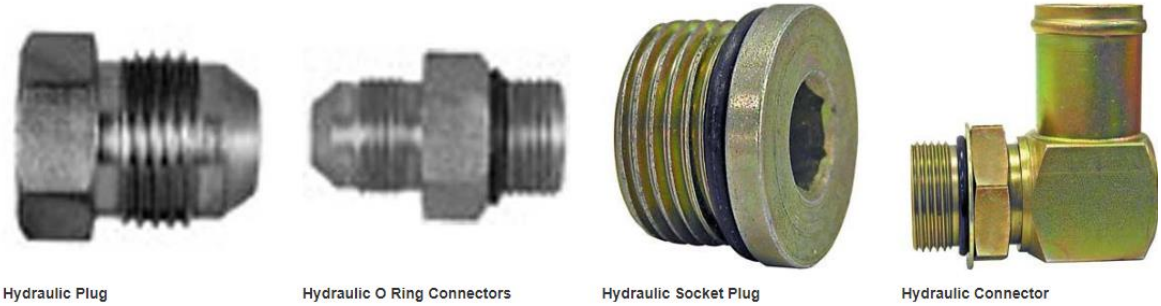
A submersible pump is suspended directly in the water tank. When you open a tap in the vehicle, a micro switch in the tap starts the pump and the water flows. Submersible pumps are used mainly in caravans.

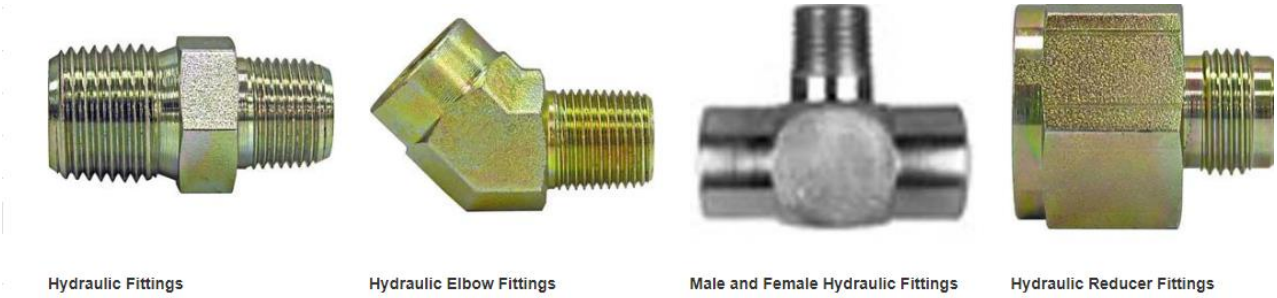
On the other hand, pressure water pumps are used more frequently in motor homes. They can be installed anywhere in the water system and maintain constant pressure in the piping. When a tap is opened, the pressure drops and the pump starts. Pressure pumps are generally more powerful than submersible water pumps – but they are also more expensive. However, they usually last longer. Individual parts can be easily repaired or replaced. Pressure water pumps have one big disadvantage compared to

submersible pumps: if the system has a leak, the entire water tank can empty into the vehicle. 35

(Figure 1.12) **motors**







(Figure 1.13) Fittings

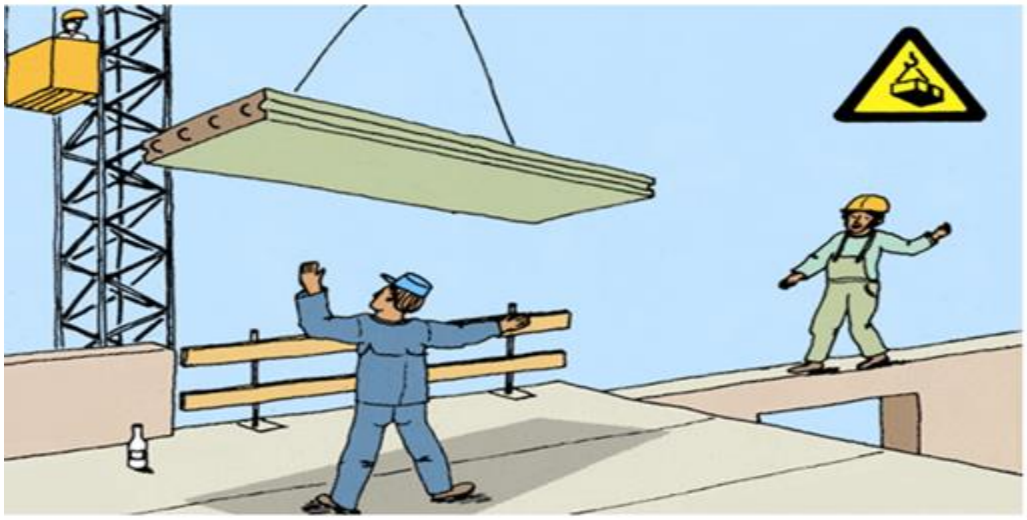
limited height scaffolding,

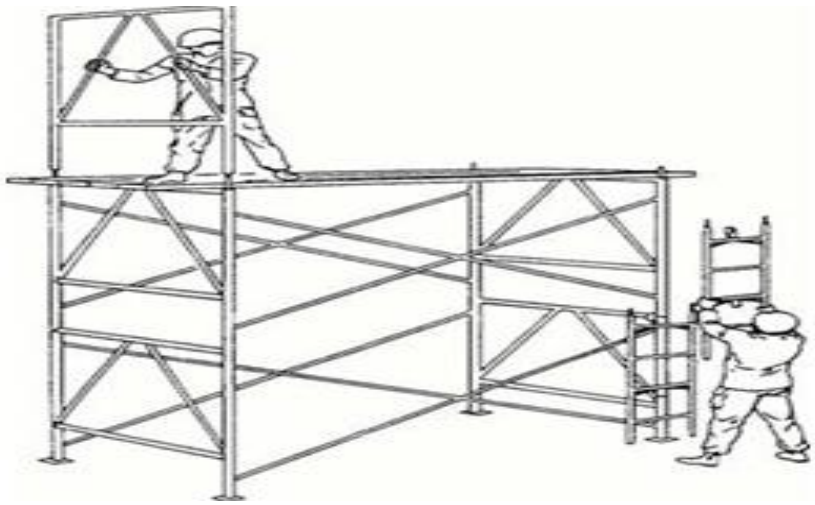
Scaffolding has been used for many centuries to provide access areas for building and for plumber than people who work on them.

Scaffolding is a major component in plumbing work . It is as old as Roman times and has been in use continuously along with the incremental improvements over the centuries. Today bamboo is used in Asia in the scaffold industry, but would never be considered for use in an advanced society's plumbing work.

The scaffold industry does well in times of a construction boom. Related industries thrive as well, such as the metal industry which produces steel scaffolding and companies producing the boards for the scaffolding. In a booming economy, one witnesses scaffolding all around when instigation of water supply system is going on at a rapid pace. Compound what you see going on around you and multiply this many times over to see how a construction boom helps various sectors of the economy.
A scaffolding tower can be seen almost anywhere construction is taking place. It is the only way workers can reach the heights required in constructing or repairing buildings. When sandblasting or doing pointing on bricks scaffolding is require. One scaffold after another is constructed until the entire scaffolding tower is in place to complete the desired installations of water supply project.

It will take some time to assemble the scaffolding tower before the project begins. This scaffolding tower can sometimes wrap around an entire building. The scaffolding tower is not an area in which time and money should be saved. The scaffolding tower must be constructed slowly and constantly tested because an accident is by nature costly, whether to the workers or those walking below. Workers on the site should be aware of the "fall zone" if the scaffolding is changed in any way.
The scaffolding tower consists of the couplings holding the tubular pieces and the boards for supporting the workers and their supplies.





Tube and Coupler Scaffolds

Working with Ladders

Ladder is very important measures in installations of water supply work to serves as an access & to reach higher or lower work points. But it is also a cause of accident for a very frequent reason when it is misused, that is, can slip away if it is improperly placed; therefore it is necessary to find a stable and secure stand for

The ladder. Ladder should be placed at an angle of approx. 70 ˚. In case of stepping over, lower point to the higher part of a building, part of the ladder has to be exceeding the top point at least 1m.

Self-Check -4	Written Test

Directions: Answer all the questions listed below.

1._____Used for on-site threading of BSP low carbon steel pipes, whether in situ or mounted in a pipe vice step. (2points

A. Pipe threading machines C .Ratchet stocks and dies

B. motors and fittings D. all

2._____An essential saw for the plumber's toolbox.(3point)

A. Pipe threading machines C .Ratchet stocks and dies

B. motors and fittings D. Junior hacksaw

Note: **Satisfactory rating – 3 points 4 Unsatisfactory - below 3 and points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-6	Preparing Work area

1.6 Preparing Work area

Before, during and after carrying out any work, the workplace must be clean and tidy to prevent tripping and falling.

Preparing the work area in order to carry out the maintenance of plant and equipment. You will be involved in activities such as clearing materials and equipment from the worksite, providing service supplies and completing isolations. You will be following your tvte college safe working practices and working within the work permit procedures. This unit deals with the following:

Prepare work areas for the maintenance of process engineering plant and equipment

- Rush cutters produce toxic exhaust fumes as soon as the engine starts running. These gases may be odorless and invisible. Never use your power tool in an enclosed or poorly ventilated space. Always make sure there is adequate ventilation.
- Check the floor of your workplace. Remember there is a risk of slipping on wet surfaces, uneven terrain or on freshly stripped wood (bark). Watch out for obstacles: take care not to trip over tree stumps or roots!
- If anyone else is nearby, especially children, keep them at a safe distance. Ensure that there is no-one within 15 meters, otherwise they may be injured by flying objects. Keep the same distance from objects such as vehicles or windows to avoid damaging property.
- Check that the brush cutter is in correct working order. Please read the relevant chapter of your Instruction Manual:
- The combination of cutting attachment, guard, handle and harness must be a permissible combination and all the parts must be correctly installed.
- The master control/stop switch must move easily. The throttle trigger lockout (if installed) and throttle trigger must move easily and the throttle trigger must return to the idle position automatically.

- Check that the spark plug boot is firmly seated. If it is loose, sparks may occur which could ignite the fuel/air mix as it is delivered, causing a fire hazard. 40
- The cutting tool or attachment must be fitted correctly, secure and in perfect condition.
- Examine protective devices (e.g. cutting tool guard, rider plate) for any signs of damage or wear. Replace any defective parts. Never use the machine if the guard is damaged or if the rider plate is worn (if the lettering and the arrow are no longer clearly visible).
- Never attempt to modify the controls or safety devices.
- Keep the handles dry and clean - free from oil and pitch - for safe control of the machine.
- Adjust the harness and handle(s) to suit your height.

1.6.1 N your own interest you should observe the following safety instructions with regard to your starting location:

- Always move at least 3 meters away from the refueling location.
- Check your working area for any obstacles (such as branches) and look at its condition. Always have an escape route available for emergencies. Slippery, uneven or icy surfaces can be hazardous and therefore should be avoided.
- Also make sure there is no-one nearby. However, you should never work alone and you should always ensure that someone else - who can help in an emergency - is within a close distance

operation shete-1	Planning & sequencing Tasks

The techniques for Planning & sequencing Tasks for pipe work

Step 1. Follows Safety precautions, supply conditions, or other special requirements

Step 2 Identify tools, instruments and equipment required

Steps 2- Identifying types of pipe

Step 3 identify types of fitting and there function

Steps 4 Aspects of taking correct measure

Steps 5- Provide instructions for completing the skills phase of the job

Steps 6 –install pipe work installation

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary sanitary drawing, templates, tools and materials you are required to perform the following tasks within 4 hour.

Task 1 Identify symbols and abbreviations of given plan/working drawings

Task 2 identify plumbing materials using drawing and its legend of given plan/working drawings

Task 3 identifies needed OH&S requirements for this water supply installation.

Task4 Identifying Quality assurance requirements for this water supply installation.

Task 5 identify needed tasks to install this water supply installation

Task 6 Plan & sequence the above tasks

Task 7 Select and check tools and equipment for this water supply installation.

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1) American Society of Plumbing Engineers (ASPE) Research Foundation. 1978. Reduced-size venting design, by E. Brownstein. Westlake Village, CA.
2) Copper Development Association, Inc. Copper solvent single-stack plumbing system handbook supplement. New York.
3) Mamas, Vincent T. 1957. National plumbing code handbook. New York: McGraw-Hill.
4) National Association of Home Builders Research Foundation. 1971. Performance of reduced-size venting in residential drain, waste and vent system. Report LR 210-17.
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Plumbing Installation Work

LEVEL II

Learning Guide # 12

Unit of Competence: Install, Service and maintain water supply Systems and Components

Module Title: Install, Service and maintain water supply Systems and Components

LG Code: EISPLI2 M11 Lo2- LG 46

TTLM Code: EISPLI2TTLM110919 v1

LO2: Identify installation requirements

Instruction Sheet	Learning Guide # 46

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- ✓ Positioning installation components
- ✓ Identifying Quantity and type of materials
- ✓ Calculating materials requirement
- ✓ Determining Allowances for fabrication and assembly
- ✓ Identifying tools and equipment.

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Position installation components
- Identify Quantity and type of materials
- Calculate materials requirement
- Determine Allowances for fabrication and assembly.
- Identify tools and equipment.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4 and Sheet 5”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3, Self-check 4 and Self-check 5” **in page -51, 93, 103, 106 and 120** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 and Operation Sheet 2” **in page -121 and 122.**
6. Do the “LAP test” **in page – 123** (if you are ready).

Information Sheet-2	Positioning installation components

2.2 Positioning installation components

Introduction

The primary task of a building cold water service and distribution system is to provide adequate flow, pressure, and volume suitable for human consumption at every device that uses water, even when the system is at peak demand.

The residential plumbing system is often taken for granted, but it is an important part of the structure.

Plumbing System installation components

1. Water supply pipes
2. Fixture – A device that uses water (sink, toilet, dishwasher, etc.)
3. Soil, waste, and vent pipes
4. Drain and sewer
5. Gas pipes
6. Storm water drainage

A complete plumbing system provides an adequate supply of water and removes waste.

There are three principal parts:

1. Water supply system.
2. Water and waste removal syste
3. 3. Plumbing fixtures

Used water and other wastes are carried to the sanitary sewer or septic tank through the waste removal system.

These pipes are isolated from the water supply system and must be sized for sufficient capacity, have the proper slope and venting, and have provisions for cleanouts.

Typically it is practical to drain as many of the fixtures as possible into a single main drain.

The drainage system is not under pressure and depends on gravity to carry the waste to the sewer.

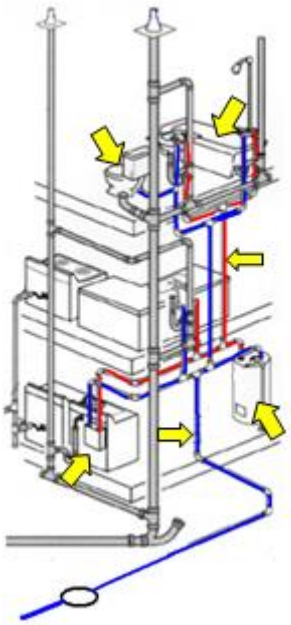
Water Supply Connections

Flexible water supply lines are used extensively. These lines supply the lavatory with hot and cold water, and connect the lavatory faucet to the angle stop valve. Flexible supply lines are normally made of a flexible steel mesh exterior with a soft plastic interior that can be routed to make connections to fittings very easy. Another type of flexible line is made of plastic. It is not as flexible as the steel mesh type but it can be bent to make the necessary connections. Supply lines can also be made of 3/8 inch copper tubing or chrome plated copper tubing for a more luxurious appearance. Although they are more rigid than steel mesh or plastic, they can be configured to make fitting connections easier.

Water Supply System

. Network of pipes that transport hot and cold potable water under pressure

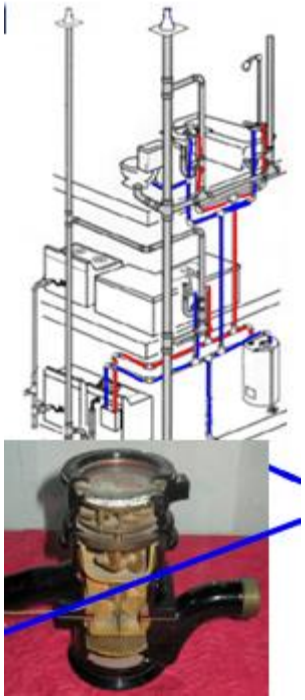
- Fixture – A device that uses water (sink, toilet, dishwasher, etc.)
- Water Heater – Large insulated tanks that heat cold water to be distributed in the hot water supply lines
- Trunk Lines – Hot or cold water pipes that serve many fixtures
- Branch Lines – Hot or cold water pipes that serve only one or two fixtures



(Figure 2.2) Network of pipes that transport hot and cold potable water under pressure

Water Supply System

- Water Main – Supply pipe installed and maintained by a public entity and on public property
- Water Service – Pipe from the water main to the building supply pipes
- Meter – Measures the amount of water transported through water service
- Valve – A fitting used to control water flow (located next to the meter)



(Figure 2.2) **Water Supply System**

Self-Check -1	Written Test

Directions: Answer all the questions listed below.

1._____ single or a double bowl made of various materials like stainless steel**.(3 points**)

A. shower head C. Kitchen Sink

B .the water closet D. Faucets

2._____ Are approved type installed receptacle, devices or appliances supplied with water or receive liquid-borne (2point)

A. shower head C. Kitchen Sink

B Fixtures D. Faucets

Note: **Satisfactory rating – 5 points Unsatisfactory – 3 below points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-3	Identifying Quantity and type of materials

1.3 Identifying Quantity and type of materials

Introduction:

There are numerous kinds of materials available for plumbing installation. So far, the materials commonly used in plumbing installations past and present are the following**:**

1.3.1 Types of Plumbing materials Pipes

1) Cost iron pipe and fittings for water
2) Lead pipe
3) Galvanized steel pipe (GSP)
4) Brace pipe
5) Copper pipe
6) Plastic pipe
7) Cement pipe and concrete pipe
8) PVC pipe fittings

Cast Iron Pipes are of two types, namely:

1. The SV type which is generally used for building installations.
2. The XV type classified as extra duty pipe used for underground installation.

Cast iron Pipe has four varieties, namely:

1. Standard pipe
2. Single Hub pipe
3. Double Hub pipe
4. Humbles pipe

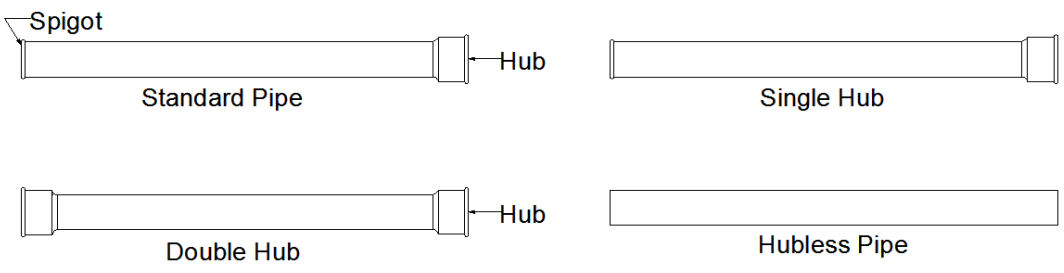


Figure 3.1

1. Cast Iron Pipe

For years, the most popular and generally specified material for drainage installation in buildings is the Cast Iron Pipe. It is durable, conveniently installed and answer to the most plumbing needs of all types of buildings less than 25 storey high. However, buildings taller than 25 storeys high do not specify the use of cast iron pipe because of vibrations which causes l leakage at the pipe joints.

To a certain extent, cast iron pipe is also affected by corrosion caused by the action of carbon dioxide, sulfur oxide and methane gases forming solutions of carbonic acid and sculpture acid which attack the metallic materials causing a slow chemical reaction or oxidation to take place forming ferrous oxide commonly called rust.

2. Lead Pipes

Lead pipe is also one of the oldest plumbing materials used by the Egyptians, the Greeks and the Roman Architecture as soil and waste pipe. Lead is highly poisonous and injurious for human health. It is never recommended for human consumption.

3. Galvanized Steel Pipe

Galvanized steel pipe is made out of a mild steel drawn through a die and welded cast in 6.0 meters long. This type of pipe is easily corroded by alkaline and acid water. The carbonic acid in water, attack the zinc coating and ultimately the steel itself. It is subject to deposits of salt and lime which gradually accumulate and eventually choke the flow of water. This pipe deteriorates faster when used as hot water supply lines.

TABLE (TABEL 1) GALVANIZED STEEL PIPE DATA IN MILLIMETER (mm)

Nominal Size		Outside Diameter	Inside Diameter	Thread per inch	Pipe Screwed into fitting
mm	inch				
10	3/8	16.87	12.20	18	12
12	1/2	21.00	15.55	14	12
20	3/4	26.25	20.60	14	12
25	1	32.87	26.22	11.5	16
32	1 1/4	41.50	34.50	11.5	16
38	1 1/2	47.50	40.25	11.5	16
50	2	59.31	59.61	11.5	20

Fig 3.2 pipe data in mm

4. **Brass Pipe**

Brass pipe is the most expensive of all types of pipe. This pipe is made of an alloy or zinc and copper mixed at proportion of 15% and 85% respectively. Brass pipe is superior material for waste and water installations because of its smooth interior surface aside from its high resistance to acids. Brass pipe fittings are of the recessed type similar in design as those of galvanized steel pipe.

5. Copper Pipes

Copper pipe is a durable material which is extremely corrosive resistant. It is easy to install as compared to other types of pipes.

Copper pipes are classified into three, depending upon its wall thickness, namely:

1) The **K** type is the heaviest. It is suitable for underground installation.
2) The **L** type is lighter than the K. It is available in both the rigid and flexible form, commonly used in residential water supply line and for radiant heating installations.
3) The type **M** is the thinnest and is available only in rigid form. This type of copper pipe is specially designed for small water supply lines and also for radiant heating installations.

1.3.2 Special Features of Copper Pipes

There are some special features of copper pipe which are worthy to mention such as:

1. It could be used as drains and vent pipe
2. It could be used as cold and water supply line.
3. It can also serve as heading line.
4. It can replace rusted or choked up sections of galvanized steel pipe.
5. There is no special tool required or threading necessary.
6. It is easily bent. A flexible vertical line can offset existing structure and underground lines can be re-routed around an obstructions.
7. Measuring is less critical
8. It needs fewer joints and fittings.
9. It comes in longer length.
10. Copper pipes may be used one size smaller than the steel pipe.
11. Copper pipe is remarkably an excellent material for hot water.

In installing hot water line, the use of bigger pipe should be avoided because head loss is high compared to that of smaller and right size of pipe.

TABLE(TABLE 2) COPPER PIPE TECHNICAL DIMENSIONS IN MILLIMETER (mm

Nominal Size		Outside Diameter	Inside Diameter		
mm	inch	mm	Type K	Type L	Type M
10	3/8	12.00	10.00	10.75	11.25
12	1/2	12.20	12.62	12.62	14.23
20	3/4	23.00	18.60	19.63	20.28
25	1	28.00	24.80	25.63	26.38
32	1 1/4	35.00	31.10	31.63	32.28
38	1 1/2	41.00	37.10	37.63	38.18

Figure 3.3

6. Plastic or Synthetic Pipes

Plastic pipe is a new in the field of plumbing and sanitary. It is now widely in different countries worldwide. This type of material was developed in Germany in 1935.

Plastic pipe has become so popular and for the last decade it has penetrated the international market. It has gained widespread acceptance after it has in many ways proven itself to be superior as sewer and cold water pipe line materials. Test indicated that plastic pipe will last for more than 50 years under normal condition.

1.3.1 Plastic pipes are of two different types:

a. The Rigid type

b. The Flexible type

The Rigid Types are:

1. Polyvinyl Pipe (PVC)
2. Chlorinated Polyvinyl Pipe (C-PVC)
3. Un plasticized Polyvinyl Pipe (U-PVC)
4. Acryl nitrite Butadiene Styrene (ABS)
5. Polypropylene (PPR)
6. Styrene Rubber Plastic

The Flexible Types are:

1. The Polyethylene (PE)
2. The Polybutylene (PB)

The PE and PB tubes are in coil form available at 30 meters long. Moreover, the PB is manufactured with special length up to 150 meters long in coil form. Presently, the plastic pipe being used for hot water lines are the Chlorinated Polyvinyl Chloride (CPVC), the Polyvinyl Dichloride (PVDC) and the Polypropylene (PP) which seems to be all right, but whether it could withstand hot water at 180° F or higher temperature plus the pressure of hot water for years without any amount of substantial collapse or damage to itself is still a matter of fact to be proven. Thus extensive research is still going on to develop plastic pipe which could be suitable for hot water.

Advantages of Plastic Pipes

The plastic pipe offers the following advantages: 55

1. Plastic pipe is more resistant to rust and corrosion.
2. Water conveyed by plastic pipe has no taste.
3. With its smooth interior surface, there is no turbulence of water and therefore has minimum resistance to flow.
4. Comparatively, the plastic pipe weighs about 1/5 of the metal pipe.
5. Plastic pipe are cast in longer length and ease to cut as well as to install.
6. The Polyethylene (PE) pipe is flexible material that weighs about 1/8 as much as the steel pipe. A 100 meter coil of a 25 mm (1 inch) diameter plastic pipe could be easily carried by one individual compared with metal pipes having the same length and diameter which could be hardly carried by 5 persons.

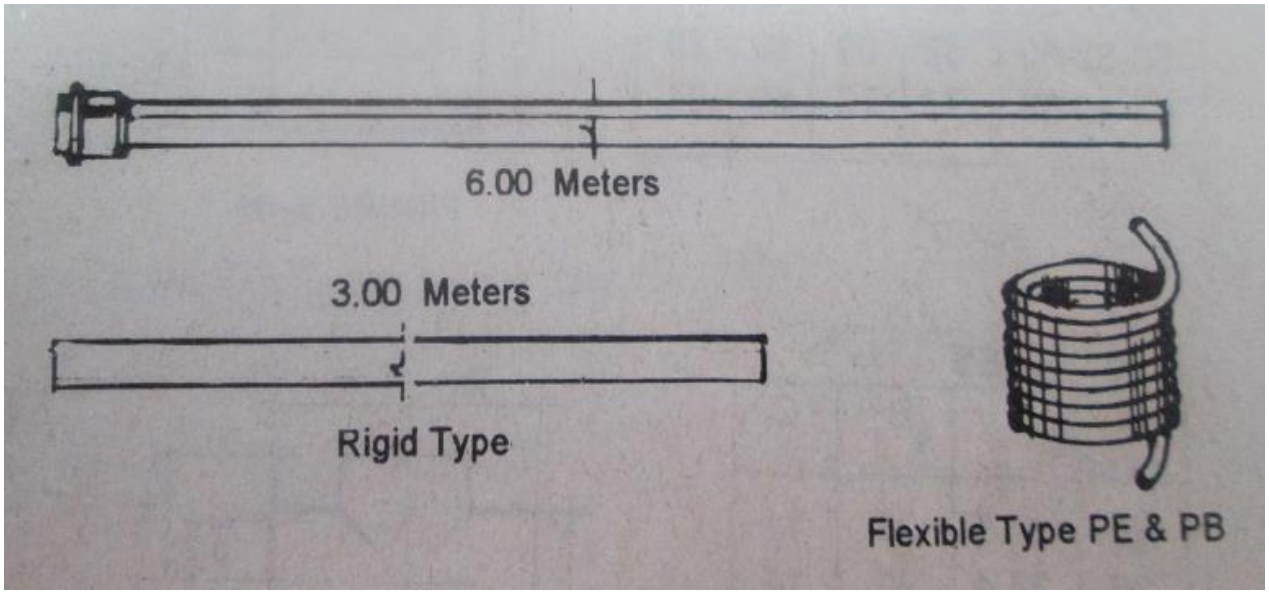


Figure 3.4

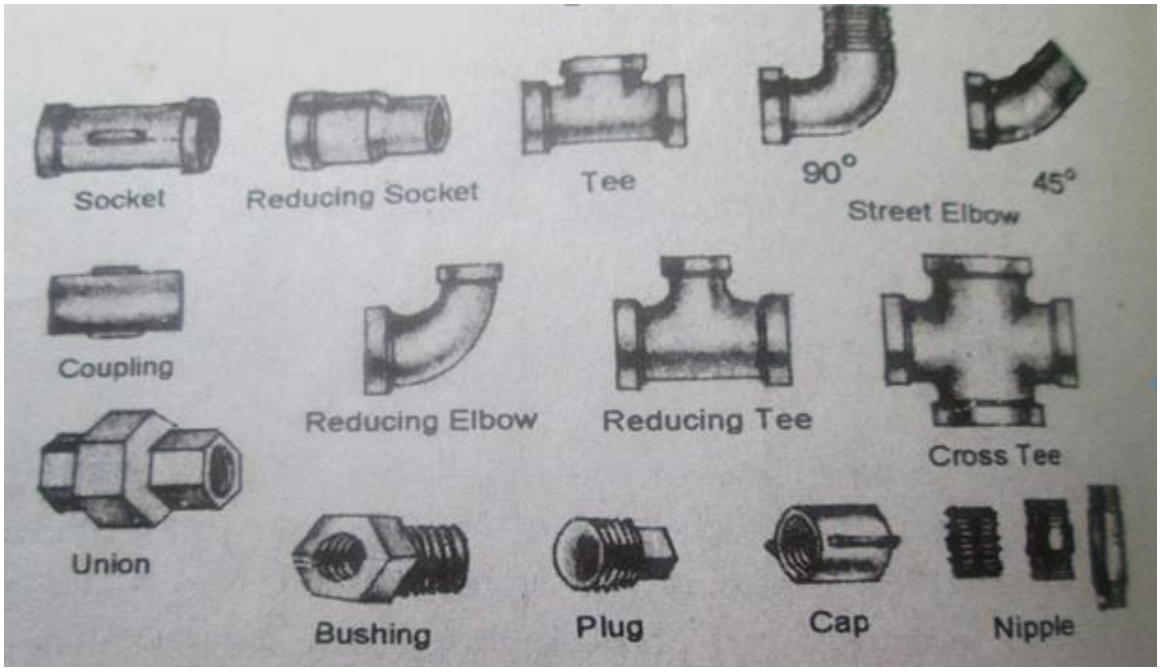


Figure 3.5

1.3.4 Galvanized Wrought Iron Pipes

Galvanized wrought iron pipe is better in quality than the steel pipe for plumbing installation. Tests showed that wrought iron pipe is resistant to acid waste than the steel pipe.

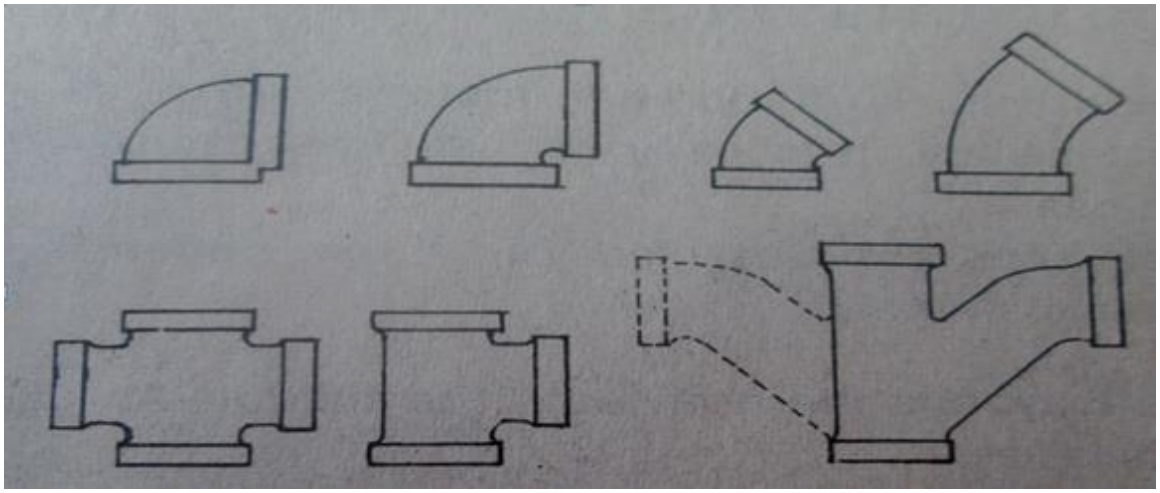


Figure 3.6

Pipe size – In the absence of measuring caliper, the inside diameter of a pipe can be determined by measuring the outside circumference of the pipe with a string

Table 3 the inside diameter could be easily known.

Table 3 PIPE DIAMETER IN MILLIMETER (mm)						
Circumference, String Length	54	67	83	113	133	160
Pipe Size , mm	10	13	20	25	32	38
Equivalent in inches	3/8	1/2	3/4	1	1 1/4	1 1/2

Figure 3.7

Table 4. QUANTITY OF TEFLON TAPE FOR PIPE JOINT (meters)							
Number of Turn	Pipe Diameter in Millimeter (mm)						
	10	12	20	25	32	38	50
1	0.054	0.067	0.083	0.113	0.123	0.150	0.200
2	0.108	0.134	0.166	0.226	0.236	0.300	0.400
3	0.162	0.201	0.249	0.339	0.350	0.450	0.600

Figure 3.8

C. Copper Pipes

Copper Pipes are classified into two types:

1. The Rigid type
2. The Flexible type

1.3.5 Copper Pipe Working Procedures:

1. In measuring the length of a rigid copper pipe, the face to face method is also applied. The depth of the soldering hub is added to the clear face to face length of the pipe.
2. Cutting of copper pipe with a suitable tube cutter will give the best satisfying result. However, in the absence of rotary tube cutter, a hacksaw with fine toothed blade with either 24 or 32 teeth per inch will do. The hacksaw blade with 24 teeth is recommended for cutting heavy pipes while the 32 teeth per inch is suitable for the thinner pipes.
3. Cutting is done through a gentle light forward strokes. After cutting, the burrs are removed inside the pipe with a file or reamer.
4. Copper pipes are bent slowly on a wide radius to avoid kinking. Bending is done with a pipe bending machine which produces a very satisfactory result.

Another way of bending is with the use of steel spring inserted inside the pipe to produce a smooth clean curve. 58

1.3.6 Identifying *Materials* /equipment

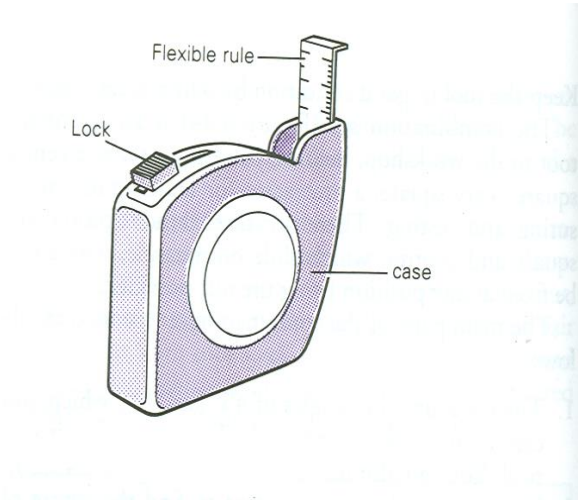
1.3.6.1 Safety of hand tools and device

- Safe handling and manipulating of hand tools and equipment is a paramount point in order to protect yourself and prolong the service life of the tools and equipment.
- It is very necessary to use hand tools and equipments for the right job and clean immediately after performing any activities.

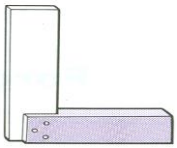
I) Measuring and marking tools

- The followings are lists of measuring and marking tools

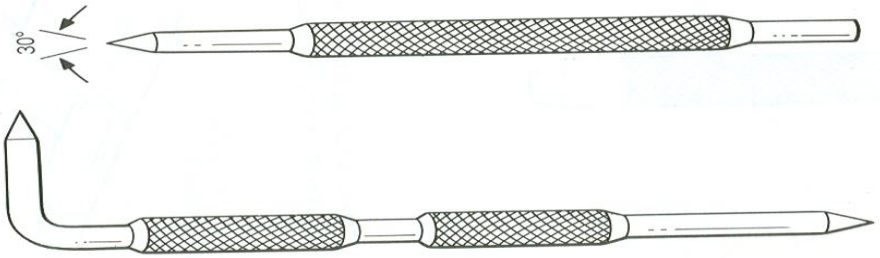
A) Tape rule



(Figure 3.9 a) tape rule



(Figure 3.10 B)Try square



(Figure 3.11) Scribers

(Figure 3.12 d) Steel rule

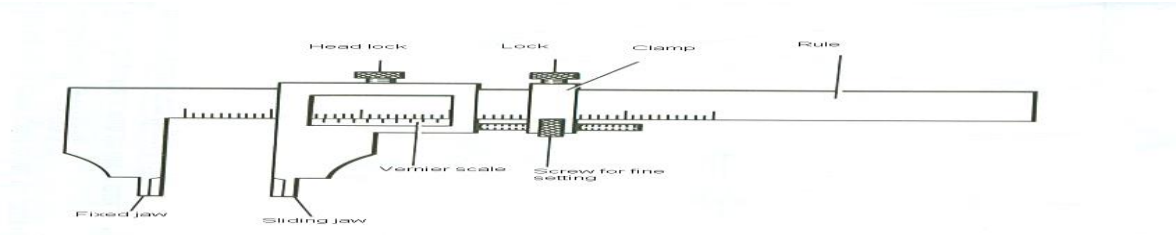


Figure 2.13) Caliper

1.3.7 Cutting, filing and Reaming Tools

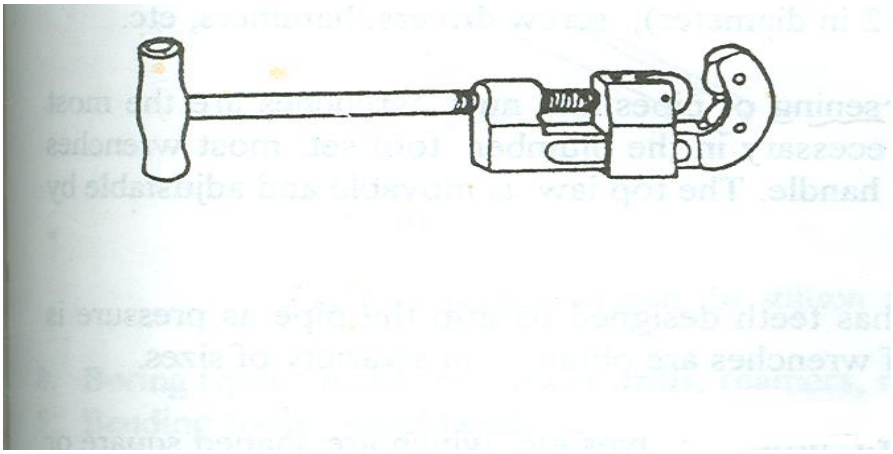
. The following listed tools are used to cut

A) **Hack saw**- It is a tool used to cut pipes and other metals.

- It has a frame and blade
- The most commonly used hack saw blades are 250-300mm long.
- The pitch, or the number of teeth per inch is also selected according to work piece hardness; it is
- 16 for soft metal
- 19 for medium hardness
- 22 for cast iron and tool steel

B) Pipe cutter: - It is used to cut pipes at right

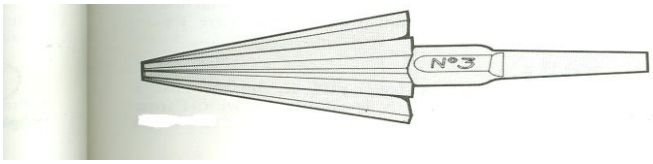
It performs the job much easier than a hack saw.



(Figure 2.14 b) Pipe cutters

3) Reaming is used to clear burrs at the end of cut pipe, the tools used for this purposes are:

- **Reamer**



(Figure 2.15 c) Reamer

D) Half round file

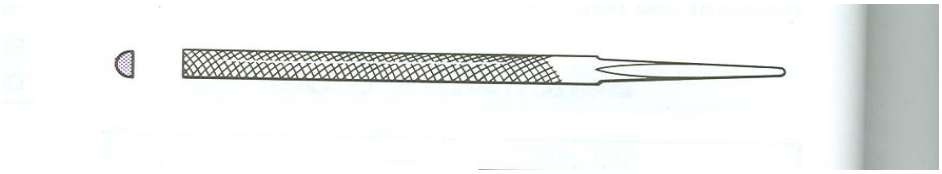


Figure 2.16 d) half round file

4. **Bending tools**:

They are used to bend pipes at the required angles. One of the most important skills a plumber should. Possesses is the ability to bend pipes of various materials quickly and accurately the followings are lists of bending tools:

Hydraulic pipe bender

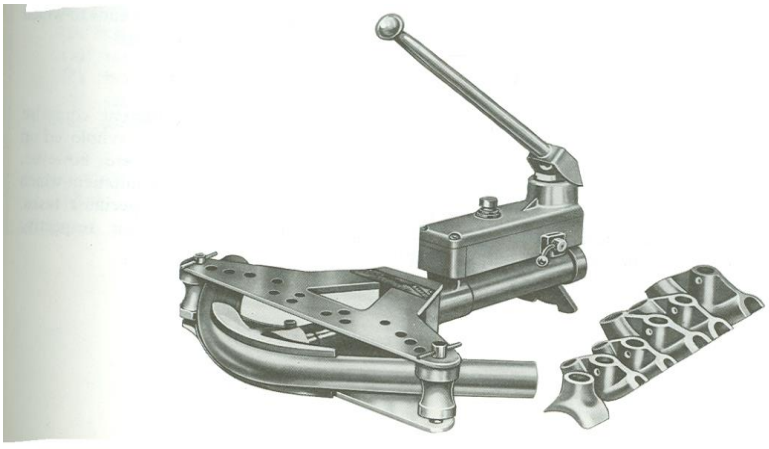
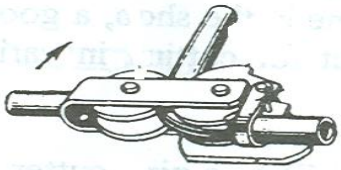


Figure 2.17 a) Hydraulic pipe bender

C. Bending springs

(Figure 2.18 d)Bending springs

D. **Manual Pipe bender**



(Figure2.19) manual Pipe bende

5) Threading and drilling tools:

- **A**re used to make threads and drill, they are:

A)Adjustable threading tools

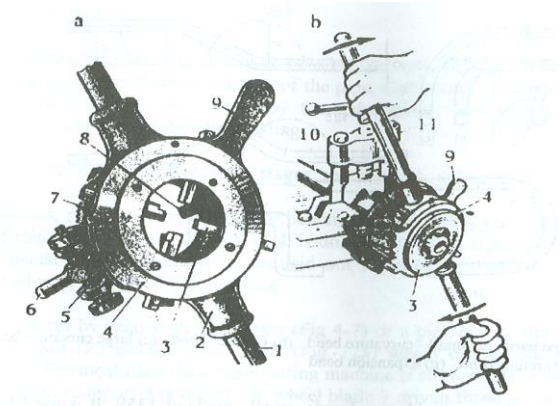
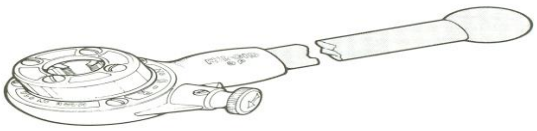


Figure 2.20 a) Adjustable threading tool



(Figure 2.21 B) Ratchet

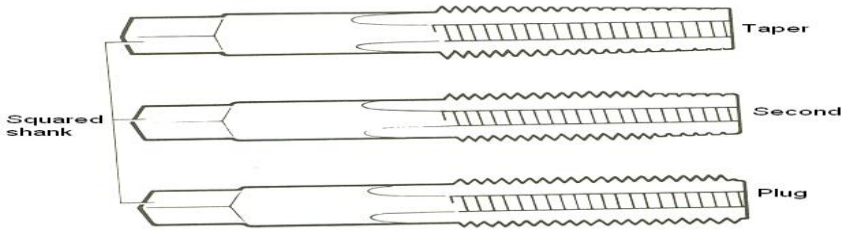
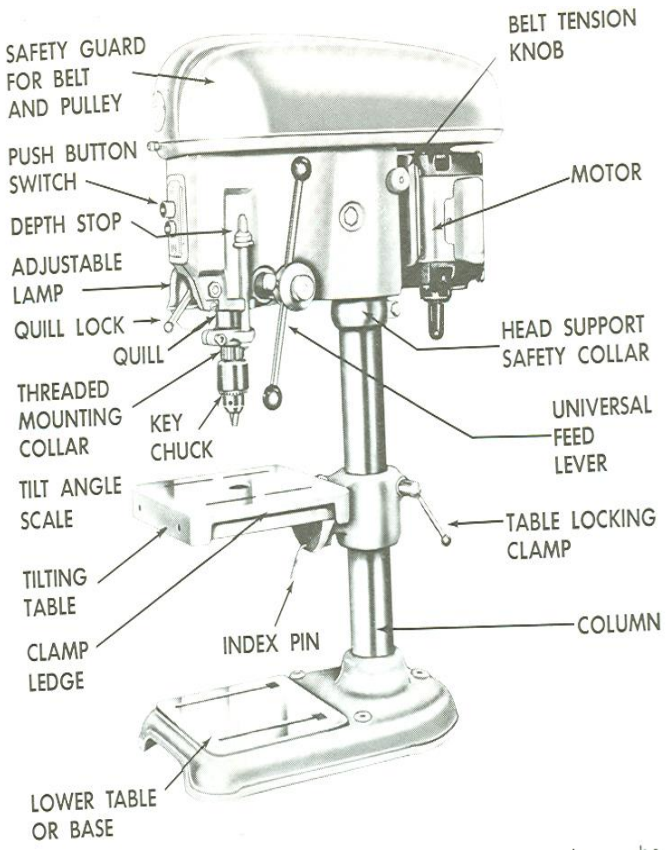


Figure 2.22 e) Tap

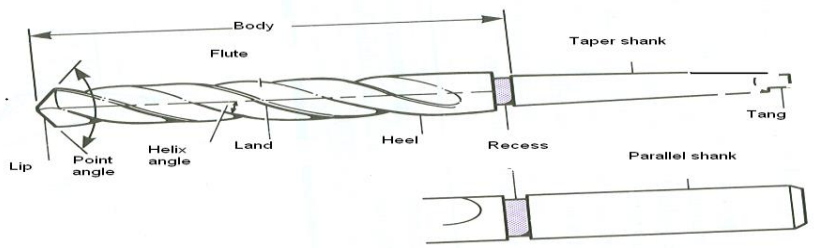
6) Drilling tools



A)Drill press_____

(Figure 2.23a) Drill press

B) Drill bit

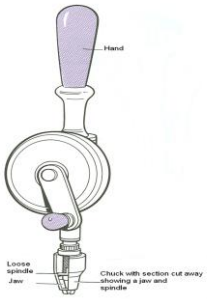


(Figure 2.24b)Drill bit

C) Portable electric drill

(Figure 2.25 c) Portable electric drills

D) **Hand drill**



(Figure 2.26) Hand drill

- **Identification of different kinds of lubrication**

Lubrication: - is primarily concerned with reducing the fractional resistance occurring at the surfaces of the solids, when one social moved relative to the other. Anything

interacted on or between two solids, to accomplished a reduction in friction or to change the frictional properties is called a lubricant. 65

Types of lubricants

1. Liquid petroleum lubricants (mineral oils)
2. Animal vegetable and fish oils

Metal cutting fluids have two basic functions.

A) As coolant

B) As Lubricants

A) As coolant - they cool the tool to reduce abrasive wear and loss of hardness and they cool the work to prevent distortion and dimensional in accuracies.

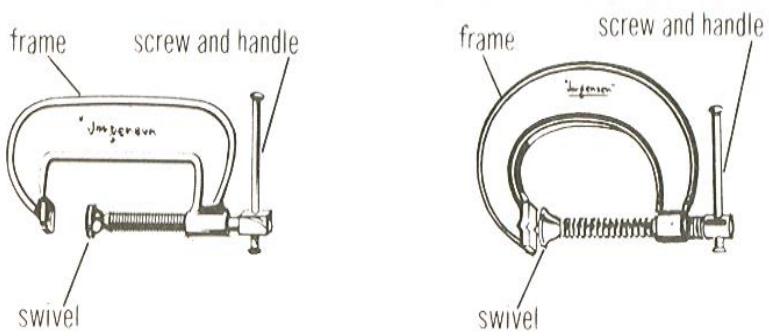
B) As lubricants - They lubricant the chip tool interface to reduce frictional heat tool wear, and power consumption and to improve surface finish.

7. Holding and fastening:

A) - Are used to hold and fasten pipes and fittings,

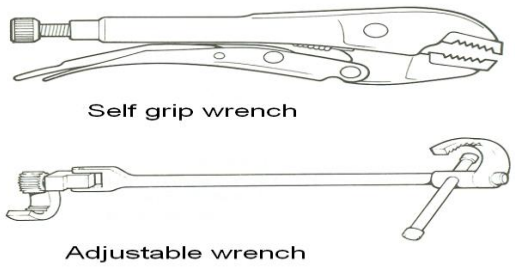
They are;-

- **Clamps**



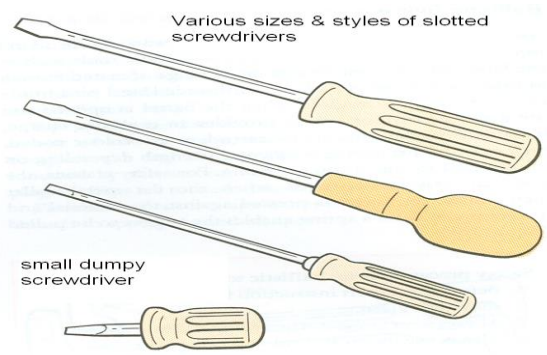
(Figure 2.27 a) j Clamp

Wrenches



(Figure 2.28 b) Wrenches

C) **Screw drivers**



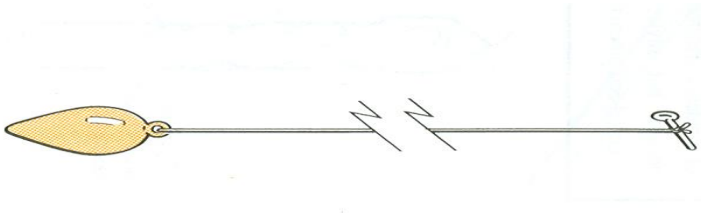
(Figure 2.29c) Screw drivers

8) Guiding tools:

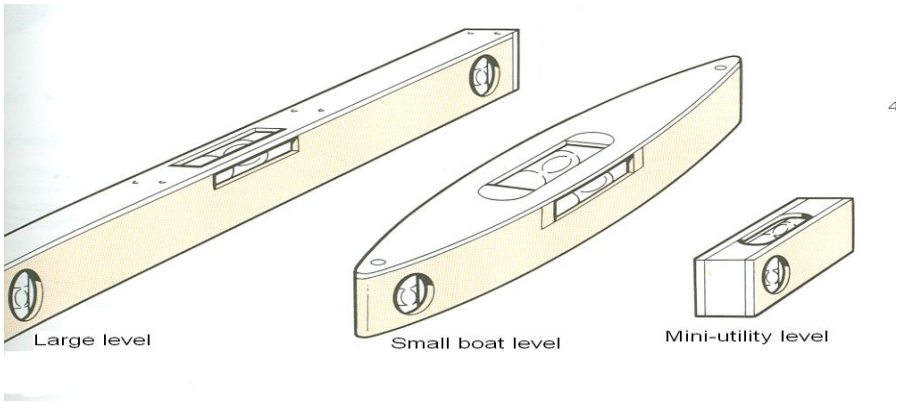
- Are tools, which help to guide the work in order to
- Obtain an accurate alignment of parts being done.

These tools include the following:

- .Sprit level
- Plumb-bob
- String



(Fig 2.30 9a) Plumb bob



(Fig 2.31 b) Sprit levels

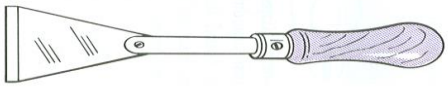
10) Cleaning tools: -

Are tools used to clean unwanted materials from the surface of the work piece while carried out for specific job?

These tools are

- Wire brush
- Rag
- Pipe line cleaner
- Scraper

(Figure 2.32 a) Wire brush

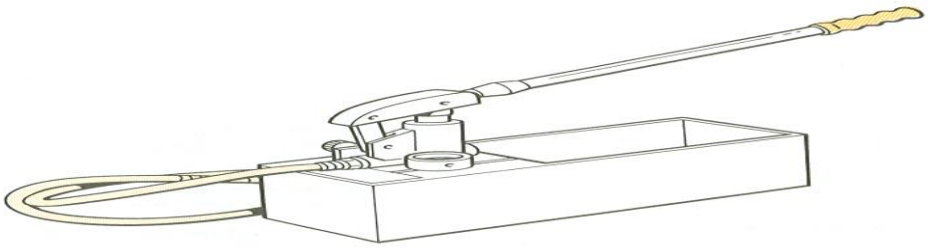


(Figure 2.33 b) Scraper

(Fig.2.34 c) Rag

11) Pressure testing instrument

- It is used to test leakage in water supply system.
- It is necessary to limit the static water pressure to 690Kpa if water is shut off by closing the branch pipe nozzle at the end of the hose
- This is achieved by fitting a spring-loaded pressure-relief valve in the outlet of the landing valve.



(Figure 2.35 a) Pressure testing (proving pump)

1.3.7 Type of valves

The term top "values" and cocks are used indiscriminately to name fittings required to control the flow of fluids, either along or at the end of pipe line. Values are usually used to control the flow along a pipe line, whilst taps are usually used at the end of a pipe line for draw off purposes.

1.3.7.1 Different Types of Valves Used in the Water System

1. Gate Valve
2. Globe Valve
3. Angle Valve
4. Check Valve
5. Foot Valve
6. Safety Valve

Defection of Valves

Values used to control the flow along a pipe line are known as the globe or gate types. Both types close slowly and therefore do not usually give rise to problems of water hammer.

Globe values

These are used on high - pressure systems figure shows a section of one type of globe value the metal to metal seating type is often used for heating systems and the

composition value for very high pressure systems where a complete shut off is required figure. shows a section of a stop value used for domestic water installations. When the 69 value is used on cold water service pipe work the jumper should be loose which tends to act as a non - return value and prevent back flow in to the main.

- actuated by a stem screw and hand wheel suited for installation that call for throttling. Globe valve affords greater resistance to flow that the gate valve because of the change in flow directions.

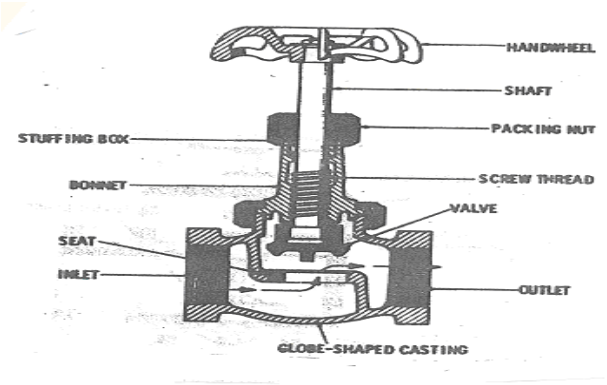
Globe Valve are Classified into Three

1. The Plug Type Disc Valve
2. Conventional Disc Valve
3. Composition Disc Valve

1.The Plug Type Disc Valve has a wide bearing surfaces producing a good resistance to the cutting effect of scsle, dirt, and other kind of foreign matter dound inside the pipe.

2.The Conventional Disc Valve has a pressure tight bearing between the disc it is recommended for cold and any temperature service.

3.The Composition Disc Valve is used for different services such as oil,gasoline, steam, hot or cold water. The disc can be turned over or removed without removing the valve



(Fig 2.36.1a) globe valve

The Gate Valve – is used mainly to completely close or completely open the line but not necessarily to control the flow of water. Gate Valve is best suited to the main supply and

pump lines wherein operation is infrequent. The name gate valve is taken from the gate-like disc that moves across the flow.

Gate Valves has Two Types:

1. The Wedged Shape or Tapered Disc
2. The Double Disc Valve

Fig 2.37 b) gate valve

The Check Valve – The main function of check valve is to prevent reversal of flow in the line. It is pricipally used in industrial pipings.

Check Valves has Two Classifications namely:

1. The Swing Check Valve
2. The Lift Check Valve

Fig 2.38 c.1)check valve

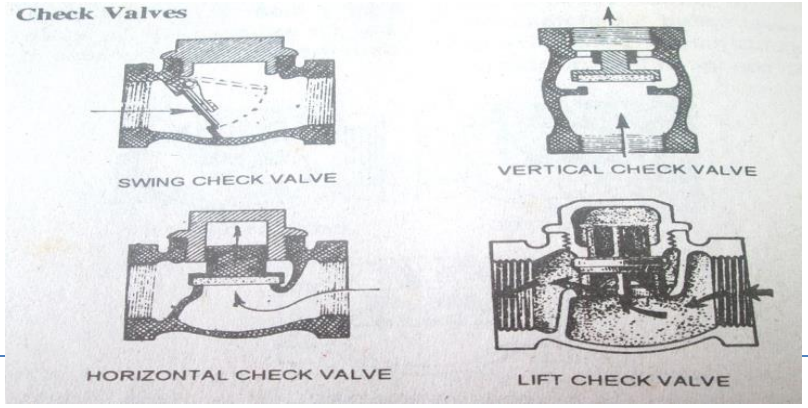


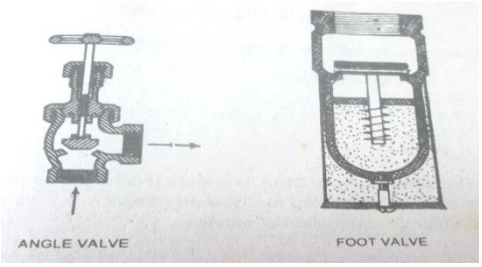
Fig 2.39) Check valve

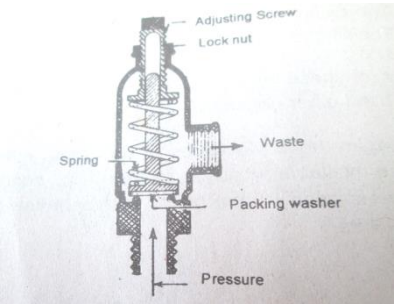
Drain valves: - These are used to drain boilers, cylinoters and sections of pipe work

The Angle Valve – operates in the in the same manner as the globe valve available in similar range of disc and seat design. Angle valve is used im making 90° turn in a line reducing the number of joints.

The Foot Valve is located at the lower end of the pump and used mainly to prevent loss of priming of the pump. It is sometimes reffered to as rentention valve.

The Safety Valve – is used on water systems, heating systems, compressed air lines and other pipe with excessive pressure





(Figure 2.40.d) safety valve

Ball valves: - These are used to supply water to storage and flushing cisterns and to automatically shut off the supply when the correct water level has been reached

(Figure 2.41e) Ball valve

Other Water Service Fittings and Devices

1. The corporation stop
2. Curb stop
3. Curb stop box
4. Meter stop
5. Water Meter

The Corporation Stop is inserted into the water main. It serves as a control stop for the water service. It also serves as a shut off for diconnection of service.

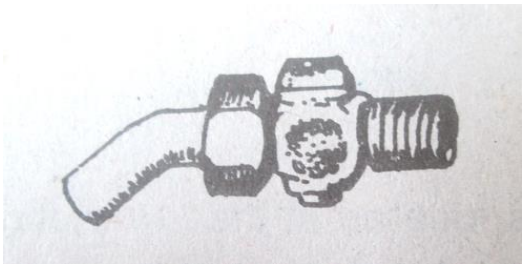


Fig 2.42) corporation stop

The Curb Stop is installed on the water service between the curb and the sidewalk line. It is accessible to cast iron stop box equipped with removable cover. The curb stop have the following services.

1. As a control stop for that portion of the service between the curb and the building.
2. As a shut off for the building in case the basement is flooded.
3. As a control valve in case the building is not use on winter time.

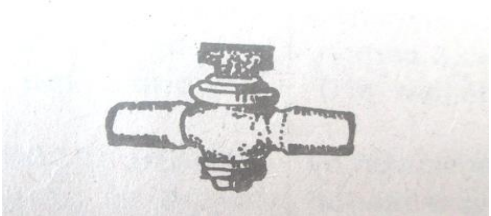
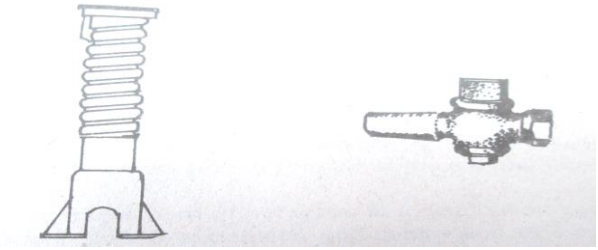


Figure 2.43 Curb Stop

The Meter Stop serves as controlling stop for the building installation.

The Water Meter is a device used to measure the amount of water that passes through the the water service 73



(Figure 2.44) Water meter

Taps

There are several types of types of taps, sometimes referred to as "screw down" types, which are designed to shut off the supply and thus prevent water hammer. shows a "bib tap" used for fitting over a sink, or for washing down purposes when it is then fitted with a hose outlet, the tap can be plain brass or chromium plated. Figure - shows a section of a "sup a tap" which incorporates a check value.

Prevents after from flowing through to the out let and this permits the jumper to be changed without shutting off the supply at the stop value.

A pillar tap, which can be, used the baths, which can be used the baths, washbasins and sinks. Dual flow swivel sink taps may be used, which separate the flow of hot and cold water, until the water discharges through the nozzle. This prevents the risk of hot water being drawn in to the cold - water main.

Spray taps

These are used for hand washing in factories schools & offices and result in the saving of a proximately 5 percent of the water that would be used with ordinary taps; because less hot water is used there is also a saving in fuel. Hot and cold water supplies are connected to the same value and are blended together before being discharged through a spry out let.

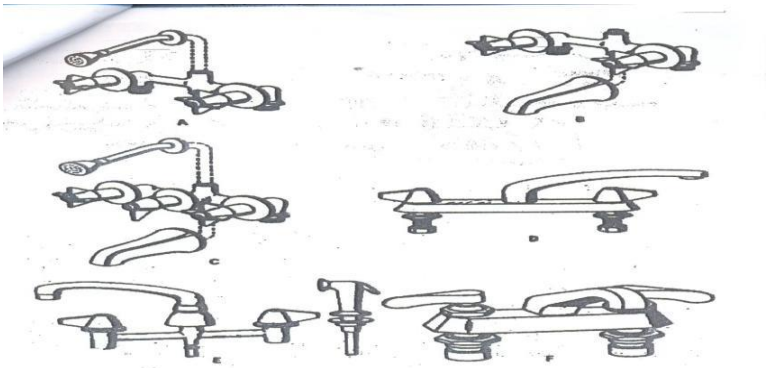


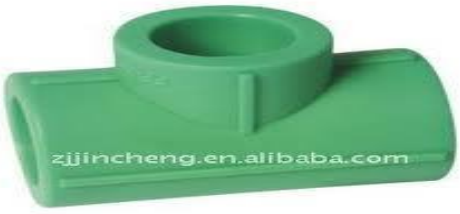
Figure2.45 Spray taps

Plastic pipe fitting

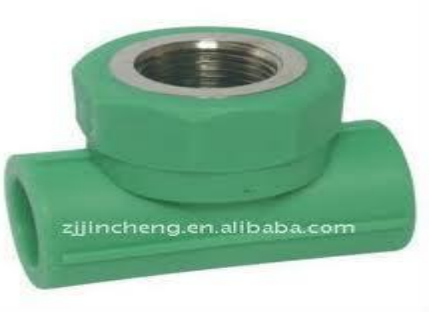
ฉ

Elbo90^{0}

45^{0} Elbow Elbow



Male elbow



Male tee

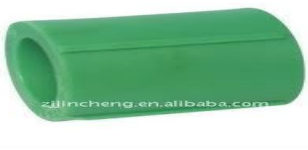
Female tee

Union

cross

Plug

Male adopter



Coupling

reducer

HDPE PIPE FITTINGS

Elbow **TEE connecter** **Socket**

Figure 2.4 5orderings/collecting in materials

The most commonly used materials for drinking water supply pipes are

1. Galvanized steel pipe
2. High density poly ethane pipe
3. Poly propylene pipe
4. U pvc pipe

Control valves are devices by which water is regulated which includes valves and taps. Taps and valves must be fulfilling the requirements:

- Sufficiently strong to resist normal and surge pressure
- Easily accessible to renew seals and washers
- Made of corrosion resistant materials
- Capable of working at appropriate temperatures
- Suitable for their purpose

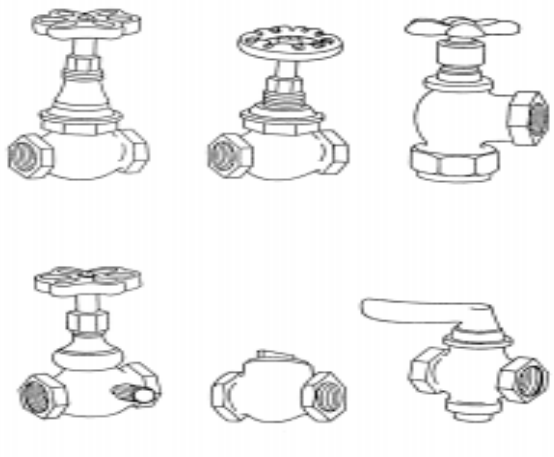


Figure 2.46 VALVES

A valve is a lid or cover to an aperture, so formed as to open a communication in one direction, and close it in the other by lifting, or sliding the cover. Valves are usually used to control the flow along a pipeline. Close slowly and therefore do not usually give rise to problems of water hammer. The most common types of valves are globe valve and gate valves. These two types of valves are extensively used in piping systems for water air and steam. Globe valve and gate valves are manufactured in different forms and shape and are available for threaded steel pipe, copper pipe and plastic pipe.

Types of valve depend on the function.

A. GATE VALVES

The gate valve is one of the most common valves found on a water distribution system. It takes its name from the gate like disk that moves across the path of the flow. Gate valves are best suited to main supply lines and pump lines, where constant water pressure and flow is necessary. These are used for the control of fluids in low-pressure systems, such an on distribution pipe work from storage cisterns, or on low pressure heating systems. They offer much less resistance to the flow of fluids than the globe value.

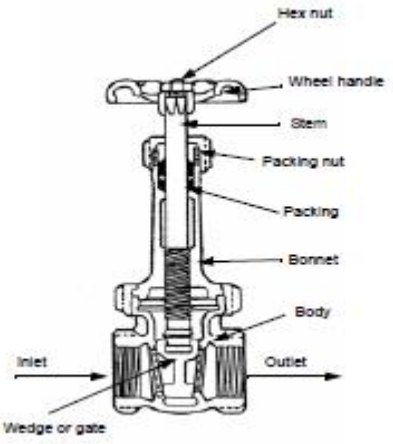


Figure 2.46 GATE VALVES

in a gate valve, a sliding gate controls the flow. This is operated by means of a screw spindle, which opens and closes the gate. The special feature of the gate valve is that, when opened, it gives full and unrestricted passage through the unit; they're being no sharp bends as in the stopcock.

GATE VALVE (F + F)

A brass gate valve with female ends for treaded steel pipe. It has a non-rising spindle and a very strong hand wheel. Manufactured in diameters of ½" to 4".

GATE VALVE (M + F)

A bras gate valve with one male and one female end for treaded steel pipe. It has a non-rising spindle and strong hand wheel. Manufactured in diameters of ½" to 2 ½".

GATE VALVE (M + M)

A brass gate valve with male ends for treaded steel pipe. It has a non-rising spindle and a very strong hand wheel. Manufactured in diameters of ½" to2 ½".

GATE VALVE

A brass gate valve with two ends for copper compression joints. It is a ferrule guard type with a loose key and square spindle head for the key. Manufactured in diameters of ½" to 2"(13/15mm – 50/54mm)

A. GLOBE VALVES

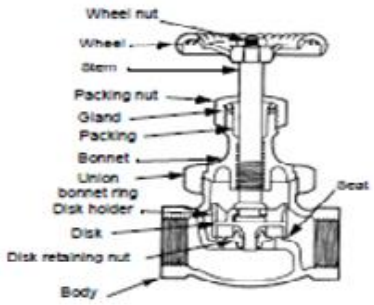


Figure 2.47 GATE VALVES

These are used on high - pressure systems the metal to metal seating type is often used for heating systems and the composition value for very high pressure is stop value systems where a complete shut off is required. A stop valve used for domestic water installations. When the valve is used on cold-water service pipe work the upper should be loose which tends to act as a non - return value and prevent back flow in to the main.

A stop cock or globe valve is a compression type valve in which the flow of water is controlled by means of a circular disk that is forced or compressed onto, or withdrawn from, an annual ring, known as the seat, which surrounds the opening through which water flow. Another type of stopcock stops the water by pressing a beveled metal disk firmly and evenly into the beveled valve seat. Globe valves must be fitted in a pipeline in the right direction the water must enter the stopcock below the valve seat.

GLOBE VALVE (F + F)

A brass stop valve with female ends for treaded steel pipe. Screw down type with a hand wheel manufactured in diameters of ½" to 2 ½".

GLOBE VALVE (F + F)

Chromium plated brass stopcock with female ends for treaded steel pipe. Screw down type with three cornered handle and chromium plated protective shield manufactured in diameters of ½" to 1 ½". 80

GLOBE VALVE (F + F)

A long type chromium plated brass stop cock with a star cross handle manufactured in diameters of ½" to 1 ½"

GLOBE VALVE (M + M)

A brass stopcock with male ends for treaded steel pipe. Screw down type with crutch handle manufactured in diameters of ½" to 2"

GLOBE VALVE (F + M)

A brass stopcock with female and one male end for treaded steel pipe. Screw down type with crutch handle manufactured in diameters of ½" to2".

GLOBE VALVE (F + F)

A brass stop valve with female ends for treaded steel pipe, ferrule guard type with loose key and square spindle head for the key. Manufactured in diameters of ½" to 2".

GLOBE VALVE (F + M)

A brass stopcock with female and one male end for treaded steel pipe, ferrule guard type with a square iron head for a loose, heavy-duty 300-1200 long key. Manufactured in diameters ½" to 2".

ANGLE GLOVE VALVE (F + F)

A brass angle valve, which is also, a stop cock, in which the inlet an outlet openings are at 90^0 angles to one another with female ends for treaded steel pipes. This screw down type valve is used where it is necessary to control the flow at the junction of a main line and a branch. Manufactured in diameters of ½" to 1 ½".

GLOBE VALVE FERRULE

A brass or cast iron ferrule stopcock with a male tread on the inlet and union connection on the outlet. The ferrule, which is a screw down type stop co0ck, is situated on the main service pipe. This valve controls the water supply to the house or building. The spindle and metal disk are always made from brass. Nominal working pressure is 16 bar. Manufactured in diameters of ¾", 1", 1 ¼", 1 ½", 2", and 2 ½".

B. ANGLE VALVE

An angle valve is a globe valve with the inlet and outlet at a 90-degree angle to one another. These valves are recommended for frequent operation, throttling, and/or a positive shutoff when closed.

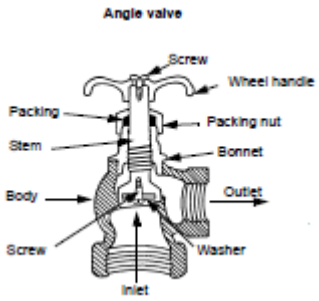


Figure 2.48 ANGLE VALVE

A. STOP-AND-WASTE VALVE

A stop-and-waste valve, also known as a *bleeder* valve, has a plug on the outlet side that allows water to be drained from pipelines. Drain valves are used to drain boilers, cyclometers (cylinder) and sections of pipe work.

B. CHECK VALVE

A check valve permits the flow of liquid within the pipeline in one direction only and closes automatically to prevent backflow. A check valve can be a swing- or lift-type. 82 Swing check valves are used in pipelines where pressure and velocity of flow are low. Lift check valves are used where pressure and velocity of flow are high.

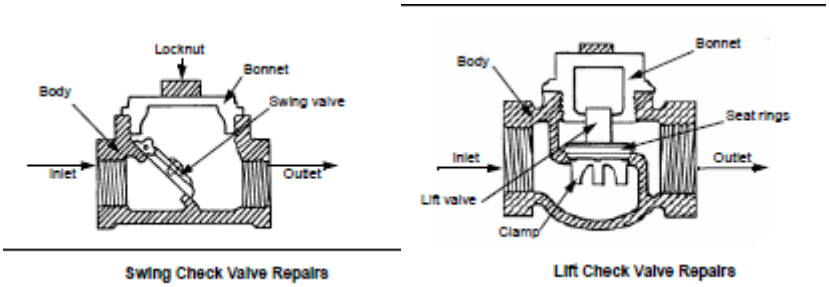


Figure 2.49 ANGLE VALVE

These are used to flow water in one direction only which is prevents back flow.

Single and double check valves

Use of check valves

Figure shows a single check valve and a double check valve. The valves are used to prevent backflow and back siphonage and are installed to provide compliance with Water Regulations. The list below shows some typical applications where the Water Regulations require single and double check valves to be installed.

- **Single check valves**
  - Connected prior to water softener
  - Unvented heating systems
  - Supply to wet sprinkler system
  - Downstream of meters and pressure reducing valves (no specific regulation but essential for correct operation of the equipment).
- **Double check valves**
  - Supply to hose taps
  - Supply to standpipes
  - Pipe connection to cisterns using Part 1 float valves
  - Supply to shower fitting.
- **Shower check valves**
  - Supply to shower spray head where shower hose pipe is unconstrained, e.g. air gap requirement cannot be guaranteed.

A. SAFETY VALVES

These are used to relive excess pressures on boilers tanks and pipe work. It is a Pressure or temperature-relief valves for water heaters

B. BALL VALVES

These are used to supply water to storage and flushing cisterns and to automatically shut off the supply when the correct water level has been reached. The valve is operated by a float, which allows the valve to be fully open when it is in the lower position. As the water level rises which gradually closes the valve and shuts off the supply of water

There are four types, namely**;**

1. Portsmouth and Croydon
2. Diaphragm
3. Equilibrium**.**

1. Portsmouth and Croydon

They are similar in construction except in the former type the plunger moves horizontally and in the latter the plunger moves vertically. The diameter of the orifice is a very important factor and governs the type of valve; for example, whether high, medium or low pressure. An orifice of smaller diameter allows the valve to close at a higher water pressure.

Figure 2.49 Portsmouth and Croydon

2. Diaphragm ball valve

It is designed to have the working parts out of contact with the water. This prevents the working parts from sticking, due to the deposit of salts and rust from the water.

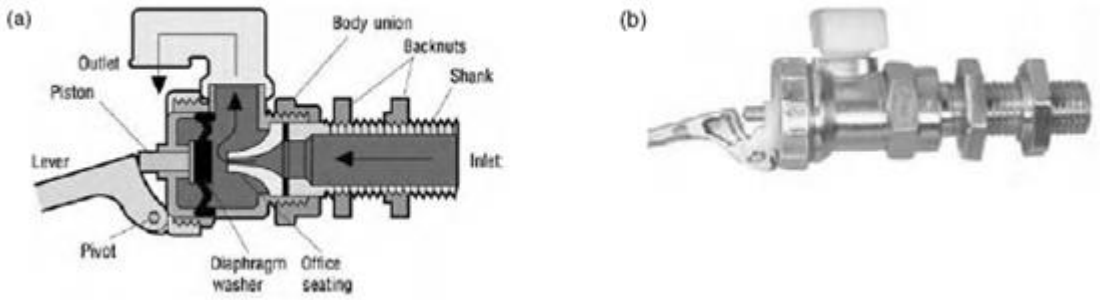


Figure 2.5 Diaphragm ball valve

B) Equilibrium ball valve

It is to transmit equal water pressures at both ends of the piston and thus reduce the force produced by the float and level. The valve is used for large diameter supplies, or for very high water pressures.

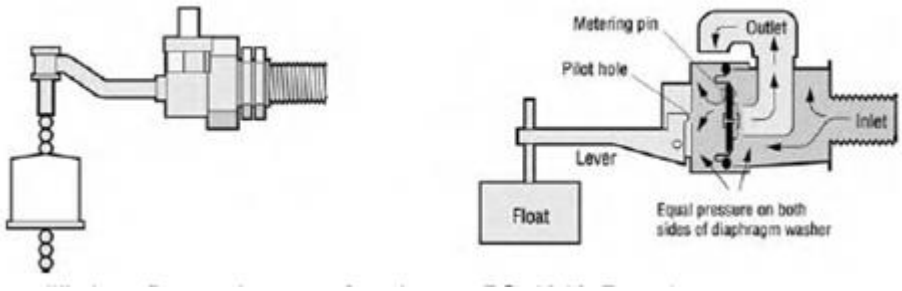


Figure 2.51 Equilibrium ball valve

C. OTHER VALVES

Other valves include

- Reducing valves, used to reduce water pressure going into a building..
- Flush meter valves in urinals and water closets.

4.2 TAPS

Taps are usually used at the end of a pipeline for draw off purposes. There are several types of types of taps, sometimes referred to as "screw down" types, which are designed to shut off the supply and thus prevent water hammer.

A. SCREW DOWN BIB-TAP

A "bib tap" used for fitting over a sink or for washing down purposes when it is then fitted with a hose outlet, the tap can be plain brass or chromium plated.

B. SWIVEL SINK TAP

Dual flow swivel sink taps may be used, which separate the flow of hot and cold water, until the water discharges through the nozzle. This prevents the risk of hot water being drawn in to the cold - water main.

C. SPRAY TAPS

These are used for hand washing in factories schools & offices and result in the saving of a proximately 5 percent of the water that would be used with ordinary taps; because less hot water is used there is also a saving in fuel. Hot and cold water supplies are connected to the same value and are blended together before being discharged through a spry out let.

D. PILLER TAP

Is variation of an ordinary bib is fitting to baths, basins and sink units.

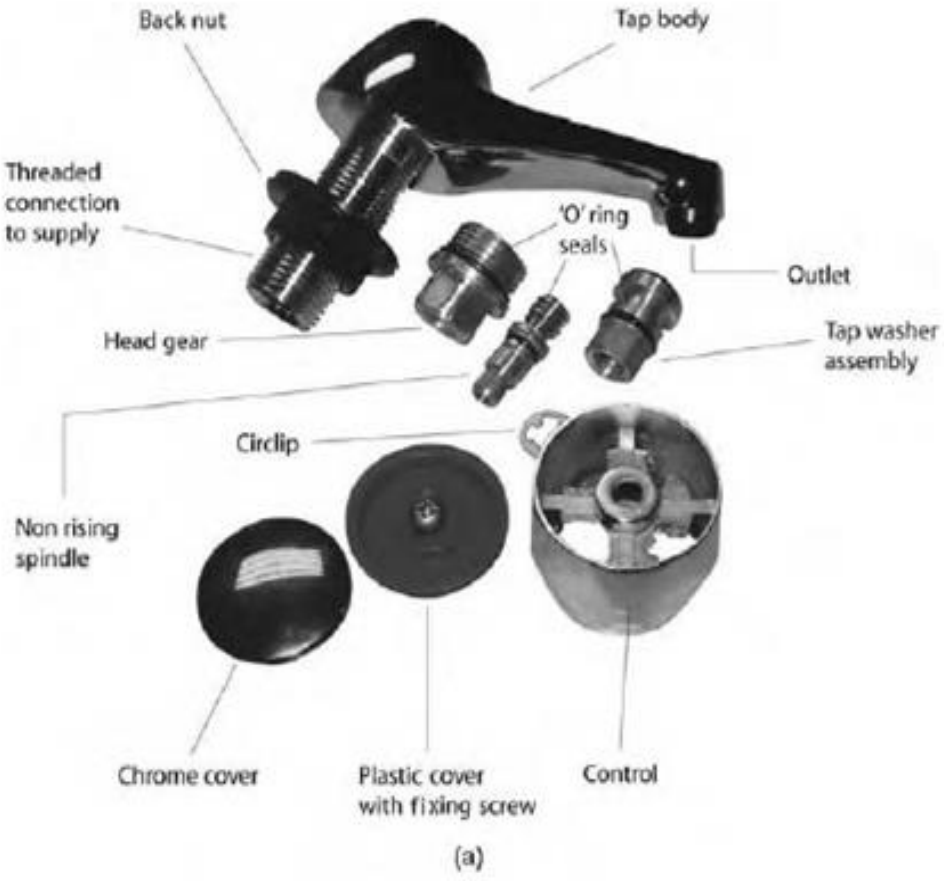
E. STOP TAP

It is used to control the flow of water in a section of pipe work. They shall be of screw down type and shall open in anti clockwise direction and have inlets and outlets. The word inlet, or alternatively a direction arrow, must be stamped on the body of the valve. This is most important for should the tap be fixed the wrong way round no water will be able to pass through. Many combination hot and cold mixer sets are available for all sanitary appliances, in which the hot and cold supplies are separately controlled.

Standard sizes: - the nominal bore of the pipe outlet to which the tap is to be fitted designates the standard size of taps. 38”, ½”, 5/8”, ¾”, 1”, 1 1/4”, 1 /2”, 86

2".

(a) Pillar tap components (b) Pillar tap seating and washer



Self-Check -2	Written Test

Directions: Answer all the questions listed below.

1._____Is variation of an ordinary bib is fitting to baths, basins and sink units (3point)

A. Pillar taps C. Spray taps

B. stop tap D .all

2._____are usually used at the end of a pipeline for draw off purposes (2point)

A. Ball valves C. Spray taps

B. safety valves D. tape

3. ---Is primarily concerned with reducing the fractional resistance occurring at the surfaces of the solids

A. Pillar taps C. Spray taps

B. stop tap D .Lubricant

Note: **Satisfactory rating – 5 points Unsatisfactory - below 3 points**
You can ask you teacher for the copy of the correct answers.

Information Sheet-3	Calculating materials requirement

2.3 Calculating materials requirement

An estimate is probable cost of a building before installation of water supply system. This estimate should not be far away from the actual cost of the building after completion of the project. it is done by mathematical calculation based on working trainings. First of all the quantity of the work is calculated based on standard unit of measurement for each work. This unit of measurement can be pieces (No), diameter.

The unit of measurement for pipe is diameter for thick surfaces such as installation of pipe. The data given below can be used to calculated materials required for making water supply the materials needed depend the diameter of pipes given on the data

Sample Problem 1. Single Unit Toilet with Bathtub

Presented on the figure is a plumbing installation for a single toilet with bathtub,

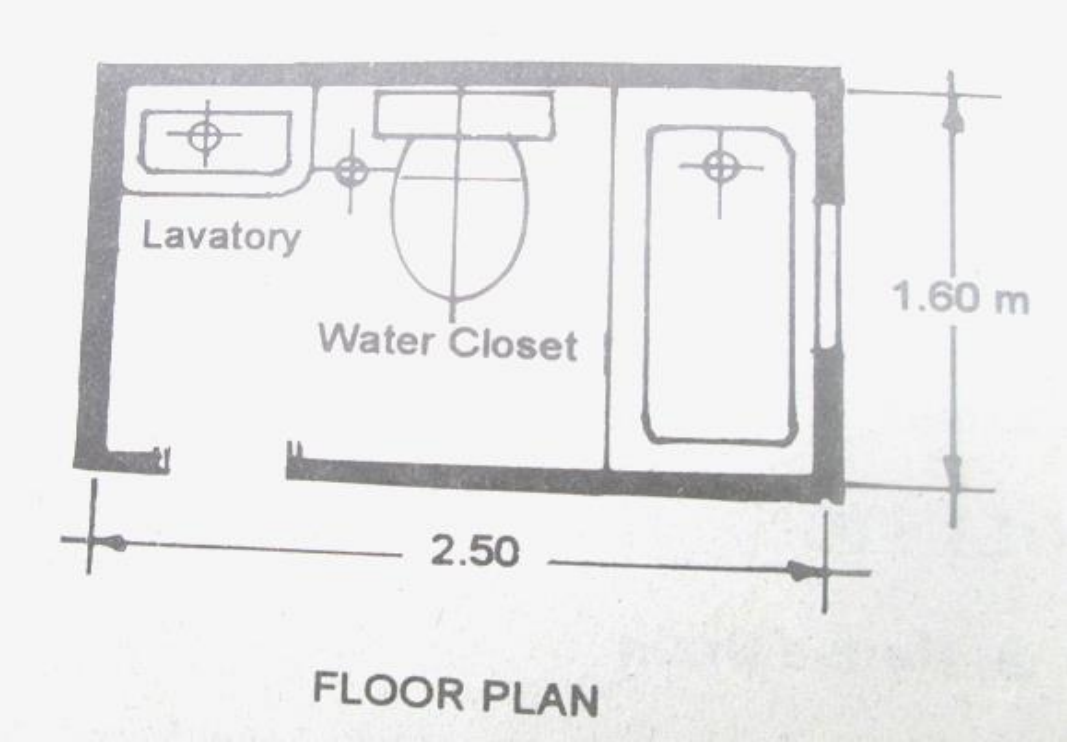


Figure 1.3

plumbing floor plan

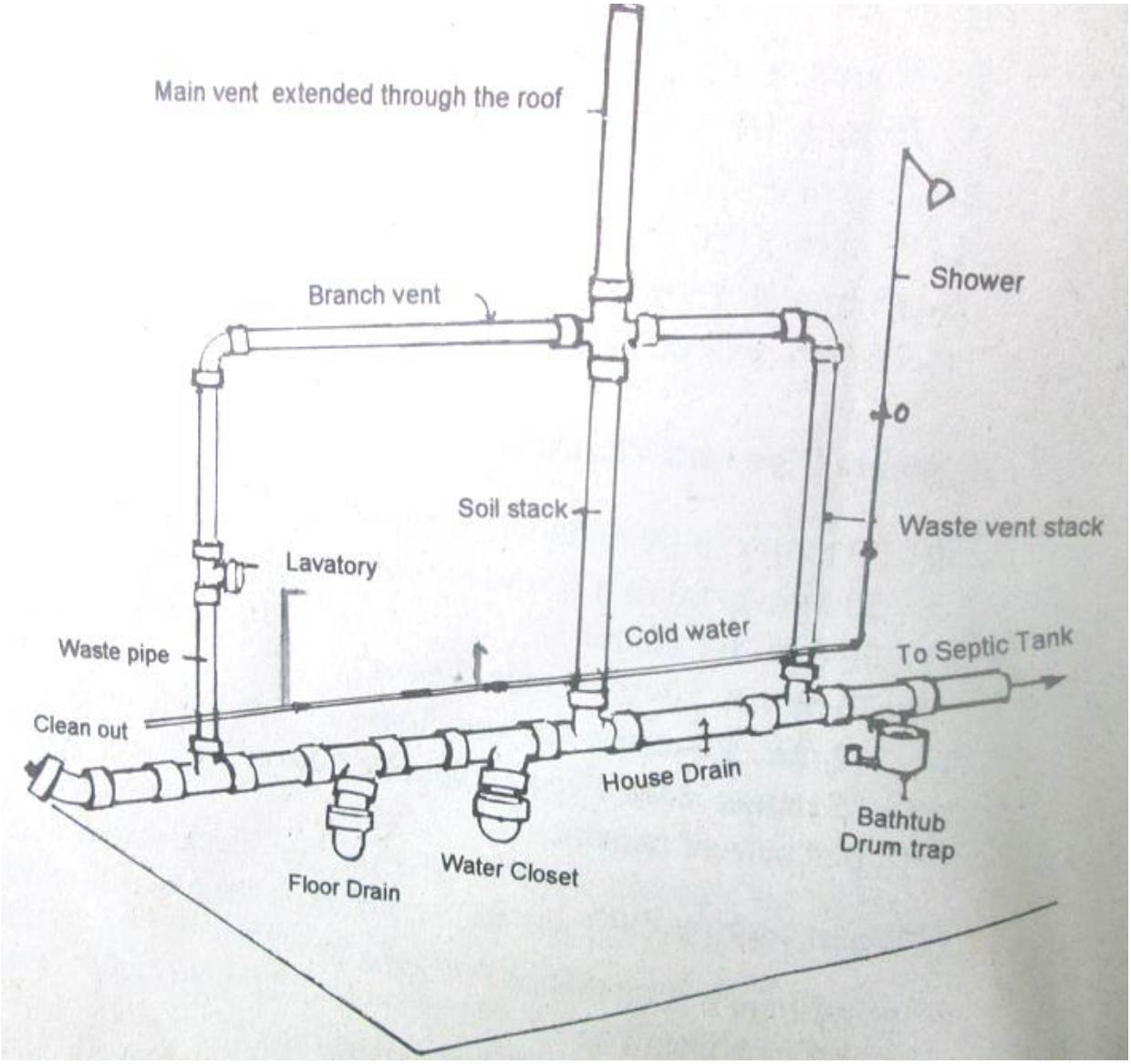


Figure 1.4 ISOMETRIC OF PLUMBING LAY -OUT

Solution: 92

A. House Drain

1 piece – 75 mm (3”) Ø 1/8 bend elbow with cleanout cover

2 pieces – 75 mm Ø x 50 mm Ø Tee for lavatory waste and vent stack

2 pieces – 75 mm Ø x 75 mm Ø Tee (for floor drain and water closet)

1 piece – 75 mm Ø 1/8 bend long sweep elbow for water closet

1 piece – 75 mm Ø P-trap

1 piece – 75 mm Ø x 50 mm Ø Y to receive drum trap

1 piece – 75 mm Ø x 75 mm Ø T to connect soil stack

1 piece – 75 mm x 3.00 meters PVC or Plastic Pipe

B. Waste Pipe and Ventilation

2 pieces – 50 mm Ø x 3.00 meters PVC or Plastic Pipe

1 piece – 50 mm Ø x 50 mm Ø Tee to receive lavatory waste

2 pieces – 50 mm Ø 1/4 elbow

1 piece - 75 mm Ø x 50 mm Ø cross tee or (2 pieces – 75 mm Ø x 50 mm Ø Tee)

1 piece - 75 mm Ø x 3.00 meters PVC or Plastic Pipe (vent stack)

1 pint - Solvent Cement

C. Water Supply Pipe

1 piece – 12 mm Ø x 6.00 meters galvanized Steel Pipe

3 pieces – 12 mm Ø galvanized steel tee

5 pieces – 12 mm Ø galvanized steel elbow (for lavatory, faucet and water closet water supply)

1 piece - 12 mm Ø galvanized steel cross tee (shower and faucet)

2 rolls - Teflon tape

D. Fixtures and other Accessories

1 set - Water Closet with accessories and fittings

1 set - 12 mm Ø control valve and flexible hose supply

1 set - Lavatory with P-trap and accessories

1 set - 12 mm Ø control valve and flexible hose supply

1 piece - 12 mm Ø water faucet

1 set - bathtub with complete accessories

1 set – 12 mm Ø shower head

1 set – 10 mm Ø drum trap

2 sets – soap holder

1 set – toilet paper holder

2 pieces – towel holder

1 piece – grab bar for bathtub

The House Sewer

The house sewer is determined by measuring the distance from the house drain terminal point to the main sewer or to the septic tank.

Remember that a good and accurate estimate for plumbing layout is based on a prepared plan and isometric drawing. Any attempt to make or present a bill of materials for plumbing installation without these fundamental requirements should not be entertained. It should be rejected outright because this is the work of lazy and dishonest plumbing technicians.

Sample Problem 2. Back to Back Single Unit Toilet

Shown in the figure below is a plumbing installation for back to back toilet using plastic pipe as materials. Prepare the bill of materials for the plumbing system.

Solution:

A. House Drain

1 piece – 100 mm (4”) Ø 1/8 bend long sweep elbow

1 piece – 100 mm Ø clean out cover

1 piece – 100 mm Ø x 50 mm Ø Wye (Y) reducer

2 pieces – 100 mm Ø double Wye (Y) or (4 pieces of 100 Ø Wye for water closet and floor drain)

1 piece – 100 mm Ø x 75 mm Ø Tee (for vertical soil stack)

2 pieces – 100 mm Ø 1/8 elbow (to receive water closet waste)

2 pieces – 100 mm Ø P-trap (for floor drain)

1 piece – 100 mm x 3.00 meters PVC or Plastic Pipe

B. Main Vent, Waste and Branch Pipe

1 piece – 75 mm Ø x 3.00 meters PVC or Plastic pipe

1 piece – 50 mm Ø 1/8 bend elbow

1 piece – 50 mm cross tee or (2 pieces of 50 mm Ø Tee)

1 piece – 50 mm Ø elbow

1 piece – 50 mm Ø Tee

C. Water Supply Line

1 piece – 20 mm Ø x 3.00 meters uPVC pipe

5 pieces – 20 mm Ø x 12 mm Ø Plain Tee reducer

1 piece – 20 mm Ø elbow

1 piece – 20 mm Ø Tee

2 pieces – 20 mm Ø x 12 mm Ø elbow reducer

2 pieces – 12 mm Ø one side threaded elbow

4 pieces – 12 mm Ø plain elbow

2 pieces – 12 mm Ø shower head

1 pint - solvent cement

4 rolls - Teflon tape

D. Fixtures and Accessories

2 sets – Water closets with complete fittings and accessories

2 sets – Lavatories with complete fittings , P-traps and accessories

4 pieces – 12 mm Ø control valve for water closet and lavatories

4 pieces – flexible plastic supply hose

2 pieces – 100 mm x 100 mm stainless steel floor drain strainer

4 pieces – soap holder

2 pieces – toilet paper holder

4 pieces – 25 mm Ø x 80 cm stainless steel towel bar

The flexible plastic supply hose for lavatory and water closet is fast gaining acceptance against the nickel plated supply pipe because it is easy to install, convenient for repair

and replace defective parts. The plastic supply hose is elastic, adjustable and is less subject to water leakage 95

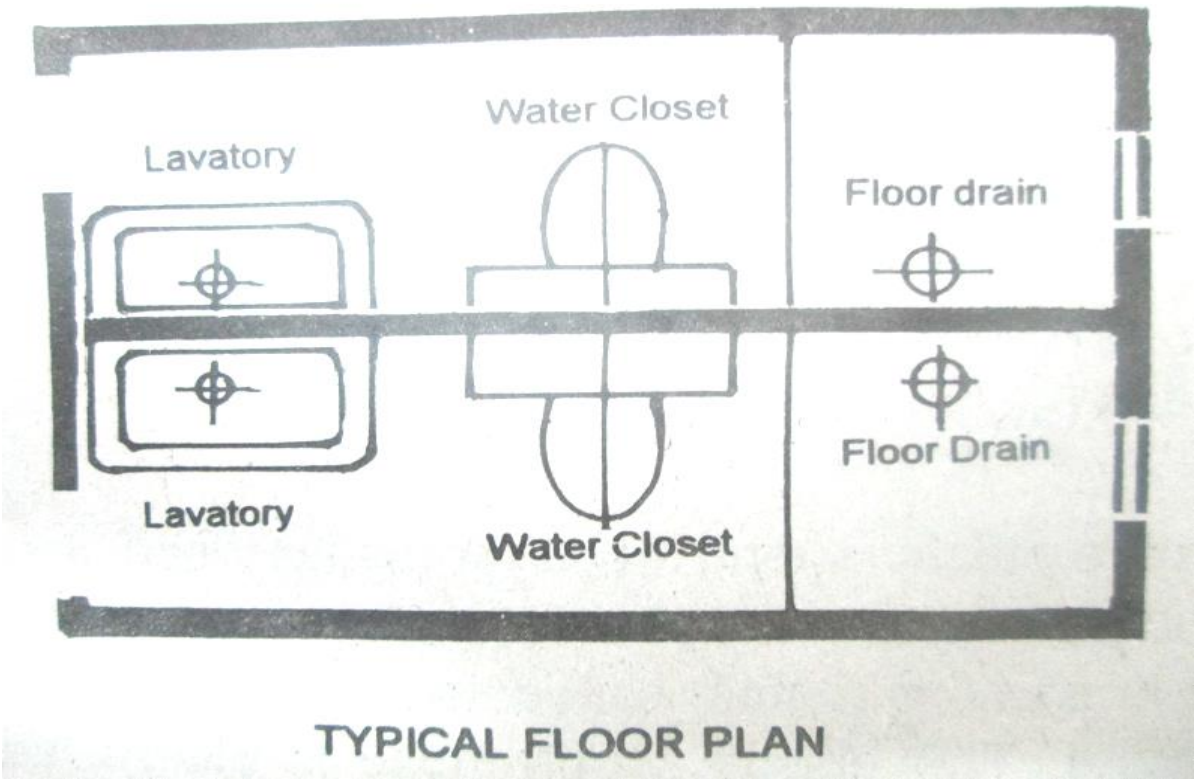


Figure 1.5 typical floor plan

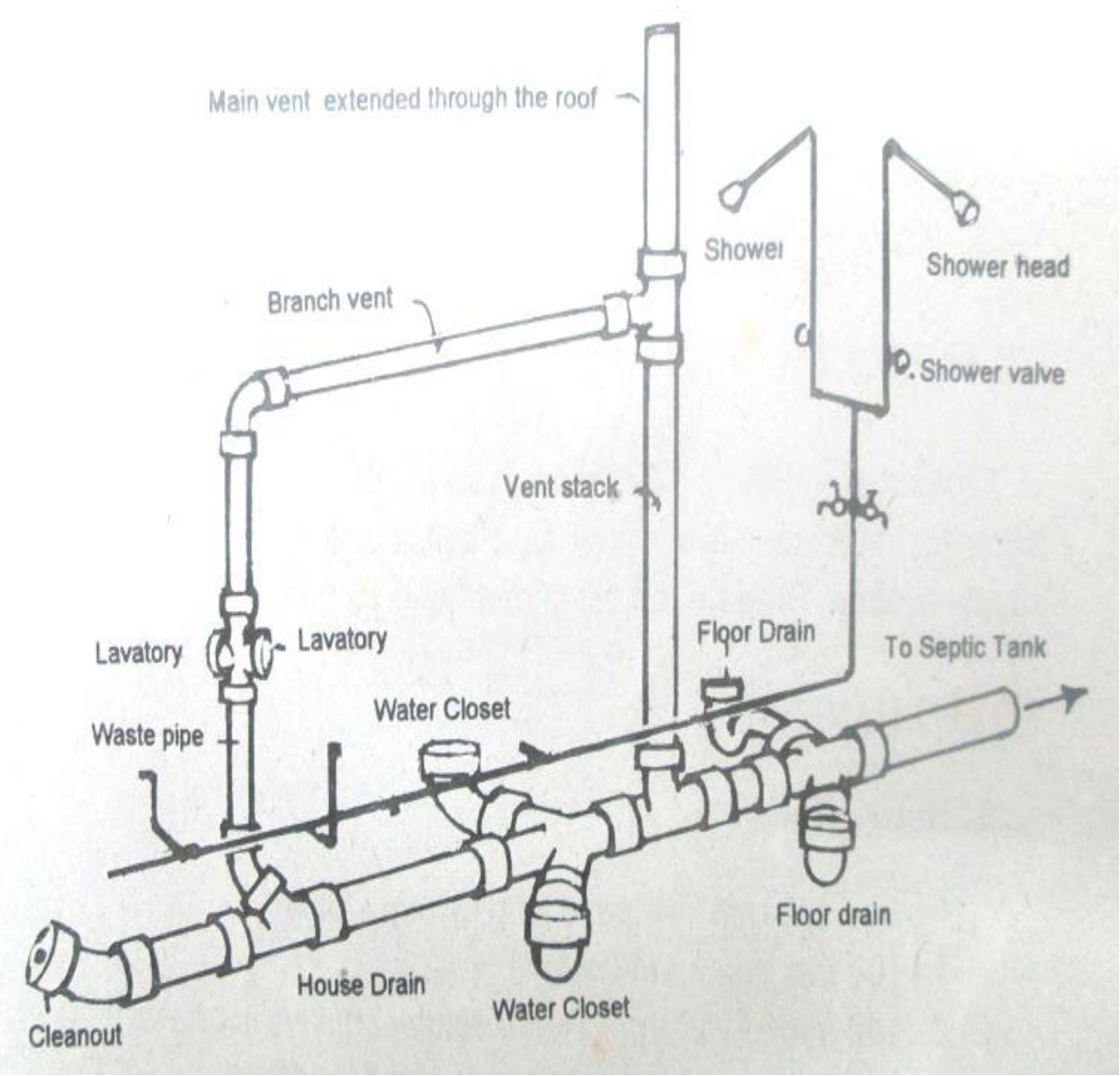


Figure 1.6 riser of water supply

Sample Problem 3. Drainage Installation with Cold and Hot Water Supply

A plumbing installation of a two storey building with basement is presented in the given 97 figure showing the DWV including the hot and cold water supply system. List down the materials required.

Solution:

A. House Drain

1 piece – 100 mm Ø x 3.00 m PVC/Plastic soil pipe

1 piece – 100 mm Ø x 50 mm Ø PVC / Plastic Tee

1 piece – 100 mm Ø x 100 mm Ø PVC / Plastic Tee

1 piece – 100 Ø PVC / Plastic long sweep elbow

B. Soil Stack

3 pieces – 100 mm Ø x 3.00 m PVC / Plastic Pipe

1 piece - 100 mm Ø x 50 mm Ø PVC / Plastic Wye (Y)

2 pieces – 100 mm Ø x 100 mm Ø PVC / Plastic Tee

1 piece - 100 mm Ø x 50 mm Ø PVC / Plastic cross tee

C. Soil Branch

2 pieces – 100 mm Ø PVC / Plastic long sweep elbow

2 pieces – 100 mm Ø PVC / Plastic tee

2 pieces – 100 mm Ø PVC / Plastic cleanout with cover

1 piece - 100 mm Ø x 50 mm Ø PVC / Plastic tee

1 piece - 50 mm Ø x 38 mm Ø PVC reducer

1 piece - 38 mm Ø PVC / Plastic elbow

D. Waste Branch

1 piece – 50 mm Ø 1/8 (45°) PVC / Plastic bend elbow

2 pieces – 50 mm Ø PVC/Plastic Tee

1 piece - 50 mm Ø PVC / Plastic long sweep elbow

1 piece – 50 mm Ø PVC / Plastic cleanout with cover

1 piece – 50 mm Ø x 38 mm PVC / Plastic reducer

1 piece – 38 mm Ø elbow

1 piece – 100 mm drum trap

1 piece – 38 mm Ø x 3.00 meters PVC / Plastic pipe

E. Waste and Vent Pipes

7 pieces – 50 mm Ø PVC / Plastic Tee

2 pieces – 50 mm Ø 1/4 (90°) bend PVC / Plastic elbow

7 pieces – 50 mm Ø x 3.00 meters PVC / Plastic pipe

F. Cold Water Pipe Installation

1 piece – 20 mm Ø x 3.00 meters uPVC / Plastic pipe

6 pieces – 12 mm Ø x 3.00 meters uPVC / Plastic pipe

1 piece – 20 mm Ø uPVC/Plastic tee

2 pieces – 20 mm Ø Gate valve

2 pieces – 20 mm uPVC / Plastic elbow

4 pieces – 20 mm Ø x 12 mm Ø uPVC / Plastic tee reducer

1 piece – 20 mm Ø x 12 mm Ø uPVC / Plastic bushing reducer

7 pieces – 12 mm Ø uPVC / Plastic elbow with one end threaded

4 pieces – 12 mm Ø uPVC/Plastic plain elbow

6 pieces – 12 mm Ø Flexible supply hose

2 pieces – 12 mm Ø water faucet (brass or chrome type faucet)

6 rolls - Teflon tape

1 liter – Solvent cement

G. Hot Water Supply (use pipe for hot water)

1 set – Heater with relief valve

1 piece – 12 mm Ø drain faucet

9 pieces – 12 mm Ø elbow

8 pieces – 12 mm Ø x 3.00 meters pipe

2 pieces – 12 mm Ø gate valve

5 pieces – 12 mm Ø Tee

4 pieces – 12 mm Ø supply control valve

H. Fixtures and Accessories

1 set – Bathtub with complete fittings and accessories

2 sets – Lavatory with complete fittings and accessories

2 sets – Kitchen sink with faucet and accessories

2 sets – Water closet with tank, fittings and accessories

2 pieces – Shower head

2 pieces – Mixing valve

2 pieces – 12 mm Ø water control valve

1 set – Hot and cold water mixing valve

Self-Check -3	Written Test

Directions: Answer all the questions listed below.

1. Write at list 8 Fixtures and Accessories there functions

1. ----------

2----------

3. ----------

4. ----------

5. ----------

Note: **Satisfactory rating – 9 points** **Unsatisfactory - below 9 points**

You can ask you teacher for the copy of the correct answers.

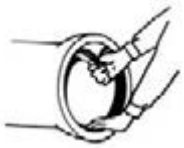
Information Sheet-4	Determining Allowances for fabrication and assembly	100

2.4 Determining Allowances for fabrication and assembly

An allowance is a planned deviation between an exact dimension and a nominal or theoretical dimension, or between an intermediate-stage dimension and an intended final dimension. The unifying abstract concept is that a certain amount of difference allows for some known factor of compensation or interference. An allowance, which is a planned deviation from an ideal, is contrasted with a tolerance, which accounts for expected but unplanned deviations. Allowance is basically the size difference between components that work together. Allowance between parts that are assembled is very important. Fabrication & assemble could be assessed in the workplace or a close simulation of the workplace environment providing that simulated or project-based assessment techniques fully replicate plumbing and services workplace conditions, materials, activities, responsibilities and either push-on joint or mechanical joint fittings may be used with push-on joint pipe. The plain end of the pipe is provided with either one or two painted gauge lines that can be used to determine if the plain end has been properly positioned in the bell socket.

The pipe manufacturer's instructions regarding the location of these lines after assembly should be followed.

Push-On Joint Assembly



Thoroughly clean the groove and the bell socket of the pipe or fitting; also clean the plain end of the mating pipe or fitting. Using a gasket of the proper design for the joint to be assembled, make a small loop in the gasket and insert it in the socket. For pipe sizes larger than 20-inches it may be necessary to make two loops in the gasket (6 and 12 o'clock). Make sure the gasket faces the correct direction and that it is properly seated. Note: In cold weather, it may be necessary to warm the gasket to facilitate insertion.

Apply lubricant to the exposed surface of the gasket and plain end of the pipe or fitting In accordance with the pipe manufacturer's recommendations. Do not apply lubricant to
The bell s octet or the surface of the gasket in contact with the bell socket. Lubricant is furnished in sterile containers and every effort should be made to keep it sterile. For underwater or very wet joint assemblies, relatively insoluble underwater joint lubricant is available and should be used.

Be sure that the shape/dimensions of the bevel on the plain end is per the manufacturer's recommendations; square or sharp edges may damage or dislodge the gasket and cause a leak. When pipe is cut in the field, bevel the plain end with a heavy file or grinder to remove all sharp edges. Do not use a saw blade to bevel the plain end. Push the plain end into the bell socket of the mating pipe or fitting, keeping the joint straight while pushing. Make deflection after the joint is assembled. Small pipe can be pushed into the bell socket with a long bar. Large pipe requires additional power, such as a jack, lever puller, or backhoe. The supplier may provide a jack or lever puller on a rental basis. A timber header should be used between the pipe and the jack or backhoe bucket to avoid damage to the pipe. Several pulling devices are available for
Large-diameter pipe, each with its own set of directions that should be followed carefully for

Convenience and smooth operation cedars.

Self-Check -4	Written Test

1. Furnished in sterile containers and every effort should be made to keep it sterile. (5point)

A. union C. pipe

B. fixture D .Lubricant. 102

Note: **Satisfactory rating – 5 points Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-5	Identifying tools and equipment.

2.5 Identifying tools and equipment

There are several type tools used by a plumber. Hand tools, in general, ease the work and accelerates the process, improves quality of work significantly. In addition tools and equipment also represents highly valued assets. For this reasons it is crucial necessary to handle tools and equipment with extra care. That means cleaning after use, storing neatly, slightly greasing if necessary and regular maintenance.

Requirements and specification Requirements of tools are:

- The material quality strength and durability
- Simple in adjust/install
- Simple in use
- Simple in maintenance
- Economical

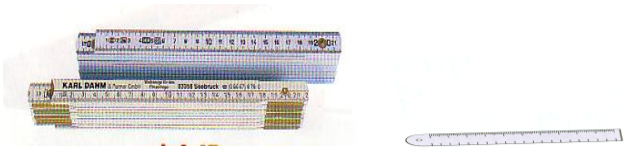
Specifications of tools are includes:

- By which material made
- Where it made technological factor
- Accuracy
- Work instruction to install and use

Types of tool

1. *Measuring and marking tools*

- Steel rule



Steel rule

Folding Rule

Figure 5.1

When using the folding rule, place it flat on the work. The “O” end of the rule should be exactly even with the end of the space or board to be measured. The reading on the rule

indicates the correct distance. A very accurate reading may be obtained by turning the edge of the rule toward the work. In this position, the marked gradations of the face of the rule touch the surface of the board.

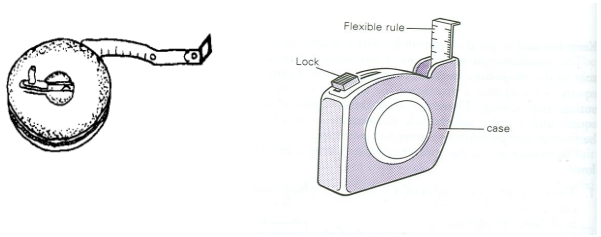


Figure 5.2 Steel tape or roller tape

It extends smoothly to full length. It returns quickly to its compact case when the return button is pressed or winds it up by crank handle. It used to measure and determine the size of the object.

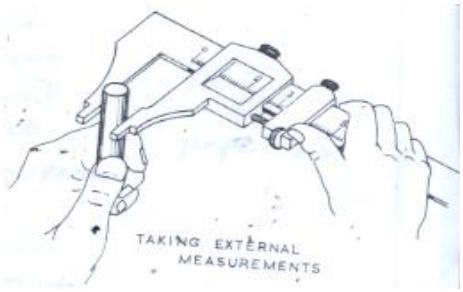
Try square

Try squares are used to provide a guide for marking straight, square and /or parallel/ lines. If one edge is straight and the handle part of the square is placed against this straight edge, then the blade can be used to measure the wood perpendicular to the edge.

T- Bevel

This tool looks like a square, but has a movable blade that can set to layout any angle.

Venire Caliper:- The *Venire* caliper is a precision measuring which is used when measurement to with in 0.1 mm are required. *Venire* caliper can be used to measure diameter of reinforcement. You have to take correct measurement when you are using venires caliper.



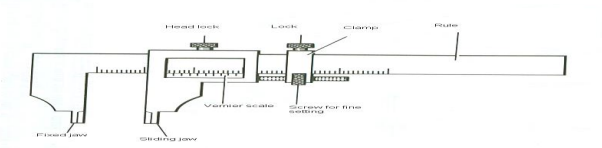


Figure 5.3 *Venire* Caliper

It is used to indicate the point that you required to show the point or cut point. Start the mark with the point of the pencil in contact with the nark on the rule move the pencil directly away from the rule while making the mark. 105

Scratch awl:

Scratch awl is a handy tool for a carpenter. It can be used to mark wood with a scratch mark. Scriber or marking knife: It is used to draw lines parallel with the edge of the timber.

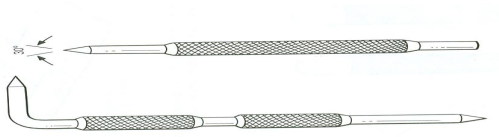


Figure 5.4 Scribers

Center Punch:

The center punch is to penetrate into the material of the work piece.

Its point must be hardened therefore soft points wear out fast

2. Leveling tools

Before placing the concrete materials on the formwork, first keep the leveling of the formwork. This leveling can be done by

a) Water level

The rubber water tube is filled with water until the level is half way up both glass tubes and them sealed when not tin use. Based on the principle that water finds its own level, so this apparatus used to find horizontal levels over longer distance.

Hose level (water level

b) Spirit level

In order to have the formwork level, this tool is very essential. When the air bubble in the level tube is located centrally between the markings on the tube. Then the straight edge makes horizontal or vertical spirit level

c) Plumb bob

To check the vertical level using plumb bob, put a nail or screw into the side of the formwork about eye level

. Leaving the head freely. If the Movement of plumb bob string stop, measure

the difference between the formwork and
the string (if the formwork sheathing erected
Vertically the difference is the same)

d) Alignment string

On the construction site, to keep the horizontal line first stretch the string on the required point. Then using spirit level, check the level of the object by observing the position of the bubble in the vial. If the bubble position is the same, the level is accurate. If the bubble position has changed, the level is not accurate. It should not be used until the fault has been corrected.

3. Cutting, filing and Reaming Tools

Pliers: - Used to tie transverse reinforcement bars with help of tying wire when reinforcements are placed in their position in the formwork

Hack saw- It is a tool used to cut pipes and other metals.

- ✓ It has a frame and blade
- ✓ The most commonly used hack saw blades are 250-300mm long.

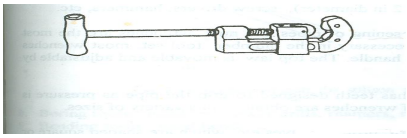


Figure 5.5 Pipe cutter

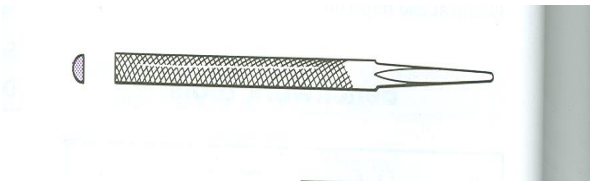


Figure 5.6 Pipe cutter Half round file Reamer

Reaming is used to clear burrs at the end of cut pipe, the tools used for this purposes are:

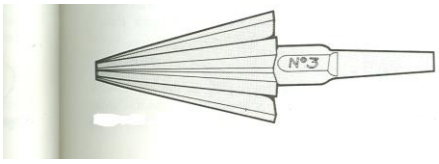


Figure 5.7 Reamer

4. Bending tools: - They are used to bend pipes at the required angles.
   - One of the most important skills a plumber should
   - Possesses is the ability to bend pipes of various materials quickly and accurately.
   - The followings are lists of bending tools

Hydraulic pipe bender

(Figure 5.8)Hydraulic pipe bender

Pipe bender

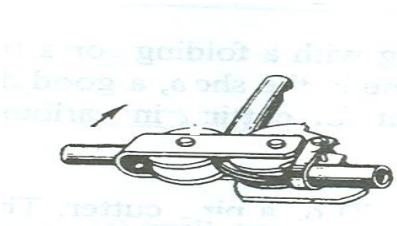


Figure5.9 Pipe bender

Threading and drilling tools: -

Are used to make threads and drill, they are

Adjustable threading tools

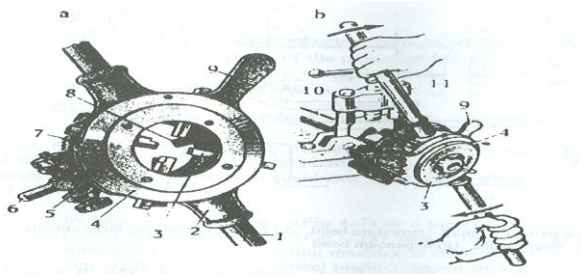


Figure 5.21 Adjustable threading tool

Ratchet

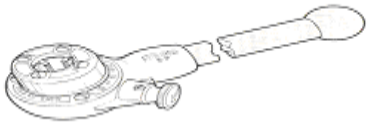
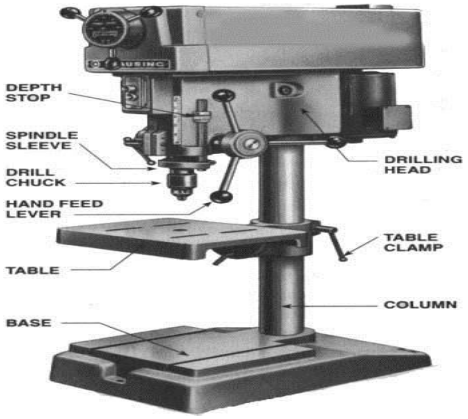


Figure 5.22 Ratchet

Drill press



Drill press

Figure 5.23 Portable electric drill

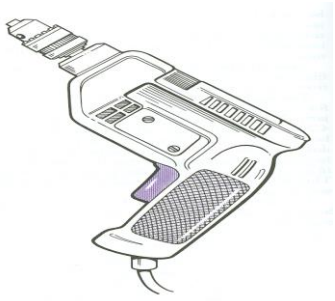


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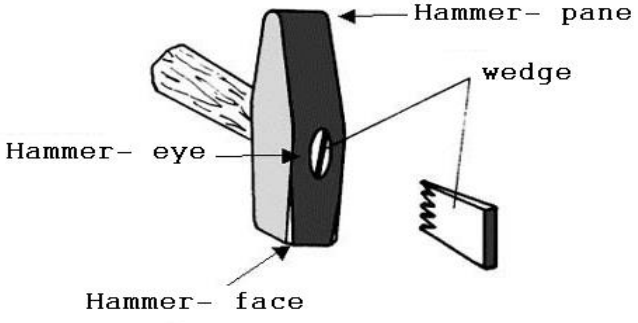
Figure 5.24 Portable electric drill

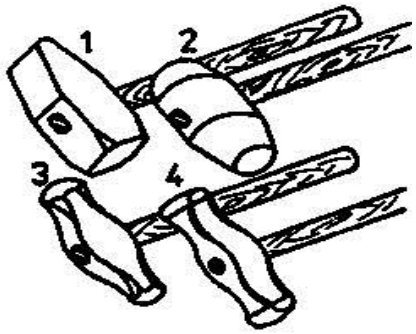
Hammering and chiseling

Engineers hammer

The hammerhead is made of tough tool steel with hardened and ground face and pane.



Different hammers are used, depending on the size of the work piece and the purpose of use.



1. 1 Engineer Hammer
2. Wooden Hammers
3. Round-faced Hammer
4. Plan face Hammer

Chiseling

Chiseling is a cutting process, which uses a hammer and a chisel to cut small chips from the work piece. .

Concrete chisel:- Used to chisel hard concrete surfaces. It is made from hardened steel.

Figure 5.24Holding tools

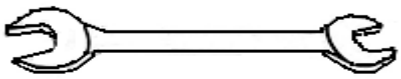
They are used tightened more securely the nut screws or others.

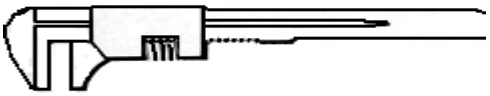
Screwing is the most common type of joining mechanical or electromechanical components. For making or detaching such joints, screwdrivers and wrenches (spanners) of various types and sizes are used.

Spanners

Spanners are available in a variety of types. The most common are

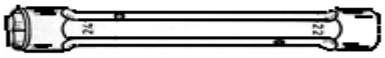
- Open ended
- Ring
- Box





Ring Spanner

Open-end spanner

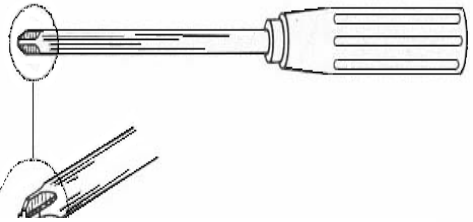


Adjustable spanner

Box spanner

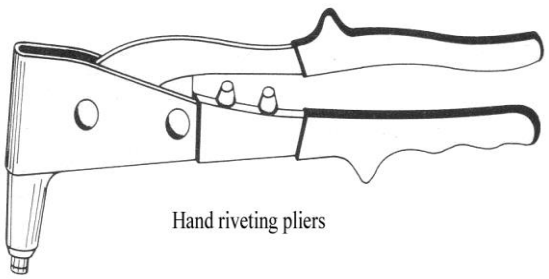
Screw driver (flat)

Screw driver (cross)



Rivet Set

Riveting tool is used for clinching blind rivets. It is a pliers-like tool used to clinching blind rivets



Hand riveting pliers

Clamps

The clamps most used to clamp boards like plywood and others. There are different types of clamps. Such as

- A steel bar clamp
- Hand screw clamp
- The c- clamp etc.

5. Cleaning tools

Cleaning tools are very essential to remove loose particles, dusts, grasses, etc before and after using the tools and also from the formwork sheathing material

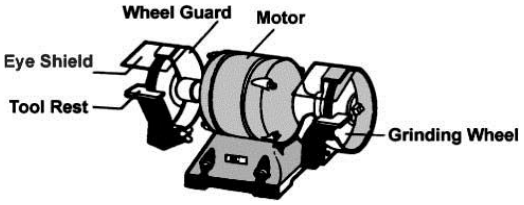
Cleaning tools are: - fiber brush, brooms, Cleaning machine, and Single bag dust extractor

Fiber brush

1. Modification of tools

Grinding Machine

In the fields of modification of tool, bench and pedestal type grinding machines are used which are equipped with two grinding wheels, mostly of a different grain size.



- PVC Pipe Cutter: This cutter makes smooth clean cuts on small diameter PVC pipe. Also used with polyethylene (PEX) tub in
- Pipe or Burring Reamer: This type of reamer is made with bit brace shank, round shank, or “T” handle
- Flaring Tool : Used to make flared ends for soft tempered tubing
- ABS Cement: Used to connect ABS Plastic pipe and fitting. Black in color. Not computable with PVC Pipe :
- Pipe Die Stock: Too much pressure on the handle may cause the cutting wheel to break.
- Teflon Tape: Used for sealing threads on metal and PVC pipe and on valves.
- Pipe Die: Pipe dies should not be used for bolt threading as they are tapered.

Tubing Cutter: Used to cut copper and aluminum tubing.

- PEX Crimp Tool : Use to close the cinch fasteners that hold PEX pipe to fittings. There are a number of other systems in use.

Pipe Die Stock: Operates as a ratchet in both directions. Hold the pipe die

- Copper Fitting: Used to clean metal parts to be soldered or welded and for cleaning pipe threads

- Copper Tube Cleaning Brush: A wire brush used to clean copper pipe or tubing for soldering. Comes in sizes 1/2" to 1".
- Pipe Tap: Used to cut internal threads in pipe fittings.
- Pipe Vise: Used for holding pipe while cutting and threading.
- Propane Torch: A propane/air torch that develops temperatures suitable for soldering.
- Solid Solder : It is available in I or 5 pound spools. Lead free solder is used for plumbing of domestic copper pipe
- Acid Brush: Used for applying pipe joint compound on threaded pipe and thinner's fluid (acid) or flux on copper pipe for soldering. The handle is tubular sheet metal 3/8 inch in diameter and 6 inches long.
- PVC Glue: Used to cut copper and aluminum tubing.
- PVC Primer: When gluing, apply glue to both the fitting and the pipe, slide the two pieces together and rotate 1/4 turn for good adhesion. Glue comes in a variety of thicknesses, set times, and colors.

PVC Pipe Cutter

Figure 5.26 Pipe or Burring Reamer

Figure 5.27 Flaring Tool

Pipe Die Stock

Copper Fitting Brush

Copper Tube Cleaning Brush

Pipe Tap

Figure 5.28 ABS Cement

Pipe Vise

Figure 5.29 Pipe Wrench

Propane Torch

Teflon Tape Solid Solder

Figure 5.31Pipe Die

PVC PEX Crimp Tool Prime

2.5.2 Cutting and threading and bending equipment,

Cutting tools, saws, drills, etc must be kept sharp and in good condition. In the course of Domestic Plumbing Work, you will frequently need to use cutting tools, such as hacksaws and wood saws. You should ensure that blades used are always fitted properly and are

sharp. Hacksaw teeth should be pointing in the forward direction of cut. After use, guards should be fitted wherever possible

Plumbing hand tools are to include hacksaw, tube cutters, cutting snips, wood saw, screwdrivers, pipe wrenches, tube flaring tools, copper tube expanders, battery operated and manual drills, tube benders, pipe bender, files and rasps, spirit levels, squares, pop riveters, ladders, silicon gun and pipe dies

Other common items of equipment e.g. vice Measure Mark out Cut Fabricate Make joint and diestock barrows, ranches buckets, pipe cuter set tools

Self-Check -5	**Written Test**

Directions: Answer all the questions listed below.

1. _____ This tool looks like a square, but has a movable blade that can set to layout any angle (3 points)

A. Pipe Tap C. T- bevel

B.Solid Solder D. Acid Brush Solid Solder

2._____Used for sealing threads on metal and PVC pipe and on valves(2point)

A. Pipe taps C. Teflon Tape

B .Solid Solder D. Acid Brush Solid Solder

Note: **Satisfactory rating – 5 points** **Unsatisfactory – 3 below points**

You can ask you teacher for the copy of the correct answers.

Operation sheet -1	Calculating materials requirement

The techniques for back to back single unit toilet

Step 1.weare personal protective cloth

Step 2 - Identifying types of pipe

Step.3 identify types of fitting and PVC pipe there function

Step.4 Aspects of taking correct measure

Steps.5– identify tools, instruments and equipment required

Steps.6- Required measurement of complete job

Steps 7- Dimensions and/or specification

Steps 9- install single unit toilet

Operation sheet 2	Positioning installation components

The techniques for identifying Water close work

Steps 1- Identifying types of pipe

Step 2 identify types of fitting and there function

Step 3 follows Safety precautions, supply conditions, or other special requirements

Step 4 Aspects of taking correct measure

Steps 5- Provide instructions for completing the skills phase of the job

Steps 6 – identify tools, instruments and equipment required

Steps 7- Required measurement of complete job

Steps 8- Step by step procedure

Steps 9- Dimensions and/or specification

Step 10.install water close

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 6 hour.

Task 1.perform position installation of water supply components

Task 2. Identify quantity and types of material for water supply installation.

Tasks 3 perform the calculating material requirement for water supply installation.

Plumbing Installation Work

LEVEL II

Learning Guide # 13

Unit of Competence: Install, Service and maintain water supply Systems and Components

Module Title: Install, Service and maintain water supply Systems and Components

LG Code: EISPLI2 M11 Lo3- LG 47

TTLM Code: EISPLI2TTLM060919 v1

LO 3: Install and test pipe system

Instruction Sheet	Learning Guide # 47

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Setting out pipe system
- Installing Fixings and supports
- Jointing and installing Pipes
- Testing Pipe system.

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Set out pipe system
- Install Fixings and supports
- Join and installing Pipes
- Test Pipe system.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3and Sheet 4”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” **in page -131, 135, 149 and 154** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 **in page -155.**
6. Do the “LAP test” **in page – 155** (if you are ready).

Information Sheet-1	Setting out pipe system

3.1 Setting out pipe system.

The preliminary site work for piping system usually begins after the site facilities are set up. Clearing the site is essential; first, all vegetation such as bushes and scrub should be removed. The site heeds to be clear of rocks and boulders in the excavation area**.** Site clearance is done by a combination of manual and mechanical methods.

3.1.1 Cold Water Supply Installation

3.1.2 Test and Inspections during Construction

Certain tests will be carried out on different systems of the installation during construction to ensure their suitability for operating at the design conditions. Certificates of such tests have to be issued together with certificates of any work tests.

Work Tests

(a) Work tests shall be carried out in accordance with the type normally associated with the specified item of equipment and to the standards as laid down in the General Specification and/or Particular Specification.

(b) Work static pressure tests shall be carried out for all items of plant and equipment, as laid down in the Specification and the Contract.

1.1.2 Installing Pipes and jointing

Installation of Direct and Indirect Cold Water Supply System

Water supply systems in building are intended to draw water from the exterior network and to distribute it among consumers in a building. Cold water is supplied under pressure, which carries it up to a storage tank in the roof and pushes it out of any taps connected to the mains supply.

Cold water supply system consists essentially

- **Cistern** – A container for water having a free water surface at atmospheric pressure.
- **Feed cistern** – Any storage cistern used for supplying cold water to a hot water apparatus.
- **Storage cistern** – Any cistern, other than a flushing cistern, having free water surface under atmospheric pressure, but not including a drinking trough or drinking bowl for animals.
- **Capacity (of a cistern)-** the capacity up to the water line

- **Water line** – A line marked inside a cistern to indicate the water level at which the ball valve should be adjusted to shut off.
- **Overflowing level** – In relation to a warning or other overflow pipe of a cistern, the lowest level at which water can flow into that pipe from a cistern.
- **Warning pipe** – An overflow pipe so fixed that its outlet end is in an exposed and conspicuous position and where the discharge of any water from pipe may be readily seen and , where practicable , outside the building.
- **Communication pipe** – Any service pipe from the water main to the stop valve fitted on the pipe(meter box)
- **Service pipe –** So much of any pipe for supplying water from a main to any premises as is subject to water pressure from that cistern.
- **Distributing pipe** – Any pipe for conveying water from a cistern, and under pressure from that cistern.
- **Supply pipe** – So much of any service pipe, which is not a communicating pipe.
- **Main** – A pipe for the general conveyance to individual premises.
- **Fitting** – Anything fitted or fixed in connection with the supply, measurement, Control, distribution, utilization or disposal of water
- **The meter box** – houses of a meter box and valves used to shut of the water meter during inspection.
- **Water meter** – Is a mechanical device used to measure the volume of water passing into the building.
- **The risers** – Are pipes supplying water to storage tanks or points in elevated position
- **Storage tank**s – Takes water from the distribution system and release it when needed For trouble-free operation in case of interruption in service or when The distribution system fails.
- **The water dispensing fixtures** – Let the water out for direct use.

Galvanized Steel Pipe

Working with steel pipe is more difficult because of the rigidity and the threading operations involved plus the joining processes. The face to face method is applied conveniently in measuring the length of the pipe for a connection. However, allowance for the thread which will enter into the fittings should be provided. Working with this type of material involves major considerations such as:

1. Direct Connections

2. Measuring and cutting
3. Threading operations
4. Sizing of pipes

a. **Direct Connections** – refers to the manner of planning and the lay-outing of the pipes including re-routing to reach the point of service. All pipe should be installed as short and direct as possible. The number of fittings and the amount of pipe cutting plus the threading processes could be reduced to the minimum if the plumbing lay-out is carefully planned.

b. **Measuring and Cutting –** Errors committed in measuring and cutting of pipes may mean additional pipes and fittings plus the cost of labor and the risk of pipe leakage. So far, the face to face methods of measuring and cutting are considered the most accurate and the procedures are the same as that of the cast iron pipe.

C. Cutting and Threading of Galvanized Steel Pipes – In cutting and threading operations, the steel pipe should be held rigidly with proper holding tools. Cutting is done by using 14 teeth per inch hacksaw blade applying a forward strokes at the rate of about one stroke per second.

Fast cutting will overheat and break the blade. After cutting, the burrs are removed from the inside edge of the pipe with the use of files or reamers. Remember that un reamed pipe increases the resistance to flow.

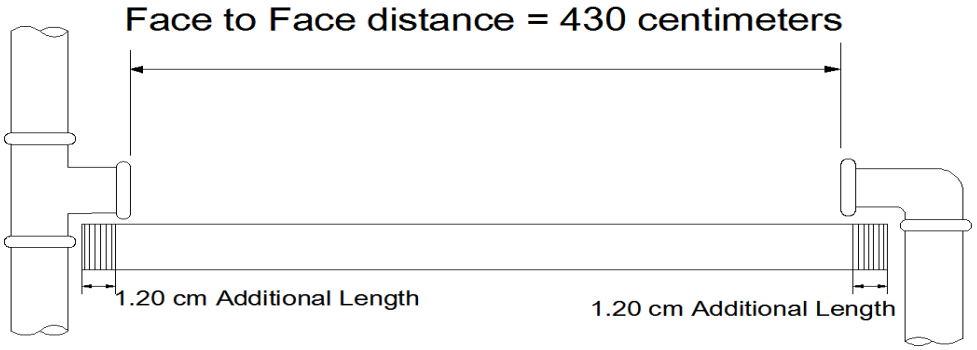
Threading of steel pipe entail a very tedious process. Thus it is important for one to know beforehand the basic rules governing the threading operations enumerated as follows:

1. Never hold threaded parts with a wrench. It will surely damage the thread.
2. Put two nuts on them, lock tightly then continue the threading operations.
3. During the process of threading, apply motor oil regularly to protect both the threaded and the thread of the pipe.
4. Threads must be slightly tapered so that the turning of fittings will be harder the deeper you screw. This will ensure tight and rigid connections.
5. Apply a thread compound on the male (external) thread only. A large amount of thread compound applied on the female (internal) thread create clog and trouble. A special tape known as Teflon Tape is now widely used on the thread instead of this liquid sealing compound).

The use of readymade nipples ranging from 2 inches to 12 inches was proven economical than fabricating them on site. The amount of cutting and threading as well as the time of installation is reduced substantially

Sample Problem 4.

Determine the length of the galvanized steel pipe required to connect the installation as shown in the figure using a 12 mm Ø pipe.



Solution:

1. The face to face distance is 4.30 m (430 cm) and referring to Table 4, the additional length of the screw inside the fitting for a 12 mm Ø pipe is 12 mm or 1.20 centimeters.

   1.20cm x 2 ends = 2.40 cm

2. Add to the face to face clear distance = 4.30 m or 430 cm

   430 cm + 2.40 cm = 432.40 cm

Plastic Pipes

The simplest method of joining plastic pipe is by cementing called Solvent Welding. Solvent welding takes only about ¼ the time it takes to assemble bell and spigot pipes.

Working With Plastic Pipes:

1. Measure the face to face distance of the fittings to be connected. Add the engagement length before cutting the pipe.

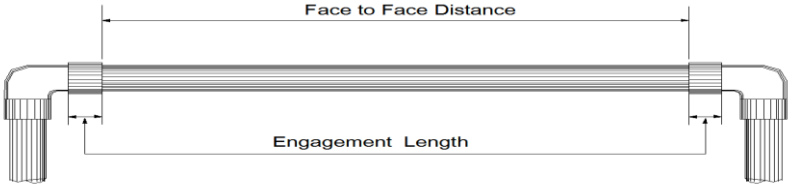
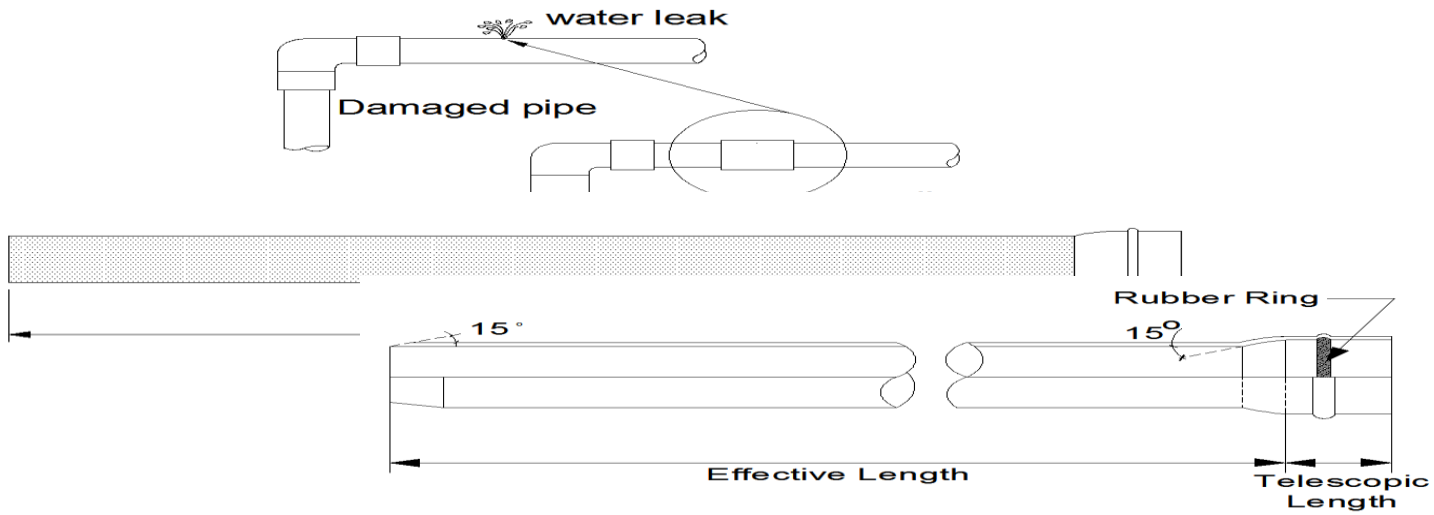


Figure 2-G

2. Some plastic pipe can be cut with a sharp knife, but all can be cut with hacksaw or handsaw. A rotary pipe cutter should not in any manner be used in cutting plastic pipes.
3. Be sure to cut pipe ends square or at a right angle with the axis of the pipe. Work on one joint at a time. Solvent is very quick setting and unforgiving of mistakes. Once an error is committed, the only last recourse is to cut the pipe and then have it replaced.
4. After cutting, remove the burrs inside the pipe, ream and clean the end portion until smooth to allow full contact with the fitting shoulder. Clean the pipe end with Methyl Ethyl Kenton (MEK) or simply Acetone. However, depending upon the type of plastic being used, the are solvent which need no cleaning.
5. Apply solvent cement using non-synthetic brush liberally to the shoulder fitting and butt end of pipe. Insert the pipe into the fitting and give it a quarter turn or turn. The span of time from cement application to the quarter turning should not be more than ½ minutes.
6. Do not disturb the pipe for several minutes after the quarter turn. Wait for about 2 hours before testing the line under pressure. Drying of the cement must be far enough advances from 15 to 20 hours to permit use of the line.



1.1.3 design layout

Lane and layout

Installation of water supply designs and layouts varies depending upon the designers working in this field, but there are no specific rules on how designs must be drawn or done. No specific formulas to follow on how a designer has to fix his definite line of routing or re-routing his pipes to serve plumbing fixtures for a particular design or arrangement. Thus, any piping layout combinations will do and beyond question provided that the Physical Laws of Nature relative to installation of water supply system and the provisions of the Code is not violated.

In the preparation of a installation of water supply plan, it must be drawn to be understood by the one implementing the layout or the plumber doing the installations. Details should be drawn in accordance with the procedure or the provisions of the water supply Code. All fixtures, sizes of pipes, fittings and other materials to use must be clearly identified on the plan. Abbreviations or codes must also be noted so as to be understood. Provide legends whenever it is necessary.

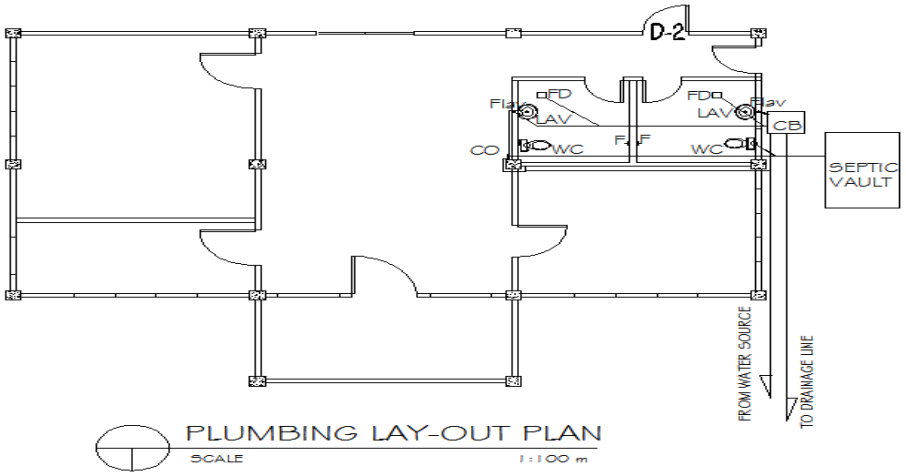


Figure1.1 plumbing lay-out plan

Self-Check -1	Written Test

Directions: Answer all the questions listed below.

1._____ A container for water having a free water surface at atmospheric pressure.

A. Storage cistern C. Cistern

B. Overflowing level D. Water meter

2.___Any service pipe from the water main to the stop valve fitted on the pipe (meter box

A. Storage cistern C. Cistern

B. Overflowing level D. Communication pipe

3.____ Are pipes supplying water to storage tanks or points in elevated position

A Supply pipe C. the risers

B Water meter D. Fitting

Note: **Satisfactory rating - 10 points Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-2	Installing Fixings and supports

3.2 Installing Fixings and supports

Introduction

The Fixing Components perform an essential function in terms of the reliability of the entire installation structure; in fact, they represent the link between the concrete (or metal load-bearing) structure and the components of the installation that run throughout the building.

Fixing Components and Fastening Solutions range that meet the Highest Quality Standards, to completely satisfy most of the fastening installation needs within a Valuable Time and Cost Saving.

A fitting is used in pipe systems to connect straight pipe or tubing sections, adapt to different sizes or shapes and for other purposes, such as regulating (or measuring) fluid flow. "Plumbing" is generally used to describe the conveyance of water, gas, or liquid waste in domestic or commercial environments; "piping" is often used to describe the high-performance (high-pressure, high-flow, high-temperature or hazardous-material) conveyance of fluids in specialized applications. "Tubing" is sometimes used for lighter-weight piping, especially that flexible enough to be supplied in coiled form.

Fittings (especially uncommon types) require money, time, materials and tools to install, and are an important part of piping and plumbing systems.

- Valves are technically fittings, but are usually discussed separately.

Common piping and plumbing fittings

Elbow, Coupling , Nipple, Reducer ,Double-tapped bushing ,Tee, Diverter tee, Cross ,Cap , Plug , Valve ,

Drain-waste-vent (DWV) and related fittings

Slip-joint fitting , Closet flange, Clean-out, Trap primer, Combo tee, Sanitary tee, Baffle tee ,Double sanitary tee (sanitary cross) ,Wye (Y) fitting, Side inlet TY (tee-wye)

Connection methods

Threaded pipe, Solvent welding , Soldering, Brazing, Welding, Compression fittings ,Push-to-pull compression fittings , Flare fittings ,Flange fittings, Mechanical fittings Crimped or pressed fittings

Figure 1.2. Location of pipe installation

Pipe Clamps - The Complete Guide ...

Figure 1.3 pipe clamps

Self-Check -2	Written Test

Directions: Answer all the questions listed below.

1. ._____Is used in pipe systems to connect straight pipe or tubing sections. (2points)

A Supply pipe C. the risers

B Water meter D. Fitting

2. ---------- Common piping and plumbing fittings (3points)

A . Elbow C .Nipple

B. Coupling , D .all

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-2	Jointing and installing Pipes

3.2 Jointing and installing Pipes

Introduction

a plumber must also have knowledge of the various pipe fittings like elbow, union, gasket, etc., joints and valves, and where these should be used while carrying out the tasks. Not only does this help in smooth functioning, but also ensures cost-effectiveness. For proper installation of the plumbing system in a building, various types of joints are used, which are. As already mentioned, various types of fittings like elbow, gasket, union, etc., are used for making joints. It helps in changing the direction of water supply from main pipes to subsidiary pipes. Proper fitting also helps in checking leakage in the plumbing lines.

Pipe joints in water supply are major components of plumbing system provided to connect multiple pipes. There are several types of pipe joints, but their selection depends on pipe sizes, material and flow pressure etc.. Pipe joint provided should withstand pressure of each pipe.

Types of Pipe Joints in Plumbing

Different types of pipe joints used in plumbing system are as follows.

1. Threaded joint
2. Brazed joint
3. Soldered joint
4. Welded joint (butt welded, socket welded)
5. Flanged joint
6. Compression joint
7. Grooved joint

1. Threaded Joint in Pipe

Threaded joint means, pipes are connected by screwing with the help of threads provided for each pipe. One pipe having internal threads and the other one having threads externally. Cast iron pipes, copper pipes, PVC and G.I pipes are available with threads.

Threaded joints are available from 6mm diameter to 300mm diameter pipes. They are preferable for low temperature areas and low pressure flows. In the areas of high temperature, the joints may expands and leaked due to thermal expansion. Installation of threaded joint is easy but good maintenance required.

Threaded Jointing Pipe

2. Brazed Joint in Pipe

Brazing is the process of jointing pipes using molten filler material at above 840^{o}C. Brazing is generally used for joining copper pipes or copper alloy pipes. The filler material majorly consist tin which has great affinity towards copper. But because of its weak property tin is added to other materials like nickel, bismuth, silver and copper.

The melting point of parent metal should be higher than filler metal. Mechanical strength of brazed joint is low compared to other joints. This type of joint is suitable in moderate range of temperature areas.

Brazed Joint in Pipe

3. Soldered Joint in Pipe

Soldering is also similar to brazing but the only difference is in case of soldering the filler metal melts at below 840^{o}C. Soldering also used to joint copper and copper alloy pipes. Before proceeding to soldering flux called paste is applied to pipes and fittings to prevent them from oxidation from flame. Here also we require skilled workers for installation.

Soldered joints are suitable for low temperature areas. These are having low mechanical strength as brazed joints.

Soldered Joint

4. Butt Welded Joint in Pipe

When the pipes are of same diameter butt welding is to done to join the pipes. It is the most common type of welding. Skilled workers are required to install the joint. These joints are generally used for large commercials and industrial piping systems.

Butt weld provides good strength for the joint and it can resist high pressure because of smooth and continuous surface inside the joint. Butt weld joints are expensive, to make it economical sometimes internal weld backing rings are used, which joins the pipe with less amount of filler material. But these rings may fail under heavy stress and cracks are developed.

The joints are fixed and do not opened for maintenance purposes. External smoothing of welded portion will give good appearance to the piping system.

5. Socket Welded Joint in Pipe

Socket welded joints are used wherever there is a high chance of leakage in joints. Pipes are connected as putting one into other as shown below and welded around the joint. Pipes having different diameters are suitable for this type of joint.

If pipes having similar diameter, then required fittings are used. Welding cost is generally lower than butt welding. Fatigue resistance is lower for socket welded joints when compared to butt weld joints. However, socket welded joint give good results when compared with other mechanical joints

6. Flanged Joint in Pipe

Flanged joints are used for high pressure flows and for large diameter pipes. In general they are used for plain end pipes or threaded pipes. Two flange components are connected by bolts at the pipe joint to prevent leakage.

Generally these are made of cast iron, steel etc. these are having good strength and do not fail against high pressure. Against high temperatures the bolts may fail under creep lost their grip so, fixing of bolts should be done properly while installing. They are also useful for repairing pipelines and maintenance purposes.

7. Compression Joint in Pipe

When the pipes have plain ends they are joined by installing some fittings at their ends then that type of joint is called compression joint. The pipe ends will be fitted with a threaded fittings or couplings hence they are connected.

So, in this case we can connect pipes of different materials and different sizes. But the joints should be properly fitted to resist flow pressure otherwise they may fail and leakage occurs. Compression fittings are available in different materials and selection of fittings may depend upon our requirement.

Compression Joint

8. Grooved Joint in Pipe

In case of grooved joint, the pipe ends consist grooved edges which are connected by elastomeric seal and then ductile iron made grooved couplings are used as lock for elastomeric seal. These grooved couplings are connected by bolts. These joints are easy to install and economical.

Grooved joints will give good resistance against pressure and allows moderate axial movement due to thermal expansion. But, in high temperature Areas elastomeric seal may lost its strength and tensional failure occurs. So, these are permitted to moderate temperature areas.

Pipe Fittings

Pipe fittings are an important component of the plumbing system. In plumbing, many types of fixtures are joined with the help of various types of material as per the requirement. Fittings are fixed in the plumbing system to join straight pipes or any section of tubes. We can say that the water-supply fittings like elbow, tee, socket, reducer, etc., are fitted to change the direction of flow, distribute the water supply from the main pipe to other pipes of equal size or lower size, etc. Any part used in connection with water supply, distribution, measurement, controlling, use and disposal of water is known as a pipe fitting

(Figure 3.1) Pipe Fittings

Type of Fittings

a. Collar
b. Elbow
c. Gasket
d. Union
e. Reducer
f. Tee 7. Nipple
g. Trap Collar

While joining two pipes in the same length, collar is used. Collar is fitted in the end of pipe

Elbow

It is installed at the time of joining two pipes. With the help of an elbow, the direction of liquid is changed. Normally a 45° or 90° elbow is used. When the two sides of pipes differ in size, an elbow of reducing size is used. This is called reducing type elbow or reducer type elbow. Elbows are categorized as follow

Long Radius (LR) Elbows Here, the radius is 1.5 times the diameter of pipe.

Short Radius (LR) Elbows In this, the radius is 1.0 times the diameter of pipe.

90° Elbow This is used when the change in direction required is 90° (Fig. 5.5).

45° Elbow this is used when the change in direction required is 45°

Fig. 5.4: Bend 45°

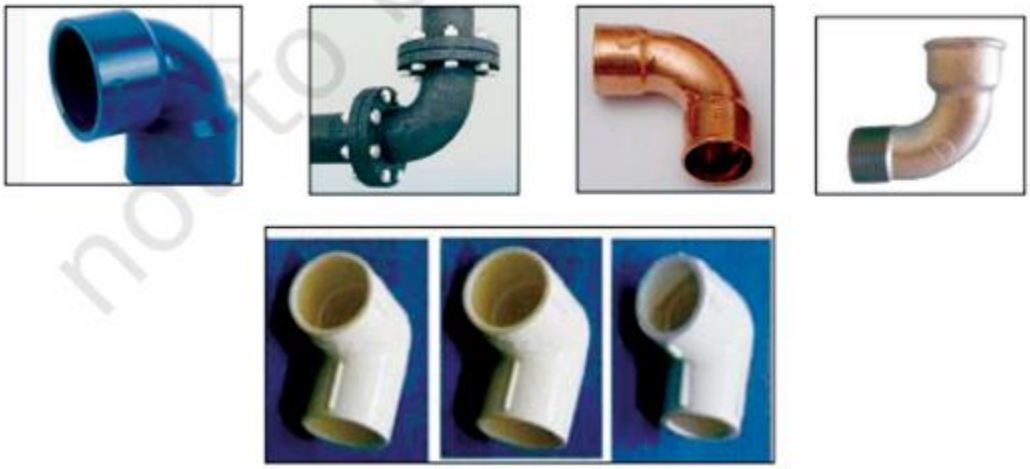


Fig. 5.5: Bend 90°

(Figure3.2) Elbow

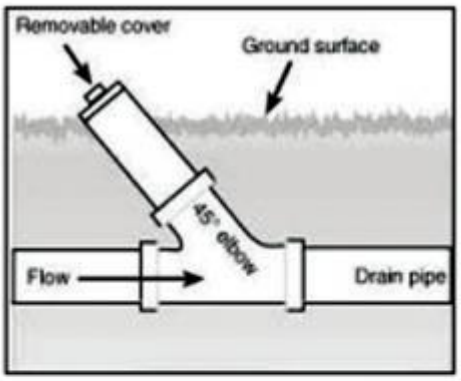


Fig. 5.6: Y-T Joint

(Figure3.3)

Fig. 5.8: Double Y-T Joint-2

(Figure 3.4) reducer and tee

Gasket

They are mechanical seals, generally ring-shaped type and fitted for sealing flange joints. A flange joint is a plate or ring to form a rim at the end of a pipe when fastened to the pipe. Gaskets are made as per by construction, materials and features. Important gaskets used are nonmetallic, spiral-wound and ring-joint type. Union When two ends of pipes are joined, the pipe fitting used is called union.

(Figure3.5) **gasket**

A union

Is made of three parts namely a nut, a male end and a female end. The male and female ends are assembled with the support of the nuts, and necessary pressure is made to connect the joint. Since the pairing ends of the union are interchangeable, the union can be changed easily in a short time.

(Figure3.6) A union

Reducer

It is used to connect pipes of different diameters. A reducer may be of various types like reducer tee, reducer elbow and reducer socket

(Figure3.7) reducer

Tee

It is an important fitting with a side outlet at 900 to the run of the pipe. Tees connect pipes of various diameters and help in changing the direction of water or material in a pipe. Tees are made in various sizes like equal or unequal. The equal tee is most commonly used

(Figure3.8) **Tee**

(Figure3.9) cross tee

Grooved joints

When two pipes are joined together by making grooves (narrow cuts or depression) at the end of pipes with the help of sockets or couplings, such joints are called grooved joints. Due to the ease of assembly of the grooved joints, the labor cost is less.

The piping system can be easily uninstalled and reinstalled frequently for maintenance. These are mostly used for fire protection.

(Figure3..10) Grooved joints

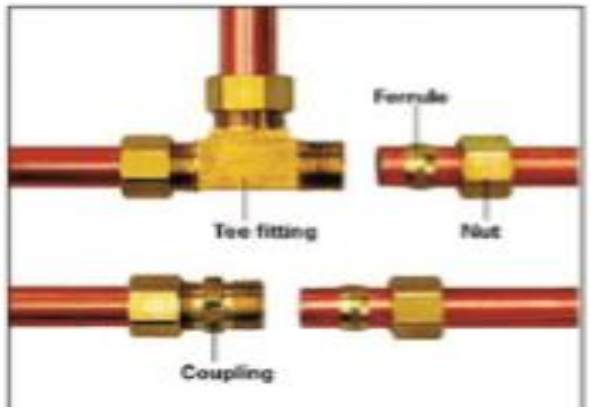
Flanged joints

This joint is commonly used for joining pipes in pumping stations, filter plants, hydraulic laboratories and boiler houses, etc. These joints are preferred due to easy process of assembly and disassembly, however these connections are costly. These joints can be disassembled and re-assembled when required. A pipe has flanged ends on both sides of the pipe length. Both the ends of pipes are joined at a proper level near one another. A hard rubber washer is placed between flanges and bolted. Flanges are generally fixed to the pipe by welding or threading. In certain cases, a flange-type joint is also called a lap joint. It may also be made by forging the process and machining the pipe end. There is no leakage in flanged joints even after rapid temperature fluctuations.

(Figure3 .11) Flanged joints

Compression joints

These are applied to join the pipe without any preparations. The cost of installation of these joints is very economical. The pipes having plain ends are joined by fixing fittings at their ends, and such a joint is called a compression joint. The pipe ends are joined with threaded fittings or couplings. Joints are placed properly to check the flow pressure, otherwise, leakage may occur. These fittings are manufactured from different types of material. Selection of fittings is done as per requirement



(Figure3.12) Compression joints

Valves

For proper functioning of the pipeline, valves made of iron or brass are used in the water-supply mains. Valves stop or control the flow of fluid like liquid, gas, condensate, etc. These are classified according to their usage like isolation, throttling and non-return corrector. Various types of valves are manufactured depending upon their use and type of construction.

(Figure3 .13) Valves

Gate valve

It is used for starting or stopping flow. For a straight-line flow of fluid, minimum flow restriction can also be done with gate valve. In service, these valves are generally either fully open or fully closed. These valves are used for various types of liquids and make a tight seal when closed

(Figure3.14) Gate valve

Parallel slide valve it has two discs without spreading mechanism which slides between the two parallel body seats. The activation

(Figure 3.15) Gate valve

Globe valve

It is a type of valve used for controlling flow in a pipeline. A component of valve includes a movable disc element and a stationary ring seat fitted in a generally spherical body. The globe valve is used for controlling flow control

(Figure 3.16)Globe **valve**

Angle valve

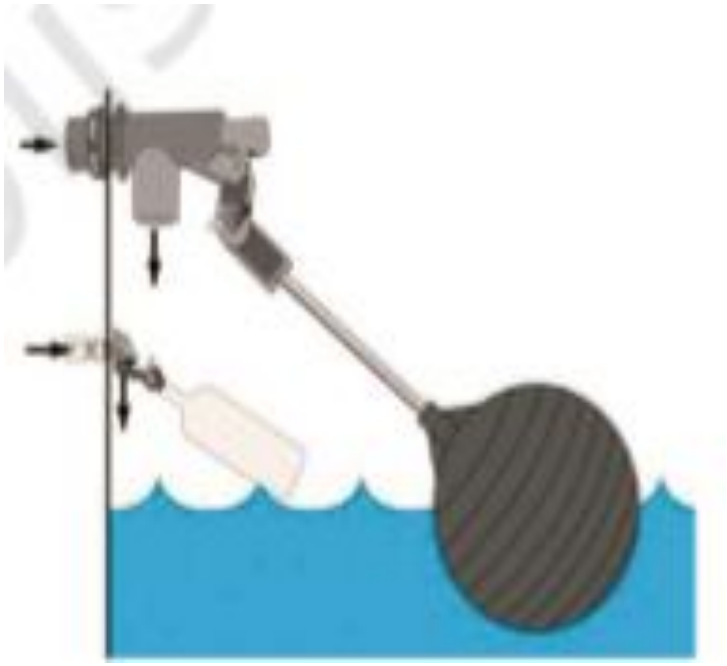
It is used to control the movement of a fluid like liquids, gases, fluidized solids, or slurries by opening, closing or partially obstructing various pathways. This type of a valve generally has a round body, in which the body ends are fitted at right angles with each other and the disc moves up and down. The valve is moved to action by the internal or external screw on the spindle. The spindle may be of the rising or non-rising type.

Fig. 5.36: Angle valve-1

(Figure 3.17) Angle valve

Float valve

It is used for stopping water when the water tank or flush toilet is filled, so that it stops overflowing. When the water level rises, the float also rises; once it rises to a pre-set level, the water level forces the lever to close the valve and stops the water flow. A float valve is a fitting used for filling water tanks as well as flush toilets



(Figure3.18) Float valve

Self-Check -3	Written Test

Directions: Answer all the questions listed below..

1._____it is used to connect pipes of different diameters (**3 points**)

A. Float valve C .Valves

B. Globe valve D .reducer

2._____It is used for stopping water when the water tank or flush toilet is filled, so that it stops overflowing. (2point)

A. Float valve C .Valves

B. Globe valve D .reducer

Note: **Satisfactory rating 4 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-4	Testing Pipe system

1.4 Testing Pipe system

Pressure testing of pipelines should normally be carried out using water. Only in exceptional circumstances should pneumatic pressure testing using compressed inert gas or air be used, and then only under carefully controlled conditions. The reason for this is because water is virtually incompressible (as are other liquids) and only a small quantity of energy needs to be introduced to increase the pressure significantly. Air, however, (like all gases) is compressible and ,as a result ,much more energy has to be put into the gas to raise its

Testing Installation

TEST FOR LEAKAGE AND PRESSURE ON PIPELINE

There is a testing pump, which is used to check pressure pipe work systems and appliances for leaks. It consists of a steel cistern for holding up to 12litres of water, a lever-operated pump, flexible rubber pipe work and couplings with flow valves and a pressure gauge.

To check for leaks, fill the system appliances with water then connect to the pump.

The system is sound if no pressure drops shows on the gauge for specified period.

A small drop in pressure is acceptable in the first few minutes to account for absorption.

When filling, care must be taken to let all air out of the system.

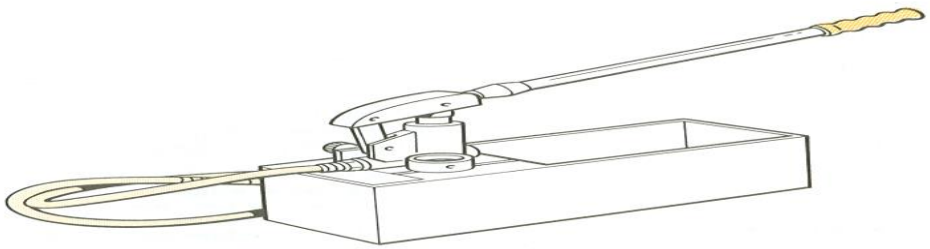


Figure3.3 a) Proving pump

Pressure

Water Regulations require that every supply pipe or distributing pipe providing water to premises be fitted with a stop valve, and that water supply systems shall be capable of being drained down and fitted with an adequate number of servicing valves and drain taps. A sufficient number of stop valves are also needed for isolating parts of the pipe work. Fitting these valves and drain taps will also facilitate hydraulic pressure testing.

Planning for the test

Before carrying out a pressure test a risk assessment must be carried out. This needs to consider hazards associated with stored energy, the possibility of blast and its effects, potential missile formation and brittle fracture. A safe system of work also needs to be established (this may require a permit-to-work system, training, use of written procedures, suitable venting arrangements, proper tools and equipment, safety restraints and personal protective equipment etc).

The following factors also need to be considered:

- Is the specified test appropriate for the service and the building environment
- Will it be necessary to divide up vertical pipe work to limit pressures in high-rise buildings?
- Will a water test leave pockets of untrained water that might cause frost damage or corrosion later?
- Can the piping, or any in-line fittings and components (valves, bellows, tanks, cylinders, radiators etc) withstand the proposed test pressure? If not, these need to be blanked-off or removed and ‘make-up ‘pieces of tube inserted.
- If a water leak occurs what damage might be caused, and could minor faults be checked by carrying out a leak test with air or inert gas at 5kPa (20mbar) before filling with water?
- Are sufficient people available to keep a progressive check for problems whilst filling the system?
- Can different services be interconnected temporarily to enable simultaneous testing?
- How long will it take to fill the system using the water supply available, and what is the best time to start the test bearing in mind the duration and time needed to undertake the necessary preparations.

Test preparation

- Check that all high points have a tap or vent to facilitate removal of air during filling and that these are all closed

- . • Blank, plug or seal any open ends and close all valves at the limits of the test section of the piping.
- Remove or blank off any vulnerable in-line fittings and components that may be damaged by the test pressure.
- Open any valves within the enclosed test section
- . • Check that the test gauge is functioning correctly, has been calibrated and has the correct range. Attach the test pump. fit a separate gauge if necessary, using suitable adaptor fittings.

Hydraulic pressure test procedure

a. Start to fill the piping and then 'walk' the route of the piping under test, continuously visually checking for leaks and by listening for the sound of escaping air.

b. Release air from all the high points systematically through the system to completely fill it with water.

c. Once the system is full, raise the pressure to the test pressure and, if a plastics piping system, continue pumping for the specified period.

d. If the pressure falls check that stop valves are not letting by, then walk the system again for leaks.

e. Once the system is proven sound, have the test witnessed if necessary and obtain a signature on the test certificate.

f. After testing release the pressure. If necessary, ensure that any vents on cylinders, tanks, and pressure-vessels are opened to atmosphere BEFORE draining down and refitting vulnerable items.

If the system has to carry fluids other than water, it may be necessary to dry out the piping internally by passing hot air through it, (this can take some time to achieve).

Testing underground water mains

Underground water mains are jointed using a variety of methods including socket and spigot, push-fit and mechanical fittings. The forces that have to be contained within the piping can be considerable so, in addition to the above procedures, the following items are also recommended when pressure testing underground water mains:

✓ Install and test long mains in sections determined by agreement with the contractor.

✓ Pressure testing must NOT commence until anchor blocks and antismoking blocks are in position and the trench partially backfilled and rammed (leaving the joints exposed). This is to prevent any movement causing damage due to the pressure inside the piping. Strutting may also be necessary on blanked ends and branches.

Testing against valves is best avoided, but in any case check that the valves can withstand the test pressure, if necessary blanking off any valves that cannot.

Fill the main slowly and allow any air to escape before beginning to test, and pressurize slowly.

Once the main is proved sound, complete backfilling, then perform a final test and obtain a witness signature as necessary.

Pneumatic leak testing at low pressure followed by hydraulic pressure testing

Due to the inherent dangers associated with pneumatic testing using compressed air or inert gas, a responsible person must be in charge of this operation at all times. This person should direct the preparations and supervise the application of the test by working to a pre-prepared written plan based on the risk assessment. A written record of the test showing the system designed working pressure, the test pressure and duration should be kept and, at the conclusion of the test, this person must verify that the system is safely depressurized and ready for safe operation at the design working pressure.

Preparation

- ✓ Check that all high points have a tap or vent and that these are all closed.
- ✓ Blank, plug or seal any open ends and use valves to limit the test section of piping to about 50 meters in length for up to 50mm bore tube,(to limit the total stored energy).
- ✓ Remove or blank off any vulnerable in-line fittings and components that may be damaged by the test pressure.
- ✓ Check that the testing gauge is functioning correctly, has the correct range, has been calibrated if necessary and connect it to the system using suitable adaptor fittings.
- ✓ Check that all flexible connections between the compressed air supply (or pump) are securely fastened at both ends to prevent ‘whipping’ should one end become detached.
- ✓ If the compressed air or inert gas is at a higher pressure than is required for the test (maximum 0.5bar pressure) a pressure reducing valve, pressure gauge and pressure relief valve set to open at the test pressure should be fitted to the connecting pipe work.
- ✓ If possible, the compressed air supply should be controlled outside the test area.

Pneumatic leak test procedure

1. Ensure that all rooms through which the piping passes are cleared of people, then pressurize the system to the leak test pressure (normally 20mbar, but a pressure of up to 0.5bar could be used).

2. Wait at least 10 minutes, checking the gauge for pressure drop, and if necessary 'walk' the route of the piping under test checking for leaks using leak detecting fluid.
3. Once the leak test is passed, release the air pressure slowly and then carry out the normal hydraulic test as previously described.

Pneumatic pressure testing

Because pneumatic pressure testing involves higher final pressures, it also involves higher risk, so this method must only be used when hydraulic testing is not practicable. No work should be carried out on the piping during the test.

Self-Check -4	**Written Test**

Directions: Answer all the questions listed below.

1._____Is used to check pressure pipe work systems and appliances for leaks (3point)

A. Float valve C .Valves

B testing pump D .reducer

2. Which one of the following true about testing pneumatic pressure testing(2point)

A. Float valve C. Higher final pressures

B testing pump

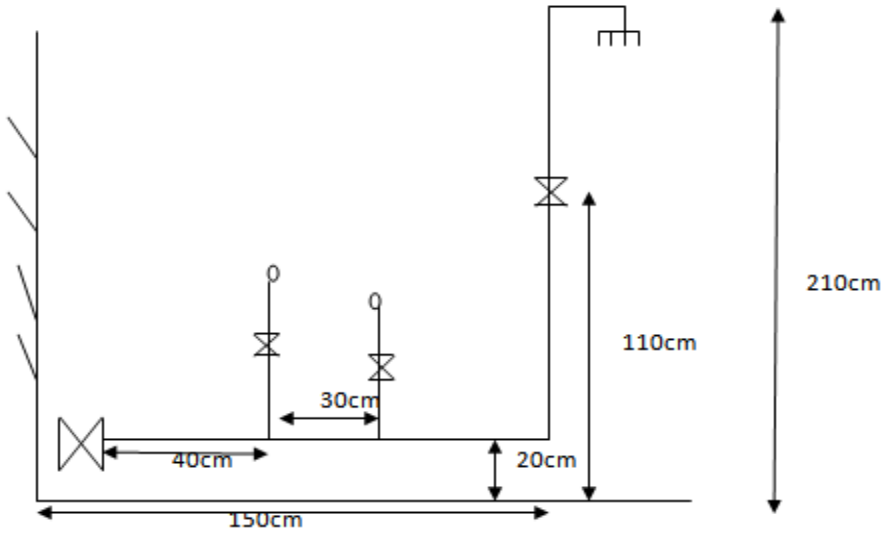
D .reduce

Note: **Satisfactory rating – 12 points Unsatisfactory - below 12 points**

You can ask you teacher for the copy of the correct answers.

Operation Sheet- 1	Setting out pipe system

Install and test the system



Step 1.Reading Plan and specifications

Step 2. Clearing site

Step 3 .Applying OH&S

Step 4.Locating plant, tools and equipment

Step 5.identify fitting

Step 6. Install and test pipe functionality

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 2 hour.

Task 1.setting out pipe system and determine the length of the galvanized steel pipe required to connect the installation pipe.

Plumbing Installation Work

LEVEL II

Learning Guide # 48

Unit of Competence: Install, Service and maintain water supply Systems and Components

Module Title: Install, Service and maintain water supply Systems and Components

LG Code: EISPLI2 **M11 Lo4- LG 48**

TTLM Code: EISPLI2**TTL**M**060919** v1

LO 4: Install and fit off sanitary fixtures

Instruction Sheet	Learning Guide # 48

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Checking Set out
- Positioning and installing Fixtures
- Assembling, installing and testing Fixtures, components and pipe
- Installing and connecting Fixtures
- Checking Completed installation

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Check Set out
- Position and installing Fixtures
- Assemble, install and test Fixtures, components and pipe
- Install and connecting Fixtures
- Check Completed installation

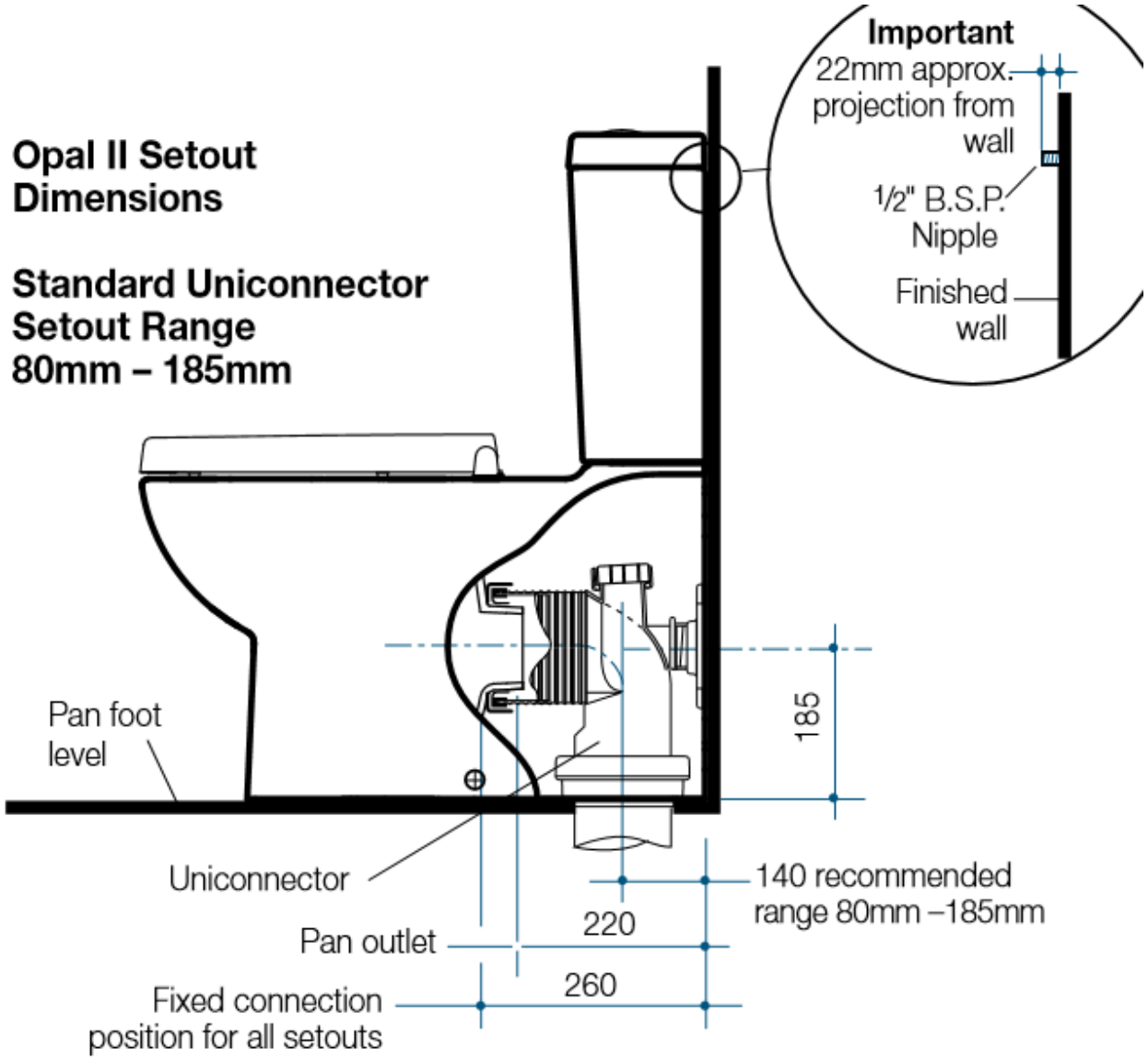
Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4 and Sheet 5”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3, , Self-check 4 and Self-check 5” **in page 163, 172, 181 and 201** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3” **in page -206 and 207.**
6. Do the “LAP test” **in page – 208** (if you are ready).

Information Sheet-1	Checking Set out

4.1 Checking set out

The setout dimension details the position of the plumbing pipe work inlet, outlet connections and fixing positions. These dimensions are the most important requirements that the customer and plumber must be aware of after the product selection has been made. Carom products have varying setout requirements depending on the product type



(Figure 4.1)

Trego Wall Faced Suite 80 – 180mm recommended setout 140mm. 180mm – 230mm with optional offset connector with bedding mix only.

Cato Wall Faced Suite 80 – 180mm recommended setout 140mm. 181mm – 220mm with optional offset connector with bedding mix only. Cube Wall Faced Suite 80 – 185mm recommended setout 140mm. 186mm – 220mm with optional offset connector with bedding mix only.

Geo Wall Faced Suite 80mm – 170mm recommended setout 140mm. 170mm – 240mm with optional offset connector with bedding mix only.

For further information visit www.caroma.com.au or call 13 14 16 3

Leda Wall Faced Suite

80mm – 180mm recommended setout 140mm. 180mm – 230mm with optional offset connector with bedding mix only.

Metro Wall Faced Suite 80 – 180mm recommended setout 140mm. 181mm – 220mm with optional offset connector with bedding mix only.

Milan Wall Faced Suite 80mm – 185mm recommended setout 140mm. 186mm – 220mm with optional offset connector with bedding mix only.

Neo Wall Faced Suite 80 – 180mm recommended setout 140mm. 181mm – 220mm with optional offset connector with bedding mix only.

Opal II and Opal II Easy Height Wall Faced Suites

80mm – 185mm recommended setout 140mm. 186mm – 220mm with optional offset connector with bedding mix only.

Opal Suite Wall Faced Suite

80mm – 185mm recommended setout 140mm. 186mm – 220mm with optional offset connector with bedding mix only

Pearl Wall Faced Suite 80mm – 185mm recommended setout 140mm. 186mm – 220mm with optional offset connector with bedding mix only.

Senate Wall Faced Suite 80mm – 180mm recommended setout 140mm. 181mm – 240mm with optional offset connector with bedding mix only.

Sterling Wall Faced Suite 80mm – 180mm recommended setout 140mm. 181mm – 240mm with optional offset connector with bedding mix only.

A Trego Suite recommended setout 140mm adjustable range 80mm – 180mm with optional offset connector. Cameo Suite recommended setout 140mm adjustable range 90mm – 190mm with orbital offset connector. Caravels 2000 Suite recommended setout 140mm adjustable range 80mm – 180mm with optional offset connector. Caravels Easy Height Suite

recommended setout 140mm adjustable range 90mm – 190mm with orbital offset connector. Regal II Suite recommended setout 140mm adjustable range 100mm – 180mm with optional offset connector. Profile 4 Suite 140mm set out fixed. Profile 4 Deluxe Suite recommended setout 140mm adjustable range 100mm – 180mm with optional offset connector.

Profile 5 with Integrated Hand Basin Suite 140mm set out fixed.

4 For further information visit www.caroma.com.au or call 13 14 16

Profile 5 Deluxe with Integrated Hand Basin Suite

Recommended setout 140mm adjustable range 100mm – 180mm with optional offset connector.

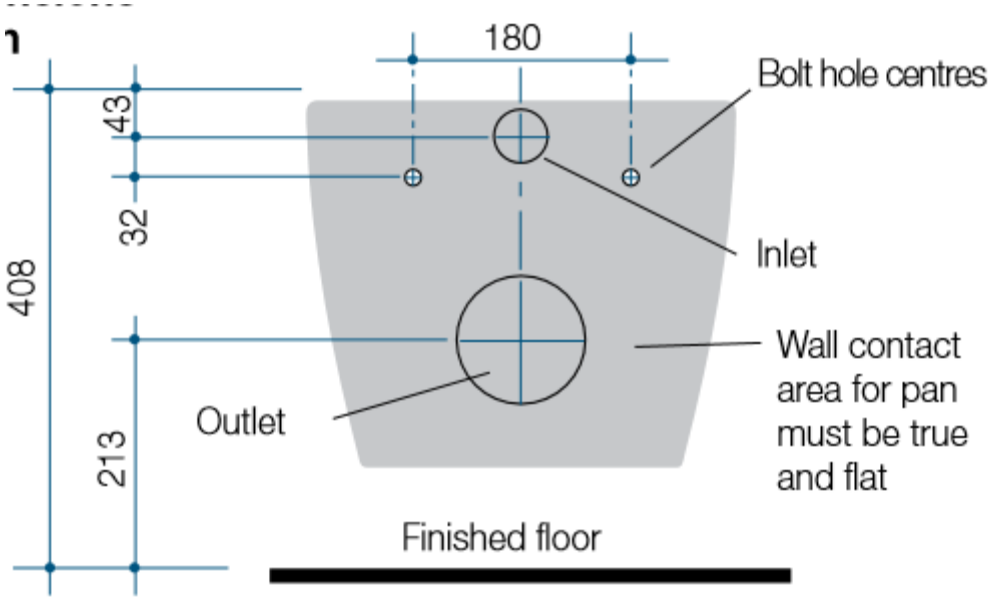
Regal II and Regal Deluxe Suite

Recommended setout 140mm adjustable range 100mm – 180mm with optional offset connector.. Senate Suite 140mm set out fixed. § Sterling Suite recommended setout 140mm adjustable range 100mm – 180mm with optional offset connector.

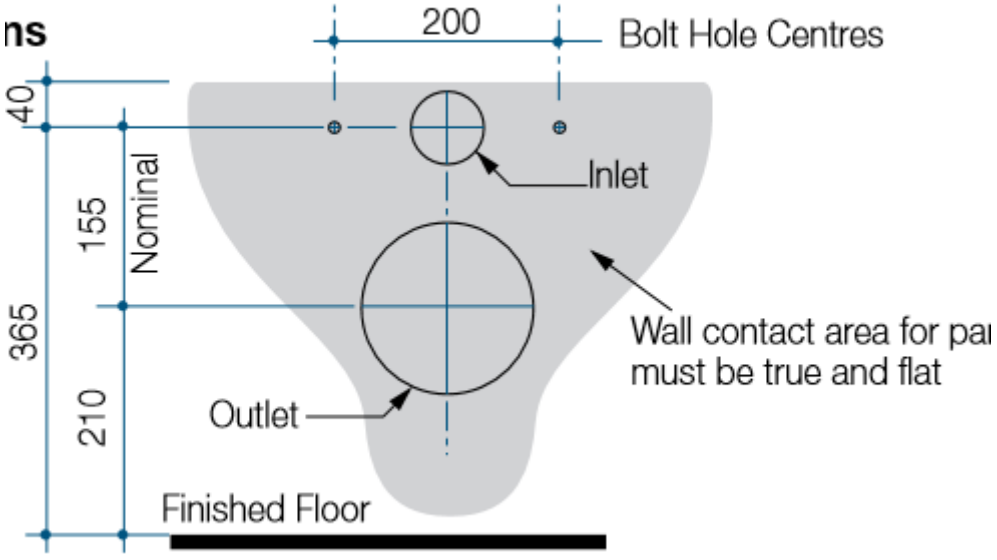
Wall Hung Pans Setout Dimension

The setout dimension for a wall hung pan is taken from the finished floor. The bolt hole and inlet positions are critical to the installation. Wall hung pans are suitable for installation with non compressible wall materials only.

Setout Dimensions for Cube Pan



Setout Dimensions for Walvit Pan



(Figure 4.2)

1. Open the meter chamber and remove the polystyrene on top of the meter plus any collected surface water (a sponge usually does the trick).
2. To ensure you're looking at the correct water meter, turn off the external stop tap and turn on a tap inside your property. If no water comes out, it’s your meter.
3. Turn the water back on at the meter and make a note of the meter reading.
4. Don't use any water for the next 30 minutes to one hour and then take a reading. If the reading’s changed, water’s escaping from somewhere.
5. To find out where, and without using any water, turn the water off at your internal stop tap. Wait 30 minutes to one hour and take another meter reading. If there’s a change in the reading, water’s escaping externally. If there’s no change, it’s escaping internally.
6. If there’s no change to the water meter readings throughout this whole test then no water is escaping and there is no leak.

Self cheek .1	

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the standard dimensions of set out for cube pan (10point)

1._____

2. ----------

3. ----------

Note: **Satisfactory rating - 10 points** **Unsatisfactory -5 below points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-2	Positioning and installing Fixtures

4.2 positioning and installing fixtures: -

Plumbing fixtures include faucets, tanks, and receptacles in kitchens and bathrooms. There are many types and styles of fixtures; some are general, while others have been adapted to meet special applications, such as for hospitals, prisons, and similar institutions. Military installations usually are planned to house large numbers of personnel, and the plumbing fixtures ordinarily are installed in batteries. Instructions for installing fixtures are given either by the manufacturer or by specifications. Sometimes you may have to design and lay out a fixture or battery of fixtures. You must know what water supplies and stack sizes are needed and work these into your design. Standard plumbing fixtures are individually tested so that the amount of liquid waste that can be discharged through their outlet orifices in a given interval is measured. The fixture unit value for different plumbing fixtures is shown in the basis for the fixture unit system comes from the fact that the washbasin, one of the smaller fixtures discharges 1 cubic foot of water per minute

Sanitary fixtures are installed after the pipe has been assembled and the rooms have been roughly finished (i.e. before applying the finishing coats of paint).The general installation procedures or a sequence of sanitary fixtures involves the following stages.

- position of sanitary fixtures is set out
- Fixtures supports and traps are installed.
- Fixtures are secured in design position and connected to the drains.
- Fixture supports are set out from the drawings.

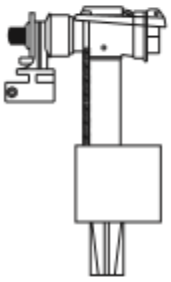
The materials, design and installation of plumbing fixtures, faucets and fixture fittings in accordance with the type of occupancy, and shall provide for the minimum number of fixtures for various types of occupancies.

Plumbing fixtures shall be constructed of approved materials, with smooth, impervious surfaces, free from defects and concealed fouling surfaces, and shall conform to standards cited in this code. All porcelain enameled surfaces on plumbing fixtures shall be acid resistant.

PARTS IDENTIFICATION

400mm hose for
Top/Rear install
(supplied with cistern)

Side Entry
Capping Plug



Side Inlet Valve
(for Top Rear and Lower Entry
Supplied with cistern)

Bottom Entry Connector
(supplied with cistern)

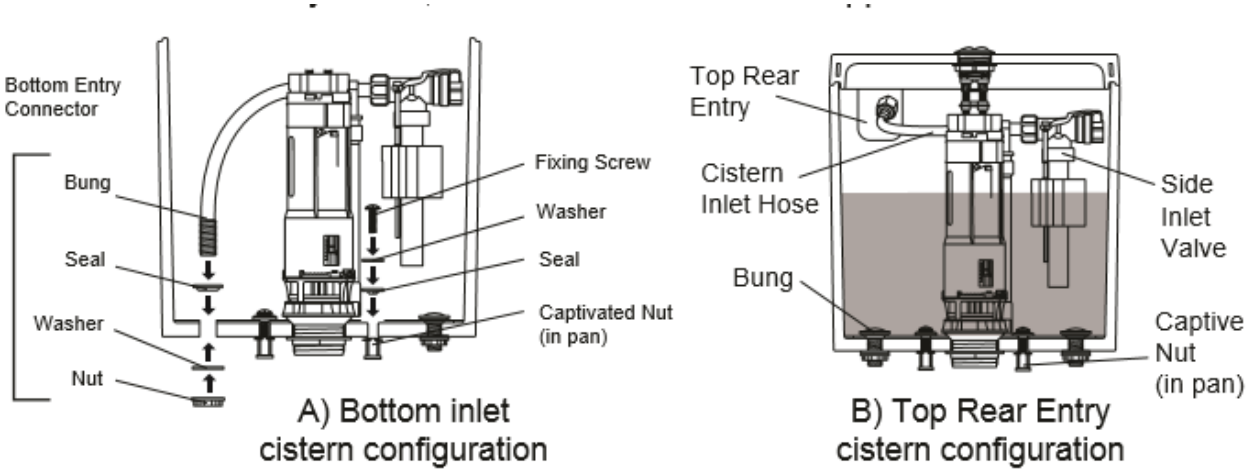
Plus:

- Pan Fixing Kit
  (supplied)

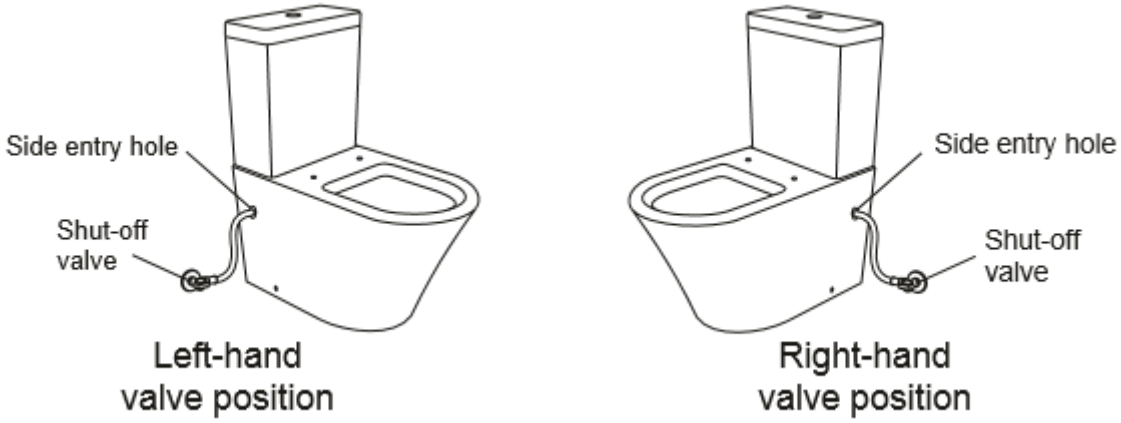
(Figure 4.2) parts identification

PREPARING TO INSTALL

1. Identify the type of toilet installation: A) Side Entry with Bottom Inlet or B) Top Rear Entry with Side Inlet Valve. For Side Entry toilets, the bottom inlet valve is supplied with the cistern



2. For Side Entry/Bottom Inlet installations, check the shut-off valve position.

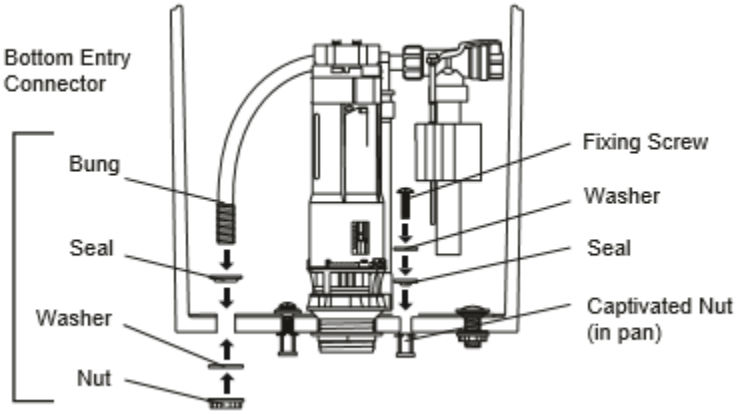


(Figure 4.3) preparing to install

CISTERN INSTALLATION - BOTTOM INLET

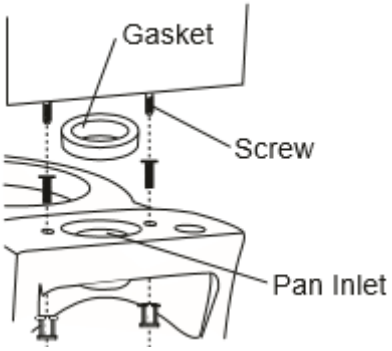
1 Remove the Side Inlet valve and 250mm hose

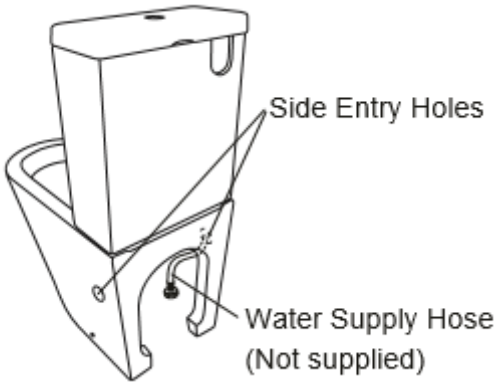
2 Install the Bottom Inlet valve to the cistern. Place the washers over the fixing screws and locate in cistern fixing holes



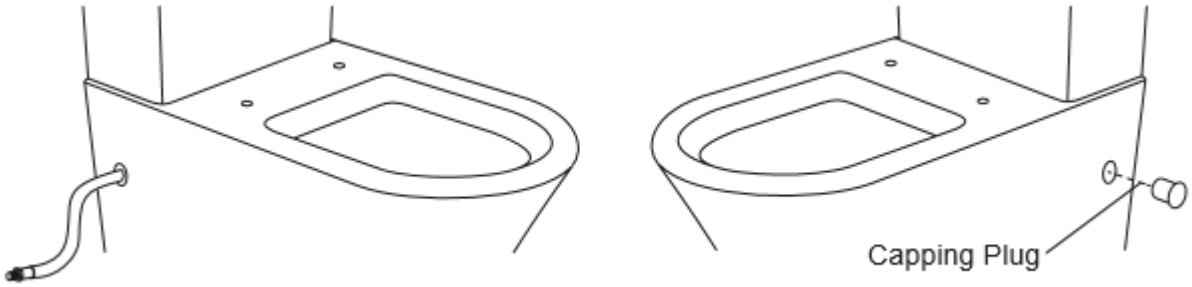
3. Position the cistern on the pan by centering the gasket on the pan inlet. Securely tighten the screws so the cistern is level.

4. Connect the supply hose to the cistern inlet and feed the hose through the appropriate side hole in the pan





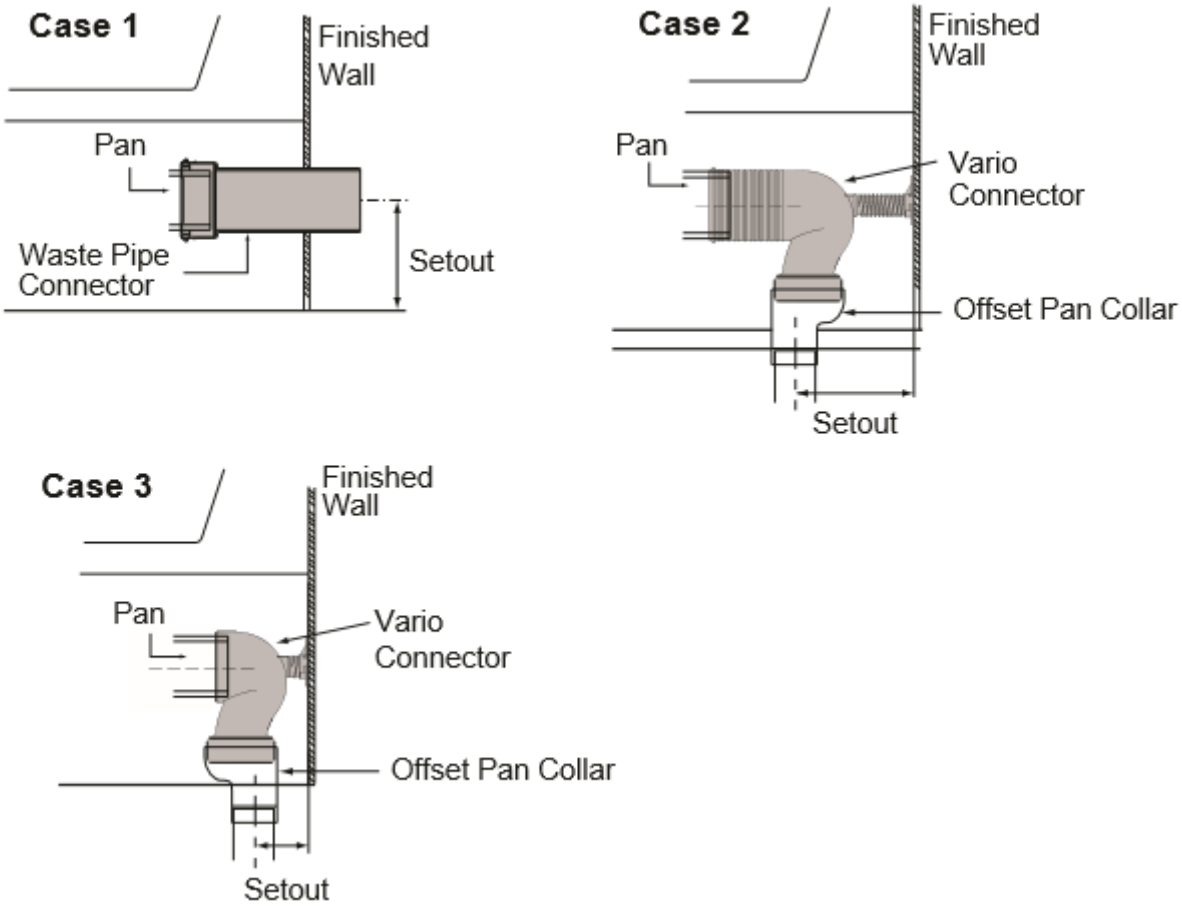
5. Connect the supply hose to the shut-off valve to test the system for leaks. Shut off the water supply and disconnect the hose. Insert a capping plug into the unused hole.



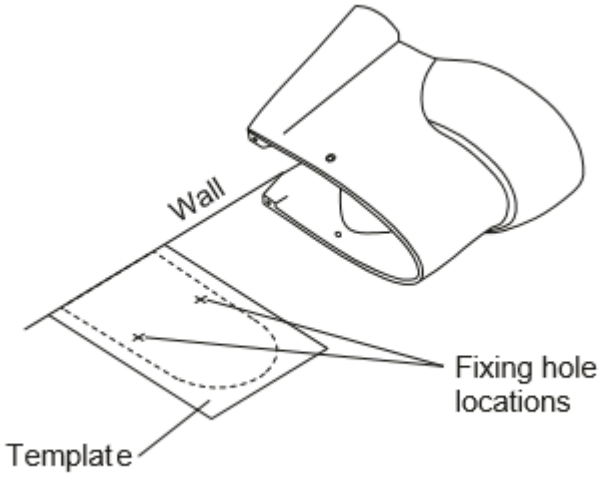
(Figure 4.5) cistern installation - bottom inlet

PAN INSTALLATION

1. Define the position of the connector: Place the connector onto the pan, and position the connector between the outlet and waste pipe. Installation instructions are supplied with each respective pan connector.

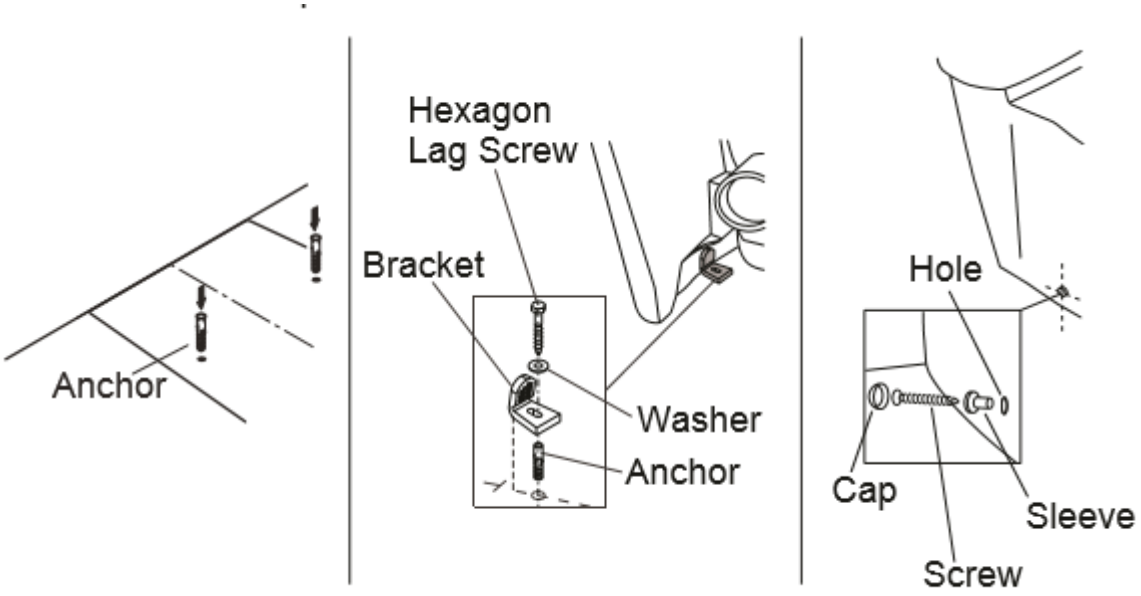


2. Using the template, mark the positions of the floor fixing kit holes.



(Figure 4.6) pan installation

3. Drill fixing holes at the marked locations on the floor and insert the anchors where required



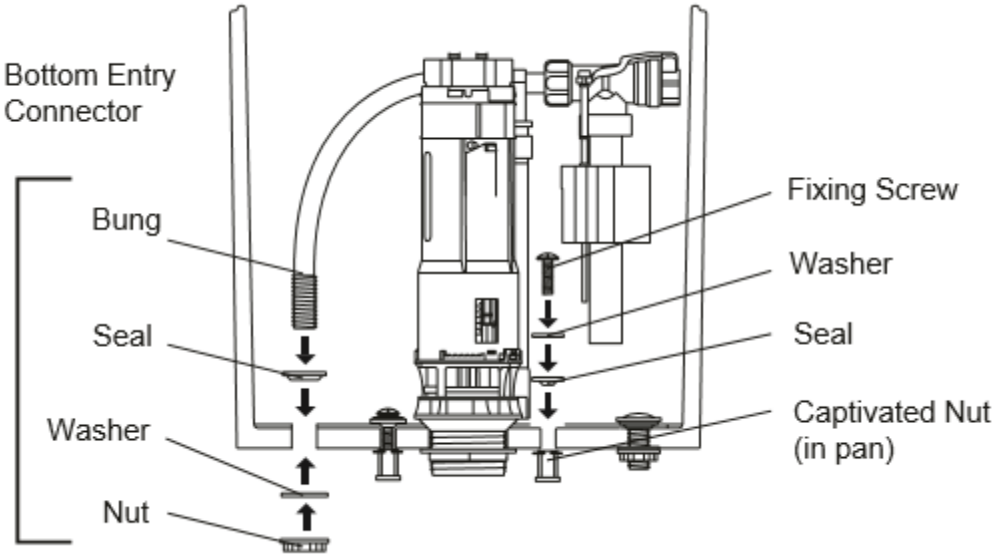
4. Place a washer onto each of the hexagon screws and fix the brackets to the floor

5. Position the toilet in the marked location, while ensuring an effective connection is made with the pan connector.

6. Install the plastic screw sleeves and use the screws to fix the toilet to the brackets. Attached the chromed caps to the screw heads

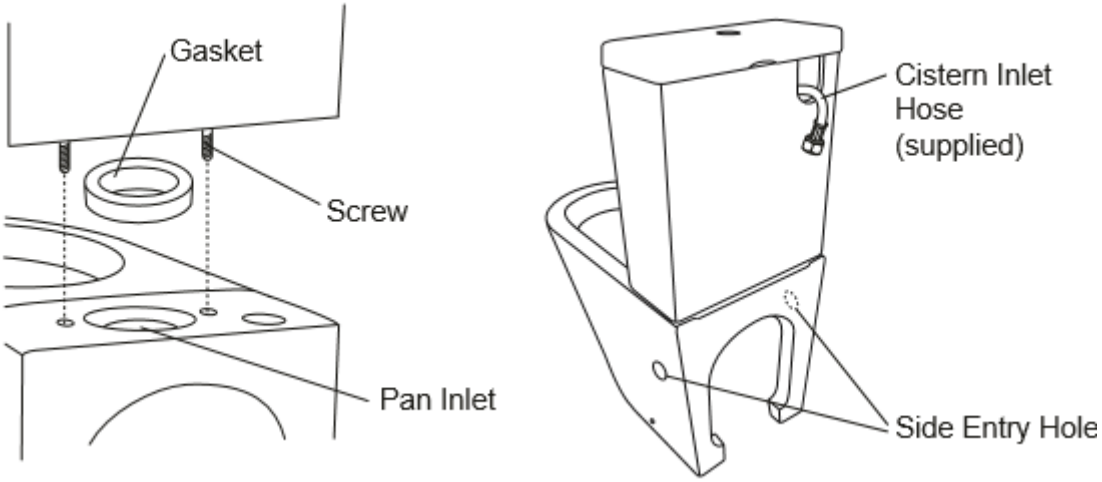
CISTERN INSTALLATION - TOP REAR ENTRY

1. Securely install the bung into the bottom inlet of the cistern. Place the washers over the fixing screws and locate in cistern fixing holes



2.Position the cistern on the pan by centering the gasket on the pan inlet. Securely tighten the screws so the cistern is level

3. Connect the supply hose to the cistern inlet and connect the hose to the water supply shut-off valve.

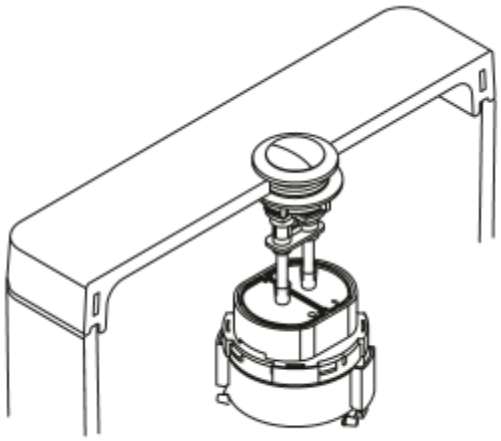


PUSH BUTTON INSTALLATION

Fit the lid and test the buttons. Adjust the rods as required.

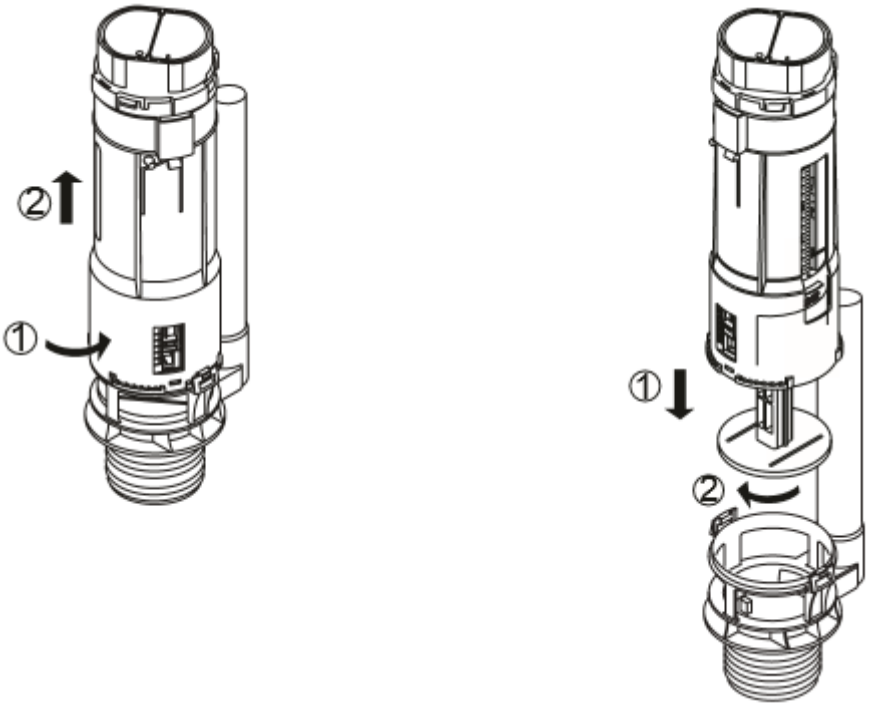
(Figure 4.7) cistern installation - top rear entry

4. Insert capping plugs into the side entry holes in the pan.
5. Connect the supply hose to the shut—off valve to test the system for leaks .shut off the water supply and disconnect the hose.



FLUSH VALVE REMOVAL AND INSTALLATION

1. Release flush valve by turning anti-clockwise and pulling straight up on the canister
2. Assemble flush valve by pushing straight down into the canister and turning clockwise.



(Figure 4.8) flush valve removal and installation

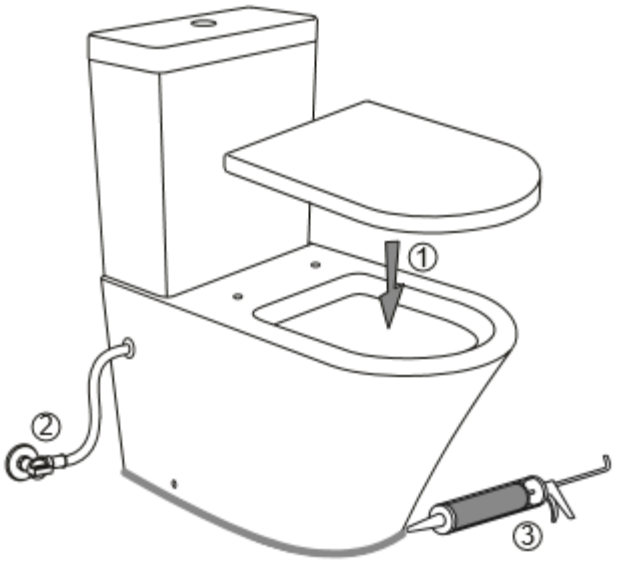
FINALISING INSTALLATION

1 Install the seat as per the supplied seat instructions Front edge of seat should follow the shape of the front edge of the pan.

2. Ensure silicon rubber washer is fitted between seat connector and pan to ensure seat is rigid.

3. Make final connection of water supply hose to shut-off valve. Test the system for leaks.

4. Apply a suitable sealant between the pan and adjacent surfaces



(Figure 4.9) finalizing installation

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the Installation procedures or a sequence of sanitary fixtures?

1._____

2._____

3. ----------

4. ----------

Note: **Satisfactory rating – 5 points** **Unsatisfactory – 3.below points**

You can ask you teacher for the copy of the correct answers.

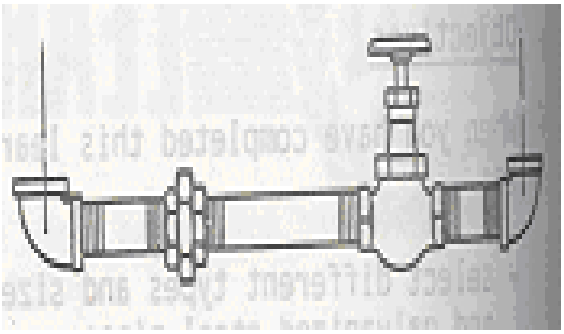
Information Sheet-3	Assembling, installing and testing Fixtures, components and pipe

4.3 **Assembling, installing and testing Fixtures, components and pipe**

1. A plumber's basic skill is his ability to assemble. Join and install the various kinds of pipes to complete the plumbing system in building

2. The plumber must know what kind of joint to use for the different kinds of piping materials. And must be able to make this joint absolutely water tight

.3. Joints must not leak. Pipes and fitting which are just screwed together will leak. In order to avoid leakages. A sealing material is placed b/n the joint pieces. Thus filling the space b/n the male and female thread



(Figure 4.3) Assembling,

4. The sealing materials generally used are hemp or sealing tape. When the hemp comes into contact with the water. It swells and makes a watertight joint.

5. When you start to joint or assemble pipes and fittings. You must know that the parallel female thread (pipe fitting) and the taper male thread (water pipe) are. Without doubt, the most satisfactory type of connection for general use.

6. A hemp packing is used to ensure that any small space b/n the two metal thread is filled. This makes the joint tight and waterproof.

a. This shows the center to face of the pipe fitting
b. This is the thread engagement, and shows the length of the thread which must be screwed
c. The whole illustration shows a parallel female thread pipefitting and a taper male thread water pipe screwed together.

Galvanized steel pipe joint

a. Parallel female thread (pipe fitting)

b. Tapered male thread (water pipe)

c. Hemp packing

Note

It is important that you leave not more than two (2) threads showing b/n the pipe and the pipe fitting to ensure that the space b/n the two metal threads is filled. Only by doing this can you be sure that the join is tight and waterproof.

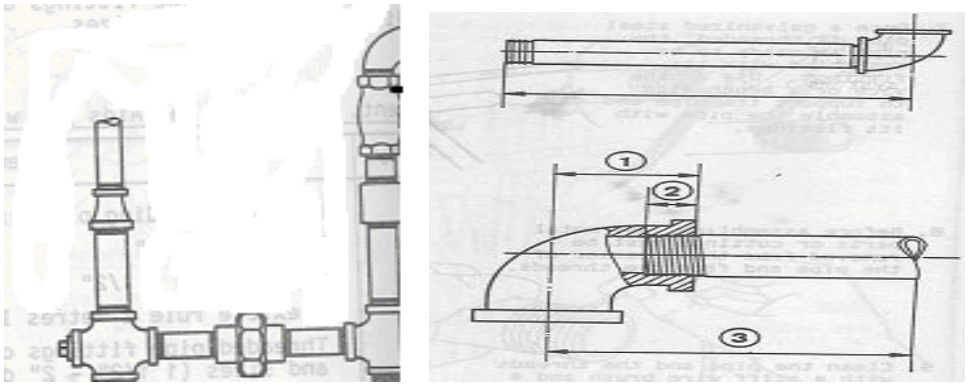


Figure 4.4) Assembling

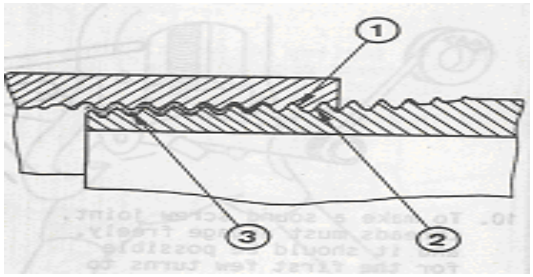


Figure 4.5) Assembling

7. Once a galvanized steel pipe thread is threaded, the pipe is read to be assembled with its fittings.

Use a pipe vice or benches vice to support the pipe and assemble the pipe with its fittings.

8. Before assembling, any metal parts or cuttings must be removed from the interior of the pipe and from the threads.

9. Clear the pipe and the threads with a stiff wire brush and a cloth.

10. To make a sound screw joint, thread must b engage freely, and it should be possible for the few turns to be made by hand without difficulty.

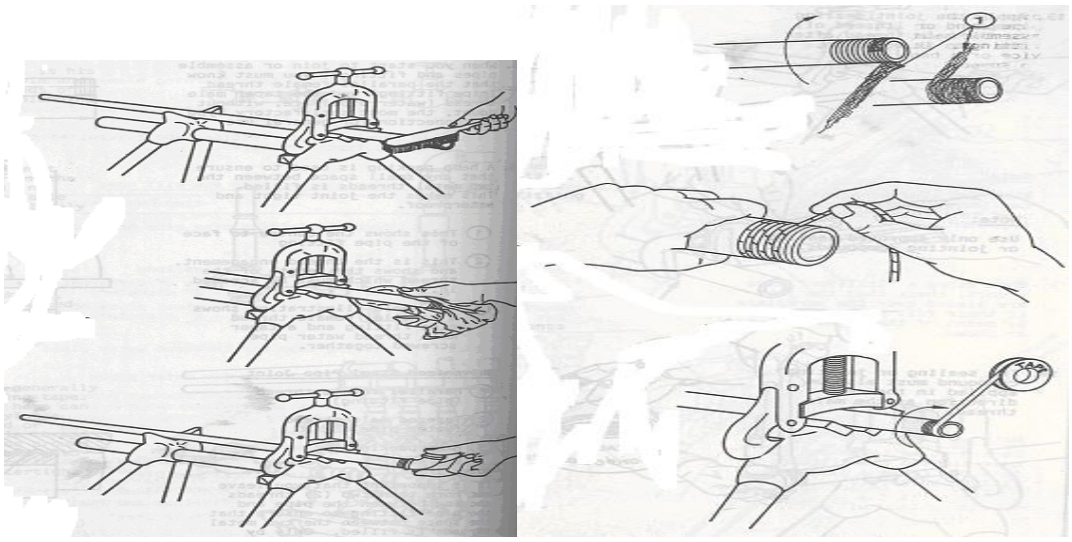


Figure 4.6) Assembling

11. When winding hemp around the threads, the hemp must be frayed open and wrapped round in the direction of the thread until the thread is fully covered with hemp, as illustrated.

a. Frayed open hemp.

Note:

Wind the hemp, string, or any other sealing material in the same direction as the male thread.

12. If using sealing tape, unroll a sufficient length of tape and wrap it around the male thread, as shown

Note

When sealing tape is used do not apply jointing compound to the joints.

13. Apply the joint sealing compound or linseed oil to the male thread after the hemp is wound on

Note:

Use only approved sealing or jointing compounds

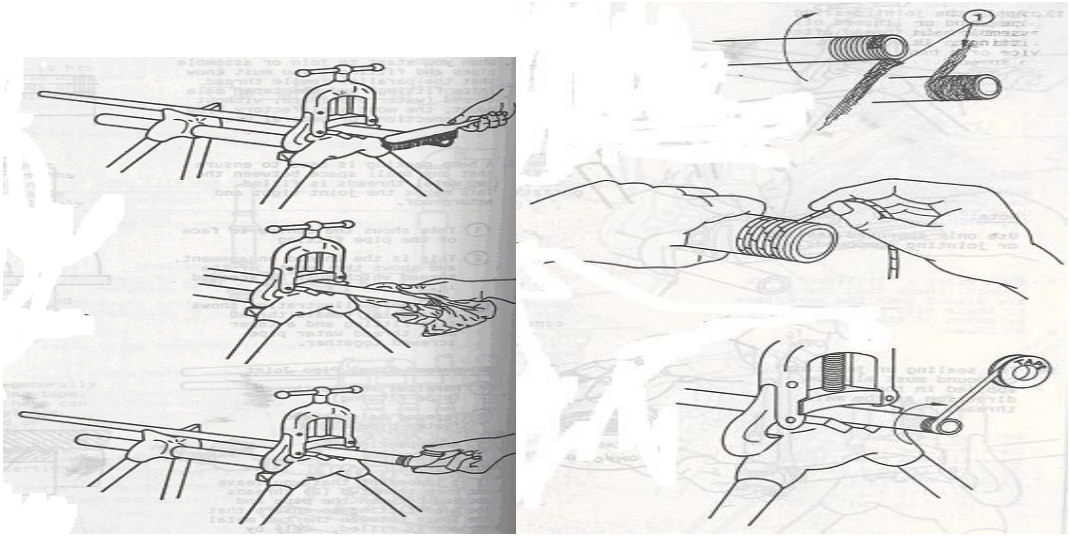
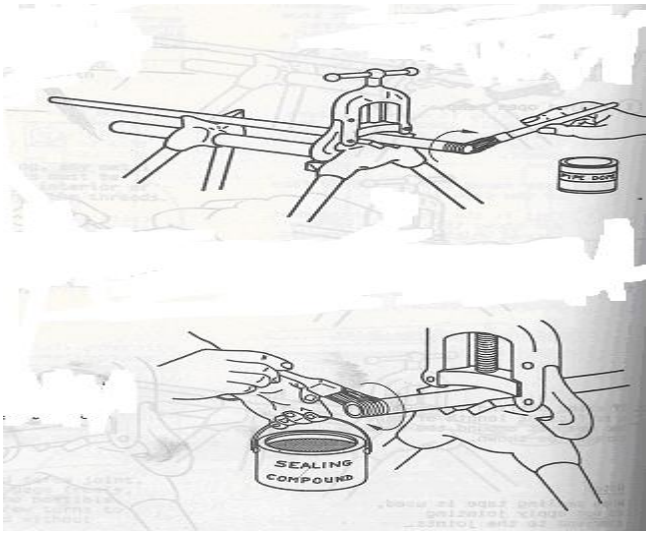


Figure 4.7) Assembling

14. The sealing or jointing compound must also be applied in the same direction as the male thread

15. Screw the pipe fitting onto the end of the galvanized steel pipe by hand as far as it will go



16. Now we have to use a pipe wrench. If you are using a straight type pipe wrench as shown in the illustration, turn the adjustment wheel to the right pipe or pipe fitting size.

Note:

The distance b/n the point of the jaws should always be less than the diameter of the pipe or pipefitting. This prevents the pipe or pipe fitting from slipping out of the pipe wrench.

17. The pipe wrench is then used to continue the screwing process, using gradual, even increase in force to tighten the threads (pipe and pipe fitting) together.

18. If you have a pipe diameter larger than 11/2” or 2”, use two pipe wrenches to tighten the joint: one pipe wrench on the pipe and one on the fitting. Turn these slowly in opposite directions.

Note

With two pipe wrenches you can increase the force used to tighten the threads together

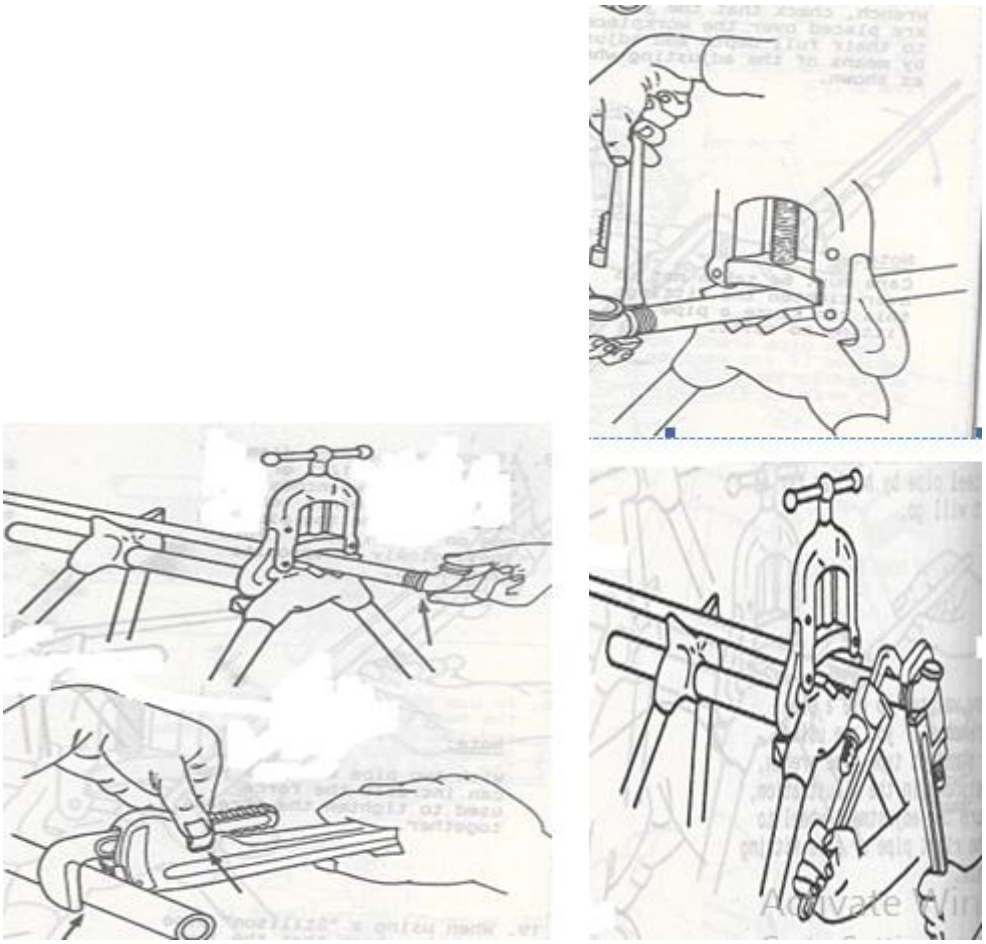


Figure 4.8) Assembling

19. When using a"stillson "pipe wrench, check that the jaws are placed over the work piece to their full depth and adjusted by means of the adjusting wheel, as shown.

Note

Care must be taken not to over tighten the fitting; this can cause a pipe fitting to split.

20. When using an adjustable pipe wrench," standard model" check that the distance b/n the points of the jaws is less than the diameter of the pipe or the pipefitting. This prevents the pipe from slipping out.

21. With your right hand held the two pipe wrench handles and using your left hand adjust the jaws to the correct size of the pipe or pipefitting diameter.

22. Use two pipe wrenches to assemble or tighten a pipe joint. Hold the pipe in one pipe wrench and the pipe fitting in the other.

23. Now, turn the two pipe wrenches in opposite directions, as shown

Note**:**

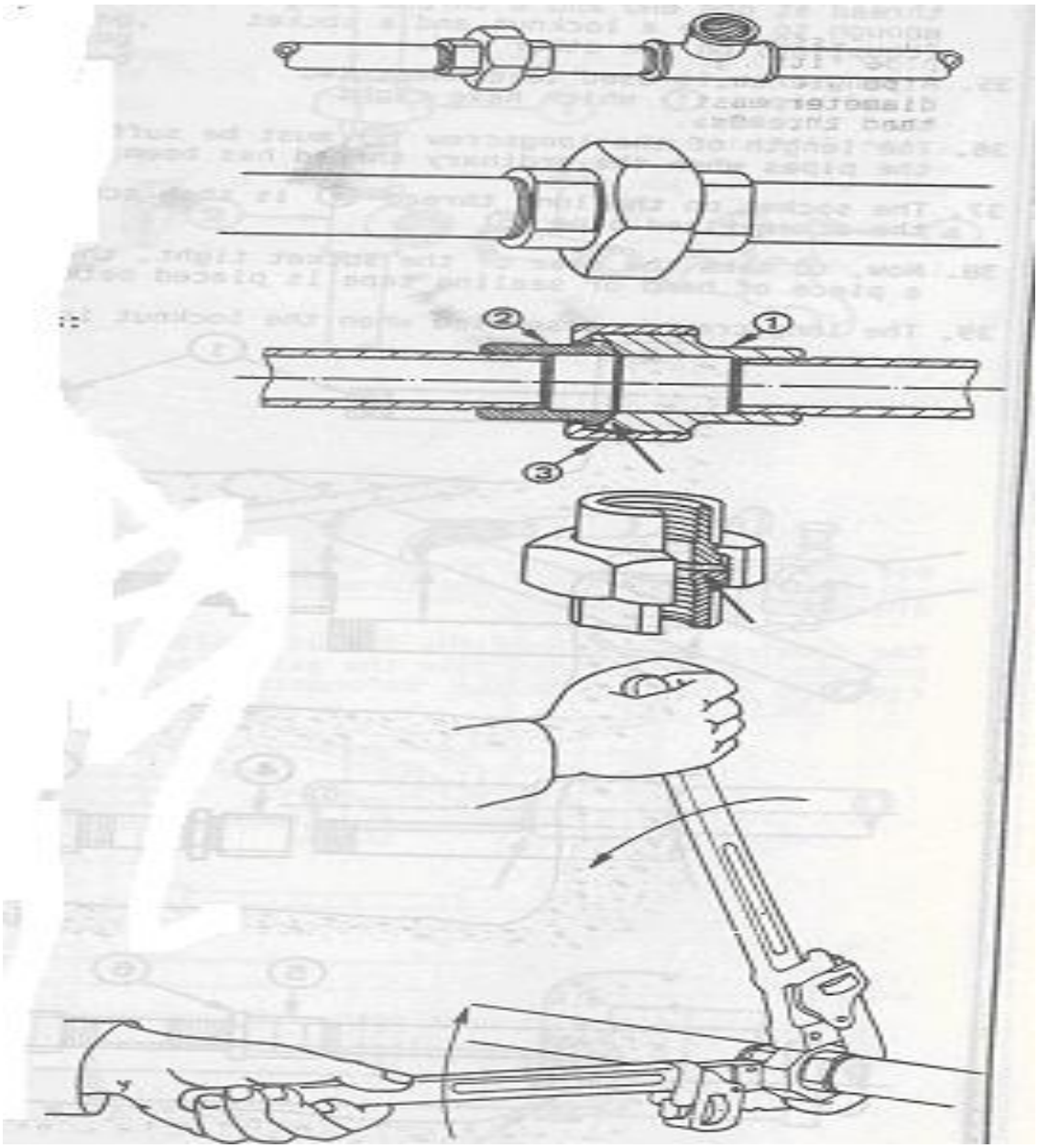
It is important that you leave not more than (2) threads showing b/n the pipe and the pipe fitting, to ensure that the space b/n the two metal threads is filled. Only by doing this can tight and water proof.

24. To continue the screwing process, pipe wrenches must be kept close to the joint, as shown

Note:

When a thread is crossed the joint must be disconnected; and if the threads are undamaged, re-engaged correctly.

25. When assembling pipe and pipe fittings using a chain pipe wrench, the pipe diameter must not be less than 2".smaller pipes and pipe fittings will be damaged or flattened if heavy gripping tools are used.



26. TO use this chain pipe wrench the head is placed on the pipe and the chain pulled round the circumference of the pipe. The chain is then engaged with the large teeth in the center of the head, as shown in the illustration.

27. Movement of the lever in the direction indicated by the arrow in the illustration causes the serrated edge

28. When pipes are assembled with pipe fittings. Special care must be taken when using unions or long screws.

29. When the thread ends of two pipes meet, the best way to assemble them, or connect them, is to use a union: this can be taken apart easily for repairs, without taking all the pipes apart.

30. a union is a device used to connect pipes: it usually consists of three(3) pieces

a. The thread end fitted with female and male threads,
b. The bottom end fitted with female threads,
c. The ring, which has an inside flange at one end.

31. Two different types of unions are manufactured: one with a ground joint (conical joint) which does not require any packing to make it watertight, and another type which requires a soft leather or rubber washer.

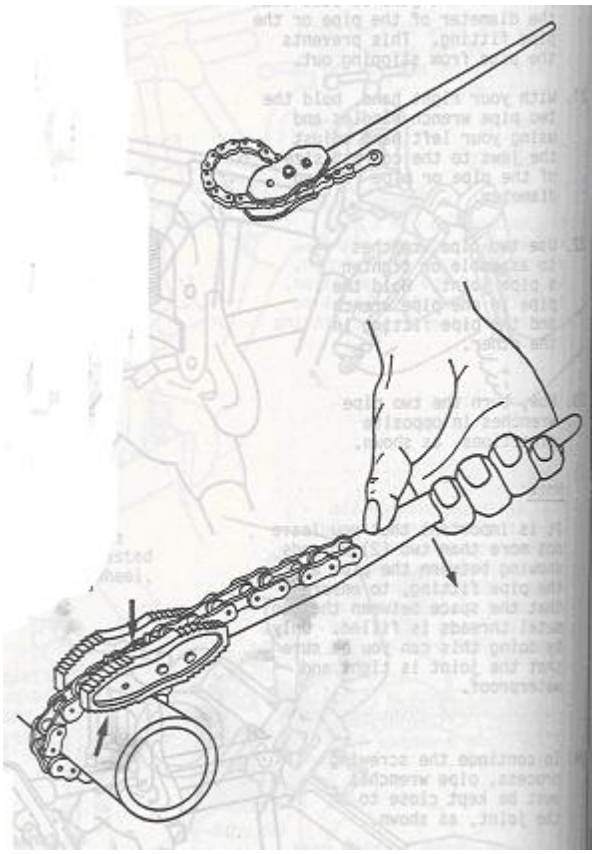
Note:

A little grease or Vaseline on the union joint ensures easy disconnection

32. use two pipe wrenches to assemble or tighten the union. Hold one side of the union in one pipe wrench and the ring of the union in the other.

33. Now, turn the two pipe wrenches gently in opposite directions, as shown.

34. A long screw is a pipe nipple with a thread at one end a thread long enough to take a locknut and a socket (coupling) on the other end



Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. **Write the main purpose of Galvanized steel pipe join at list 5 (10point)**

1._____

2._____

3._____

Note: **Satisfactory rating – 10 points** **Unsatisfactory – 6 below 7 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-4	Installing and connecting Fixtures

4.4 installing and connecting fixtures

Water Closets

Water closets, devices designed to receive human waste and dispose of it properly in a sanitary sewer system, come in various shapes, designs, and colors. Most water closets mount on the floor, but some models are wall-hung. Modem water closets have various design features which create different flushing actions.

Installation

To install a water closet follow these procedures as a general guide.

1. Slip the water closet flange over the closet bend and slide it down until it is level with the finish floor.
2. . With a hammer and cold chisel, break off the portion of the closet bend that projects above the water closet flange. Do not break the closet bend below the flange.
3. Place the two brass closet hold-down bolt heads in the slots of the flange.
4. On the bottom of the water closet, as shown in *,* , slip the preformed sealing ring over the horn to form a sealing gasket for the water closet against the face of the flange. Do not use putty as it will dry out
   and leave a possible sewer gas leak.
5. Turn the water closet bowl right side up and set it on the flange with the horn projecting down into the flange. Place a wedge under the low side of the water closet if un level. In setting the bowl on the flange, as shown in *B*, guide the two hold-down bolts up through the bolt holes on either side of the base of the water closet. Use your full weight to press down an twist slightly to settle the bowl and the wax ring into position. The bowl should be perfectly level when settled.
6. Install nuts on the hold-down bolts and tighten them alternately. Do not over tighten them as this may crack the base of the water closet
7. A wall-mounted water closet is attached to the wall by a chair carrier, similar to the one shown in. The chair carrier is positioned and bolted to the floor. A standard fitting is used to connect between the drain and the closet bowl after the chair carrier is bolted down. The fittings are for 4-inch iron or soil pipe. The bolt holes in the chair carrier are slotted to facilitate installation of the closet bowl.

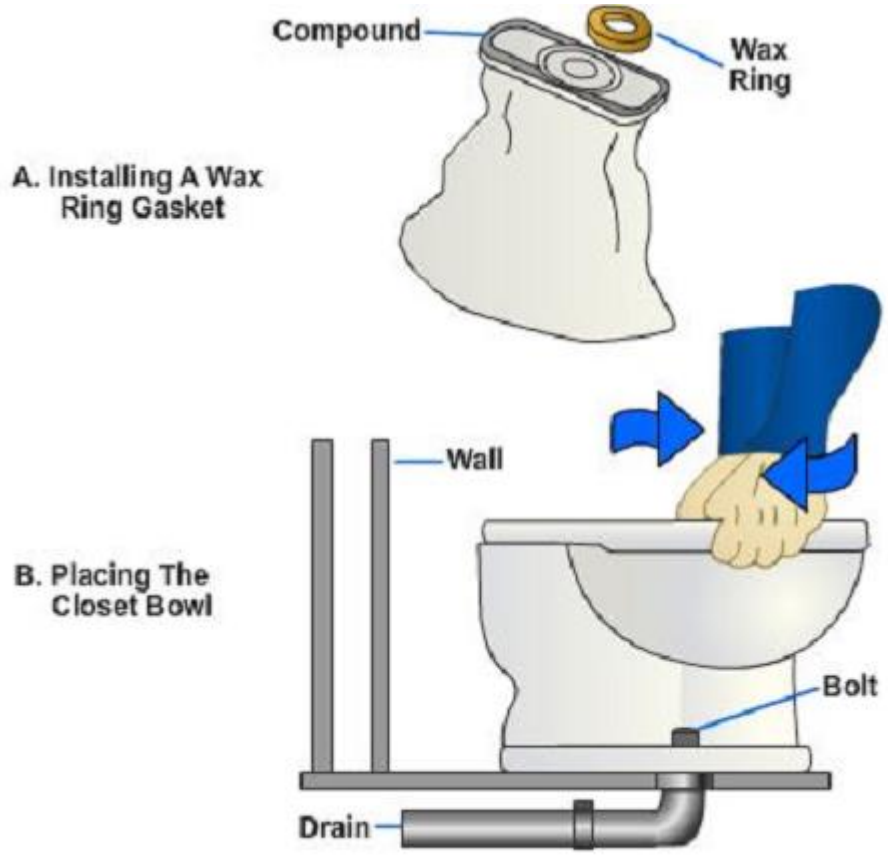
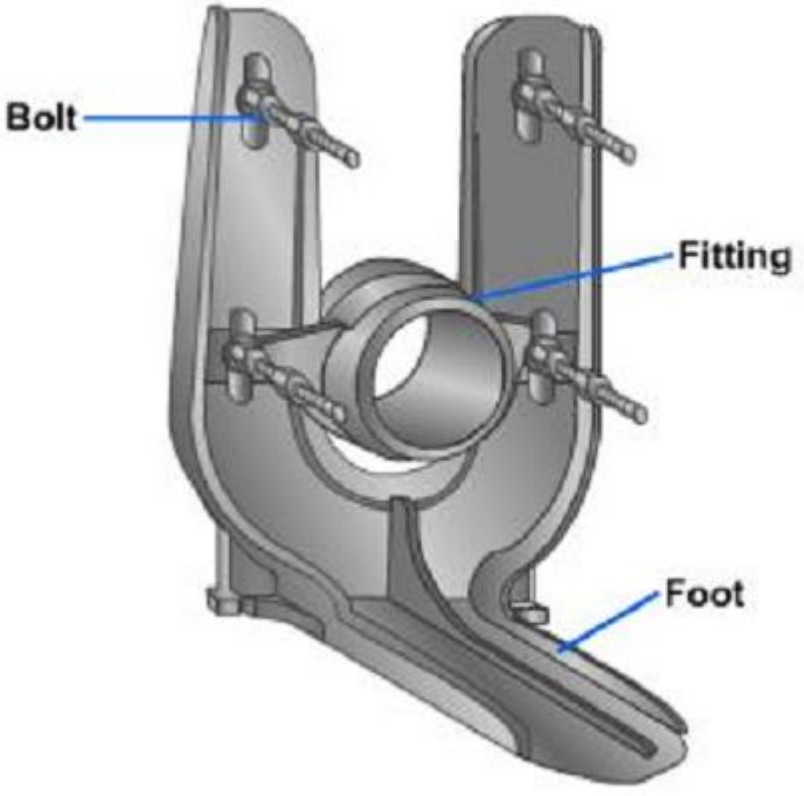


Figure 6-3 — setting a closet bowl



Wall-mounted water closet.

WC Tank Water Supply Connection

The water supply is connected from the rough-in plumbing to a shutoff valve and from the valve to the inlet at the bottom of the tank. Use and the following steps to connect the water supply:

1. 1. Slide the chrome cover on the pipe projecting out from the wall and push it against the wall.
2. Coat the threads with joint compound or Teflon tape and screw the shutoff valve onto the pipe. Tighten the valve so that its other opening is straight.
3. Bend the flexible tube with a spring bender to get a proper fit. (Steel-coated flexible supply line is commonly used.)
4. Slide the inlet-coupling nut on with the tubing threads up, and

a. Attach it to the tank's inlet and tighten hand tight.

5. Slide the coupling nut threads and compression ring down onto the tubing. Screw the coupling nut onto the valve hand tight.
6. Tighten the inlet-coupling nut and valve-coupling nut.
7. Open the shutoff valve for the water supply and check for leaks
8. Adjust to get a proper water level of 1 inch below the top of the

i. Overflow tube. If an adjustment is made, check the operation.

9. Place the tank cover on the tank and install the water closet seat

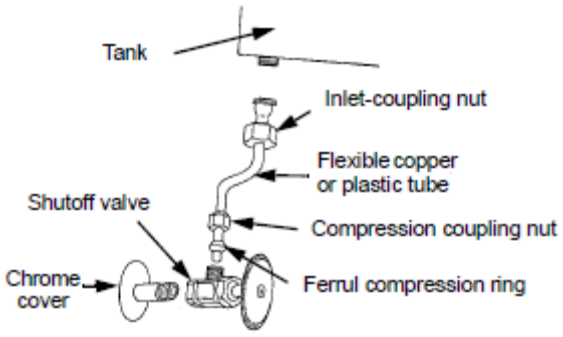


Figure 4.5 Tank Water Supply Connection

URINALS

A urinal is a fixture that carries human liquid waste to the sewer. It is made of vitreous china or enameled cast-iron

Urinal Types

Wall Hung: This urinal can have a built-in water-seal trap or a P-trap with a wash down or siphon-jet flushing action. The flushing device for a wall-hung urinal is a flush meter valve.

Stall: The stall urinal is set into the floor. A beehive strainer covers the waste outlet, which is caulked to a P-trap below floor level. The flushing action is the wash down-type produced by a flush meter valve.

Trough: A trough urinal is wall hung with a flush tank. The urinal has perforated pipe across the rear, which allows water to flow down the back of the trough when flushed.

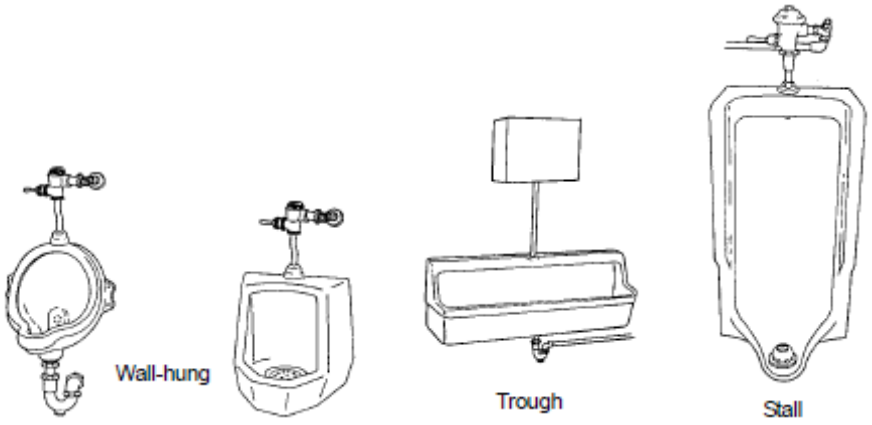


Figure 4.6 urinals

Urinals Installation

Wall Hung: Use the following steps and the manufacturer's instructions to hang a Wall-hung urinal:

1. Install the mounting board and bracket.
2. Install the urinal on the bracket.
3. Make the waste connection to the rough-in piping.
4. Ake the water connection to the rough-in piping to include the
5. Flush meter valve.
6. Turn on the main water supply and flush the urinal several times to check for leaks.

Trough: Use the following steps and the manufacturer's instructions or military construction drawing to hang a trough urinal

1. Install the mounting board for the trough and tank.
2. Attach the tank to the wall and install the flushing mechanism.
3. Install the hanger for the trough bowl.
4. Attach the bowl to the wall.
5. Install the waste connection to the rough-in piping.
6. Install the piping from the tank to the trough bowl.
7. Install a water line between the tank and the rough-in piping.
8. Turn on the main water supply and flush the urinal several times to check for leaks.

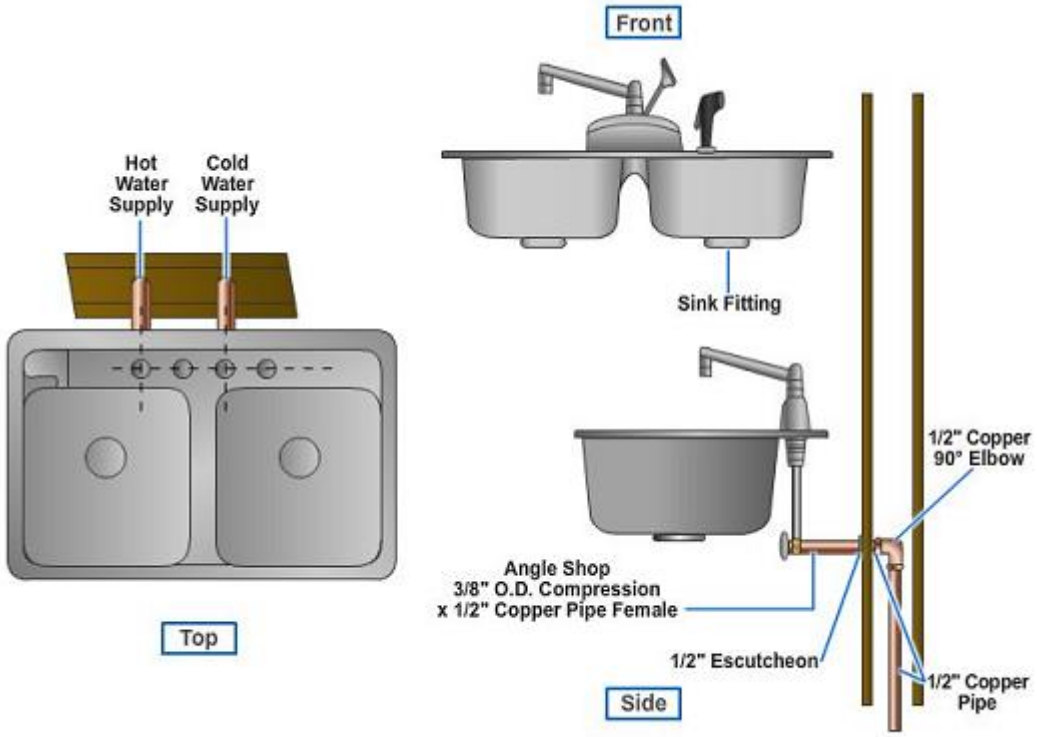
Sinks

Sinks are made in different patterns, each intended to serve specific purposes. Two common types of sinks are the kitchen sink and the service sink (slop sink)

Kitchen Sink

The kitchen sink is available in different sizes and may have either a single or a double bowl made of various materials like stainless steel, enameled steel, plastics, or cast iron.

Kitchen sink must be built into a cabinet or hung from a bracket that is screwed to a mounting board. The bracket should be screwed into the mounting board in a position where the sink, when mounted, is at a convenient height for use. As a rule of thumb, the distance between the top of the drain board and finished floor should not be less than 36 inches. After screwing the bracket into place, lower the sink into position on the bracket, so the lugs, cast into the back of the sink, fit down into the corresponding notches in the bracket. Screw the strainer and tailpiece into the sink bowl and connect the trap to the rough-in waste. To complete the installation, select a suitable faucet. Install the faucet on the sink and connect the water supply to it,



Kitchen sink water supply hookup

Then install and connect the waste lines to the sink, as shown in *Figure 6-12*.

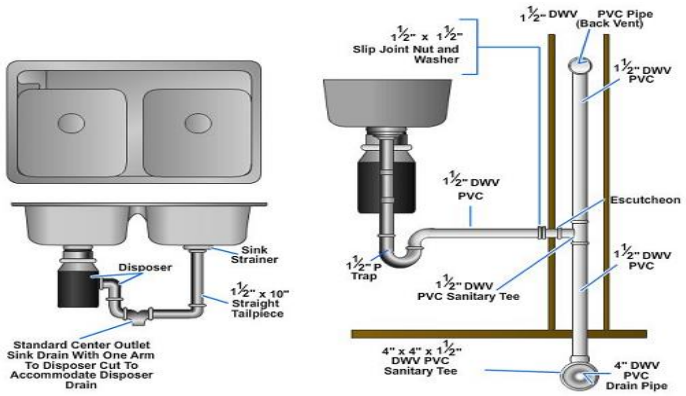


Figure 4.6 kitchen sink waste hookup

Service Sink

A service sink, also referred to as a slop sink, is especially useful for filling a bucket or washing out a swab. It has a deep bowl and is generally constructed of cast iron and finished in enamel, but can also be made of other various materials. The slop sink installation is similar to the kitchen sink installation. The slop sink is also mounted on a bracket and mounting board. In addition to the hanger, the slop sink has a built-in adjustable stand trap that bolts to the floor and provides a pedestal support.

The stand trap should be adjusted to take most of the weight off the hanger and prevent the unit from sagging. After the fixture has been set in place and the waste supply has been connected, suitable faucets are installed and connected to the water supply, and the unit is ready for use.

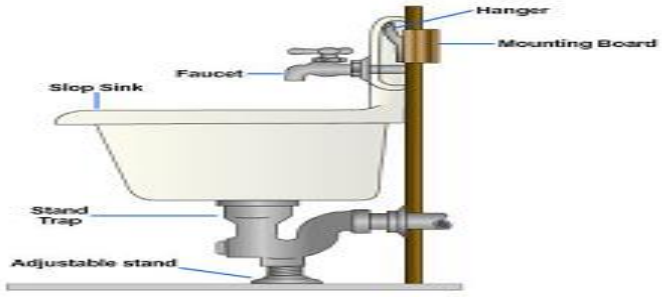


Figure 4.7 Service Sink

LAVATORIES/HAND WASHBASINS (HWB)

A lavatory is designed for washing one's hands and face. Lavatories come in a variety of shapes, sizes, and colors. They are made of vitreous china, enameled cast iron, stainless steel, and plastic. Hot and cold water is supplied through the supply system and the waste drains into the sanitary sewer.

Wall Hung:

This lavatory hangs on a bracket attached to the wall. It may or may not have legs added support.

Vanity: Vanities are installed on a cabinet or counter.

Pedestal: This lavatory's weight rests on the floor and does not require support

Trough: This lavatory is mostly used in commercial plants and certain military facilities.

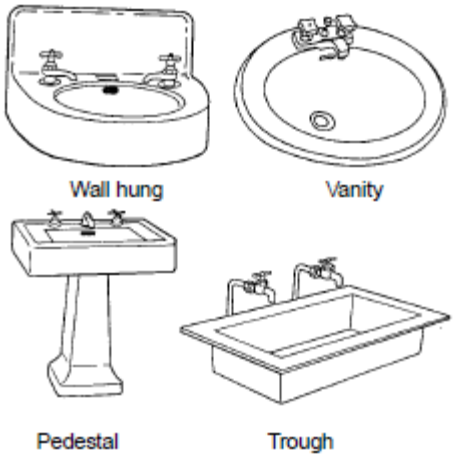


Figure 4.8 Lavatories

Wall Hung HWB Installation

Use the following steps, the manufacturer's instructions, and to install

a wall-hung lavatory

1. Install the mounting board between the studs at the proper height, using the same method as for a wall-hung flush tank. Refer to the manufacturer's specifications and plans for the required height and elevation
2. Attach a hanger bracket on the finished wall using the proper length of wood screws at the recommended height. The metal bracket must be level.
3. Place the lavatory on the bracket and push down. Make sure the lavatory is level.

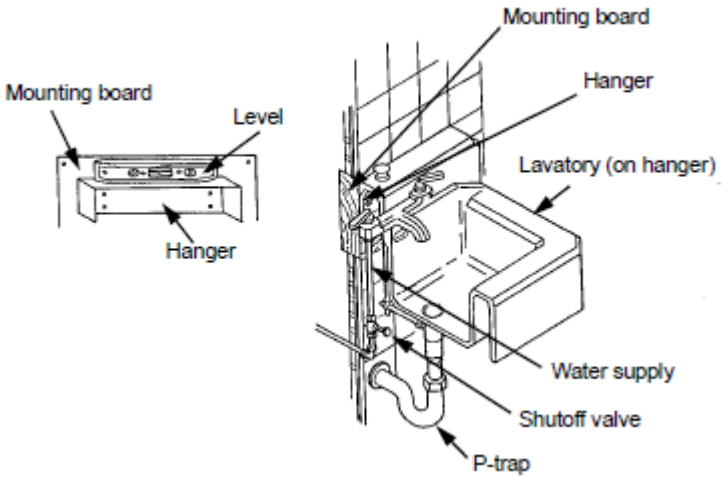


Figure 4.9 HWB Faucets Installation

Use the following steps and to install faucets:

1. Apply plumber's putty on the bottom of the faucet (either single or combination). If a gasket comes with the combination faucet, putty is not required
2. Place the faucet on the top rear of the bowl, with the threaded end through the holes.
3. Place a washer and attach a locknut to each threaded end under the bowl.
4. Tighten each locknut with a basin wrench
5. Wipe off any excess putty, if used, around the faucet.

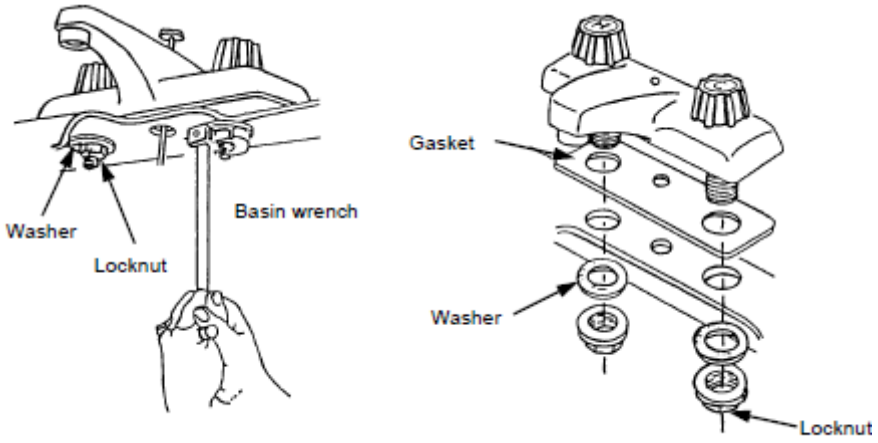


Figure 4.10

Pop-Up Plug Repairs

Use the repair steps below when the pop-up plug (stopper) fails to keep Water in the bowl.

1. Loosen the clevis screw with pliers.
2. Push the pop-up plug (stopper) down so that it sits snugly on the flange.
3. Tighten the clevis screw. Ensure that it fits snugly on the flange.
4. Squeeze the spring clip and pull out the pivot rod from the clevis hole. The stopper then should operate easily. Place the pivot rod through the next higher or lower hole in the clevis
5. Close the stopper and fill the bowl with water.
6. Check the water level to ensure that the stopper holds water in the bowl.
    i. NOTE: If steps 1-6 do not fix the problem, continue by using the following steps:
7. Tighten the pivot-ball retaining nut. If the leak continues, remove the nut with pliers.
8. Squeeze the spring clip, sliding the pivot rod out of the clevis hole.
9. Slide the pivot-ball retaining nut and worn washers off the pivot rod.

10. Slide new washers (plastic or rubber) and the ball nut onto the pivot rod and tighten the pivot ball.
11. Reassemble the pivot rod into the clevis hole.
12. Run water into the lavatory and check the connection for leaks.

NOTE: Check the pop-up stopper's ability to hold water after repairing the pivot-ball connection.

HWB Water Supply Connection

Shows how to connect water services (hot and cold) for a lavatory. After installation, turn the water supply on and check for leaks.

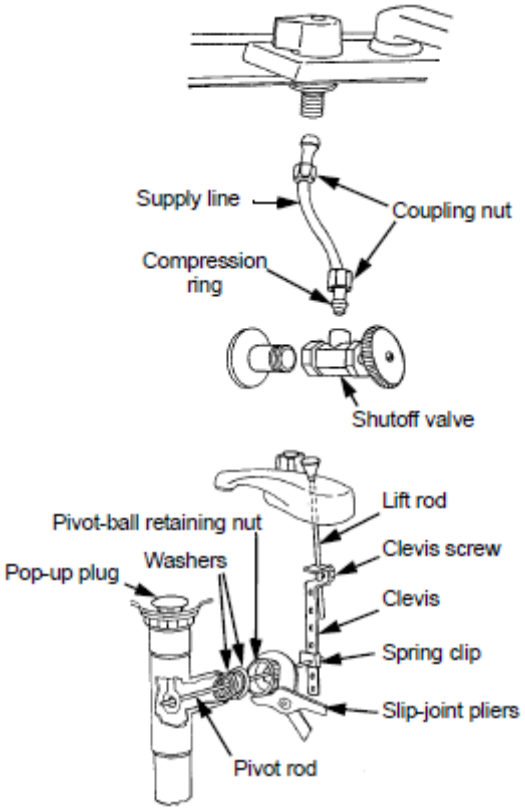


Figure 4.11 Hwb water supply connections

SHOWERS

A shower tray is a receptacle of shower water which is sprayed on the user's body from shower head or spray placed above .Bath trays are generally made square in shape having minimum area of 1024sq. in and if made rectangular in no case its shortest side shall be less than 750mm (30 in). Shower trays are rated at 2 duffs and require minimum 38 mm (11/2 in) waste pipe. However, it should be drained out by 50mm (2 in) waste pipe. Shower trays are generally constructed of fiber glass material or of enameled steel sheet. A typical shower tray has been shown in. . Bath trays are mounted on floor and its top sides shall turn up on all sides at least 50mm (2in.) above finished floor level.

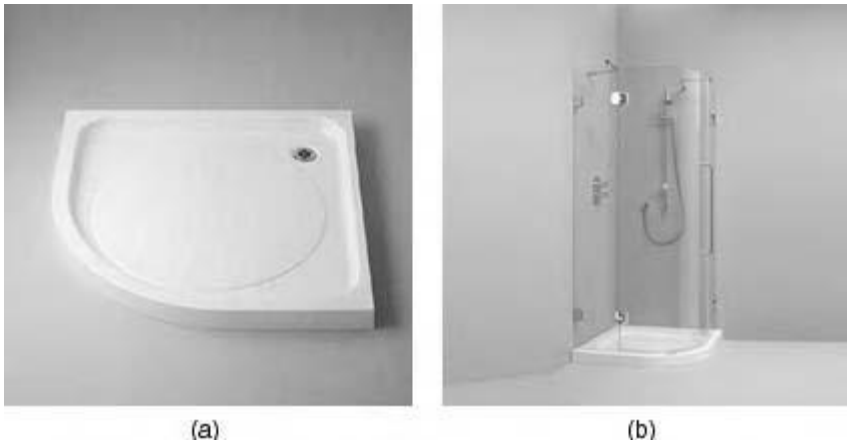


Figure 4.12 SHOWERS

A shower has many advantages over a bathtub which include—the small amount of space required for installation, the small amount of water used compared with bathtub use, and sanitation. The types of showerheads. The two types of individual shower installations are: tiled and the steel-stall. (Group showers are usually tile or concrete.)

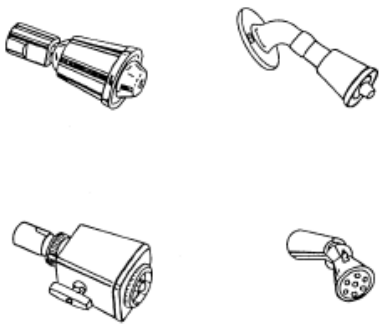


Figure 4.13 Shower hade

Types of Individual Shower Installations

Tile Shower Installation

The tile shower has tile or marble walls on three sides with a waterproof shower curtain or door that can be closed while the shower is in use. The tiled floor slopes to the center (or rear) where a drain is placed. The wall should be waterproofed by setting the tile in waterproof cement. The floor is generally laid upon a lead shower pan, which forms a waterproof base on which to lay the tile, as shown in *Figure 4-21*.Complete waterproofing is the most important requirement of shower installation. Tile installed with good-quality waterproof cement provides a waterproofed wall. For the floor, a waterproof base (shower pan) under the shower is necessary, since water standing on the tile surface can seep through and cause leaks.

Lead Shower Pan

Before installing the *lead shower pan*, a carpenter must rough in the general outline of the stall and lay a solid base of subflooring or plywood. Without a solid base, the shower pan is soft and flexible. If not supported properly, the pan will sag and leak under the weight of the tile. Inspect the rough in of the trap underneath the flooring to ensure that the outlet is correctly placed.

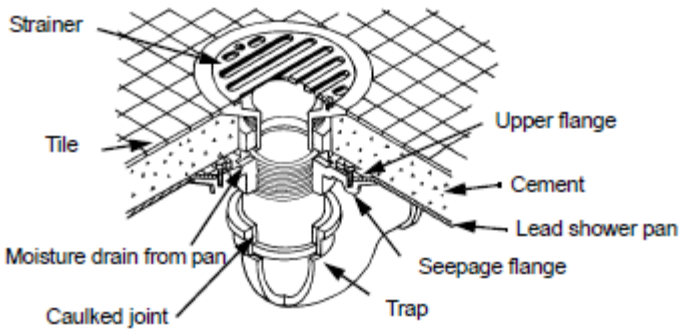


Figure 4.14 Lead **Shower Pan**

Many types of shower drains are available. The one has the proper-length nipple for placing the seepage flange at a level with the lead pan threaded into the nipple. The lead pan is made by using a solid sheet of lead 6 to 8 inches larger than the size of the shower floor and bending up the edges at right angles to the desired height.

Use Figure and the following procedure to install a lead shower pan:

1. Cut a hole where the drain is located and lower the lead shower pan into place. The pan should rest firmly on the seepage flange of the shower drain.
2. Coat the inside of the lead shower pan with asphalt.
3. Place pipe-joint compound or putty under the top of the flange.
4. Place the upper flange on top of the lower flange and attach them together to form a watertight joint between the shower waste and the shower pan.
5. Thread the strainer down into the flanges to the desired level of the tile.
6. Complete the installation by laying cement in the shower pan and Tiling the floor.

Concrete Shower Pan

Concrete shower pans with prefabricated, steel shower stalls are easy to install. They are often set up after the original construction. In this case, the cement base is laid directly on top of the floor.

Install Shower Installation:

The stall shower is a prefabricated unit with three sides and a base, fitted together. The sides are thin sheets of grooved steel, fitted together with a watertight joint. The base is usually precast concrete. Spray from the showerhead causes considerable noise as it hits the thin steel, and the metal sides tend to rust rapidly.

Water Supply Connection

The water supply for a shower may be hidden in the wall or exposed. *Figure shows* exposed hot-and cold-water lines tied into a single water line ending in a showerhead. The cold-water line is brought in on the right side while the hot-water line is brought in on the left.

A variety of faucet and valve combinations is available on unexposed installations

The compression valve provides a tempered water line of chromium-plated tubing, ending in a gooseneck and showerhead. In the single-handle mixing valve, the hot and cold water are mixed in a cast-brass mixing chamber. The handle controls a piston-like valve. By turning the valve handle clockwise, warmer water is supplied to the showerhead. A greater variety of showerheads than valves is available

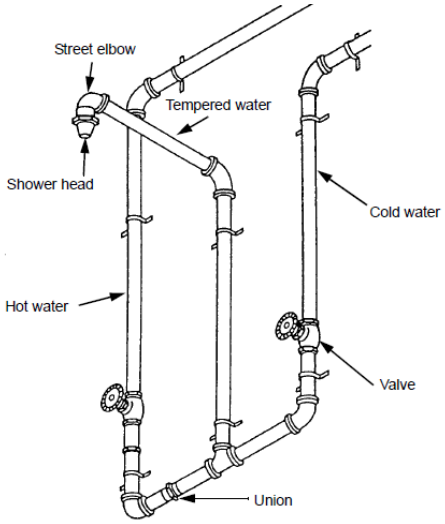
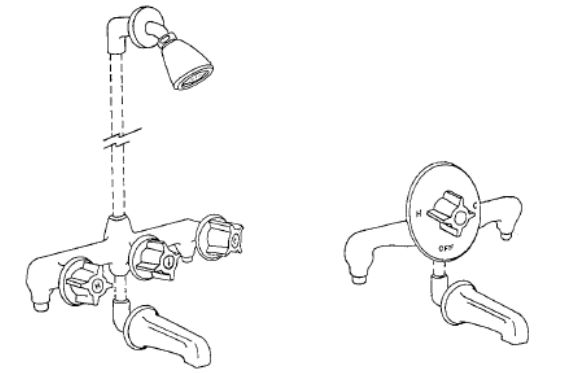


Figure 4.15Water Supply Connection



BIDETS

Bidets are used for cleaning excretory organs (or perinea) and may also be used as a footbath. They are mostly made of vitreous china. The bidets are about the same size and shape as a water closet. The hot and cold water supply and the drain fitting are very similar to those used for lavatories. The water enters through and warms the hollow flushing rim which serves as a seat. The plumbing engineer should recommend that a soap dish and towel rack be provided within easy reach for the convenience of the user.There are two types of bidet, one referred to as over the rim and the other termed, ascending spray. They can be floor standing. back to the wall or wall mounted. The type of bidet shown in the illustration is floor standing. The bidet can be supplied for use with pillar taps, mono-block fittings and pop-up waste**.**

Water supplies are 13mm internal diameter. A mixed supply of hot and cold water is connected to an ascending spray, either through an individual control valve or by a thermostatic valve, which eliminates any risk of scalding. Since the spray may be submerged if the waste became blocked, the bidet represents a special risk to the

contamination of the water supply by back siphon age; this may be reduced by having the supply pipes at least 2m above the bidet. Some water authorities may require bidets to be supplied from a separate cold water cistern, or separate hot and cold water supplies. Figure shows details of a bidet, including the water supplies and waste connections.

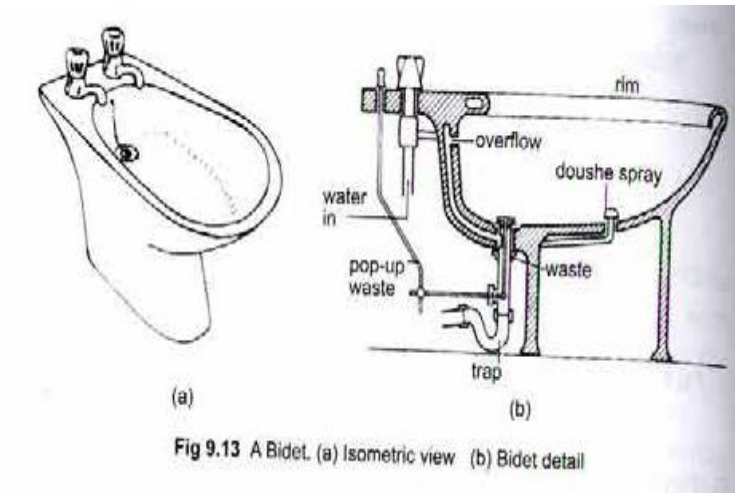


Fig 9.13 A Bidet. (a) Isometric view (b) Bidet detail

Figure 4.16 Bidet

BATHTUBS

A bathtub is a receptacle for holding water and is shaped for allowing one or two human body to soak in for taking bath. Water holding capacity of a bathtub depends on its size

A standard bathtub holds about 150 to 180 liters of water for soaking. Pressure in the faucet shall be such that bathtub is filled in 3minutes.

The length of a single bathtub shown in fig. 9.2 a, varies from 1500 to 1800mm (5 to 6ft.) in Length and width is 375mm (1ft.3in.) above the floor level. Bathtubs are manufactured from enameled cast iron, enameled pressed steel and fiberglass in a variety of sizes, shapes and colors to suit the user's need and taste

Bath Tub Trim: Generally for supplying hot and cold water in the bathtub a bathtub mixture faucet is mounted on the wall at the drain end of the bathtub

Bathtub may be used both as a bathtub and as a shower bath.

So sometimes, combination of bath and shower fittings is also installed. In this type of fitting, the bathtub mixing faucet contains a flow diverting knob attached. Flow of water is diverted from bathtub spout to the showerhead by this knob. The drain fitting used in a bathtub is a combination of waste and overflow fittings. The lift waste fitting shown in fig.9.2b is a type of waste and overflow fittings that is commonly used. The waste and overflow outlet shall be at least 3.75cm (11/2in). Where shower-head is installed above built-in bathtubs, water proof joints should be ensured between the tub and the walls, and the wall shall be finished with smooth, non-corrosive and non-absorbing materials up to a height of 1800mm (6ft) above the floor.

Figure 4.17 Baths (a) Standard pattern bath, (b) Corner bath

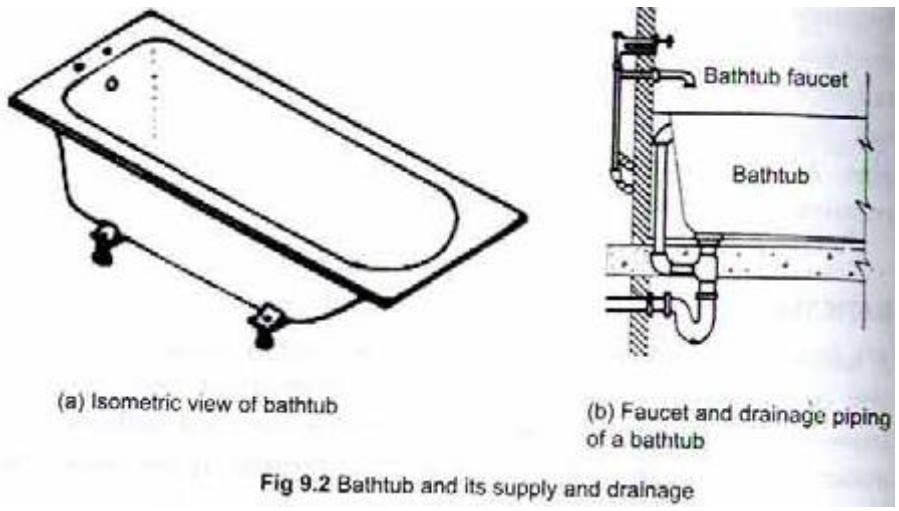


Fig 9.2 Bathtub and its supply and drainage

Figure 4.18 Corner bath

A variety of built-in bathtubs is available. They are designed to be recessed for corner installation of square, rectangular, and angled tubs and tubs with one or more ledge seats. Tubs are made of enameled cast iron or steel and fiberglass

Installation

Modern cast-iron tubs are designed to rest on the floor and fit against the wall framing (studs). They need no wall support, except that steel tubs have flanges supported by .inch boards, nailed to the studs. Use a waterproofing cement to caulk the joint between the finished wall surface and the tub. Mount the over-rim tub filling, with or without a shower diverter, on the wall at one end of the tub. The drain may be the pull-out or pop-up type install removable service panel in the wall behind the tub to provide access to the trap and the water supply valve.

Figure 4.19 Waste fittings (a) Standard slotted-type, (b) Pop-up waste

LAUNDRY TUBS

Laundry tubs are usually placed in the basement or utility room

The most common type is concrete with a metal rim, although enameled cast-iron/steel and plastic units are also available. They come in single- and double-compartment styles.

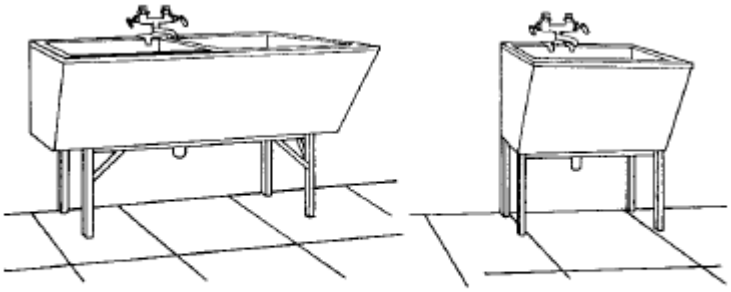


Figure 4.20laundry tubs

Laundry Tubs Installation

Use the following steps, to install a tub.

- Assemble the metal stand by bolting its sections together.

✓ Place the stand in a convenient place in front of the rough-in piping and carefully set the tub on the stand.

✓ Connect the P-trap to the tub as shown in

✓ Connect a swing-combination faucet to the hot- and cold-water supply lines. Usually, the faucet is furnished with a hose bib for attaching a hose.

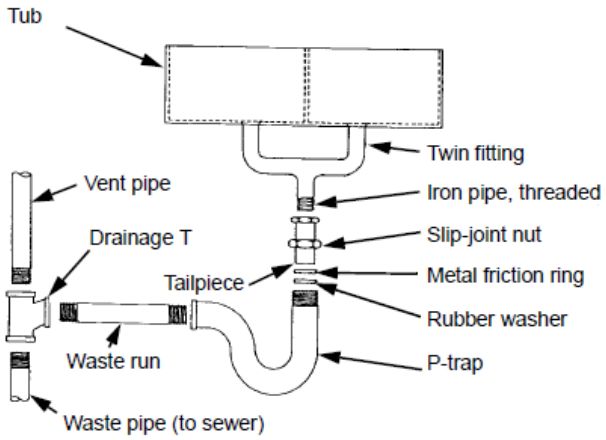


Figure 4.21 Laundry Tubs Installation

DRINKING FOUNTAINS

Drinking fountains are made of porcelain enameled steel, cast iron, or stainless steel.

Types

The three types of drinking fountains are the pedestal, wall-hung, and electrically cooled. The pedestal fountain needs no wall support. The wall-hung fountain is bolted to a mounting board on the wall. The electrically cooled fountain has a refrigerating unit in which the water

supply tubing passes over the refrigerating coils to be cooled before being supplied to the drinking outlet.

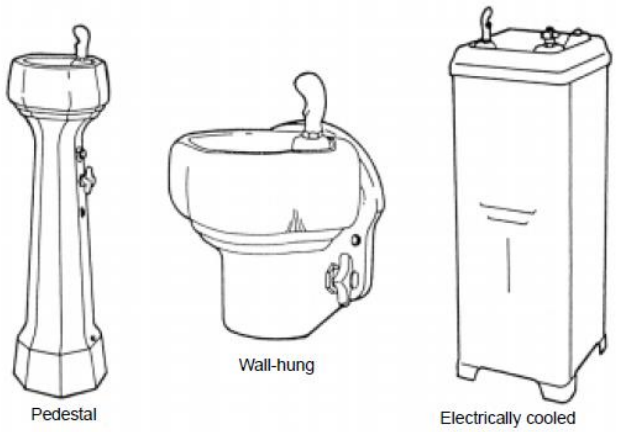


Figure 4.21 **Drinking fountains**

Installation

Sanitation is an extremely important consideration when installing drinking fountains. Water from the drinking outlet should not fall back on the bubbler head. The bubbler head should project at least 3/4 inch above the rim of the fountain and be located so that a person's mouth cannot touch it. The fountain drain should have a good strainer to keep chewing gum and other objects from entering the drain line.

Install fountains with the bubbler head at a height designed for the average user. Ensure that the mounting is sturdy to support considerable weight in addition to that of the fixture. Install a 1 1/4-inch P-trap below the waste pipe. The electrically cooled fountain requires a nearby electrical outlet. Follow the manufacturer's instructions when installing a water fountain

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. is a receptacle for holding water and is shaped for allowing one or two human body to soak in (5point)

A. water fountains

B installation

C. bathtubs

D. drinking fountains

Note: **Satisfactory rating – 4 points** **Unsatisfactory 3 below points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-5	Checking Completed installation

5.5 **Checking Completed installation**

If after running an installation, you need to verify that a particular feature, component checked.

1. Check the bathtub: - Check whether dripping after the bathtub filled with water.

Bath installation checking is important, not only need to meet use standard, if there is any leakage accidents will bring trouble to your neighbor. So bathtub checking should be divided into two phases:

First, Should take water testing several times after installation is finished. Flushing is unobstructed, look around if there is leakage, no leakage can pass.

Second, Bathtub outfall should be directly connect with drain, avoid connect by plastic hose, not to make a open trench drain away water and sealed by silica gel (The place against the wall may come out fine draw after a long time service for human body overloading and Water dynamic load)

Figure 5.5 check the bathtub

2. Floor drain checking

Eligibility requirements or not, blabber on the ground, the water should flow to the floor drain, and no residue.

Figure 5.6 Floor drain checking

3. Shower room assembly process should be in strict accordance

The assembled shower room is neat and bright appearance, the doors is parallel, perpendicular, bilateral symmetry, the two doors should be open convenient, without aperture and no leakage. the gap between shower room and shower tub should be sealed by silica gel, to prevent water seepage.

Figure 5.7 Shower room assembly process should be in strict accordance

. Basin checking

Basin ‘surface should be level, cold and hot water connector should be located in the basin bottom, cold and hot water on-off or faucet has obvious identification marks. Top mount basin should be firm, and under mount basin should be support stably by solid wood cabinets, if no cabinet, should be fixed it on the wall by iron stand, at the same time, need to make a 8-12cm breakwater, at last, sealed around the basin and wall by silica gel, no leakage.

Figure 5.8 Basin checking

2 Toilet checking

Mainly checking the distance of toilet hole from pipeline is reasonable or not, if the distance too small, water tank will into wall, if too far, will left a big distance between the toilet and wall. Toilet should be fixed by expansion bolt, no wood screw; the toilet bottom cannot fixed by cement, the right way is to use silica gel, to ensure watertight performance.

Some toilet use sealing rubber gasket to fixed, and sealed by silica gel. Checking can use manual test method, pay attention to if there is oscillation phenomenon. Toilet and tank installation position should be accurate. Distance random error should not be over than 10mm

Figure 5.9 Toilet checking

6. Sanitary ware

Connecting pipe cannot have the defects. Pressure pipe and outlet connections must be tight, without leakage.

Self check 5	

. 1. Write at list 6 types of Installation, you need to verify that a particular feature, component checking (10point)

1----------

2----------

3----------

4. ----------

5. ----------

6. ----------

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Operation Sheet-1	Positioning and installing Fixtures

Preparing to install

Step 1- Identify the type of toilet installation

Step 2- For Side Entry/Bottom Inlet installations; check the shut-off valve position.

Step 3- Remove the Side Inlet valve and 250mm hose

Step 4- Install the Bottom Inlet valve to the cistern. Place the washers over the fixing screws and locate in cistern fixing holes

Step 5- Position the cistern on the pan by centering the gasket on the pan inlet

Step 6- Connect the supply hose to the cistern inlet and feed the hose through the appropriate side hole in the pan.

Step 7-- Connect the supply hose to the shut-off valve to test the system for leaks. Shut off the water supply

Step 8----- Define the position of the connector:

Step 9---- Using the template; mark the positions of the floor fixing kit holes

Step 10--- Drill fixing holes at the marked locations on the floor and insert the anchors where required

Step 11-- Place a washer onto each of the hexagon screws and fix the brackets to the floor

Step 12- Position the toilet in the marked location, while ensuring an effective connection is made with the pan connector.

Step 13 -- Install the plastic screw sleeves and use the screws to fix the toilet to the brackets. Attached the chromed caps to the screw heads

Step 15-- Securely install the bung into the bottom inlet of the cistern. Place the washers over the fixing screws and locate in cistern fixing holes

Step 16-- Position the cistern on the pan by centering the gasket on the pan inlet

Step 17--- Connect the supply hose to the cistern inlet and connect the hose to the water supply shut-off valve

Step 18- Insert capping plugs into the side entry holes in the pan

Step 19-- Release flush valve by turning anti-clockwise and pulling straight up on the canister

Step 20--- Assemble flush valve by pushing straight down into the canister and turning clockwise

Step 21-Connect the supply hose to the shut-off valve to test the system for leaks

Step 22-Install the seat as per the supplied seat instructions Front edge of seat should follow the shape of the front edge of the pan.

Step 23- Ensure silicon rubber washer is fitted between seat connector and pan to ensure seat is rigid.

Step 24- Make final connection of water supply hose to shut-off valve. Test the system for leaks

Step 25- Apply a suitable sealant between the pan and adjacent surface

Operation sheet 2	Assembling, installing and testing Fixtures, components and pipe

Assemble. Join and install the various kinds of pipes to complete the plumbing system in building

Step 1.identifay types of tools and equipment

Step 2.use protective cloth

Step 3.identify types of fitting and there function

Step 4.take correct measurement

Step 5.implement and install

Operation Sheet-3	**Installing and connecting Fixtures**

Determine Technical Install Shower Installation

Step 1- interpreted plans

Step 2-identify tools and equipment

Step 3-folow safety requirement

Step 4-identify fitting and their function

Step 5-properly implement and install

LAP Test	Practical Demonstration

Name: _____

_____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 7 hour.

Task 1. Installing and connecting Fixtures

Task 2. Assembling, installing and testing Fixtures, components and pipe

Task 3 perform .positioning and installing Fixtures

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Plumbing Installation Work

LEVEL II

Learning Guide # 49

Unit of Competence: Install, Service and maintain water supply Systems and Components

Module Title: Install, Service and maintain water supply Systems and Components

LG Code: EISPLI2 M11 L06- LG 49

TTLM Code: EISPLI2TTLM060919 v1

LO 5: Service and maintain sanitary systems

Instruction Sheet	Learning Guide # 4

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying defective pipes , fixtures and fittings
- Checking replacements materials
- Securing Joints
- Repairing Damaged areas
- Clearing Clogged pipes and fittings
- Using tools and equipment
- Using PPE

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Identify defective pipes , fixtures and fittings
- Check replacements materials
- Secure Joints
- Repair Damaged areas
- Cleared Clogged pipes and fittings
- Use tools and equipment
- Use PPE

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3, Sheet 4 , Sheet 5 , Sheet 6 and Sheet 7”.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 , Self-check 4 , Self-check 5 and Self-check 7” **in page -212, 216, 218,228,238,242 and 254** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 ” **in page -254.**
6. Do the “LAP test” **in page –246** (if you are ready).

Information Sheet-1	Identifying defective pipes , fixtures and fittings

5.1 Identifying defective pipes, fixtures and fittings

Introduction

A pipe failure / corrosion often the first sign of corrosion problem. yet in many example sign of an impending pipe failure have been evident for months or years ,and gone ignored. Failure can be mirror with significant losses due to water damage as well as the cost of pipe replacement

Identifying Defective *pipes and fittings.*

To qualified the design of the pipe fitting, manufacturer performed a various test including burst test to ensure that the design will meet the all the standard and the code requirement. In this test a pipe and fitting are welded and dummy pipe spool is then pressurized to pre define calculated bust test pressure. If the fitting with stand the test all the future product manufactured using that design will consider safe to use. Lap joint stub are exempt from the roof test because they are used with flange assembly and design considering applicable pressure-temperature rating

There are many type of pipe defect from those

1. weld defect
2. due to corrosion
3. Ac corrosion
4. Due to old joints

1.4 disconnecting Defective *pipes and fittings*

How to des connect a galvanized pipe fitting

Common to find galvanized steel pipe water pipe in older homes and outdoor water pipes .galvanized pipe comes in diameter from ½ inch to8inch which 2 inch and large pipe normally reserved for industrial use .the threaded pipe connect with threaded fitting when to remove a fitting you sometimes have your work cut out

1.5 Checking replacements of defects**.**

Pipe repairer take on various forms, ranging from temporary clamps to the replacement of entire piping system. in many example the denial of the corrosion problem result in multiple or stage repair over years. Wasting valuable time that could have otherwise been used to correct the problem and minimize far greater corrosion damage. All too the often one or multiple individual frailer are fixed without further investigation in to the hidden cause

.obvious physical indicator such as thread leak and high rust deposit Allow high condition corrosion to continue unabated, there by producing a much greater repair problem once the true corrosion problem is finally realized

Operation sheet -1	Identifying defective pipes , fixtures and fittings

Install the pipe perfectly

4. read sanitary drawing
5. identify the defecated area
6. Install /commission the defecated pipe and fittings.
7. test the installation

Self-Check -1	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. One of the following is defects of pipe (5point)

A. weld defect C. due to old joints

B. AC corrosion D .all

Note: **Satisfactory rating – 4 points Unsatisfactory -3 below points**

You can ask you teacher for the copy of the correct answers.

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Information Sheet-2	Checking replacements materials

Replacing Supply Pipes

Introduction

When replacing old water supply, use 3/4″ pipe for the main distribution pipes and 1/2" pipes for the branch lines running to individual fixtures. For convenience, run hot and cold water pipes parallel to one another, between 3" and 6" apart.

Use the straightest, most direct routes possible when planning the layout, because too many bends in the pipe runs can cause significant friction and reduce water pressure.

Remove old supply pipes that are exposed, but pipes hidden in walls can be left in place unless they interfere with the installation of the new supply pipes.

Support supply pipes every 6 ft along vertical runs and 10 ft. along horizontal runs.

How to Replace Water Supply Pipes

1. Shut off the water on the street side of the water meter, then disconnect and remove the old water pipes from the house side. Attach 3/4″ male threaded adapter and full-bore control valve to a short length of 3/4" pipe, then attach this assembly to the house side of the water meter. Extend the 3/4″ coldwater distribution pipe toward the nearest fixture, which is usually the water heater.
2. At the water heater, install a 3/4″ T-fitting in the coldwater distribution pipe. Use two lengths of 3/4" pipe and a full-bore control valve to run a branch pipe to the water heater. From the outlet opening on the water heater, extend a 3/4" hot-water distribution pipe, also with a full-bore control valve (page 245). Continue the hot and cold supply lines on parallel routes toward the next group of fixtures in your house
3. Establish routes for branch supply lines by drilling holes into stud cavities. Install T-fittings then begin the branch lines by installing brass control valves. Branch lines should be made with 3/4″ pipe if they are supplying more than one fixture; 1/2" if they are supplying only one fixture

1 Attach an adapter and control valve to the house side of the water meter.

2 Install a 3/4" T-fitting, two lengths of 3/4" pipe and a control valve to run a branch pipe to the water heater

3 Drill holes into stud cavities, and install T-fittings and brass control valves to establish routes for branch supply lines

4. Extend the branch lines to the fixtures. In our project, we are running 3/4" vertical branch lines up through the framed chase to the bathroom. Route pipes around obstacles, such as a main waste-vent stack, by using
   45° and 90° elbows and short lengths of pipe.
5. Where branch lines run through studs or floor joists, drill holes or cut notches in the framing members, then insert the pipes. For long runs of pipe, you may need to join two or more shorter lengths of pipe, using couplings as you create the runs. Where branch lines run through studs or floor joists, drill holes or cut notches in the framing members, then insert the pipes.

6. Install 3/4" to 1/2" reducing T-fittings and elbows to extend the branch lines to individual fixtures.

In our bathroom, we are installing hot and cold stub-outs for the bathtub and sink, and a cold-water stub-out for the toilet. Cap each stub-out until your work has been inspected and the wall surfaces have been

4 Extend the branch lines to the fixtures. Route pipes around obstacles using 45° and 90° elbows and short lengths of pipe.

5 Where branch lines run through studs or floor joists, drill holes or cut notches in the framing members

6 Install 3/4" to 1/2" reducing T-fittings and elbows to extend the branch lines to individual fixtures.

Pipe repairer take on various forms, ranging from temporary clamps to the replacement of entire piping system. in many example the denial of the corrosion

Problem result in multiple or stage repair over years. Wasting valuable time that could have otherwise been used to correct the problem and minimize far greater corrosion damage. All too the often one or multiple individual frailer are fixed without further investigation in to the hidden cause .obvious physical indicator such as thread leak and high rust deposit Allow high condition corrosion to continue unabated, there by producing a much greater repair problem once the true corrosion problem is finally realized

For many decades, the two most common materials for indoor plumbing were iron and galvanized steel. both metals are sturdy, they are also inclined toward corrosion over time, which eventually leads to water contamination, leaks, and busted pipes. it is often necessary to schedule pipe replacement to swap out these outdated materials for modern ones.

Most plumbing problems occur at or near such fixtures as sinks, tubs, and toilets. Sometimes, however, the pipes themselves are the root of the problem. Pipes can be temperamental -- they can leak, sweat, freeze, or make loud noises. In the following article, we'll tell you how to deal with all of these difficulties.

The Most Common Types of Pipe Replacement Material

- ✓ **Copper:** This is the metal that superseded iron and galvanized steel as the new standard for plumbing. Copper is durable, corrosion-resistant, and extremely light, making it easy to work with. Copper also has greater flexibility than steel and iron, making it less likely to break when encountering extra force or strung between two distant supports. In general, copper will outlast most other piping material.
- ✓ **PEX:** One of the most popular of the different types of plastic pipes used in plumbing, PEX stands for cross-linked polyethylene. It is especially common for freshwater pipes that carry drinking water to taps. PEX is less expensive than copper, does not suffer from corrosion or pinhole leaking (which is sometimes an issue with copper), and can often last for 50 years.
- ✓ **CPVC:** An advance over standard PVC pipes, some plumbers prefer CPVC (chlorinated polyvinyl chloride) over PEX piping. These pipes are most commonly used for hot water lines because they have a high resistance to heat.

When handling pipe replacement for a home, a plumber will probably use a combination of these materials to complete the job. Normally, copper pipes are used for main lines, and various color-coded plastic pipes (red for hot, blue for cold) branching off to fixtures. Using these flexible materials, plumbers have greater freedom for designing plumbing than they once did, which is a reason that it's always a good idea to have pipe replacement done during a remodeling, since it permits more options.

Leaks in Pipes

There are all kinds of plumbing leaks. Some can flood your home, while others are not nearly so damaging. Your approach to stopping a leak depends on the type of leak it is. If the leak is at a joint, tighten the joint. If the leak is in a pipe, remove the section that is leaking and replace it with a new section. Unfortunately, this is more easily said than done. For example, when you turn a threaded galvanized steel pipe to unscrew it from its fitting at one end, you tighten the pipe into its fitting at the other end. With copper pipe, the new section must be sweat-soldered in place. Most pipe replacement jobs are best left to a plumber, but, as a do-it-yourselfer, you may consider an alternative:

Self-Check -2	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. One of the most popular of the different types of plastic pipes used in plumbing.(2point)

A .copper C. CPVC

B PEX D. metal

2. This is the metal that superseded iron and galvanized steel as the new standard for plumbing (3point)

A .copper C. CPVC

B PEX D. metal

Note: **Satisfactory rating – 4 points** **Unsatisfactory – 3 below points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-3	Securing Joints

1.3 Securing Joints

Pipe thread leak:- every pipe thread is an inherent point of weakness, with approximately 50%of the pipe wall cut away .often a thread leak is the very first sign of corrosion problem and will prompt further investigation left to continue undressed ,however total pipe separation often occurs to produce devastating water related damages

For more uniform but high corrosion activities a more dangerous condition exist at the thread since the pipe wall is reduce more evenly and does not provide the telltale leak indication of problem for all forms of thread leak the potential always exist to suffer total thread frailer.

To secure joints provides special training for fitters to make sure they receive as much practical experience as possible in fitting the wieldable EW Joint correctly. The training course concludes with both a theoretical and a practical test and successful participants are presented with a certificate.

We also supply all the tools and equipment necessary for fitting these joints correctly. This means you can be sure of achieving the high level of quality needed to ensure the profitability of vulnerable and cost-sensitive installations. Once the preparations for the installation have been completed correctly, the fitter simply has to activate the computer-controlled thermoplastic welding procedure. A computer then controls and monitors the entire process

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page

1. Pipe thread leak:- every pipe thread is an inherent point of weakness, proximately 50%of the pipe wall cut away(5point)

A .copper C. Securing Joints

B. PEX D. metal

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-4	Repairing Damaged areas

1.3 Repairing Damaged areas

however total pipe separation often occurs to produce devastating water related damages

For more uniform but high corrosion activities a more dangerous condition exist at the thread since the pipe wall is reduce more evenly and does not provide the telltale leak indication of problem for all forms of thread leak the potential always exist to suffer total thread frailer.

Types of Valves

Many types of valves are used. The most common types are shown in *Figure.*

Gate Valve

A gate valve is used to start or stop liquid, steam, or gas flow. This valve has a split or solid wedge disk that fits into a machine surface called a *seat.* Raising the disk to start the flow and seating the disk to stop the flow operates the valve.

Globe Valve

A globe valve is a compression-type valve that controls the flow of liquid by means of a circular disk, forced (compressed) onto or withdrawn from an annular ring seat that surrounds the opening through which liquid flows. All globe valves operate with a rising stem.

Angle Valve

An angle valve is a globe valve with the inlet and outlet at a 90-degree angle to one another. These valves are recommended for frequent operation, throttling, and/or a positive shutoff when closed.

Check Valve

A check valve permits the flow of liquid within the pipeline in one direction only and closes automatically to prevent backflow. A check valve can be a *swing-* or *lift-type.* Swing check valves are used in pipelines where pressure and velocity of flow are low. Lift check valves are used where pressure and velocity of flow are high.

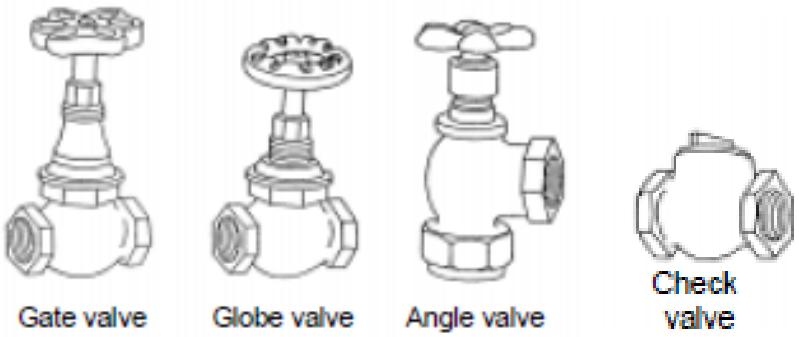


Figure 7-1. Valves

Repairing Valves

Valves and fixture control (operating) devices are a vital part of a plumbing system. Gate, globe, and check valves should be inspected periodically for leaks and proper operation. If a leak is found or the valve operates improperly, the problem is located. A repair is made to restore the valve to a serviceable operating condition.

Leakage and wear of valves and control devices may require simple or extensive repair. Check all valves regularly for leaks. Most leaks are from leaky washers or bonnets that have been used for a long period of time. The plumber must determine the malfunction and make the repair.

How to Repair Gate Valves

The part of the gate valve that usually needs attention is the bonnet packing. Use the following steps and to repair a gate valve:

NOTE: During disassembly, check all parts for wear and replace as needed.

Leak at the stem and the packing nut.

1. 1. Tighten the packing nut. If the leak continues, turn the water supply off.
2. Remove the wheel handle, packing nut, and old packing.
3. Replace with new packing.
4. Replace the packing nut and wheel handle.
5. Turn the water supply on and check for any leaks.
6. Valve will not close properly to stop the water flow.
7. Turn the water supply off, then disassemble the valve from the wheel handle to the body.
8. Resurface the disk with a mixture of oil and lapping compound.
9. Reassemble the valve.
10. Turn the water supply on and check for leaks and proper operation.

Unknown malfunction in valve.

1. Turn the water supply off, and then disassemble the valve until the fault is found.
2. Replace the faulty parts and reassemble the valve.
3. Turn the water supply on and check for leaks and proper operation.

How to Repair Globe Valve

To repair a globe valve, use the following procedures and Figure 7-3.

Leak at the stem and packing nut.

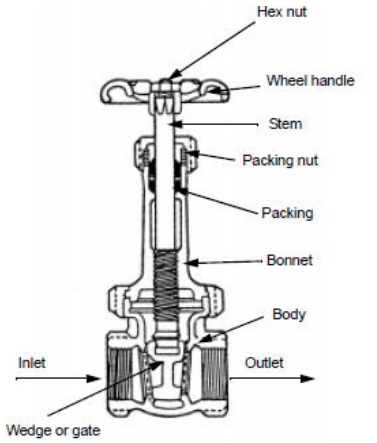
1. Tighten the packing nut. If the leak continues, turn the water supply off.
2. Remove the wheel handle, packing nut, and old packing
3. Replace with new packing.
4. Replace the packing nut and the wheel handle.
5. Turn the water supply on and check for leaks.

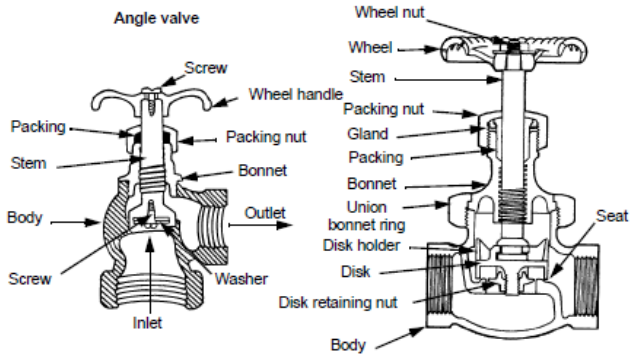
valve will not regulate or control the amount of water flow.

1. Turn the water supply off.
2. Disassemble the valve from the wheel handle to the body.
3. Composition disk: Remove the old disk and replace it with a new one. Plug or conventional disk: Remove the disk and insert a washer; then lay the disk to the seat for a snug fit.
4. Reassemble the valve.
5. Turn the water supply on and check for leaks and proper operation.

Unknown malfunction in the valve.

1. Turn the water supply off; then disassemble the valve until the fault is found.
2. Replace the faulty parts and reassemble the valve.
3. Turn the water supply on and check for leaks and proper operation.





. Gate Valve Repairs

Globe and Angle Valve Repairs

How to Repair Angle Valve

This valve is repaired the same as a globe valve.

How to Repair Check Valve

Use the procedures below to repair the swing and lift check valves.

NOTE: During disassembly, check all parts for wear and replace as neede Swing Check Valve

Use the following procedures and Figure 7-4 to repair a swing check valve:

Loose disk locknut that is causing water backflow.

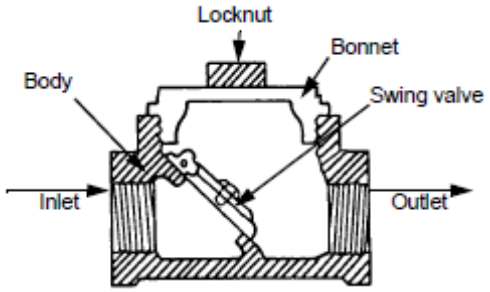
a. Turn the water supply off and remove the cap.
b. Tighten the locknut.
c. Replace the cap.
d. Turn the water supply on and check for leaks and proper operation.

Hinge not closing completely.

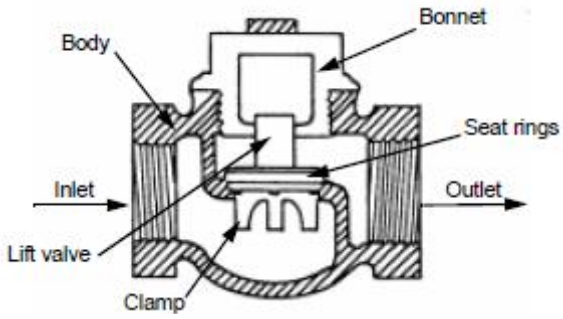
a. Turn the water supply off and remove the cap.
b. Replace the hinge pin and/or hinge with a hinge pin.
c. Replace the cap.
d. Turn the water supply on and check for leaks and proper operation.

Worn disk face that is causing a leak.

a. Turn the water supply off and remove the cap.
b. Remove the locknut and then the disk.
c. Attach a new disk to the hinge and tighten the locknut.
d. Replace the cap.
e. Turn the water supply on and check for leaks and proper operation



Swing Check Valve Repairs



Lift Check Valve Repairs

Lift Check Valve

Use the following procedures and to repair a lift check valve:

NOTE: To avoid repair or replacement of the lift check valve, inspect it once a year.

- ✓ Inspect for wear, freedom of motion, and alignment.
- ✓ Inspect the clapper and body seat rings.
- ✓ Remove any dirt or foreign matter lodged in the valve
- ✓ If the disk or body seat ring surfaces show signs of wear or corrosion, resurface or replace them

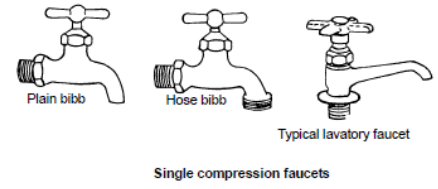
Faucet Maintenance

Types of Faucets

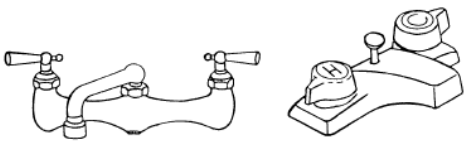
All lavatories, sinks, bathtubs, and showers may have compression or non-compression faucets

Compression Faucet

A compression (or *washer*) faucet works by raising the washer on a seat for water flow and compressing the washer onto the seat to stop the water flow. A compression faucet can be a single faucet for hot and cold water or a combination faucet.



Single compression faucets

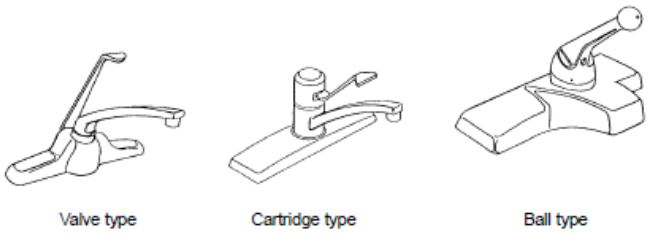


Combination compression faucets

. Compression Faucets

Non-compression Faucet

A non-compression faucet (commonly called *washer-less*) has a single lever or knob that opens and closes parts for water flow and shutoff. Non-compression faucets come in three basic types: valve, ball, and cartridge. A single handle controls them.

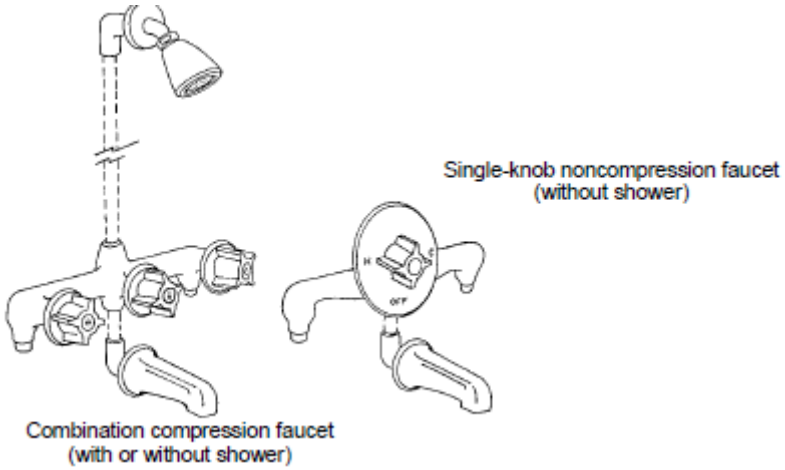


Non-compression Faucets

Faucets

A bathtub faucet may be a combination compression or a single-knob no compression faucet

These faucets are mounted in the wall on the drain end of a bathtub, with or without a shower



Bathtub Faucets

Repairing Faucets

A leaky faucet is the most common home plumbing problem. Faucets on lavatories/sinks are valves that receive a great deal of use, resulting in leaks or failures over a period of time through wear and tear. Leaks occur when washers, 0-rings, or seals inside the faucet are dirty or worn. When this happens, the malfunction of the faucet is determined and repaired. The repair must restore the faucet to a serviceable, operating condition Fixing leaks is easy, but the techniques for making repairs will vary, depending on the design of the faucet. Before beginning work, you must first identify your faucet design and determine what replacement parts are needed. Directions for repairing faucets include shutoff valves, supply tubes, diverter valves, sprayers, and aerators. Before repairing any faucet, drain it by turning the water off at the fixture shutoff valve

Compression Faucets

When repairing compression (or washer) faucets, always check the valve seat. If it I chipped or rough, reface it with a refracting tool or replace .

How to Repair Single Compression Faucets

Use the following procedures and *(lift side*) to repair single compression faucets.

NOTE: During disassembly, check all parts for wear and replace as needed

Leak at the stem and the packing.

1. Turn the water supply off at the shutoff valve, and remove the cap, screw, and handle.
2. Remove the packing nut with a wrench, the old packing material, and the washer.
3. Place a new washer onto the stem's lower end, and reassemble all parts in order.
4. Turn the water supply on and check for leaks and proper operation.

Leak at the spout.

1. Turn the water supply off at the shutoff valve. Remove the cap, screw, and handle.
2. Remove the packing nut with a wrench; then remove the stem from the body.
3. Remove the screw and washer from the bottom of the stem.
4. Place a new washer onto the bottom of
5. Check the valve seat inside the body. If it is chipped or rough, reface the seat with a defacing tool. If the seat is even, place the stem into the body. Replace if needed.
6. Reassemble all the parts in the proper order.
7. Turn the water supply on and check for leaks and proper operation.

Leak at the base of the body.

- Turn the water supply off at the shutoff valve. Remove the cap, screw, and handle.
- Remove the packing nut with a wrench.
- Remove the worn washer from the packing nut.
- Slide a new washer into the packing nut for a snug fit.
- Reassemble parts in the proper order.
- Turn the water supply on and check for leaks and proper operation.

How to Repair Combination Compression Faucets

Use the following procedures and *(right side)* to repair combination compression faucets.

Leak at top of stem.

1. Turn off water supply at shutoff valve.
2. Remove cap, screw, and handle.
3. Step3. Remove packing nut with a wrench.
4. Remove stem from body.
5. Remove worn washer by sliding it off the lower end of the stem.
6. Slide a new washer onto the stem's lower end.
7. Reassemble all parts in their proper order.
8. Turn on water supply to check for leaks and proper faucet operation.

Leak at spout:

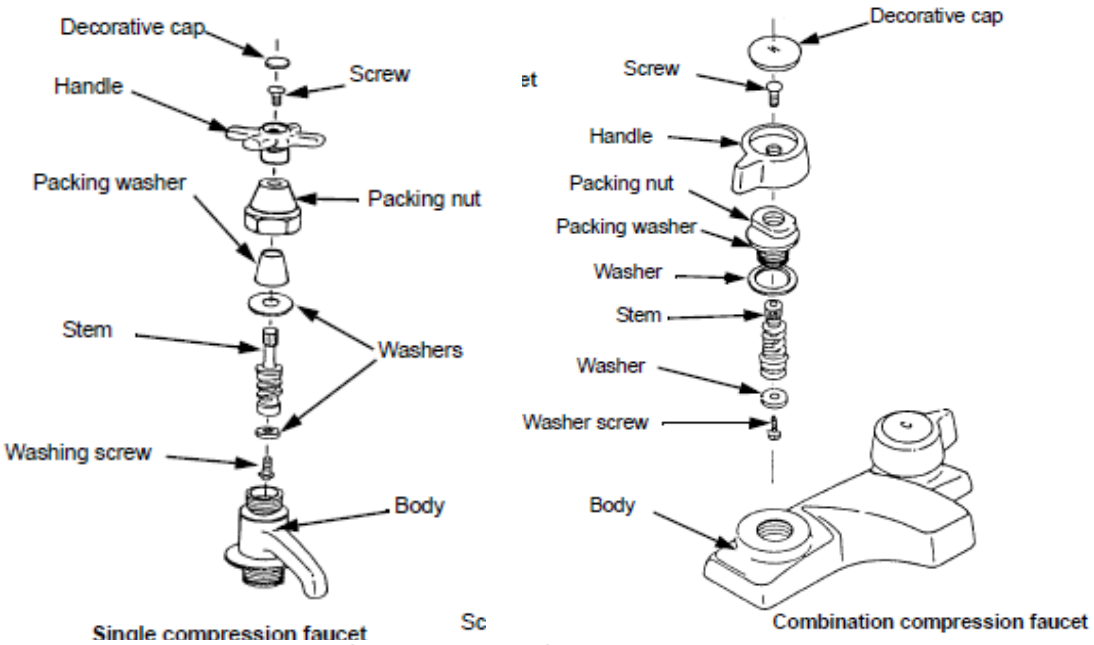
1. Turn off water supply at shut off valve.
2. Remove cap, screw and handle.
3. Remove packing nut with a wrench.
4. Remove stem from body.
5. Remove screw and worn washer from the bottom of the stem.
6. Place a new washer into the bottom of the stem and secure to stem with a new screw.
7. Check valve seat inside of body. If it is chipped or rough, reface seat

ii. Prefacing tool. If a seat is ok, place stem into body.

1. Reassemble all parts in their proper order.
2. Turn on water supply and check for leaks and proper faucet operation

Leak at base of body:

1. Turn of water supply at shut off valve.
2. Remove cap, screw and handle.
3. Remove packing nut with wrench.
4. Remove worn washer from packing nut.
5. Slide a new washer onto packing nut for a snug fit.
6. Reassemble all parts in their proper order.
7. Turn on water supply and check for leaks and proper faucet operation.



Compression Faucet Repairs

Most piping systems used today are manufactured using PVC, a hard plastic that is known to be durable. However, when pressure is put on the pipe, it is bound to break. When a pipe breaks at one point, it makes no sense replacing the entire system. PVC couplings are often used to repair that section of the pipe by cutting out the broken part and installing a new piece.

Here is how the repair process is conducted:

1: Locate the Damaged Area

You will need to find out where the fluid is leaking in order to determine the section of the pipe that needs repair. Look out for damp patches or odors in case the piping system transports waste water.

2: Mark the Area

Once you identify the point of damage, the next step is to mark the section that is going to be repaired; mark the cutting 6 inches away from the point of breakage/fracture on each side. You can use a felt pen to mark the cutting point.

3: Cut Out the Piece

With two marks now, you can cut the two sections of the pipe using a hacksaw. Try and make straight cuts on both sides. With the two cut pipe ends, measure the distance between them and use this to determine the length of the new piece of PVC that will be installed in that section. Make sure the new pipe that you will fit in this section has a similar diameter to the existing pipe.

4: Apply Primer

Don't use PVC glue before applying a primer. The primer needs to be applied on one end of the new pipe and also on one end of the existing pipe both on the outside sections. Apply primer on the interior of the coupling as well. Give the primer time to dry.

5: Fit the Coupling

Push the one end of the coupling onto the end of the pipe that doesn't have any primer. Next, apply the PVC glue onto all the areas that have primer and then push the other end of the coupling onto the new pipe. Wait until the area is stuck. This should take less than a minute and then let go. Make sure that half of the coupling is pushed inside the new pipe and the other half is in the existing pipe.

Self-Check -4	**Written Test**

Directions: Answer all the questions listed below.

1. One direction only and closes automatically to prevent backflow(2point)

   A. Globe valve C. check valve

   B .Angle valve D. union

2. That controls the flow of liquid by means of a circular disk,(2point)

   A. Globe valve C. check valve

   B. Angle valve D. union

3. One of the following is inlet and outlet at a 90-degree angle to one another(2point)

   A. Globe valve C. check valve

   B. Angle valve D. union

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-5	Clearing Clogged pipes and fittings

Introduction

Cleanouts The cleanout provides access to horizontal and vertical lines to facilitate inspection and provide a means of removing obstructions such as solid objects, greasy wastes, and hair.

Cleanouts, in general, must be gas- and water-tight, provide quick and easy plug removal, allow ample space for the operation of cleaning tools, have a means of adjustment to finished surfaces, be attractive in appearance, and be designed to support whatever traffic is directed over them.

Some cleanouts are designed with a neoprene seal plug, which prevents “freezing” or binding to the ferrule. All plugs are machined with a straight or running thread and a flared shoulder for the neoprene gasket, permitting quick and certain removal when necessary. A maximum opening is provided for tool access. Recessed covers are available to accommodate carpet, tile, terrazzo, and other surfaces finishes and are adjustable to the exact floor level established by the adjustable housing or by the set screws.

Waste lines are normally laid beneath the floor slabs at a distance sufficient to provide adequate backfill over the joints. Cleanouts are then brought up to floor-level grade by pipe extension pieces. Where the sewer line is at some distance below grade and not easily accessible through extensions, small pits or manholes with access covers must be installed. When cleanouts are installed in traffic areas, the traffic load must be considered when the materials of construction are selected

Expanded, Waste pipes

Waste pipes are bigger than supply pipes. Hand basins have a 32mm waste outlet pipe; showers, washing machines, sink and bath a 40mm pipe; and toilets a 110mm pipe (the same size as a modern soil stack).

Another important difference is that waste pipes must slope downwards at the rate of at least 20mm in every meter to ensure the water runs away freely. In the past they were made of lead, but modern systems are just made of plastic. Depending on the type of plastic used, the pipes can be joined by simple push-fit connectors that contain rubber ring seals, by compression-type connectors with rubber 'olives', or by solvent welding - using specially formulated solvent cement that softens the plastic and dries to form a strong, watertight joint.

Cutting, jointing and fixing waste pipes

Cut plastic waste pipes with a hacksaw, then remove the burrs inside and out with a half-round file before you fix them. Solvent-weld fittings are neat but permanent - so while they're ideal on visible pipe work, it's better to use compression fittings under and behind your sinks so you can take them apart again for cleaning and unblocking. When you run pipes along an interior or exterior wall, it's a good idea to hold them in place with waste pipe clips - which you can get in lots of different colors and sizes. Use wall plugs and screws to attach the clips to a masonry wall, or hollow-wall fixings on plasterboard. Don't forget to check for hidden pipes and cables before you drill.

today' s pipe cleaning methods address the traditional causes of drain clogs with new technology. Plumbing in houses more than 25 years old may be prone to blockages which are, at the same time, harder to clear without damaging the pipes. Traditional measures such as using a large-gauge snake can over-stress older plumbing and cause leaks that make even more extensive repair procedures necessary. What's worse, while these old-school methods may punch a hole in a blockage and provide a short-term correction, the conditions inside the pipe that promote blockages in the first place often remain unchanged. The inevitable recurrent clogged plumbing eventually leaves major dismantling or excavation as the last option.

Advances in pipe cleaning technology including power-Roding and hydro-jetting have added important options to your plumber's weapons against slow or clogged drains. These alternatives require the services of a professional plumber who's invested in this specialized equipment and the training to use it correctly.

How Blockages Happen

Usually, it's not the last solid object that swirls down the drain that causes a clog. The fact is, the clog that's causing the headache today actually began long ago with the gradual accumulation of sludge on the inside of the pipe, slowly constricting its internal diameter and restricting free flow of water. Sludge is a sticky concoction of soap scum, grease, hair, food particles and even the dissolved minerals in the water. Once a layer of sludge forms, more sludge tends to accumulate in that segment of the pipe, increasingly narrowing the size of the pipe until only a small channel allows free flow of water. At that point, any minor bit of solid matter flushed down the drain may instigate a total blockage.

When a common drain snake, such as those sometimes used by do-it-yourselfers, drills a hole in the clog or pushes it down, water flow may resume. However, the accumulation of

sludge that formed the foundation for the blockage is still intact. In time, another clog will form at that site.

Power-Roding

Power-Roding is technology that takes the basic design of the plumbing snake, yet brings it into the 21st century to make it a precision device for pipe cleaning, not just clearing blockages. The equipment utilizes a thin metal cable which the plumber threads into the pipe to the location of the clog. At the end of the cable, the system incorporates razor-sharp cuttings blades that are sized to the measurements of the interior of the pipe. An electric motor rotates the cable at high speed and the sharp blades lacerate accumulation of sludge, scouring the walls of the pipe as it simultaneously liquidates the blockage. All this residual matter is reduced to tiny bits that are easily flushed away when a strong force of water is introduced into the pipe. Since the power-Roding equipment is sized to fit the pipe exactly and the cutting instrument is very efficient, the system is much less stressful to clogged plumbing than an old-school universal snake that relies on simple blunt force to push clogs down the pipe.

Hydro-Jetting

This method represents the current state of the art. Hydro-jetting employs the power of high-pressure water to both eliminate clogs in plumbing and clean internal pipe surfaces of sludge to prevent a repeat blockage. Instead of mechanical cutting blades, a hydro-jetting system uses a high-pressure water line threaded into the pipe. The cleaning head at the end of the line integrates precision nozzles that discharge jets of water at approximately 3,500 ps.i.

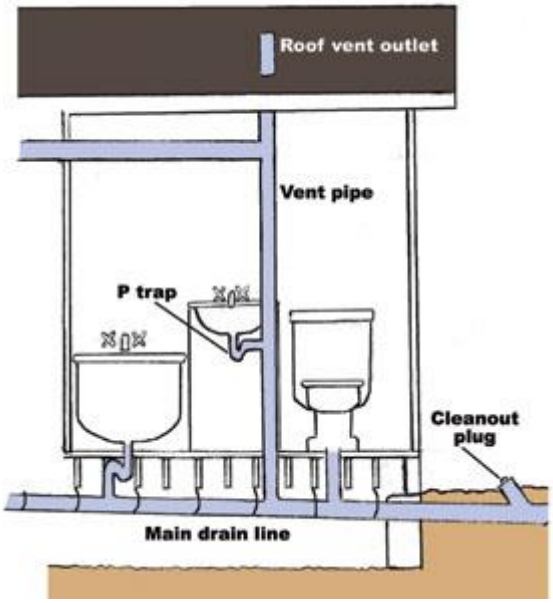
This ultra high-pressure stream acts like a knife to cut through obstructions and scour the pipe walls. The blast of water instantly turns sludge and clogs to a semi-solid state and flushes it away into the sewer. While the high-pressure water obliterates sludge and blockages including tree roots, it does not traumatize clogged plumbing pipes or joints like mechanical pipe cleaning equipment.

Clearing the clogs (clear clogged plumbing)

By Matt Weber

Solving common household drain problems.

Everybody knows that plumbing can be a messy, smelly and altogether nasty job. Nobody wants to do it except plumbers, who make good money doing the work nobody else wants to undertake. The best way to handle a plumbing problem is to avoid it completely, but once the pipes are clogged you can usually solve the problem by following the guidelines detailed here.



A closet auger is similar to a plumbing snake but the end of the auger is bent to fit through the tight curves of a toilet trap. A closet auger operates using a hand crank to rotate a cable encased in a rigid shaft.

If more than one fixture is clogged, then you may need to clean out the main drain line. To do this, locate the clean-out plugs on the large drain pipes in your basement or crawlspace. These drain lines may be found in a garage or outdoors, along the foundations of the house. Each plug has a cap with a square fitting at the top. Remove the cap with a wrench. Be ready with a bucket to catch dripping water. Also, make absolutely sure no one is going to be using the facilities while you have the main drain line open. Use a plumbing snake to break up any clogs in the open main line, running it in both directions of the pipe.

Some devices use compressed air to blast through tough clogs.

If you don't have a plumbing snake handy, or you want to avoid removing the traps, you might try one of the new clog-removal products that utilize compressed air. Hardware and home stores now sell products that shoot compressed air into the drain that forces the clog to move. Some compressed-air products are sold in disposable cans, which often work quite well. However, if the air-burst doesn't work and requires repeat treatments, the compressed air cans can get expensive.

Another type of compressed-air product is a reusable device that uses cartridges of compressed CO2. Once the tool is loaded with a CO2 cartridge, just press down firmly on the handle and a needle punctures the cartridge, sending a powerful burst of air into the drain, instantly unclogging it. The advantage is that you can keep the tool for future clogs, and all you have to replace are the individual cartridges.

Access the drain of a tub by removing the overflow plate.

Liquid Clog Removers

Although frequent use of chemical cleaners can damage your plumbing, they can be helpful opening the occasional plugged pipe. If water is slowly draining but the pipe is not completely clogged, then a liquid cleaner may do the trick. But don't be suckered by the thin liquid products on the market. On more than one occasion I've poured a watery cleaner down a sluggish drain only to hear the product rush straight past the clog and into the nether regions of my plumbing system, leaving the problem stuck in the drain, mocking me. Each time this happened, I could swear I heard somewhere in the distance the faint sound of the manufacturer laughing at me.

Chemical cleaners use either an acid or a base to dissolve stubborn clogs and organic matter, so choose a thicker product rather than the cheapest, thin liquid plumbing agents. The thicker products stick to the inside of the pipe and give the chemicals better coverage and contact with the blockage. Some products foam-up and cling to the inside walls of the pipe. Allow the product to sit as directed, usually about 30 minutes, and follow with running water to test the drain.

There are a few red flags when it comes to chemical cleaners. The first is that the active ingredient is often chlorine bleach. This is bad news for septic tanks, because bleach can kill the beneficial bacteria of a septic system. These products are best suited for systems connected to a city sewer. Furthermore, liquid clog removers aren't intended for all household clogs. For example, clog removers are not designed to remove the waste that may be clogging your toilet. Also, laundry drain clogs are often due to accumulated clothing fibers. Liquid drainers don't dissolve these fibers, so those problems will probably have to be removed physically, not chemically. The general rule of chemical cleaners: Read the instructions on the label and only use it as intended. Always use in a well-ventilated area and wear rubber gloves. Don't use a plunger if a liquid cleaner is in the drain, or you risk splashing caustic chemicals on your skin. And don't pour in a liquid cleaner if the drain is completely blocked. Otherwise you'll be faced with a sink full of caustic water – another mess you'll have to deal with. Stoppages in fixtures are usually caused by materials lodged in the drain, trap, or waste line. Obstructions often can be removed by manually operated devices, chemicals, or both. The method depends upon the seriousness and nature of the stoppage. The obstruction should be entirely removed and not merely moved from one place to another in the line. After the stoppage has been relieved, pour boiling water into the fixture to ensure complete clearance. Some of the methods used in clearing stoppages in fixtures are explained below. When using a snake or sewer tape, keep track of the length of tape in the pipe so you can determine the break or stoppage location. Also, with plastic pipe, exercise care not to use sharp ends that could cut through the wall of a pipe or fitting. The force cup plunger is commonly used for clearing stoppages in service sinks, lavatories, bathtubs, and water closets. One type of force cup has a round, rubber suction cup, about 5 inches in diameter, fastened to a wooden handle, as shown in When using the force cup, partly fill the fixture with water. Place the force cup over the drain opening and work the handle up and down to provide alternate compression and suction. Take care not to raise the cup off of the drain opening. The downward pressure or upward suction often clears the stoppage. Another type of force cup, shaped to fit the opening of water closet drain, works more efficiently than the round type in clearing stoppages in water closets. The closet auger and plumber's snake are used for opening clogged water closet traps, drains, and long sections of waste lines The closet auger is a cane-shaped tube with a coiled spring or "snake" inside and a handle for rotating the coiled hook on the end of the snake. To insert the closet auger into the trap of the water closet, retract the coiled spring all the way up into the cane line curve of the closet auger. Hook the cane end, with its projecting hook, into the trap. Then start turning the

handle to rotate the coiled spring as it is pushed down into the trap of the water closet. Rotate the handle continuously until the snake reaches the obstruction in the drain. Turn the handle slowly until the obstruction is caught on the coiled hook of the closet auger. Continue rotating the handle and pull back at the same time to bring the obstruction up into the water closet where you can remove it.

NEVER assume that the water closet is clear after one object is brought up and removed. Insert the snake of the closet auger again and repeat the procedure until the closet auger passes down into the closet bend and branch. Withdraw the closet auger. Put four or five pieces of toilet paper in the water closet and flush them through the fixture to make sure that it is completely open. Look for remnants or tattered pieces of toilet paper remaining in the bowl, this is a tell tale sign of an obstruction still remaining in the fixture.

Trap and drain augers, such as the one, are used in clearing obstructions in traps and waste pipes. Trap and drain augers, also known as sink snakes, are made of coiled, tempered wire in various lengths and diameters. They are very flexible and easily follow bends in traps and waste lines when pushed into them. In clearing stoppages from lavatories, service sinks, and bathtubs, first use a plumber's force cup. When the obstruction is in the trap and is not cleared by the action of the plunger, clear the trap by inserting a wire or snake through the cleanout plug at the bottom of the trap. If the trap is not fitted with such a plug, remove the trap. Protect the finish of the packing nut with adhesive tape or wrap a cloth around the jaws of the wrench. Do not use a heavy steel-spring coil snake to clear traps under lavatories, sinks, or bathtubs. Use a flexible wire or spring snake that easily follows the bends in the trap. Use a spring snake for clearing stoppages in floor drains. Remove the strainer or grate and work through the drain, or insert the snake through the cleanout plug opening nearest the obstruction. Stoppage clearance tools should be used with caution.

One reason why safety is so important is that a *caustic* chemical may have been poured into the stopped-up fixture in an effort to clear it. Caustic agents can cause serious injury if splashed into your face by a force cup. These caustic agents can also burn your hands while using a sink snake. When manually operated devices fail to clear stoppages, however, there are several types of chemicals that you can use to dissolve or burn them out. These chemicals are discussed briefly below.

Caustic Potash (Potassium Hydroxide)

Stoppages can be burned out by pouring a strong solution of caustic potash (potassium hydroxide) and hot water into the line through the fixture opening. Pour the mixture slowly into the pipe through a funnel. Since this solution can cause serious bums, personnel must wear goggles and rubber gloves. This chemical damages glazed earthenware, porcelain, and porcelain-enamelled surfaces.

Caustic Soda (Sodium Hydroxide)

Kitchen and scullery sink stoppages are often tough problems because of grease, oil, or fat washed into the drain along with coffee grounds and small bits of garbage. Grease congeals and acts as a binder for solid particles but can usually be cleared by successive applications of a chemical cleaner. Effective cleaners include caustic soda (sodium hydroxide) with bauxite (an aluminum compound or ore) and other ingredients to intensify their action, or sodium hydroxide mixed with sodium nitrate and aluminum turnings. Adding water creates ammonia gas, which helps change grease to soap. This gas causes boiling and heating and helps dissolve the grease. When clearing a partially blocked drain, drop a small quantity of cleaner (2 to 8 ounces) into the open drain and follow with scalding hot water. Such cleaning agents cannot be satisfactorily used when the drain is completely plugged, since some flow is required to loosen the obstruction. A completely blocked drain must first be partially cleared with a plumber's snake before you can use the chemical cleaner effectively.

View A: Force Cup

Tools for clearing stoppages in plumbing fixtures.

Clogged pipes are clear.

Clogged pipe is annoying .just thought of standing in the shower while the water slowly rises instead of draining is enough to make any one cringe. First it covers your feet and swells upward toward the shins. at that point you are most likely thinking One way to clear a clogged pipe is using chemical

Self-Check -5	Written Test

Directions: Answer all the questions listed below.

1. High-pressure water to both eliminate clogs in plumbing and clean internal pipe surfaces of sludge to prevent a repeat blockage (3point)

A. liquid clog remover's C. motor jet

B. Hydro-Jetting D. Lifting jet

2. One of the following is true about the plumbing can be helpful opening the occasional plugged pipe.(2point)

A. liquid clog remover's C. motor jet

B. Hydro-Jetting D. Lifting jet

Note: **Satisfactory rating – 5 points** **Unsatisfactory -3 below points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-6	Using tools and equipment

5.6 Using tools and equipment

Find the plumbing tools and equipment you need for cutting, flaring, bending, reaming, cleaning, installing and repairing. Pipe and tube cutters quickly and safely slice through metal and PVC. Find faucet, pipe and other specialty wrenches for drains, shower valves, garbage disposals and much more. Unclog your systems with heavy-duty drain cleaning equipment. Flare and swag steel, copper, brass and aluminum pipe with the right flaring tool. Whether your plumbing issue is big or small, we've got the tools and equipment you need to get the job done.

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Product Categories

Swaging Tools

Flaring And

<u>Conduit, Pipe, and Tubing Reamers</u>

Drain Cleaning Equipment Pipe and Tube Cutters

Pipe Extractors **Pipe Freezing and Pipe Thawing Units**

Pipe Inspection Equipment **Pipe Inspection Equipment Accessories**

Pipe **Threading** **Equipment**

Pipe/Tube Brushes

Self-Check -6	Written Test

Directions: Answer all the questions listed below.

1. What are the deferent between tools and equipment(5point)t

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-7	Using PPE

7.1 Using Appropriate PPE

7.1.1 Occupational Health Requirements Personal safety, work cloth and shoes.

Various forms of accidents occur at various stages of construction and in various operations. In order to avoid these accidents, we have to follow the following safety precautions.

Protective clothing: - Adequate protective clothing should be provided for the heads, eye and feet as follows:

1. .Helmets should be worn especially in areas where there is likelihood of objects falling from roofs or multistory building.
2. Goggles or face shields should be worn during drilling, chiseling or grinding operation on metal, store, and concrete. These operations produce dust and flaying chips which could be injurious to eye.
3. The feet should be protected from nails and other sharp objects and from heavy falling objects by hard-rolled leather boots with metal toe-cap

Personal protective equipment (**PPE**) refers to protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection. The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter. Protective equipment may be worn for job-related occupational safety and health purposes, as well as for sports and other recreational activities. "Protective clothing" is applied to traditional categories of clothing, and "protective gear" applies to items such as pads, guards, shields, or masks, and others.

The purpose of personal protective equipment is to reduce employee exposure to hazards when engineering controls and administrative controls are not feasible or effective to reduce these risks to acceptable levels. PPE is needed when there are hazards present. PPE has the serious limitation that it does not eliminate the hazard at source and may result in employees being exposed to the hazard if the equipment fails.

Any item of PPE imposes a barrier between the wearer/user and the working environment. This can create additional strains on the wearer; impair their ability to carry out their work and create significant levels of discomfort. Any of these can discourage wearers from using PPE correctly, therefore placing them at risk of injury, ill-health or, under extreme circumstances, death. Good ergonomic design can help to minimize these barriers and can therefore help to ensure safe and healthy working conditions through the correct use of PPE.

Practices of occupational safety and health can use hazard controls and interventions to mitigate workplace hazards, which pose a threat to the safety and quality of life of workers. The hierarchy of hazard controls provides a policy framework which ranks the types of hazard controls in terms of absolute risk reduction. At the top of the hierarchy are elimination and substitution, which remove the hazard entirely or replace the hazard with a safer alternative. If elimination or substitution measures cannot apply, engineering controls and administrative controls, which seek to design safer mechanisms and coach safer human behavior, are implemented. Personal protective equipment ranks last on the hierarchy of controls, as the workers are regularly exposed to the hazard, with a barrier of protection. The hierarchy of controls is important in acknowledging that, while personal protective equipment has tremendous utility, it is not the desired mechanism of control in terms of worker safety.

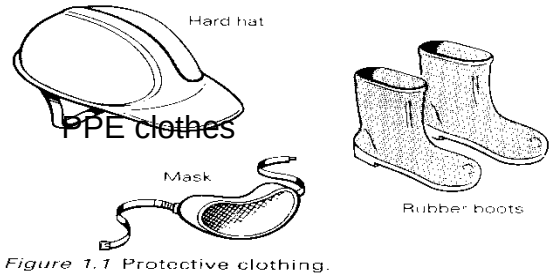

Figure 1.1 Protective clothing.

Self-Check -7	Written Test

Directions: Answer all the questions listed below.

1. Adequate protective clothing should be provided for the heads, eye and feet as follows (2point)

A. Protective clothing C .goggle

B .helmet D. glove

2. Should be worn especially in areas where there is likelihood of objects falling from roofs or multistory building. (3point)

A. head protective C .goggle

B .helmet D. glove

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Operation sheet -1	Identifying defective pipes , fixtures and fittings

Install the pipe perfectly

a. read sanitary drawing
b. identify the defecated area
c. Install /commission the defecated pipe and fittings.
d. test the installation

Operation sheet 2	Checking replacements materials

Replace Water Supply Pipes

Step 1. Shut off the water on the street side of the water meter.

Step 2. At the water heater, install a 3/4″ T-fitting in the coldwater distribution pipe.

Step 3. Establish routes for branch supply lines by drilling holes into stud cavities.

Step.4. Extend the branch lines to the fixtures. In our project

Step 5. Where branch lines run through studs or floor joists

Step 6. Install 3/4" to 1/2" reducing T-fittings and elbows to extend the branch lines to individual fixture

Operation Sheet-3	Repairing Damaged areas

Technically repair combination compression faucets

Step 1- Identify tools and equipment

Step 2- ware safety cloth

Step 3- Locate the Damaged Area

Step 4- Mark the Area

Step 5- Apply Primer

Step 6- Fit the Coupling

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1**.** Identify and checking replacements materials for water supply installation

Task 2 Repairing Damaged areas for any water supply and fixtures gate valve, angle valve

Task 3 Identifying defective pipes , fixtures and fittings

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Plumbing Installation Work

LEVEL II

Learning Guide # 50

Unit of Competence: Install, Service and maintain water supply Systems and Components

Module Title: Install, Service and maintain water supply Systems and Components

LG Code: EISPLI2 **M11LO6- LG 50**

TTLM Code: EISPLI2**TTL**M**060919** v1

LO 6: Clean up

Instruction Sheet	Learning Guide # 50

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Clearing Work area
- Clearing Tools and equipment

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to:

- Clear Work area
- Clear Tools and equipment

Learning Instructions:

7. Read the specific objectives of this Learning Guide.
8. Follow the instructions described below 3 to 6.
9. Read the information written in the information “Sheet 1and Sheet 2”.
10. Accomplish the “Self-check 1and Self-check 2” **in page -251 and 253** respectively.
11. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page .**
12. Do the “LAP test” **in page –** (if you are ready).

Information Sheet-1	Clearing Work area

6.1 Cleaning Work area.

1) All excess material should not be wasted, but used or safely removed from site according to appropriate legislation.
2) Identify the waste types that are likely to be produced and aim to reduce the amount of waste as much as possible, through identifying routes to reuse or recycle materials.
3) -Control access to storage areas to minimize risk of theft or damage.
4) .-Store any materials away from sensitive locations in fenced off areas.
5) -Label all waste storage and skips, detailing the type of waste.
6) -Employ a just-in-time policy to deliver materials in order to reduce the storage time on site.

Self-Check -1	Written Test

Directions**:** Answer all the questions listed below.

1. Write at List 6 the procedures of cleaning work area.(10point)

1----------

2. ----------

3. ----------

4. ----------

5. ----------

6. ----------

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

Information Sheet-2	Clearing Tools and equipment

6.2 Clearing Tools and equipment

Proper tools and equipment are essential for the effective operation of any civil works site. Equipping the construction site with the correct tools and equipment plays an essential role in achieving timely and good quality results. For every construction activity there is an optimal combination of tools, equipment and labor. Depending on the nature and content of the works, the technical staff needs to know which tools to use and how to effectively combine them with manual labor. Once on site, equipment requires trained operators and supervisory staff who are proficient in its operation and maintenance.

Faulty equipment is a common reason for delays on construction sites. A major responsibility of the project management is to ensure that tools and equipment are maintained in a good condition and are readily available when required for the various work activities. For certain construction activities, particularly hauling of materials and compaction, high labor productivity and good quality of work may be difficult to achieve using only manual labor and hand tools. In such cases, using light construction equipment can increase the efficiency of work. Site supervisors need to know how to use the tools and how to operate the equipment in order to secure good work progress and the expected high quality results. It is also important that staff know the full potential, as well as the limitation, of the use of manual and equipment-based works methods.

Finally, tools and equipment need regular maintenance, requiring good workshop facilities, a reliable supply of spare parts and qualified mechanical staff.

Complete documentation

The owner shall submit to the city any and all documents required to provide for a permanent easement for access and maintenance to all installation of water supply lines and related structures. The easement along water supply lines shall be centered along the line. Larger easements for pump stations or other structures shall be provided as needed. No structures or permanent landscaping shall be located within dedicated ease

Self-Check -4	Written Test

Directions: Answer all the questions listed below.

1. What type of cleaning must be done(5point)

Note: **Satisfactory rating – 5 points** **Unsatisfactory 3 below points**

You can ask you teacher for the copy of the correct answers.

The teachers who developed the TTLM

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1. Name of the facilitator

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