Draft Study Material

ADVANCE PLUMBING TECHNICIAN

(Qualification Pack: Ref. Id. QF-1023)

Sector: Plumbing

(Grade XII)

PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION
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Preface

Vocational Education is a dynamic and evolving field, and ensuring that every student has access to quality learning materials is of paramount importance. The journey of the PSS Central Institute of Vocational Education (PSSCIVE) toward producing comprehensive and inclusive study material is rigorous and time-consuming, requiring thorough research, expert consultation, and publication by the National Council of Educational Research and Training (NCERT). However, the absence of finalized study material should not impede the educational progress of our students. In response to this necessity, we present the draft study material, a provisional yet comprehensive guide, designed to bridge the gap between teaching and learning, until the official version of the study material is made available by the NCERT. The draft study material provides a structured and accessible set of materials for teachers and students to utilize in the interim period. The content is aligned with the prescribed curriculum to ensure that students remain on track with their learning objectives.

The contents of the modules are curated to provide continuity in education and maintain the momentum of teaching-learning in vocational education. It encompasses essential concepts and skills aligned with the curriculum and educational standards. We extend our gratitude to the academicians, vocational educators, subject matter experts, industry experts, academic consultants, and all other people who contributed their expertise and insights to the creation of the draft study material.

Teachers are encouraged to use the draft modules of the study material as a guide and supplement their teaching with additional resources and activities that cater to their students' unique learning styles and needs. Collaboration and feedback are vital; therefore, we welcome suggestions for improvement, especially by the teachers, in improving upon the content of the study material.

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Date: 24 March 2025

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Module 1	SENSOR BASED FIXTURES

Module Overview

This module introduces students to the basic concept, components and applications of sensor-based plumbing systems. It explores various types of sensors used in modern plumbing, such as flow, pressure, temperature and leak detection sensors thereby highlight their significance in improving efficiency, safety and automation. This module also covers essential components like solenoid valves, battery boxes along with their installation, maintenance and repair.

Learning Outcomes

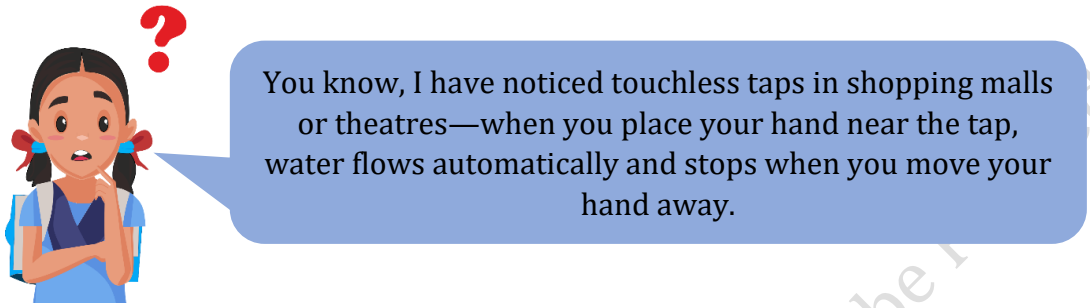
After completing this module, you will be able to:

- Explain the role of Sensors and its applications.
- Brief about the working principle of different types of sensors.
- Identify the various types of plumbing sensors available in the market.
- Understand the key components of Sensor-Based Plumbing Systems.
- Compare the different types of Sensor-Based Fixtures.
- Develop practical skills related to installation of various plumbing fixtures.

Module Structure

1.1 Introduction to Sensors and its application
1.2 Basic Components of a Sensor based Plumbing System
1.3 Selection of Sensor-based fixtures (requirements of a sensor-based fixture)
1.4 Working principle of different types of sensors
1.5 Concept of Sensor based faucet and its types
1.6 Sensor based faucet (Installation and repair)
1.7 Sensor based urinal (Installation and repair)
1.8 Sensor based Cistern (Installation and repair)
1.9 Sensor based Shower (Installation and repair)

In the previous grade, we had explored the role of an Advanced Plumbing Technician and gained an understanding of the basic installation and maintenance of plumbing fittings and fixtures. In this unit, we will go through various sensor-based fixtures which are becoming increasingly popular in the market today.



The above mentioned is an example of sensor based plumbing fixtures. There are many such innovative fittings and fixtures available in the market to enhance efficiency, convenience and hygiene.

Let us explore these advancements in detail: When we talk about "advanced" plumbing; both the materials and the technology are different from traditional ones. These new innovations meet the needs of homes, businesses and industries, focusing on saving resources, making plumbing easier and convenient for everyone.

1.1 Introduction to sensors and their application

First, let us understand what is a sensor? A sensor is a device that detects changes in its surroundings such as light, temperature, movement, pressure and converts this information into a signal that can be used to trigger an action or provide data.

For example, a motion sensor can detect as someone enters in the room and automatically the lights are switched on. Here a sensor senses the motion and respond quickly as “switching on” the light.

What is a Sensor? Sensors play an important role in modern plumbing systems which enables efficient monitoring, control and automation of various processes. (Refer Fig. 1.1) They provide real-time data about the condition and performance of plumbing components which are helping to optimize water usage, detect leaks and improve overall system efficiency. They detect changes in environmental factors such as movement, water flow, temperature and trigger appropriate responses within the system.

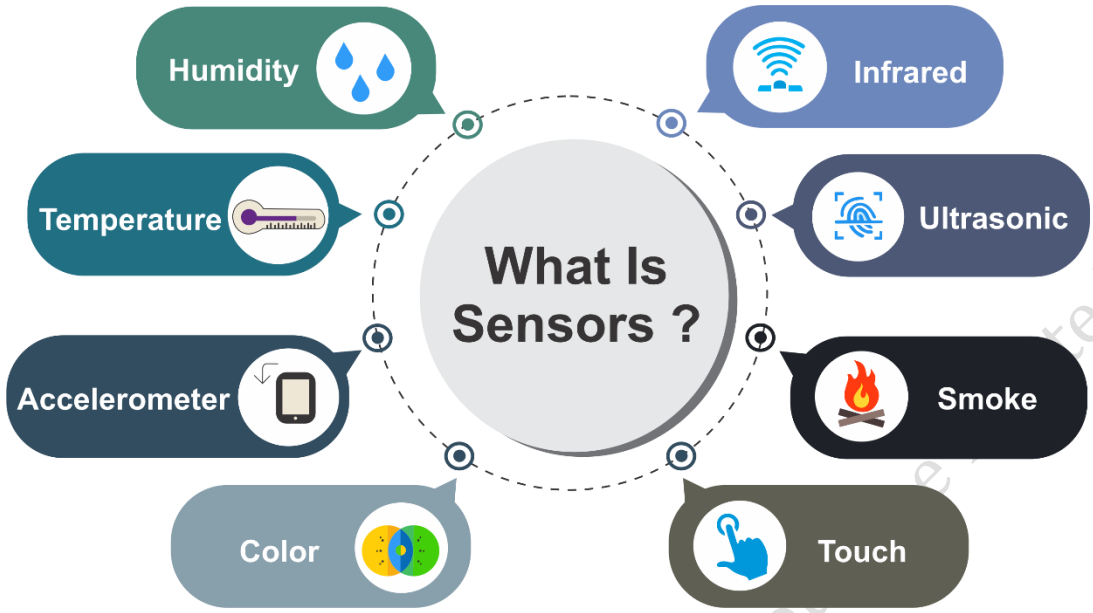


Fig. 1.1: Sensors

Importance of Sensors in Plumbing Systems

The integration of sensors in plumbing systems improves water management, reduces wastage and enhances system reliability. They play a crucial role in ensuring safety, maintaining hygiene and supporting sustainability by optimizing resource usage and minimizing manual intervention.

Here are some common sensors used in plumbing systems along with their applications:

1. **Flow Sensors:** Flow sensors measure the rate of water flow within the plumbing system. They are often installed in pipes and can be used to monitor water consumption, detect blockages and to identify abnormal flow patterns. Flow sensors as shown in Fig. 1.2 are essential for water conservation efforts and can be used in both residential and commercial applications.

Fig. 1.2: Flow Sensor

Application: Flow sensor helps in detecting leakages which enables early identification of plumbing issues and optimize the potential water wastage.

2. **Pressure Sensors:** Pressure sensors measure the pressure of water within the plumbing system. They are installed at various points, including at the main water supply, specific appliances, or fixtures like showers and faucets.

Fig. 1.3: Pressure Sensor

Application: Pressure sensors assist in maintaining consistent water pressure, preventing damage to pipes and fixtures, and alerting users to sudden pressure drops, which might indicate leaks or other problems. An example of pressure sensor is shown in Fig. 1.3.

3. **Temperature Sensors:** Temperature sensors monitor the temperature of water in different parts of the plumbing system. They are used to ensure water is delivered at appropriate temperatures for different applications, such as bathing, washing dishes, or heating systems.

Fig. 1.4: Water Temperature Sensor

Application: Temperature sensors as shown in Fig. 1.4 are crucial for safety, preventing scalding incidents, and optimizing energy usage in water heaters and HVAC systems.

4. **Level Sensors:** Level sensors measure the water level in tanks or reservoirs. They can be used in both water supply and wastewater systems to manage water storage and prevent overflows or low-levels. (Refer Fig. 1.5)

Fig. 1.5: Level Sensors

Application: Level sensors are vital for maintaining an adequate water supply, preventing potential flooding and automating the operation of pumps and other water control mechanisms.

5. **Water Quality Sensors:** Water quality sensors assess the chemical composition and purity of water. They can detect impurities, contaminants, and other factors that might affect water safety and potability.

Fig. 1.6: Water Quality Monitoring Sensor

Application: Water quality monitoring sensors (shown in Fig. 1.6) are essential to ensure safe supply of water for consumption which are widely used in water treatment plants and distribution systems.

Parameter	Domestic Use (Drinking Water - BIS 10500:2012)	Industrial Use	Irrigation Use (FAO Standards & BIS 11624:1986)
pH	6.5 – 8.5	6.5 – 9.0	6.5 – 8.4
Turbidity (NTU)	≤ 1 (desirable), 5 (permissible)	Varies by industry	Not a major concern
Total Dissolved Solids (TDS) (mg/L)	≤ 500 (desirable), 2000 (permissible)	Varies by industry (e.g., <2000 mg/L for boilers)	< 2000 mg/L (Preferably < 1000 mg/L)
Hardness (as $CaCO_3$) (mg/L)	≤ 200 (desirable), 600 (permissible)	Depends on industrial process	< 150 mg/L (preferred), < 750 mg/L (maximum)
Chlorides (Cl^-) (mg/L)	≤ 250 (desirable), 1000 (permissible)	< 500 mg/L (varies)	< 300 mg/L (preferably)
Sulphates (SO_4^{2-}) (mg/L)	≤ 200 (desirable), 400 (permissible)	< 500 mg/L (varies)	< 1000 mg/L
Nitrate (NO_3^-) (mg/L)	≤ 45	Varies by industry	< 50 mg/L (to prevent crop toxicity)
Fluoride (F^-) (mg/L)	1.0 (desirable), 1.5 (permissible)	Varies by industry	< 1.5 mg/L
Iron (Fe) (mg/L)	≤ 0.3	< 1.0 mg/L (varies)	< 5.0 mg/L

6. **Leak Detection Sensors:** Leak detection sensor (shown in Fig. 1.7) is used to monitor leaks in plumbing systems; both in supply and wastewater lines. It uses various technologies such as moisture sensors, acoustic monitoring or pressure drops to identify leaks.

Fig. 1.7: Leak Detection Sensor

Application: Leak detection sensor can quickly identify leaks that prevent water damage to property which helps to conserve water resources and reduce water bills.

7. **Water Usage Sensor:** Water usage sensor (shown in Fig. 1.8) tracks water consumption patterns in specific areas or appliances. It gives water consumption trends which helps to identify the opportunities for conservation.

Application: Water usage sensor is often used in smart homes and commercial buildings to promote water efficiency and raise awareness of wasteful practices.

Fig. 1.8: Water Usage Sensor

1.2 Basic Components of a sensor-based plumbing system

A sensor-based plumbing system comprises of various internal components that work together to monitor, control, optimize water flow and its usage. While the specific components can vary depending on the type and complexity of the plumbing system. Here are some of the common internal parts found in sensor-based plumbing systems:

1. **Sensors:** The primary internal component is the sensor itself. The sensors, as discussed in the previous section includes flow sensor, pressure sensor, temperature sensor, level sensor, water quality sensor, leak detection sensor and water usage sensor. Each types of sensor (shown in Fig. 1.9)- Add its name is responsible for

Fig. 1.9: Sensor

measuring specific parameters related to water flow, pressure, temperature, quality and usage.

2. **Microcontroller/Processor:** The sensors are connected to a microcontroller (shown in Fig. 1.10) or processor, which acts as the brain of the plumbing system. It receives data from the sensors and processes this information to make decisions or trigger an appropriate action. The microcontroller/processor can be a dedicated hardware unit or part of a smart plumbing system's central control unit.

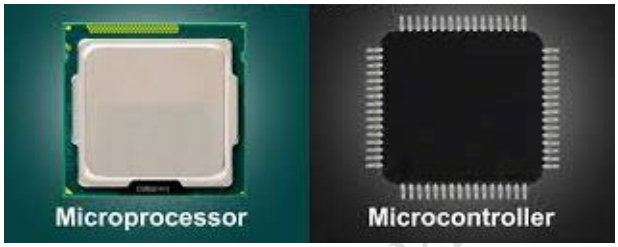


Fig. 1.10: Microprocessor/controller

3. **Actuators:** Actuators (shown in Fig. 1.11) are devices that respond to signal from the microcontroller/processor and take physical actions based on the data received from the sensors. In a sensor-based plumbing system, actuators might include solenoid valves, motorized valves or pumps. These actuators control the flow of water, pressure or other parameters to achieve the desired system behaviour.

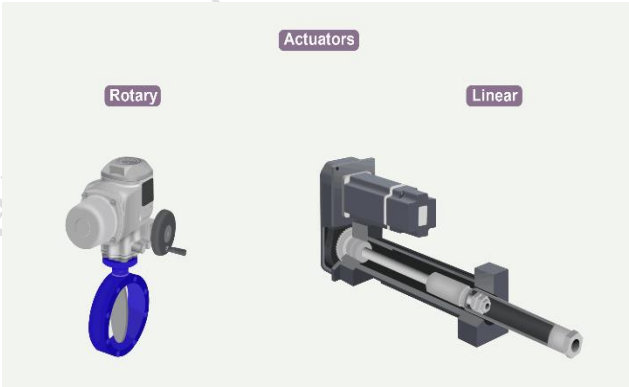


Fig. 1.11: Actuators

4. **Display/Interface:** Many sensor-based plumbing systems have a user interface or display that allows users to view real-time data and system status. This interface can be a physical control panel or a digital display connected to the microcontroller/processor. It enables users to monitor water usage, detects leakage, adjust settings and receive alerts. Interface can be a desktop or a mobile phone as shown in Fig. 1.13.

Fig 1.13 Interface

5. **Communication Module**: In sensor-based advance plumbing systems, there is communication module which is integrated into the system. This module enables the plumbing system to connect to a network (e.g., Wi-Fi or Bluetooth) and communicate with other smart devices or a central monitoring system. This connectivity allows for remote control and monitoring capabilities.

6. **Power Supply:** Sensor-based plumbing systems require a power source to operate the sensors, microcontroller, actuators and communication module. This power supply can be provided through wired connections or batteries, depending upon the system design and application.

These internal components work together to create an intelligent and efficient plumbing system capable of automatically adjusting water flow, detecting leaks, optimizing water usage and ensuring overall system performance and safety.

1.2.1 Solenoid valve, battery box, battery, and its application

The solenoid valve, battery box, and battery are essential components in any sensor-based system. Let us discuss each of these components in detail:

1. **Solenoid Valve:** A solenoid valve is an electromechanical device that controls the flow of fluids such as water, gas or air by using an electric current to actuate a plunger or valve mechanism. When the coil of the solenoid valve is energized, it creates a magnetic field which moves the plunger which allows the fluid to flow through the valve.
   When the coil is de-energized, the plunger returns to its original position, closing off the flow. (shown in Fig. 1.14)

Fig. 1.14: Solenoid valve

Application: Solenoid valves have numerous applications in plumbing systems, including:

- **Water Control**: They are commonly used in automatic irrigation systems, faucets and toilets to control water flow.
- **Automatic Shut-Off**: In emergency situations or leak detection systems, solenoid valves can quickly shut off water supply to prevent any damages.

- **Water Treatment**: Solenoid valves play an important role in regulating the flow of water in the water treatment plants.
- **Water Heater**: Solenoid Valve is used to control the supply of water in a water heater, turning it on or off as and when needed.
- **Dishwashers and Washing Machines**: Solenoid valves control water flow in appliances like dishwashers and washing machines.

2. Battery Box: A battery box is a protective container which is designed to shield the batteries from environmental factors like moisture, dust and external impacts which reduces the risk of damage and ensure its proper operation. (shown in Fig. 1.15)

Fig. 1.15: Battery box

Application: Battery box is commonly used in various applications including:

- **Sensor-Based Systems**: In sensor-based plumbing systems, a battery box protects battery from external environmental conditions.
- **Emergency Power Supplies**: Battery boxes are used in backup power systems, like uninterruptible power supplies (UPS) which provides temporary power during power-cut.
- **Remote Installations**: Battery box protects batteries in off-grid or remote installations, such as weather stations, surveillance cameras and telecommunications equipment.

3. Battery: A battery is an electrochemical device that stores and provides electrical energy through chemical reactions between its components (anode, cathode, and electrolyte). Batteries come in various types, including rechargeable and non-rechargeable, each with its own advantages and applications. (shown in Fig. 1.16).

Fig. 1.16: Battery (with Labelling)

In plumbing applications, dry batteries are mostly used due to their reliability, portability, and leak-proof nature. The most commonly used types include:

- **Alkaline Batteries ($Zn\text{-}MnO_2$):** Used in wireless leak detectors and smart water meters.

Lithium-ion Batteries (Li-ion): Found in advanced plumbing sensors, such as flow monitoring systems and IoT-based water quality sensors.

Application: Batteries have numerous applications in plumbing systems and beyond, such as:

- **Powering the Sensors**: Batteries provide the necessary electrical power to sensors in sensor-based plumbing systems which allows them to function continuous power supply without any rely.
- **Backup Power**: In case of power-cut, batteries can serve as backup power source for various functions such as alarms, emergency shut-off system etc.
- **Wireless Devices**: Batteries are essential for operating wireless devices including remote controls, wireless sensors, and smart home devices. They are easily portable and flexible to replace.

1.2.2 Installation and replacement of battery in sensor-based faucet

Sensor-based faucets are also known as touchless or automatic faucets. Due to their convenience and water-saving features, these are becoming popular in both residential and commercial areas.

Here is a step-by-step guide on how to install and replace the battery in a sensor-based faucet:

Installation of Battery: Following are the steps for the installation of a battery-

Step 1- Gather Materials: Before you begin, make sure you have the necessary materials, including the battery required for the sensor-based faucet (usually AA or AAA batteries).

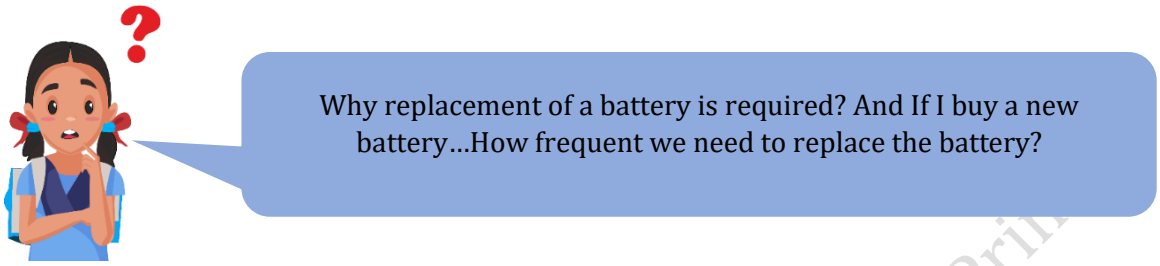
Step 2- Prepare the Faucet: Ensure that the water supply to the faucet is turned off. If it is a new faucet installation, follow the manufacturer's instructions to connect the faucet to the water supply lines.

Step 3- Locate the Battery Compartment: On most sensor-based faucets, the battery compartment is usually located either on the top or underneath the faucet spout, depending on the faucet's design. Some faucets may have a small cover or panel that needs to be removed to access the battery compartment.

Step 4- Insert the Battery: Open the battery compartment and insert the battery following the correct polarity (+ and -) as indicated. Make sure to match the positive and negative ends of the battery with the corresponding markings inside the battery compartment.

Step 5- Close the Battery Compartment: Once the battery is inserted, close the battery compartment securely.

Step 6- Test the Faucet: Turn on the water supply and test the sensor-based faucet by placing your hand near the sensor area. The faucet should activate and provide water flow automatically.



Replacement of Battery: The following steps are followed for replacement of battery-

Step 1- Turn Off Water Supply: Before replacing the battery, turn off the water supply to the faucet.

Step 2- Remove the Old Battery: Open the battery compartment as you did during installation and carefully remove the old battery.

Step 3- Dispose of Old Battery Properly: If the battery is dead or no longer usable, dispose it responsibly following local regulations for battery recycling or disposal.

Step 4- Insert the New Battery: Insert the new battery into the battery compartment, ensuring the correct polarity (+ and -).

Step 5- Close the Battery Compartment: Close the battery compartment securely.

Step 6- Test the Faucet: Turn on the water supply and test the faucet's functionality by activating it with the sensor.

Note: Following are the Important points which should be followed during installation and replacement of battery -

- ✓ Always refer to the manufacturer's instructions for your specific sensor-based faucet model. Different faucets may have slight variations in their battery installation process.
- ✓ Use high-quality batteries from reputable brands to ensure long-lasting performance and avoid leakage issues.
- ✓ Regularly check the battery level or indicator on the faucet to monitor battery life and plan for replacements when needed.
- ✓ If the faucet stops working after installing a new battery, double-check the battery's orientation and ensure it is securely inserted.
- ✓ By following these steps and tips, you can easily install and replace the battery in a sensor-based faucet, ensuring its smooth operation and convenient touchless functionality.

1.3 Selection criteria of the sensor-based faucet

Various factors have to be considered for the selection of sensor-based faucet to meet the specific needs and preferences. Here are some of the essential criteria to consider while choosing a sensor-based faucet:

1. Sensor Technology: Different sensor-based faucets use various sensor technologies, such as infrared, capacitive or touch-activated sensors. Consider which technology aligns with your preferences and requirements. Infrared sensors are commonly used in public restrooms and commercial buildings, while touch-activated sensors are popular in modern kitchens and bathrooms.

2. Power Source: Sensor-based faucets require a power source to operate the sensors and control the water flow. Some faucets are hardwired to an electrical supply, while others use batteries. Consider the available power source options and choose one that suits your installation and maintenance preferences.

3. Water Efficiency: Look for a sensor-based faucet with water-saving features. Some models offer adjustable flow rates or timed shut-offs to conserve water. Water-efficient faucets can significantly reduce water consumption and utility costs over the time.

4. Durability and Build Quality: Faucet should be selected from high-quality materials, such as stainless steel, brass etc., to ensure durability and resistance to corrosion. A well-built faucet will have a longer lifespan and require less maintenance.

5. Design and Aesthetics: Sensor-based faucets come in various designs and finishes. Consider the overall aesthetics of your kitchen or bathroom and choose a faucet that complements the décor and style of the space.

6. Installation and Retrofitting: Check if the sensor-based faucet requires any specific installation or retrofitting. Some faucets may have different mounting requirements or may need additional components for installation. Ensure that it fits your existing plumbing setup or can be easily installed without major modifications.

7. Water Temperature Control: Sensor-based faucets may have different methods for controlling water temperature. Some models have a single temperature setting, while others offer temperature adjustment options. Choose one that aligns with your preferences and requirements for hot and cold-water supply.

8. User-Friendly Features: Consider additional features that enhances user experience, such as touchless activation, adjustable sensor range or multi-function pre-sets. User-friendly features can add convenience and make using the faucet more efficient.

9. Brand Reputation and Warranty: Choose a reputable brand known for its manufacturing reliability and high-quality plumbing features. Check the warranty offered by the manufacturer to ensure adequate coverage for potential issues.

10. Budget: Sensor-based faucets come in a wide price range. Determine your budget and select a faucet that offers the desired features while staying within your price range.

1.4 Concept of sensor-based faucet and their types

The concept of a sensor-based faucet revolves around the integration of electronic sensors that detect hand movements or the presence of objects near the faucet that automatically controls the water flow. This touchless or automatic operation offers numerous benefits, including water conservation, hygiene and convenience. When users place their hands within the sensor's range, the faucet activates the water flow and it automatically turns off when the hands are retrieved. This technology is widely used in both residential and commercial buildings, such as public restrooms, kitchens and hospitals.

Types of Sensor-Based Faucets:

1. **Infrared Sensor Faucets:** Infrared sensor faucet (shown in Fig. 1.17) uses infrared light to detect the presence of objects, specifically the heat emitted by hands or other objects within the sensor's field. When an object is detected, the faucet's valve opens, allowing water to flow. When the object is not within the sensor field range, the valve closes, turning off the water flow.

Fig. 1.17: Infrared sensor faucets

2. **Capacitive Sensor Faucets:** Capacitive sensor faucet (shown in Fig. 1.18) uses the principle of capacitive touch to detect the presence of an object (e.g., hands) near the faucet. When a conductive object, such as a human hand, approaches the faucet, it changes the capacitance in the sensor, triggering the water flow. Like infrared sensor faucets, the water flow stops when the object is no longer present. Capacitive sensor faucets are known for their sensitivity and responsiveness, making them popular choices for both residential and commercial applications.

Fig. 1.18: Capacitive sensor faucets

3. **Touch-Activated Sensor Faucets:** Touch-activated sensor faucet (shown in Fig. 1.19) combines the concept of touch and sensor technology. These faucets have a small touchpad or touch-sensitive area on the faucet body which when touched, activates the water flow. Some touch-activated faucets require a single touch, while others require multi-touch options for different flow rates or temperature adjustments. Touch-activated sensor faucets are user-friendly and often used in modern kitchens and bathrooms.

Fig. 1.19: Touch-Activated sensor faucets

4. **Time-Controlled Sensor Faucets:** Time-controlled sensor faucets operate on a preset timer that controls the water flow for a specific duration. When such faucets are activated, the water flows for a predetermined time before it automatically shuts off. These faucets are commonly used in public areas to conserve water and prevent wastage in case a user forgets to turn off the faucet. Each type of sensor-based faucet offers unique benefits, including water efficiency, reduced risk of cross-contamination and improved hygiene. The choice of this kind of sensor faucet depends on the specific requirements of the application, intended usage and the desired level of automation and convenience.

1.5. Sensor-based faucet (Installation and Repair)

A sensor-based faucet is an automatic tap equipped with infrared or motion sensors to detect hand movements and control water flow.

Fig. 1.21: Infrared Sensor faucet

1.5.1 Installation of Infrared Sensor Faucet

The installation procedure for an infrared sensor faucet may slightly vary depending on the specific model and manufacturer. It is essential to follow the manufacturer's instructions provided with the faucet.

Tools and Materials needed: Following are the basic tools and materials required for the installation of a sensor faucet:

- Infrared Sensor faucet
- Flexible supply lines (included with the faucet or purchased separately)
- Adjustable wrench or pliers
- Teflon tape or thread sealant
- Screwdriver
- Basin wrench (optional, for hard-to-reach areas)

Requirement of sensor faucet for its smooth operation –

1. Minimum Pressure requirement (1 bar).
2. Adequate flow of water.
3. Debris free water supply.

However, here is a general step-by-step procedure for installing an infrared sensor faucet:

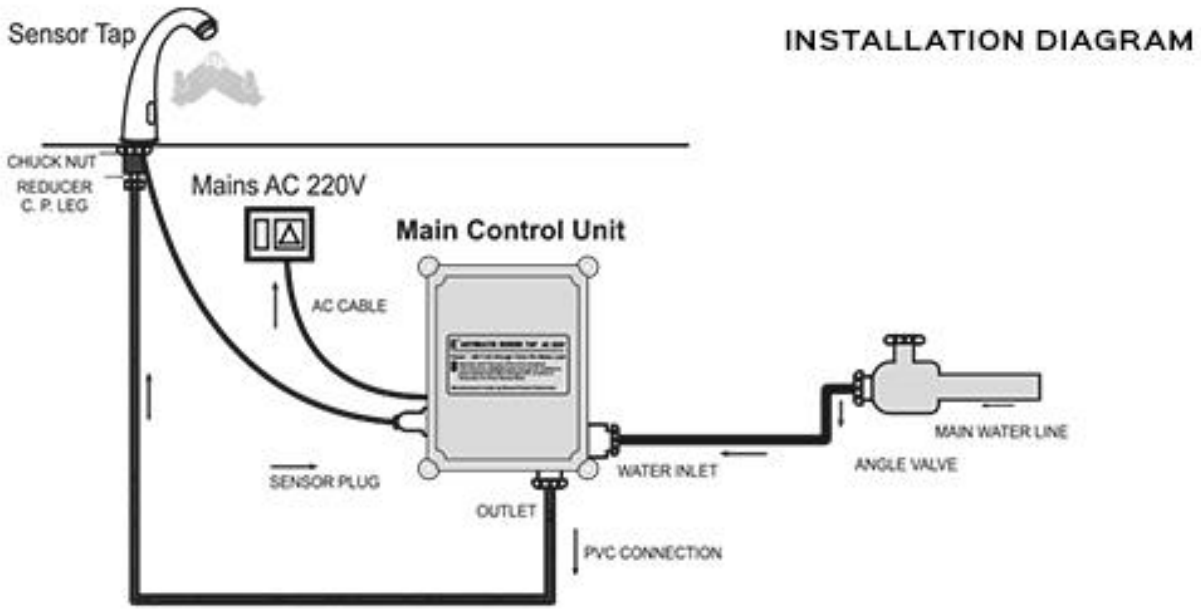


Fig. 1.22: Installation of Sensor based faucet

Basic steps involved in installation of a infrared sensor faucet (as shown in Fig. 1.22) are as follows:

Step 1 –

Unpack the Faucet – Carefully remove the sensor faucet from its packaging.

Step 2 –

Connect the Flexible Hose – Attach the faucet's flexible hose and tighten it securely.

Step 3 –

Pass Cables Through the Basin Hole – Adjust the flexible hose and sensor signal cable through the hole in the washbasin.

Step 4 –

Position the Faucet – Secure the sensor tap in the desired position on the washbasin.

Step 5 –

Fix and Tighten the Fittings – Attach and firmly tighten all the provided fittings to stabilize the faucet.

Step 6 –

Insert Batteries/ Power soruce – Open the battery compartment and insert 4 AA alkaline batteries for power.

Step 7 –

Connect the Water Pipe – Attach the flexible pipe from the faucet to the 'outlet' point of the control unit. Ensure leakproof connections

Step 8 –

Connect the Sensor Cable – Plug the sensor cable from the faucet into the control unit. Water should not enter the wire connections and battery box.

Step 9 –

Test the Faucet – Ensure the installation is complete, and the sensor faucet is working correctly.

Step 10 –

Clean Up: Dispose of any packaging materials and clean up the work area, ensuring everything is tidy and ready for use.

Table: Common Problems in Sensor-Based Plumbing Fixtures and Their Remedial Measures

Problem	Possible Causes	Remedial Measures	What Should Be Done
Sensor not detecting motion	Low battery, dirty sensor, faulty wiring	Replace battery, clean sensor, check connections	Regular maintenance and battery checks
Water not dispensing	Clogged aerator, sensor misalignment, valve issue	Clean aerator, adjust sensor, check solenoid valve	Inspect system periodically
Continuous water flow	Faulty solenoid valve, stuck sensor	Reset or replace solenoid valve, clean sensor	Turn off water supply before repair
Inconsistent water temperature	Mixing valve issue, clogged filters	Adjust or replace mixing valve, clean filters	Ensure proper water pressure
Delayed sensor response	Weak battery, sensor obstruction	Replace battery, remove obstructions	Use manufacturer-recommended batteries
Dripping faucet	Worn-out valve, sensor malfunction	Replace valve, recalibrate sensor	Inspect valves regularly
Low water pressure	Blocked filters, supply issue	Clean filters, check supply line	Schedule periodic filter cleaning
Error codes on digital display	Internal sensor error, electrical fault	Reset device, check wiring, consult manual	Follow manufacturer troubleshooting steps

1.6. Installation and Repair of a Sensor-based Urinal

A sensor-based urinal (shown in Fig. 1.21) is an automated restroom fixture that uses infrared or motion sensors to detect user presence and flush water automatically.

Fig. 1.21: Sensor based urinal

It promotes hygiene by eliminating the need for manual flushing, reducing the spread of pathogens. These urinals conserve water by using controlled flushing mechanisms that operate only when necessary. They are commonly used in public restrooms, offices, and commercial spaces to enhance cleanliness and efficiency. Additionally, sensor-based urinals require minimal maintenance, as they prevent issues like continuous flushing or water wastage.

1.6.1 Installation of Sensor based Urinal

Installing a sensor-based urinal involves a few steps to ensure proper functioning and hygiene. Keep in mind that specific models and manufacturers may have slightly different instructions, so always refer to the product manual provided by the manufacturer. Sensor-based urinals consist of several key components that work together to detect user presence, initiate flushing, and manage the overall operation of the fixture. As usual a sensor-based fixtures, sensor-based urinal consists of a sensor, solenoid valve, control circuit, flushing mechanism and a urinal bowl. A power supply is needed for its functioning. Below is a general procedure for the installation process (Refer Fig.1.22)

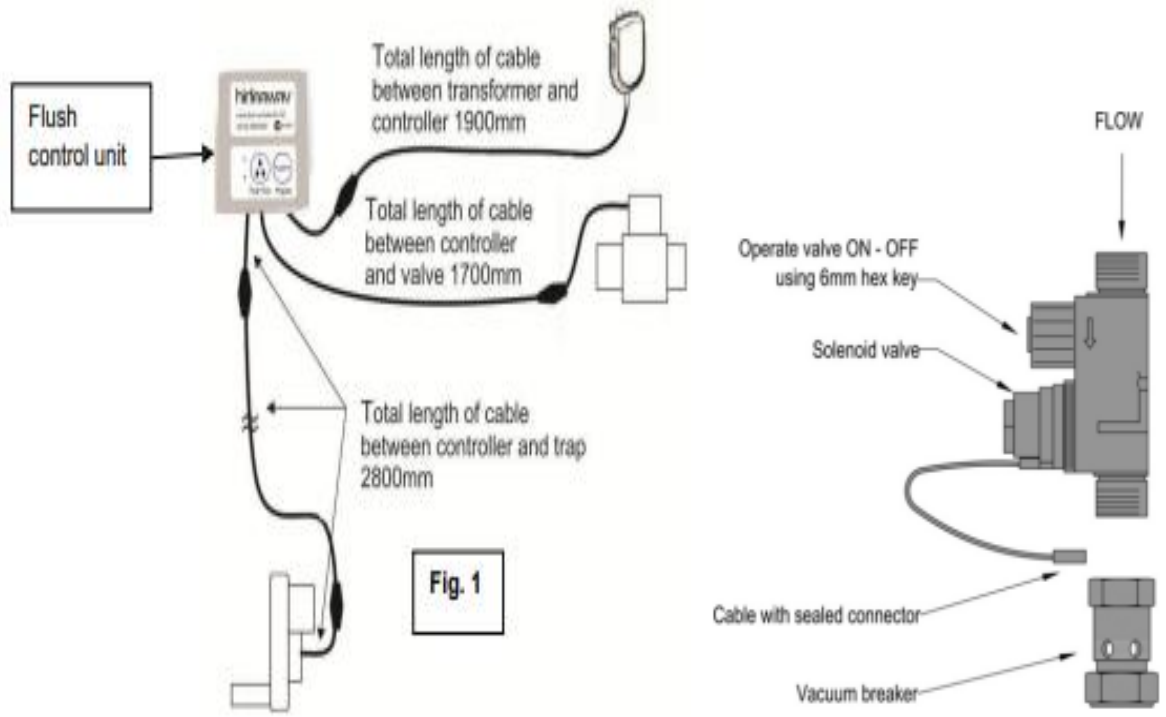


Fig. 1.22: Basic diagram of installation and arrangement of sensor-based urinal

Following are the tools and materials required for installation of a sensor-based urinal:

1. Sensor-based urinal
2. Mounting brackets or screws (if required)
3. Screwdriver or drill (if required)
4. Water level Sensor
5. Measuring tape
6. Water supply line and valve (if not already in place)
7. Silicone sealant (if required)
8. Pipe joint compound or plumber's tape (if required)

Following are the steps for the installation of sensor-based urinal:

1. Cut out paper template supplied, place in position flat on wall aligning centre of cut out holes with inlet and outlet.

2. Mark hole centres through template onto wall to provide wall locations for two 'L' shaped brackets. (Refer Fig. 1.23)

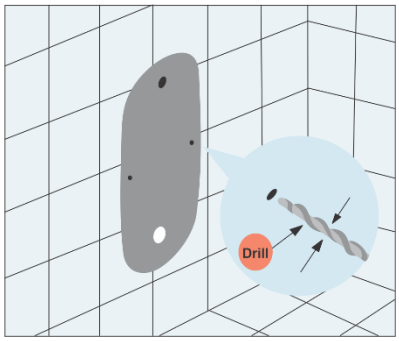


Fig. 1.23: Marking hole centres

3. Fit 'L' shape mounting brackets to wall with fixings supplied. (Refer Fig. 1.24)

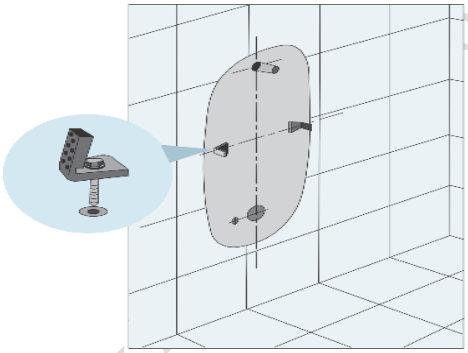


Fig. 1.23: Fitting of L shape mounting brackets

4. Before fitting waste trap, cut 50mm PVC DWV (Poly Vinyl Chloride Drain-Waste-Vent) flush with finished wall. (Refer Fig. 1.25)

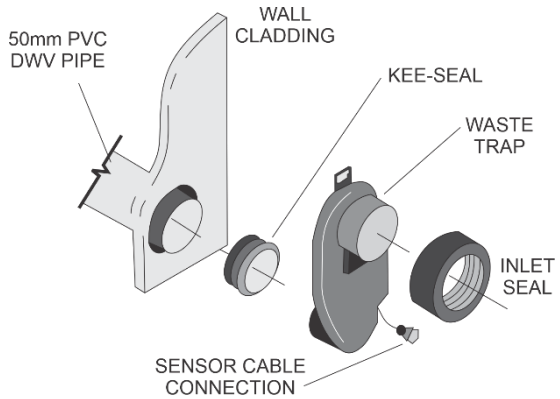


Fig. 1.25: Cutting of 50 mm DWV flush

5. Fit kee-seal to waste trap and lubricate before gently pushing into 50mm PVC DWV pipe so trap finishes flush with face of wall. Fix waste trap to wall with single screw. (Refer Fig. 1.26)

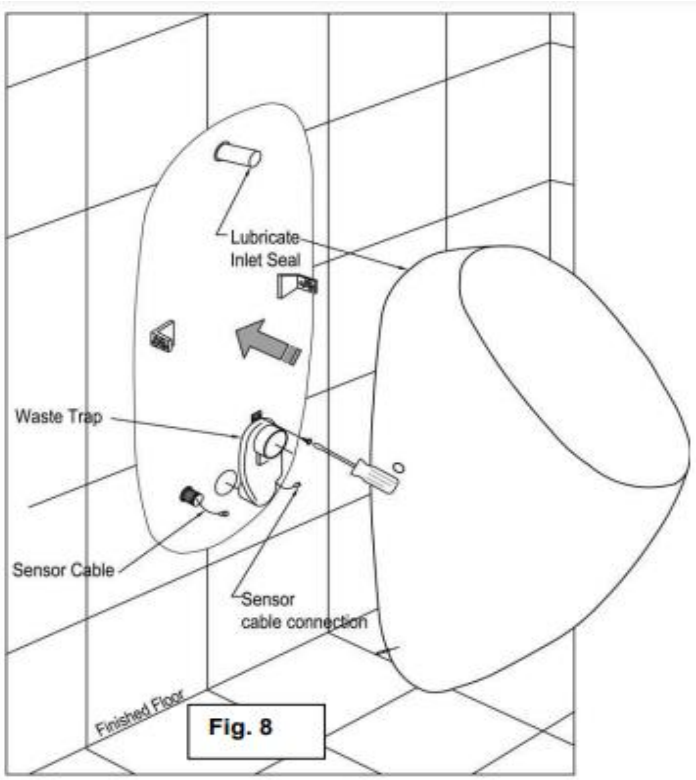


Fig. 1.26: Fixing waste trap to wall

6. Ensure sensor cable is installed through finished face of the wall and connected to trap before installing urinal.
7. Lubricate and fit rubber inlet seal to trap. Carefully lift urinal into installed position, ensuring it is fitted with:
   - Inlet pipe fully inserted into urinal rubber inlet seal
   - Outlet fully inserted into waste trap inlet seal
8. Urinal mounting screws are fitted using plastic sleeves. It is provided and tightened into L shape brackets (Refer Fig. 1.27).

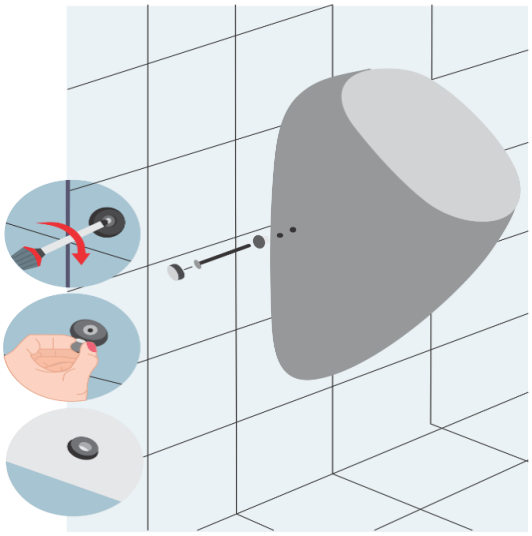


Fig. 1.27: Fitting of mounting screws and tightening into L shaped brackets

NOTE

- Do not over tighten screws as this may crack urinal side wall.
- Do not seal the urinal to the wall yet. Urinal should only be sealed once urinal has been fully commissioned.

1.6.2 Repairing process of the sensor-based urinal and its application

Repairing a sensor-based urinal will vary depending on the specific issue. However, here is a general procedure for the troubleshooting and its repair process:

Step 1- Identify the Problem: Before attempting any repairs, it is crucial to identify the problem with the sensor-based urinal. Common issues include sensor failure, flushing mechanism problems, water leakage, electrical issues etc., Carefully observe the urinal's behavior to detect the exact problem.

Step 2- Turn off water supply: Before starting any repairs, turn off the water supply to the urinal. This prevents water from flowing while you work, reducing the risk of flooding.

Step 3- Check sensor alignment: Ensure that the sensor is correctly aligned and not obstructed. Dust or dirt buildup on the sensor lens can affect its performance. Clean the sensor's lens with a soft, damp cloth to remove any dirt for its proper functioning.

Step 4- Test power supply: If the sensor-based urinal is not responding, check the power supply and make sure its terminals or batteries are properly connected.

If it is battery problem, replace the batteries and check the power connection if it is wired to the building supply line.

Step 5- Inspect flushing mechanism: If the urinal flushes inconsistently or does not flush at all, inspect the flushing mechanism. Check the solenoid valve and control circuit for any signs of damage or malfunction. It is essential to follow the manufacturer's instructions for disassembly and reassembly of these components.

Step 6- Address water leakage: If you notice water leaking from the urinal or the surrounding area, check the water supply line, drain pipe, and seals. Tighten any loose connections, replace damaged parts, and apply the plumber's tape or pipe joint compound to ensure watertight seals.

Step 7- Test the repairs: After making the necessary repairs, turn the water supply back on and test the sensor-based urinal to ensure that it's functioning correctly. Verify that the sensor detects movement and activates the flushing mechanism as intended.

1.7. Sensor based cistern

Sensor based cistern will be in built and wall mounted. Sensor based cistern typically involves mounting the cistern, connecting it to the water supply, and setting up the sensor. Keep in mind that specific models and manufacturers may have slightly different instructions, so always refer to the product manual provided by the manufacturer. The general procedure for the installation process of a sensor-based cistern is given below:

A sensor-based cistern consists of a few essential components that ensure efficient water management:

1. **Water Level Sensor** – Detects and monitors the water level inside the cistern.
2. **Control Unit** – Acts as the system's brain, processing sensor data and managing operations.
3. **Automated Valve –** Regulates water flow based on sensor readings.
4. **Power Supply** – Provides energy through electricity or solar power.

Let us go through each part with the help of a figure (Refer Fig. 1.28):

1. Water Inlet
2. 1 inch screw nut
3. Water volume adjuster
4. 220v power wiring
5. Battery box
6. Valve Cover
7. Solenoid Valve
8. Output Power Plug
9. Solenoid valve plug
10. Slurry Mould
11. Water Outlet

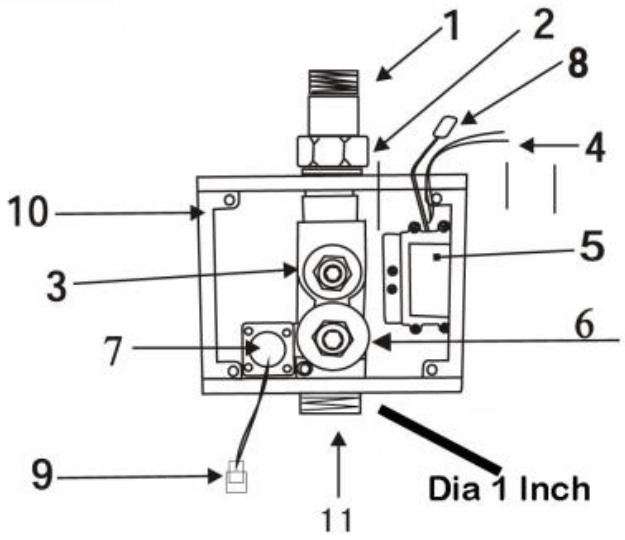


Fig. 1.28: Components of inbuilt Sensor based cistern

1.7.1 Installation of inbuilt Sensor based cistern

The general dimension of the overall sensor is given as follows:

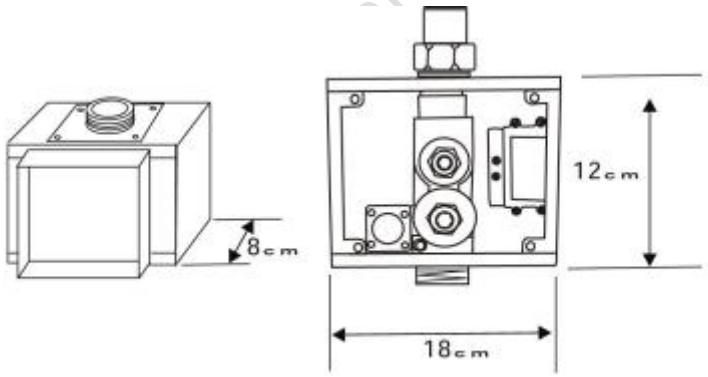
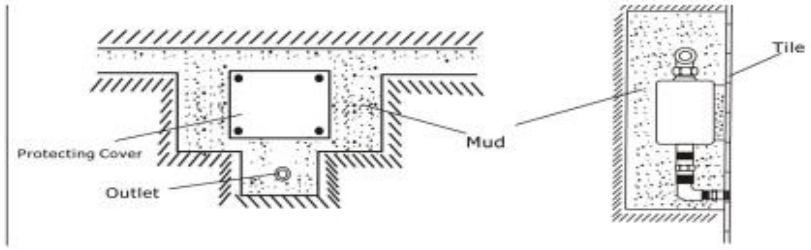


Fig. 1.29: Dimension of a sensor kit

Step 1: Make sure to mark the appropriate points and cut according to product size while installation of the inbuilt cistern. (Refer Fig. 1.30)

Step 2: Clean the impurities and silt from pipeline. Screw down the water inlet nut. (Refer Fig. 1.31)

Step 3: Check connections for leaks during water pressure test. Grout the gap between control box and the wall tiles. Once grout is dry, remove and dispose the protective cover. (Refer Fig. 1.32).



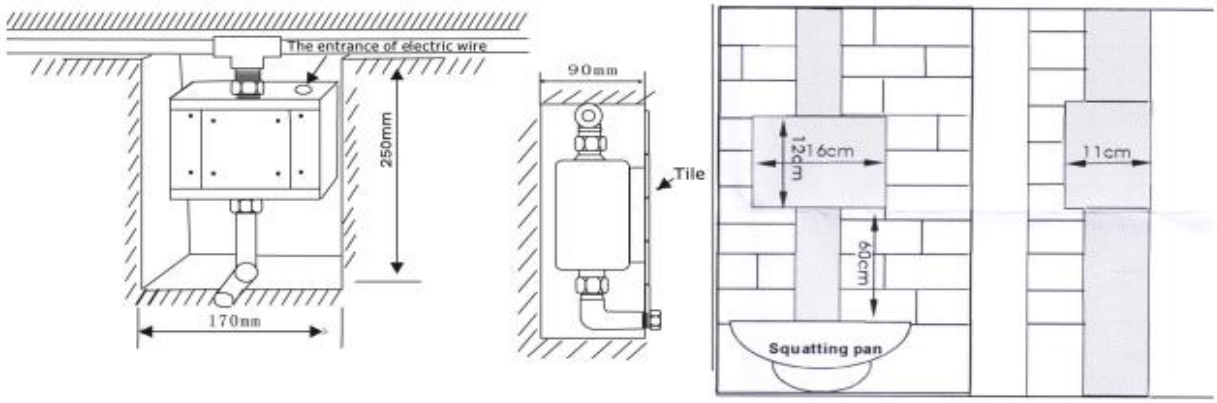


Fig. 1.30: Appropriate cutting as per the required dimension

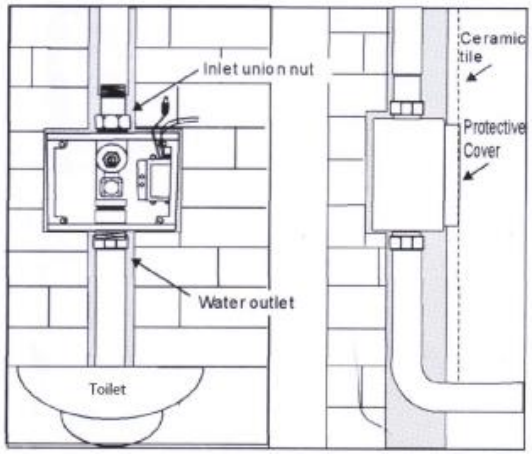


Fig. 1.31: Cleaning of pipeline and screwing inlet union nut

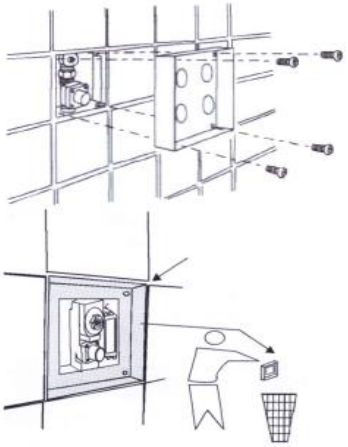


Fig. 1.32: Check interference of leak and grout the gap

4. Open the battery holder and insert batteries as required. Connect sensor panel, power cables and solenoid valve. Put the power adapter and battery holder back into the mortar. When the power is turned on, the LED light will flash once. (Refer Fig. 1.33)

NOTE

a) Do not mistake the polarity of the batteries. Do not mix old and new batteries.
b) Tighten the screws on the battery box to eliminate moisture around the batteries

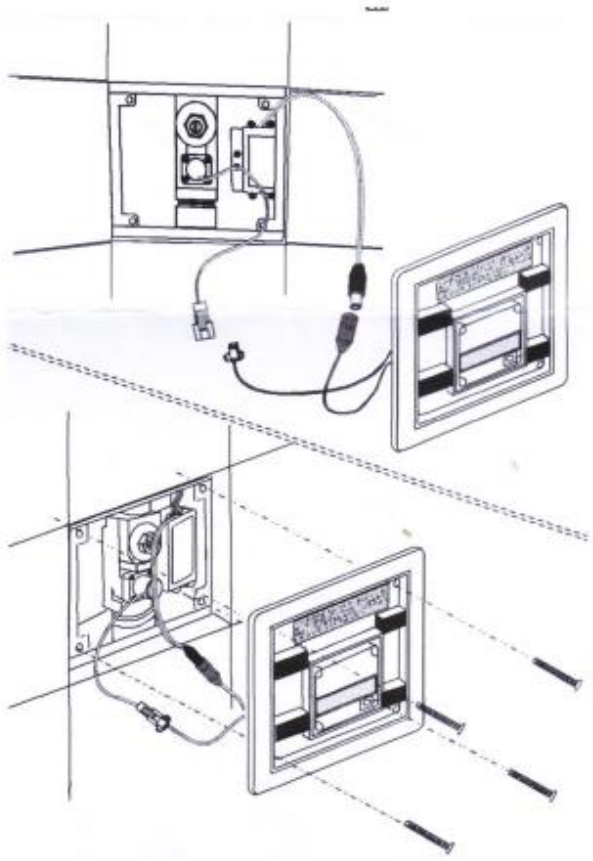


Fig. 1.33: Insertion of batteries and powering on

5. Screw the fixed panel with 4 long screws and cover the panel. (Refer Fig. 1.34)

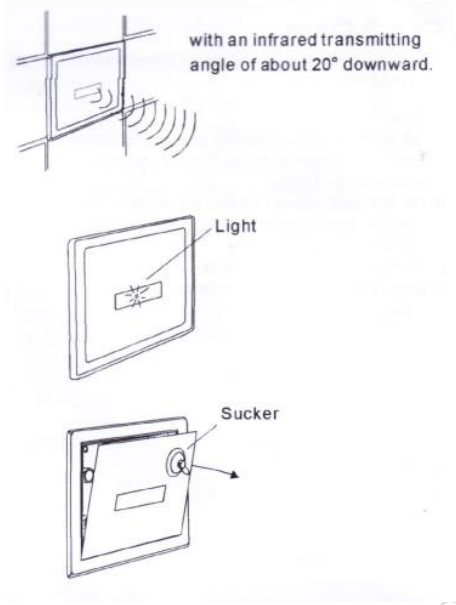


Fig. 1.34: Fixing the panel

NOTE

To adjust water flow, use a small screw driver and turn valve clockwise to shut off or anti – clockwise to open. (Refer Fig. 1.35)

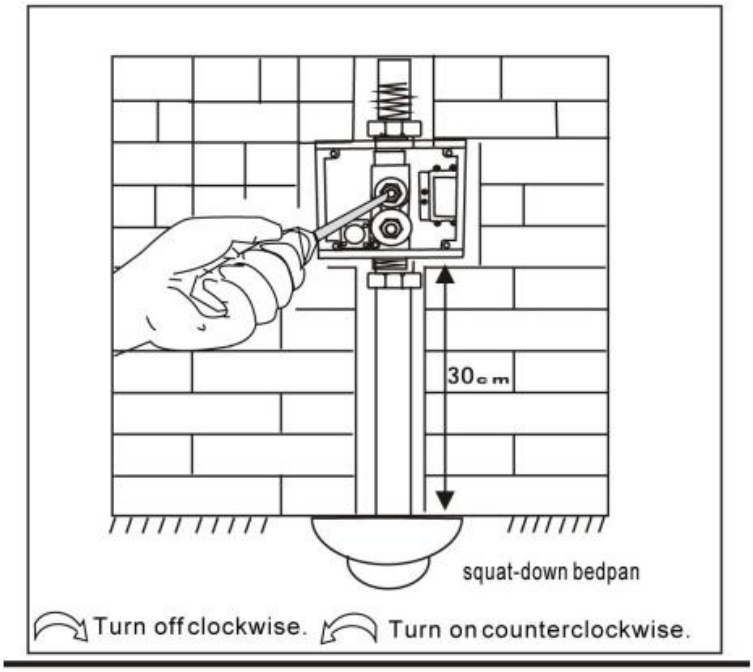


Fig. 1.35: Adjusting water flow

Although the time can be adjusted for every sensor. For example, when user passes into the sensing range for 10 seconds, the valve will flush for 10 seconds. Once the user has left the sensor, the valve will flush for 6 seconds. (LED light will flash once every 3 seconds.). This varies as per the manufacturers settings.,(Refer Fig. 1.36)

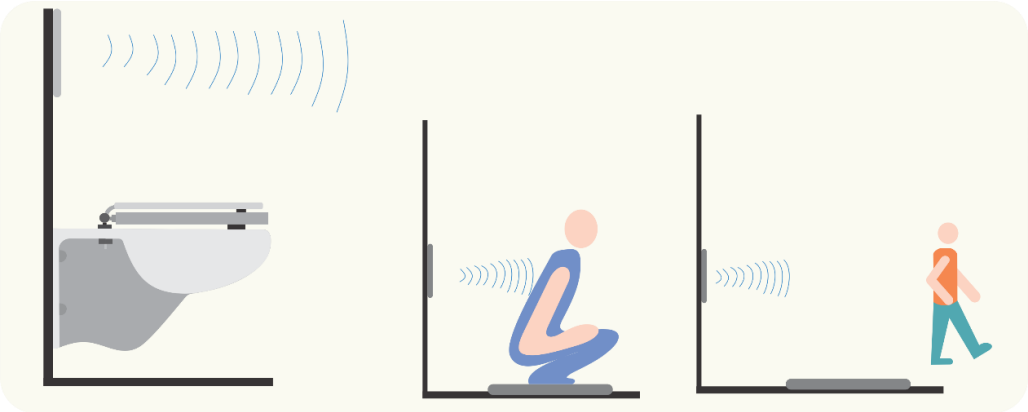


Fig. 1.36: Sensor range

1.7.2 Troubleshooting of Sensor based cistern

S.NO	PROBLEM	REASON	SOLUTION
1.	No flow of water	• Non-availability of water. • Inadequate pressure. • The power supply or valve hasn't been switched on. Discharged batteries. • Not plugged into socket correctly/ No power supply. • There are obstacles before the sensor window. • Debris stuck in solenoid valve.	• Check supply of water. • Turn on the water valve or switch the power on. • Attach a pressure pump if required. • Replace the batteries • Check electrical connections. • Check sensor window is clear of obstacles up to 1 meter. • Clean the solenoid valve and install an inline filter.

		• Sensor eye or defects in solenoid valve	• Check and replace the defective parts.
2.	Can't shut off water	• Water pressure is too low. Solenoid is blocked. • Batteries are discharged.	• Increase the water pressure. • Open the solenoid valve and clean out any impurities and silt.
3.	Little amount of water flowing from valve	• Water pressure is too low. Water regulation valve is not opened enough.	• Increase water pressure. Open the water regulation valve to its fully open position.

1.8. Sensor-based shower

A sensor-based shower (shown in Fig. 1.38), also known as a smart or automated shower, utilizes sensor technology to control and regulate various shower functions. A sensor-based shower works automatically to provide a convenient and water-efficient experience. It is not commonly used in India.

Fig. 1.38: Sensor based shower

Key Features of Sensor based faucet:

- **Intelligent Valve Sensor System**: Ensures accurate control over water temperature and flow, providing a consistent and comfortable shower experience.
- **Digital Interface – Touchpad**: Offers user-friendly operation, allowing seamless adjustments to water settings.
- **Thermostatic Mixer** – CPU iV6/6 OUT: Maintains the desired water temperature, enhancing safety and comfort.
- **Safety Measures**: Features like automatic shut-off in case of water supply failure ensure user safety.
- **Aesthetic Design**: Combines functionality with modern design, complementing premium bathroom aesthetics.

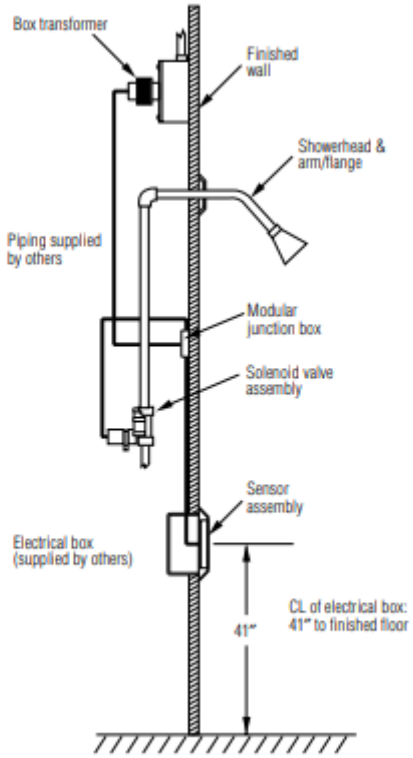


Fig. 1.39: Schematic diagram of Sensor based shower

The components of Sensor-Based Shower include key components:

1. **Sensor**: Detects presence and activates water flow.
2. **Water Valve**: Controls water flow to the showerhead.
3. **Mixing Valve**: Balances hot and cold water for the right temperature.
4. **Showerhead**: Delivers water in various spray patterns.
5. **User Interface**: Allows manual adjustments and displays temperature or flow settings.
6. **Communication Module**: Connects with smart devices for remote control.
7. **Water-Saving Mode**: Reduces flow while lathering to save water.
8. **Safety Features**: Prevents overheating with automatic temperature control.
9. **Control Unit**: Processes data from sensors and manages functions.
10. **Power Supply**: Runs on electricity or batteries.

1.8.1. Installation procedure and repair of the sensor-based shower

Following basic steps needed to be followed for the installation of sensor-based shower head:

Step 1: Determine Shower Component Layout (Refer Fig. 1.40)

- Identify locations for shower sensor, solenoid valve, control box, and transformer.
- Mount the sensor on the shower wall at approx. 41" height (adjust for children).
- Drill a 5/8" hole for the sensor cord and secure the stainless-steel plate.
- Keep solenoid within 2 feet of the modular junction box (or up to 100 feet with extra cables). (Refer Fig. 1.40)

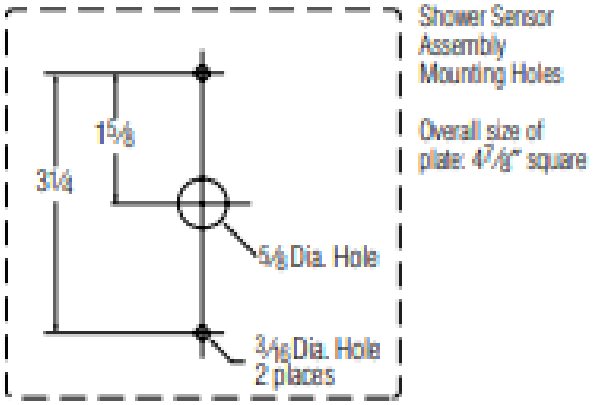


Fig. 1.40: Sensor assembling mounting holes

Step 2: Install Solenoid

- Flush water lines before installation.
- Connect supply line to 3/4" NPT solenoid using thread sealant (not Teflon tape).
- Ensure solenoid manual override is off.
- Connect solenoid outlet to the showerhead piping.

Step 3: Install Modular Junction Box (Ref. Fig. 1.41)

- Mount the box near the solenoid and sensor.
- Drill holes using the box base as a template and secure the box.

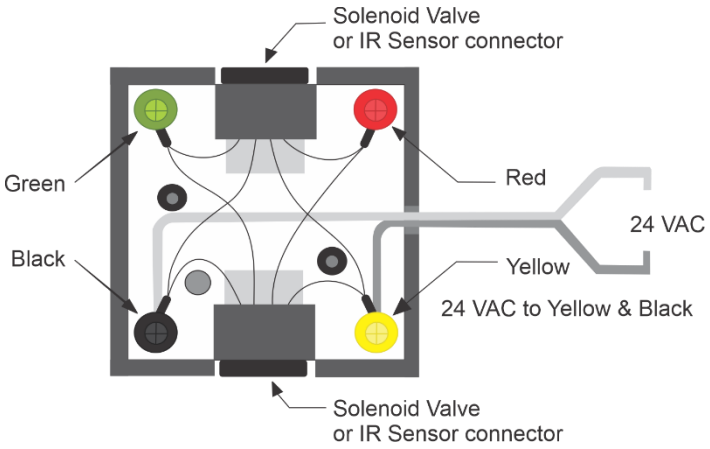


Fig. 1.41: Modular Junction Box

Step 4: Transformer Installation

- Install transformer remotely (e.g., chaseway, closet, or ceiling).
- Connect power supply wires to the modular junction box.
- Plug in solenoid and sensor cables.
- Do not power the transformer until all wiring is complete.

Note: Plug in Transformer: This type of Transformer is designed to be plugged into a 110V AC wall outlet. To avoid permanent damage to the transformer, sensor or solenoid valve, do not plug transformer into outlet until all wiring has been completed. (Refer Fig. 1.42)

Box Mount Transformer: This type of transformer is designed to be mounted on an 110 VAC supply electrical junction box ("J" box should be mounted inside chase wall or above ceiling). (Refer Fig. 1.43)

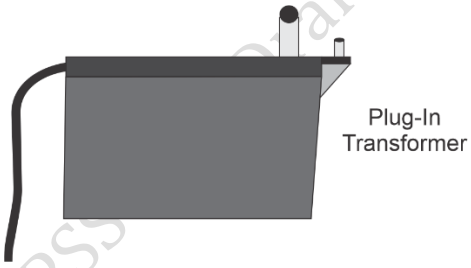


Fig. 1.42: Plug in Transformer

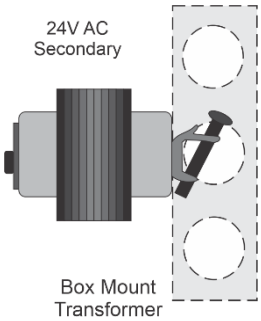


Fig. 1.43: Box Mount Transformer

Step 5: Start-Up

- Supply power to the transformer.
- Activate the sensor and check for a red activation light. (Refer Fig. 1.44)
- Turn on the water supply and test for leaks.

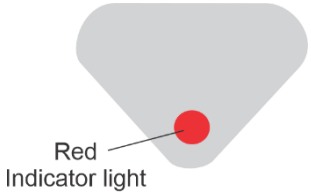


Fig. 1.44: Sensor assembly activation list

Step 6: Sensitivity Adjustment

- Adjust sensor range (factory set to 18") using the upper potentiometer at the back.
- Turn clockwise to increase and counter clockwise to decrease range.

Step 7: Shower Time Adjustment

- Default shower time is 14 minutes, adjustable via the lower potentiometer.
- Turn clockwise to increase and counter clockwise to decrease time.

Step 8: Secure Sensor Assembly

- Tighten screws and apply a plumber's putty gasket to prevent leaks.
- Clean with mild soap; avoid abrasive cleaners on the lens.

1.8.2 Maintenance & Troubleshooting

I. Cleaning the Shower Area

- Cover the sensor lens with black tape to block light and prevent activation.
- Use mild soap for cleaning; avoid abrasive cleaners.

II. Routine Maintenance

- Check electrical connections for corrosion.
- Ensure solenoid valve is clean and functioning.
- Verify water temperature is safe for use.

III. Troubleshooting Issues

Case 1: No Sensor Light & No Water Flow

Steps:

- Check transformer/battery box at junction box and transformer.
- Use a voltmeter to confirm transformer /battery power.
- If power is present but no response, replace sensor assembly.
- Ensure no object is blocking the sensor at start-up.

Case 2: Sensor Light On, But No Water

- Ensure the water supply is open.
- Check solenoid manual override is OFF.
- If issue persists, repair/replace solenoid.
- Check if maximum run time has been reached; adjust if needed.

Case 3: Water Flows Continuously

- Unplug solenoid from the control box:
- If water still flows, clean or replace the solenoid (check for debris/lime).
- If water stops, check and correct electrical wiring in the modular junction box.

ACTIVITIES

Activity 1: Make a list of different types of sensors used in the plumbing system.

Material Required

1. Notebook
2. Pen

Procedure

1. First visit the sanitary hardware shop.
2. Identify the different types of sensors available in the hardware shop.
3. Make a list of the identified different types of sensors available in the hardware shop.
4. Write their name and specification.

Activity 2: Draw the line diagram of solenoid valve, battery box, battery and label it.

Material Required

1. Notebook
2. Pen
3. Pencil
4. Sharpener
5. Eraser

Procedure

1. First visit any house or building.
2. Identify the location of the solenoid valve, battery box, and battery is fitted.
3. Draw the line diagram of the solenoid valve, battery box, battery is fitted in any house or building.

Activity 3: Draw the line diagram of a sensor-based urinal.

Material Required

1. Notebook
2. Pen
3. Pencil
4. Sharpener
5. Eraser

Procedure

1. First visit any house or building.
2. Identify the location of the sensor-based urinal is fitted.
3. Draw the line diagram of the sensor-based urinal is fitted in any house or building.

CHECK YOUR PROGRESS

A. Answer the following questions

1. What is a sensor and write its application in plumbing?
2. Write the different types of sensors used in plumbing.
3. Brief the internal parts of a sensor-based plumbing system.
4. Explain the terms solenoid, battery box, and battery and write their application.
5. Describe the installation and replacement of the battery in a sensor-based faucet.
6. Explain the concept of sensor-based faucet and their types.
7. Write the selection criteria of sensor-based faucet.
8. Describe the installation and repair process of sensor-based faucet.
9. Explain the installation and repair process of sensor-based urinal.

B. Fill in the blanks

1. A _____ is a device that detects changes in its surroundings and converts this information into a signal.
2. _____ sensors measure the rate of water flow in plumbing systems.
3. Pressure sensors help in maintaining consistent _____ in plumbing fixtures.
4. A _____ valve is an electromechanical device that controls the flow of fluids using an electric current.
5. The _____ is responsible for processing data received from sensors and making decisions in a plumbing system.
6. A _____ is a protective container designed to house batteries safely.
7. _____ sensors are commonly used to detect leaks in plumbing systems.
8. The most commonly used sensor technology in public restrooms is _____ sensors.

C. Multiple Choice Questions (MCQs)

1. Which type of sensor is used to measure the rate of water flow in a plumbing system?
a) Pressure Sensor
b) Flow Sensor
c) Temperature Sensor
d) Level Sensor

2. What is the function of a solenoid valve in a plumbing system?
a) Measure temperature
b) Detect water quality
c) Control fluid flow
d) Store battery power

3. Which sensor-based faucet type uses infrared light to detect the presence of hands?
a) Capacitive Sensor Faucet
b) Infrared Sensor Faucet
c) Foot Pedal Sensor Faucet
d) Time-Controlled Sensor Faucet

4. What is the purpose of a battery box in a sensor-based plumbing system?
a) Store water
b) Protect batteries from environmental factors
c) Measure water flow
d) Increase water pressure

5. What should be checked first if a sensor-based faucet stops working?
a) Water temperature
b) Solenoid valve connections
c) Power source (battery or electrical supply)
d) Faucet design

Module 2	ADVANCE PIPE FITTINGS

Module Overview
This module covers essential advance pipe fittings used in residential and commercial buildings. It introduces students to various advanced pipe fittings, service connections, water supply systems, and modern technologies like rainwater harvesting, solar water heating, and hydro pumping systems.

Learning Outcomes
After completing this module, student will be able to: • Identify different advanced pipe fittings used in plumbing. • Explain the service and house sewer connections. • Describe the process of drinking water connection from the main supply to residential units. • Understand the rainwater harvesting filter column and its role in water management. • Explain the working and installation process of a solar water heater. • Describe the pressurized water pumping system and its importance.

Module Structure
2.1 Advance Pipe Fittings in Plumbing 2.2 Service and House Sewer Connections 2.3 Drinking Water Connection 2.4 Rainwater Harvesting Filter Column 2.5 Solar Water Heater and Installation 2.6 Pressurized Water Pumping system

In this unit, we are going to learn about Advance pipe fittings which are used in modern and innovative solutions in plumbing. These fittings are designed to provide improved performance, ease of installation, durability, and enhanced functionality compared to traditional pipe fittings.

Here are some examples of advanced pipe fittings:

1. **Push-to-Connect Fittings**: Push-to-connect fittings as shown in Fig. 2.1, also known as push-fit or quick-connect fittings, are designed to join pipes without the need for soldering, threading, or specialized tools. They feature a simple push and lock mechanism, making installation faster and more convenient.

Fig. 2.1: Push to Connect Fittings

2. **Compression Fittings**: Compression fittings are widely used in plumbing and gas systems. They consist of two components - a compression nut and a compression ring as shown in Fig. 2.2. When the nut is tightened, the ring compresses around the pipe, creating a watertight seal.

Fig. 2.2: Compression Fitting

3. **Grooved Fittings**: Grooved fittings as shown in Fig. 2.3 utilize a mechanical coupling system to join pipes without welding or threading. They are commonly used in fire protection, HVAC, and other industrial systems.

Fig. 2.3: Grooved Fitting

4. **Flange Fittings**: Flange fittings as shown in Fig. 2.4 are used to connect pipes and equipment in various industrial applications. They provide a secure and leak-resistant connection and are commonly used in high-pressure and high-temperature systems.

Fig. 2.4: Flange Fitting

5. **Camlock Fittings**: Camlock fittings as shown in Fig. 2.5, also known as cam and groove fittings which are used to quickly connect and disconnect hoses and pipes. They are popular in fluid transfer applications.

Fig. 2.5: Camlock Fitting

6. **Shark Bite Fittings**: SharkBite fittings as shown in Fig. 2.6 are push-to-connect fittings that are widely recognized for their ease of installation and versatility.

Fig. 2.6: Shark bite Fitting

These advance pipe fittings offer various benefits, including time and cost savings during installation, improved performance, and reduced maintenance requirements.

2.1. Advanced Pipe Fittings in Plumbing

Advanced pipe fittings are focussed on ensuring safety, efficiency, and durability in plumbing systems. These fittings are manufactured with high-quality materials, precision engineering in compliance with relevant standards. Some of the commonly used advanced pipe fittings in plumbing are as follows:

1. **CPVC (Chlorinated Polyvinyl Chloride) Fittings**: CPVC is used for both hot and cold-water supply systems. The fittings are connected using solvent cement, which chemically welds the joints, ensuring a reliable and leak-resistant connection.
2. **PEX (Cross-linked Polyethylene) Fittings**: PEX is a flexible, durable plastic tubing widely used in modern plumbing systems. It is made from cross-linked polyethylene, which enhances its strength, heat resistance, and flexibility. PEX pipes and fittings have gained popularity in plumbing due to their flexibility and resistance to corrosion. PEX fittings come in various types, including crimp, clamp, and push-fit connections. Refer Fig. 2.7 for the comparison of CPVC and PEX pipes.

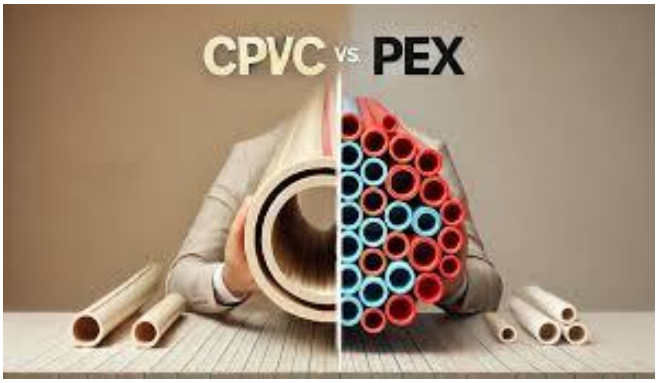


Fig. 2.7: CPVC versus PEX

S.No.	Feature	CPVC (Chlorinated Polyvinyl Chloride)	PEX (Cross-Linked Polyethylene)
1.	Material	Plastic (Chlorinated PVC)	Flexible plastic (polyethylene)
2.	Flexibility	Rigid; needs fittings for bends	Very flexible pipe which can be bend easily
3.	Installation	Requires glue (solvent cement)	Uses crimp, clamp, or push fittings
4.	Heat Resistance	Handles hot water well	Handles hot water well, but better for freezing conditions since flexible in expansion.
5.	Freezing Resistance	Can crack in freezing temperatures	Expands and resists bursting
6.	Durability	Long-lasting; but may become brittle over time	Very durable and resistant to damage
7.	Usage	Used in homes and industries for hot & cold water	Mostly used in homes for water supply
8.	Cost	Generally cheaper	Slightly more expensive
9.	Best For	Hot water pipes, industrial usage	Plumbing in cold regions.

3. **PP-R (Polypropylene Random) Fittings**: PPR (Polypropylene Random Copolymer) pipes shown in Fig. 2.8 are durable plastic pipes used for hot and cold-water systems. They can resist high temperatures (up to 95°C). These pipes resist corrosion, abrasion, and scaling. PPR pipes are joined using fusion welding, providing seamless, leak-proof connections. They have a smooth interior which ensures better flow. PPR pipes are eco-friendly, recyclable, and long-lasting (up to 50 years). They are ideal for residential, commercial and industrial plumbing systems.

Fig. 2.8: PPR Pipes

4. **Manifolds**: Manifold as shown in Fig. 2.9 is a distribution device that connects multiple water lines to various parts of a building. It allows independent control of water flow to different fixtures through individual valves. Manifolds reduce pipe complexity, ensure even water pressure, and simplify installation. They are commonly used for residential and commercial purposes. Manifold are made from materials like brass or stainless steel. It is durable and prevents leakage. They provide efficient water distribution and easy isolation of sections for repairs.

Fig. 2.9: Manifold with 2 inlets and 4 outlets

2.2. Service and House Sewer Connections

In a residential plumbing system, service connection involves connecting house sewer lines (from individual properties) to the main sewer system. This process is essential for the proper disposal of wastewater and sewage from residential units. The connection usually passes through two key chambers: the master chamber and the main chamber.

Let's break down the process:

1. **House Sewer Lines:** House sewer lines refer to the pipes within a residential property that collect and carry wastewater from sinks, toilets, showers, and other plumbing fixtures. These pipes are typically installed underground and connect to the main sewer line outside the property.

2. **Master Chamber:** The master chamber is a small underground access point located within the property's boundary or near the building. It serves as a junction where the house sewer lines from different parts of the property (e.g., kitchen, bathroom, laundry) converge before connecting to the main sewer line.
3. **Main Chamber:** The main chamber is a larger underground access point located outside the property, usually near the street or the property line. It serves as a connection point between the master chambers of different properties and the municipal or community sewer system.

Here's an overview of how the process works:

Step 1- Excavation: The plumber or contractor will need to excavate the ground to access the sewer lines and create a pathway for the new connections.

Step 2-House Sewer Line Routing: The house sewer lines from different parts of the residential units are laid out and connected to the master chamber. The master chamber is often equipped with inspection ports or cleanouts for maintenance and inspection purposes.

Step 3-Master Chamber Connection: The house sewer lines are connected to the master chamber using appropriate fittings and jointing methods, such as PVC or clay pipes and suitable seals to ensure a watertight connection.

Step 4- Main Chamber Connection: From the master chamber, the sewer line continues outside the property and connects to the main chamber. The main chamber is connected to the main sewer line making a secure and sealed joint.

Step 5-Backfilling and Compaction: Once the connections are in place and inspected for quality, the excavated area is backfilled with soil and compacted to the ground level.

Step 6-Inspection and Approval: The newly connected sewer lines undergo inspection by local authorities or utility companies to ensure compliance with regulations and safety standards.

2.3. Drinking water connection

Connecting a drinking water supply from a municipal pipeline to an overhead, ground level or underground storage tank involves several steps. First let us view the standard process of supply of drinking water in a village or a town (Refer Fig. 2.10 (a) and 2.10 (b))

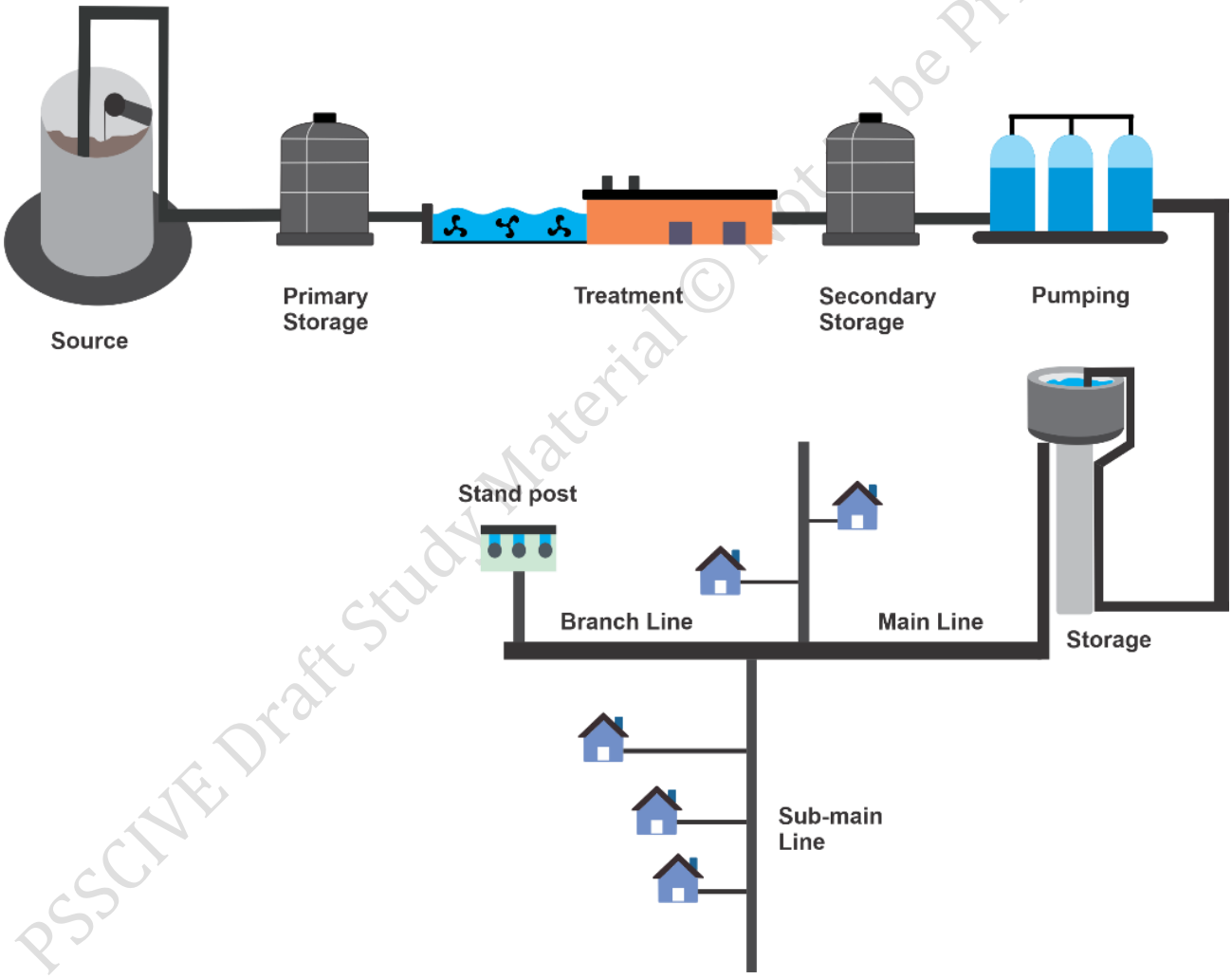
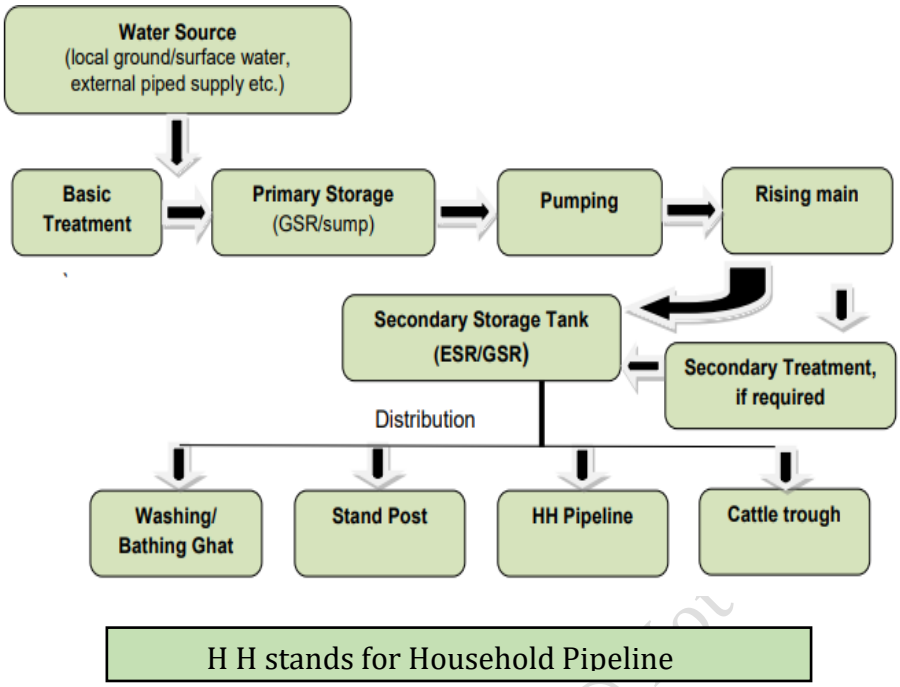


Fig. 2.10(a): Standard Process of Drinking Water Supply



H H stands for Household Pipeline

Fig. 2.10 (b): Block diagram of Standard Drinking water supply process

In Fig. 2.10(b), Some terms need to be understood:

1. Ground Service Reservoir (GSR): GSR is ground level or plinth level storage tank. The plinth level is generally not more than 3 m. Storage capacity of the service reservoirs is estimated based on pumping hours, demand and hours of supply. Systems with higher pumping hours require less storage capacity. Normally, such reservoirs are calculated to store half to one day daily water requirement.

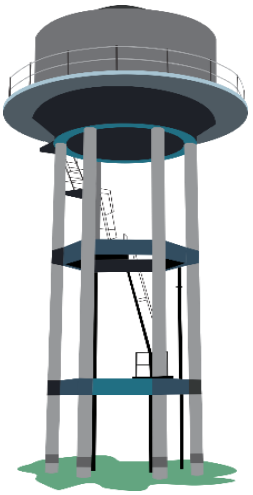


Fig. 2.11: Elevated Surface Reservoir (ESR)

2. Elevated Surface Reservoir (ESR) or elevated storage tank: ESR is constructed, where water is to be supplied at elevated height (less than the level of ESR) or where the distance is large and topography is undulating. Generally, ESR shown in Fig. 2.11 is at height more than 15 m. Water can be distributed directly from this storage tank by gravity.

3. Sump: Sump shown in Fig. 2.12 is used as additional storage at village/town level. It is not used for direct distribution of water.

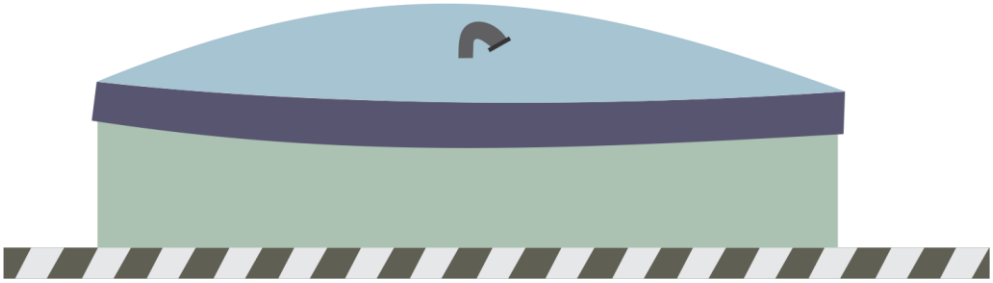


Fig. 2.12: Sump

4. Stand Post: Stand post with one or more taps are installed at near the storage tank, in the villages/towns where household tap connection is not available or possible. Stand posts are constructed of masonry or concrete structures. Stand posts should have normal output of 12 litres/minute. One stand post is estimated for every 250 persons. (Add image)

Fig. 2.13: Stand Post

Now, let us go through some basic steps required for proper distribution of water pipeline in a village/town:

Step 1-Permits and Approvals: Before initiating any work, you need to obtain permits or approvals from the local municipal or water authority. This ensures that the installation complies with local regulations and safety standards.

Step 2- Selecting the Storage Tank: Determine whether you need an overhead tank, which is installed above ground level and relies on gravity for water flow, or an underground tank, which is buried beneath the ground. The choice depends on factors like available space, aesthetics, and water demand.

Step 3- Choosing the Water Meter (if required): Some municipalities mandate the installation of a water meter to measure the volume of water consumed by a property. The water meter is usually placed between the municipal water supply and the storage tank to monitor water usage accurately. If required, choose an appropriate water meter size and type as per local regulations.

Step 4- Routing Pipes: Once you have the necessary approvals and the tank selected, route the pipes from the municipal water pipeline to the storage tank location. This can involve digging trenches for underground pipes or creating a suitable support structure for overhead tanks.

Step 5- Valves and Control Mechanisms: Install isolation valves and control mechanisms along the pipeline to regulate water flow and control the water supply to the tank. This helps in maintenance and emergency situations.

Step 6- Water Meter Installation (if required): If a water meter is mandatory or desired, it is installed in line with the pipeline between the municipal supply and the storage tank. The meter measures the water flow and consumption.

Step 7- Connection to Storage Tank: Connect the pipeline to the storage tank's inlet valve. Ensure a secure and watertight connection to prevent leaks.

Step 8- Overflow and Ventilation: Install overflow pipes and ventilation systems to prevent water from overfilling the tank and to allow air circulation inside the tank during filling and emptying.

Step 9- Testing and Inspection: After the installation is complete, conduct pressure tests and leakage tests to ensure the system's integrity and compliance with regulations. Local authorities or utility companies may inspect the installation for approval.

Step 10- Commissioning: Once the system passes testing and inspection, it is commissioned, and the tank is ready to be used for storing and distributing drinking water.

2.4. Rainwater harvesting filter column

A rainwater harvesting filter column for a bore-well recharging system is an essential component that helps to filter and purify rainwater before it is directed into the bore-well for groundwater storage as shown in Fig. 2.14. The purpose of this filter column is to remove debris, sediments, and contaminants from the collected rainwater, ensuring that only clean water enters into the bore-well.

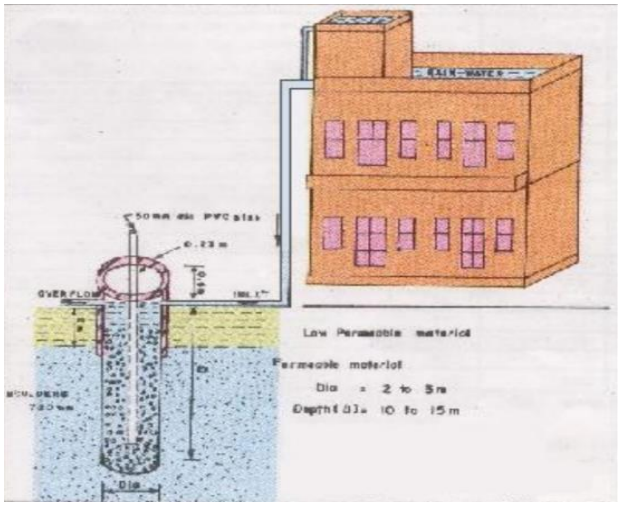
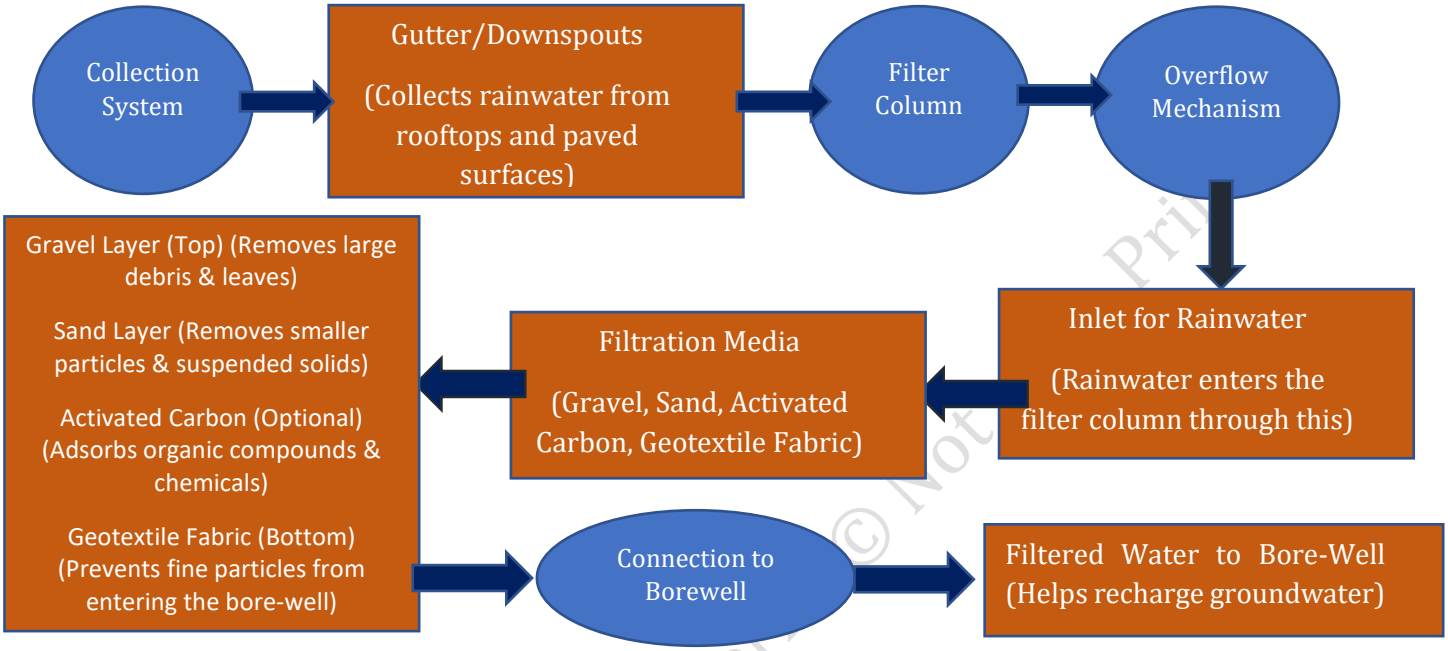


Fig. 2.14: Rain water Harvesting filter column

The basic outline of working of a rainwater harvesting filter column for bore-well recharging is given below:



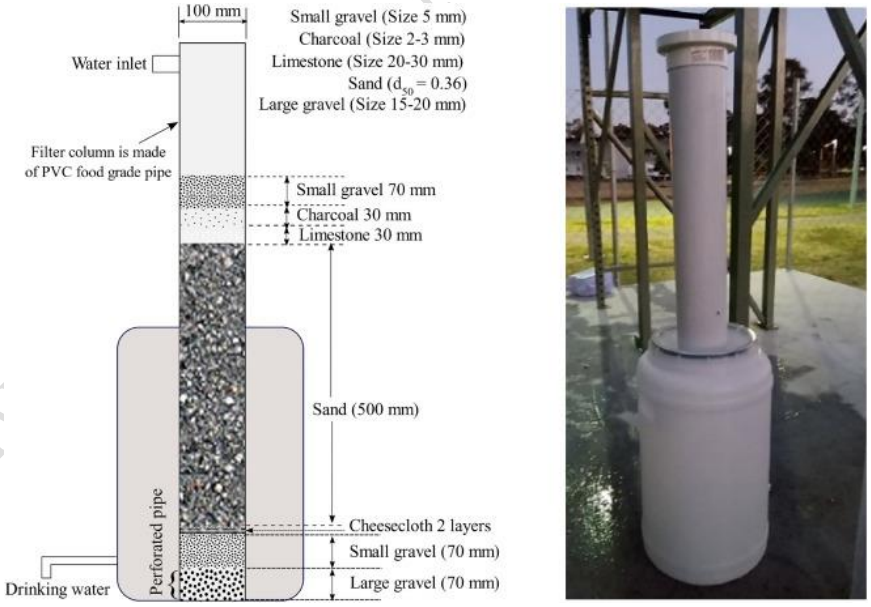


Fig. 2.15: Proper Gradation Rain Water Harvesting filter column

Fig 2.15 shows a properly graded rainwater harvesting filter column which uses different layers of materials that get finer as you go down. The top layer is made of coarse gravel to catch big debris like leaves. Below that, fine sand helps filter out smaller particles. Sometimes, an activated carbon layer is added to clean chemicals and bad smells. At the bottom, a fabric layer stops very small particles from passing through, ensuring clean water goes into the groundwater. This setup makes sure the water is well-filtered and safe for usage

Research has shown that increasing the depth of the filter media in the column improves the quality of rainwater initially, up to a certain point, after which it stabilizes and becomes constant. As shown in the graph in Fig 2.16.

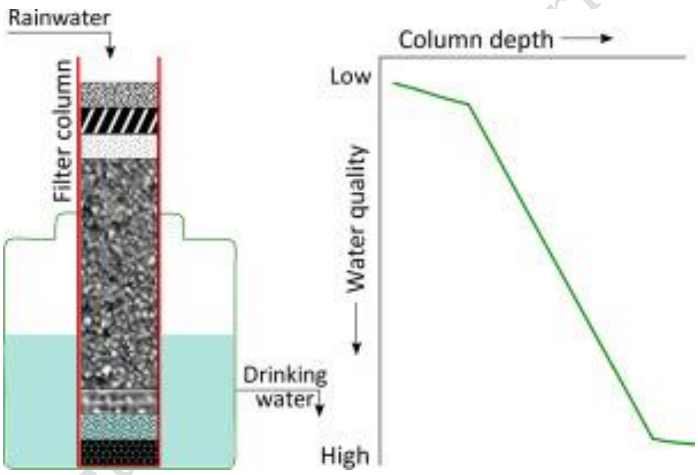


Fig. 2.16: Water quality VS Column Depth

The basic steps for a rain water harvesting filter column are as follows:

1. **Collection System:** Rainwater is collected from rooftops, paved surfaces, or other catchment areas and channelled into the filter column. This can be achieved through gutters, downspouts, and pipes that direct the rainwater towards the filter.
2. **Filter Column:** The filter column is a vertical structure that houses various filtration media to remove impurities from the rainwater. The column is typically made of concrete or PVC and has an inlet at the top to receive the rainwater and an outlet at the bottom to direct the filtered water into the bore-well.
3. **Filtration Media:** The filter column contains different layers of filtration media that progressively filter the rainwater. The layers can include materials such as gravel, sand, activated carbon, and geotextile fabric. Each layer serves a specific purpose in removing particles, organic matter, and pollutants from the water.

4. **Gravel Layer:** The first layer at the top of the filter column is usually coarse gravel or pebbles. This layer helps to prevent large debris and leaves from entering the subsequent filtration layers.
5. **Sand Layer:** Below the gravel layer, there is a bed of fine sand. Sand acts as a primary filter, removing smaller particles and suspended solids from the rainwater.
6. **Activated Carbon Layer (Optional):** In some systems, an activated carbon layer is added to adsorb organic compounds and certain chemicals that might be present in the rainwater.
7. **Geotextile Fabric:** At the bottom of the filter column, there is a geotextile fabric layer. This fabric prevents fine particles from passing through and ensures that only clean water enters the bore-well.
8. **Overflow Mechanism:** To prevent overloading or flooding of the filter column during heavy rainfall, an overflow mechanism is included. This diverts excess rainwater away from the system once the storage capacity is reached.
9. **Connection to Bore-Well:** The filtered rainwater collected at the bottom of the filter column is then directed into the bore-well through a connecting pipe. This process helps in recharging the groundwater level and replenishing the bore-well.

2.5. Solar water heater

A solar water heater shown in Fig. 2.17 is an energy-efficient system that uses the sun's heat to warm water for various domestic or industrial applications. The system typically consists of solar collectors, which absorbs heat from sunlight and transfers to water tank, where the water is stored for later use.

Fig. 2.17: Solar Water Heater

Solar water heaters are a sustainable alternative to traditional water heating methods, reducing the need for electricity or gas. They are widely used in homes, hotels, and industries, particularly in sunny regions, and contribute to reducing carbon emissions and energy costs. Solar water heating systems eco-friendly and cost-effective in the long run.

1. Installation of Solar water heater

Installing a solar water heater can be a great way to harness the power of the sun to heat water for various purposes, such as bathing, washing, and other domestic needs.

Let us understand the general components involved in solar water heater as given in Fig. 2.18.

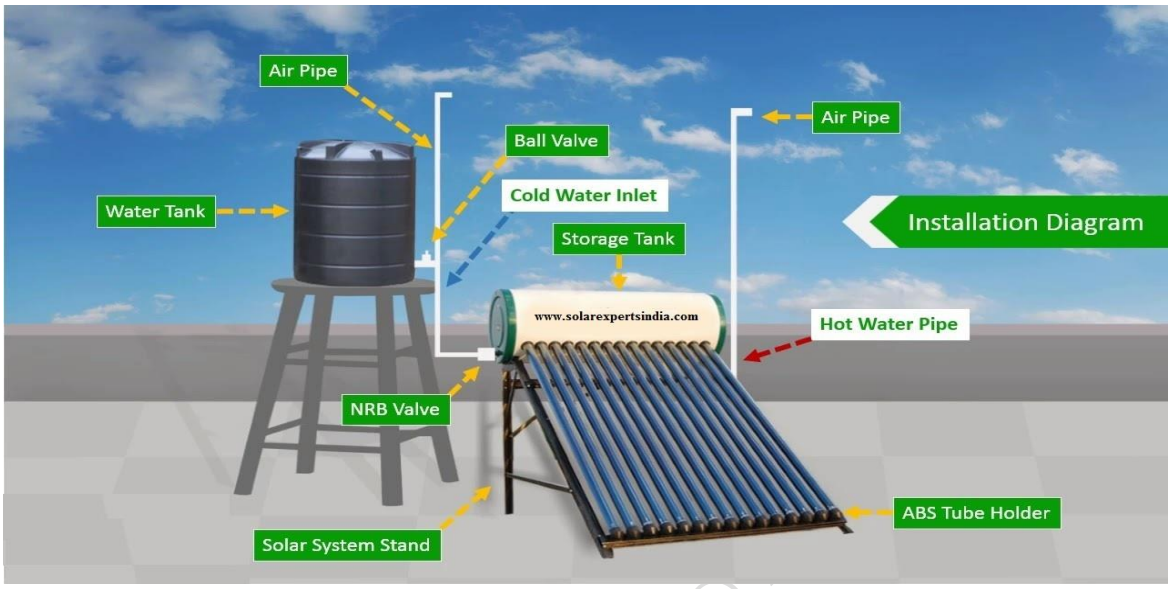


Fig. 2.18: Solar Water Heater

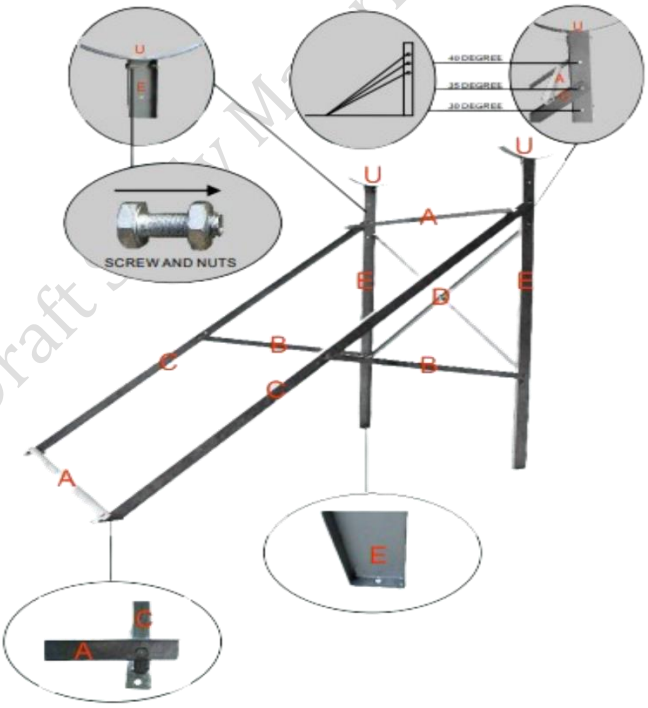


Fig. 2.19: Assembly diagram of the support base on a flat surface

Solar water heater installations can vary depending on the specific type and model, so it's essential to follow the manufacturer's instructions and guidelines.

The following steps of installation of solar water heater

Step 1-Selection of the Location: Choose a suitable location for installing the solar water heater. Ideally, it should be south-facing and receive maximum sunlight throughout the day. Ensure there are no obstructions like trees or buildings that cast shadows on the solar collectors.

Step 2-Gather Tools and Materials: Before starting the installation, gather all the necessary tools and materials. The materials and tools required includes the solar water heater kit, mounting frame, mounting brackets, fasteners, pipe insulation, plumbing tools etc.

Step 3- Installation of Mounting Structure: Depending on your roof type (e.g., flat, sloped, or ground-mounted), install the appropriate mounting structure to hold the solar collectors securely in place. Follow the manufacturer's guidelines for proper installation and waterproofing to prevent leaks.

Step 4- Installation of Solar Collectors: Attach the solar collectors to the mounting structure, ensuring they are positioned at the correct angle (normally 45 degree) for optimal sunlight absorption. Secure the collectors tightly and make sure they are facing the sun's direction.

Step 5- Connect Pipes and Insulate: Connect the solar collectors to the storage tank using appropriately insulated pipes. Connect the inlet to the solar collector and outlet to the tank. The heated water from the collectors will flow into the tank. Insulate the pipes to minimize heat loss during transportation.

Step 6- Install the Storage Tank: Place the storage tank in a convenient location near the solar collectors. Ensure it is well-insulated to maintain the water temperature for extended periods.

Step 7- Connect to the Existing Water System: Connect the solar water heater system to your existing water supply. In a two-tank system, the preheated water from the solar collectors will flow into the conventional water heater, where it gets further heated if necessary. In a one-tank system, the solar collector will directly heat the water that is used.

Step 8- Check for Leakages and Test the System: Thoroughly check the entire system for leakages, loose fittings or any other issues. Thereafter, fill the system with water and test it under the sun to ensure it is working properly.

Step 9- Monitoring and Maintenance: Regularly monitor the solar water heater's performance to ensure it is functioning efficiently. Clean the solar collectors periodically to remove dust and debris that might hinder sunlight absorption. Also, check for any signs of damage or wear and perform maintenance as recommended by the manufacturer.

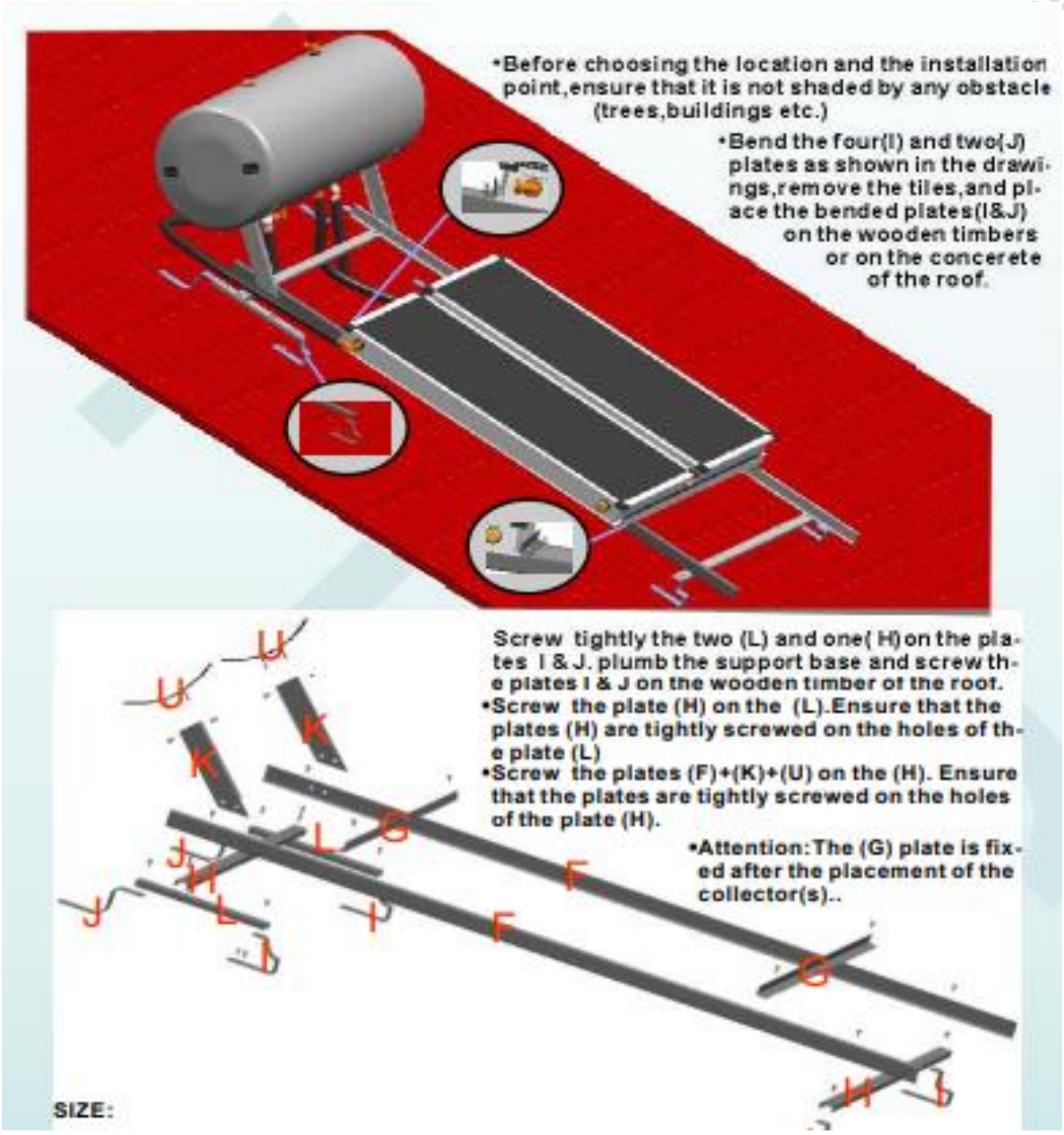


Fig. 2.20: Assembly diagram of the support base on a flat surface

Refer Fig. 2.20 for the basic understanding of the fittings required in installation of solar water heater.

2.5.1. Advantages and Limitations of Solar water heater

Solar water heaters offer several advantages and limitations, which can help you decide whether they are a suitable option for your specific needs and location. Let us explore both the aspects:

Advantages (Merits) of Solar Water Heater:

1. Solar water heaters utilize energy from the sun, which is a renewable and virtually inexhaustible resource. It helps reduce to reliance on finite fossil fuels, contributing to a more sustainable energy mix.
2. By harnessing solar energy to heat water, solar water heaters can significantly reduce your electricity or gas bills, particularly in areas with ample sunlight.
3. This device produces no greenhouse gas emissions during operation, leading to a smaller carbon footprint and a positive impact on the environment.
4. It provides a measure of energy independence, reducing dependence on utility companies and their fluctuating energy prices.
5. Solar water heaters have lower operating and maintenance costs, leading to long-term financial savings.
6. It is more cost-effective. Many governments and municipalities offer financial incentives to encourage the adoption of solar technology
7. Solar water heaters are well-established and reliable technology, with many systems lasting 20-30 years or more with proper maintenance.

Limitations of Solar Water Heater:

1. Cloudy days and limited sunlight may lead to reduced performance.
2. It may have higher initial cost as compared to the conventional water heaters.
3. It requires ample space for its installation.
4. A backup heating system is required in case of cloudy weather.
5. Periodical inspections and maintenance are essential.

6. Hard water may impact the impact of solar water heater in case of non- proper maintenance.

ACTIVITIES

Activity 1: Make a list of advance pipe fittings used in residential units.

Material Required

1. Notebook
2. Pen
3. Pencil
4. Sharpener
5. Eraser

Procedure

1. Take a round of any residential building.
2. Identify the advance pipe fittings used in residential buildings.
3. Make a list of the identified advance pipe fittings fitted in residential buildings
4. Write their name and specification.
5. Draw the line diagram of any two pipe fittings fitted in residential buildings.

Activity 2: Draw the line diagram of house sewer line connecting through chambers to mains.

Material Required

1. Notebook
2. Pen
3. Pencil
4. Sharpener
5. Eraser

Procedure

1. First visit any house or building.
2. Identify the location of a house sewer line.
3. Draw the line diagram of a house sewer line.

Activity 3: Draw the line diagram of the Solar water heater.

Material Required

1. Notebook
2. Pen
3. Pencil
4. Sharpener
5. Eraser

Procedure

1. First visit any house or building.

2. Identify the location of the Solar water heater is fitted.
3. Make a list of solar water heater parts.
4. Draw the line diagram of the solar water heater fitted in any house or building and label it.

Activity 4: Draw the line diagram of Hydro-Pneumatic Water pressure Pumping system.

Material Required

1. Notebook
2. Pen
3. Pencil
4. Sharpener
5. Eraser

Procedure

1. First, visit any water plant.
2. Identify the location of the Hydro-Pneumatic Water pressure Pumping system is fitted.
3. Make a list of Hydro-Pneumatic Water pressure Pumping system parts.
4. Draw the line diagram of the Hydro-Pneumatic Water pressure Pumping system and label it.

CHECK YOUR PROGRESS

A. Answer the following questions

1. What do you mean by advance pipe fittings?
2. How advance pipe fitting is used in residential unit.
3. Write down the process of connecting the house sewer line.
4. Explain the drinking water connection from the municipal pipeline to the overhead tank.
5. Describe the rainwater harvesting filter column.
6. Explain the installation process of the water closet (Floor and wall mounting units).
7. What is a solar water heater and how is this device installed in-house?
8. Describe the hydro-pneumatic water pressure pumping system and write its application.

B. Fill in the blanks

1. _____ fittings use a push and lock mechanism for easy installation without soldering or threading.
2. The _____ chamber serves as a junction where house sewer lines from different parts of a property converge before connecting to the main sewer line.
3. _____ pipes are highly flexible and resistant to corrosion, making them ideal for residential water supply systems.
4. The storage capacity of a _____ is estimated based on pumping hours, demand, and hours of supply.

5. In a sewer connection system, the _____ chamber is typically located outside the property near the street or property line.

C. Multiple Choice Questions (MCQs)

1. Which of the following is a characteristic of PEX pipes?
   a) Rigid and requires fittings for bends
   b) Flexible and resistant to freezing
   c) Cannot be used for hot water supply
   d) Requires solvent cement for connection

2. What is the main function of a master chamber in a sewer system?
   a) To filter rainwater before it enters the drainage system
   b) To store drinking water before distribution
   c) To collect and channel house sewer lines before connecting to the main chamber
   d) To increase water pressure in hydro-pneumatic systems

3. Which type of fitting is commonly used for quick connection and disconnection of hoses and pipes?
   a) Flange fittings
   b) Camlock fittings
   c) Compression fittings
   d) Grooved fittings

4. Elevated Surface Reservoirs (ESR) are constructed at a height of more than:
   a) 3 meters
   b) 10 meters
   c) 15 meters
   d) 30 meters

5. Which of the following is NOT an advantage of using advanced pipe fittings?
   a) Faster installation
   b) Increased maintenance requirements
   c) Improved performance and durability
   d) Cost and time savings

Module 3	STANDARD OPERATING PRACTICES (SOPs) IN PLUMBING

Module Overview
This module provides an understanding of Standard Operating Procedures (SOPs) in the plumbing sector. The importance and application of SOPs is also being discussed. It covers SOPs for pipe laying and fitting installations, cold and hot water systems, and occupational health and safety (OHS) practices. Additionally, it introduces essential plumbing tools and equipment's required. In this module, Fire sprinkler systems and their installation are included. The module aims to enhance student's technical knowledge and safety awareness in plumbing operations.

Learning Outcomes
After completing this module, student will be able to: • Explain the key objectives and characteristics of SOPs in plumbing. • Identify and apply common SOPs used in plumbing. • Brief about the SOPs for laying pipelines and fittings. • Understand OHS practices and their importance in plumbing jobs. • Implement safety measures and OHS guidelines in the workplace. • Recognize tools and equipment used in plumbing tasks. • Explain the significance of fire sprinklers and their installation procedures.

Module Structure
3.1 Objective of using SOPs 3.2 Key Characteristics of Standard Operating Procedures (SOPs) 3.3 Common SOPs in Plumbing sector 3.4 SOP to be followed during installation of Pipes and Fittings in plumbing 3.5 Applications and awareness of Occupational Health and Safety (OHS) Practices 3.6 General introduction of Tools & Equipment 3.7 Fire Sprinklers in Workplace

In this unit, we are going learn about Standard Operating Practices (SOP) which are also known as Standard Operating Procedures (SOP). shown in Fig. 3.1 SOPs are detailed instructions that prescribe the approved methods for carrying out specific tasks or activities.

Fig. 3.1: Standard Operating Procedures

It is an essential component of for performing efficient operations across various industries/sectors.

These practices are designed to ensure that all employees follow the same set of guidelines while performing their a specific task.

Standard Operating Procedures (SOPs) in plumbing are a set of established guidelines and protocols that outline the standardized methods for performing various plumbing tasks. These SOPs help ensure that plumbing work is done safely, efficiently, and consistently.

3.1 Key characteristics of SOPs

SOPs promote accountability by defining roles and responsibilities while improving training and knowledge transfer. The well-documented SOPs contribute to operational efficiency, quality control, and workplace safety. Following are some of the key features of SOPs:

1. **Clarity**: SOPs should be clear and easy to understand which uses concise language.
2. **Step-by-step instructions**: They provide a detailed, step-by-step outline of how to perform a particular task or process.
3. **Purpose and scope**: Each SOP should have a clear statement of its purpose and the activities it covers.
4. **Roles and responsibilities**: SOPs often specify the roles and responsibilities of individuals involved in the process.
5. **Compliance and standards**: SOPs ensure compliance with industry regulations, internal policies, and quality standards.
6. **Revision control**: SOPs need to be regularly reviewed and updated to reflect changes in processes or regulations.
7. **Training and implementation**: SOPs should be made available to all relevant personnels. The training should be provided to ensure proper implementation.
8. **Documentation**: SOPs must be documented and stored in a central location for easy access by authorized personnel.

3.2. Objective of using SOPs

In order to obtain consistent outcomes, SOPs are the ideal option. Employees are provided with step-by-step procedure to complete an activity effectively. Following are the benefits of using SOPs:

1. **Consistency**: SOPs promote consistent practice which reduces errors and variations.
2. **Efficiency**: Clearly define the procedures to streamline the operations, so as to increase the efficiency of the tasks performed.
3. **Quality assurance**: To maintain the high-level quality product, SOPs must be followed.
4. **Training and onboarding**: SOPs serve as valuable tools for training new employees.
5. **Safety**: SOPs help in identifying potential safety hazards which can prevent accidents.
6. **Compliance**: SOPs ensure that the organization adheres to industry regulations and standards.
7. **Continuous improvement**: By regularly reviewing and updating SOPs, organizations can identify areas for improvement.
8. **Time Saving**

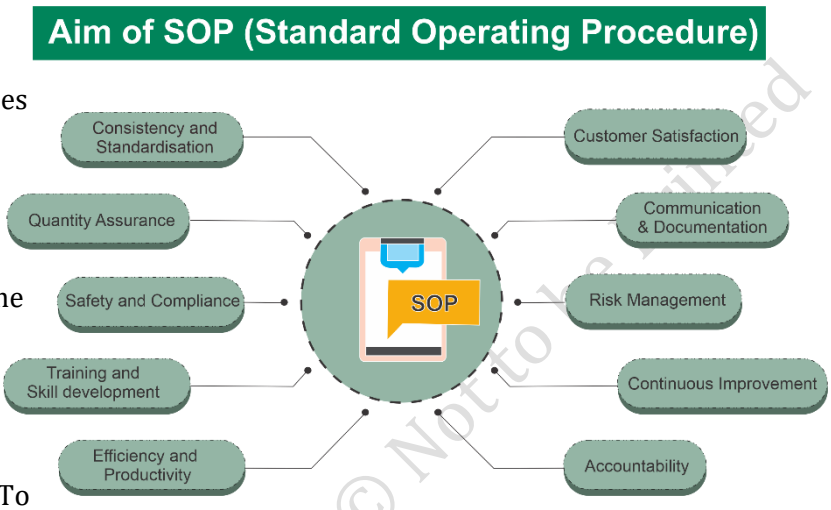


Fig. 3.2: Aim of Standard Operating Procedures

3.3 Common SOPs in Plumbing Sector

Standard Operating Procedures (SOPs) in the plumbing sector are essential guidelines that ensure consistency, safety and efficiency in various plumbing-related tasks. These SOPs provide step-by-step instructions for the installation, maintenance, and repair of various plumbing systems.

By following the standardized procedures, the plumbers can minimize errors, prevent hazards and ensure compliance with industry regulations and safety standards. Here are some of the parameters which are included in the SOPs of plumbing:

1. **Safety Procedures**: Safety is the paramount in plumbing work. SOPs should cover the proper use of personal protective equipment (PPE), handling hazardous materials, securing work areas and following safety regulations.
2. **Leak Detection and Repair**: SOPs for the leak detection includes pressure tests, visual inspections and other techniques to identify leakages. Repair procedures should specify the correct tools and materials for fixing different types of leakages.
3. **Pipe Laying**: SOPs for pipe laying cover procedures for measuring, cutting, and joining of the pipes using appropriate fittings and techniques. They should also include guidelines for securing pipes to walls and floors.
4. **Fixture Installation**: This includes the proper installation of sinks, faucets, toilets, bathtubs, showers and other plumbing fixtures, ensuring they are securely connected and leakage-free.
5. **Drain Cleaning**: SOPs should outline methods for clearing clogged drains, such as using drain snakes, augers or drain cleaners. Proper disposal of debris should also be addressed.
6. **Water Heater Installation and Maintenance:** SOPs for water heaters should cover installation procedures, safety measures and regular maintenance tasks like flushing the tank to remove the sediments.
7. **Backflow Prevention**: Guidelines to prevent backflow and cross-contamination in the plumbing system by installing and testing of backflow prevention devices.
8. **Gas Line Installation and Repair**: If plumbing work involves gas lines, specific SOPs must be followed to ensure safe installation and repair which adheres to the gas safety standards.
9. **Grease Trap Cleaning**: SOPs for commercial plumbing includes procedures for cleaning and maintaining grease traps to prevent blockages to ensure compliance with health regulations.
10. **Water Quality Testing**: For certain applications, SOPs should give detailed procedures for testing water quality, including measurements of pH, hardness and other essential water quality parameters.
11. **Emergency Response**: Guidelines for responding to plumbing emergencies, such as bursting of pipes or gas leaks should be addressed.

3.4. SOP to be followed during installation of Pipes and Fittings

The following is a general Standard Operating Procedure (SOP) to be followed during the installation of pipes and fittings in plumbing work. Keep in mind that specific tasks and requirements may vary depending on the project and local building codes, so it's essential to refer to manufacturer guidelines and adhere to local regulations.

I. Pre-Installation Preparation:

a. Gather all the necessary tools, materials and equipment required for the installation.

b. Ensure the work area is clean, dry and free from any obstructions.

c. Review the plumbing plan and layout to understand the scope of work.

II. Inspection and Quality Check:

a. Inspect pipes and fittings for any damage, defects, or discrepancies.

b. Verify that the pipe material and size confirm to the specified requirements.

c. Check that fittings and connectors are suitable for the application.

III. Measurement and Marking:

a. Measure and mark the pipe lengths and cutting points accurately.

b. Use appropriate tools, such as a pipe cutter or saw, to cut the pipes to the required lengths.

IV. Cleaning and Deburring:

a. Clean the pipe ends and fittings to remove any dirt, debris, grease etc.

b. Deburr the edges of the cut pipes and fittings to ensure smooth connections.

V. Dry-Fit Assembly:

a. Dry-fit the pipes and fittings together in proper alignment and fit without any adhesives.

b. Make any necessary adjustments to achieve the desired layout and angle.

VI. Joint Preparation:

a. Apply primer to the pipe ends and on the threaded portion of the fittings.

b. Apply an appropriate solvent cement or adhesive to both the pipe and fitting surfaces.

VII. Assembly and Jointing:

a. Join together the pipes and fittings together firmly as required.

b. Make sure the joints are fully inserted and sealed to achieve a watertight connection.

VIII. Support and Securing:

a. Securely fasten the pipes to walls or floors using appropriate hangers, brackets, or clamps.

b. Ensure adequate support to prevent sagging or stress on the joints.

IX. Pressure Testing (if applicable):

a. Perform a pressure test on the installed pipes to identify any leaks or weaknesses.

X. Final Inspection and Sign-Off:

a. Conduct a final inspection to verify that all pipes and fittings are correctly installed

XI. Clean-Up:

a. Clean the work area, removing any debris, waste materials etc.

b. Properly dispose of any leftover materials or packaging.

3.5. Applications of Occupational Health and Safety (OHS) Practices

Applications of OHS (Occupational Health and Safety) practices are essential in ensuring the safety and well-being of workers in the workplace. By adhering to OHS practices, employers can create a safer work environment by preventing accidents, injuries, and illnesses. Fig 3.3 includes various parameters included in work safety practices.

Fig. 3.3 Work Safety Practices

Some common applications of OHS practices in the usage of tools and equipment are as follows:

1. **Training and Education:** OHS practices begin with proper training and education for the workers on the safe usage of tools and equipment. Workers should receive comprehensive training on how to operate, handle and maintain tools and equipment safely. This includes understanding the risks associated with each tool and how to use them correctly to minimize the accidents.

2. **Hazard Identification and Risk Assessment:** Workers should be able to identify potential hazards related to the usage of tools and equipment. A thorough risk assessment

should be conducted to identify the potential risks, such as sharp edges, electrical hazards, moving parts or ergonomic issues. Once hazards are identified, appropriate control measures should be implemented to reduce the risks.

3. **Proper Tool Selection:** Choosing the right tools and equipment for specific tasks is crucial for ensuring worker safety. OHS practices emphasize the selection of appropriate tools that are suitable for the job. Use of a wrong tool for a task can lead to accidents and injuries.

4. **Regular Maintenance and Inspection:** Regular maintenance and inspection of tools and equipment are essential for identifying and addressing potential issues before they lead to accidents. OHS practices include establishing maintenance schedules and conducting regular inspections to ensure that tools are in good working condition and safe to use.

5. **Safe Handling and Storage:** OHS practices emphasize the safe handling and storage of tools and equipment. Workers should be trained to carry tools safely. Avoid dragging or throwing of tools and store them in designated locations to prevent tripping hazards.

6. **Personal Protective Equipment (PPE):** OHS practices often require the use of appropriate personal protective equipment, such as safety glasses, gloves, ear protection and hard hats while working with specific tools and hazardous environment.

7. **Emergency Procedures:** OHS practices include establishing clear emergency procedures for dealing with accidents, injuries or equipment malfunctions. Workers should know how to respond to emergencies and where to find emergency equipment like fire extinguishers, first aid kits etc.

8. **Reporting and Investigating Incidents:** OHS practices promote a culture of reporting of misses, incidents and injuries. Reporting allows for timely investigation and implementation of corrective actions to prevent similar incidents in the future.

3.6 Awareness of Occupational Health and Safety (OHS)

Awareness of Occupational Health and Safety (OHS) is essential for every worker in any job or workplace. Awareness of OHS-related matters ensures that workers can identify potential hazards, follow safety protocols and take appropriate actions to prevent accidents and injuries. OHS helps the workers in following ways:

- Awareness of OHS guidelines helps workers to identify potential hazards and risky situations in their work environment. This awareness allows them to take preventive measures to avoid any accidents or injuries.

- OHS practices includes measures to protect workers health from any harmful exposure such as noise, vibrations and other workplace hazards. Awareness of these practices enables workers to safeguard their health and well-being while performing their duties.

- Understanding OHS guidelines ensures that the worker knows the correct use of tools and equipment which reduces the risk of accidents and equipment malfunctions.

- OHS training often includes emergency response procedures. Awareness of these procedures empowers workers to respond quickly and appropriately during in any emergencies such as fires, chemical spills or accidents.

- Awareness of OHS includes knowledge of the appropriate Personal Protective Equipment (PPE) required for specific tasks. Workers can use PPE correctly to protect themselves from hazards.

- The workers who are aware of OHS practices are more likely to report the hazards, incidents or unsafe conditions promptly. Effective communication about safety concerns helps in addressing issues before they originate and further escalate.

- OHS regulations and standards varies with industries and conditions. Awareness of these requirements ensures that workers and the organization as a whole comply with legal obligations, avoiding potential penalties and legal issues.

- When workers are conscious about the OHS practices, they contribute to build a safety culture in the workplace. A safety-focused culture encourages everyone to prioritize individual safety following the safety protocols.

- OHS also addresses factors related to mental health and stress in the workplace. Awareness about the mental health can give support and resources for workers to cope with the work-related stress for maintaining their mental health to balance their work and life.

3.7. General introduction of Tools & Equipment

Tools and equipment are essential for plumbers' part to execute various works in plumbing projects. These tools and equipment are designed to perform specific functions of the plumbing that aids to enhance the productivity and efficiency of work. Here is a general introduction to the concept of tools and equipment:

1. **Tools:** Tools are handheld or manually operated devices that enable individuals to perform various tasks. They are designed to be simple, portable and light in weight. Common types of plumbing tools are:

    - **Hand Tools:** These are non-powered tools that require physical effort to operate. Examples: hammers, pliers, screwdrivers, chisels, hand saws, and measuring tools like tape measures and callipers, Pipe vice, Bench vice etc.

    - **Power Tools:** Power tools are motor-driven and significantly reduce the effort required to complete tasks. Examples: drills, saws, sanders, grinders, and electric screwdrivers.

    - **Cutting Tools:** These tools are designed for cutting pipe materials such as PVC/CPVC/Cast Iron/Steel pipes etc. The cutting tools are mainly the utility knives, scissors, hacksaws, pipe cutters etc.

    - **Fastening Tools:** Fastening tools are used to join pipe materials together to avoid leakage that include nails, screws, bolts, rivets, staple guns, chemical adhesives, washers etc.

    - **Measuring and Marking Tools:** These tools are used to mark and measure the jobs accurately for cutting and fitting. Examples: Levels, squares, rulers, compasses, marking pens, set squares etc.

2. **Equipment:** Equipment refers to larger, more complex machinery or devices used to perform specific functions or processes. Unlike tools, the equipment may be stationary or mobile and often requires a power source to operate. Equipment is typically used in industrial settings, construction sites, manufacturing facilities and in other specialized environments. Examples of equipment include:
    - **Construction Equipment:** This category includes heavy machinery used in construction projects such as excavators, bulldozers, cranes, concrete mixers, and pavers, compacters, vibrators etc.
    - **Industrial Machinery:** Industrial equipment is used in manufacturing processes which includes machines like CNC (Computer Numerical Control) machines, lathes, milling machines, Pipe threading machines, Pipe welding and cutting machines etc.

3.8. Fire Sprinklers in Workplace & Installation

Fire sprinklers are an essential component of fire protection systems in the workplace. They are designed to detect and suppress fires in early stages to prevent significant property damage, injuries and loss of life.

Industrial fire hazards in plumbing can arise from various sources. The basic types of fire hazards include:

- **Electrical Hazards** – Faulty wiring, overloaded circuits, and short circuits can cause fires.
- **Flammable Liquids and Gases** – Leakage of fuels, solvents, or pressurized gases can ignite easily.
- **Hot Work Operations** – Activities like welding, soldering, and grinding generate sparks that may cause fires.
- **Combustible Materials** – Paper, wood, insulation, and plastic piping can catch fire if exposed to heat.
- **Improper Storage of Chemicals** – Storing flammable chemicals near heat sources can increase fire risks.

Here is an overview of fire sprinklers used in the workplaces and their installation process.

1. **Types of Fire Sprinklers:** There are different types of fire sprinklers, each designed for specific applications. Some common types include:

    - **Wet Pipe Sprinklers:** These are the most common type and contain water under pressure within the pipes. When the sprinkler head is activated by heat, water immediately discharges onto the fire.

    - **Dry Pipe Sprinklers:** These are suitable for areas where there is a risk of freezing. These systems use compressed air or nitrogen gas. When the system is activated, the air is released, which allows nitrogen gas/compressed air to flow and extinguish the fire.

    - **Pre-Action Sprinklers:** These systems combine elements of both wet and dry systems, requiring a pre-action, such as smoke detection or heat activation before water is released into the pipes.

    - **Deluge Sprinklers:** Deluge systems have open sprinkler heads, and when activated, all heads in the area discharge water simultaneously.

2. **Workplace Fire Sprinkler Installation:** Fire sprinkler installation should be carried out by experienced and qualified professionals following the local fire codes, regulations, and National Fire Protection Association (NFPA) standards.
   The installation process generally involves the following steps:
   Step 1-
   Fire Risk Assessment: Conduct a thorough assessment of the workplace to determine the fire hazards, layout, occupancy, and fire protection needs.
   Step 2-

System Design: Based on the fire risk assessment, a fire protection engineer or qualified professional will design the sprinkler system, determining the number and placement of sprinkler heads, pipe layout, and water supply requirements.

Step 3-

Water Supply: Ensure that the building's water supply is sufficient to meet the demand of the sprinkler system. In some cases, a dedicated water tank or reservoir may be required.

Step 4-

Pipe Installation: Pipes are installed throughout the building to connect the sprinkler heads to the water supply. The type of pipe used will depend on the specific system design and local regulations.

Step 5-

Sprinkler Head Installation: Sprinkler heads are strategically positioned according to the system design. The type of sprinkler heads used will vary based on the system type and the hazards present.

Step 6-

Water Flow Test: Before finalizing the installation, a water flow test is conducted to ensure that the water supply can deliver the required flow and pressure to all sprinkler heads.

Step 7-

System Testing and Commissioning: The entire system is thoroughly tested to verify proper operation and functionality. This includes testing individual sprinkler heads and conducting a full-scale system activation test.

Step 8-

Training and Maintenance: Once the system is installed and commissioned, employees and building occupants should be trained on how the system works, including any relevant evacuation procedures. Regular maintenance and inspections are crucial to ensure the system remains in optimal working condition.

ACTIVITIES

Activity 1: Make a list of SOPs to be followed during installation of pipes and fittings.

Material Required

1. Notebook
2. Pen
3. Pencil
4. Sharpener
5. Eraser

Procedure

1. Take a round of any residential building.
2. Identify the pipes and fittings fitted in residential buildings.

3. Make a list of the pipes and fittings fitted in residential buildings
4. Make a list of SOPs to be followed during installation of pipes and fittings.

Activity 2. Draw the line diagram of Fire Sprinklers in the workplace.

Material Required

1. Notebook
2. Pen
3. Pencil
4. Sharpener
5. Eraser

Procedure

1. First, visit the workplace.
2. Identify the location of Fire Sprinklers in the workplace.
3. Draw the line diagram of Fire Sprinklers.

Activity 3: Draw the line diagram of the cold-welding joint.

Material Required

1. Notebook
2. Pen
3. Pencil
4. Sharpener
5. Eraser

Procedure

1. First, visit the workplace.
2. Identify the location of cold-welding joints in the workplace.
3. Draw the line diagram of a cold-welding joint.

CHECK YOUR KNOWLEDGE

1. Answer the following questions

1. What are the key characteristics of SOP?
2. Write the benefits of using SOP in the plumbing system.
3. Explain the importance of SOP in plumbing work.
4. Explain the SOP to be followed during the installation of pipes and fittings.
5. Explain the application of OHS practices in plumbing work.
6. Difference between tools and types of equipment used in plumbing work.
7. What is a fire sprinkler and its types?

B. Mark the correct option

1. What is the primary purpose of Standard Operating Procedures (SOPs) in plumbing?
   a) To increase errors in plumbing tasks

b) To ensure consistency, safety, and efficiency
c) To reduce the need for training plumbers
d) To eliminate the use of tools and equipment

2. Which of the following is NOT a benefit of using SOPs?
a) Promoting consistent practices
b) Increasing errors in the work process
c) Ensuring compliance with industry regulations
d) Improving efficiency in operations

3. What is the correct order of steps for pipe installation as per SOPs?
a) Cleaning and deburring → Measurement and marking → Final inspection
b) Inspection and quality check → Measurement and marking → Joint preparation
c) Pressure testing → Dry-fit assembly → Joint preparation
d) Clean-up → Joint preparation → Final inspection

4. In cold-welding joint preparation for CPVC pipes, what is applied first?
a) Solvent cement
b) Water sealant
c) Primer
d) Epoxy resin

5. Which OHS practice emphasizes the importance of selecting the right tool for a specific task?
a) Hazard identification and risk assessment
b) Safe handling and storage
c) Proper tool selection
d) Emergency procedures

C. Fill in the blanks

1. _____ preparation is essential in plumbing SOPs to ensure a strong and leak-free connection between pipes and fittings.

2. Occupational Health and Safety (OHS) practices help in identifying _____ and preventing workplace accidents.

3. _____ are necessary in OHS to protect workers from exposure to harmful substances, noise, and other workplace hazards.

4. The _____ assembly step in pipe installation ensures that all joints are properly aligned before applying adhesive or sealant.

Module 4	WORKING EFFECTIVELY WITH OTHERS

Module Overview
This module focuses on developing teamwork and collaboration skills essential for workplace success. It covers key aspects of team management, teamwork, conflict resolution, and maintaining good relationships with colleagues. Students will also learn how to handle disputes professionally and maintain necessary documentation, such as daily log reports and incident reports. By understanding these concepts, students will be better equipped to work efficiently in a team-oriented plumbing environment.

Learning Outcomes
After completing this module, you will be able to: • Explain the importance of team management in the workplace. • Demonstrate effective teamwork skills for better collaboration. • Identify strategies to resolve disputes and conflicts professionally. • Apply conflict management techniques in workplace scenarios. • Develop strong team working skills for a productive work environment. • Maintain positive relationships with colleagues and peers. • Prepare accurate daily log reports and incident reports.

Module Structure
4.1 Team Management 4.2 Team Work 4.3 Resolving Disputes 4.4 Conflicts 4.5 Team Working Skills 4.6 Maintaining good relationship with colleagues 4.7 Daily Log Reports 4.8 Incident Reports

Now that you are skilled in operating a Plumbing work efficiently, So, Is skill enhancement your only asset? The answer is NO, because many managerial skills are also required. One most important skill is the ability to work effectively with others.

A skilled individual can work efficiently on their own, but when many skilled workers collaborate effectively, the quality and precision of the work are significantly elevated. The fundamental skill in both personal and professional contexts, essential for achieving collective goals and fostering a harmonious environment – Working effectively with others. It involves collaboration, communication, and the ability to navigate diverse perspectives and personalities. Effective teamwork is built on mutual respect, trust, and a shared vision. By valuing each team member's contributions and fostering an inclusive atmosphere, teams can leverage individual strengths to achieve superior outcomes.

Clear and open communication is critical, ensuring that ideas, expectations, and feedback are exchanged constructively. Active listening, empathy, and adaptability are key components, helping to resolve conflicts and build stronger interpersonal relationships. In professional settings, effective collaboration can drive innovation, enhance productivity, and improve job satisfaction.

Moreover, working well with others involves recognizing and respecting cultural differences and diverse viewpoints. This diversity can be a powerful asset, bringing in varied ideas and approaches that can lead to more creative and effective solutions. Developing these skills requires ongoing effort and a willingness to grow and learn from experiences and interactions. Ultimately, the ability to work effectively with others not only contributes to individual and collective success but also creates a positive and supportive community, fostering a sense of belonging and shared purpose.

4.1 Team Management

There are some tasks which can't be done alone. Teamwork is the collaborative effort of a group to achieve a common goal or to complete a task in the most effective and efficient way. This concept is seen within the greater framework of a team, which is a group of inter dependent individuals who work together towards a common goal. And it should have similar objective and interests. As a plumber you may be employed with a construction company, Maintenance Company or you may free-lance with few others as a team. (Refer Fig. 4.1).

Fig 4.1 Team Management

Let's read a short story!

At Vidya Mandir School, a group of Class 8 students—Rahul, Priya, Aarav, Meena, and Aisha—were assigned to create a science project on sustainable living. Initially, they struggled with different ideas and poor communication. However, they decided to meet regularly, dividing tasks based on their strengths. Rahul handled the technical parts, Priya and Meena worked on the design, Aarav managed the timeline, and Aisha came up with innovative solutions. By listening to each other and working together, they built an impressive model of a sustainable village, showcasing solar energy and rainwater harvesting, winning praise for their teamwork and creativity.

To achieve the set of goals, the team management play major role and with help of different activities which actually bind a team member individually.

Characteristics of a Good/Effective Team

- **Elevating goal:** A goal which has been circulate/communicated with all.
- **Result driven structure**: The target has been combining fixed by all the team members. For getting it, they will fully commit.
- **Competent members**: Obtain the team target, each team member must have the necessary skill set.
- **Unified Commitment**
- **Collaborative Climate:** This will enhance the overall workability of the team members. A better leader can create such to keep their workers highly motivated to achieve their targets.
- **Standards of excellence:** In any organization, quality orientation play vital role to achieve success

4.2 Team Work

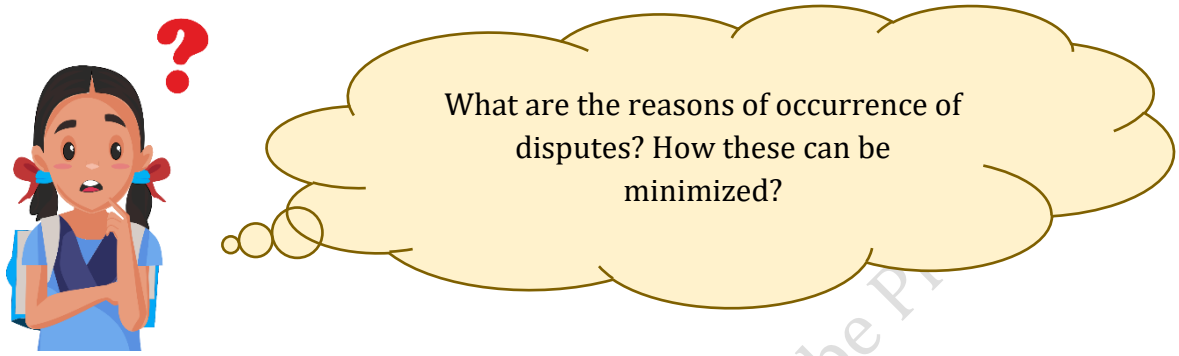
To obtain the team objective, sum of the attempts by each team member are called team work. In other words, team work is the backbone of any team**.**

So, let us go through the pornts which every team member should keep in mind for a good team work. Following are such points:

1. Think about your team first.
2. Never underestimate your team member
3. Discuss – Before implementing any new idea, it must be discussed with each and every member on an open platform.
4. Avoid criticism–Stay away from criticism and making fun of your team members. Help each other and be a good team player.
5. Transparency must be maintained and healthy interaction must be promoted among the team members.
6. The team leader must take the responsibility of encouraging the team members to give their level best and should intervene immediately in cases of conflicts.
7. Avoid conflicts in your team. Don't fight over petty issues and find faults in others. One should be a little adjusting with each other and try to find an alternative best suited to all the team members.
8. Rewards and Recognition – Healthy competition must be encouraged among the team member

4.3 Resolving Disputes

It is defined as an argument or disagreement, especially an official one between, for example, workers and employers or two countries with a common border.



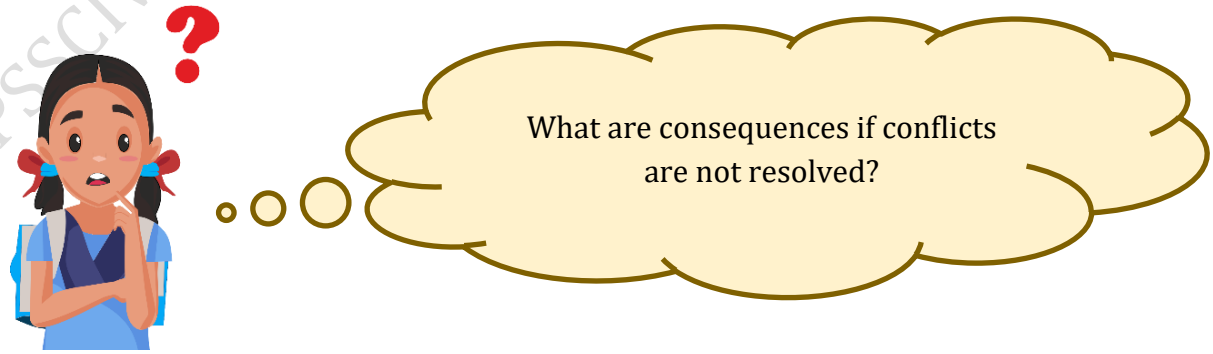
There are two ways of solving a dispute:

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

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

4.4 Conflict

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



4.4.1 How you can avoid conflict?

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

- **Focus on solution than problem** - Rather than dwelling on the past happenings and events, talk about how you want things to be.
- **Avoid blaming and criticizing others by using words** – 'you should…., you make me feel……'
- **Never give any personal comments**: If you do not like at any given point of time any action or reaction of any of your colleagues, do not comment on the person, and just talk about the behaviour not about the person.
- Offer support and collaboration and make it obvious that you are a part of the solution.
- Recognize the positive intention.

4.4.2 Resolving Conflict

When a team oversteps the mark of healthy difference of opinion, resolving conflict requires respect and patience. There are the following ways of solving a conflict:

- Negotiation
- Mediation
- Arbitration
- Litigation

4.4.3 Preventing Conflict

Following are some tips to keep the conflict situations apart**:**

- **Dealing with conflict immediately** – avoid the temptation to ignore it.
- **Being open** –if people have issues, they need to be expressed immediately and not allowed to fester.
- **Practicing clear communication** – articulate thoughts and ideas clearly.
- **Practicing active listening** – paraphrasing, clarifying, questioning.
- **Practicing identifying assumptions** – asking yourself "why" on a regular basis.
- **Encouraging different points of view** – insist on honest dialogue and expressing feelings.
- **Not looking for blame** – encourage ownership of the problem and solution.
- **Demonstrating respect** – if the situation escalates takes a break and waits for emotions to subside.
- **Keeping team issues within the team** –talking outside allows conflict to build and fester, without being dealt with directly.
- To explore the process of conflict resolution in more depth, take our Bite -Sized

Training session on Dealing with Conflict.

4.5 Team Working Skills

Team work is important because it helps us synergize, it complements our individual weaknesses, it does help in productivity and it helps one build new and better skills. Team work is an important part of a working culture. Good team works enhance effective and efficient achievement of an organization's work. Members of a team are more committed to work on goals that they helped to create. The most important thing about team work is that it enables individuals in the team to focus on one main objective. Team work is also important since everyone contributes their unique abilities, which make the result of their objective more diverse. Team work is generally important because it gives everyone a sense of belonging. Various team working skills are mentioned in Fig. 4.2.

Fig 4.2 Team Working skills

Some of the skills that will help one in working effectively are as follows

- **Demonstrates Reliability**
  A reliable team member who gets work done and does his fair share to work hard and meet commitments. He or she follows through on assignments. Consistency is key.
- **Communicates Constructively**
  Teams need people who speak up and express their thoughts and ideas clearly, directly, honestly, and with respect for others and for the work of the team. That's what it means to communicate constructively.
  Such a team member does not shy away from making a point but makes it in the best way possible — in a positive, confident, and respectful manner.

- **Listens Actively**
  Good listeners are essential for teams to function effectively. Teams need team players who can absorb, understand, and consider ideas and points of view from other people without debating and arguing every point. Such a team member also can receive criticism without reacting defensively.

- **Functions as an Active Participant**
  Good team players are active participants. They come prepared for team meetings and listen and speak up in discussions. They're fully engaged in the work of the team and do not sit passively on the side lines. Team members who function as active participants take the initiative to help make things happen, and they volunteer for assignments.

- **Shares Openly and Willingly**
  Good team players share. They're willing to share information; knowledge and experience. They take the initiative to keep other team members informed. Much of the communication within teams takes place informally. Beyond discussion at organized meetings, team members need to feel comfortable talking with one another and passing along important news and information day-to-day. Good team players are active in this informal sharing.

- **Cooperates and Pitches – into Help**
  Cooperation is the act of working with others and acting together to accomplish a job. Effective team players work this way by second nature. Good team players, despite differences they may have with other team members concerning style and

perspective, figure out ways to work together to solve problems and get work done. They respond to requests for assistance and take the initiative to offer help.

- **Exhibits Flexibility**
  Teams often deal with changing conditions — and often create changes themselves. Good team players roll with the punches; they adapt to ever – changing situations. They don't complain or get stressed out because something new is being tried or some new direction is being set. In addition, a flexible team member can consider different points of views and compromise when needed. He or she doesn't hold rigidly to a point of view and argue it to death, especially when the team needs to move forward to decide or get something done. Strong team players are firm in their thoughts yet open to what others have to offer — flexibility at its best.

- **Shows Commitment to the Team**
  Strong team players care about their work, the team, and the team's work. They show up every day with this care and commitment up front.
  They want to give a good effort, and they want other team members to do the same.

- **Works as a Problem Solver**
  Teams, of course, deal with problems. Sometimes, it appears, that's the whole reason why a team is created — to address problems.
  Good team players are willing to deal with all kinds of problems in a solution – oriented manner.
  They're problem - solvers, not problem-dwellers, problem-blamers, or problem - avoiders. They don't simply rehash a problem the way problem – dwellers do. They don't look for others to fault, as the blamers do. And they don't put off dealing with issues, the way avoiders do.

- **Interact with colleagues, seniors within and outside the team**
  Interaction with seniors is extremely essential and should be done with lot of care. Seniors by virtue of a prolonged experience will offer guidance and support, which will also help to improve your skills. Interaction with seniors should be based on the principles of mutual respect and should not confrontational in nature. Good relationships are also often necessary if we hope to develop our careers. After all, if your boss doesn't trust you, it's unlikely that he or she will consider you when a new position opens up. Overall, we all want to work with people we're on good terms with.

4.6 Maintaining good relationship with colleagues

There are several characteristics that make up good, healthy working relationships:

- **Trust** – This is the foundation of every good relationship. If you trust the people you work with, you can be open and honest in your thoughts and actions, and you don't have to waste time and energy "watching your back."
- **Mutual Respect** – When you respect the people that you work with, you value their input and ideas, and they value yours. Working together, you can develop solutions based on your collective insight, wisdom and creativity.
- **Mindfulness**–This means taking responsibility for your words and actions. Those who are mindful are careful and attend to what they say, and they don't let their own negative emotions impact the people around them.
- **Welcoming Diversity** –People with good relationships not only accept diverse people and opinions, but they welcome them. For instance, when your friends and colleagues offer different opinions from yours, you take the time to consider what they have to say, and fact or their insights in to your decision - making.
- **Open Communication** –We communicate all day, whether we're sending emails and IMs, or meeting face – to -face. The better and more effectively you communicate with those around you, the richer your relationships will be. All good relationships depend on open, honest communication.

4.7 Daily Log Reports

The daily log is a book, or software program, into which a supervisor records the day's activities. Record keeping helps ensure project organization, as well as keeps tabs on day-to-day employee happenings. The daily log is essential because it keeps a consistent record, which could be useful if you're ever sued, and need to prove that your workers performed a safety inspection, or conflict wash and led immediately and efficiently. Following is included under daily log section:

- Date and day plan
- Times of incidents
- Work performed
- Safety topics or any safety issue
- Problems and delays
- Employee conflict
- Equipment usage
- Materials purchased
- General management
- Drawing and maps studied with supervisor/team members/self

4.7.1 Importance of log reports

A supervisor is the crew leader on a construction jobsite. It's up to him to plan, organize, and direct work in a safe, and timely, manner. All supervisors will experience conflict at some point, as well as safety violations and work place injuries. By keeping a daily record of all activities, your construction site supervisor can protect your business from arbitration and/or litigation.

4.8 Incident Reports

In order to understand the incident report, you'll first need to understand what constitutes an incident. There are two types of events that are considered "incidents."
An event that resulted in an injury. For example: An employee is handling materials and suffers a cut to the finger.
An event that resulted in a near-miss, otherwise known as an event that almost resulted in injury or damage. For example: An employee is handling materials and almost suffers a cut to the finger.

NOTE

Each member of the project team is expected to keep a project diary. The diary contains summaries of the day's events in the member's own words. While interacting with senior's note down the information, expectation as communicated by the seniors. They are used to keep track of any daily work activity, conversations, observations, or any other relevant information regarding the construction activities. Diaries can be referred to when disputes arise and a diary happens to contain information connected with the disagreement. Hand written diaries can be used as evidence in court.

ACTIVITIES

Activity 1: Observation of team work in your school/office

Material Required

1. Notebook
2. Pen or pencil

Procedure

1. Make a group or team.
2. Give some task to each other and perform as team.
3. Write down all task assign by the other team.

Activity 2: Prepare a daily log/activity in your school/office

Material Required

1. Notebook
2. Pen or pencil

Procedure

1. Make a book or software.
2. Record the all daily activities.
3. Check daily log sections.
4. Check the performance of the students/employee.

CHECK YOUR PROGRESS

A. Mark the Correct option

1. Which of the following is NOT a characteristic of a good/effective team?
   a) Unified Commitment
   b) Competitive Climate
   c) Lack of Communication
   d) Standards of Excellence

2. What is the purpose of maintaining daily log reports?
   a) To keep a record of only completed tasks
   b) To ensure project organization and record daily activities
   c) To document only financial transactions
   d) To track employee behaviour only

3. Which of the following is an essential skill for effective teamwork?
   a) Avoiding collaboration
   b) Ignoring team discussions
   c) Demonstrating reliability
   d) Working independently without coordination

4. What is the first step in resolving conflicts effectively?
   a) Ignoring the issue
   b) Blaming team members
   c) Practicing clear communication
   d) Avoiding teamwork

5. Which of the following is a key characteristic of a good working relationship?
   a) Trust
   b) Disrespect

c) Avoiding diversity
d) Poor communication

B. Fill in the blanks

1. The _____ is a document that records daily activities, incidents, and safety topics on a construction site.

2. Conflict can be avoided by focusing on _____ rather than problems.

3. Good team players exhibit _____, meaning they can adapt to changing situations and perspectives.

4. An event that results in an injury or a near-miss is considered an _____ in a workplace setting.

C. Answer the following questions:

1. What do you mean by Team Management and their importance?
2. Define the term team work?
3. What is a Daily Log?
4. What do you mean by Incident Report?
5. What are the methods of resolving a conflict?
6. What considerations you will keep in mind while resolving a conflict?

ANSWER KEY

Unit 1: Sensor Based Fixtures

B. Fill in the blanks

1. Sensor
2. Flow
3. water pressure
4. solenoid
5. Microcontroller/Microprocessor
6. Battery box
7. leak detection
8. Infrared

C. Mark the correct option

1 – b
2– c
3– b
4– b
5 – c

Unit 2: Advance Pipe Fittings

B. Fill in the blanks

1. Push-to-Connect
2. **master**
3. PEX (Cross-linked Polyethylene)
4. **Ground Service Reservoir (GSR)**
5. main

C. Mark the correct option

1 – b
2– c
3– b
4– c
5 – b

Unit 3: Standard Operating Procedures

B. Mark the correct option

1 – b
2– b
3– b
4– c
5 – c

C. Fill in the blanks

1. Joint
2. hazards
3. PPE (Personal Protective Equipment)
4. Dry fit

Unit 4: Working Effectively with others

B. Mark the correct option

1 – c
2– b
3 – c
4– c
5 – a

C. Fill in the blanks

1. Daily Log report
2. Solutions
3. Flexibility
4. Incident

GLOSSARY

***Backflow*:** Backflow is a term used in plumbing to describe the undesirable reverse flow of water or other substances in a plumbing system.

***Clogging*:** Clogging, in the context of plumbing, refers to the blockage or obstruction of pipes, drains, or fixtures, preventing the smooth flow of water or waste through the plumbing system.

***Consumption*:** Consumption, in a general sense, refers to the act of using or utilizing something, often related to resources or goods.

***Disposal*:** Disposal refers to the process of getting rid of or discarding waste, unwanted items, or materials that are no longer needed.

***Flushing*:** Flushing, in the context of plumbing and sanitation, refers to the act of using water to clean and remove waste or debris from a fixture or plumbing system.

***Grouting*:** Grouting is a construction and home improvement process used to fill gaps or spaces between tiles, stones, or bricks with a cement-based material called grout.

***Joining*:** Joining refers to the act of connecting or bringing together separate components to form a unified whole.

***Leakage*:** A leakage is an amount of liquid or gas that is escaping from a pipe or container by means of a crack, hole, or other fault.

***Pedestal*:** It refers to a support or base upon which an object or structure is placed, often to elevate it or give it prominence.

***Pipework*:** Pipework refers to the system of pipes and associated components used to transport fluids, gases, or other materials within a building, industrial facility, or infrastructure network.

Remodelling: It refers to the process of making significant changes or improvements to an existing structure, space, or building.

***Roof Drainage*:** Roof drainage refers to the system and process of effectively removing rainwater, snowmelt, and other precipitation from the surface of a roof to prevent water damage and flooding.

***Sediment*:** Sediment refers to the solid particles that settle at the bottom of a liquid or are deposited by wind or water.

***Substance*:** In a general sense, a substance refers to any material or physical matter that has a distinct and measurable composition.

***Threading*:** This refers to the process of creating a helical ridge (screw threads) on a cylindrical surface, like a bolt or a screw.

Threatening: Threatening is an adjective that describes behavior, actions, or statements that convey a sense of harm, danger, or intent to cause harm to someone or something.

FURTHER READINGS

1.Indian Plumbing Association (IPA)

Website:www.indianplumbing.org

2.Advance Plumbing Technician Course

Website:https://www.nqr.gov.in/sites/default/files/COURSE%201023_Advanced%20Plumbing%20Technician.pdf