Plumbing installation

Level-II

Learning Guide-26

Unit of Competence: Read plans and calculate plumbing quantities

Module Title: Reading plans and calculating plumbing quantities

LG Code: EISPLI2 M07 LO2-LG-26

TTLM Code: EISPLI2 M07 TTLM 0919v1

LO2: Identify types of drawings and their functions

Instruction Sheet	Identify types of drawings and their functions LG-26

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

- Identifying types of plans and drawings in the plumbing industry
- Identifying Key functions of plumbing drawing
- Identifying Key users of drawings

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 types of plans and drawings in the plumbing industry
- Identify Key functions of plumbing drawing
- Identify Key users of drawings

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, and Sheet 3”.
4. Accomplish the “Self-check 1, Self-check t 2 and Self-check 3” respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet.
6. Do the “LAP test” (if you are ready).

Information Sheet-1	Identifying types of plans and drawings in the plumbing industry

1.1 Plumbing Plans

Plumbing plans are prepared to show how pressurized fresh water and gravity-drained wastes are routed through the building. These plans are coordinated with the other structural and architectural plans to ensure proper location, operation, and protection of the plumbing systems.

Plumbing drawings are often done in plan view and elevation views, and sometimes an isometric drawing is provided. A number of plumbing materials are used in both residential and commercial projects, such as cast iron, copper, steel, and plastic pipe. Although the materials might vary, the drawing techniques and symbols used are primarily the same in all systems.

The fire-protection system, which is considered separate from the plumbing, is usually a sprinkler system utilizing its own separate water system. This system is fed from dedicated water mains that in turn connect through piping to the individual sprinkler heads.

In the case of a fire, heat sensor devices activate these heads to open and allow the directionally controlled flow of water to the fire's source. In most buildings, these sprinkler heads are visible, and they can be located on ceilings and walls, depending on the amount of coverage needed. However, recessed sprinkler heads that have a smooth cover flush with the ceiling are available at a higher cost. The cover is dropped away when the head activates and lowers below the ceiling to spray the water.

Although interior designers do not design these sprinkler systems, it is important to recognize the location of the heads in a drawing and coordinate them with other ceiling-mounted items.

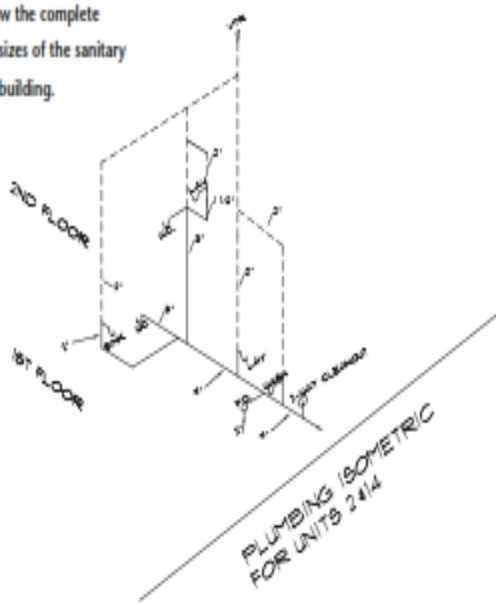
For example, the designer should consider how the individual heads will fit with the design scheme of the reflected ceiling plan, as well as check for interference with light fixtures, ceiling treatments, and other features.

1.2 Scale of Plumbing Drawings

A variety of scales may be used to draw plumbing systems, depending whether the drawings are depicted in plan views, isometrics, or enlarged details. The most common scale is 1:50 metric for residential and small commercial projects and 1:100 metric for large commercial ones. Floor plans serve as the base drawing and are turned into plumbing plans by the addition of piping, controls, and other devices. Domestic water lines and sanitary sewer lines are drawn as an overlay on the floor plans. It can be difficult to show a lot of piping details and other components that are close together in a space, such as a boiler room and other heavy water-usage equipment. In these instances, a portion of this area is drawn at a larger scale and referenced to the plans.

As most plumbing plans show only the horizontal positions of pipes and fixtures, a schematic is drawn to show the vertical elements of the system. This is often done with an isometric and is generally not drawn to scale to conserve space on the drawings.

Figure 15-12 An isometric drawing is often made to show the complete layout and piping sizes of the sanitary sewer system in a building.



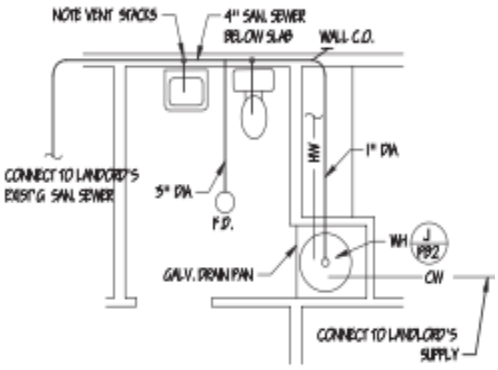


Figure 15-11 A large-scale drawing is made of this restroom to indicate pipe sizes and related information that could not be shown on a small-scale floor plan.

1.3 Drafting Standards for Plumbing Drawings

In small projects, domestic water supply and sanitary sewer systems are drawn on the same plan, as they are not often overly complicated.

Solid, dashed, and other line types are developed to distinguish between the systems. In the sewage system, the waste line is shown as well as the various required vent lines as dictated by the building codes.

Lines are drawn to depict the various sizes of piping in vertical risers and vents as well as the horizontal runs. However, a plumbing system consists of more than runs of piping. Pipe elbows, fittings, valves, traps, faucets, and numerous other items are sized to work with the piping system and must be accurately called out. In addition to adding notes to the drawings, standard symbols have been developed and are placed on the sheet to coincide with the proper item. A legend is included to accurately identify the type of pipe, and other specific elements that must be connected. A schedule or legend is also developed to indicate a fixture's type, manufacturer, size, color, and other special features such as a lavatory and faucet set. Special plumbing systems such as the automatic fire extinguishing system are generally drawn by a fire-protection engineer and coordinated into the designer or architect's drawings.

1.4 Designation of Materials for Plumbing Plans

Plumbing materials are basically shown in a simplistic manner. Double lines are primarily used to indicate sizes of air ducting, and water-piping systems are indicated mostly with single lines. The actual material might be called out in the plan, although it is usually found in the accompanying schedule or specifications. Include an abbreviations legend on this sheet or cross-reference to the title sheet where all the abbreviations are listed.

1.4.1 Notations

- Note the minimum fall required for the gravity sanitary sewer (often /4" per foot of horizontal run).

- Call out pipe sizes on the plan and their use (hot water, cold water, sanitary sewer, vents, etc.).
- Label the plumbing fixtures and cross-reference to a schedule or the specifications.
- Call out special devices such as vents through the roof, floor drains, clean-outs, and hose bibs where applicable.
- Note where existing and new plumbing lines are to be extended, removed, or connected.

1.4.2 Dimensions

- Dimension to centerlines of sink, lavatories, drains, faucets, supply lines, and other items where required.
- Dimension maximum runs, lengths, and sanitary sewer line fall.
- Dimensioning Plumbing Plans

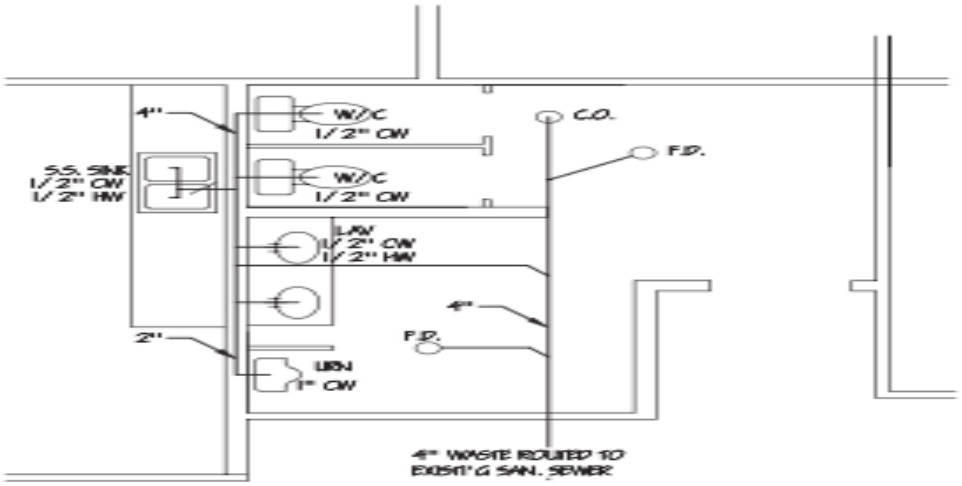
1.4.3 Checklist for Plumbing Plans

General

- Title the drawing, note its scale, and indicate north (or reference direction). Cross-reference this drawing to related drawings.
- Title any accompanying schedules and key them to the plan.
- Place schedules on the same sheet as the plumbing plan (preferred) or on a sheet immediately preceding or following the plan.
- Clean up the plan so the plumbing information and key codes are clear, dark, and very legible.

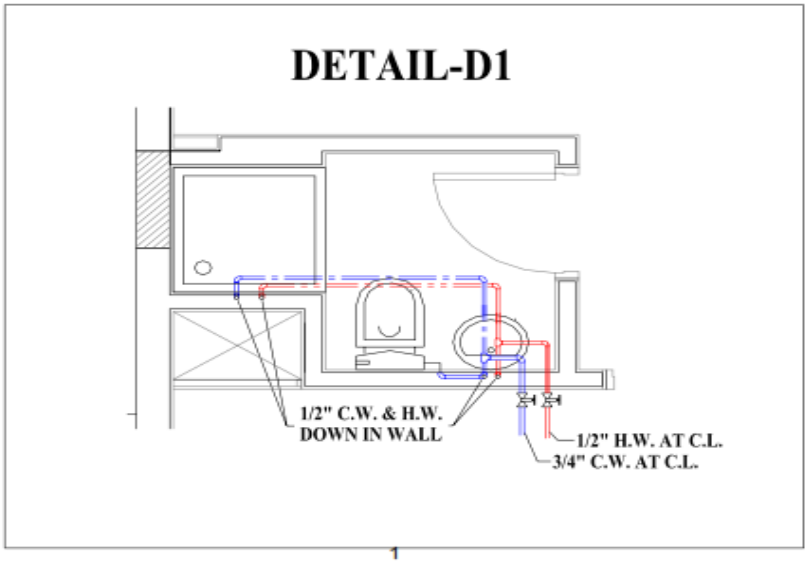
- Clearly show the directional run of each pipe and draw its line weight and style to match that shown in the accompanying legend.

- Indicate special features such as valves, faucets, sinks, etc. with a standard symbol on the plan. Cross-reference to the specifications or a legend that details information such as manufacturer and model.

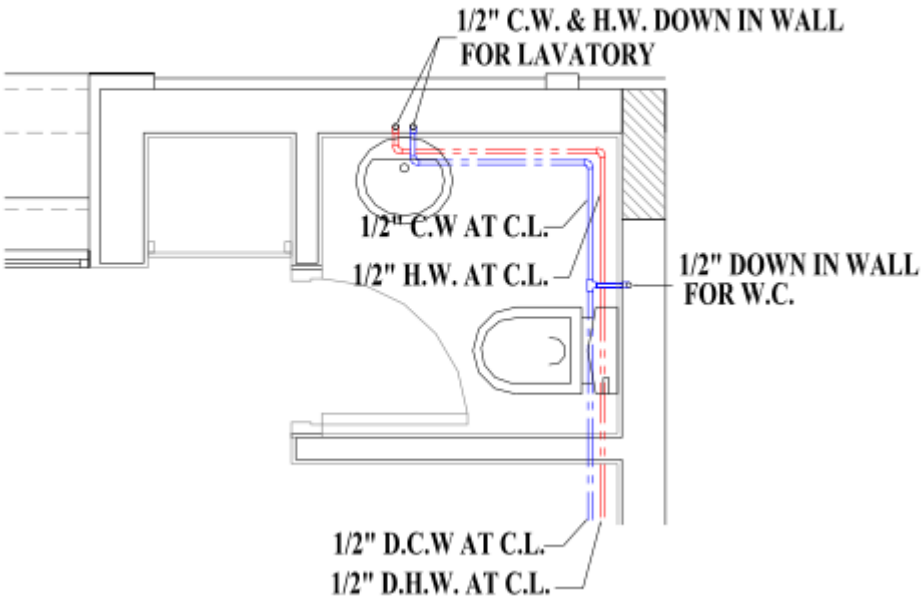


- PLUMBING PLAN @ MEN'S RM 30

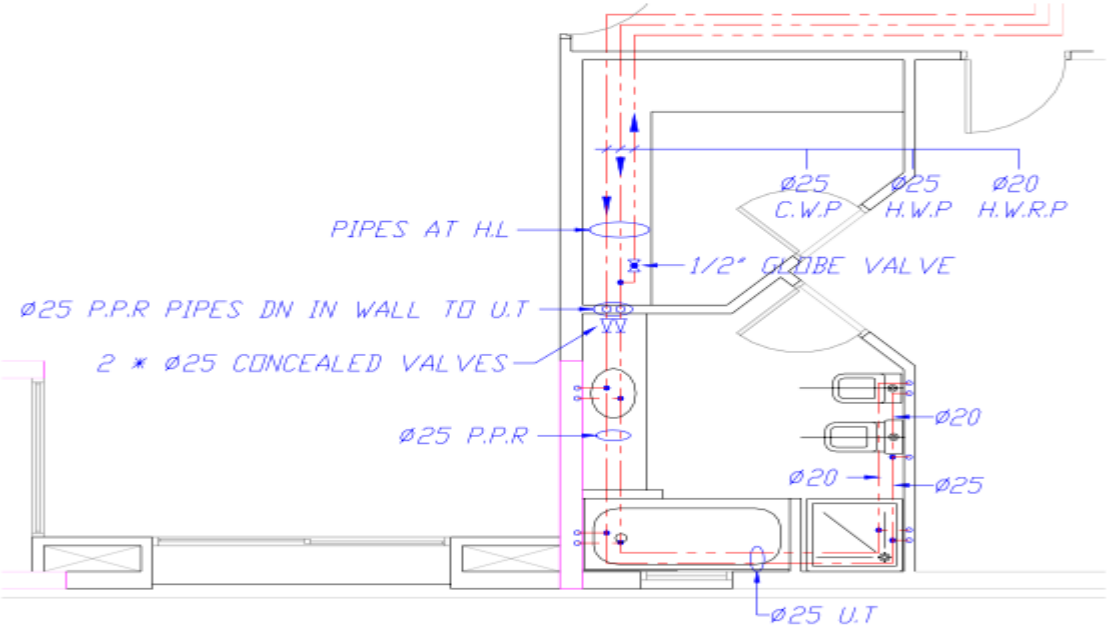
EXAMPLE OF WATER DISTRIBUTION SYSTEM INSIDE BATHROOM – GALV. STEEL PIPES



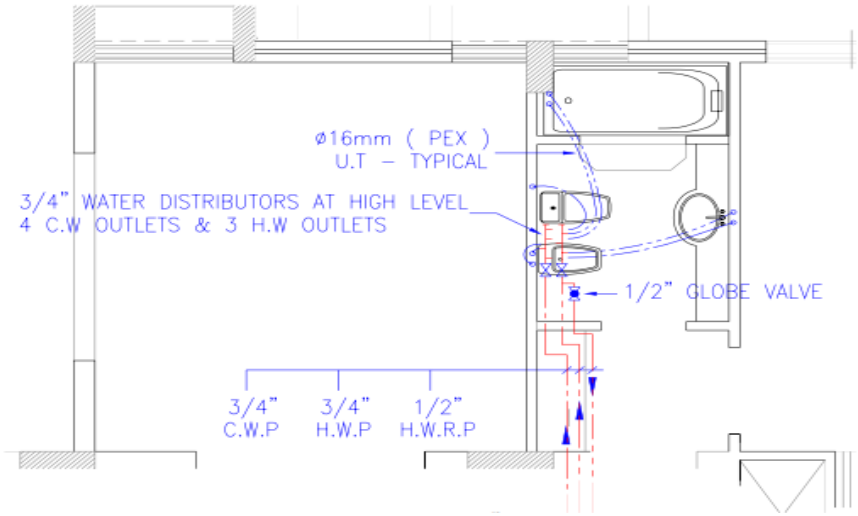
DETAIL-D2



DETAIL OF WATER DISTRIBUTION SYSTEM INSIDE BATHROOM – P.P.R PIPES



DETAIL OF WATER DISTRIBUTION SYSTEM INSIDE BATHROOM - PEX OR PEX -AL-PEX PIPES



1.4.4 Plumbing drawing

1. Single Line Drawings

The single line format is most commonly used. Figure below is an example of a single line. The single line format represents all piping, regardless of size, as single line. All system equipment is represented by simple standard symbols. By simplifying piping and equipment, single lines allow the system's equipment and instrumentation relationships to be clearly understood by the reader.

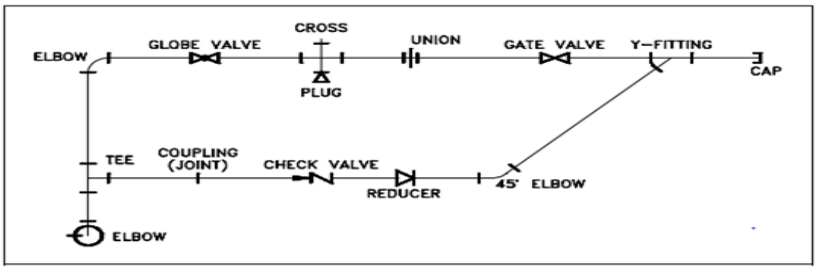


Figure – Single line Drawing

2. Pictorial or Double Line Drawings

Figures example of a Single Line Pictorial or double line drawings present the same type information as a single line, but the equipment is represented as if it had been photographed. Figure below provides an example illustration of a pictorial drawing. This format is rarely used since it requires much more effort to produce than a single line drawing and does not present any more information as to how the system functions. Pictorial or double line drawings are often used in advertising and training material.

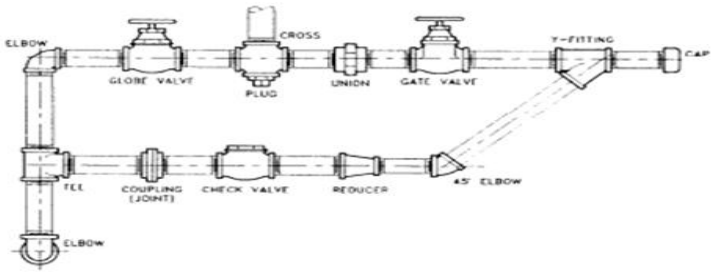


Figure Double line drawings

3. **Isometric plumbing drawings**

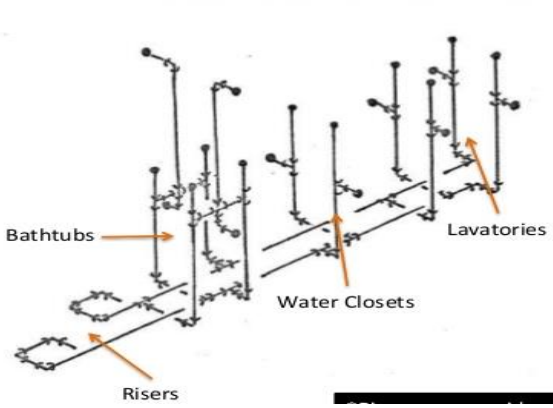
All commercial building permit applications, in which the plumbing system has not been designed by a mechanical engineer, must include two sets of isometric plumbing drawings. See Figure (A,B,C,D and E)

The isometric drawings should include the following information:

- Isometric drawings of drain, waste and vent must include the size, location and type of pipe.
- Isometric drawings of hot and cold water piping must include the type and size of pipe and method used for sizing pipe.
- The isometric drawings are to specify whether combustible or non-combustible plumbing is to be used.
- Grease traps must be installed in the plumbing system for restaurants and businesses that prepare food. The location and size of the grease interceptors

must be included on the isometric drawing. For further information see the Building Inspections handout titled Grease Interceptors in Kitchens.

- Isometric drawings to include the plumbing company name and contact phone number.



Qty.	Mat.	Unit Prince	Total
15ft	¾" cop. pipe		
20ft	½" cop. pipe		
6	¾" ells		
16	½" ells		
8	¾" tees		
10	½" tees		
14	½" adapter		
10	½" caps		

Figure A - Isometric Plumbing Drawings with BOQ

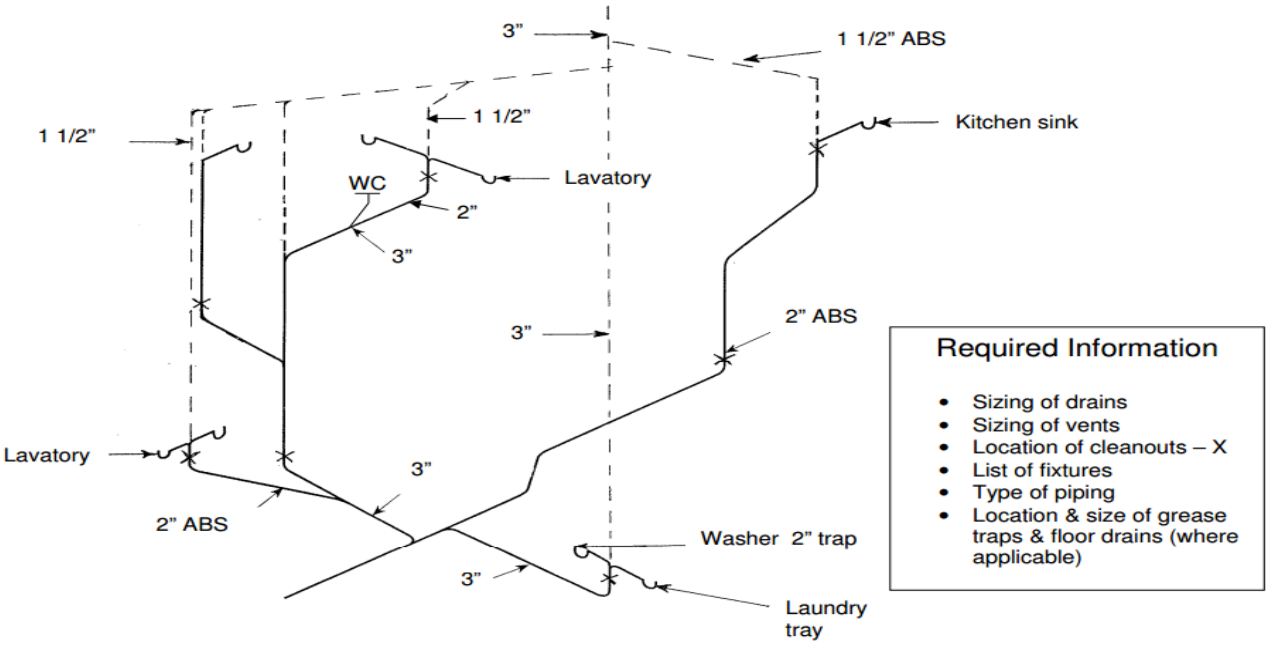


Figure B - Isometric Plumbing Drawings

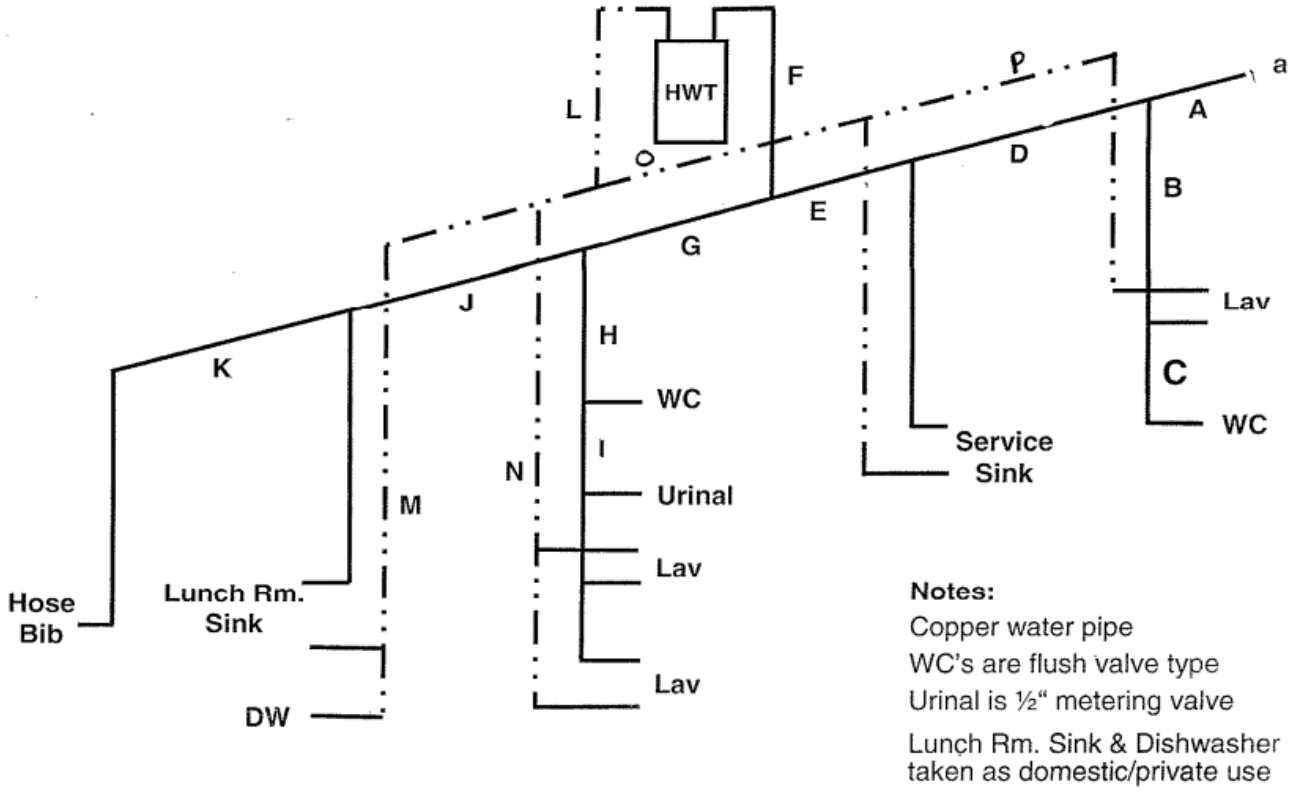


Figure C - Isometric Plumbing Drawings

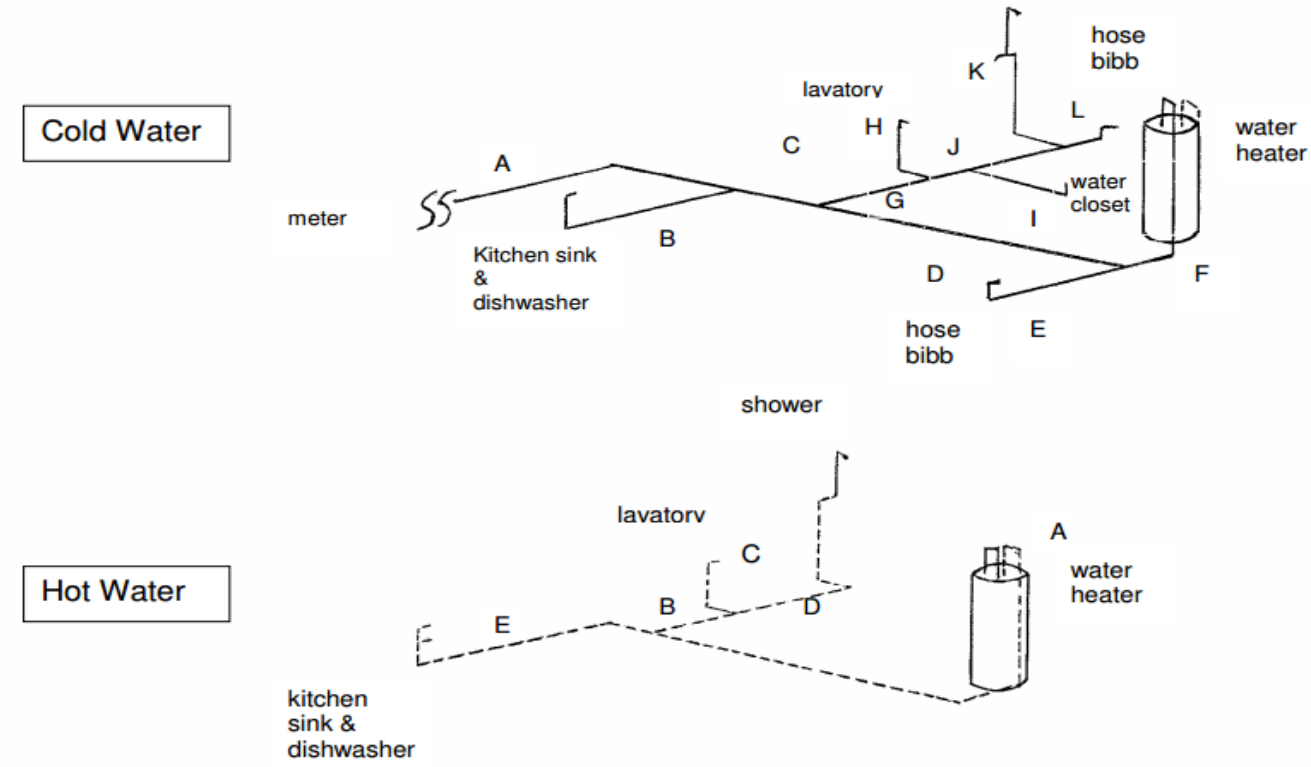


Figure D - Isometric Plumbing Drawings

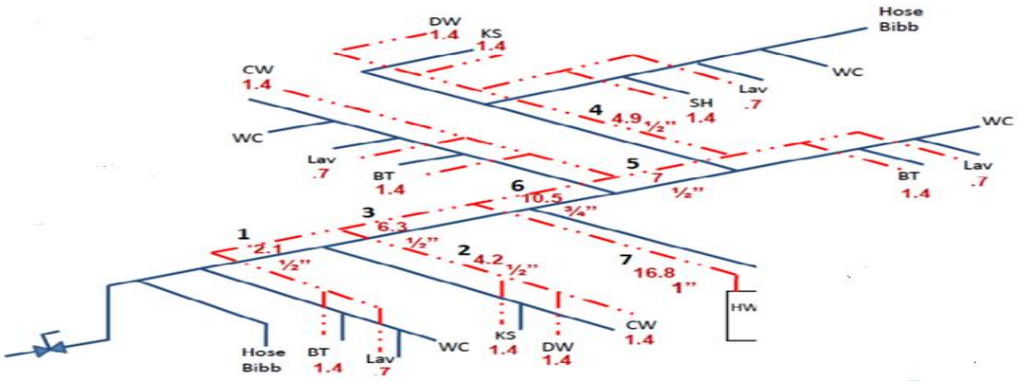


Figure E - Isometric Plumbing Drawings

4. **Building Drainage drawings**

For the design and installation for drainage piping, one of the following building drainage systems shall be adopted :

- Single stack system
- One-pipe system
- Two-pipe system

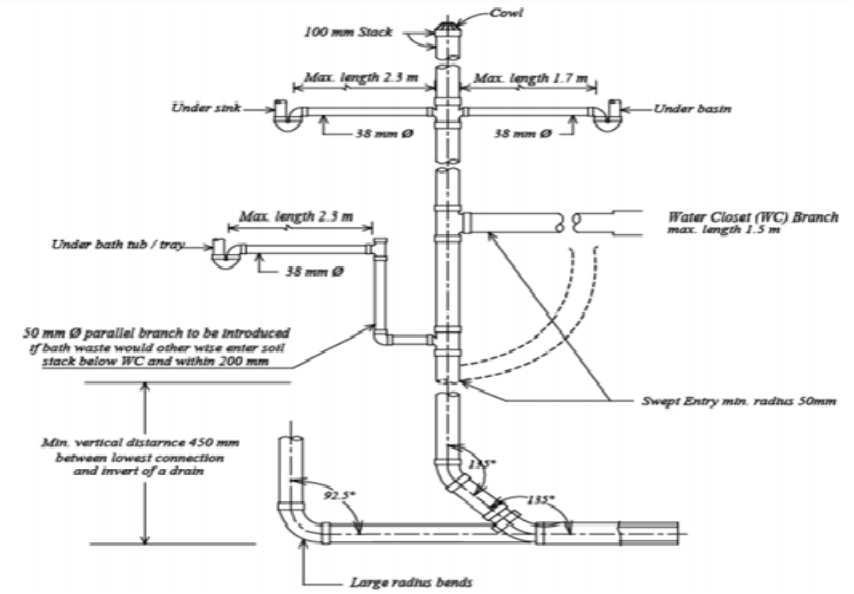


Figure Single stack system

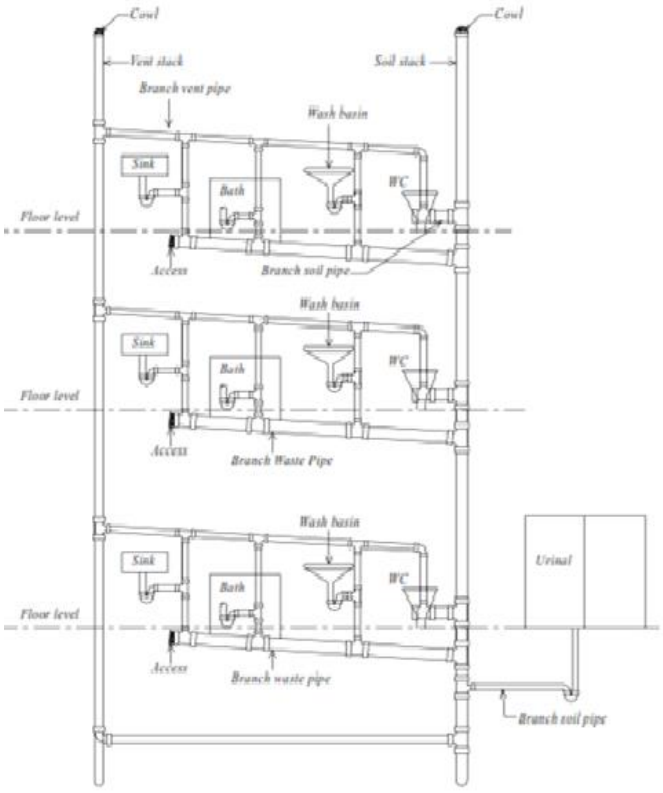


Figure One pipe system

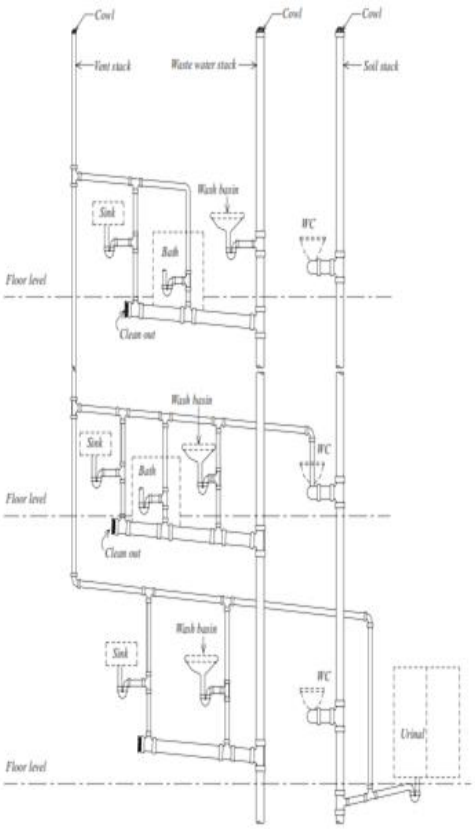
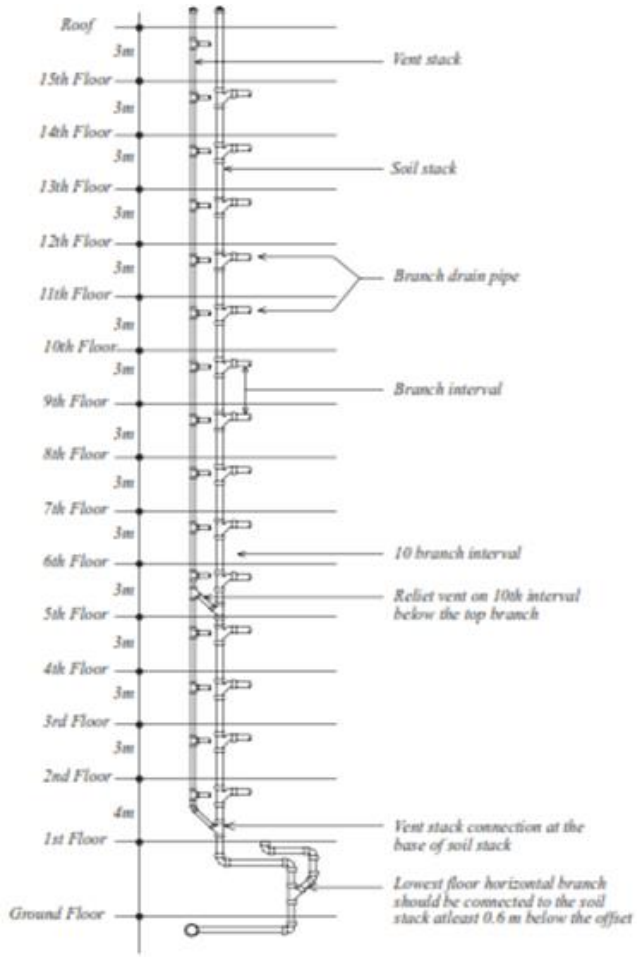
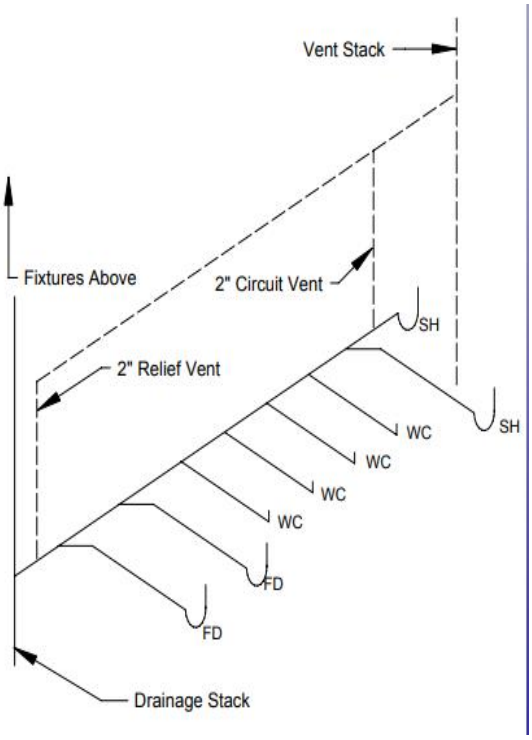


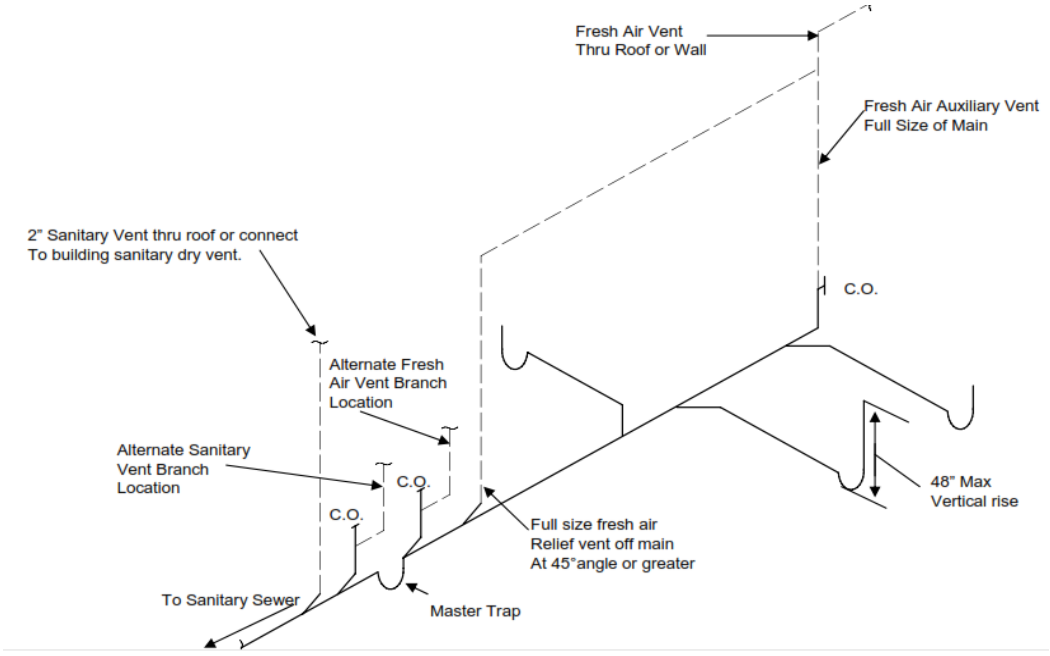
Figure Two-pipe system

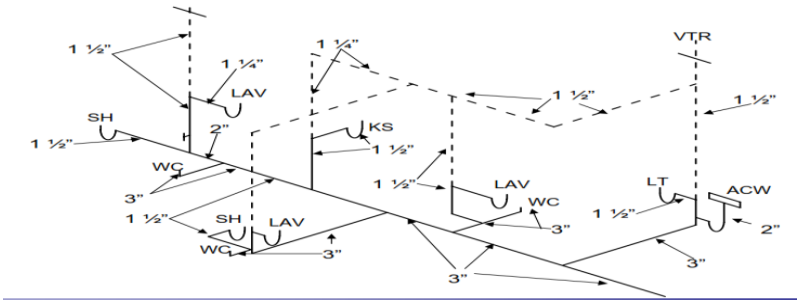
5. **Vent system drawing**

Soil and waste stacks in a building having more than 10 branch intervals shall be provided with a relief vent at each tenth interval counting from the top floor.


Roof
3m
15th Floor
3m
14th Floor
3m
13th Floor
3m
12th Floor
3m
11th Floor
3m
10th Floor
3m
9th Floor
3m
8th Floor
3m
7th Floor
3m
6th Floor
3m
5th Floor
3m
4th Floor
3m
3rd Floor
3m
2nd Floor
4m
1st Floor
Ground Floor
Vent stack
Soil stack
Branch drain pipe
Branch interval
10 branch interval
Relief vent on 10th interval below the top branch
Vent stack connection at the base of soil stack
Lowest floor horizontal branch should be connected to the soil stack atleast 0.6 m below the offset


Vent Stack
Fixtures Above
2" Circuit Vent
2" Relief Vent
SH
SH
WC
WC
WC
WC
FD
FD
Drainage Stack

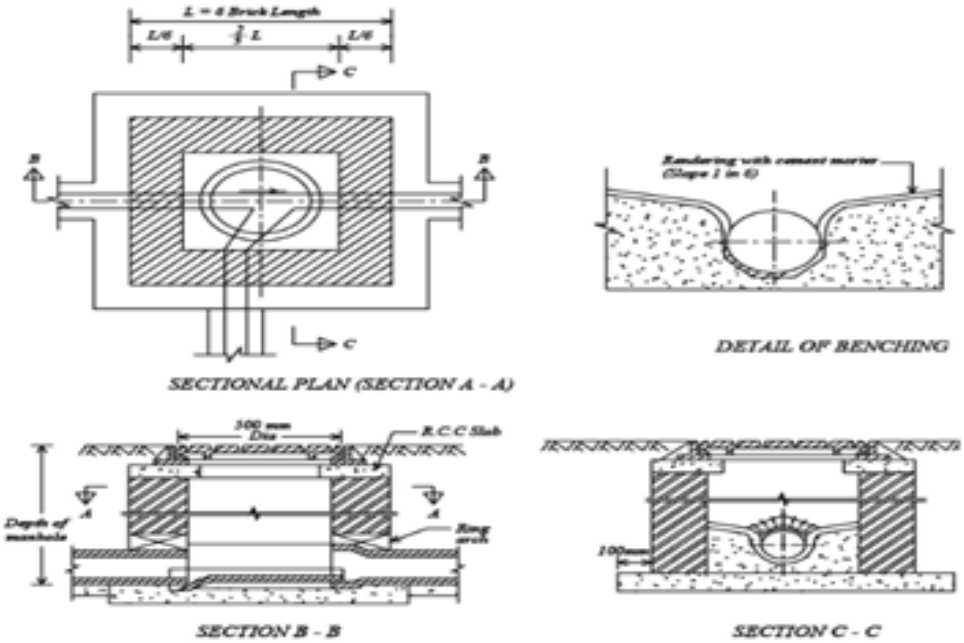

Fresh Air Vent
Thru Roof or Wall
Fresh Air Auxiliary Vent
Full Size of Main
2" Sanitary Vent thru roof or connect
To building sanitary dry vent.
C.O.
Alternate Fresh
Air Vent Branch
Location
Alternate Sanitary
Vent Branch
Location
C.O.
C.O.
48" Max
Vertical rise
Full size fresh air
Relief vent off main
At 45°angle or greater
To Sanitary Sewer
Master Trap

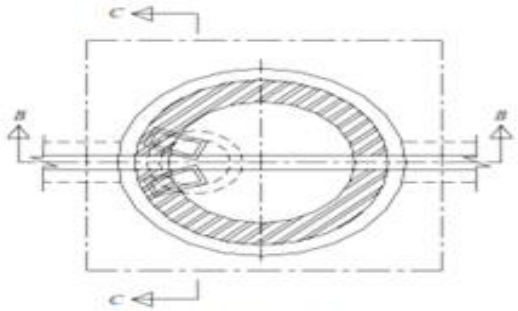


6. Chambers and manholes drawings

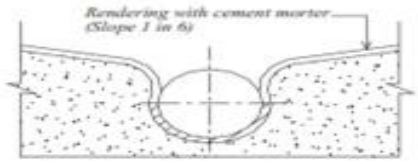
Inspection chambers and manholes shall have removable non-ventilating covers of durable material and be of suitable strength. Inspection chambers and manholes in buildings shall have mechanically fixed airtight covers unless the drain itself has watertight access covers.

Manholes deeper than 1 m shall have non-corrosive steps or fixed ladders. Figure below show the details of typical manholes at smaller depth (<1 m) and at higher depth (>1 m) respectively. Figure below shows the details of a drop manhole. The drop manhole is a manhole that serves as a junction and receives sewer l ines at two different elevations.

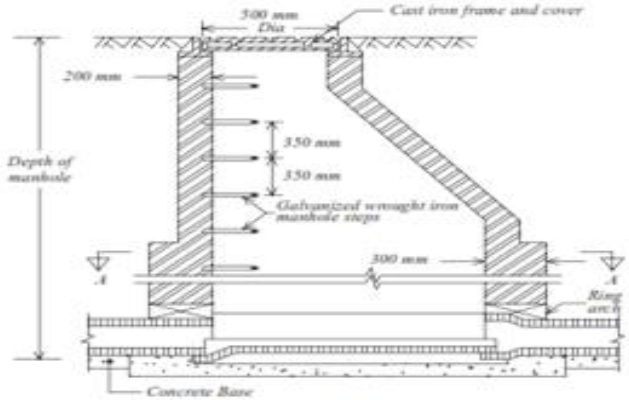




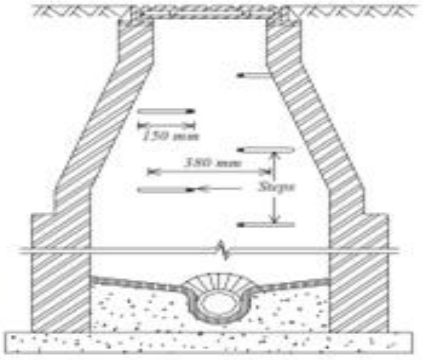
SECTIONAL PLAN (SECTION A - A)



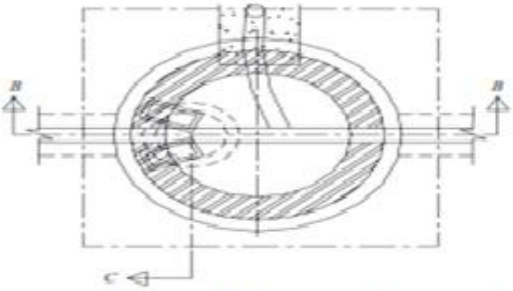
DETAIL OF BENCHING



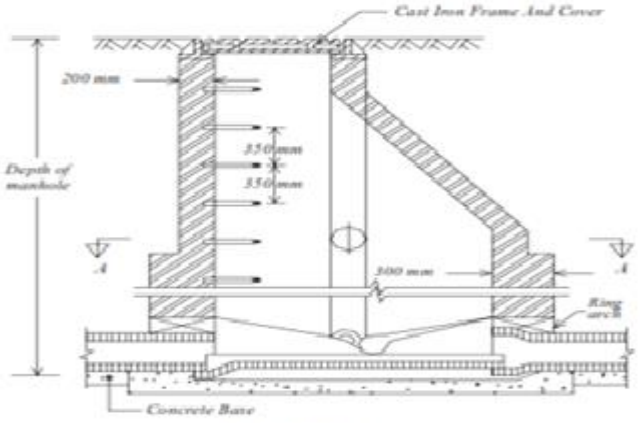
SECTION B - B



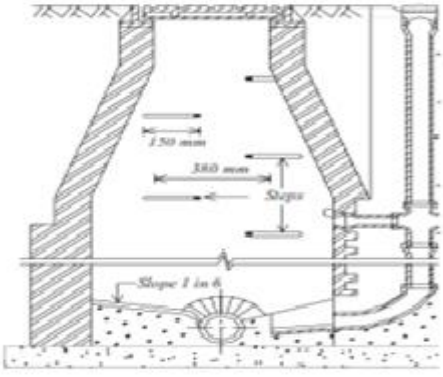
SECTION C - C



SECTIONAL PLAN (SECTION A - A)



SECTION B - B



SECTION C - C

7. Bedding and Backfilling

The choice of bedding and backfilling depends on the depth of the bed, and size and strength of the materials. Figures show two types of bedding and backfilling and minimum and maximum depth of cover for each type of bedding for rigid piping. The bedding and backfilling for flexible piping is shown in Figure below. The minimum depth of bedding for flexible pipings shall be 0.3 m where there will be no extra surcharge load coming on pipe other than back filling. The depth shall not be more than 10 m. The flexible pipe may be laid with less cover in fields and gardens. The bedding and backfilling shall be in accordance with Figure below.

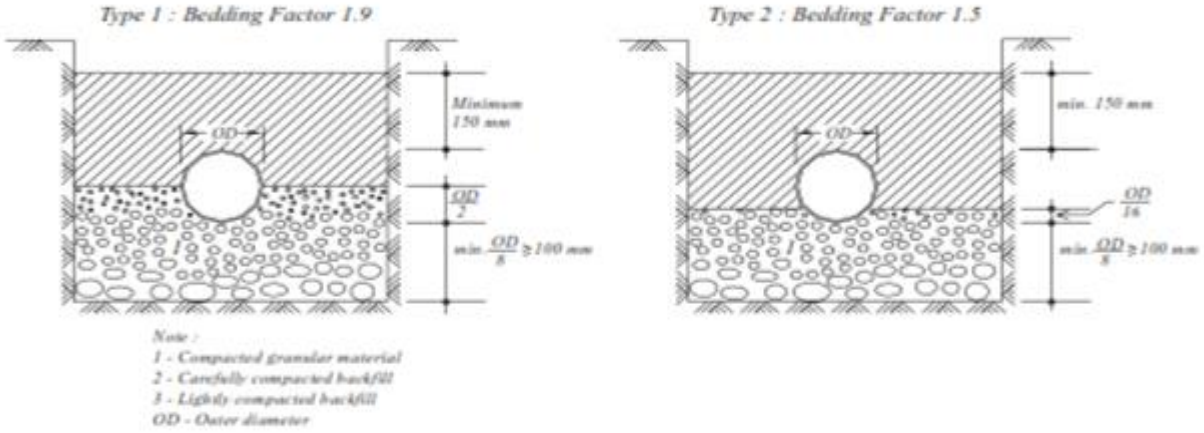


Figure Bedding for rigid pipes

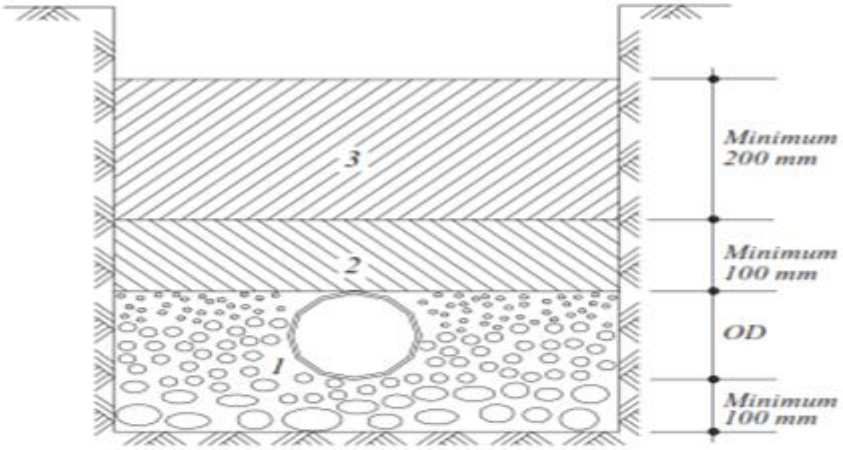


Figure bedding for flexible pipes

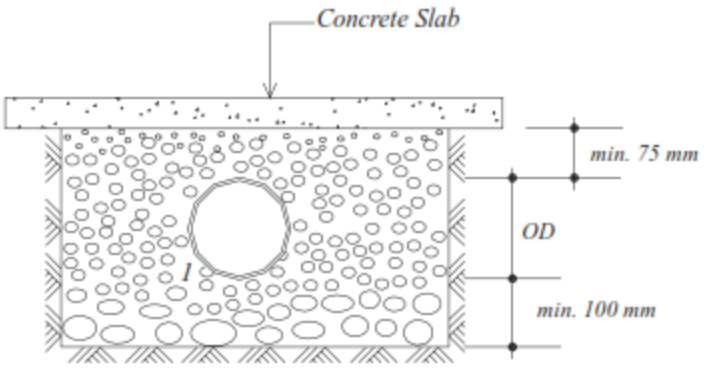
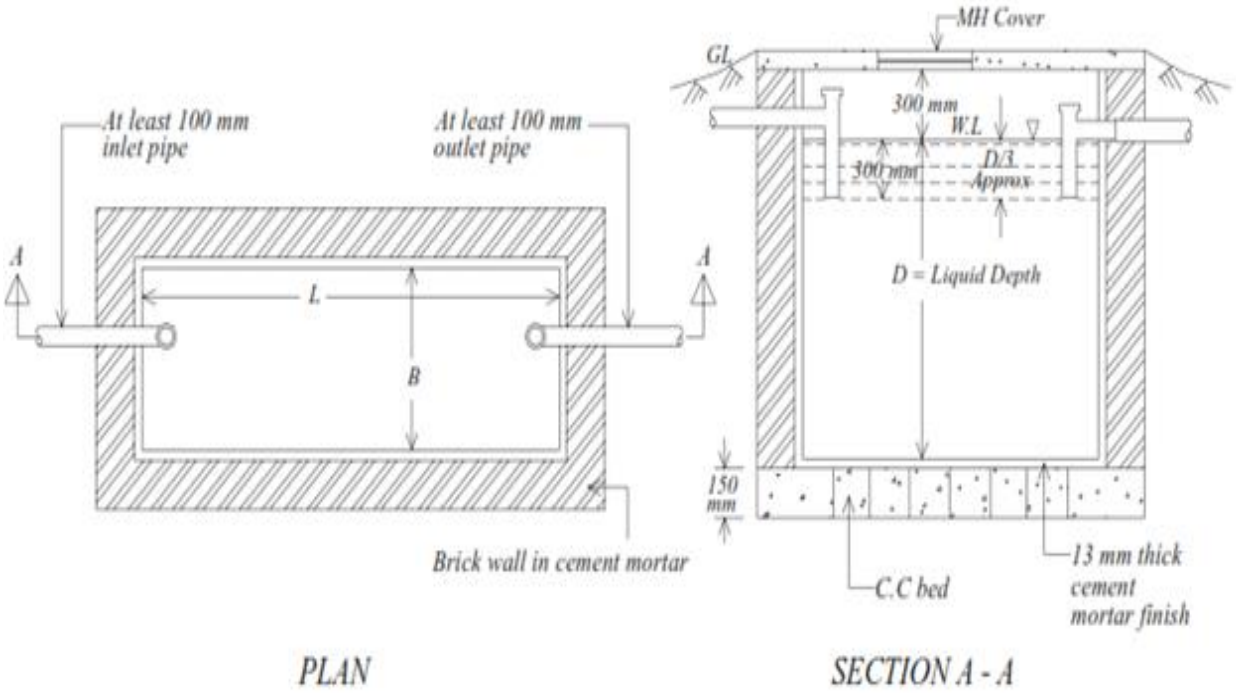
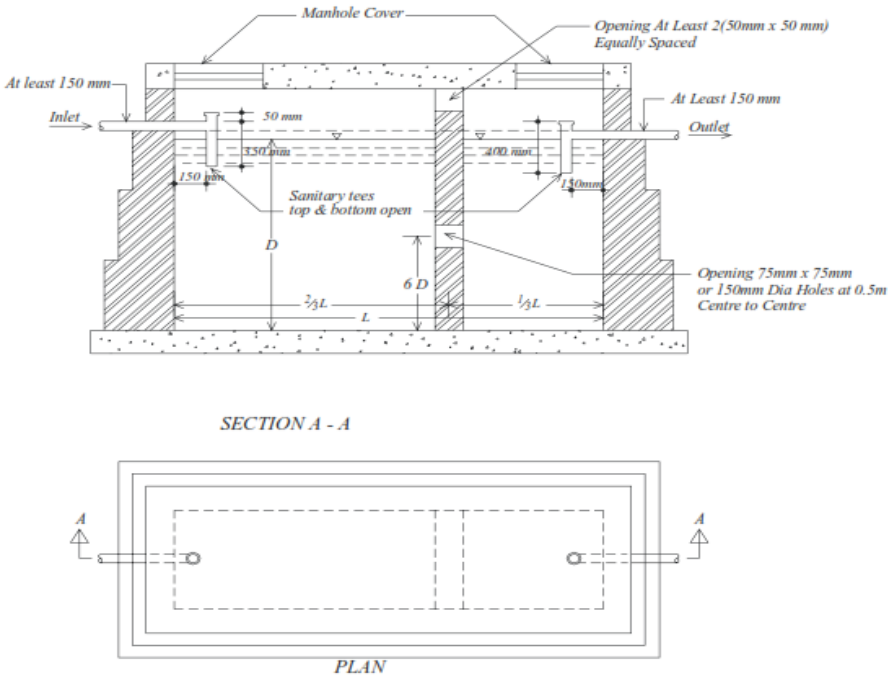


Figure flexible pipes bedding under concrete slab

8. Septic tank(s)

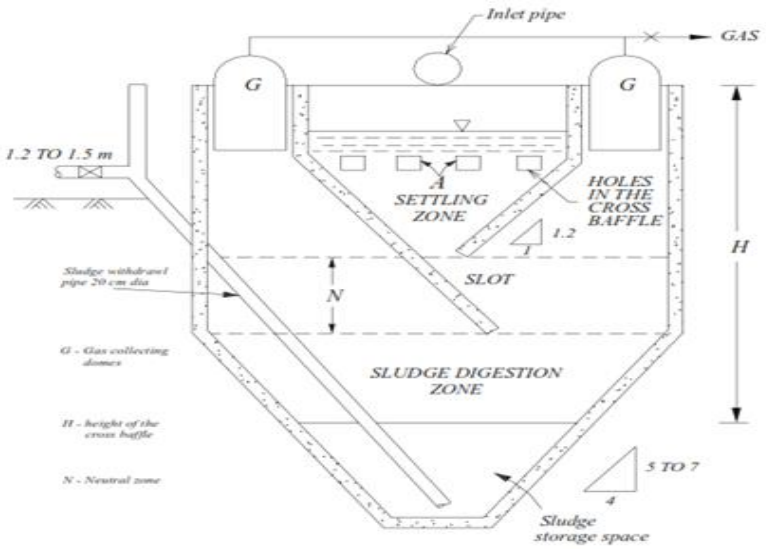
Septic tanks discharging into either a subsurface disposal fiel or one or more seepage Pits shall be required for the approval of drainage and sanitation plans for the places where public sewers are not available.





9. Imhoff tank(s)

Figure below discharging into either a subsurface disposal field or one or more seepage pits shall be required.For the approval of drainage and sanitation plans for the places where pub lic sewers are not available.



10. Distribution box drawing

A distribution box shall be provided to receive the effluent from the septic tank or Imhoff tank to assure equal distribution to each individual line of disposal field. The distribution b ox shall be conneced to the septic tank or Imhoff tank by a watertight sewer line and shall be located at the upper end of disposal field. Figure shows the plans and sections of typical distribution boxes.

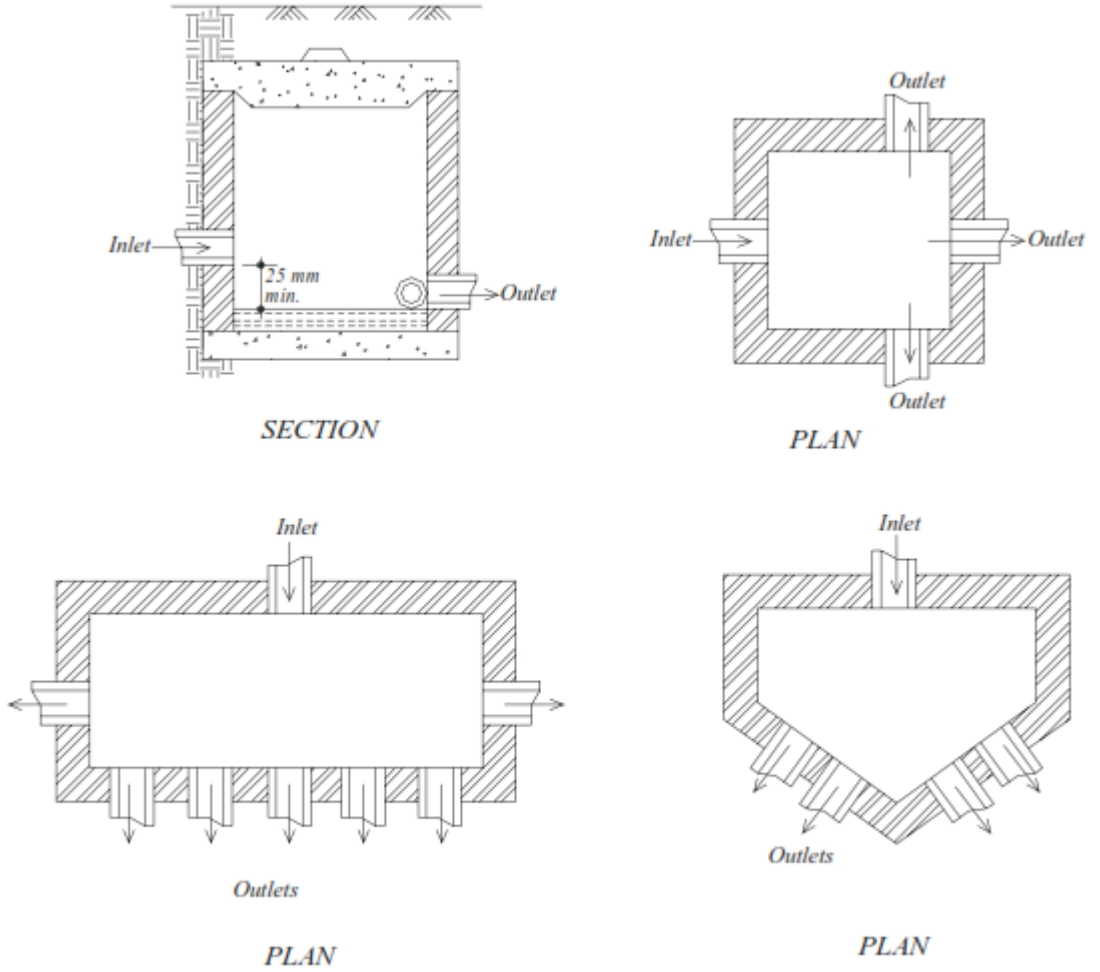


FIG. 8.6.19 DISTRIBUTION BOXES

11. Soak pit

Seepage pit (soak pit) shall be lined with stone, brick or concrete blocks laid up dry with open joints that are backed up with at least 75 mm coarse aggregate. The joints above the i nlet shall be sealed with cement mortar.

A reinforced concrete cover shall be provided. For cover area more than 0.75 m the pit shall have an access manhole. The bottom of the pit shall be filled with coarse gravel, or crushed stone/brick to a depth of 0.3 m.

Figure below provides the details of a seepage pit.

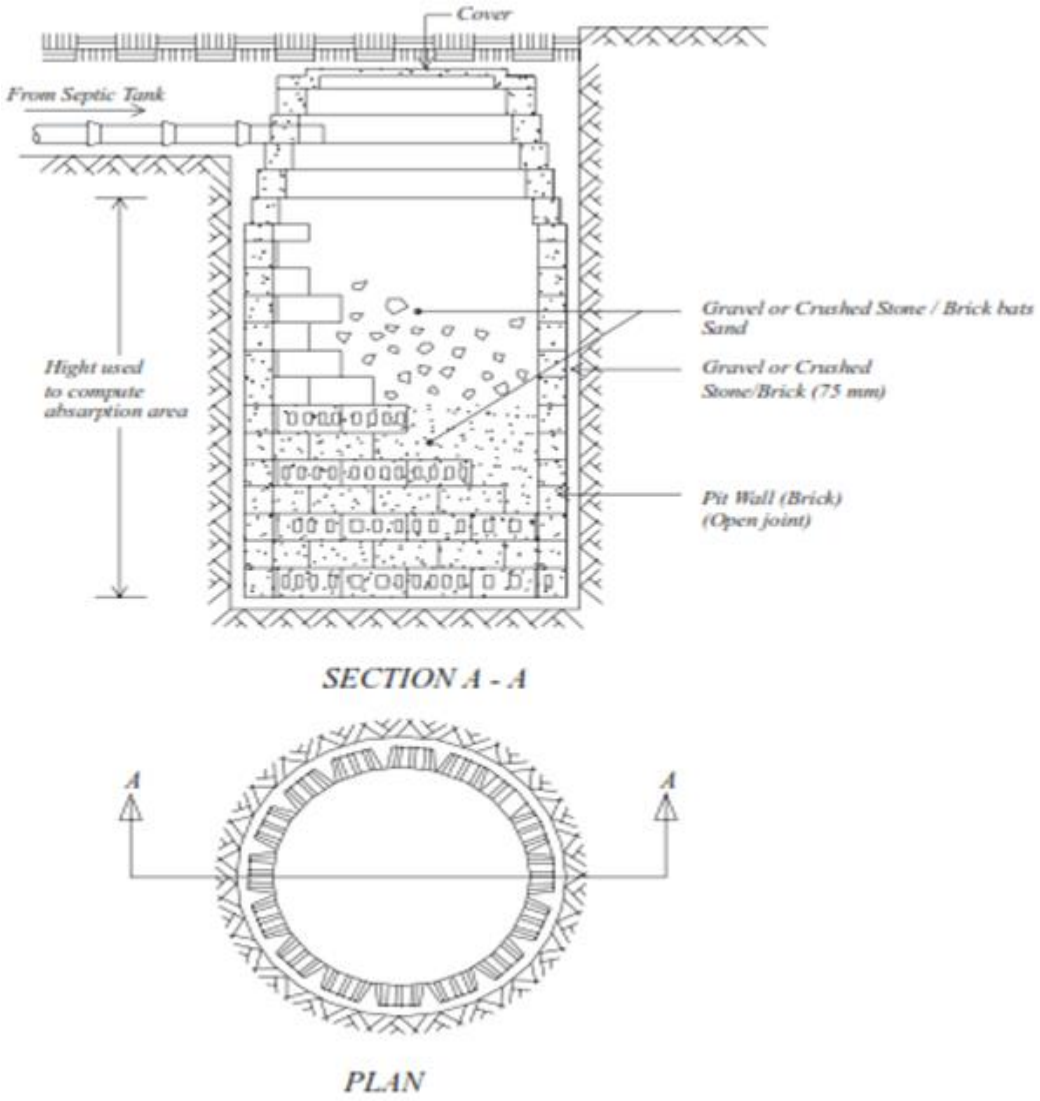
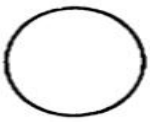
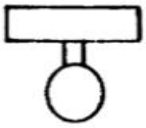


Figure – Typical seepage pit

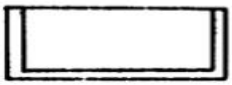
Self-Check - 1	Written Test

Directions: Match the construction element with its related job description for all the questions listed below. Use the Answer sheet provided in this page.

1. 

2. 

3. 

4. 

A. Water closet
B. Urinal, wall-hung
C. Sink service, wall-hung
D. Water heater

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 = _____

Rating: _____

Name: _____ **Date:** _____

Answer sheet

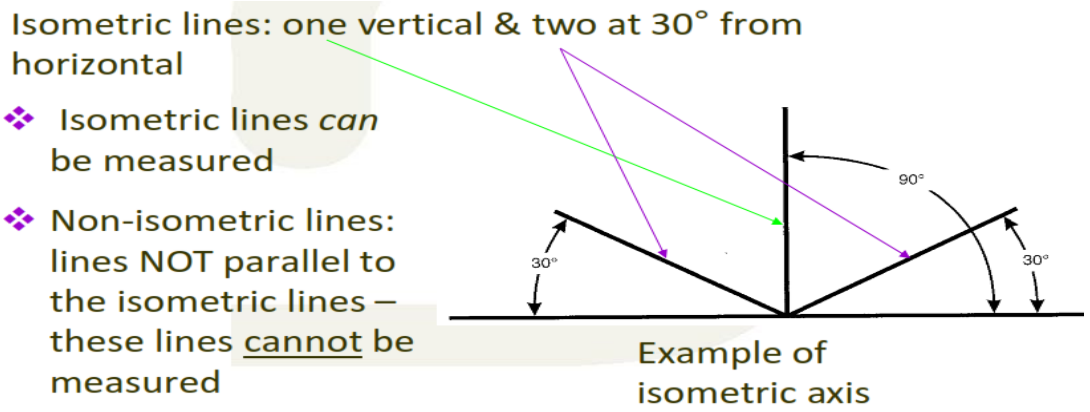
1. _____ **2.** _____ **3.** _____ **4.** _____

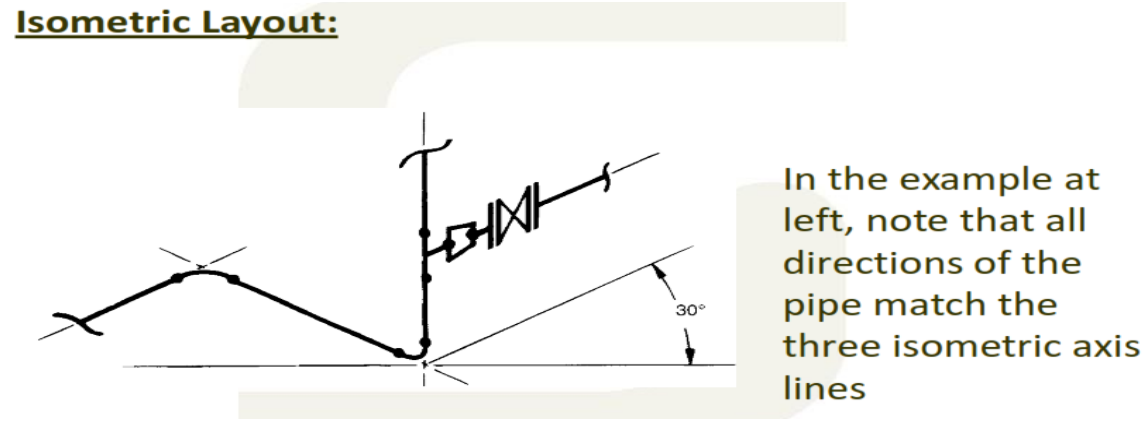
Information Sheet- 2	Identifying key functions of plumbing drawing

2.1 Piping isometric

An isometric drawing is a type of pictorial drawing in which three sides of an object can be seen in one view. It's popular within the process piping industry because it can be laid out and drawn with ease and portrays the object in a realistic view.

Isometric Layout:





Scale:

Isometric drawings isometric drawings

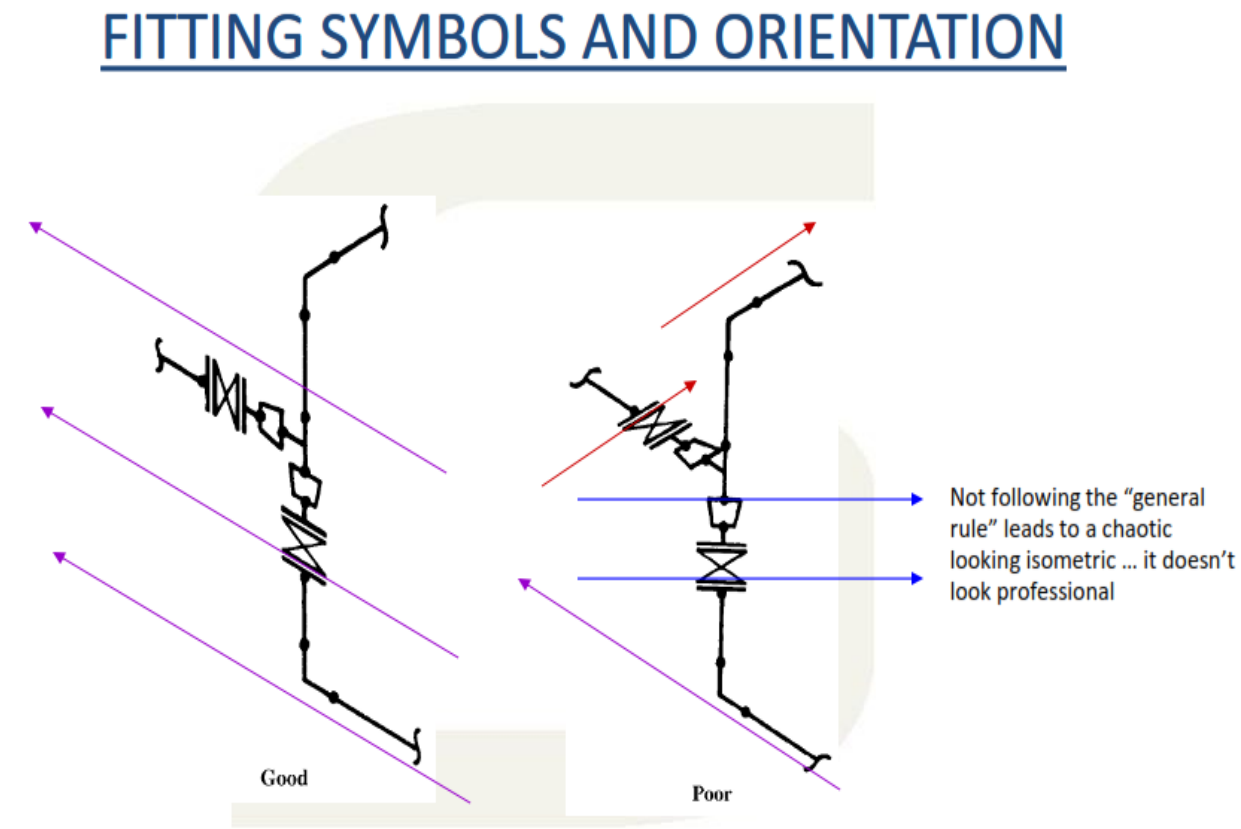
- Isometrics are rarely drawn to scale

- However, pipe lengths should be shown Proportionately
- Many companies draw isometrics on A3 size paper which is a limited space so sometimes proportion may be sacrificed
- It's important that the written dimensions are accurate

2.2 Fitting symbols and orientation

- When orienting fittings and valves it's important to know that there are good methods and poor methods in this orientation process

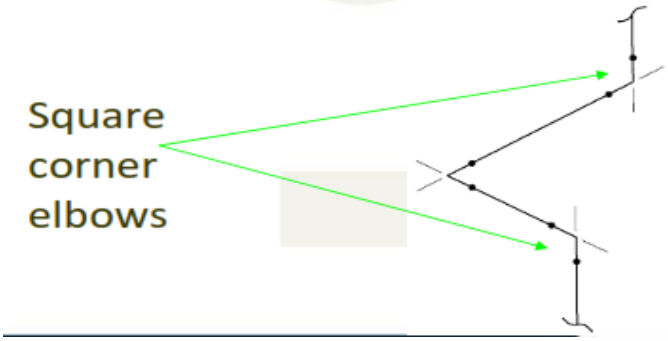
- The general rule for producing an isometric using good techniques, is to draw the fittings so they are parallel to the last direction change or branch in the pipe



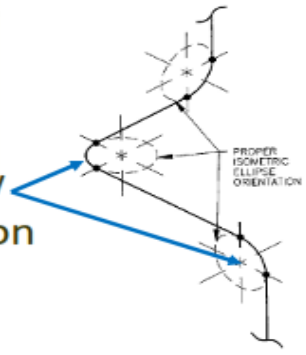
FITTING SYMBOLS AND ORIENTATION

- Fittings are drawn the same shape as they appear on the plan & elevation drawings EXCEPT they're at an isometric angle.
- Elbows can be drawn a couple of ways… check with company standards

Square corner elbows



Curved Elbow Representation



Self-Check - 2	Written Test

Directions: Match the construction element with its related job description for all the questions listed below. Use the Answer sheet provided in this page.

1. Non isometric lines not parallel to isometric lines cannot be measured.

   A. False B. True C. Not Both

2. Fittings are drawn the same shape as they appear on the plan and elevation drawings except they're at isometric angle.

   A. True B. False C. Not both

3. Piping Isometrics are must be drawn to scale

   A. True B. False C. Not both

Note: **Satisfactory rating - 2 and 4 points** **Unsatisfactory - below 2 and 4 points**

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

Score = _____

Rating: _____

Name: _____ **Date:** _____

Answer sheet

1. _____ **2.** _____ **3.** _____

Information Sheet- 3	Identifying key users of drawings

3.1 Use of drawing

The working drawings provided to contractors for bidding serve many purposes in the overall construction process. Below are some applications of working drawings other than physical construction.

1. Estimating and Take-offs

The builder and subcontractors use working drawings to calculate all of their materials, labor, and other expenses.

2. Permitting

In residential construction, the requirement for plans in the permitting process varies by jurisdiction. Some architects create a set of plans specifically for permitting; they may have a slightly different look than actual working drawings.

3. Permanent Record

A set of working drawings constitutes a permanent record of construction and design, along with all details and specifications. Provide a set to the homeowner for future repairs, additions, or remodeling projects.

4. Legal Record

The working drawings become part of the legal record for the building. If legal issues arise during or after construction, courts may use working drawings as a basis for determining important facts.

Self-Check - 3	Written Test

Direction: Match the right column with left column to key users of drawing.

1. Estimating and Take-offs	A. Used to calculate quantity
2. Permitting	B. Used to fill legislation requirement
3. Permanent Record	C. Used to future repair
4. Legal Record	D. Used in court

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 = _____

Rating: _____

Name: _____ **Date:** _____

Answer sheet

1. _____ **2.** _____ **3.** _____ **4.** _____

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

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

Task 1: Select plumbing drawing with its specification before demonstration day

Task 2: Identifying types of plans and drawings in the plumbing this drawing.

Task 3: Identifying Key functions of plumbing drawing

Task 4. Identifying Key users of this drawings

List of Reference Materials

1. Construction drawings and details for interiors, W. Otie Kilmer and Rosemary Kilmer
2. Field piping engineering.www.seabirdgroups.com