

ROMIA TVET BUREAU



INSTALLATION CONSTRUCTION WORK LEVEL-I

Learning Guide #01

Unit of Competence: Install Service and Maintaining Water Supply System and Components

Module Title Installing Service and Maintaining Water Supply System and Components

LG Code: CON ICW1 M17,L01 ,LG01 0910

TTLM Code: CON ICW1 TTLM17 0519

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This learning guide is developed to provide you the necessary information regarding the following Learning out comes and contents

Module learning out comes and contents

LO1. . Prepare for work

- 1.1 Obtaining Drawings and specifications.
- 1.2 defining **OH&S** requirements
- 1.3 Installing water services workplace environment.
- 1.4 Identifying **Quality assurance** requirements.
- 1.5 Tasks are planned and sequencing of task in conjunction.
- 1.6 **Setting out Tools and equipment.**
- 1.7 installing water piping systems
- 1.8 Preparing Work area.

LO2. Identify installation requirements

- 2.1 Calculating Quantity materials.
- 2.2 Identifying type of materials as standard.
- 2.3 Identifying **Materials** /equipment.
- 2.4 orderings/collecting in materials

LO3: Install and test pipe system

- 3.1 Setting out Pipe lines and fixture.
- 3.2 excavating Trenches as requirements
- 3.3 Checking Installation of supports and clips.
- 3.4 Installing Pipes are and jointing
 - 3.4.1 job specifications,
 - 3.4.2 design layout and

3.4.3 Testing Installation.

LO4: Repair defective pipes and fittings

- 4.1 Identifying Defective *pipes and fittings*.
- 4.2 disconnecting Defective *pipes and fittings*
- 4.3 replacing Defective *pipes and fittings*
- 4.4 Checking replacements of defects.
- 4.5 Checking Joints are tightly secured.
- 4.6 Restoring or repairing damaged areas.
- 4.7 Clogged pipes are clear.
- 4.8 Observing correct usage of tools and equipment.
- 4.9 Using Appropriate PPE.

LO5: Clean up

- 5.1 Cleaning Work area.
- 5.2 Cleaning Tools and equipment
- 5.3 Completing Documentation

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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 provide the learners with the required knowledge and skill to cast concrete including all necessary components, concrete finishing, dressing and cure concrete

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
3. Accomplish the “Self-check 1”.
4. Ask your teacher the key correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
5. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to learning activity #2.
6. Submit your accomplished Self-check. This will be part of your training portfolio.
7. Read the information written in the “Information Sheet 2”. Try to understand what are being discussed. Ask you teacher for assistance if you have not understood it.
8. Accomplish the “Self-check 2”.
9. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You get the key answer only after you finished answering the Self-check 2).
10. Read the information written in the “Information Sheets 3, 4, 5and 5”. Try to understand what are being discussed. Ask you teacher for assistance if you have not understood it.

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11. Accomplish the “Self-check 3”.
12. Accomplish the “Self-check 4”.
13. Accomplish the “Self-check 5”.
14. If you earned a satisfactory evaluation proceed to “Operation Sheet 1” in page. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #17.
15. Read the “Operation Sheet 1” and try to understand the procedures discussed.
16. Access the information as described in the Operation Sheet 1.
17. Read all the contents and try to understand the procedures discussed.
18. Request access to the equipment and software described in the. Practice the steps or procedures as illustrated in your. Go to your teacher if you need clarification or you want answers to your questions or you need assistance in understanding a particular step or procedure.
19. Do the “LAP test” in page __ (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advice
20. You on additional work. But if satisfactory you can proceed to Learning Guide #15.

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1.1. Obtaining Drawings and specifications.

Definition of water supply plan: - is the plan view drawing which shows the installation system and it is generally traced from the floor plan.

- 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

1.1.1 Symbols of pipe lines, fittings & device

Standard symbols are those that are recognized & accepted by drafters, designers, Contractors and trade workers. . The following abbreviations & symbols are widely used in 'SN' drawings

SYMBOLS FOR PIPE LINES AND OTHER	
PIPE LINE AND OTHER	SYMBOLS
COLD WATER SUPPLY PIPE	—————
HOT WATER SUPPLY PIPE	—————
HOT & COLD WATER SUPPLY LINE	—————
SEWERAGE PIPE	>—————>
GAS LINE	————— G —————
CHANGE OF PIPE DIAMETER	————— 20/25 —————
PIPE SLEEVED	—————
COUPLING	————— I —————
THREE WAY VALVE	————— X —————
HOSE BIB	————— I —————
VENT PIPE	—————
RAIN WATER PIPE	○ RWP
Vent pipe or soil and vent pipe	S & VP ○ VP
Discharge pipe	○ DP
Rodding eye or cleaning eye	○ RE/CE
Cold water storage tank	[CWST]
Gas water heater	[GWH]
Gully	[G]
Intercepting trap	[IT]
Fresh air inlet	[FAI]
Calorifier (indirect) cylinder	⊙
Draining tap	⊙ DT
Cold and hot water drawoff	————— I —————
Water pump	○
Boiler	B
Man hole	MN
Floor drain	⊙ OR ⊙
Water meter	————— (M) —————

SYMBOLS FOR SCREWED PIPE FITTINGS		
PIPE FITTING	SINGLE LINE	DOUBLE LINE
CAP		
PLUG		
UNION		
COUPLING		
45° ELBOW		
90° ELBOW		
90° LONG RAD ELBOW		
45° LATERAL		
90° BASE ELBOW		
TEE		
CROSS		
TAPER REDUCER (CONCENTRIC)		
TAPER REDUCER (ECCENTRIC)		
RETURN BEND		
DOUBL BRANCH		
SIDE OUTLET		
GATE VALVE		
GLOBE VALVE		
CHECK VALVE		

Fig.1.1.1 symbol of pipe fitting

A) ABBREVIATIONS

WC- Water Close

BT - Bath Tub

D- Dryer

BD- Bidet

AV- Air Vent

UR - Urinal

CO- Clean Out

S- Sink

DF - Drinking Fountain

KS- Kitchen Sink

FL- Flow line

SH- Shower

RCP- Reinforced Concert Pipe

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FD- Floor Drain	D- Roof Drain
HB- Hose Bib	SOV- Shut off Valve
HWB- Hand Wash Basin	V- Vent
CW- Cold Water	VS- Vent Stack
HW- Hot Water	VTR- Vent through Roof
WH- Water Heater	WS- Waste Stack
MH- Man Hole	W - Washer
ST - Septic Tank	YD- Yard Drain
B- Boiler	HWC _Hot Water Cylinder

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.

2.1. (Single line (Diagrammatic) lay out

2. This is used on small scale drawings such as architectural plans, plant layouts etc, or on sketches.
3. - All fittings & run of pipes are shown by a single line regardless of the pipe diameter.

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4. - OR- these drawings simplify the creation of piping drawings by representing the center lines of pipes as thick solid lines
5. - Also symbols used to represent various components and drawn as thick lines.

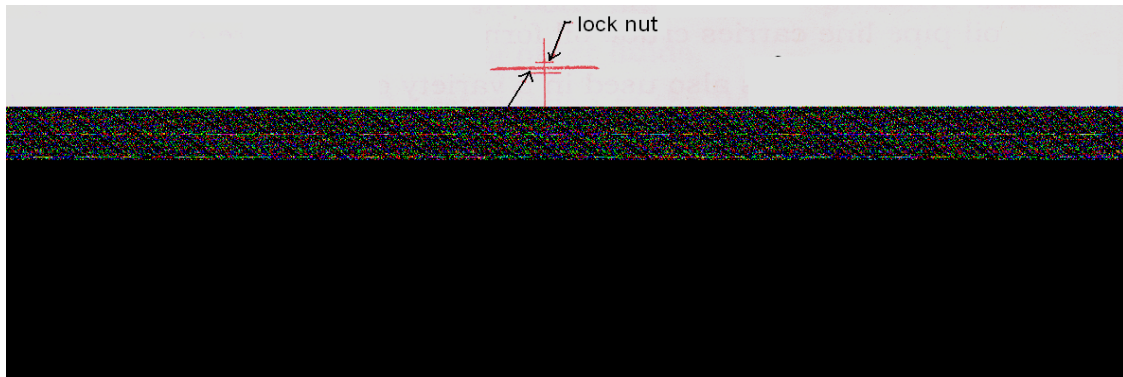
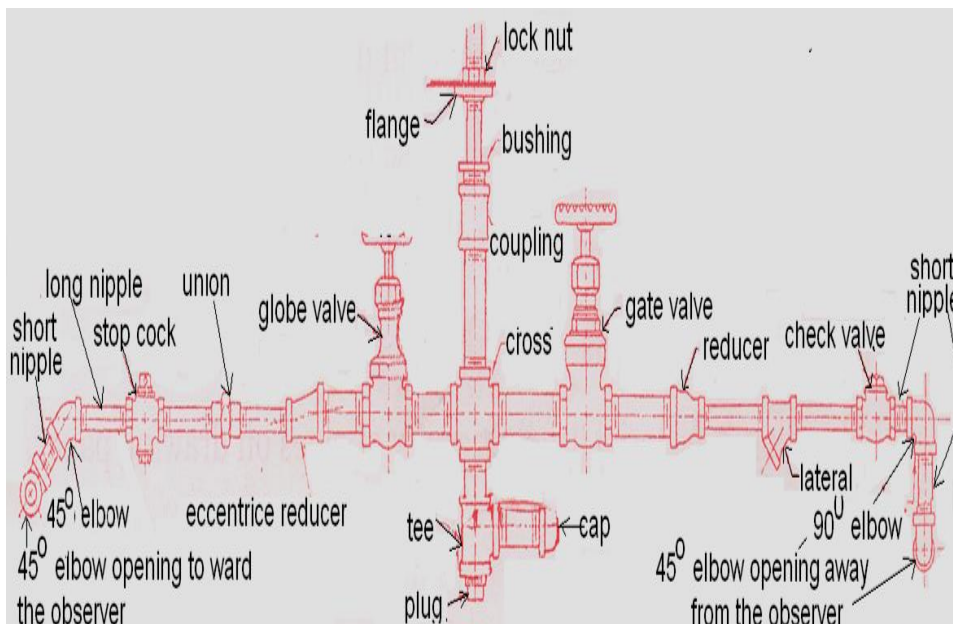


Fig 1.1.2 Double line (scale layout)

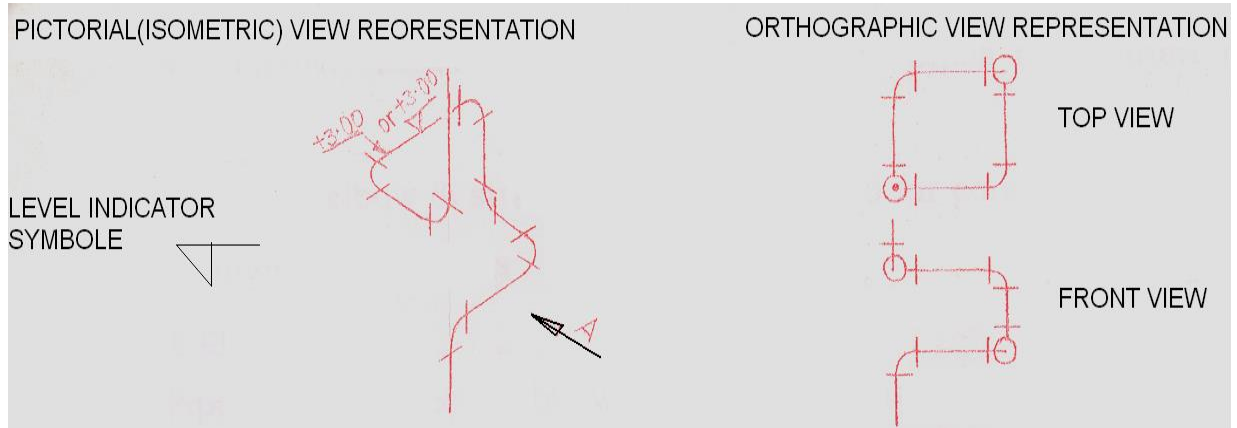
6. - This is used principally for large pipes as in power plant & boiler work where lengths are critical & pipe is not cut. OR- represents pipes as two parallel solid black lines.
7. - This drawing takes more time but is much more realistic looking than single line drawing.



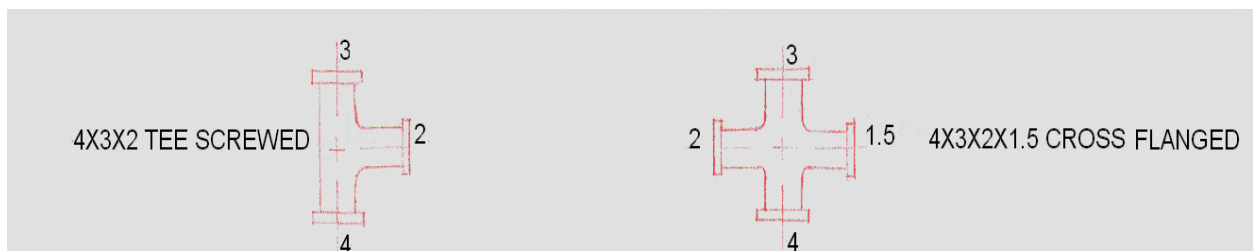
8. - Double line drawings are us piping systems illustration & presentation drawings.
9. - Any type of pipe drawing [single line or double line] may be made as multiview, axonometric & oblique projection.

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10. - 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.]



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



1.2 Defining **OH&S** requirements.

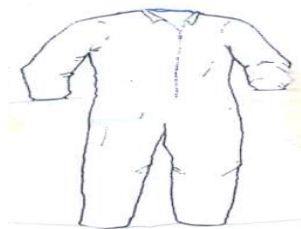
Occupational Health Requirements

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:

- A. Helmets should be worn especially in areas where there is likelihood of objects falling from roofs or multistory building.
- B. Goggles or face shields should be worn during drilling, chiseling or grinding operation on metal, stone, and concrete. These operations produce dust and flying chips which could be injurious to eye.
- C. 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



Over all clothe

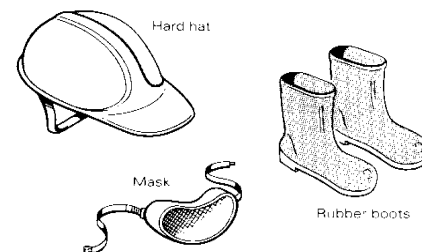


Figure 1.1 Protective clothing.

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1.2.1 PERSONAL SAFETY AND FIRST AID

-Accident will happen on building site, but developing the skills that you need to do your work safely can reduce the number.

- People disregarding the recommended procedure generally cause for accidents.
- While performing an activity you should concentrate on your work.

FIRST AID

- A building site or workshop should have a first aid box, which at least contains the following:-

- Plasters
- Bandages
- Ointment
- Disinfectant

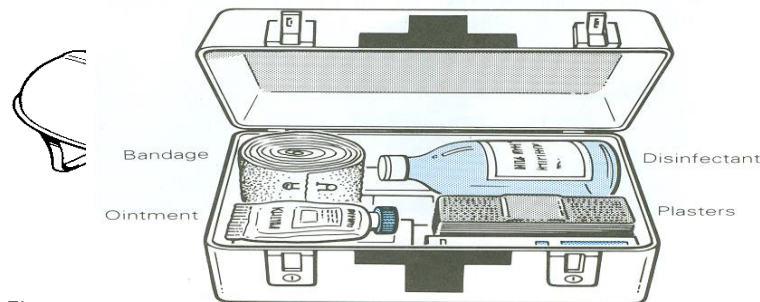


Figure 1.2

Figure 1.2 First aid kit

1.3 SAFETY PREVENTATION ON HAND TOOLS AND EQUIPMENT

-Most accidents with tools are caused by workers striking themselves or other workers; through the use of defective tools, or through misuse of tools.

- The damaged tools and equipment must be repaired immediately or taken out of service.

1.4 SAFETY ON WORKING AREA

-A site may have excavations or holes due to this if shallow excavations are not protected then they should be surrounded by excavated material.

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- Deep excavations must be surrounded by barriers.

Assessment Questions

1. What is the advantage of knowing personal safety?
2. Why safety for hand tools and equipment is required?
3. Why safety is needed for working area?
4. Write the necessary things that should be in first aid kit.

Care and proper order supports the installation process, and avoid accidents!

What does an accident?

Personally: Consequences of the accident may: -

- For short times
OR
- Permanently

In worst case

Worries for the
Family



- Permanent pain
OR
- Handicap

- Loss of salary so that
financial deficiency
for medical treatment
& other expenses

For the company and society: Consequences of the accident may: -

- Reduction of public
health and public
wealth

- Damage of goods &
company's properties



- Affects activities
and progress of the
construction

Loss of working time
and money

Basic safety signs for personal protection

Behavior and rules to avoid accidents

- ❖ Keep Tools, Materials, Equipment's, etc., in proper way at working area and keep them all neat/tidy/.
- ❖ Wear tight clothes during work
- ❖ Wear safety boots
- ❖ Wear Helmet
- ❖ Do not stop under lifted loads
- ❖ Use only proper and safe tools
- ❖ Report safety deficiencies immediately
- ❖ Obey safety signs and signals
- ❖ Do not drink alcohol at work

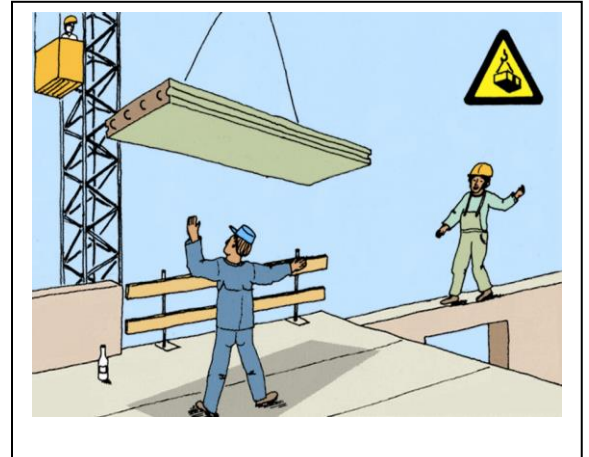


Fig. 4

In addition: -

- ❖ Never stop under lifted loads
- ❖ Use all safety measures
- ❖ Do not drink Alcohol
- ❖ Do not walk on top tie beams without safety protections or guard rails

Safety measures to be taken whenever using Scaffolds and ladders

Scaffolds and ladders are very essential structures in construction and they are commonly used as an access and working places when the height of work extends beyond the hand range of the working people.

But, Scaffolds and ladders may cause an accident if they are misused or erected improperly; so that they must have tight stand, be anchored against shifting or sliding. In addition sufficient protecting rails or guards should provide and braced properly.

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Scaffolds must bear the load of materials, tools and working people safely. In order to protect the people against falling down a triple side protection is necessary. (See Fig. 5 above).

If the height of work exceeds 2m, a three-part side protection and anchoring is necessary. The proper side protection consists of barrier handle, intermediate barrier and footboard. The footboard should sufficiently protect materials and tools from falling down.

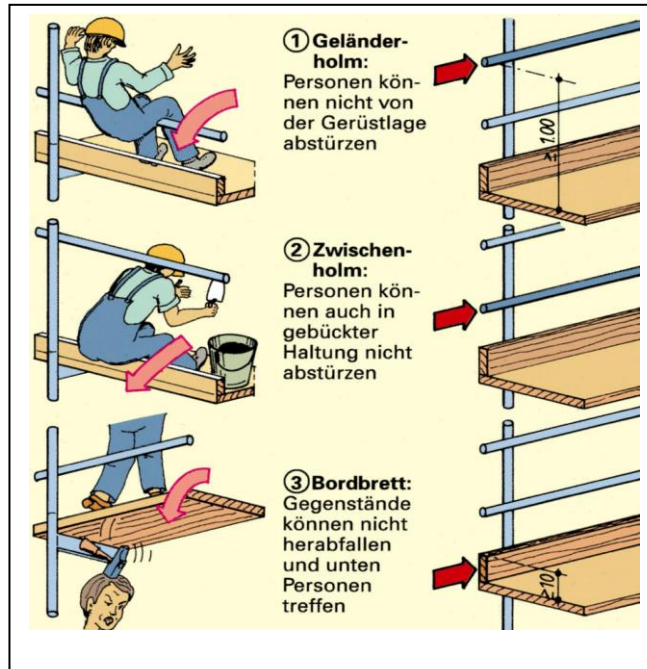


Fig.5

Working with Ladders

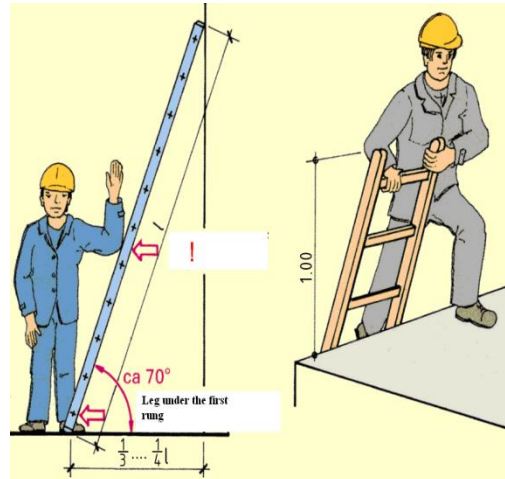
Ladder is very important measures in construction to serves as an access & to reach higher or lower work points. But it is also a cause of accident for a very frequent reason when it is misused, that is, can slip away if it is improperly placed; therefore it is necessary to find a stable and secure stand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

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(See Fig.6)

The top barrier -
handle protects
People from
falling down from

While workers are
performing
different tasks on
the scaffolds, in
different position,
the intermediate
barrier protects



Footboard
prevents tools
from falling
down.

The “ten commandments” in using Scaffolding:

1. Check scaffolding for structural stability.
2. Only stand over on scaffolds that have side protection or guard rails, (when exceeds 2m in height).
3. Do not use scaffolds if you are not free from feeling giddiness/ vertigo.
4. Leave the scaffold immediately when you feel unsafe.
5. While working on scaffolds be concentrated and avoid hastiness.
6. Walk slowly on scaffolds. Do not run in any case.
7. Do not allow unnecessary loads on scaffolding /avoid over loading of materials, tools etc.
8. Use a ladder to climb from one floor to another. Never use the winch for transporting people.
9. No alcohol drinks whenever using ladders and working on scaffolds.
10. Always be aware that there could be an accident

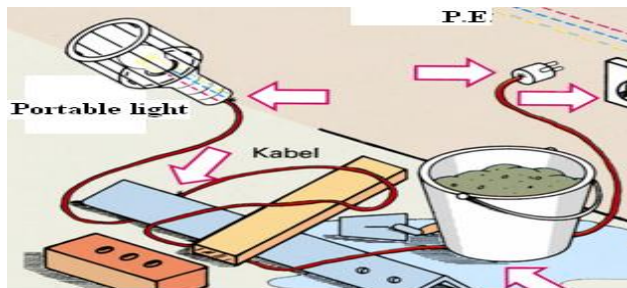
19.1.1. Regulatory requirements.

Safety measures to be taken whenever using Electrical Equipment

In every site there are a lot of electrical hand tools and machines employed and in use. The purpose of every electrical tool is to ease the work, to accelerate, safe time, ease the work

process, and to attain a better quality of work. The most common are drilling machine, concrete mixer, circular saw, lamps, extensions cable, cutting machines, electrical vibrators, but when the tools, machines and distribution board are not in safe condition, i.e., if they are miss handled and installed improperly Fig. 7, they are source of hazard and accidents to anybody. A broken cable, for instance, exposed cable wires connected to body of a machine under power, and if someone touches the machine, it will give a heavy electrical shock or accident can possibly exist.

Similarly, human body conducts a current, if there is a direct contact between his body and any materials of good conductors with electrical power, the person becomes part of the circuit and the current starts to flow through his body. Starting from a current of 0.05 Ampere the power can even cause of death.



As illustrated in Fig. 7 an inappropriate use of a hand lamp and misaligned or confusing cable lining is cause for danger. If the cable is broken by any means, and if somebody touches the bucket, trowel or iron bar or stops on the floating water, he will suffer a heavy electrical shock and may cause of death.

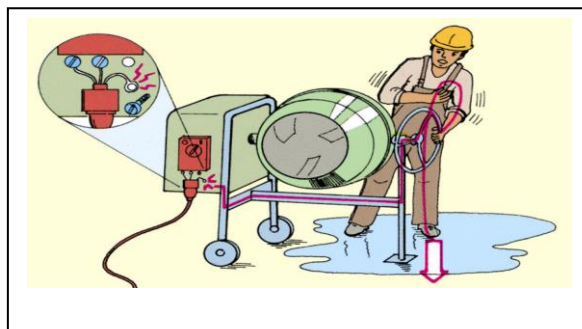


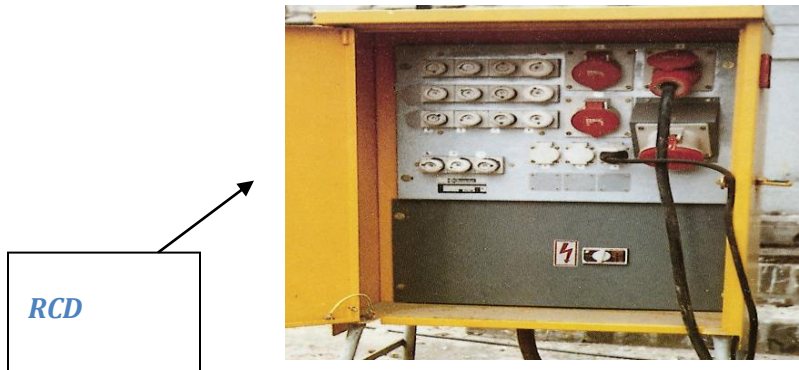
Fig. 8

As shown in Figure 8, the connecting cable of the mixer is broken and sets the machine still under power. The man who possibly touches the mixer and stands over the floating water is a

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good conductor for the current passing through the cable. The power goes through his body may cause the person to die.

Other cause for electrical accidents and measures to be taken



Accidents can be avoided, when the distribution board is connected to the main board according to the safety rules. The most important thing is the RCD (*Residual Current Device*) cuts the power off immediately when a current occurs in the circuit. It is therefore very important to safe lives on site.

The following has to be kept that:-

- Electrical tools and equipment must be in safe condition
- Electrical tools and equipment must be connected to the main board
- The RCD must be checked every day
- Do not use broken tools
- Flexible cables must be protected at exposed points (lifted, covered)
- Lamps should be protected from rain.

An RCD at the distribution board safes lives

1.3 Installing water services workplace environment.

Introduction

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In order to provide the water supply system which allows him to know correct drawings and specification the process required efficiently and effectively and economically, the installation should organize in proper manner.

A proper building Site has to be organized according to the following measures.

- ❖ Safety precautions have to be followed
- ❖ Economical aspects has to be taken into account
- ❖ Environmental protection has to be considered
- ❖ Should ensure that adequate the adequate specification and right diameter
- ❖ Should be checked adequate tools, equipment's and other auxiliary tools are on site.

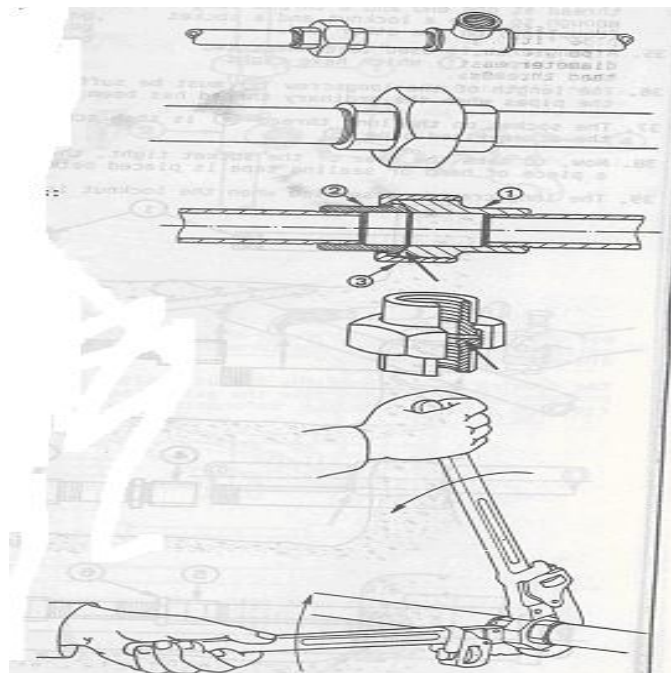


Fig.1.1 water supply devices

The following measures should to be taken to organize a installation of water supply system.

- Floor and basement plan which shows the main, riser, distribution pipe, etc.

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- Master plot plan
- Drawing and flow diagram of the pumping plant, tanks, meter box and other equipment.
- Assembly drawings
- Flow, pressure and temperature calculations
- Specification of equipment and mater

1.5 Identifying *Quality assurance* requirements.

Water quality refers to the

- ✓ Chemical
- ✓ Physical
- ✓ biological, and
- ✓ Radiological characteristics of water the most common standard used to asses water quality related to the health of ecosystem safety of human contact and drinking water.

The acceptable acidity level of potable water is in general water with PH lower than 7is consider acids and greater than 7 is consider as basic . the normal range for ph in surface water system 6.5 to 8.5 and the PH range for ground water system is between 6 to 8.5

1.6 Tasks are planned and sequencing of task in conjunction.

1.7 *Setting out Tools and equipment.*

1.8 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 labor.

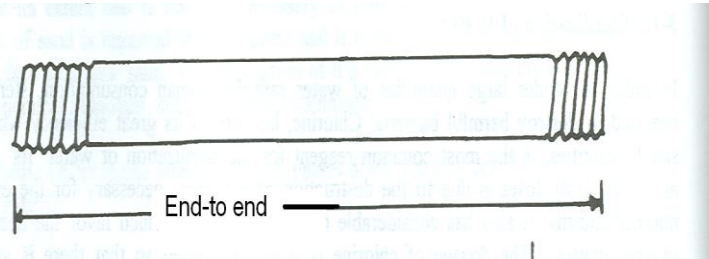
We have three methods to measure pipes, they are

END TO END MEASUREMENT

- It is the measurement of a pipe without any fittings.

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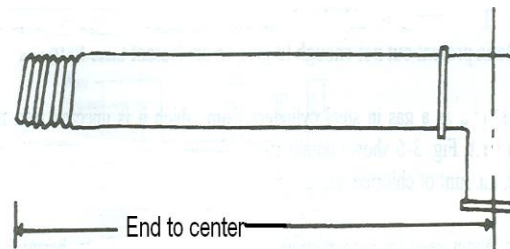
- It is also known as installation lengths
- It is made by tightening a fitting on the threaded end of a pipe, placing the end of the rule exactly at the end.



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.

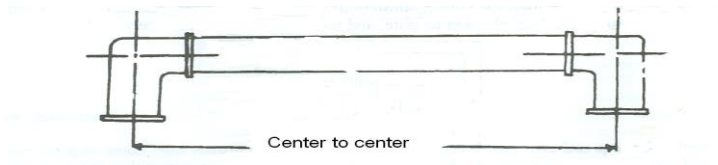
-It is also known as installation lengths, and made by tightening a fitting on the threaded end of a pipe, placing the end of the rule exactly at the center of the fitting measuring along the pipe and making the proper distance.



CENTER TO CENTER MEASUREMENT

-It is a distance between the centers of two fitting in a pipeline.

-It is also called construction lengths.



1.9 Preparing Work areas

- 2 All excess material should not be wasted, but used or safely removed from site according to appropriate legislation.
- 3 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.
- 4 -Control access to storage areas to minimize risk of theft or damage.
- 5 .-Store any materials away from sensitive locations in fenced off areas.
- 6 -Label all waste storage and skips, detailing the type of waste.
- 7 -Employ a just-in-time policy to deliver materials in order to reduce the storage time on site.
- 8 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.
- 9 Keep work area free from un necessary item, that cause slipping hazards

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Self-Check 1	Written Test
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Note: Satisfactory rating - 3 and 5 points

Unsatisfactory - below 3 and 5 points

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

1. Define the word water supply plan.
2. Mention n three types of pipe measurement.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. -----

2. -----

Operation Sheet: plan and prepare

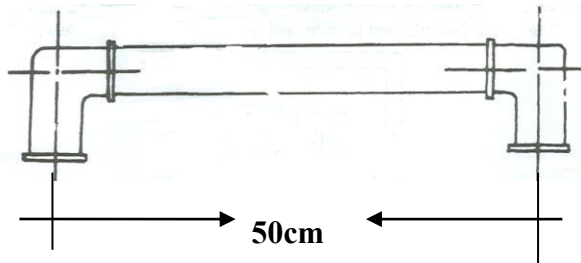
Purpose: To prepare pipe measurement

1. Plan/working drawing interpretation
2. Identifying and applying necessary requirements

1. Equipment Tools And Materials:

- a. pipe
- b. hack saw
- c. vice
- d. die stock
- e. meter

Given drawing



Conditions or Situations for the Operations: - Before starting you have to know:-

Procedure:

1. Identify type of measurement.
2. take correct measurement

Precautions

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1. wear personal protective clothes

Quality Criteria

- ❖ The pipe length must be as perfect dimension

Lap test: plan and prepare

Unit of competency: install and maintain water supply component

Reading:-TTLM

Objectives at the end of this session trainees will be able

- ❖ Identifying types of measurement
- ❖ Purpose and advantages of measurement
- ❖ Aspects of taking measurement

Laboratory work (It may include the following)

1. Identifying types of pipe
2. Purpose and advantages measurement
3. Aspects of taking correct measure
4. Provide instructions for completing the skills phase of the job
5. Tools, instruments and equipment required
6. Required measurement of complete job
7. Step by step procedure
8. Dimensions and/or specifications
9. Safety precautions, supply conditions, or other special requirements

Evaluation criteria

1. Practical work demonstration
2. Written test

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INSTALLATION CONSTRUCTION WORK LEVEL-I

Learning Guide #02

Unit of Competence: Install Service and Maintaining Water Supply System and Components

Module Title Installing Service and Maintaining Water Supply System and Components

LG Code: CON ICW1 M17L02, LG 02 0910

TTLM Code: CON ICW1 TTLM17 0519

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2.1 Calculating Quantity of Materials

Introduction to Estimating Required Materials

Objective: - After completing the learning element the trainee will be able to calculate quantity of material required for Installation of water supply.

An estimate is probable cost of a building before construction. 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 calculate materials required for making water supply. The materials needed depend on the diameter of pipes given on the data.

2.2 Identifying type of materials as standard.

2.3.1 Types of Plumbing materials Pipes

Types of pipes

1. Cast iron pipe and fittings for water
2. Lead pipe
3. Galvanized steel pipe (GSP)
4. Brass pipe
5. Copper pipe
6. Plastic pipe
7. Cement pipe and concrete pipe

8. PVC pipe fittings

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 storey high do not specify the use of cast iron pipe because of vibrations which causes 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 sulphuric 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 material 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 2.2.1 GALVANIZED STEEL PIPE DATA IN MILLIMETER (mm)

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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 2.2.1 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 of 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.

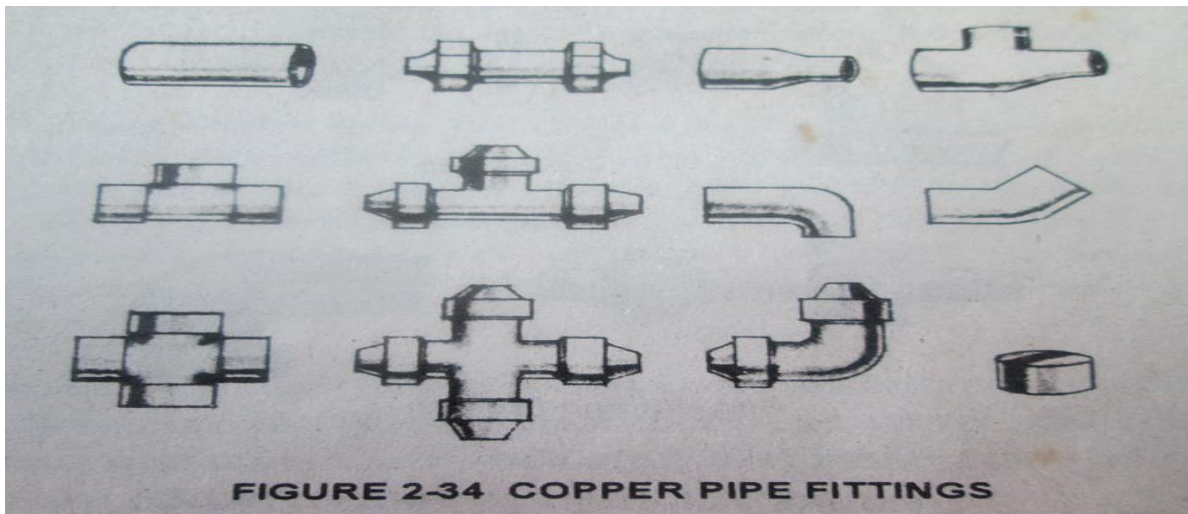
Special Features of Copper Pipes

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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 nor 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 2-32 COPPER PIPE TECHNICAL DIMENSIONS IN MILLIMETER (mm)

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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

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.

Types of Plastic Synthetic Pipes

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)

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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:

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.

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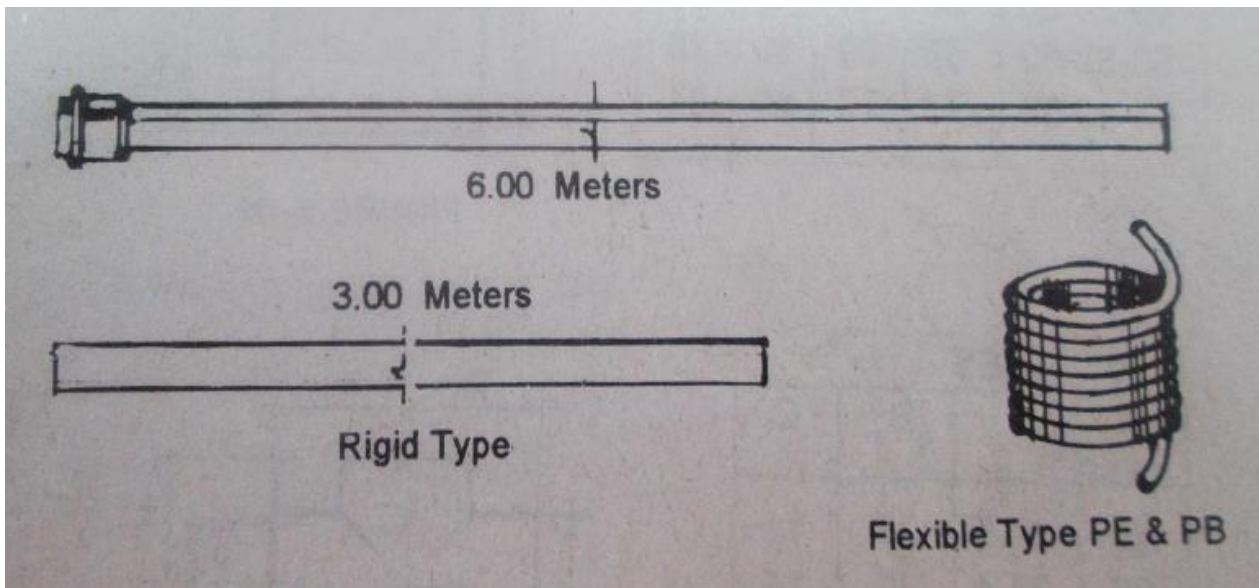


Table 4. AMOUNT OF SCREWED PIPE INTO FITTING

Pipe Diameter		Standard fitting	Drainage Fitting
mm	inch	(mm)	(mm)
12	1/2	12	-
20	3/4	12	-
25	1	16	-
32	1 1/4	16	16
38	1 1/2	16	16
50	2	20	16
75	3	-	22
100	4	-	25

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 5, the inside diameter could be easily known.

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

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

C. Copper Pipes

Copper Pipes are classified into two types:

1. The Rigid type
2. The Flexible type

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

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

2.3 Identifying *Materials /equipment*

2.3.1 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

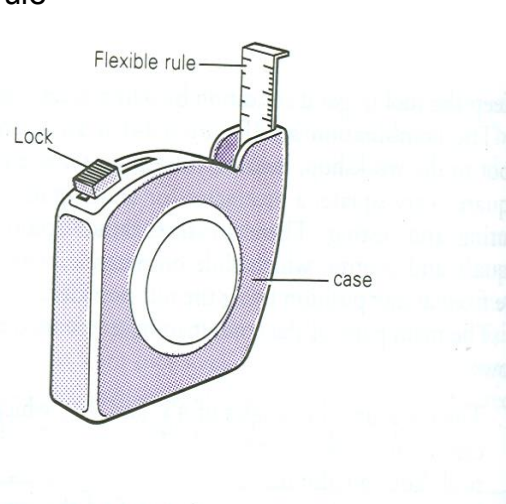
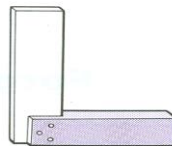


Fig 2.3 1 a) tape rule

B) Try square



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Figure 2.3.2 b) Try square

C) Scribes

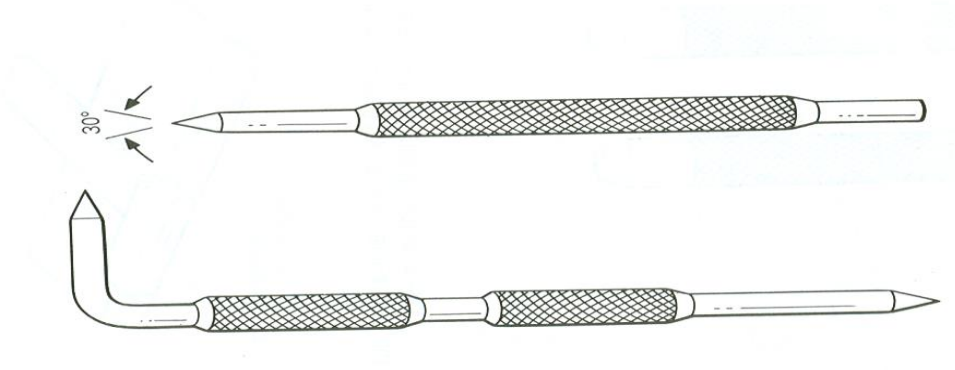


Figure 2.3.3c) Scribes

D) Steel rule



Figure 2.3.4 d) Steel rule

E) Caliper

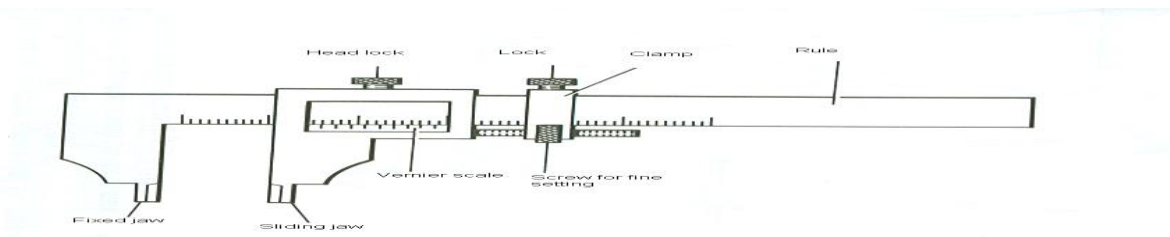


Figure 2.3.5 e) Caliper

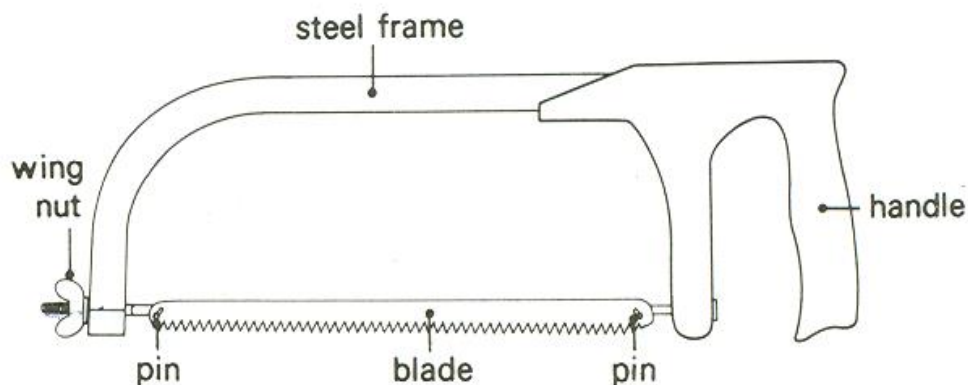
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2.3.2 Cutting, filing and Reaming Tools

-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



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Figure 2.3 2 a) Hacksaw

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

-It performs the job much easier than a hack saw.

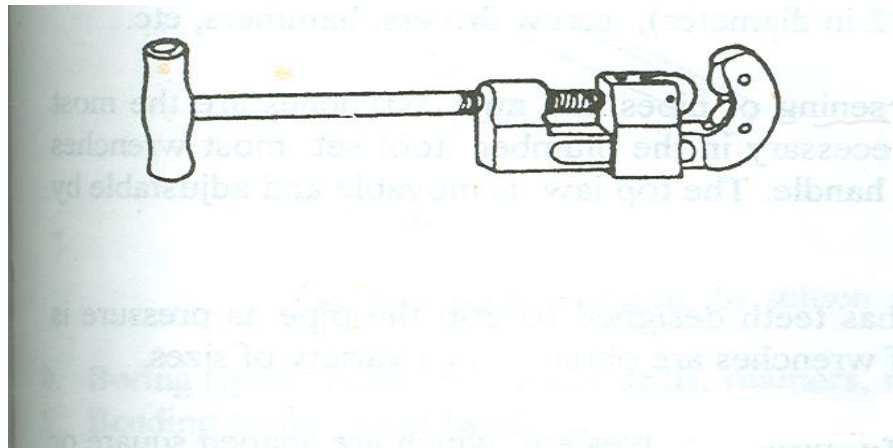


Figure 2.3.2 b) Pipe cutter

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

- **Reamer**

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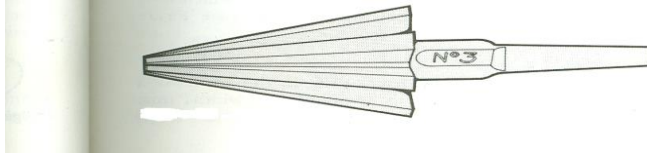


Figure 2.3 .3 c) Reamer

D) Half round file



Figure 2.3.4d) 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

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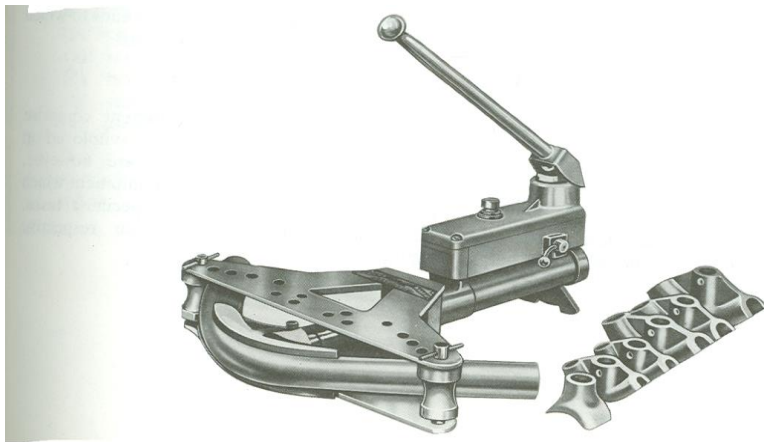


Figure 2.3.4 a) Hydraulic pipe bender

B) Bending springs

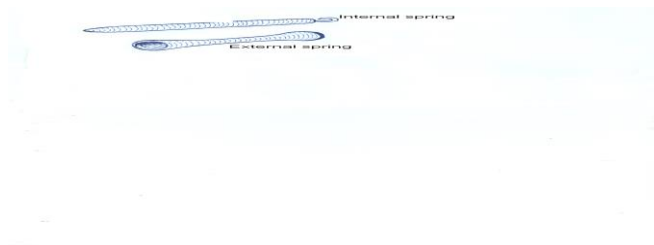


Figure 2.3 4d)Bending springs

C) Manual Pipe bender

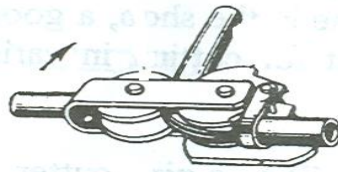


Figure2.3.4 manual Pipe bender

D)Bending jig



Figure2.3.4 d) bending jig

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5) Threading and drilling tools:

- are used to make threads and drill, they are:

A) Adjustable threading tools

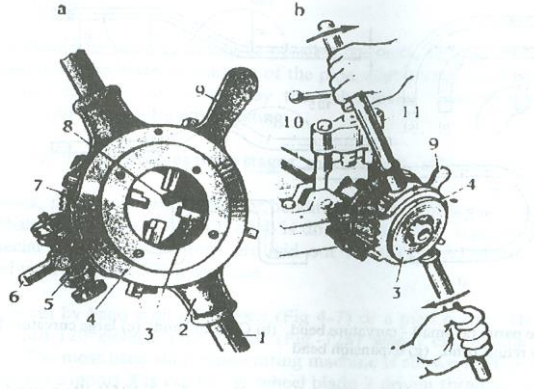


Figure 2.3.5a) Adjustable threading tool

B) Ratchet

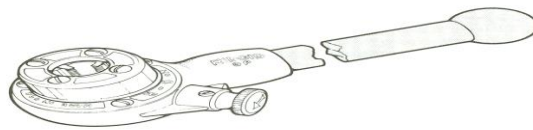


Figure 2.3.5c) Ratchet

Tap

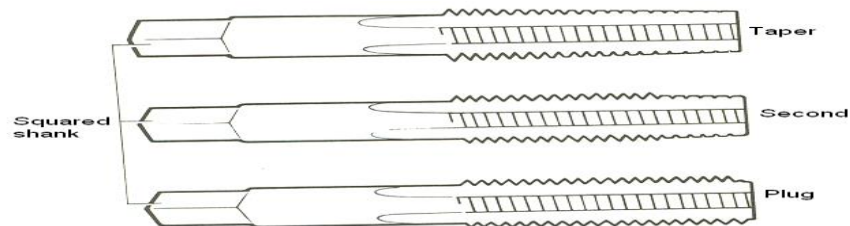


Figure 2.3.5 e)Tap

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6) Drilling tools

A) Drill press

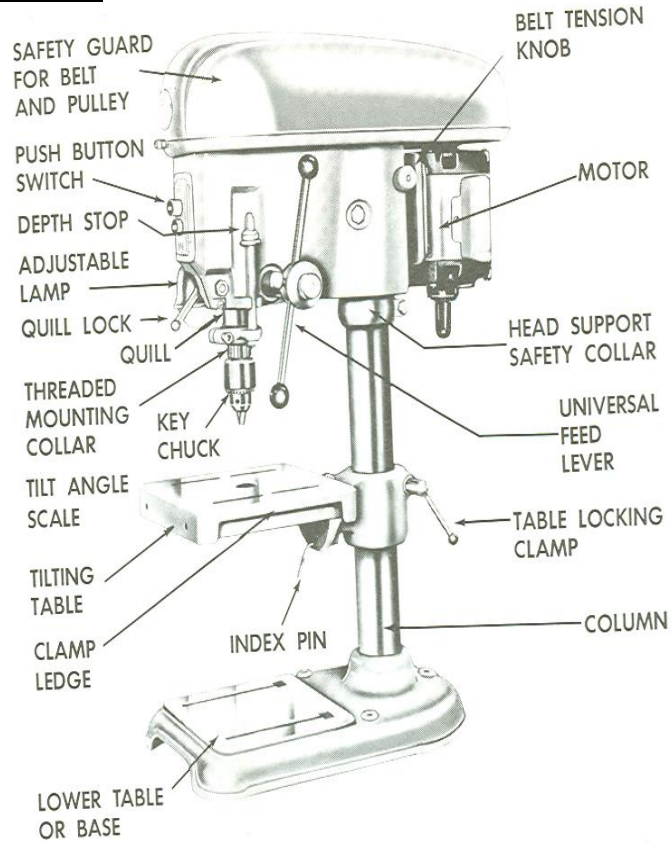


Figure 2.3.6a) Drill press

B) Drill bit

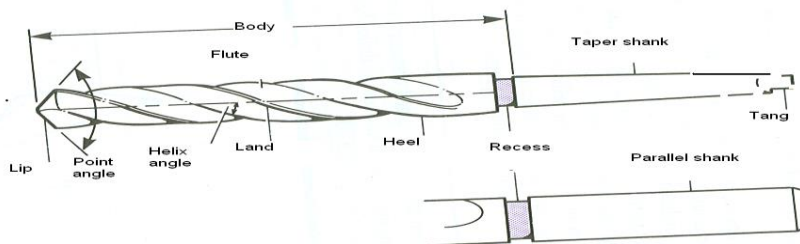


Figure 2.3.6 b) Drill bit

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C) **Portable electric drill**



Figure 2.36 c) Portable electric drill

D) **Hand drill**

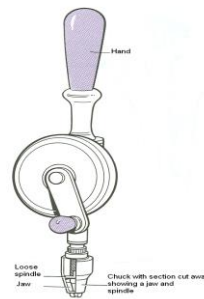


Figure 2.3.6 d) Hand drill

- **Identification of different kinds of lubrication**

Lubrication: - is primarily concerned with reducing the frictional resistance occurring at the surfaces of the solids, when one solid moved relative to the other. Anything introduced on or between two solids, to accomplish a reduction in friction or to change the frictional properties is called a lubricant.

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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 inaccuracies.

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

8.Holding and fastening:

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

They are;-

- **Clamps**

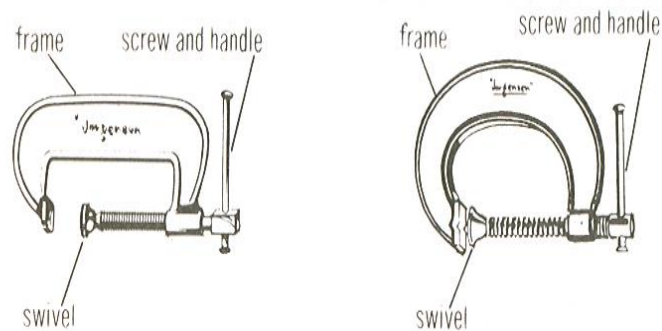


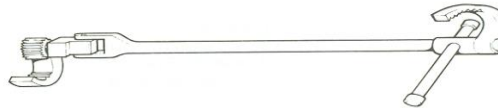
Figure2.3.8 a) j Clamp

- **Wrenches**

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Self grip wrench



Adjustable wrench

Figure 2.3.8b) Wrenches

C) Screw drivers

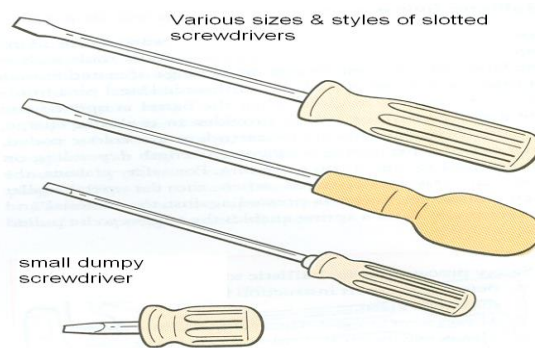


Figure 1.3.8c) Screw drivers

9) 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:

- Spirit level
- Plumb-bob
- String

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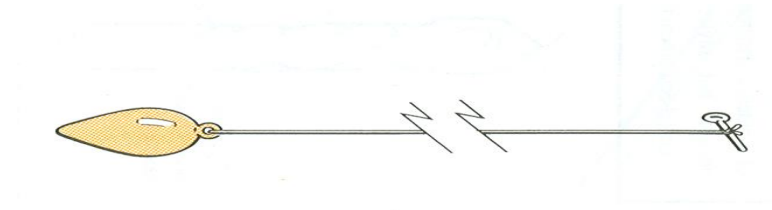


Fig 2.3.9a) Plumb bob

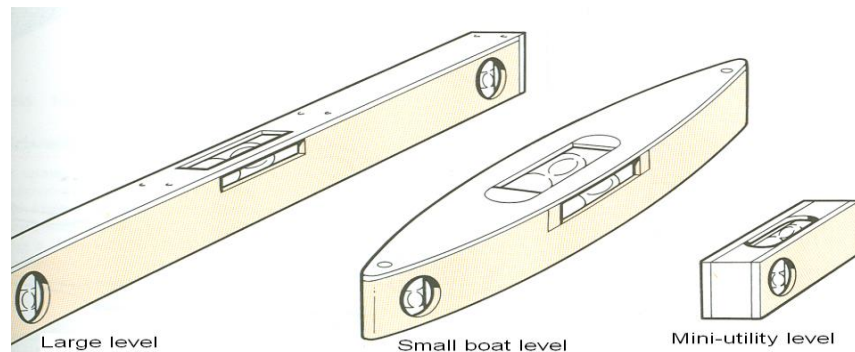


Fig 2.3.9 b) Spirit level

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



Fig 2.3.10 a) Wire brush

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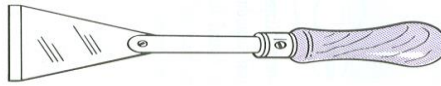


Fig 2.3.10b) Scraper



Fig.2.3.10 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.

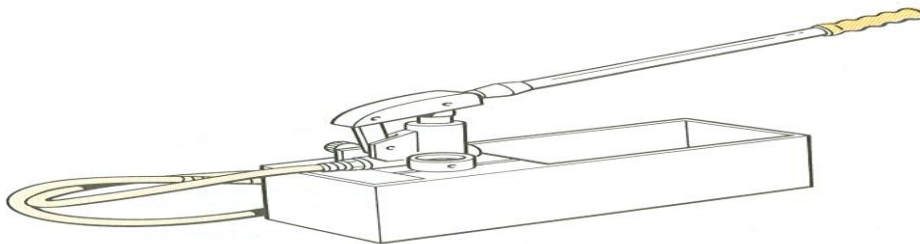


Figure 2.3.9 a) pressure testing (proving pump)

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2.3.3 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.

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 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

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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

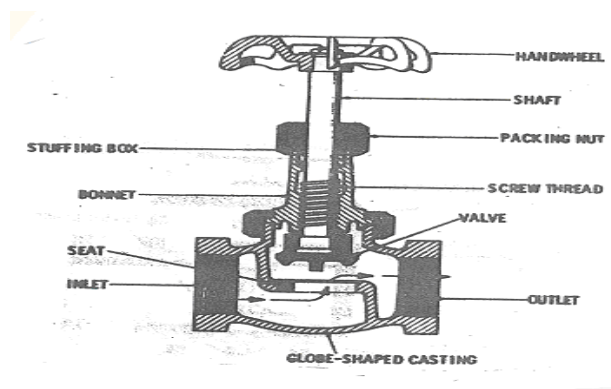


Fig2.3.1a)globe valve

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

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Fig 2.3.2 b) gate valve

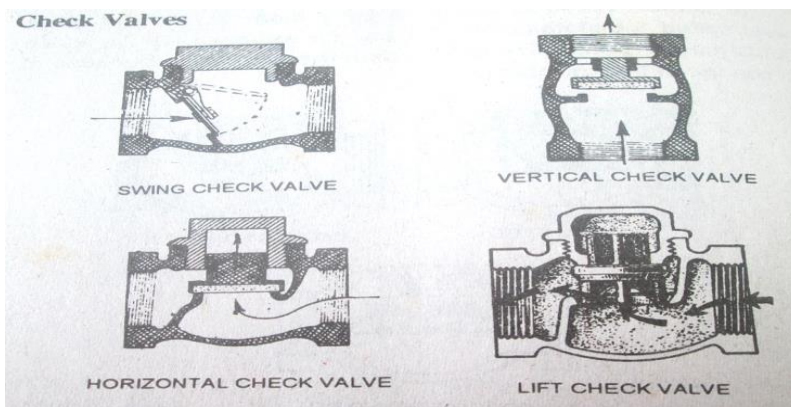
The Check Valve – The main function of check valve is to prevent reversal of flow in the line. It is principally used in industrial pipings.

Check Valves has Two Classifications namely:

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



Fig 2.3.3 c.1)check valve



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Fig 2.3.4.c.2) Check valve

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

The Angle Valve – operates in the same manner as the globe valve available in similar range of disc and seat design. Angle valve is used in 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 referred to as retention valve.

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

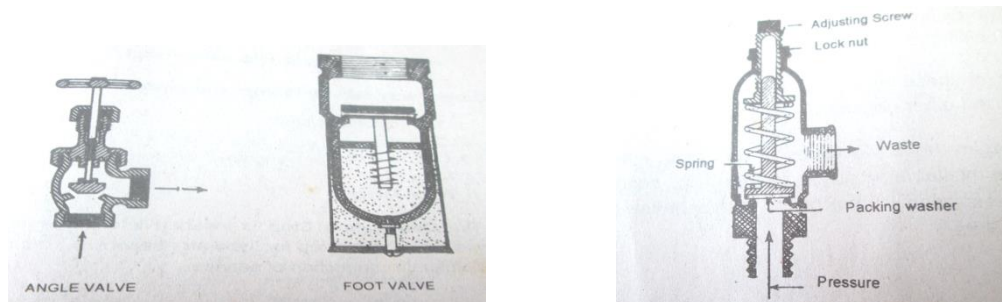


Fig2.3.4.d)safety valve

- **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



Fig 2.3.4e)Ball valve

Other Water Service Fittings and Devices

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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 disconnection of service.

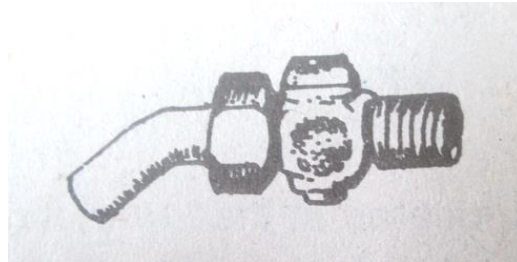


Fig 2.3.4.a) corporation stop

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.

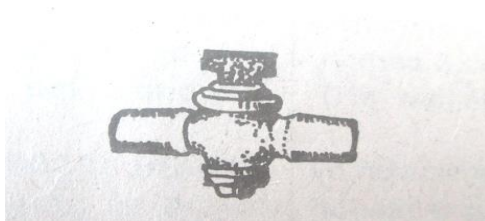


Fig 2.3.4 b) Crup stop

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

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

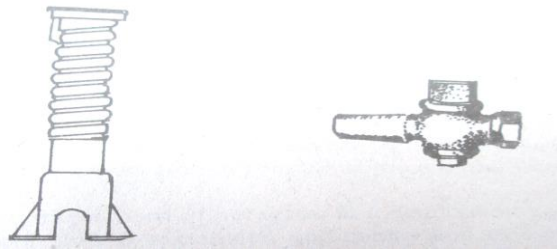


Fig2.3.4f) Water meter

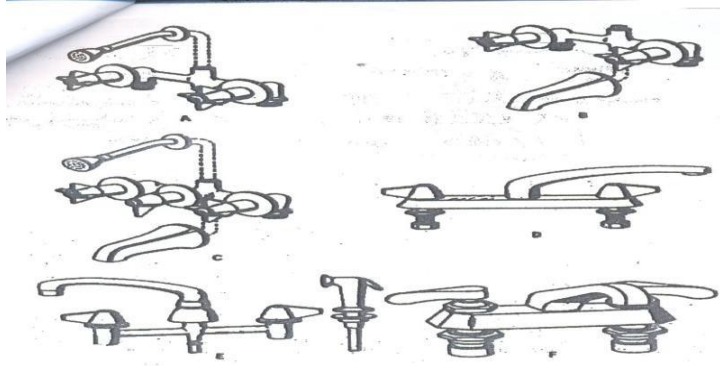
Taps

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. Figure - 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 incorporate 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. Figure ___ shows 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.



Plastic pipe fitting



Elbo90°



45° Elbow

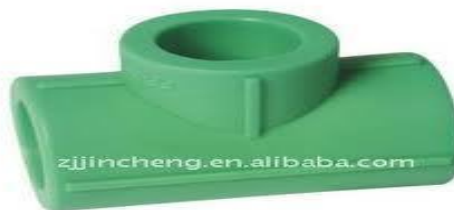


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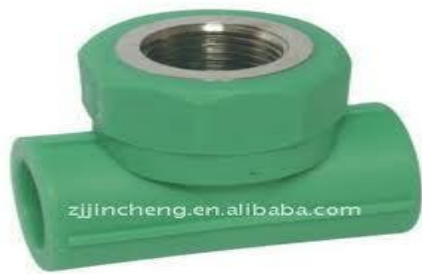
Elbow



Male elbow



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Male tee



Female tee



Union



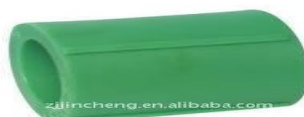
cross



plug



Male adapter



Coupling



reducer

HDPE PIPE FITTINGS



Elbow



TEE connector



CONNECTER

Socket

2.4 orderings/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

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Self check	Written test
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Instructions: Write all your answers on the provided answer sheet..

1. Identify the type of cutting tools.
2. Mention n two type of bending. Equipment

Note: Satisfactory rating - 3 and 5 points

Unsatisfactory - below 3 and 5 points

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

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1-----

2-----

INSTALLATION CONSTRUCTION WORK LEVEL-I

Learning Guide #03

Unit of Competence: Install Service and Maintaining Water Supply System and Components

Module Title Installing Service and Maintaining Water Supply System and Components

LG Code: CON ICW1 M17L03, LG 03 0910

TTLM Code: CON ICW1 TTLM17 0519

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3.1 Setting out Pipe lines and fixture.

3.1 Setting out Pipe lines and fixture.

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 needs to be clear of rocks and boulders in the excavation area.

Site clearance is done by a combination of manual and mechanical methods.

The points to be considered for the sitting out of piping system

- Work should begin after official permission has been given by the local authority
- The working drawing and specification should contain all the information that the plumber needs to complete the setting out.
- The site should be prepared before the work starts

The tools and materials should be prepared before the work starts

3.2 excavating Trenches as requirements

3.3 Checking Installation of supports and clips.

3.3.1 Cold Water Supply Installation

3.3.1.2 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.

3.3.1.2 Work Tests

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(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.

3.4 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.

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- **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 tanks** – 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

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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 is 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 before hand the basic rules governing the threading operations enumerated as follows:

1. Never hold threaded parts with a wrench. It will surely damage the thread.

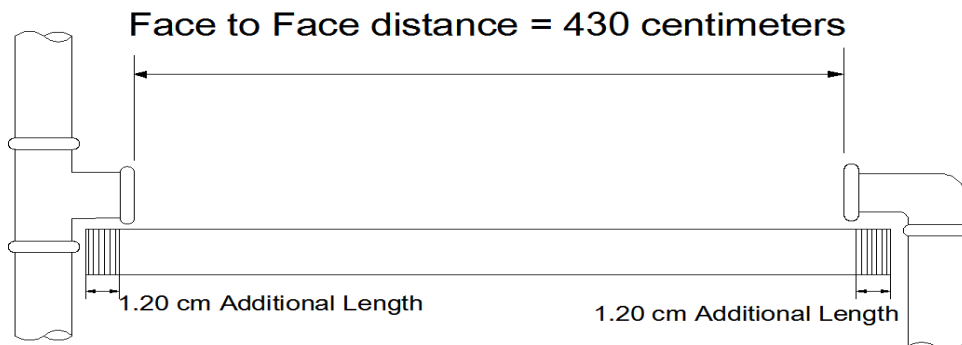
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2. Put two nuts on them, lock tightly then continue the threading operations.
3. During the process of threading, apply motor oil regularly to protect both the threader and the thread of the pipe.
4. Threads must be slightly tapered so that the turning 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 ready made 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 \varnothing 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 \varnothing pipe is 12 mm or 1.20 centimeters.

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$$1.20\text{cm} \times 2 \text{ ends} = 2.40 \text{ cm}$$

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

$$430 \text{ cm} + 2.40 \text{ cm} = 432.40 \text{ cm}$$

Plastic Pipes

The simplest method of joining plastic pipe is by cementing called Solvent Welding. Solvent welding takes only about $\frac{1}{4}$ 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.

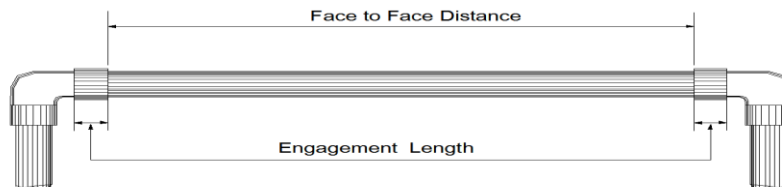


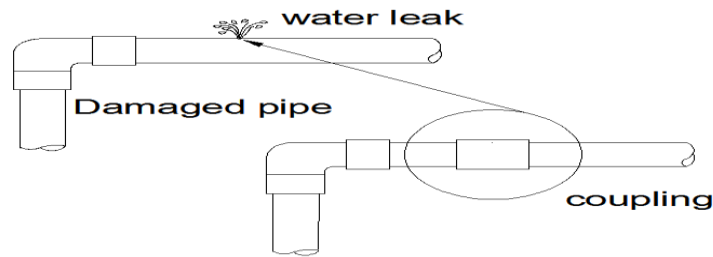
Figure 2-G

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 Keton (MEK) or simply Acetone. However,

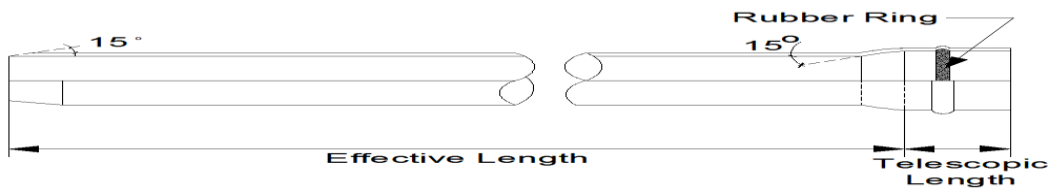
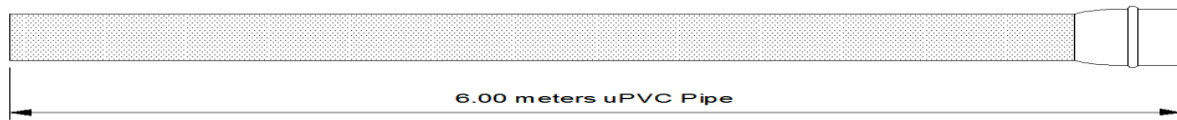
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depending upon the type of plastic being used, the are solvent which need no cleaning.

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 $\frac{1}{2}$ 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 advance from 15 to 20 hours to permit use of the line.



Eg.



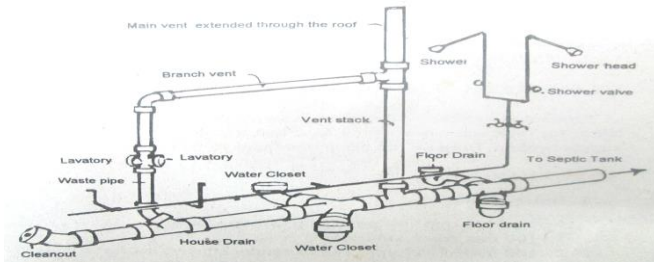


Fig 3.4 isometric lay out

3.5 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.

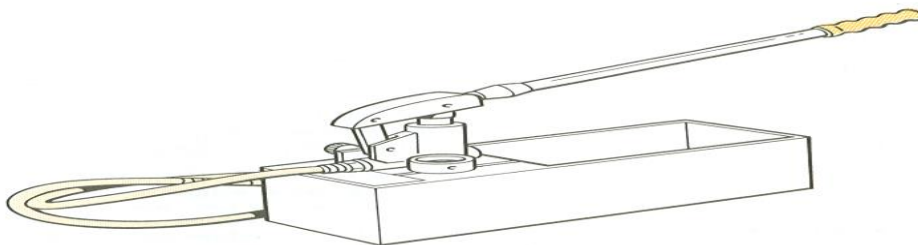


Figure3.3 a) Proving pump

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Self-Check #3	Written Test
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Note: Satisfactory rating - 3 and 5 points

Unsatisfactory - below 3 and 5 points

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

1. The purpose of testing of pipe.

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. -----

Operation Sheet: install and test pipe functional

Purpose:

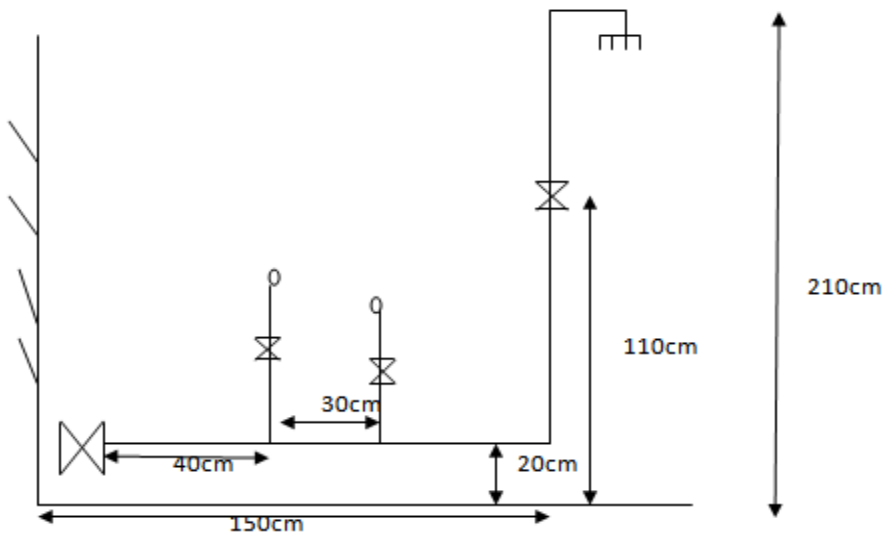
- ❖ Reading Plan and specifications
- ❖ Clearing site
- ❖ Applying OH & S
- ❖ Locating plant, tools and equipment

Equipment Tools and Materials

- ❖ Die stock
- ❖ Hack saw
- ❖ vice
- ❖ pipe
- ❖ Teflon

Conditions or situations for the Operations:

Before starting the operation you have to know about types of drawings and symbols and abbreviation.



Procedure

1. Reading Plan and specifications
2. Applying OH & S
3. Locating plant, tools and equipment

Precautions

First free from other secondary problems like depression.

Quality Criteria

- ❖ The installation system must be functional.

Lab test: -install and test the system

Unit of competency: : **Install Service and Maintaining Water Supply System and Components**

Reading:-TTLM

Objectives at the end of this session trainees will be able

- ❖ Reading Plan and specifications
- ❖ Applying OH & S
- ❖ Locating plant, tools and equipment

Lab test

- ❖ Reading Plan and specification
- ❖ Applying OH & S
- ❖ Locating plant, tools and equipment

Provide instructions for completing the skills phase of the job

- Tools, instruments and equipment required
- Required illustrations or drawings of complete job
- Step by step procedure
- Dimensions and/or specifications
- Safety precautions, sanitary conditions, or other special requirements

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Supplies and materials	Tools and instruments	Equipment
Pipe	Die stock	vice
Teflon	Hack saw	
	Meter	

Evaluation criteria

3. Practical demonstration
4. Written test

INSTALLATION CONSTRUCTION WORK LEVEL-I

Learning Guide #04

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Unit of Competence: Install Service and Maintaining Water Supply System and Components

Module Title Installing Service and Maintaining Water Supply System and Components

LG Code: CON ICW1 M17L04, LG 04 0910

TTLM Code: CON ICW1 TTLM17 0519

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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

4.1 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

4.2 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

4.3 replacing Defective *pipes and fittings*

4.4 Checking replacements of defects.

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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

4.5 Checking Joints are tightly secured.

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.

4.6 Restoring or repairing damaged areas.

4.7 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.

4.8 Observing correct usage of tools and equipment.

4.9 Using Appropriate PPE

4.9.1 Occupational Health Requirements

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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:

- A. .Helmets should be worn especially in areas where there is likelihood of objects falling from roofs or multistory building.
- B. Goggles or face shields should be worn during drilling, chiseling or grinding operation on metal, stone, and concrete. These operations produce dust and flaying chips which could be injurious to eye.
- C. 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

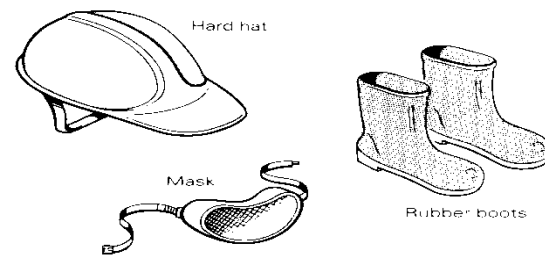


Figure 1.1 Protective clothing.

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

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

1) What is the different type of pipe defects

Answer Sheet

Score = _____
Rating: _____

Name: _____

Date: _____

Short Answer Questions

1. -----

_____.

Operation Sheet: Place, compact and vibrate the concrete

Purpose

- ❖ Identify defect perfectly
- ❖ **Decommission/repair the defecated pipe and fittings**

Equipment Tools and Materials

- ❖ Hack saw
- ❖ Die stock
- ❖ meter
- ❖ vice
- ❖ pipe
- ❖ reamer
- ❖ wrench

Conditions or Situations for the Operations

- Before starting the work you have to know about types of drawings and Purposes and symbols.

Procedure:

2. read sanitary drawing
3. identify the defecated area
4. Install /commission the defecated pipe and fittings.
5. test the installation

Precautions

- ❖ use proper material in write condition

Quality Criteria

- ❖ the installation system must be freeform defects/ linkages

Lap test: -install the pipe perfectly

Unit of competency: : **Install Service and Maintaining Water Supply System and Components**

Reading:-TTLM

Objectives at the end of this session trainees will be able

- ❖ know the right material
- ❖ installation of water supply

Laboratory work (It may include the following)

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- a. read sanitary drawing**
- b. take write dimension**
- c. install the pipe**
- d. test the installation**

Provide instructions for completing the skills phase of the job

- ❖ Tools, instruments and equipment required
- ❖ Required illustrations or drawings of complete job
- ❖ Step by step procedure
- ❖ Dimensions and/or specifications
- ❖ Safety precautions, sanitary conditions, or other special requirement

Supplies and materials	Tools and instruments	Equipment
Pipe	Hack saw	Vice
Teflon	Die stock	
	Meter	
	Wrench	
	Meter	

Evaluation criteria

- 5. Practical demonstration
- 6. Written test

INSTALLATION CONSTRUCTION WORK LEVEL-I

Learning Guide #05

Unit of Competence: Install Service and Maintaining Water Supply System and Components

Module Title Installing Service and Maintaining Water Supply System and Components

LG Code: CON ICW1 M17L05, LG 05 0910

TTLM Code: CON ICW1 TTLM17 0519

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5.1 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.

5.2 Cleaning 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.

5.3 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 easements

Self-Check 5	Written Test
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Note: Satisfactory rating - 3 and 5 points

Unsatisfactory - below 3 and 5 points

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

Score = _____

1. What type of cleaning must be done

Answer Sheet

Name: _____

Date: _____

Short Answer Questions

1. _____

Operation Sheet: Finish concrete

Purpose

- Measuring perfect length
- -install pipe fittings
- Testing the installation

Equipment Tools and Materials

- ❖ Die stock
- ❖ Hack saw
- ❖ wrench
- ❖ vice
- ❖ meter

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Conditions or situations for the operations

- ❖ Before starting the operations, you have to know

Procedure

- ❖ Measuring perfect length
- ❖ -install pipe fittings
- ❖ Testing the installation

Precautions

- ❖ use proper material in write condition

Quality Criteria

- ❖ the installation system must be freeform defects/ linkages

Lap test: -install the pipe perfectly

Unit of competency: **Install Service and Maintaining Water Supply System and Components**

Reading:-TTLM

Objectives at the end of this session trainees will be able

- ❖ know the right material
- ❖ installation of water supply

Laboratory work (It may include the following)

- e. read sanitary drawing**
- f. take write dimension**
- g. install the pipe**
- h. test the installation**

Provide instructions for completing the skills phase of the job

- ❖ Tools, instruments and equipment required
- ❖ Required illustrations or drawings of complete job
- ❖ Step by step procedure
- ❖ Dimensions and/or specifications

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- ❖ Safety precautions, sanitary conditions, or other special requirements

Supplies and materials	Tools and instruments	Equipment
Pipe	Hack saw	Vice
Teflon	Die stock	
	Meter	
	Wrench	
	Meter	

Evaluation criteria

7. Practical demonstration
8. Written test

Supplies and materials	Tools and instruments	Equipment
Cement		
Water	float	
Sand	Straight edge	
Aggregate		

Evaluation criteria

9. Practical demonstration
10. Written test

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