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Open Vocational Education Programme

Drinking Water Purifier Technician

NSQF Level 3.5

National Institute of Open Schooling

Open Vocational Educational Programme

DRINKING WATER PURIFIER TECHNICIAN

NATIONAL INSTITUTE OF OPEN SCHOOLING

(An autonomous institution under Ministry of Education, Govt. of India)
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A Word with You

Dear Learner,

Welcome to the course on **"Drinking Water Purifier Technician".**

I am glad that you have chosen this vocational course.

Today water purifiers have become a day-to-day necessity leading to increased demand of both domestic and commercial water purifiers.

Water purifier needs routine services for its smooth functioning and it also requires proper installation and maintenance. Keeping this fact in mind, NIOS has designed this course to train you as a skilled and professional technician for Installation, Repairing and Maintenance of Domestic and Commercial Drinking Water Purifier Systems.

This is a NCVET approved qualification at NSQF level 3.5, it furthers ensure quality assurance across this vocational sector.

This course will accommodate the knowledge and skills required for assembling, installing and repairing wide variety of drinking water purifier systems available in the market. This course has been written progressively and in very simple language giving insight of each and every technology used in water purifier systems.

The course covers all core elements pertaining to a Drinking Water Purifier Technician such as -: **Water Quality Testing, Technology Used in Water Purifiers, Components of Water Purifier, Working Procedure of a Range of Water Purifier System, Configuring Water Purifier System, Inspecting Water Purifier Systems, and Troubleshooting Techniques.**

In this programm our goal is to give learners a fundamental understanding of the Water Purification Industry. Additionally, this course contains **Employability Skill** module which enhance your soft skills and helps you towards gaining employment and business opportunities available in this sector.

After completing this course; learner may be able to find work at establishments such as - **Water Purifier Service Centers, Water Purifier Retail Chains/Shops, Water Purifier Assembling Plants, Water Purifying Plants etc.**

As this is a skill based vocational course, so practical training is very important to master your skills.

So, we request you to kindly attend the Personal Contact Programme (PCP) at your alloted Accredited Vocational Institutes (AVIs).

Wishing you good luck and success!

Ms. Priyanka Goyal

Course Coordinator

How to use the Learning Material

Congratulations! You have accepted the challenge to be a self-learner. It means, you have to organize your study, learn regularly, keep up your motivation and achieve your goal. Here it is solely you, who is responsible for your learning. NIOS is with you at every step. It has developed the material in 'Drinking Water Purifier Technician' keeping only you in mind. A format supporting independent learning has been followed. You can take the best out of this material if you follow the instructions given below.

Title: will give a clear indication of the contents within. Do read it.

Introduction: This will introduce you to the lesson linking it to the previous one.

Objectives: These are statements that explain what you are expected to learn from the lesson. The objectives will also help you to check what what you have learnt after you have gone through the lesson. Do read them.

Notes: Each page carries empty space in the side margins, for you to write important points or make notes.

Intext Questions: Very short answer self check questions are asked after every section, the answers to which are given at the end of the lesson. These will help you to check your progress. Do solve them. Successful completion will allow you to decide whether to proceed further or go back and learn again.

What You Have Learnt: This is the summary of the main points of the lesson. It will help in recapitulation and revision. You are welcome to add your own points to it also.

Terminal Questions: These are long and short questions that provide an opportunity to practice for a clear understanding of the whole topic.

Answers To Intext Questions : These will help you to know how correctly you have answered the questions.

Key Learning Outcomes: This box provides additional information. The text in boxes is important and must be given attention. It is not meant for evaluation, but only to improve your general knowledge.

Activities: Certain activities have been suggested for better understanding of the concept.

Web site: These websites provide extended learning. Necessary information has been included in the content and you may refer to these for more information.

COURSE OVERVIEW

LESSON

1. Introduction to the Sector and Job Role
2. Pre-Installation Activities
3. Site Preparation
4. Electrical Connections
5. Installing Pre-Filters and Post-Filters
6. Routine Maintenance of Water purifier System and Fault Finding
7. Troubleshooting of Water Purifier System
8. Planning and Adopting a Systematic Approach
9. Use of Technology for Waste Management
10. Maintain Safety at Workplace

EMPLOYABILITY SKILL WORKBOOK (60 hrs)

PRACTICAL

1. Water Quality Testing
2. Market Survey for Water Purifier
3. Installation Location
4. Installation of Water Purifier
5. Tools Used In Electrical Installation
6. Selection of wiring for Electrical Connections
7. Internal Electrical Connections
8. Pre and Post Filters
9. Routine Maintenance
10. Fault Diagnosis
11. Customization of WPU
12. Waste Water Utilization
13. Waste Management
14. Safety Equipments

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1

INTRODUCTION TO THE SECTOR AND JOB ROLE

1.1 INTRODUCTION

The water purification sector in India is of great importance due to the country's diverse water sources, varying levels of contamination, and the critical need for clean and safe drinking water. In this context the need of water purifier technician is vital to ensure safe drinking water & prevent water borne diseases. The responsibilities of a water purifier technician include a wide range of tasks related to the operation, maintenance, and monitoring of water treatment facilities. Details of this sector and associated job roles are discussed in this lesson.

1.2 LEARNING OBJECTIVE

After reading this lesson learner will be able to:

- Discuss the overview of water purification industry
- Analyze various impurities in the different drinking water sources.
- Describe types of water purification system according to the level of impurities
- Identify the scope of water purification sector in India.
- Identify the job opportunities of Drinking Water Purifier Technician.

1.3 OVERVIEW OF WATER PURIFICATION INDUSTRY

The water purification industry plays a vital role in ensuring access to clean, safe, and potable water for households, industries, agriculture, and communities around the world. This industry encompasses a wide range of technologies, processes, and products aimed at treating and purifying water from various sources to remove impurities, contaminants, and pathogens. Here's an overview of the water purification industry:

1. **Importance of Water Purification:**
   Access to clean water is a fundamental human right and is critical for public health and well being.

The water purification industry is essential for mitigating waterborne diseases, reducing environmental pollution, and supporting sustainable water management.

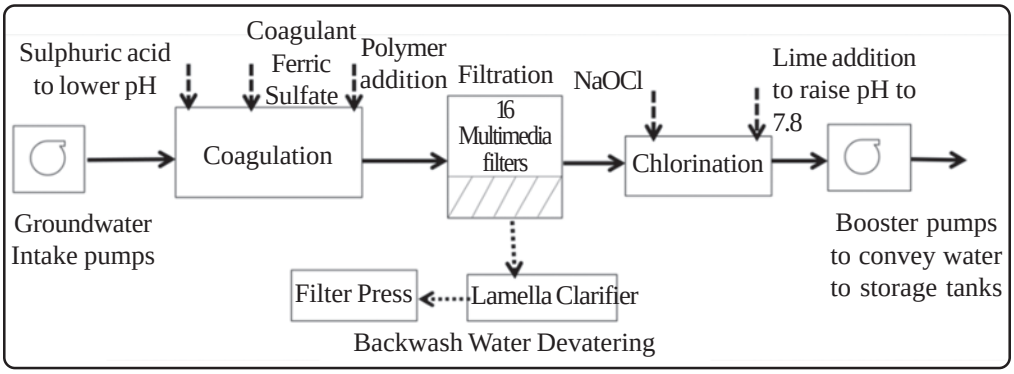
2. Water Sources:

Water purification involves treating water from diverse sources, including rivers, lakes, groundwater, reservoirs, and municipal water supplies. Different sources may contain varying levels and types of impurities, necessitating tailored purification processes.

3. Water Treatment Processes:

The industry employs a variety of treatment processes to remove contaminants and impurities, including:

Filtration, Chemical Treatment, Membrane Filtration, Reverse Osmosis, UV Disinfection, Distillation.



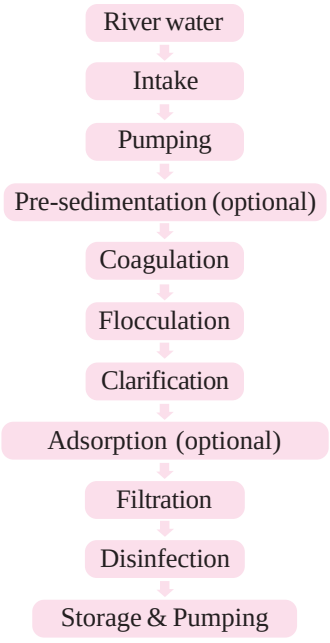


Figure 1.1 : Water Treatment Processes

4. Water Purification Technologies:

Water purification technologies play a crucial role in ensuring access to clean and safe drinking water, a fundamental necessity for human health and well-being. Various methods and technologies are employed to remove contaminants, impurities, and pathogens from water sources, making it suitable for consumption. Here are some prominent water purification technologies:

a. Filtration:

Mechanical Filtration: Involves passing water through a physical barrier to remove larger particles, sediment, and debris. Common filtration materials include sand, gravel, and ceramic.

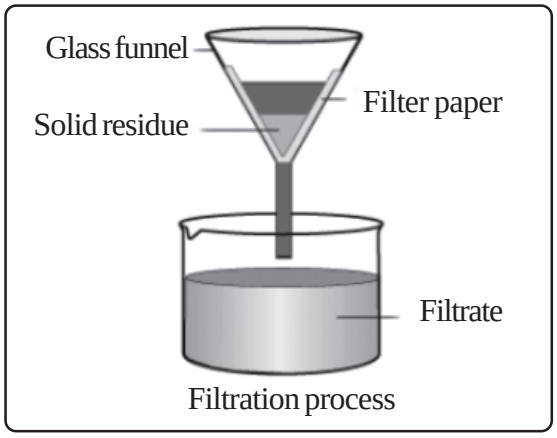


Figure 1.2 : Mechanical Filtration

Membrane Filtration: Utilizes membranes with specific pore sizes to separate contaminants. Microfiltration, ultrafiltration, nanofiltration, and reverse osmosis fall under this category, with decreasing pore sizes.

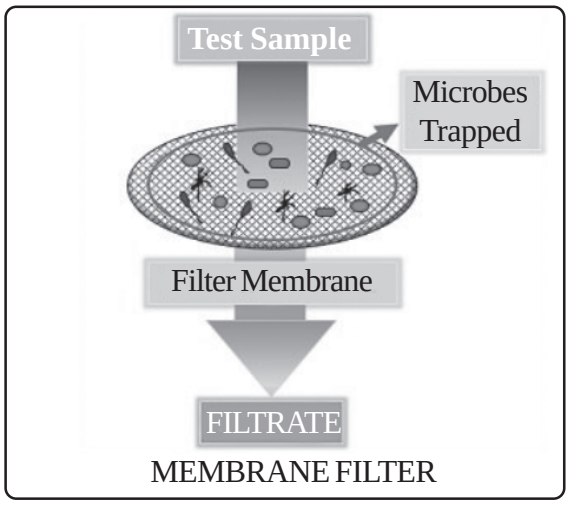


Figure 1.3 : Membrane Filtration

b. Chemical Treatment:

Chlorination: Involves the addition of chlorine or chlorine compounds to disinfect water and eliminate bacteria and viruses. However, it may lead to the formation of disinfection by-products.

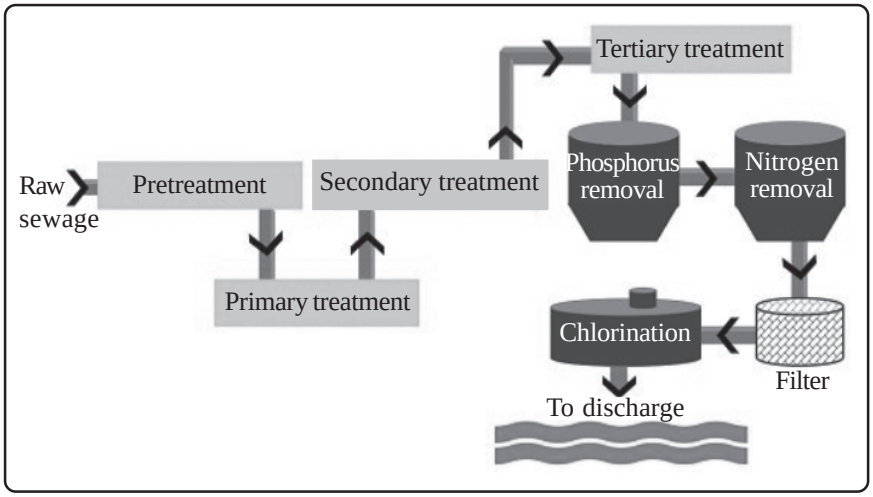


Figure 1.4 : Chemical Treatment

Ozonation: Uses ozone, a powerful oxidizing agent, to kill bacteria and viruses. Ozone is effective in breaking down organic pollutants and has fewer by-products than chlorination.

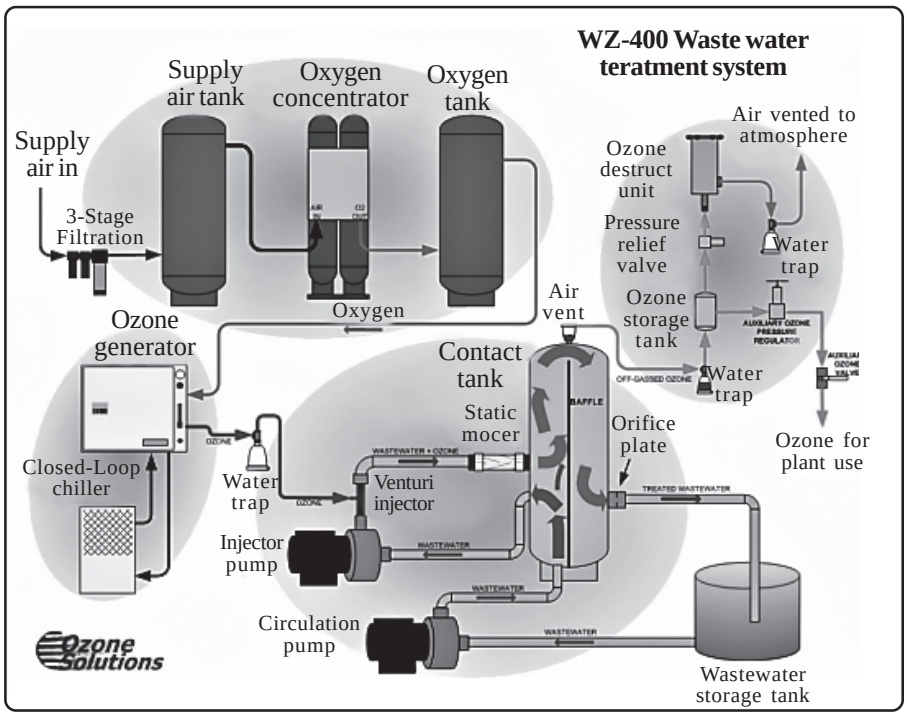


Figure 1.5 : Ozonation

UV Treatment: Ultraviolet (UV) light is employed to inactivate microorganisms by disrupting their DNA, preventing them from reproducing. UV treatment is chemical-free and leaves no residual taste or odour.

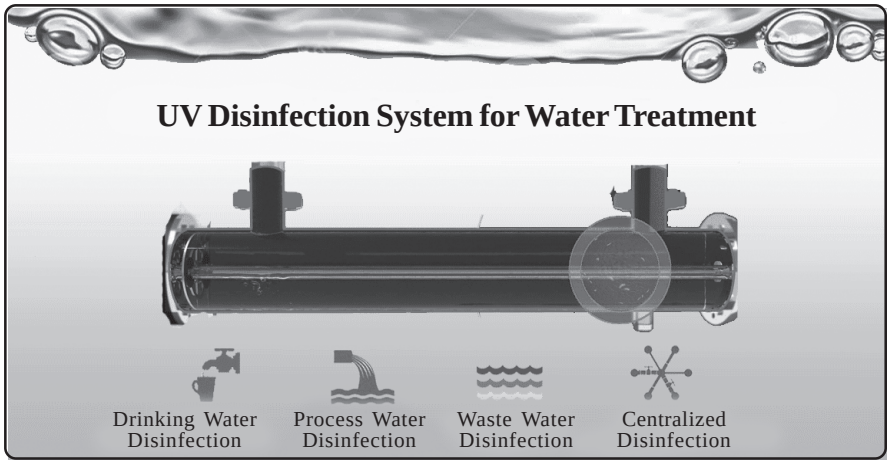


Figure 1.6 : UV Treatment

c. Coagulation and Flocculation:

Coagulation: Involves the addition of chemicals that cause small particles to clump together, forming larger particles called floc.

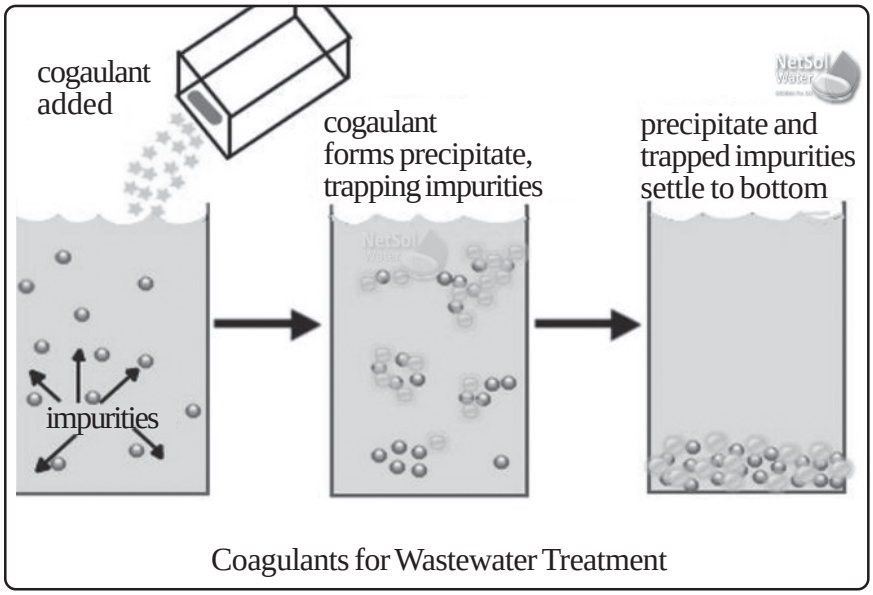


Figure 1.7 : Coagulation and Flocculation

Flocculation: Agitates the water to encourage the collision and merging of floc particles, which can then be easily removed through sedimentation or filtration.

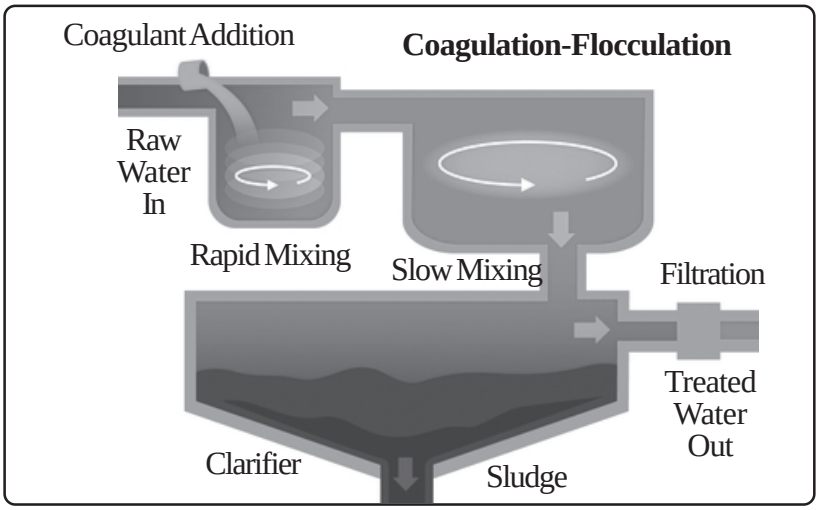


Figure 1.8 : Flocculation

d. Activated Carbon Adsorption:

Activated Carbon Filters: Adsorb and remove organic compounds, chlorine, volatile organic compounds (VOCs), and some heavy metals. Activated carbon has a large surface area that attracts and binds contaminants.

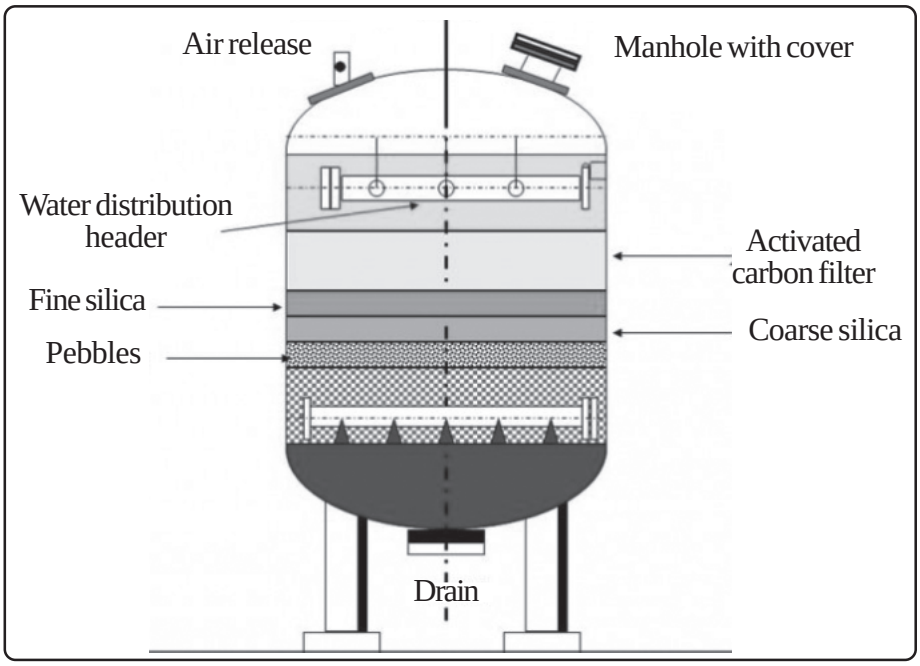


Figure 1.9 : Activated Carbon Adsorption

e. Ion Exchange:

Ion Exchange Resins: Remove ions from water by exchanging them with ions of similar charge on the resin. Commonly used for water softening to remove calcium and magnesium ions.

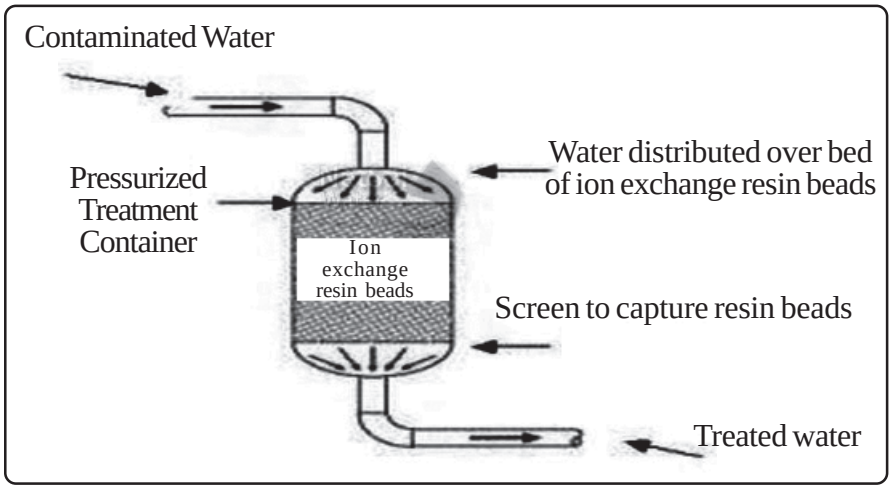


Figure1.10 : Ion Exchange

f. Distillation:

Water Distillers: Heat water to create steam, which is then condensed back into liquid form. This process removes contaminants that have higher boiling points than water, producing purified water.

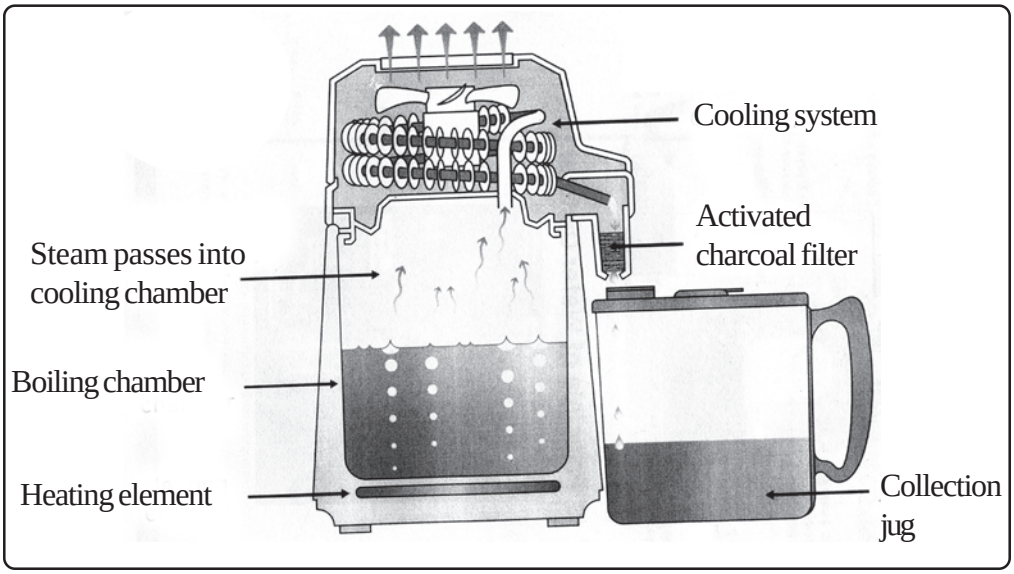


Figure 1.11 : Distillation

g. Desalination:

Reverse Osmosis (RO): Forces water through a semi-permeable membrane to remove salts and other impurities, making seawater or brackish (mixture of freshwater and saltwater) water suitable for drinking and industrial purposes.

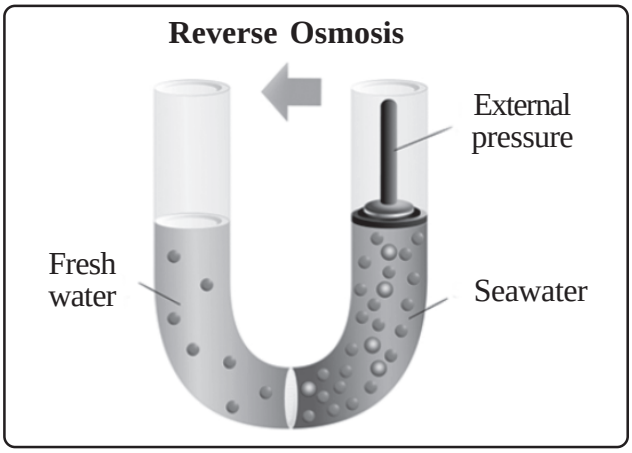


Figure 1.12 : Desalination

Each water purification technology has its strengths and limitations, and the choice of method depends on factors such as the source water quality, the type of contaminants present, cost considerations, and the desired water quality standards. Sometimes multiple technologies are combined in water treatment process to achieve desirable water purification. Advances in research and technology continue to improve the efficiency, affordability, and sustainability of water purification methods, contributing to global efforts to ensure access to clean and safe water for all.

5. Market Growth:

The global water purification industry has experienced significant growth due to increased awareness of water quality issues, population growth, and industrial expansion. Rising concerns about water scarcity, pollution, and the impact of climate change are driving the demand for advanced purification technologies.

6. Environmental Considerations:

The industry is increasingly focused on sustainability and reducing the environmental footprint of water treatment processes. Efforts are made to minimize chemical usage, energy consumption, and waste generation in water purification.

7. Applications:

Water purification serves various sectors, including residential, industrial, agricultural, healthcare, and municipal:

- **Residential:** Home water filters, purifiers, and treatment systems.

- **Industrial:** Water purification for manufacturing processes and cooling systems.
- **Agriculture:** Irrigation water treatment and livestock drinking water.
- **Healthcare:** Purified water for medical and pharmaceutical applications.
- **Municipal:** Public water supply treatment and wastewater treatment.

8. **Future Trends:**

The water purification industry continues to evolve with ongoing research and innovation in areas such as decentralized water treatment, water recycling, and advanced materials. Increasing adoption of smart technologies and decentralized treatment systems is expected.

In conclusion, the water purification industry is an indispensable component of global efforts to provide safe and clean water resources. It addresses a wide range of challenges related to water quality, environmental sustainability, and public health, and it continues to adapt and innovate in response to evolving water-related issues around the world.

1.4 VARIOUS IMPURITIES PRESENT IN DIFFERENT DRINKING WATER SOURCES

Drinking water can come from various sources, and each source can have its own set of impurities and contaminants. The presence of these impurities can vary depending on the geographical location, treatment processes, and environmental factors. Here's an overview of some common impurities found in different drinking water sources:

Drinking water sources	Common impurities		
Groundwater: Groundwater is often considered a relatively clean source of drinking water, but it can still contain impurities such as:	**Minerals:** High levels of minerals like calcium, magnesium, and iron can lead to hard water, which may cause scaling in pipes and appliances.	**Heavy Metals:** Groundwater may contain heavy metals like arsenic, lead, and mercury due to natural geological processes or pollution.	**Nitrates:** Agricultural runoff and septic systems can introduce nitrates into groundwater, which pose health risks if consumed in high concentrations.

Drinking water sources	Common impurities		
Surface Water: Surface water sources like rivers, lakes, and reservoirs are more susceptible to pollution and may contain.	**Microorganisms:** Bacteria, viruses, and protozoa can be present, leading to waterborne diseases if not treated properly.	**Organic Matter:** Decaying plant material and organic runoff can result in taste and odour issues, as well as the formation of disinfection byproducts during treatment.	**Sediments:** Suspended solids and sediments can make water cloudy and may carry pollutants and pathogens.
Rainwater: Rainwater harvesting systems are becoming popular in some regions, but rainwater can still contain impurities.	**Airborne Pollutants:** Rain can pick up pollutants such as dust, pollen, and chemicals from the atmosphere.	**Roof Contaminants:** Contaminants from roofing materials like asphalt shingles or metal roofs may leach into rainwater.	
Spring Water: Springs are natural sources of groundwater, and their water quality can vary.	**Minerals:** Like other groundwater sources, spring water can be rich in minerals depending on the geological formations it passes through.	**Microbial Contamination:** Springs can be vulnerable to microbial contamination if not protected from surface runoff and wildlife.	
Seawater: In regions with limited freshwater sources, seawater desalination is used, but it presents its own set of challenges.	**Salinity:** Seawater is very high in salt content, and desalination processes must remove salts effectively to make it safe for drinking.	**Energy Usage:** Desalination requires significant energy input, which can have environmental impacts.	

Drinking water sources	Common impurities	
Well Water: Well water quality varies widely, but common impurities include.	**Bacteria and Viruses:** Well water can become contaminated with pathogens from surface runoff, septic systems, or nearby livestock.	**Radon:** Some well water may contain elevated levels of radon gas, which can be harmful when inhaled.
Municipal Tap Water: Municipal water supplies typically undergo extensive treatment, but they may still contain impurities such as:	**Chlorine and Disinfection Byproducts**: Chlorine is often used to disinfect water, but it can react with organic matter to form disinfection byproducts.	**Lead and Other Pipe Contaminants:** Older infrastructure with lead pipes can leach lead into tap water.

It's essential to regularly test and treat drinking water to ensure it meets safety standards and is free from harmful impurities, regardless of its source. Local water authorities and environmental agencies typically monitor and regulate drinking water quality to protect public health.

Health risks associated with specific water quality issues

Various water quality issues can pose potential health risks to individuals who consume or come into contact with contaminated water. Here are some specific water quality issues and the potential health risks associated with them:

Bacterial Contamination: Elevated levels of total coliforms and E. coli in water can indicate bacterial contamination. Drinking water contaminated with harmful bacteria can lead to gastrointestinal illnesses, including diarrhea, vomiting, and stomach cramps.

Chemical Contaminants: Chemical contaminants in water can have a wide range of health effects, depending on the specific chemicals involved.

Heavy Metals (e.g., lead, mercury): Lead exposure can lead to developmental and neurological issues, while mercury exposure can harm the nervous system.

Organic Compounds (e.g., pesticides, solvents): Some organic chemicals can cause cancer, reproductive problems, or damage to liver and kidneys.

Industrial Pollutants (e.g., PCBs): Exposure to polychlorinated biphenyls (PCBs) can lead to skin problems, liver damage, and developmental issues in children.

Nutrient Pollution: Elevated levels of nutrients, particularly nitrogen and phosphorus, can lead to algal blooms (dense layer of tiny green plants) in water bodies. Consuming water contaminated with algal blooms can result in illnesses, including gastrointestinal and neurological symptoms.

Dissolved Oxygen Depletion: Low dissolved oxygen (DO) levels in water can lead to hypoxia, harming aquatic life. In areas where drinking water is sourced from affected water bodies, the treatment process may be compromised, potentially affecting water quality and public health.

Radon: Radon is a naturally occurring radioactive gas that can dissolve in groundwater. Inhaling radon released from water into indoor air can increase the risk of lung cancer.

Sulfate and Hydrogen Sulfide: High levels of sulfate and the presence of hydrogen sulfide in water can affect taste and odour. Inhaling hydrogen sulfide gas released during water use can cause respiratory irritation and other health issues.

TDS and Hardness: Elevated levels of total dissolved solids (TDS) and water hardness can affect the taste of water and, in some cases, contribute to scaling in pipes and appliances. While not directly harmful to health, these issues can impact water quality and user satisfaction.

Chlorine Residual: While chlorine is added to water as a disinfectant, excessive chlorine levels can have adverse health effects, including skin and eye irritation, respiratory problems, and a risk of disinfection byproducts.

pH: Extreme pH levels in water (either highly acidic or highly alkaline) can affect the taste of water and, in some cases, irritate the gastrointestinal system. However, pH extremes are relatively rare in drinking water.

Turbidity: High turbidity in water can reduce the effectiveness of disinfection processes and may indicate the presence of pathogens. It can indirectly affect health by increasing the risk of waterborne diseases.

Water quality testing, monitoring, and treatment are essential for identifying and mitigating these potential health risks. Drinking water utilities and regulatory agencies have guidelines and standards in place to ensure that water quality remains within safe limits to protect public health.

1.5 TYPES OF WATER PURIFICATION SYSTEM ACCORDING TO THE LEVEL OF IMPURITIES

Water purification systems are essential for ensuring the availability of clean and safe drinking water. These systems vary in complexity and efficiency depending on the level of impurities present in the water source. Following are different types of water purification systems categorized according to the level of impurities they address:

Sediment Filtration

Purpose: This system primarily removes large particles and sediment from water.

Mechanism: Sediment filters use a physical barrier, such as a mesh or sand bed, to trap particles and debris.

Typical Applications: Well water, surface water, or municipal water with high sediment content.

Activated Carbon Filtration

Purpose: Removes chlorine, organic chemicals, bad odors, and tastes from water.

Mechanism: Activated carbon adsorbs impurities onto its porous surface.

Typical Applications: Municipal tap water, water with organic contaminants.

Reverse Osmosis (RO)

Purpose: Effective against a wide range of impurities, including dissolved salts, heavy metals, and contaminants.

Mechanism: Uses a semipermeable membrane to separate impurities from water molecules.

Typical Applications: Well water, brackish water, seawater, and places with high levels of dissolved solids.

Ultraviolet (UV) Sterilization

Purpose: Kills bacteria, viruses, and other microorganisms.

Mechanism: UV light damages the DNA of microorganisms, preventing them from reproducing.

Typical Applications: Surface water, groundwater, and where microbial contamination is a concern.

Distillation

Purpose: Removes dissolved solids, heavy metals, and some organic compounds.

Mechanism: Boiling of water to produce steam, then condensing it back into liquid form, leaving the impurities behind.

Typical Applications: Well water, water with high mineral content.

Ion Exchange (Water Softeners)

Purpose: Removes hardness-causing ions like calcium and magnesium.

Mechanism: Exchanges these ions with sodium or potassium ions through resin beads.

Typical Applications: Areas with hard water, primarily for improving taste and preventing scale buildup in plumbing.

Chemical Treatment (Chlorination, Ozonation)

Purpose: Kills or neutralizes bacteria, viruses, and other microorganisms.

Mechanism: Chemical disinfectants like chlorine or ozone are added to water to disinfect it.

Typical Applications: Municipal water treatment, well water disinfection.

Multi-Stage Filtration Systems

Purpose: Combines various filtration methods to address multiple impurities simultaneously.

Mechanism: Sequentially passes water through different filter media to remove specific contaminants.

Typical Applications: Customized systems for specific water quality issues.

Desalination (Reverse Osmosis for Brackish/Saltwater)

Purpose: Removes salt and minerals from brackish or seawater to make it potable.

Mechanism: Similar to standard RO, but designed for high salinity water sources.

Typical Applications: Coastal regions with limited fresh water sources.

The choice of a water purification system should be based on the specific impurities present in the water source and the desired water quality. Some systems, like multi-stage filtration, may be necessary in areas with complex water quality issues. Regular water testing can help determine the most suitable purification method for a given location.

1.6 SCOPE OF THE WATER PURIFICATION SECTOR

1.6.1 Water Purification Sector in India

The water purification sector in India is of paramount importance due to the country's diverse water sources, varying levels of contamination, and the critical need for clean and safe drinking water. India faces significant challenges in ensuring access to clean water for its vast population, and the water purification sector plays a crucial role in addressing these challenges. Here's an overview of the water purification sector in India:

1. **Water Quality Challenges:** India's water sources are often contaminated with pollutants, including pathogens, heavy metals, chemicals, and industrial effluents.

   Rural areas face challenges related to microbial contamination, while urban areas deal with a complex mix of pollutants, including industrial and agricultural runoff.

2. **Government Initiatives:** The Indian government has launched various programs and initiatives to improve water quality, such as the National Rural Drinking Water Program (NRDWP) and the National Urban Drinking Water Mission (NUDWM).

   The Swachh Bharat Abhiyan (Clean India Mission) includes a focus on providing access to clean drinking water and sanitation facilities.

3. **Public and Private Sector Involvement:** Both public and private entities are actively involved in the water purification sector.Public sector organizations like the Water Supply and Sanitation Departments in various states are responsible for delivering safe drinking water to rural areas.

   Private companies manufacture, distribute, and install water purification systems for both residential and industrial use.

4. **Types of Water Purification Technologies:** Common water purification technologies used in India include:

   RO (Reverse Osmosis) Systems: Widely used for removing dissolved solids and contaminants from drinking water.

   UV (Ultraviolet) Purifiers: Effective against microorganisms like bacteria and viruses.

   Activated Carbon Filters: Used to improve taste and remove organic compounds.

Multi-stage Filtration Systems: Combining various methods for comprehensive water treatment.

Community Water Treatment Plants: Large-scale purification facilities serving multiple households or communities.

5. **Challenges and Concerns:**

Access Disparities: There is a significant urban-rural divide in access to clean water. Rural areas often face inadequate infrastructure and resources.

Groundwater Depletion: Excessive use of groundwater without proper replenishment leads to water scarcity and quality issues.

Water Quality Monitoring: Regular monitoring and testing of water sources for contamination are often lacking in many regions.

Energy Consumption: RO systems, while effective, can be energy-intensive, which may not be sustainable in areas with unreliable power supply.

6. **Sustainability and Innovation:** Increasingly, there is a focus on sustainable water purification methods, including rainwater harvesting, greywater recycling, and solar-powered purification systems.

Innovations like point-of-use water purifiers, IoT-based water quality monitoring, and low-cost filtration systems are emerging to address water purification challenges.

7. **Future Outlook:** The water purification sector in India is expected to continue growing as awareness of water quality issues increases.

Sustainable and cost-effective solutions will be critical to improving access to clean water, especially in underserved regions.

In summary, the water purification sector in India plays a vital role in ensuring access to safe and clean drinking water for its diverse population. While progress has been made, there are still significant challenges to overcome, and ongoing efforts, innovations, and investments are crucial to addressing India's water quality concerns.

1.6.2 Reasons for the growth of India's Water Purification sector

The water purification sector in India has experienced significant growth in recent years, driven by a combination of factors, including environmental concerns, increasing

awareness of waterborne diseases, government initiatives, and changing consumer preferences. Here are some key reasons for the growth of India's water purification sector:

- India faces significant challenges related to water quality, with many water sources contaminated by pollutants, including bacteria, viruses, heavy metals, and chemicals. **The rising awareness of these contaminants** and their health risks has driven the demand for water purification solutions.
- Increased **awareness of waterborne diseases,** such as cholera, typhoid, and gastroenteritis, has led people to prioritize clean and safe drinking water. Consumers are more willing to invest in water purification systems to protect their health and that of their families.
- India's **rapid urbanization** has led to increased demand for clean water in urban areas. The expansion of cities and the need for clean water in households, offices, and industries have driven the growth of the water purification sector.
- The Indian **government has launched several initiatives** to improve access to clean drinking water, such as the National Rural Drinking Water Program (NRDWP) and the National Urban Drinking Water Mission (NUDWM). These programs have focused on upgrading water supply infrastructure and promoting water purification.
- As disposable **incomes rise,** consumers are more willing to invest in water purification systems to ensure their water is safe and tastes good. This shift in **consumer preferences has boosted the sales of water purifiers and filters.**
- **Industries and commercial establishments** require large quantities of clean water for various processes. The industrial and commercial sectors have contributed to the growth of the water purification sector by adopting advanced water treatment technologies.
- Ongoing **advancements in water purification technologies** have made systems more efficient, cost-effective, and user-friendly. Innovations like RO (Reverse Osmosis) systems, UV (Ultraviolet) purifiers, and IoT-based water quality monitoring have gained popularity.
- The **degradation of natural water sources** due to pollution and over-extraction has raised environmental concerns. Water purification is seen as a means to reduce the strain on natural water bodies and ecosystems.

- **Increasing water stress** in many parts of India, particularly **during dry seasons** and droughts, has heightened the importance of efficient water purification and recycling systems to optimize water use.
- **Stringent water quality regulations and standards,** coupled with stricter enforcement, have encouraged industries and households to invest in water treatment and purification systems to meet compliance requirements.
- **Various public awareness campaigns,** including those initiated by NGOs and community organizations, have educated people about the importance of clean water and the benefits of water purification.

1.7 JOB ROLES AND RESPONSIBILITIES OF A DRINKING WATER PURIFIER TECHNICIAN

A drinking water purification technician plays a critical role in ensuring the provision of safe and clean drinking water to the public. Their responsibilities encompass a wide range of tasks related to the operation, maintenance, and monitoring of water treatment facilities. Here are some of the key responsibilities of a drinking water purification technician:

Operate Water Treatment Equipment: Technicians are responsible for operating and controlling various water treatment equipment and systems, including pumps, filters, chemical feed systems, and disinfection equipment.

Water Quality Monitoring: Regularly monitor and test the quality of the raw water source and the treated water to ensure compliance with safety and quality standards. This involves conducting chemical, physical, and microbiological tests.

Adjust Treatment Processes: Make necessary adjustments to treatment processes based on water quality test results to maintain consistent water quality and meet regulatory standards.

Chemical Handling: Handle and add chemicals, such as chlorine, coagulants, and disinfectants, in the correct proportions to treat water effectively while adhering to safety protocols.

Maintain Equipment: Perform routine maintenance and inspections of treatment equipment to ensure they are functioning correctly. This includes troubleshooting and repairing mechanical and electrical issues as they arise.

Calibration of Instruments: Calibrate and maintain laboratory instruments and monitoring equipment used in water quality testing to ensure accurate results.

Record Keeping: Maintain detailed records of water treatment processes, equipment maintenance, chemical usage, and water quality data. These records are essential for regulatory compliance and troubleshooting.

Emergency Response: Be prepared to respond to water quality emergencies, such as equipment failures or contamination incidents. Technicians may need to take immediate corrective actions to protect public health.

Compliance with Regulations: Ensure that all water treatment processes adhere to local, state, and national regulations and standards for drinking water quality and safety.

Sampling and Analysis: Collect water samples from various points in the distribution system and treatment process and analyze them for impurities and contaminants.

Safety Procedures: Follow strict safety procedures when working with chemicals, equipment, and electrical systems to prevent accidents and ensure the well-being of all personnel.

Training and Education: Stay updated on the latest developments in water treatment technology and attend training programs to enhance knowledge and skills.

Customer Relations: Communicate with the public and address concerns or inquiries regarding water quality, explaining treatment processes and safety measures in place.

Collaboration: Work closely with other water treatment professionals, including engineers, laboratory technicians, and supervisors, to maintain efficient operations.

Environmental Responsibilities: Implement environmentally friendly practices and waste disposal methods to minimize the impact of water treatment operations on the environment.

Overall, a drinking water purification technician's primary responsibility is to ensure that the water treatment plant operates effectively and efficiently to provide clean and safe drinking water to the community while complying with all relevant regulations and standards. Their work is crucial for protecting public health and the environment.

INTEXT QUESTIONS 1.1

1. What is the primary purpose of the water purification industry?

   a) To extract minerals from water sources

   b) To generate electricity from water treatment processes

   c) To ensure the availability of clean and safe drinking water

d) To control water pollution in oceans and rivers

2. What factors have contributed to the growth of the water purification industry?

a) Decreased awareness of water quality issues

b) Reduced industrialization

c) Environmental conservation efforts

d) Limited government regulations

3. Which of the following is a common microbial impurity found in untreated water sources?

a) Calcium

b) Iron

c) Bacteria

d) Organic chemicals

4. In groundwater sources, what impurity is often associated with "hard water"?

a) Lead

b) Chlorine

c) Calcium and magnesium

d) Arsenic

5. Which water purification system is effective for removing dissolved salts and heavy metals?

a) Distillation

b) Activated carbon filtration

c) Ultraviolet sterilization

d) Ion exchange (water softeners)

6. What is the primary purpose of using ultraviolet (UV) sterilization in water treatment?

a) To improve taste and odor

b) To remove sediment and debris

c) To kill microorganisms like bacteria and viruses

d) To reduce dissolved solids

WHAT YOU HAVE LEARNT

- Overview of water purification industry
- Various impurities in the different drinking water sources.
- Types of water purification system according to the level of impurities
- Scope of the Water Purification Sector and its sub-sectors in India.
- Role of the water purifier technician.
- Job role and opportunities for a Drinking Water Purification Technician

TERMINAL QUESTIONS

1. What are the common types of impurities found in drinking water from natural sources like rivers and lakes?
2. What impurities are typically found in groundwater sources of drinking water?
3. How does the level of impurities in water affect the choice of water purification system?
4. What are the responsibilities of a water purifier technician in their job role?
5. What is the scope of the water purification sector in terms of employment and market demand?

ANSWERS TO INTEXT QUESTIONS

1.1

1. c) To ensure the availability of clean and safe drinking water
2. c) Environmental conservation efforts
3. c) Bacteria
4. c) Calcium and magnesium
5. a) Distillation
6. c) To kill microorganisms like bacteria and viruses

Lesson - 1

Introduction to the sector and job role

Notes

Key Learning Outcomes

Being able to :

- Identify the types of impurities in the different drinking water sources.
- Suggest the type of water purification system according to the level of impurities.
- Illustrate the job role of the water purifier technician.
- Distinguish between different water purification technologies based on level of impurities.

2

PRE-INSTALLATION ACTIVITIES

2.1 INTRODUCTION

Water pollution has become one of the foremost problems in India. Millions of people suffer from water-borne diseases in India due to contaminated water. Some of the common water borne-diseases are typhoid and diarrhea. There are different types of water purifier available in the market which are capable of removing contaminants from water and make it safe and hygienic for drinking.

This lesson gives you detailed information on what is a water purifier, the different methods of water purification, and the different types of water purifiers in India.

Before choosing a water purifier system, identification of water is of utmost importance. Therefore, the survey of water purifier system available in market is necessary for its selection. The knowledge of procuring permissions from local authorities is also necessary before performing installation for commercial water purifier. Identification of suitable location and the installation activities are explained in this lesson. In this lesson you will learn to perform pre installation activities efficiently.

2.2 LEARNING OBJECTIVE

After reading this lesson learner will be able to:

- Identify the different source of drinking water used for drinking in various regions of the country.
- Identify the different types of water purifiers available in the market and their sub components.

- Identify the range of equipment to check the quality of water.
- Differentiate between commercial and domestic water purifier.

2.3 DIFFERENT DRINKING WATER SOURCES AND RANGE OF AVAILABLE WATER PURIFIERS IN THE MARKET

Introduction

Water is the most abundant compound found on Earth and is essential for the survival of all life forms. More than 70% of Earth's surface is covered with water in the form of snow, glaciers, oceans, rivers and lakes. It is the only substance on earth that exists in all three physical states, in liquid state at standard temperature and pressure, in solid state as ice and in gaseous state as water vapor.

However, very little of this water is drinkable, as 96% of the Earth's water is salt water. Around 98% of the remaining freshwater is in the form of glaciers and polar ice caps. This leaves just about 1% of the freshwater on the surface in the form of rivers and lakes. Not all of this freshwater is safe for human consumption as it is contaminated with bacteria.

As you have learned about the impurities present in the water in lesson 1, now in this lesson you will learn about the equipment used to check the quality of water available for drinking. In the market range of water purifiers are available for purification of drinking water both for commercial and domestic uses.

The water purifier technician, should have proper knowledge of impurities present in the drinking water supply of their working region and also the specifications of the available water purifier range in the market.

Generally in metro city's following types water sources are available

- Govt.tube well
- Ground water
- Tankers

In rural & remote areas following types of water sources are available:

- River
- Pond
- Well
- Ground water

2.3.1 Methods for checking the water quality of different water sources

1) Physical examination:

- **Check the water quality by visual inspection:**

  In visual inspection we can detect suspended impurities and turbidity in water sample using the naked eye.If water sample is transparent you can say that the water sample is free from suspended impurities.

2) With the help of equipment:

- **TDS meter:**

  TDS meter is used to check the quality of water for both domestic and commercial water purifier.

- **Use and working:**

  TDS meter measures the conductivity of the solution and estimates the TDS from that reading.

Table 2.1 TDS Level Chart for Drinking Water

TDS in Water (measured in PPM)	Suitability for Drinking Water
Between 50-150	Excellent for drinking
150-250	Good
250-300	Fair
300-500	Poor, not good for drinking
Above 1200	Unacceptable

Figure 2.1 : TDS meter

- **Hardness Test kit:**

The Water Hardness Test Kit is a simple and accurate way of to measure the total hardness of water supply. It is commonly used in commercial water purifier unit.

The general rule of thumb is to drink clean water, with hardness being somewhere in the middle of soft and hard, 60 mg/L to 120 mg/L. the hardness level of the drinking water should not go beyond 170 mg/L, as it indicates very high levels of calcium and magnesium.

Figure 2.2 : Hardness kit

- **pH meter:**

A pH meter is an instrument used to measure hydrogen ion activity in solutions - in other words, this instrument measures acidity/alkalinity of a solution. The degree of hydrogen ion concentrate is ultimately expressed as pH level, which generally ranges from 1 to 14.

The safe range for drinking water **pH levels is between 6.5 and 8.5**. This range is considered optimal for human consumption and ensures that the water is free from harmful contaminants. Drinking water with a pH outside this range may affect its taste, quality, and safety.

Figure 2.3:pH meter

2.3.2 Types of water purifier

As you know the basic function of water purifier is to make water drinkable by removing the impurities present at an acceptable limit.

Different water purifiers available in market uses one or combination of water purification techniques.

As a water purification technician you should have proper knowledge of all the available water purifiers in the market.

Let us now have a look at different types of water purifiers available in India.

1. UF (Ultra Filtration) Water Purifier

This is one of the different types of water purifier that uses hollow fibers of a membrane made of a thin layer of material to separate water from other particles present in water. This purifier can only block larger particles and hence is less effective than RO purifiers. These are therefore suitable for water with a low TDS level. Other than removing germs and bacteria, it is incapable of removing chemicals from water.

Figure 2.4 : UF (Ultra Filtration) Water Purifier

2. R O (Reverse Osmosis) Water Purifier

The RO water purifiers remove metal particles like arsenic, fluoride, lead, chlorine, nitrates, and sulfates. It uses a semi-permeable membrane to purify water. The water pump in the RO water filter pressurizes the raw hard water to pass through the RO membrane (semi permeable membrane) that removes all the metal particles.

RO membranes are made up of tightly wrapped semi-permeable material usually Polypropylene.

These water purifiers work best on hard water. These are one of the different types of water purifier that are preferred in parts of India, where the water has very high TDS levels. They are widely preferred in Indian households since they work on different sources of water like tap water, municipal water, bore well, etc. by improving the taste and odor of water.

The different types of RO water purifiers are wall-mounted or counter-top water purifiers and under-sink or under-counter water purifiers.

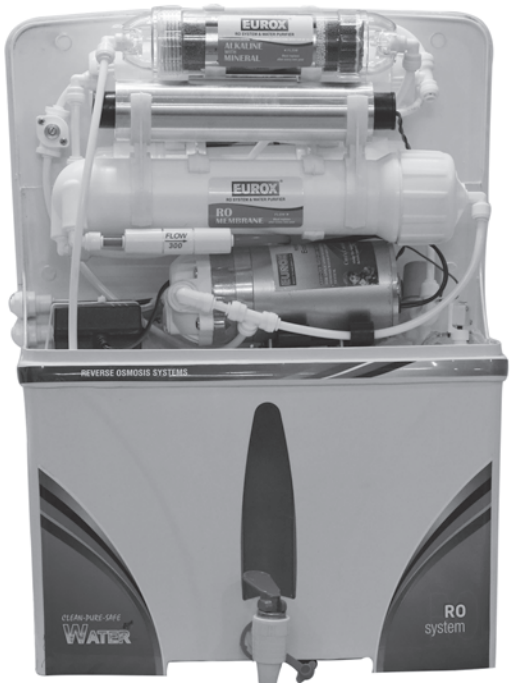


Figure 2.5 : Reverse osmosis (RO) Water purifier

3. UV(Ultra Violet) Water Purifier

This is one of the different types of water purifier in which the water has to pass through a UV lamp fitted in the filter. When the water passes through the UV light, it kills all water-borne disease-causing micro-organisms, pathogens, and cysts making the water healthy and suitable for drinking.

However, the micro-organisms killed by the UV remain in the water, though it doesn't cause any harm. They are suitable in regions where the water has a low TDS level. It keeps the taste of the water intact and has a high-efficiency rate as compared to RO, UF, and Activated Carbon Filters water purifiers.

4. Activated Carbon filters

This is the water filter that work best for disease-causing pesticides and heavy metals. It removes chlorine from water. Filter used in it is made of small pieces of carbon. Along with improving RO membrane life, it blocks chlorine and other particles that damage the membrane life. This type of filter is used in combination with UF, RO and UV water filters to improve taste and smell of water.

5. Composite Filters: These types of filters are available in various combination of the above-mentioned filters like-: UF+UV, RO +UV, RO+UF+UV

6. Softener: Hard water destroys appliances, leaves filmy soap across floor of bathrooms and make water undrinkable. A water softner is a filteration system which removes hardness causing calcium and magnesium minerals from hard water, which cannot be removed by RO water purifier system. Softener utilities a process of ion exchange for removing hardness. Sodium carbonate known as washing soda or common salt (Nacl) is used in softner for softening hard water.

Some of the companies producing softners in Indian market are:

1. Kent water softner
2. Ionnix water softner
3. Purifit high hardness filter
4. Alton hard water softner filter
5. Harvey Water Softeners Ltd
6. 3 M

Figure 2.6 : Two different model of Composite Filters

2.3.3 Difference between various water purifier technologies

a) Difference between RO and UV water purifiers -

RO water purifiers : They are best suited for hard water where the TDS levels are very high. They help in removing heavy metals, fluoride, arsenic, and other toxic impurities from water. It improves the taste and smell of water. They are capable of removing dissolved salts from water. It kills and filters the dead bodies of bacteria. They can work on muddy water. They require electricity to boost water pressure.

UV water purifiers

UV water purifiers use a UV lamp to remove contaminants from water. They are ideal for purifying tap water and municipal water. They work best on the water that has low TDS levels. It does not alter the taste and smell of water. They are incapable of removing dissolved salts from water. It is incapable of removing the dead bodies of bacteria from the water. They cannot work on muddy water. They can work with normal water pressure.

You are suggested to check the TDS level of water before selecting a water purifier.

b) Difference between Gravity based water purifier and RO water purifier

Let us now see the difference between gravity-based water purifiers and RO.

Gravity based water purifiers

It uses a gravitational force as well as a filter to purify water. It can work without electricity or running water. The purifier works by removing dirt and pollutants as water flows from one section to another. It also has an activated carbon module that removes parasites, viruses, and other impurities, thereby making water safe and healthy for consumption. These purifiers can be used where the TDS level of water is low.

RO membrane water purifiers

They are best for areas that have **high TDS levels.** RO water purifiers help in removing heavy metals, fluoride, arsenic, and other toxic impurities from water. It works on electricity. RO water purifiers are one of the finest water purifiers which are available in the market.

With the increasing amount of pollution, buying a water purifier has become a necessity to prevent diseases.

Table 2.2 Comparison of different water purifier Technologies

S. No	Parameter	RO water purifier	UV water purifier	UF water purifier	MF (Micro filter) water purifier
1.	**Electric power required**	Needs electricity for purification	Needs electricity for purification	Does not need electricity	Does not need electricity
2.	**Ability to remove bacterias and vires**	Filters out all the Bacteria and Viruses from the Wate	Kills all bacteria and viruses but their dead bodies remain in the `water	Filters out all the Bacteria and Viruses from the Water	Filters out only bacteria
3.	**pressure water required**	Requires high water pressure. Therefore an extra water pump is used in all RO purifiers	Works with Normal Tap Water Pressure	Works with Normal Tap Water Pressure	Works with Normal Tap Water Pressure
4.	**Ability to remove desolved salt & have metal**	Removes dissolved salts and harmful heavy metals	Cannot remove dissolved salts and harmful heavy metals	Cannot remove dissolved salts and harmful heavy metals	Cannot remove dissolved salts and harmful heavy metals
5.	**Ability to remove visible impurities of filter**	Filters out all the suspended and visible impurities like mud, rust, dirt, sand etc.	No filter	Filters out all the suspended and visible impurities like mud, rust, dirt, sand etc.	Filters out all the suspended and visible impurities like mud, rust, dirt, sand etc.

6.	**Size filter membrane**	Size of membrane: 0.0001 Micron	No membrane	Size of membrane: 0.01 Micron	Size of membrane: 0.1 Micron
7.	**TDS**	90% TDS reduction	90% TDS reduction	90% TDS reduction	90% TDS reduction
8	**Water wastage**	Wastes a lot of water	No wastage of water	No wastage of water	No wastage of water

2.3.4 Water purifier available in Indian market

Water purifier are available for both soft and hard water.One has to select suitable water purifier depending upon whether raw water is soft or hard. So it is must to check the quality of water for desirable softness before selecting the water purifier technique.

Generally, for soft water gravity based purifiers can give proper result.

a) Water purifier for soft water

1. Kent Gold Plus UF Gravity Water Purifier

It is the best gravity water purifier that uses UF technology to get rid of harmful micro-organisms like bacteria, viruses, cysts from water. It also has a Nano-silver, carbon layer that removes disinfectants from water. It also comes with sediment and activated carbon filters that eliminate disinfectants from water.

It makes water drinkable by removing chlorine, bromine, and iodine from water. It is made of transparent, non-breakable food-grade polycarbonate. It has a detachable storage space that can be cleaned easily. It can both be mounted on the wall as well as kept on the kitchen platform.

Features:

- *Storage capacity - seven liters.*
- *Does not require electricity.*
- *Purification Method: Activated Carbon*
- *Filtration Capacity : 7 L/hr*
- *Material : Food-grade, Non-breakable Plastic*
- *Other Features: Use of nano-silver carbon for better disinfection of water; Long life membrane expected to last up to 4000 Liter.*

2. Kent Gold Star 22 liters Gravity Based Water Purifier

This gravity-based water purifier uses ultra-filtration for removing bacteria, cyst, and chemicals like chlorine and iodine from water. It has a storage capacity of 14 liters of purified water and 8 liters of non-purified water.

It consists of an SS filter that removes visible particles, a sediment filter to remove impurities, and an activated carbon filter to remove bad odor from water and make water drinkable. It is made of high-quality food-grade, non-breakable plastic.

It has SS Filters that remove visible particles, a sediment filter to remove impurities, and an activated carbon filter to remove unpleasant odor from water

Features:

- *Capacity : 22L*
- *Purifying Technology : Gravity Based*
- *Filtration Capacity : 22 L/hr*
- *Filter Type : Sediment Filter, Activated Carbon Filter, Stainless Steel Mesh*
- *Membrane Type : Hollow Fibre Hydrophilic UF Membrane, Spin-welded UF Membrane*
- *Other Features : Food-grade, Non-breakable Plastic*

3. HUL Pureit WPWL 100 Classic 23 Litre Gravity Based Water Purifier

This gravity-based water purifier contains four stages of purification. The activated carbon trap removes pesticides from water. The germ kill kit removes germs, bacteria from water; the virus removal technology can remove 1 crore virus from 1 liter of water. It is made of high-quality and unbreakable plastic.

Figure 2.7 : HUL Pureit gravity based water purifier

The germ kill kit in this water purifier removes germs, bacteria from water.

Features:

- *6-month warranty.*
- *EPA certified.*
- *Functions without electricity.*

4. Tata Swach Non-Electric Gravity Cristella Plus 18 Litre Purifer

It has a purification capacity of 3000 liters. It purifies the water of harmful chemicals such as chlorine, bromine, and iodine. It has a capacity of 18 liters with storage space for 9 liters of purified water. It uses advanced silver nanotechnology that can eliminate 100 crores of bacteria and 1 crore of viruses from 1 liter of water. Made of scratchless and food-grade plastic.

Figure 2.8 : Tata Swach Non-Electric Gravity Cristella Plus

Features:

- *Warranty of 6 months.*
- *Does not require electricity to run.*

5. Pureit Advanced 23 liter Gravity Water Purifier

It comes with a double layer of protection and storage space of 23 liters. It functions on 4 purification stages- pre-programmed germ killed processor, advanced microfiber mesh, carbon polisher, and micro-charges membrane. The activated carbon present in it removes bad odor from water. The germ kill kit helps to remove micro-organisms from water, thus making water fit for drinking. It is made of high-quality, unbreakable plastic.

Figure 2.9 : Pureit Gravity Water Purifier

Features:

- *Storage space of 23 liters.*
- *Runs without electricity.*

6. Whirlpool Destroyer 6 liter Water Purifier

This purifier is designed with elector-absorption technology. The best part about this purifier is that it doesn't waste water since it has an auto shut-off button. It has a 5 stage purification process. It has a storage space of 6 liters.

Figure 2.10 : Whirlpool Destroyer 6 liter Water Purifier

Features:

6 times higher purification rate than RO purifiers.

b) Water Purifiers for hard water

Since nowadays water is contaminated with harmful chemicals, micro-organisms, and pollutants, water purifiers have become an integral part of our homes. They guarantee us safe and pure drinking water. Water purifiers are essential where the water has a very high TDS level. RO water purifiers work best on hard water. Following are some water purifier used for hard water.

1. Kent Grand 8- Liter Mineral RO+UV+UF water purifier

Kent Grand has a RO+UV+UF along with advanced mineral RO technology. The TDS controller retains essential minerals.

Features:

- *Has a storage capacity of 8 Liters.*
- *Can be used for TDS (500-2500) (use a TDS meter to find out the correct TDS of your water source before buying a water purifier).*
- *Reduces water wastage*
- *Recommended for mounting on the wall*

Figure 2.11: Kent Grand Water Purifier Model

2. Eureka Forbes Aquasure from Aquaguard 6 Liters RO+UV+MTDS water purifier

Eureka Forbes Aquasure has a water level indicator. MTDS technology ensures a good taste of water. It is one of the types of ro water purifier.

Features:

- *Has a storage capacity of 6 liters.*
- *Comes with a warranty of 1 year and free installation.*
- *Has smart energy-saving technology.*

3. HUL Pureit 5 Liters Advanced RO+UV 6 Stage Water Purifier

HUL Pureit is made of engineering-grade plastic material. It boasts a 6 stage purification process.

Figure 2.12: HUL Pureit Water Purifier

Features:

- *Comes with a storage capacity of 5 liters.*
- *The TDS controller works on hard water.*
- *Has a UV+RO+MF+TDS controller which ensures safe water.*

4. Kent Pearl 8 Liter Mineral RO+UV+UF Water Purifier

Kent Pearl comes with a smart alarm system. It will tell you when it is time to change the filter. This water purifier is suitable for purifying municipal water, tap water, and groundwater.

Features:

- *Offers double purification of RO+UV+UF.*
- *Has a storage space of 8 liters.*
- *Has a TDS controller with mineral RO technology.*

So, you can choose from the above-mentioned different types of water purifier depending upon the requirements.

Note:

Things to be kept in mind while purchasing the water purifier system

- Select a machine with water purification technology that is appropriate for the family's domestic water sources.
- Choose the suitable storage capacity.
- To ensure user safety, it is suggested that you select a machine with features that prevent against overheating.

Things to be kept in mind while using the water purifier system

- It should be installed in a cool location and should not be near a heat source.
- Set the machine back from the wall by at least 10-15cm.
- Clean and check the machine on a regular basis.
- Use a plug for electrical connection that isn't shared with any other electrical devices.

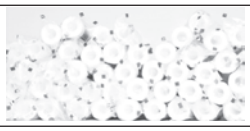
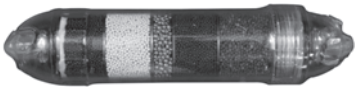
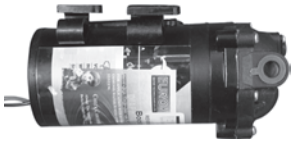
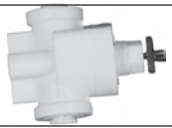
INTEXT QUESTIONS 2.1

1. Visual inspection is done to check……in raw water.
2. Range of pH of drinkable water is…….to…….
3. R.O. water filter is usually used for…… water.
4. TDS meter is used to check……of water.
5. Only UV water purifier has …… membrane
6. MF water purifier does…….work on electricity.

2.4 COMPONENTS OF TYPICAL WATER PURIFIER SYSTEM

The components of typical water purifier system are given in the below table and also the connections of different membranes are explained in the block diagram.

Table 2.2 Components of Typical water purifier system

S. No.	Name of component	Image
1.	Pre Filter (Spun Filter)	
2.	Post filter	
3.	UV barrel	
4.	Pre filter housing	
5.	Copper filter (optional)	
6.	Solenoid valve	
7.	Float switch	
8.	Power supply (SMPS 24 V)/ Power supply for UV	
9.	Booster Pump	
10.	TDS controller	
11.	Water Tank	

12.	Tap /Faucet	
13.	Accessories-:	
	Grade Pipe (Inlet and outlet)	
	Drain Pipe	
	Clamps screws gitti	
	Three-way connector	
	Inlet water valve	
	C-Clamp 2.5"	

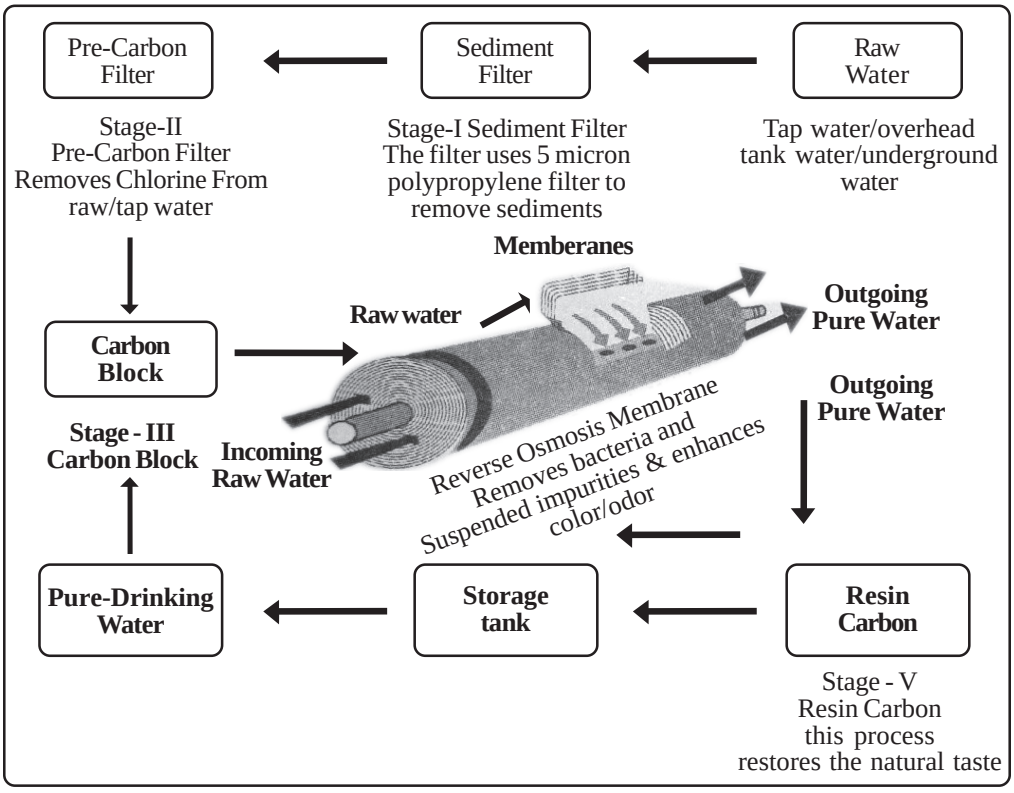


Figure 2.13: Block Diagram of water purifier functioning

Table 2.3 Functions of Main Parts

Parts	Functions
Transformer	AC 110 V or 220 is transformed into AC 24 V/AC 36 V supply power to RO pump, solenoid valve and auto flushing
Low pressure switch	Auto power cut-off when water supply stops. "On at over 5 psi, OFF at below % psi"
Solenoid valve	After machine stop, water supply is cut off and no waste water is drained to save water.
RO pump	Push original water to normal water making pressure at 80-100 psi
Pure water check valve	Make pure water be stored in the pressure tank and hence reach the power cutoff pressure.
High pressure switch	When the pressure tank is filled with water, it cuts off power and stop machine. Clockwise turn for increasing pressure. Anti Clockwise turn for reducing pressure. The pressure is set at 38 psi (off) - 32 psi (ON) when the machine is ex-work
Auto flush valve	Automatically control the flushing cycle (i.e. When machine is started. It first flushing for 15 seconds "ON" and then being increasing pressure to make water for 30 minute "OFF" and flush again for 15 seconds. It's OFF-ON-OFF until power is cut off.
Flow limiting valve	Limited flow at 300 cc/minute.
Pure water pressure tank	Store pure water. The inside of tank bottom must be filled with 8 psi pressure.

Figure 2.14: A typical domestic water purifier without casing

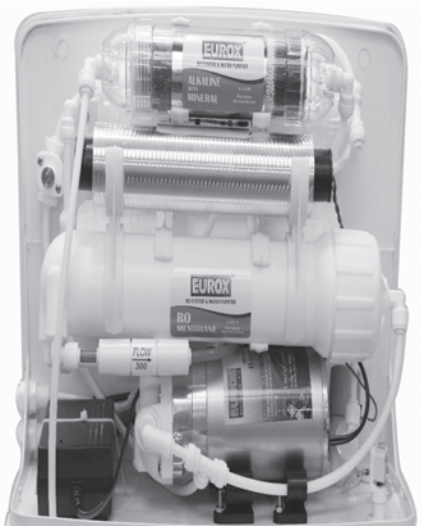


Figure 2.15 : Internal components of a domestic water purifier system

Figure 2.16 : Side view of a domestic water purifier unit

2.5 DIFFERENCE BETWEEN THE DOMESTIC AND COMMERCIAL WATER PURIFIER UNIT

According to its capability, water purifier may be divided mainly into three categories: Domestic, Commercial, and Industrial.

Domestic water purifier is used for household purposes, **Commercial** water purifiers is used in small businesses like hotels and restaurants and **Industrial** water purifiers is used in many different huge enterprises, including factories and distilleries.

In India, there are significant differences between domestic and commercial water purifier plants in terms of technical specifications due to variations in capacity, and

usage requirements. Below table shows some key differences between Domestic and commercial water purifier.

Figure 2.17 : Commercial water purifier 50 LPH -100 LPH

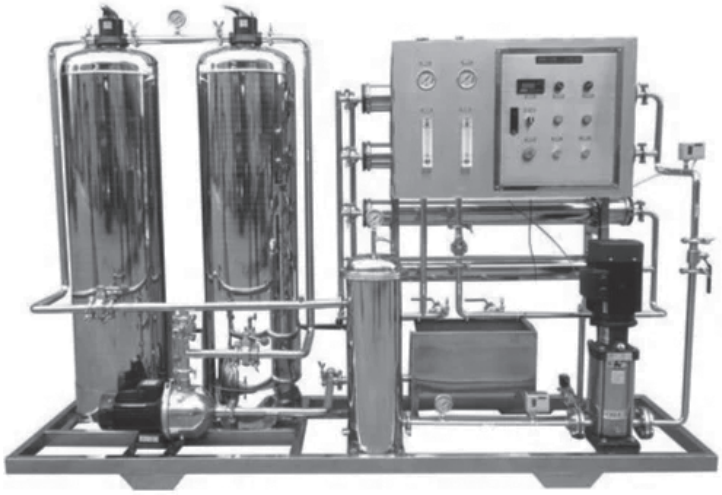
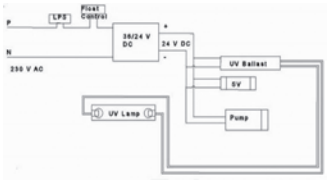
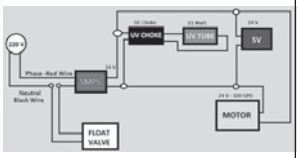


Figure 2.18 : Commercial water purifier surface mounted

Table 2.4 Comparison between the Domestic and Commercial Water purifier

S. No.	Features	Domestic water purifier	Commercial water purifier
1.	Capacity and Flow rate	5LPH to 100LPH (Lower)	25LPH to 1000 LPH (Higher)
2.	Filtration technology	Activated carbon filters, sediment filters, and sometimes UV (Ultraviolet) purification for disinfection	Include multi-stage filtration processes such as reverse osmosis (RO), ultrafiltration (UF), and advanced oxidation processes (AOPs)
3.	No. of RO membrane used	1	2 to 6
4.	No. of pump used	1	More than 1
5.	Monitoring and Control Systems	Basic monitoring systems, often limited to filter replacement indicators or simple alarms for system malfunctioning	Real-time monitoring of water quality parameters, automated backwashing systems for filtration media, and remote access capabilities for maintenance and troubleshooting
6.	Power supply	24 V DC	48V DC / 230 V AC
7.	Electrical circuit		

Note:

Both domestic and commercial water purifiers must comply with relevant regulatory standards for water quality and safety. However, commercial water purifier plants may be subject to additional regulatory requirements due to their larger scale and potential impact on public health.

2.6 HOT AND COLD-WATER DISPENSER WITH WATER PURIFIER

Besides domestic and commercial water purification system, Hot and cold water dispenser are also commonly used in hotels and restaurant, offices, hospitals and healthcare facilities and is used to give potable hot or cold or both type of water .

These dispensers also include water purification technology, RO filtration technology is extensively used in it. This hot and cold water dispenser is built differently depending on the brand and model. They are, however, mostly made up of components such as:

- Cold sensor
- Cold water bottle
- Hot water bottle
- Filter cores depending on each type of machine: Nano filter core, coarse filter core, carbon filter core, RO filter membrane.
- Waste water regulation device
- Water supply
- DC converter
- Electronic valve
- Cooling block
- Turbochargers

Figure 2.22 : Hot and Cold-water dispenser with water purifier

Technique for producing hot and cold water

Hot and cold water dispensers, commonly used in India, operate based on a simple mechanism involving heating and cooling systems. Here's a basic overview of how they work:

Water Source: The dispenser is connected to a water source, typically a water tank or a direct water supply line.

Cooling System: The cold water dispenser component contains a cooling system. This system usually comprises a compressor, condenser, evaporator, and refrigerant. The dispenser contain a block similar to a refrigerator to produce cold water, however this block is much smaller in size .This process results in chilled water being dispensed from the cooler tap.

Heating System: The hot water dispenser component consists of a heating element, usually located near the water storage tank. When the hot water function is activated, the heating element is energized, heating the water in the storage tank to the desired temperature. The hot water is then dispensed through the hot water tap. Thermal relays are also used in the gadget to adjust the water temperature. In addition, the machine contains a second thermal relay that will immediately cut the power if the water temperature dips too low, preventing the bottle from breaking due to freezing water.

Temperature Control: Most hot and cold water dispensers come with temperature control settings, allowing users to adjust the temperature of the water according to their preferences.

Safety Features: To prevent accidents, dispensers include safety features such as child locks or hot water safety locks to prevent unintended dispensing of hot water.

Filtration System: dispensers also feature built-in water filtration systems to purify the water before dispensing. These filtration systems typically consist of activated carbon filters or reverse osmosis membranes. The same filters that are used with RO filters will help to remove dirt, germs, viruses, and other harmful substances from the water, resulting in a pure source of water.

User Interface: The dispenser is equipped with a user interface, often consisting of buttons or knobs, to control the temperature settings and dispensing functions.

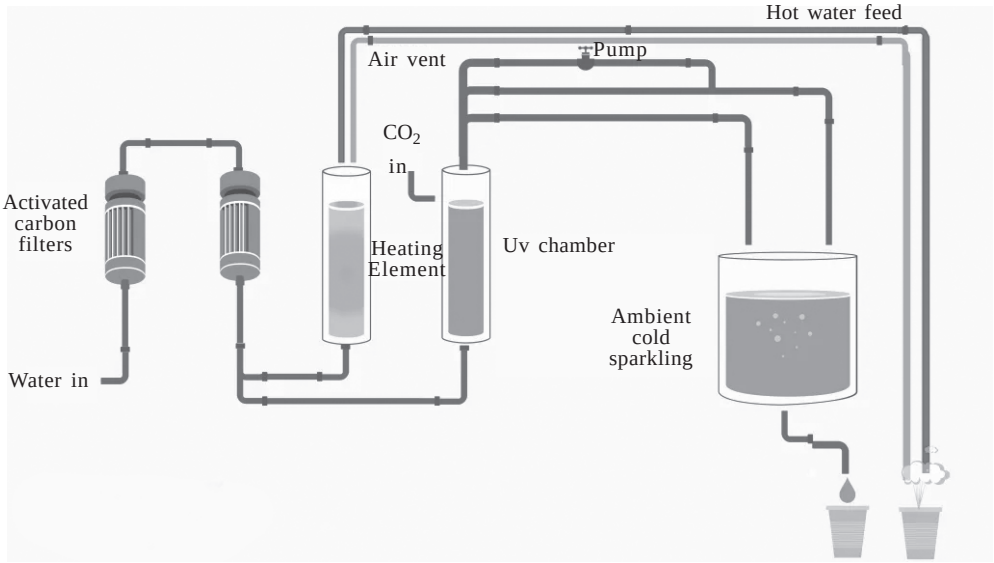


Figure 2.23 : Dispenser functional Diagram

2.7 PROCUREMENT OF LEGAL DOCUMENTS FROM COMPETENT AUTHORITIES

For Installation of domestic water purifier **no permission** is required except legal electrical and water connection.No legal documents has to be procured from local authorities/ Government.

However for installing commercial water purification plant water testing report from Government approved testing laboratory and other legal documents like commercial electrical and water connection paper are required.

If you want to setup a service provider shop and want to get financial assistance /loan from MSME /Bank a detailed project report (DPR) has to be made and the legal permissions thereafter from labour department,safety / fire department and other necessary permissions from local authorities and central Govenments must be taken Few of the permissions /legal documents are listed below :

1. Tax registrations such as Goods and Services Tax (GST) registration, professional tax registration, etc.
2. PAN Permanent Account Number.
3. Labour department permission .
4. Land papers from MCD/ local authorities.
5. EPF No Employe Provident Fund of employees, when hiring of staff is done.

6. Pollution control certificate from local pollution board office.

7. MCD permission for commercial activities.

8. Commercial Electrical connection.

9. Commercial water connection.

All legal permissions are to be taken from local authorities or central Government and may vary from state to state.

If Mineral water bottle plant is to be established in addition to the above certificates,some more additional documents are required .

Note:

For individual no license is required presently for installation of drinking water purifier system at home.

INTEXT QUESTIONS 2.2

Fill up the blanks:

1. Heating element is an integral part of ____and cold dispenser.

2. R O technology reduces TDS upto ____percent.

3. Activated carbon filter improves ____and ____ of water.

4. Number of booster pump for commercial WPU is more than ___.

5. Legal permissions are required in the case of _____ WPU.

WHAT YOU HAVE LEARNT

- Different water sources like -ground water, river, pond, well etc.
- Methods of checking water quality by using TDS meter, Hardness kit and pH meter.
- Range of Water purifiers available in Indian market liike :Ultra Filter, Reverse osmosis, Ultra violet , Activated Carbon Filters and Composite Filters.
- Comparison of different water purifier technologies.
- Major components of a water purifier are Pre Filter, Post Filter, UV barrel,

solenoid valve, Float switch, Booster Pump, TDS controller, Water Tank , Tap Faucet and Acessories like drain pipe , three way connector, inlet and outlet pipe, clamp etc.

- Block diagram of a simple Water Purifier Unit.
- Difference between domestic and commercial WPU and their comparison.
- Components and working of hot and cold-water dispenser.
- Procurement of legal documents from component authority is required for installing commercial water purification plant .

TERMINAL QUESTIONS

1. List different water sources available in India.
2. Name the different methods used to test the water quality and explain any one in brief.
3. Draw a neat block diagram of a domestic WPS and name each block.
4. Name different components of a domestic WPS and give their functions.
5. Compare domestic and commercial a WPS and write any 4 points.
6. Briefly explain Hot and Cold dispenser.
7. Explain in brief the procurement of legal documents from component authority for installation of commercial water purification system.

ANSWERS TO INTEXT QUESTIONS

2.1

1. Turbidity
2. 6.5-8.5
3. Hard Water
4. Quality
5. No
6. Not

2.2

1. Hot
2. 90
3. Taste, odour
4. 1
5. Commercial

Key Learning Outcomes

Being able to :

- Analyze the quality of source drinking water.
- Identify water purifier installation location.
- Illustrate different water purifier technologies
- Illustrate the technology used in various water purifier system available in the market
- Identify appropriate water purifier as per customer need.
- Identify the legal requirement for installation of water purifier systems if any.

3

SITE PREPARATION

3.1 INRODUCTION

Before installation of Water Purifier System, the location of the unit to be installed is to be identified. As a range of Water Purifier System has little changes in installation procedure, we have to read and observe all the steps given in the manufacturer installation guide very carefully.

A successful installation is only possible if we follow all the points of installation instructions of manufacturer word to word. This lesson covers the stepwise procedure for installing the domestic and commercial water purifier system and also the important points which a water purifier should keep in mind while performing installation.

3.2 LEARNING OBJECTIVE

After reading this lesson learner will be able to:

- Identify the component of site preparation for both domestic and commercial WPU.
- Define the importance of site preparation.
- Identify the installation location at site considering all factors such as water supply and drainage, electricity supply, customer needs etc.
- Understand the installation procedure of the water purifier system.

3.3 FACTORS TO BE CONSIDERED IN IDENTIFICATION OF INSTALLATION LOCATION AT SITE

3.3.1 Components Of Site Preparation

Water purifier technician has to take care of certain points before starting the installation process of the WP unit at the site.

Following are the important site preparation components of both commercial and domestic WP unit:-

Water Purifier System Location

- The water purifier system should be located on a level surface.
- The area where water purifier is going to be installed must be sheltered form Sun, wind and rain.
- The temperature in this area should be maintained between 35°F and 95°F.
- If these limits are exceeded, the components may be damaged and the warranty may be considered void.
- It is important to allow sufficient space around the unit for easy maintenance.

Electrical supply

A properly sized electrical service must be provided by the customer. Motors and electrical requirements must be according to the supply voltage. Electrical supply to the system must be compatible with the requirements for each model. Install the system in accordance to local and national electrical codes. It is recommended to use branded electrical accessories (detail explained in lesson 4).

Plumbing

Plumbing is an important check for installation of Water Purifier System given by manufacturer. The membranes and high-pressure pumps require a continuous and stable flow of water to the system. Refer to the manual of WPS for minimum flow rate and minimum feed pressure

Feed water

Piping used for feeding water to the water purifier system should be either copper or plastic. Iron and carbon steel pipe will increase the iron content of the water. This will adversely affect the water purifier system's performance. Temperature of the feed water must not exceed 95^{o} F.

It is recommended to install a pressure gauge on the feed water line. In case of water purifier this will help to maintain the pressure of the feed water.

Concentrate (waste water) line connection

Connect the waste line to the backside of the system. The tubing or piping used for discharge of the concentrate should be run to an open drain in a free manner. Any blockage in the drain can increase pressure in the back, which will increase the system operating pressure. This may result in damage to the system components.

Pre-filtration

Most water purifier systems come with particulate pre-filters to remove suspended particles down to five micron in size. Change pre-filter cartridges at least once every month. Additional pre-treatment may be required, depending on the feed water parameters

If the pre-filters become blocked and the water flow to the pump is reduced or interrupted, it will result in the formation of an empty space within the pipe. This may damage the pump.

Inspection

Prior to start-up, carefully inspect the system. Check plumbing, electrical connections and make sure no connections have become loose during shipment.

3.3.2 Survey for identifying appropriate location for installation of water purifier unit

- **Water purifier system** can be put in a basement or under a sink in a residential facility or a terrace in a commercial facility.
- Install the device in a location where it will not be exposed to cold weather. If a connection can be made without using more than 12" of tubing, connecting to a remote site might be considered; otherwise, a delivery pump may be required. Further runs can be performed, and if necessary, a pump can be added afterwards.
- The location of **water purifier system** is chosen wisely, we should consider the place with minimum possible distance of electric connection, the dry place with relatively less humid conditions and reachable location which is approachable to all.

Following are some guidelines regarding component placement

- Faucet (tap) should be installed on or near the sink where drinking/cooking water is often used. A score of two "If there isn't an existing hole, a level surface is necessary to attach the faucet. The mounting surface should be no more than 1-1/4 inch thick. Alternatively, a faucet extender would be required.
- It might be put at a handy location, such as within 10 feet of the faucet. Because full tanks may weigh up to 15 kg, be sure any place you choose is leveld. The bladder tank can be positioned vertically.
- The water purifier unit can be installed on either side of the sink, under a cabinet, in the basement or a terrace. The unit may be mounted on the left or right side of the cabinet making it simpler to reach for future maintenance.
- A feed water connection to the **water purifier unit** is provided via an **Angle Stop Valve**. This assembly should be placed as near to the water purifier unit as practicable. It connects the top of your cold water shut-off valve to the bottom of the riser tube that runs between it and the faucet.

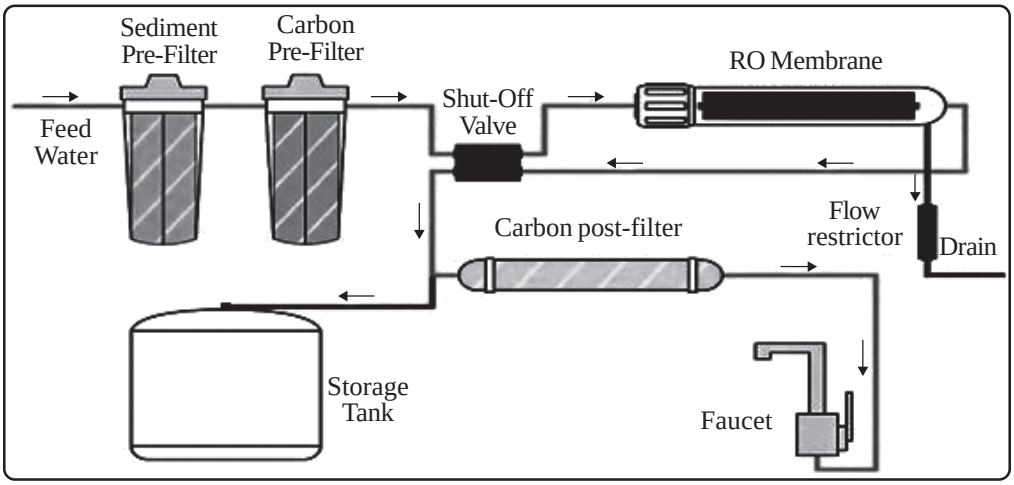


Figure 3.1 : Water Purifier connection diagram

- Here's an easy-to-understand diagram of how a **water purifier system works**. The phases are identified in the **water purifier water plant** flow diagram, Fig. 3.1, while the arrows indicate water flow, i.e. the plumbing connection.
- Despite their differences in quality, most water purifier plants have the same appearance. The components are also standard and function in the same way. These are the components of a conventional water purifier plant and the associated plumbing line from input to output:

- **Intake Valve**: The inlet valve is the water purifier system's raw water supply. The valve is usually installed on the cold-water line.
- **Pre-Filter:** To protect the membrane from salt, silt, and chlorine, most water purifiers include a pre-filter. Typically, a sediment or carbon filter is used.
- **Water Purifier Membrane:** The water purifier membrane is the most important component for removing substantial health risks.
- **Post-Filter:** Purified water passes through a post-filter before reaching the faucet. A polish filter is another name for it. The by-product tastes sweeter and fresher as a result of this filter, which removes odour and poor taste.
- **Storage Tank:** The filtered water is kept in this pressure tank until the customer turns on the faucet.
- **Backward Flow Limiting Valve:** A restricting valve is used to keep treated water from flowing back into the storage tank. Reverse flow has the potential to harm the membrane by rupturing it.
- **Drain Line:** The drain line is primarily connected to the water purifier membrane's output side. It releases contaminated and impurity-laden effluent. The reject water is usually put to a good use such as watering plants or garden etc.
- **Faucet:** A faucet is a treated water flow-controlled tap that is commonly put on the reachable areas in sinks. In commercial spaces, these faucets are fixed at different places.

3.4 INSTALLATION OF DOMESTIC WATER PURIFIER

The installation process of any water purifier whether it is Domestic or Commercial begins with selecting a proper location for installation of the given WP unit.

Following are some general guidelines before selecting a site for installation:

- Ensure that single-phase power socket connection is within 3m from the point of installation.
- Ensure that raw water supply is within 3m from the point of installation.
- Ensure that raw water supply tank is at least 10 feet above the purifier.
- Ensure that there is a sink near the purifier.
- Ensure that waste water drain is within 3m from the point of installation.
- Ensure that enough space is there as per the dimensions of the purifier.

3.4.1 Steps to be performed while installing water purifier unit

Step 1: Unpacking the purifier

1. Carefully place the water purifier packing box on a plane surface.
2. Cut the packing strips on the packing box with the help of a knife.
3. Open the water purifier packing box and check for the following components:-
   - Waterpurifier tank (1 No.)
   - RO Membrane (1 No.)
   - Filters (Sediment, carbon, candle 1 No. each)
   - Instruction Manual (1 No.)
   - Food grade white pipe 3/8" (3 m)
   - Food grade pipe 1/4" (white and blue 3 m each)
   - Screws and plastic Inserts (2 No.s each)
   - 3 way connector (1 No.)
   - Tee Joint (1 No.)
   - Diverter Valve /S.S Ball Valve (1 No.)
   - Tray with Cover (1 No.)
   - Metal Bottom Bracket (1 No.)
   - Wall Brackets (2 No.)
   - Tray Metal Strips (1 No.)
   - Drilling Sticker (1 No.)

Figure 3.2 : Plumbing accessories

Note :Some more parts may be there in the box depending upon the model and type of the purifier.

4. Check for any physical damage or missing part.
5. Take out all the accessories from the packing box.
6. Take out water purifier main unit from the packing box carefully (provide proper support as it contain internal connections which may damage if unit drop from a height).
7. Place the water purifier on the plane surface.
8. Remove the cardboard packing and remove the polythene cover from the water purifier.

Step 2: Installation of water purifier

1. Keep all the plumbing accessories and tools ready before turning off the main water supply line, so that it is interrupted for minimum possible time. Fig 3.2
2. Turn off the main supply line, Fig 3.3.
3. Always install purifier on the normal water supply and not on the hot water supply.
4. Take out the tap from the water supply line carefully, using pipe wrench

Figure 3.3 : Turn off the water supply line

5. Use teflon tape to create a leak-free joint, fig 3.4.
6. It should be wrapped tightly on a three-way connector in a clockwise direction;otherwise it may loosen while tightening on the water supply line fig. 3.4.

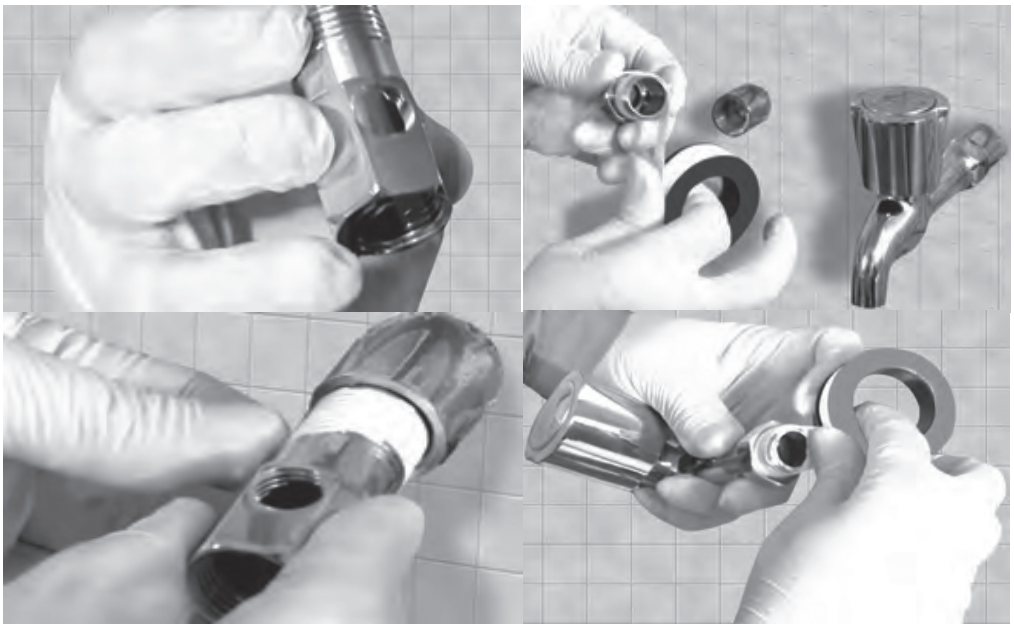


Figure 3.4 : Applying Teflon tape

8. Insert the end of the external thread of the three-way connector into water supply line.

9. Now, insert the tap into the hex end of the three-way connector and tighten it using pipe wrench.

10. Use SS ball valve; use Teflon tape again on the SS ball valve thread to create a leak free joint, fig 3.6.

11. Insert the SS ball valve into the ¼ inch port of the three-way connector, fig 3.7.

12. Take a white pipe. Broaden up its mouth from one end by inserting a screwdriver into it.

13. Move a hex nut present on the SS ball. Insert this hex nut into the white pipe from the non-broadened end.

14. Push the broad end of the white pipe onto the SS ball valve. Make sure that pipe completely slips over the nipple of SS ball valve.

15. Tighten the hex nut securely on the SS ball valve to lock the pipe in its place fig 3.8

Figure 3.5 : Three way connection of water purifier

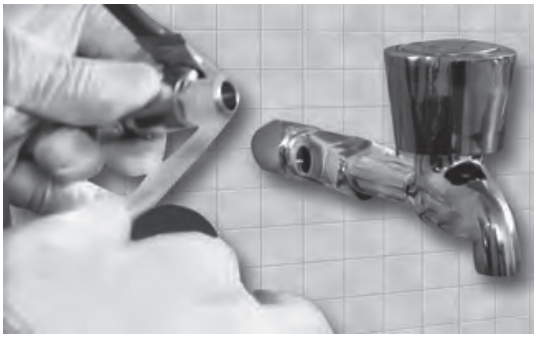


Figure 3.6 : Applying Teflon tape on valve

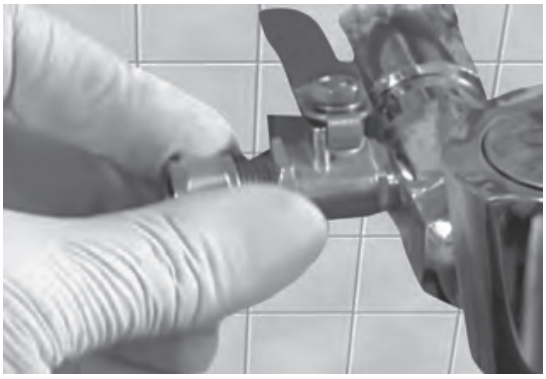


Figure 3.7 : Fixing valve in to 3 way connector

Figure 3.8 : Fixing tube in to outlet of valve

Figure 3.9 : Off position of supply line lever

16. Drill holes to hang the purifier (use drill sticker which come along with WP unit).

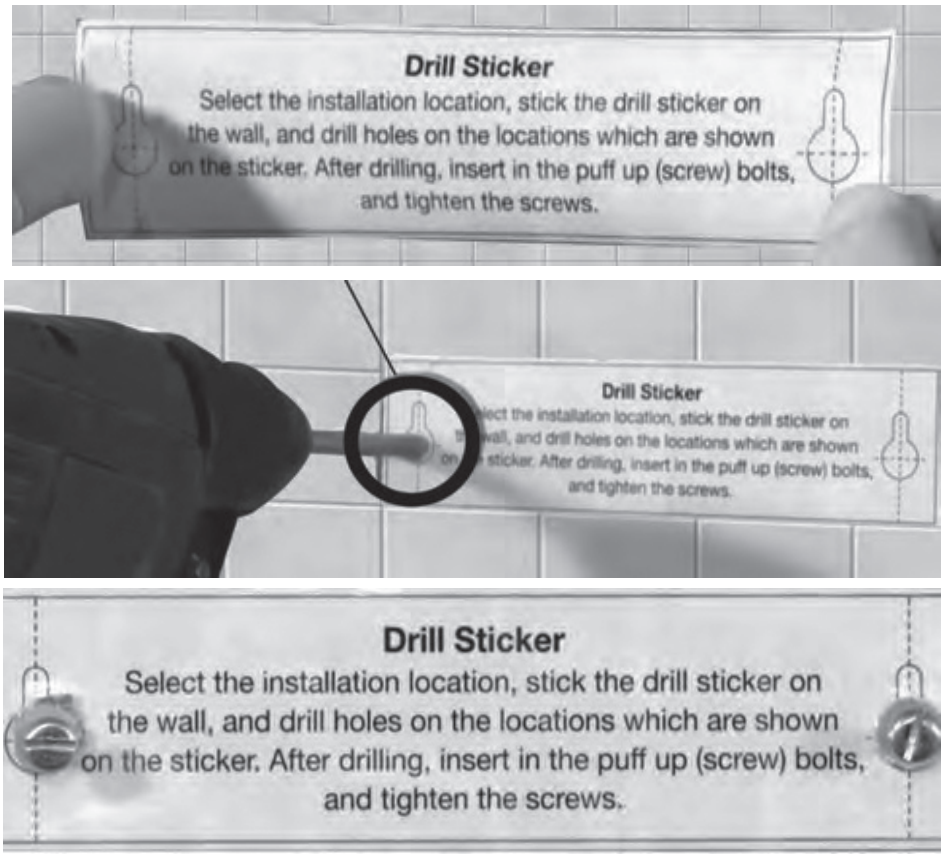


Figure 3.10 : Drilling of holes using Drill Sticker

17. Insert the plastic inserts and metallic tray as well.

18. Remove the back cover of the purifier and open the dead blocks.

19. Attach purifier membranes to the drain pipe using jointers.

20. Insert the white pipe in to the inlet of the water tank of the purifier, fig. 3.8.

22. Drain the pre-carbon filter and sediment afterwards by completely filling the water tank and then empty the tank (first filled water in the purifier tank should not be used for drinking purpose).

23. Do a final check of all the connections and mount your purifier.

24. Enjoy the healthy water by water purifier.

3.5 INSTALLATION OF UNDERSINK DOMESTIC WATER PURIFIER

Under-sink : Under sink water purifies now a days is in fashion due to following reasons:

- Beautification
- Less space is required

In under sink water purifier the faucet is connected on the sink and the machine is kept under the sink.

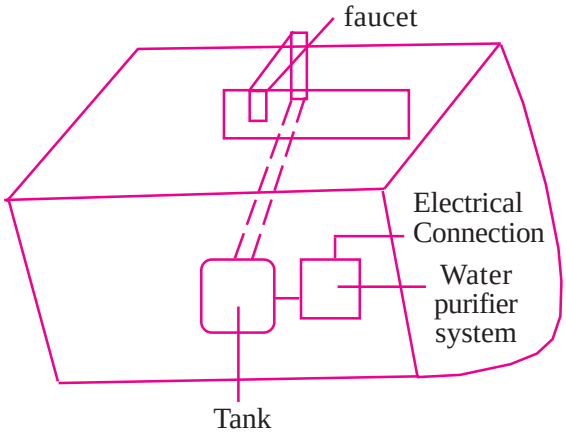


Figure 3.11 : Under sink water purifier block diagram

All the working of the under-sink water purifier is the same as of wall mounted WPS except there is a pressure tank, which releases water when the faucet is made ON. It has a diaphragm which create pressure on the treated water.

3.6 INSTALLATION OF COMMERCIAL WATER PURIFIER UNIT

Commercial water purifier unit is generally installed on ground on a concrete platform (plain and leveled surface). Following are the steps to be followed for installing commercial water purifier.

A **Commercial water purifier** plant is a complex system that uses the reverse osmosis process to remove impurities and contaminants from water on a larger scale. These plants are used in a variety of applications, such as drinking water treatment, industrial processes, and desalination. Installing a reverse osmosis plant may seem difficult, but with the right tools and knowledge, it can be installed easily.

Here are the steps you need to follow to install a typical commercial water purifier plant (also commonly known as reverse osmosis plant):

Step 1: Choose the Right Location

The location of your reverse osmosis plant is critical. Choose a location that is near a water supply, electrical connection, and drainage system. The location should also have sufficient space for the plant and any other equipment that may be required. Ensure that the location has adequate ventilation and is free from dust, debris, and other contaminants.

Step 2: Gather the Necessary Materials

Before you begin the installation process, make sure you have all the necessary materials. Here is a list of materials you will need:

- Reverse osmosis system
- Pre-treatment equipment (depending on the source water quality)
- High-pressure pump
- Pressure vessels
- Membrane modules
- Instrumentation and control equipment
- Piping and fittings
- Electrical wiring and controls
- Valves and gauges

Step 3: Install Pre-treatment Equipment

If the quality of the source water is poor, you may need to install pre-treatment equipment, such as sediment filters, carbon filters, or water softeners. This equipment is installed to protect the reverse osmosis membranes from damage and clogging.

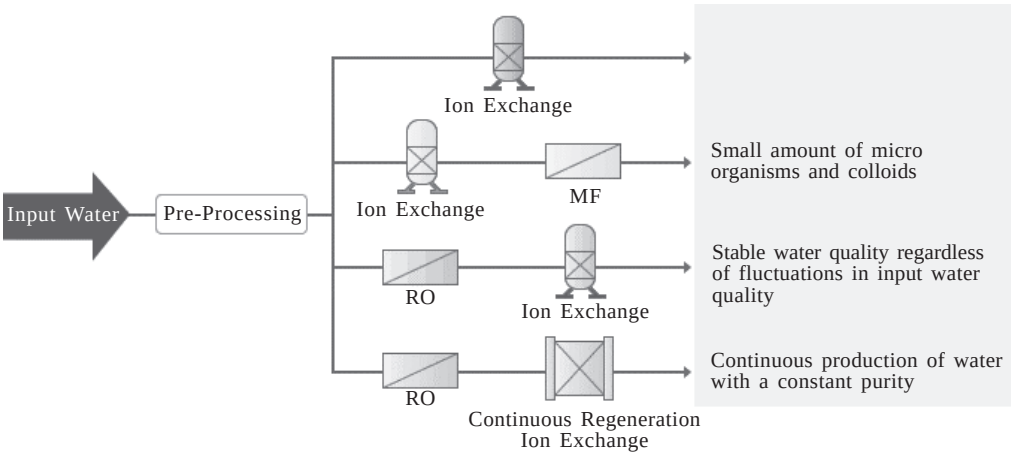


Figure 3.12: Block diagram of water-flow in a commercial plant

Step 4: Install High-Pressure Pump and Pressure Vessels

The high-pressure pump is the heart of the reverse osmosis system. It is responsible for generating the pressure needed to force water through the reverse osmosis membranes. Install the high-pressure pump and connect it to the pressure vessels using piping and fittings.

Step 5: Install Membrane Modules

Install the membrane modules in the pressure vessels. The number of membrane modules required will depend on the size of your reverse osmosis plant and the amount of water you need to treat. Connect the membrane modules to the piping and fittings.

Figure 3:13:Membrane module used in commercial plant

Step 6: Install Instrumentation and Control Equipment

Install the instrumentation and control equipment, such as pressure gauges, flow meters, conductivity meters, and pH meters as given in the manufacturer installation

manual.These instruments are used to monitor the performance of the reverse osmosis system and ensure that it is functioning correctly.

Step 7: Connect Electrical Wiring and Controls

Connect the electrical wiring and controls for the high-pressure pump and instrumentation equipment. Make sure to follow all safety guidelines and electrical codes.

Step 8: Test and Commission the Plant

Before the reverse osmosis plant can be put into operation, it must be tested and commissioned. This involves running water through the system and checking the performance of the pre-treatment equipment, high-pressure pump, pressure vessels, and membrane modules. Once the plant has been tested and commissioned successfully, it can be put into operation.

Tips for successful installation

- Make sure to follow the manufacturer's instructions for your specific water purifier plant.
- Consider having the water quality tested before and after installation to ensure that the reverse osmosis plant is performing correctly.

In brief, you can say that installing a commercial water purifier plant requires careful planning, preparation, and execution. By following these steps and tips, you as a technician can successfully install a water purifier plant and enjoy high-quality water for your needs.

INTEXT QUESTIONS 3.1

1. Water purifier system should be located on ……surface.
2. Prefilter should be changed at least……every month.
3. Ensure that single phase electrical power socket should be within……. meter of the point of installation.
4. Teflon tape is used to create a ……. free joint.
5. In commercial water purifier unit, more than …….RO membrane to used.

WHAT YOU HAVE LEARNT

- Identification of different part of a water purifier system after unboxing it.
- Importance of following manufacturer's guideline while installing water purifier systems.
- Important components of site preparation of the water purifier unit are: location, electrical supply, plumbing, feed water, drain water connections, pre-filtration requirement.
- The location of water purifier should be chosen wisely ,it should be at minimum possible distance with electrical connections, the place should be dry and not too hot or too cold and location should be reachable for drawing water and for maintenance.
- Installation procedure for the domestic water purifier wall mounted and under sink water purifier unit.
- Installation procedure for the commercial water purifier unit.

TERMINAL QUESTIONS

1. Enlist the various factors to be considered in identification of installation location at site. explain any one of them.
2. Give any two guidelines regarding component placement.
3. List any 5 components found inside a typical domestic water purifier packing box.
4. What is the importance of Teflon tape and where it is applied while making inlet pipeline connections in a WPU?
5. Explain with the help of diagram the use of drill sticker.
6. Explain in brief the procedure for installation of commercial water purifier.

ANSWERS TO INTEXT QUESTIONS

3.1

1. Level
2. Once

Notes

3. Three
4. Leak
5. One

Key Learning Outcomes

Being able to :

- Identify the different parts of a water purifier unit after unboxing.
- Identify a suitable location for installation of a water purifier unit.
- Demonstrate the plumbing process and water connection in a WPS.
- Carry out fall installation process for a WPS.

4

ELECTRICAL CONNECTIONS

4.1 INTRODUCTION

In previous lessons you have learnt about the components and working of water filters. Water filter which operates on electricity needs a reliable and safe electrical connection. In this lesson you will learn about the electrical wiring and electrical accessories of most of the electrically operated water filter. The technician should know that depending upon the condition of installation area of water purifier unit; he should choose the type of wiring (generally concealed conduit or surface conduit). In this lesson you will learn about internal and external connection of a typical water purifier.

4.2 LEARNING OBJECTIVE

After reading this lesson learner will be able to:

- Identify a range of electrical wiring systems and accessories
- Identify the tools used in electrical wiring job.
- Identify a range of wiring materials
- Describe the importance of following manufacturer's guidelines for proper installation of electrical equipments.

4.3 FUNDAMENTAL OF ELECTRICAL WIRING SYSTEM

There are different types of electrical wiring systems such as tee system, loop-in system, cleat wiring, batten wiring, casing and capable wiring, lead sheathed wiring and conduit wiring. Electric circuit wiring in residences and buildings is known as domestic circuits.

While carrying out electrical connection for a WPU you can select the type of wiring depending upon the availability of the space. Most preferred wiring system is concealed conduit system.

4.3.1 Types of Electrical Wiring

The different types of electrical wiring system used in water purifier electrical connections are as follows.

Tee system or Joint box system

This wiring is used to connect appliances together. It uses a small amount of cable and is inexpensive, making it perfect for temporary installations Fig 4.1.

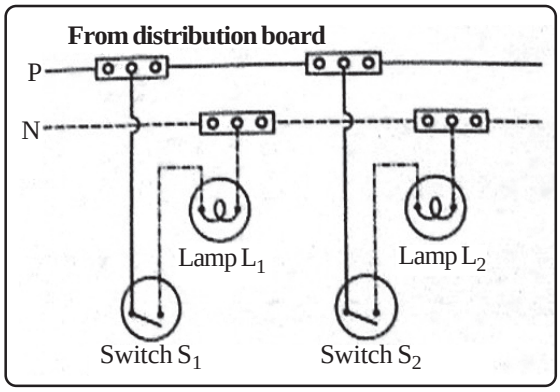


Figure 4.1 : Tee or joint box system

Loop-in system

This system is set up in such a way that the lighting and other appliances are connected in parallel, allowing each device to be controlled separately. Thus, it makes it easier to find a flaw such as a damaged wire in such a system Fig 4.2 .

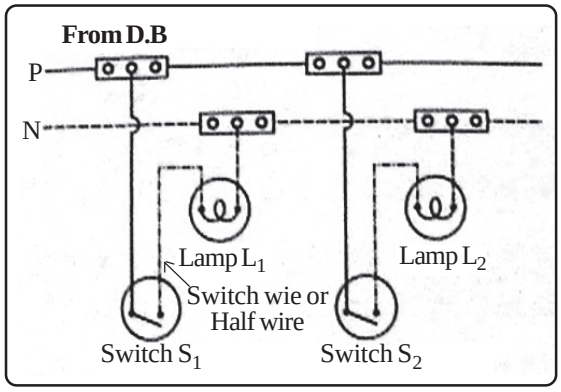


Figure 4.2 : Loop-in system

Conduit Wiring

Surface conduit wiring Fig 4.3 and concealed conduit wiring are two types of of wiring used in water purifier system ,concealed conduit system is preferred due beautification but if it is not possible you can adopt surface conduit system.

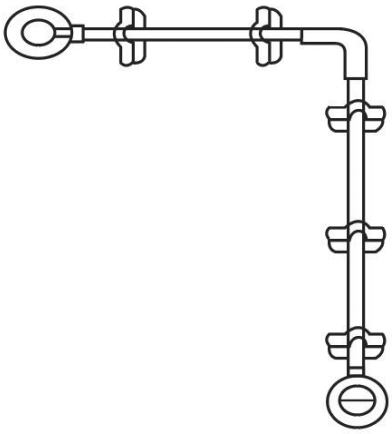


Figure 4.3 : Surface mounting conduit system

Cables and conductors

In Water purifier connection,usually1.5 mm square multistrand wire is used.

4.4 DOMESTIC ELECTRIC CIRCUITS

Electric circuit wiring in residences and buildings is known as domestic circuits. A pair of insulated copper or aluminium wires transport electricity to our dwellings. A water purifier is connected to 6 A socket (Domestic) or 16 A socket (used for large water purification system)

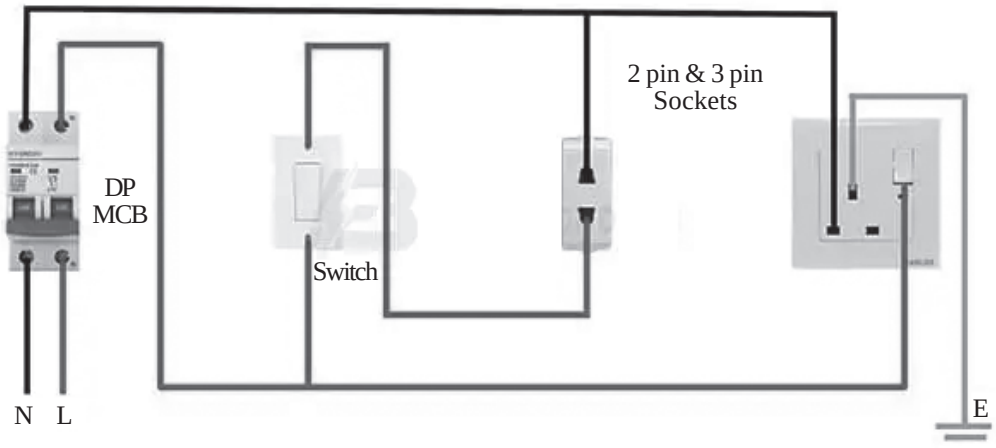


Figure 4.4 : A simple circuit showing 2 Pin and 3 Pin socket with MCB for water purifier external circuit (N-Neutral, L-Live E-Earth)

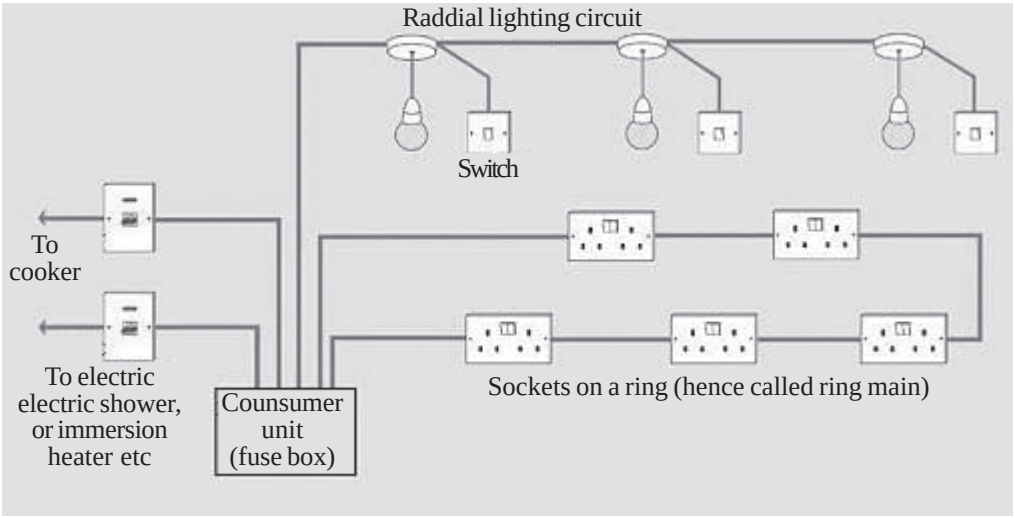


Figure 4.5 : Domestic Wiring circuit

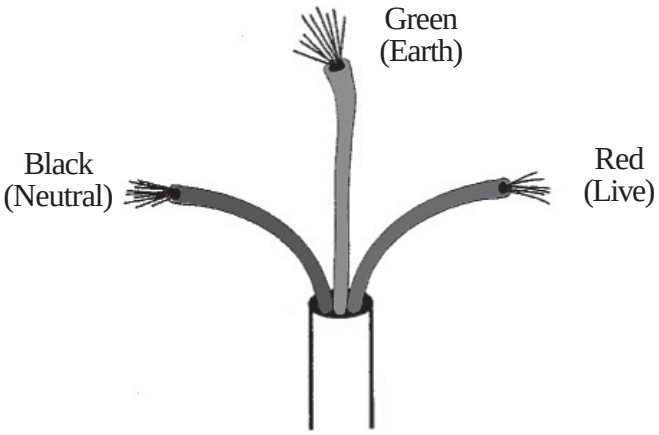


Figure 4.6 : Sketch of 3 wire cable

Wire types and color coding

The 3 types of wires used in a domestic electric circuit are as follows:

1) Live wire

2) Neutral wire

3) Earth wire

Live wire

- A live wire is one that conducts electricity.
- It is responsible for carrying the high voltage and delivering it to the appliances.
- It is also known as phase wire or hot wire.
- It is red in colour.

Neutral wire

- The wire having zero potential is called neutral wire.
- This wire completes the circuit by providing a path for the current to return to the power source.
- It is black in colour.

Earth wire

- It is green in colour.
- The circuit breaker will blow if something goes wrong inside the machinery or circuit, the live wire is then linked to a metal part, protecting the user from electrocution or even a small shock.
- When a live wire makes contact with a neutral wire, the circuit's resistance drops dramatically and a big amount of current flows through it.
- A precautionary connection created in metallic connections to prevent harm due to fluctuations is known as the earth or ground.
- The primary purpose of earthing is to protect people from electrical shock.
- The earth wire connects the metallic body of electric appliances to the earth, allowing any leakage of electric current to be transported to the ground.

Note: The potential difference (or voltage) supplied in our country is 220V.

Things To Remember

- *Electrical Wiring is a wiring system that is a network of wires that connect various accessories for the distribution of electrical energy from the supplier meter board to a variety of electrical appliances.*
- *A wire is a single electrical conductor capable of carrying electricity, usually made of copper or aluminium.*
- *There are different types of electrical wiring systems such as tee system, Loop-in system, cleat wiring, batten wiring, casing and capable wiring, lead Sheathed wiring and conduit wiring.*
- *Electric circuit wiring in residences and buildings is known as domestic circuits.*
- *The three types of wires used in a domestic electric circuit are live wire, a neutral wire and earth wire.*

4.5 ELECTRICIAN TOOLS LIST

The following table illustrates various common tools required in making electrical connection to a water purifier along with their uses.

Table 4.1: Electrician Tools List

Names	Images	Uses
1. Tape Measure		Use to measure distance or size.
2. Electrical Tape		Use to cover and insulate a broad range of cables, wires, and other materials that conduct electricity.
3. Cable Ties		Use for holding items together, most commonly electrical cables or wires.
4. Electric Drill		Use for drilling circular holes in the material.
5. Level		Use to determine whether a surface is horizontal (level) or vertical (plumb).
6. Wire/Cable Lugs		Use for connecting cables to electrical appliances, other cables, surfaces, or mechanisms.
7. Wire Strippers		Use for removing theprotective coating of an electric wire in order to replace or repair the wire.
8. Hacksaw		Use for cutting thin metal such as aluminum, brass, steel, or copper.

9. Pliers		Use for gripping.
10. Voltage Tester		Use primarily on AC currents, although some can also be used on DC currents.
11. Crimpers		Use to make cold weld joints between wires and a connector by deforming one or both of them to hold the other.
12. Gloves		Use to protect and comfort hands against cold or heat, damage by friction, abrasion or chemicals, and disease
13. Line Tester		Use to test the presence of current and to identify phase / live wire in electrical installations.
14. Stubby screwdriver		Use to facilitate access to screws located in areas that cannot be reached easily by a regular screwdriver.

4.6 PLANNING AND DESIGNING A WIRING OUTLET

Planning and designing a wiring layout is crucial for ensuring safe and efficient electrical connections in any building or electrical system. Here are some of the key reasons why this process is of utmost importance:

Safety: Safety is the primary concern when it comes to electrical systems. Poorly planned wiring layouts can lead to electrical fires, electric shocks, and other hazardous situations. Proper planning ensures that wires are installed correctly, minimizing the risk of accidents.

Code Compliance: Many countries have strict electrical codes and regulations that govern how wiring should be installed. A well-thought-out design helps ensure compliance with these codes, avoiding legal issues and penalties.

Efficiency: Efficient wiring layouts reduce energy wastage. When wires are laid out logically and with proper consideration of the load, electrical energy is used more efficiently, which can lead to cost savings over time.

Reliability: Properly designed wiring layouts are more reliable. They reduce the chances of short circuits, overloads, and other electrical issues that can disrupt the flow of electricity.

Scalability: A well-planned wiring layout allows for easy expansion or modification of the electrical system in the future. This is important in both residential and commercial settings where changes in electrical requirements may occur.

Organization: An organized wiring layout makes it easier to locate and troubleshoot issues when they arise. Labeling wires and using color-coding can streamline maintenance and repair efforts.

Aesthetics: In residential and commercial spaces, an attractive wiring layout can enhance the overall aesthetics of the environment. Concealed wiring or aesthetically pleasing conduit systems can improve the appearance of a room or building.

Functionality: Wiring layouts should take into account the specific needs of the space. Proper planning ensures that outlets, switches, and lighting are strategically placed to meet the functional requirements of the area.

Equipment Protection: Well-designed wiring layouts can include features like surge protection, which can safeguard sensitive electrical equipment from voltage spikes and fluctuations.

Resilience: In certain environments, such as industrial facilities or data centers, the wiring layout must be resilient to external factors like moisture, vibration, or extreme temperatures. Planning for these conditions is essential for system reliability.

Cost-Effectiveness: Careful planning can also save costs by minimizing the amount of wiring needed, reducing material waste, and preventing the need for extensive repairs or modifications in the future.

Ease of Troubleshooting: In the event of electrical issues or system malfunctions, a well-documented wiring layout makes troubleshooting easier. Technicians can quickly identify and address problems, reducing downtime and repair costs.

Environmental Considerations: Designing for energy efficiency not only saves costs but also reduces the environmental impact of electrical systems by reducing energy consumption.

Longevity of Components: Proper wiring reduces the risk of electrical stress on components, such as motors and pumps, which can extend their lifespan. This can result in cost savings by reducing the frequency of component replacement.

Integration with Control Systems: Many modern water purifier systems have electronic control panels that manage various functions. A well-designed wiring layout allows for the seamless integration of control systems, enabling advanced monitoring and automation capabilities.

In conclusion, planning and designing a wiring layout is not just a technical requirement but a critical aspect of ensuring the safety, efficiency, and functionality of an electrical system. It's an investment in the long-term performance and reliability of the electrical infrastructure while also contributing to safety and sustainability goals.

4.7 TO CREATE AN EFFICIENT WIRING LAYOUT FOR YOUR WATER PURIFIER SYSTEM, CONSIDER THE FOLLOWING STEPS

1. **Create a Wiring Diagram**: Begin by creating a detailed wiring diagram that includes all electrical components, connections, and their interrelationships. This diagram serves as a blueprint for the installation.

2. **Choose the Right Wiring Materials:** Select appropriate wiring materials, such as wires, conduits, and connectors, that meet electrical code requirements and the specific needs of your RO system.

3. **Plan Cable Routing:** Determine the optimal routing of cables and wires to minimize interference and reduce the risk of damage. Properly secure and protect the wiring to prevent wear and tear.

4. **Label Connections:** Clearly label all electrical connections, components, and control points. This simplifies maintenance and troubleshooting.

5. **Follow Manufacturer Recommendations:** Adhere to the manufacturer's guidelines and specifications for electrical connections. This ensures compatibility and optimal performance.

6. **Consider Future Expansion:** If you anticipate future modifications or expansions of water purifier system, plan the wiring layout to accommodate these changes without major disruptions.

7. **Hire Qualified Professionals:** If you are unsure about electrical design and wiring, consider hiring qualified electricians or technicians who specialize in water purifier system installation and maintenance.

In summary, careful planning and designing of the wiring layout for water purifier system will provide increased safety, reliability, efficiency, and overall performance of the system, while also ensuring compliance with electrical codes and regulations.

4.8 POWER CABLES AND THEIR RATINGS

Power cables, also known as electrical cables or cords, come in various types and ratings to suit different electrical devices and applications. The key factors to consider when selecting a power cable for a specific device or application include voltage rating, current capacity (ampacity), conductor size, insulation type, and connector types. Let's explore these factors in more detail:

Voltage Rating

Power cables are rated for specific voltage levels. Common voltage ratings include, 240V, 480V, and others. It's crucial to choose a cable with a voltage rating that matches or exceeds the voltage of the electrical device you are connecting it to. Using an undersized cable with a lower voltage rating can be dangerous and may cause overheating or electrical breakdown.

Current Capacity (Ampacity)

The ampacity of a cable is its maximum current-carrying capacity without exceeding its temperature rating. It's essential to select a power cable with an ampacity suitable for the current load of the device. Using a cable with insufficient ampacity can lead to overheating and potential fire hazards.

Conductor Size (Gauge)

The conductor size, often referred to as the wire gauge, affects the cable's ampacity. Smaller gauge numbers indicate thicker conductors capable of carrying higher currents. When choosing a power cable, consider the device's current requirements and select a cable with an appropriate conductor size.

Insulation Type

The insulation material used in the cable determines its electrical and thermal properties. Common insulation materials include PVC (Polyvinyl Chloride), rubber, and thermoplastic materials. The choice of insulation depends on factors like temperature, flexibility, and resistance to environmental conditions. Some applications may require specialized insulation, such as heat-resistant cables for high-temperature environments.

Connector Types

Power cables come with various connector types, such as NEMA, IEC, or proprietary connectors specific to certain devices. Ensure that the cable's connector type matches the receptacle or plug on your device to ensure a secure and safe connection.

Cable Length

Consider the length of the cable required for your application. Using excessively long cables can result in voltage drop and reduced efficiency, while very short cables may limit your flexibility in device placement.

Power cables come in various types, ratings, and compatibility with different electrical devices. The choice of power cable depends on factors like voltage, current, environmental conditions, and the specific device or application. Here are some common types of power cables, their ratings, and compatibility with various electrical devices:

Appliance Power Cords

Rating: Ratings can vary widely based on the appliance's power requirements, ranging from low to high current and voltage.

Compatibility: Used with various household appliances like refrigerators, washing machines, ovens, and televisions.

Always ensure that the power cable you choose matches the electrical requirements of the device or equipment you intend to use. Using the wrong cable can lead to electrical hazards, equipment damage, or inefficient operation. Additionally, it's crucial to follow safety guidelines and local electrical codes when selecting and installing power cables.In commercial water purifier three phase 3 ½ core power cable is used for 16 A socket and switch connection. For domestic water purifier 1.5 mmsquare mutistrand wire can be used alongwith 6 A socket and switch.

Compliance with BIS Standards: All the accessories should be ISI and should comply the Indian standards as per Indian Electricity rules 1956 amended from time to time.

It's important to consult the device's user manual or specifications to determine the recommended cable type, voltage requirements, and connector type. If in doubt, seek advice from a qualified electrician or technician to ensure safe and appropriate cable selection for your water purifier unit.

INTEXT QUESTIONS 4.1

1. Name any two types of wiring systems.
2. Name any two types of tools used in electrical wiring.
3. What is the colour of phase and neutral wire?
4. What is the use of line tester?
5. Give the current rating of domestic water purifier socket and switch.

4.9 TYPES OF ACCESSORIES USED IN ELECTRICAL CONNECTIONS

Electric switches and outlets are fundamental components of electrical wiring systems. They serve various functions in controlling the flow of electricity in a building. Below are the principles of electric switches and outlet installations with explanations of the functions of their various components and wiring configurations.

COMPONENTS

Switch Mechanism: This is the actual switch that you physically toggle or press to make or break the electrical connection.

Terminals: Switches have terminals where wires are connected. They typically include a common terminal (COM) and one or more traveler terminals.

Toggle or Rocker: It is the part you interact with to turn the switch ON or OFF.

WIRING CONFIGURATIONS

Single-Pole Switch: A single-pole switch has two terminals (one common and one traveler). It is used to control a single light or device from one location.

Although the electrical connection can be done by using different types of wires and electrical accessries but few of them are given below which are used commonly in India for water purifier electrical connection.

You know that electrical connections rely on various types of wiring and accessories to safely and efficiently transmit electricity from one point to another. Here are some common types of wiring and accessories used in electrical connections:

ELECTRICAL WIRING TYPES

1. **Non-Metallic Sheathed Cable (NM or Romex):** NM cable is widely used for residential wiring. It consists of insulated conductors (usually copper)

surrounded by a non-metallic sheath. NM cable comes in various sizes and configurations for different applications.

2. **Armoured Cable (AC):** AC cable has a flexible metal sheath that provides physical protection to the conductors. It's commonly used in industrial and commercial applications where additional durability is needed.

3 **Conduit:** Conduit is a hollow tube used to encase and protect electrical wires. There are various types of conduit, including rigid metal conduit (RMC), electrical metallic tubing (EMT), and flexible conduit. Conduit is often used in exposed or outdoor wiring installations.

4 **Bare Copper Wire:** This is uninsulated copper wire used for grounding purposes. It's typically used in combination with other wiring methods.

WIRING ACCESSORIES

1. **Electric Switches:** Electric switches are devices that allow or interrupt the flow of electrical current in a circuit. They come in various types, including single-pole, double-pole, three-way, and four-way switches. In domestic water purifier a single pole 6 A 230 V switch is used in commercial either MCB of 16 A 230 V or switch of 16 A 230 V is used.
2. **Electrical Boxes:** Electrical boxes are enclosures used to protect electrical connections and wiring from damage. They come in various sizes and types, including junction boxes, switch boxes, and outlet boxes.
3. **Wire Connectors:** Wire connectors, also known as wire nuts or twist-on connectors, are used to join wires together safely. They come in various sizes and are color-coded to indicate the number and size of wires they can accommodate.

Figure 4.7 : Wire Connectors

4. **Cable Clamps and Straps:** These accessories secure cables and conduits to walls, ceilings, or other surfaces to prevent movement and potential damage.

Figure 4.8 : Cable Clamps and Straps

5. **Conduit Fittings:** Fittings like couplings, connectors, and elbows are used to connect and secure conduit sections, ensuring proper routing and protection of wires.

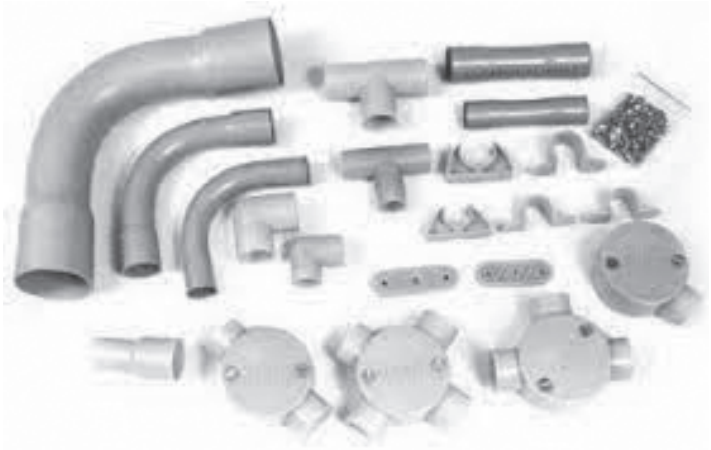


Figure 4.9 : Conduit Fittings

6. **Electrical Tape:** Electrical tape is used for insulating and bundling wires, providing an extra layer of protection.

7. **Wire Markers:** Wire markers are labels or tags used to identify wires in complex electrical systems, making troubleshooting and maintenance easier.

Figure 4.10 : Wire Marker

CIRCUIT PROTECTION

1. **Circuit Breakers:** Circuit breakers are protective devices that automatically open (trip) when there is an overcurrent or fault in the electrical circuit. They help prevent electrical fires and damage to equipment.In water purifier circuit single pole 6 A MCB is used.

Figure 4.11 : MCB

2. **Fuses:** Fuses are similar to circuit breakers but are one-time-use devices. When a fault occurs, the fuse element melts, opening the circuit and protecting against overcurrents.In water purifier domestic type 6 A fuse is used. In commercial water purifier system 16 A fuse is used.

These are some of the common types of wiring and accessories used in electrical connections. The choice of wiring and accessories depends on the specific application, local electrical codes, and safety requirements. Proper installation and adherence to safety guidelines are crucial for safe and reliable electrical connections.

In short we can say that the items used in domestic and industrial electrical wiring are called electrical accessories, e.g., switch, holder, socket, plug-top, ceiling rose, fuse cut-out etc.

- A switch is used to make a circuit ON and OFF.
- A holder is used with a lamp,

- A ceiling rose is used with a ceiling fan, tube light or a pendant lamp.
- A socket is the female part of electrical connections to be made.

For India there are three associated plug types, types C, D and M. Plug type C is the plug which has two round pins, plug type D is the plug which has three round pins in a triangular pattern and plug type M is the plug which also has three round pins. India operates on a 230V supply voltage and 50Hz.

Figure 4.12 : Plug pins

- A plug is the male part of electrical connections

In water purifier electrical connection, we use switch, socket and plug for making electrical connection of water purifier, if the electrical wiring is present near the water purifier. In other case wiring is to be done till the point near to the water purifier location if its not already present at water purifier installation location , this needs conduit, wire saddles and other electrical accessories used for standard wiring system .

4.10 ELECTRICAL CONNECTION OF A WATER PURIFIER

An RO (reverse osmosis) water purifier typically consists of the following electrical components:

1. **Power supply:** The purifier needs a power source to operate, usually in the form of a standard electrical outlet.
2. **Booster pump:** Some RO systems include a booster pump to increase water pressure, which may require a separate electrical connection.
3. **Solenoid valve:** This valve is used to control the flow of water through the system and is typically operated using an electrical signal.
4. **UV lamp (in some models):** If the RO system includes a UV sterilization stage, it will have a UV lamp that requires an electrical connection.
5. **Control panel:** Many WP systems have a control panel with buttons or a digital display that requires electrical power.

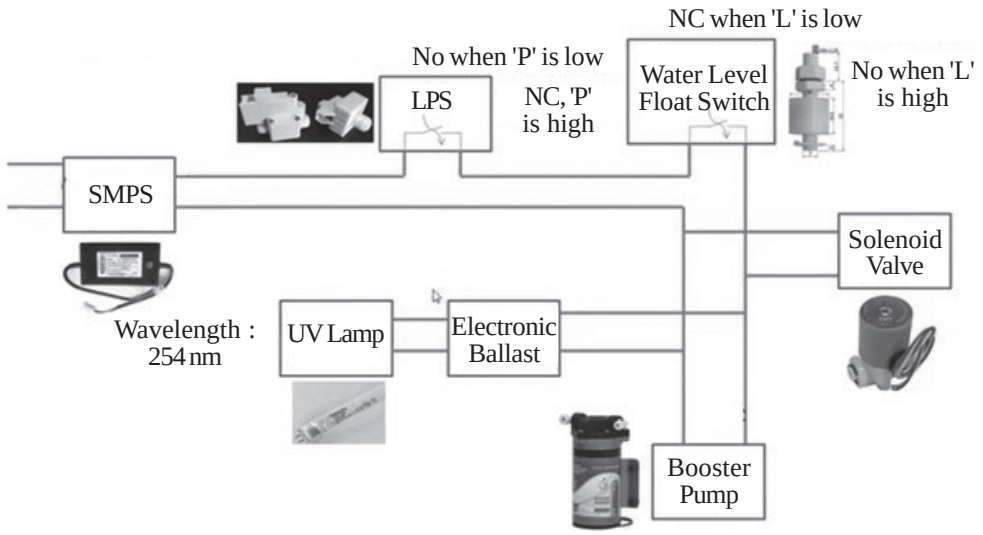


Figure 4.13 : Electrical connection of a water purifier

These components work together to purify water through the filtcration process, ensuring that the water is safe and clean for consumption. Keep in mind that the specific electrical circuitry may vary depending on the manufacturer and model of the water purifier.

This is the electrical connection of a water purifier circuit in which the household AC current 230 V is being converted into 24V DC with the help of SMPS and whenever there is a high signal in both the low pressure as well as water level sensor, the DC voltage at the output of the SMPS in connected in parallel to booster pump as well as UV lamp as well as the solenoid valve. When any one of the sensor signal goes low even when the input voltage is available, the entire circuit will be disconnected from the supply.

4.11 PRECAUTIONS TO BE TAKEN WHILE DOING ELECTRICAL WORK IN A WATER PURIFIER

Following the general precautions to be taken while doing electrical work in a water purifier:

1. Do not plug or unplug the power cord with wet hands to avoid any unwanted accident due to electrical shock.
2. If the power cord is damaged, it must be replaced immediately.
3. If the UV lamp breaks, carefully sweep all the fragments, wipe the area with a wet towel, and dispose of all the pieces in a sealed plastic bag and hand over the bag to the service technician for proper disposal.

4. Plug off the water purifier before opening its case.

5. Wrap bare wires with insulating tape.

INTEXT QUESTIONS 4.2

1. Name any two electrical accessories.
2. Name any two types of electrical wiring.
3. What is the use of wire markers?
4. Name any two types of protection devices.
5. Name any two types of switches.
6. Name any two electrical components of a water purifier.

WHAT YOU HAVE LEARNT

- Fundamental of electrical wiring system
- Domestic electric circuits
- Electrician tools
- Colour coding
- Wiring layout planning in connection with WPU
- Power cable, their rating
- Types of electrical wiring accessories and protective devices.
- Electrical connections of water purifier
- Testing of wiring connection before connecting to electrical appliance (like water purifier).
- Precautions to be taken while doing electrical work in a water purifier unit.

TERMINAL QUESTIONS

1. Describe tee system of wiring with the help of neat and labelled diagram.
2. Explain surf act conduit wiring with the help of neat and labelled diagram.
3. What are the three color codes of wiring and draw a neat sketch of color coding of a typical 3 wire cable.

4. Enlist the tools used by a technician for electrical work of WP.
5. Write names of any 6 tools along with their uses.
6. What is the importance of planning and designing a wiring layout for efficient electrical connection of WPU.
7. Write the names of any 6 wiring accessories.
8. Explain importance of following manufactures guidelines for proper installation and positioning wiring of switches and outlets.
9. What are the various precautions to be taken while performing electrical trouble shooting in a water purifier unit.
10. Name any 4 electrical components of a water purifier and give functions of any two of them.
11. Draw a neat and labelled electrical connection diagram of a typical water purifier.

ANSWERS TO INTEXT QUESTIONS

4.1

1. Tee system and Loop in system
2. Tester and Wire cutter
3. Red and Black
4. Used to test the presence of current and to identify phase / live wire in electrical installations.
5. 6 Amperes

4.2

1. Switch and socket
2. Non metallic sheathed cable and armoured wire
3. Wire markers are labels or tags used to identify wires in complex electrical systems, making troubleshooting and maintenance easier.
4. Fuse and MCB
5. Single pole switch and double pole switch
6. Solenoid switch and Booster pump

Lesson - 4

Electrical Connections

Notes

Key Learning Outcomes

Being able to :

- Identify a range of tools required for electrical connection of a water purifier .
- Explain the different type of wiring systems
- Identify wire according to colour coding
- Describe the importance of following manufacturer's guidelines for proper installation.
- Identify different types of power cables and other wiring accessories.

5

INSTALLING PRE-FILTERS AND POST-FILTERS

5.1 INTRODUCTION

In previous lesson technologies of water filter has been described now,in this lesson you will study pre and post filters in details, Pre and post filters plays an important role in water purification process. Sedimental impurities and odors of raw water is removed by pre filter, thus cleaning the water so that the life of RO membrane post filter increases. Post filters ensure that good quality drinkable water should be available to the consumer.

5.2 LEARNING OBJECTIVE

After reading this lesson learner will be able to:

- Explain pre filters and their uses.
- Explain post filters and their uses.
- Identify the need of pre and post filters depending upon the quality of raw water.
- Perform the replacement of pre and post filters.
- Identify the compatible filters for obsolete models of WPU.
- Carry out proper routine maintenance of the installed WPU.

5.3 PRE AND POST FILTERS

Pre and post filters in a reverse osmosis (RO) system are crucial components that play specific roles in the purification process. Their importance lies in their ability to enhance water quality, protect the RO membrane, and ensure the overall efficiency and

effectiveness of the RO system. Here's a closer look at the importance and use of pre and post filters:

Pre-Filters: Pre-filters are positioned before sediment and carbon filter and the RO membrane and are designed to remove larger particles and contaminants from the water. These could include sediment, sand, chlorine, and other particulates that could potentially clog or damage the RO membrane. By removing these larger contaminants, pre-filters help prolong the lifespan of the RO membrane and ensure its effective operation.

RO Membrane: The RO membrane is the core component of the RO system. It selectively allows water molecules to pass through while blocking the majority of dissolved salts, minerals, and other impurities. The filtered water that passes through the membrane is known as permeate, while the concentrated impurities that are rejected by the membrane are referred to as the reject stream.

Post-Filters: After water has passed through the RO membrane, it goes through post-filters, also known as polishing filters. These filters are responsible for further improving the taste, odor, and overall quality of the purified water. They can remove any residual tastes or odors, as well as any remaining contaminants that might have passed through the RO membrane.

It's worth noting that the specific types of pre and post filters used in a reverse osmosis system can vary based on factors such as water source quality, the manufacturer's recommendations, and the desired level of water purification. Regular maintenance and replacement of these filters are important to ensure the continued effectiveness of the RO system.

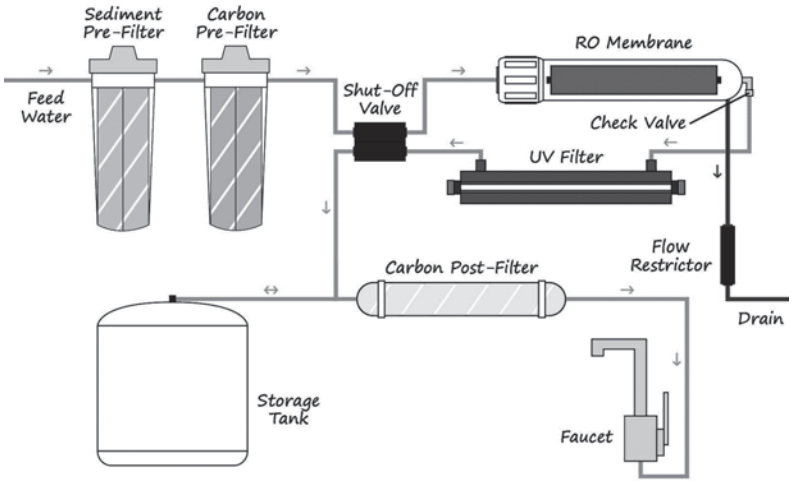


Figure 5.1: Block diagram of a typical domestic water purifier system containing Pre and Post filters

5.3.1 Importance and use of Pre and Post filters of water purifier (RO)

1. Pre-Filter Importance and Use

Removal of Sediments: Pre-filters are typically the first line of defence in an RO system. They are designed to remove larger particles and sediments from the incoming water, such as sand, silt, and rust. This is essential because these particles can clog the RO membrane, reducing its effectiveness and potentially causing damage.

Protection of RO Membrane: By preventing sediments and larger particles from reaching the delicate RO membrane, pre-filters help prolong the life of the membrane. A clean and well-maintained RO membrane is critical for effective filtration.

Improved Water Quality: Pre-filters also contribute to better water quality by eliminating turbidity and ensuring that the water entering the RO membrane is as clean as possible. This results in higher-quality purified water.

Extended Filter Life: By reducing the workload on the RO membrane and preventing clogs, pre-filters can extend the lifespan of the entire RO system. This will save money on maintenance and replacement costs.

2. Post-Filter Importance and Use

Taste and Odor Improvement: Post-filters, often carbon filters, are positioned after the RO membrane and are responsible for removing any remaining tastes or odors in the purified water. This can result in a significant improvement in the taste and smell of the water.

Final Purification: Post-filters act as the last line of defence to ensure that the water leaving the RO system is of the highest possible quality. They can remove any residual impurities or organic compounds that might have passed through the RO membrane.

Enhanced Drinking Water: For drinking water applications, post-filters are essential in making the purified water more palatable and enjoyable to drink. They are especially important if your source water has undesirable tastes or odors.

Compliance with Regulations: In some areas, post-filters might be required to meet local water quality regulations or taste standards. They ensure that the water meets these standards.

In summary, pre-filters and post-filters are integral to the effective operation of an RO system. Pre-filters protect the RO membrane and improve water quality by removing sediments, while post-filters enhance the taste and odor of the purified water and

provide final purification. Regular maintenance and replacement of these filters are essential to ensure the continued efficiency and performance of your water purifier system.

5.3.2 Types of water filters

A wide range of water purifiers pre-filters and post-filters were available in the market from various manufacturers and brands. These filters come in different sizes and made up of different materials to cater to the diverse needs of WP systems and source water quality. Keep in mind that the availability and specific products can vary depending on your location and the current market trends. Here's an overview of some common types of filters:

1. **Sediment Pre-filters**: These filters typically use polypropylene or pleated materials to remove larger particles like sand, silt, and rust from the water. They help protect the RO membrane from clogging and extend its lifespan.

Figure 5.2: Sediment Pre Filters

2. **Carbon Pre-filters:** Carbon filters, contain block or granulated form, of carbon and are used to remove chlorine, odors, and some organic compounds from the water. They can improve the taste and odor of the purified water.

Figure 5.3: Carbon Pre Filter

3. **Reverse Osmosis Membranes**: Although not technically pre-filters, the RO membrane is a crucial component of the system. It's responsible for removing dissolved minerals, heavy metals, and other contaminants from the water.

Figure 5.4 : Reverse Osmosis Membrane

4. **Post-carbon Filters**: These filters are installed after the RO membrane to further enhance water taste and remove any residual odors or tastes that might be present.

Figure 5.5 : Post Carbon Filter

5. **Alkaline Filters (Optional):** Some RO systems come with alkaline filters that add minerals back to the purified water, which can enhance its taste and provide some health benefits.

6. **UV Filters (Optional):** Ultraviolet (UV) filters can be used as post-filters to disinfect the water, killing bacteria, viruses, and other microorganisms. They are often used in conjunction with RO systems to provide extra safety.

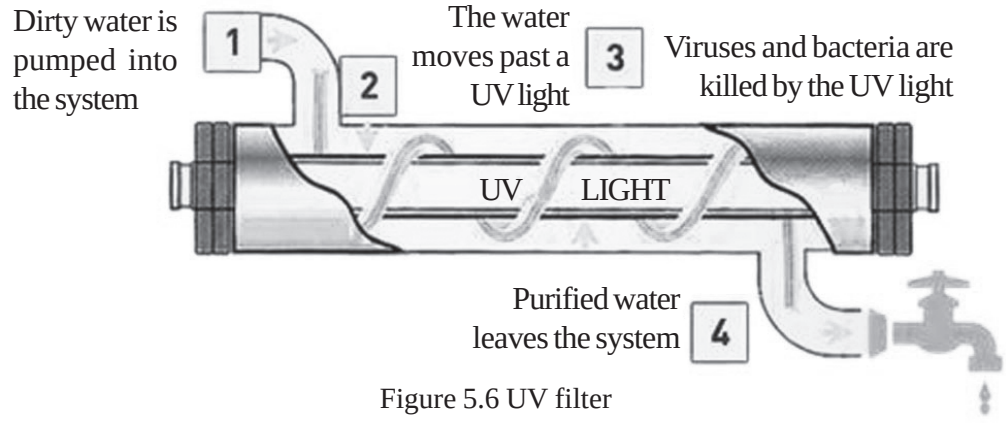


Figure 5.6 UV filter

7. **Mineral Filters (optional):** These filters add specific minerals to the purified water to improve taste and potentially provide health benefits.

8. **Specialized Filters (optional):** Depending on your water source and specific requirements, you may find specialized filters designed to remove specific contaminants like fluoride, arsenic, nitrates, or lead.

9. **pH Enhancing Filters (optional) :** pH enhancing filters adjust the pH level of the purified water to make it more alkaline, (pH range above 7.5) which some people prefer for drinking.

10. **Deionization (DI) Filters (optional) :** DI filters are used to further remove ions from water, resulting in extremely pure water. They are often used in laboratory and specific industrial applications.

11. **Mineralization Filters:** These filters add specific minerals to the purified water, often calcium and magnesium, to enhance the taste and provide potential health benefits.

When choosing pre and post-filters for your water purifier system, it's essential to consider factors such as the water quality in your area, the specific contaminants you want to remove, and the manufacturer's recommendations for your water purifier system model. Filters are typically labeled with specifications indicating their filtration capacity and compatibility, making it easier to select the right ones for your needs.

When selecting filters for WPU, it's crucial to consider local water quality, the contaminants want to be removed, and the manufacturer's recommendations for specific WPU model. Filters are typically labeled with specifications indicating their filtration capacity and compatibility with different RO systems, making it easier to choose the right ones for needs.

These filters are available at local home improvement stores, plumbing supply stores, appliance retailers, or online through e-commerce platforms. Always check the compatibility and recommended replacement schedule for specific water purifier system to maintain its effectiveness.

5.4 MAINTENANCE SCHEDULE OF WATER PURIFIER SYSTEM

The maintenance schedule for an RO (Reverse Osmosis) system should include **mandatory replacement of filters.** It is necessary for ensuring the system's efficiency and the quality of the drinking water. Below is the general maintenance schedule that you can follow, but please note that specific recommendations can vary based on your

system's model and manufacturer. *(Always refer to the manufacturer's guidelines for the most accurate maintenance schedule:)*

i) Monthly Maintenance

Maintenance schedule categorise on the basis of duration is as follows:-

- ***Visual Inspection***: Check the entire RO system for any visible leaks, damaged components, or loose connections. Address any issues promptly.
- ***Check Pressure Gauges***: Monitor the pressure gauges on your RO system. Pay attention to the feed water pressure and the product (permeate) water pressure. Abnormal readings may indicate a problem.
- ***Replace Pre-Filters***: Pre-filters, especially sediment and carbon filters, should be replaced every 3 to 6 months, depending on water quality. If your source water has high sediment levels or chlorine, you may need to replace these filters more frequently.
- ***Inspect the RO Membrane:*** Inspect the RO membrane for any signs of damage or fouling. While the membrane doesn't need to be replaced as often as pre-filters, it might need replacement every 2-3 years or as recommended by the manufacturer.

ii) Every 12 Months

- ***Replace Post-Filters***: Post-filters, particularly carbon filters, should be replaced annually. This helps maintain the taste and odor quality of the purified water.
- ***Sanitization:*** Perform a sanitization procedure as recommended by the manufacturer to prevent bacterial growth within the system. This is typically done annually.

iii) Every 2-5 Years

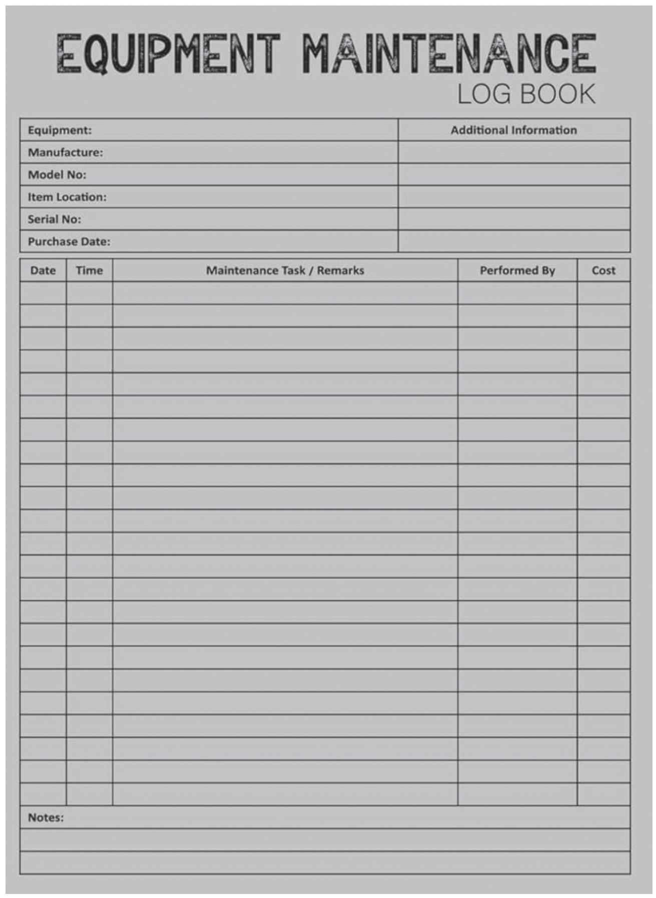
- ***Replace Storage Tank:*** If you have a storage tank in your RO system, it might need replacement every 2 to 5 years, depending on its material and condition.

Following checks are done as and when needed:-

- ***Float Valve Inspection***: If your RO system has a storage tank with a float valve, check and clean it as needed to ensure proper tank operation.

- ***Check Faucet and Connections***: Inspect and clean the faucet and all connections to prevent clogs and maintain water flow. Replace the faucet or any components if they are worn or damaged.
- ***Check O-Rings and Seals***: Periodically inspect and replace O-rings and seals as needed to prevent leaks.

Remember to keep a **maintenance log** where you record the dates of **filter replacements, system inspections,** and any issues encountered. This log can help you track maintenance history and ensure that you adhere to the recommended schedule.



EQUIPMENT MAINTENANCE
LOG BOOK

Equipment:	Additional Information
Manufacture:	
Model No:	
Item Location:	
Serial No:	
Purchase Date:	

Date	Time	Maintenance Task / Remarks	Performed By	Cost

Notes:

Figure 5.7 : Log book

Additionally, the quality of your source water can affect the frequency of filter replacements. If your tap water contains a high level of contaminants or sediment, you may need to replace filters more often. Always consult the manufacturer's guidelines for your specific RO system, as they may have their own recommended maintenance schedule.

Steps involved in routine maintenance of a Water Purifier

In general the step wise proledure for regular maintenance of a water purifier unit is as follows:

1.) Regular Inspection

- Visually inspect the entire RO system for any leaks, cracks, or damaged components.
- Check the pressure gauges and indicators for proper readings.

2.) Pre-Filter Maintenance

- Inspect pre-filters
- Replace sediment and carbon filters if too much clogging to maintain good water quality.

3.) RO Membrane Inspection

- Monitor the RO membrane performance through the system's pressure and TDS (Total Dissolved Solids) readings.
- If there's a significant drop in pressure or increase in TDS, it might be time to replace the membrane.

4.) Post-Filter Replacement

- Replace post-filters according to the manufacturer's recommendations.
- These filters help enhance the taste and odor of the purified water.

5.) Sanitization

- Periodically sanitize the RO system to prevent bacterial growth.
- Follow the manufacturer's instructions for using approved sanitizing solutions.

6.) Tank Cleaning

- Clean the storage tank periodically to prevent bacterial buildup.
- Rinse the tank with a mixture of water and a small amount of bleach, then thoroughly rinse with clean water.

7.) Faucet and Connections

- Inspect and clean the faucet and all connections to prevent clogs and maintain water flow.

8.) Pressure Check

- Monitor the system's pressure regularly to ensure it's within the optimal range.
- Adjust the pressure as needed based on the manufacturer's recommendations.

9.) Annual Service

- Consider a professional service annually to ensure the system's overall health.
- This might include comprehensive cleaning, membrane replacement, and more advanced maintenance tasks.

10.) Record Keeping

- Maintain a maintenance log to track filter replacement dates, pressure readings, and any issues encountered.

INTEXT QUESTIONS 5.1

1. Name any one pre filter used in RO.
2. Name any one post filter used in RO.
3. What is the use of pre carbon filter?
4. Name any two components of WP system.
5. Output of carbon post filter is connected to _____.

5.5 ACTIVITIES INVOLVED IN INSTALLING PRE-FILTERS AND POST-FILTERS

5.5.1 Physical examination to ensure the replacement of old preinstalled pre and post filters

Performing a physical examination to ensure the replacement of old preinstalled pre and post filters in a reverse osmosis (RO) system is an important step in maintaining the system's performance and water quality. Here's how you can physically inspect and verify the replacement of these filters:

- **Visual Inspection**

  Filter Housing: Start by visually inspecting the filter housing units. Ensure they

are clean and free of any visible cracks, leaks, or damage. The filter housings should be securely fastened and properly sealed.

Filter Condition: Examine the old filters that were removed. They should appear dirty or discolored, indicating that they have captured contaminants. If they still look clean, it might suggest they were not effectively filtering the water and needed replacement.

- **Labeling and Compatibility**

  Check the labels on the new filters to ensure they are the correct replacements for your specific RO system model. The labels should match the manufacturer's recommendations.

- **Installation Date**

  If possible, label the filter housings with the installation date of the new pre and post filters. This will help you keep track of when they were last replaced and when the next replacement is due.

- **Water Flow and Pressure**

  Monitor the water flow and pressure in your RO system. A significant drop in water flow or a decrease in pressure may indicate a problem with the filters or the system's overall performance.

- **Post-Filter Inspection**

  For the post-filter, which is typically the final stage in the water purifire containing system, you can examine the filtered water for any unusual taste, odor, or color. It should be clear and clean.

If the pre or post filter is not up to the mark ther it needed to be replaced

Professional Inspection

If you are unsure about the condition of your WP system or the effectiveness of the filter replacement, consider having a professional technician to inspect the system. They can perform more detail tests and provide recommendations.

By conducting these physical inspections and tests, you can ensure that the replacement of old pre and post filters in your RO system has been done correctly, and your system is delivering clean and purified water as expected. Regular maintenance and monitoring are essential for the long-term performance of your RO system.

5.5.2 Procedure involved in replacement of pre and post filters

Replacing the old filters in a WP system is an essential maintenance task to ensure that the system continues to provide clean and high-quality water. Here's a step-by-step procedure for replacing the old filters in an RO system:

Tools and materials needed

- New replacement filters (sediment filter, carbon filter, and post-filter) compatible with the water purifier system.
- A wrench or filter housing removal tool (if necessary).
- A bucket or towel to catch any water that may spill.

Step 1: Turn off the Water Supply

Before you begin, turn off the water supply to the RO system. Locate the shut-off valve near the water inlet and turn it clockwise to shut off the water flow.

Step 2: Release Pressure

To prevent water from spraying when you open the filter housings, release the pressure in the system. Do this by opening the RO faucet and allowing any remaining water to drain out. Close the faucet once the water has drained.

Step 3: Locate the Filter Housings

Identify the filter housings in your RO system. You will typically have three: a sediment pre-filter, a carbon pre-filter, and a post-filter. The order may vary depending on your specific RO system model.

Step 4: Remove the Old Filters

Use a wrench or filter housing removal tool if necessary to unscrew the filter housings. Turn them counterclockwise to open them. Be prepared for some water to spill out when you remove the housing.

Step 5: Dispose of the Old Filters

Take out the old filters from the housing and dispose of them properly.

Step 6: Install the New Filters

Insert the new replacement filters into their respective housing units. Ensure they are properly seated and positioned according to the manufacturer's instructions. Typically, the sediment filter is first in line, followed by the carbon filter, and then the post-filter.

Step 7: Reassemble the Filter Housings

Carefully screw the filter housing units back onto their respective ports. Use a wrench or filter housing removal tool if necessary, but be cautious not to overtighten, as this can damage the housing or seals.

Step 8: Turn on the Water Supply

Once the filter housings are securely in place, turn the water supply back on by turning the shut-off valve counterclockwise.

Step 9: Check for Leaks

Inspect the filter housings for any signs of leaks. If you notice any leaks, turn off the water supply and try reseating the filters or replacing the housing O-rings.

Step 10: Flush the System

Turn on the RO faucet and let the water run for a few minutes to flush out any air bubbles and any loose carbon fines from the new filters. The water may initially appear cloudy but should clear up.

Step 11: Monitor for Proper Operation

Check the RO system's performance to ensure it is producing clean and filtered water as expected. It may take some time for the system to reach its optimal performance.

By following the above steps a technician can successfully replace the old filters in the WP system, ensuring that it continues to provide clean and high-quality drinking water. Regular filter replacement is crucial for maintaining the efficiency and effectiveness of a WP system.

5.5.3 Activities after filter replacement

After changing the filters in a WP system, it's important to perform cleaning and clearance work to ensure the system operates efficiently and the water quality remains high. Here are the steps to perform cleaning and clearance activities following a filter change in your WP system:

Step 1. Turn on the RO System

After replacing the filters and ensuring there are no leaks, turn on the RO system.

Step 2. Flush the System

Allow the RO system to run for at least 30 minutes to flush out any residual air, loose

particles, or carbon fines from the new filters. You can do this by opening the RO faucet and letting the water run continuously.

Step 3. Check for Leaks

Inspect the filter housings and all connections for any signs of leaks. If you notice any leaks, turn off the water supply, recheck the connections, and fix any issues before proceeding.

Step 4. Monitor Water Quality

Test the water quality periodically to ensure it meets your desired standards. You as a techinician can use a water quality testing kit or have water tested by a professional lab (for industrial WPS) . As a technician this step is important to verify that the new filters are effectively removing contaminants.

Step 5. Check Water Pressure and Flow Rate

Ensure that the water pressure and flow rate are within the manufacturer's recommended specifications. A significant drop in pressure or flow rate could indicate an issue with the water purifier system or filters.

Step 6. Record Keeping

Keep a maintenance log that includes the dates of filter changes, cleaning activities, and any issues or observations related to your RO system's performance. This log can help you track maintenance intervals and identify any recurring problems.

5.6 IDENTIFICATION OF COMPATIBLE FILTERS AVAILABLE IN MARKET FOR OLD OBSOLETE WATER PURIFIER UNITS

Identifying compatible filter parts for an old model of a reverse osmosis (RO) system can be a bit challenging, but it is possible. Here are steps to help to find compatible filters for old RO system:

1. **Locate Model Information**

   Find any identifying information about old RO system. This may include the manufacturer's name, model number, and manufacturing date. Look for a label or name plate on the system or in the user manual.

2. **Contact the Manufacturer**

   Reach out to the manufacturer of the RO system. They may have information on

compatible replacement filters for older models. Manufacturers often provide support through their websites, customer service hotlines, or email.

3. Visit the Manufacturer's Website

Check the manufacturer's website for information on replacement filters. They may have a section dedicated to replacement parts where you can search for filters based on your RO system's model number.

4. Online Retailers and Specialty Stores

Search online retailers that specialize in water filtration and RO systems. Many of these retailers offer a wide range of replacement filters for various RO system models, including older ones. You can search by your system's brand or model number.

5. Check Filter Specifications

If you can't find your exact model's replacement filters, you can look for filters with the same specifications. Check the specifications of your old filters, including dimensions, filtration capacity, and micron ratings. Look for replacement filters with similar specifications that fit your RO system.

6. Consult Water Treatment Professionals

Reach out to local water treatment professionals or plumbing supply stores. They often have access to a wide range of replacement filters and may be able to help you identify compatible ones based on your system's age and specifications.

7. Bring Old Filters as Samples

If possible, bring your old filters to a plumbing supply store a reputed spare parts shop as sample. They may be able to visually identify or measure the filters to find suitable replacements.

8. Consider Custom Solutions

In some cases, if you can't find exact replacements, you may need to explore custom solutions. A senior professional can assist with this, but it may be more expensive than using off-the-shelf filters.

9. Be Prepared for Discontinuation

Keep in mind that for very old models, it's possible that replacement filters are no longer available. In such cases, you may need to consider upgrading to a latest water purifier system.

5.7 INTERACTION WITH CUSTOMERS FOR JUSTIFICATION OF NEED OF REPLACEMENT AND COST OF FILTERS

Interacting with customers to justify the need for the replacement of water filters and discussing the associated costs is an important part of providing transparent and effective service. Here's a guide on how to communicate with customers in this context:

1. Schedule an Appointment

Arrange a convenient time to visit the customer's location to assess their water filtration system. It's essential to do this in person to accurately evaluate the condition of the filters.

2. Initial Assessment

Begin by conducting an initial assessment of the customer's water filtration system. Examine the filter housings, check for any visible signs of damage or wear, and inquire about the system's performance and any issues the customer may have noticed.

3. Water Quality Testing

Perform water quality testing to demonstrate the effectiveness of the current filters. You can use testing kits or portable water quality meters to show the customer the levels of contaminants in their water.

4. Explain the Importance of Filter Replacement

Educate the customer about the importance of regular filter replacement. Emphasize that filters have a finite lifespan and that they become less effective over time. Explain that failing to replace filters can result in lower water quality and potentially harmful contaminants in their drinking water.

5. Show Filter Condition

If possible, show the customer the condition of their existing filters. Display any sediment or contaminants trapped in the filters as evidence of their effectiveness.

6. Discuss Water Quality Concerns

Ask the customer about any specific water quality concerns they may have, such as taste, odor, or visible particles in the water. Address these concerns and explain how new filters can help alleviate them.

7. Present Replacement Options

Offer the customer options for replacement filters, including different filter types and price points. Explain the benefits of higher-quality filters and how they can enhance water quality.

8. Cost Breakdown

Provide a clear breakdown of the cost associated with replacing the filters. Include the cost of the filters themselves, any labor charges, and any additional parts or materials required for the replacement. Be transparent about pricing.

9. Cost Justification

Justify the cost by highlighting the long-term benefits of clean, filtered water. Explain that investing in filter replacement is a cost-effective way to ensure the health and safety of their family or employees.

10. Customer Input

Listen to the customer's concerns and preferences. Allow them to ask questions and express their budget constraints. Tailor your recommendations based on their needs and preferences.

11. Provide Written Estimates

Offer the customer a written estimate that includes all costs, including labor and materials. This helps ensure transparency and provides a clear record of the agreement.

12. Obtain Customer Consent

Before proceeding with the filter replacement, obtain the customer's consent in writing or through a signed work order. This ensures that the customer agrees to the scope of work and associated costs.

13. Schedule the Replacement

Once the customer agrees, schedule a convenient time to perform the filter replacement.

14. Post-Installation Testing

After replacing the filters, conduct water quality testing again to demonstrate the improved water quality to the customer.

15. Provide Maintenance Tips

Offer maintenance tips to help the customer extend the lifespan of their new filters and maintain good water quality.

Effective communication, transparency, and a customer-centric approach are key to ensuring that customers understand the need for filter replacement and are comfortable with the associated costs. This approach helps build trust and satisfaction with your services.

INTEXT QUESTIONS 5.2

1. Name any one tool used to remove Pre and Post filter.
2. What is the primary step followed in routiene maintenance of water purifier.
3. Significant drop in water output in water purifier indicates that there is problem in _____.
4. Filter housing is inspected for _____.
5. Technician must educate the customer for regular replacement of _____ .

WHAT YOU HAVE LEARNT

- Function and working of pre filter.
- Function and working of post filter.
- Types of pre filters available in market.
- Types of post filter available in market.
- Importance of post filter and its use.
- Maintenance schedule of water purifier mandatory for replacement of filters.
- Steps involved in routine maintenance of water filter.
- Identification of compatible filters available in market for old obsolete water purifier units.

TERMINAL QUESTIONS

1. What are the different types pre and post filters of a water purifier?
2. Describe the step to step procedure for replacement of Pre filter.
3. Describe the step to step procedure for replacement of Post filter.
4. How do u identify the filter which is to be replaced?
5. Write step by step maintenance schedule of a water purifier.
6. Give a detailed procedure for cleaning and clearance activities after completion of maintenance.
7. How do u identify chocked filter and how it is removed?
8. How do you convince customer for replacement of filter by its compatible part if the water purifier unit is old?

ANSWERS TO INTEXT QUESTIONS

5.1

1. Sediment Pre filter
2. Carbon Post filter
3. Pre-Carbon filters are used to remove chlorine, odors, and some organic compounds from the water.
4. Booster Pump and RO membrane
5. Faucet

5.2

1. 3 in 1 spanner
2. Visual inspection by technician
3. Filter
4. Leaks
5. Filters

Lesson - 5

Installing Pre-Filters and Post-Filters

Notes

Key Learning Outcomes

Being able to :

- Illustrate the functiouing of pre and post filters depending upon the quality of water.
- Identify the range of pre and post filters available in the market.
- Carry out replacement of pre and post filters effectively.

6

ROUTINE MAINTENANCE OF WATER PURIFIER SYSTEM AND FAULT FINDING

6.1 INTRODUCTION

To make sure your water purifier lasts longer and works reliably, regular maintenance is necessary. If the purifier stops working properly, it's important to diagnose the problem. The role of the technician is to figure out what's causing it and fix it. This lesson explains how to do routine maintenance and troubleshoot problems step by step.

6.2 LEARNING OBJECTIVE

After reading this lesson learner will be able to:

- Explain the importance of maintaining a WPU.
- Perform routine service and maintenance of a WPU as per the manufacturer's guide lines.
- Illustrate the need of replacing filters and other parts of water purifier.
- Diagnose potential faults during routing maintenance in the installed WPU.
- Convey the customer about potential fault effectively.

6.3 ROUTINE MAINTENANCE OF THE WATER PURIFIER

In today’s polluted environment, it has become necessary to consume filtered and high-quality water. Because water makes up most of the human body, it’s important that the water we drink should be clean and free of toxins which could harm us. Investing in a home water purifier is one of the most effective ways to obtain purified water. A suitable water purifier will offer clean and safe water if regularly maintained.

Excess salts, suspended particles, and bacteria can be removed by an effective water filter.

Maintenance is essential for the long life of any water purifier. Hence it is also essential to avail an effective water purifier service.

Maintenance

The technical meaning of maintenance involves functional checks, servicing, repairing or replacing of necessary parts.In other words maintenance, refers to a set of processes and practices which aim to ensure the continuous and efficient operation of water purifier system.

A water purifier's maintenance is mostly related to the replacement of the sediment filter, carbon filter, RO membrane, UV lamp (if present) and labour charge.

6.3.1 Types of Maintenance

There are mainly 2 types of maintenance : (a) Corrective maintenance and (b) Preventive maintenance

(a) **Preventive maintenance:** Water purification system preventative maintenance is the process of regularly inspecting and servicing a water filtration system to ensure it is running efficiently. It involves a series of tasks that should be performed to ensure the system continues to operate correctly and any potential issues are addressed.

(b) **Corrective maintenance**: It involves the replacement or repair of part after it fails. In response to equipment failure, corrective maintenanceinvolves identification of the failure (it may be a part of the system) and rectify the failure so that the system can be restored to its normal working condition.

The majority of the filters in the system should be changed at least every three to twelve months. The number of filters depend on the type of water purifier system. The RO membrane should be replaced every 1.5 to 2 years, depending on the TDS level in your water. Additionally, the RO system needs to be sanitised at least once a year. As a result it is advised to do reverse osmosis system maintenance at least once a year.

It is very important to make a schedule for water purifier service to assure purity and get many benefits. Most of the manufactures prescribe standard maintenance schedule.

6.3.2 Stepwise procedure to maintain Water Purifier

1. Replace water purifier system filters on a regular basis.

The important factor in the maintenance of a water purifier is to service, replace and clean the filters and membrane every 6-8 months. There are a number of filters that must be adjusted at a specific time interval. To calculate the replacement schedule for all filters and membranes, seek information in the user manual guide. Filters and membranes must be replaced because of pollutants present in the water deposits on the filter surface. The deposit additionally blocks the channels for quite a while. Therefore, the water quality decreases. Also, when it takes a long time for your filter to fill up the storage tank, it's time for a replacement.

Filters and membranes must be replaced on a regular basis as part of water purifier service because pollutants from the water settle on the filter surface. The deposits eventually choke the filters out over time. This lowers the filtration capacity and lowers the water quality. If it takes a long time for your water purifier to fill the storage tank, you should have the filters and membrane checked and, if necessary, replaced. Impurities formed on the filter surface may eventually be transmitted to the purified water if the filters are not replaced on time. Choked filters and membranes waste electricity because they lower purification capacity, requiring the purifier to run for longer periods of time to purify the same amount of water.

Sediment filter - A sediment filter present in a water purifier should be replaced every 4-6 months. The pre-filter step is designed to strain out sediment and dirt, and it is critical because the sediment filter protects the RO membrane from dirt.

Carbon filter - A carbon filter removes chlorine and other pollutants that impact the RO membrane's performance and longevity, as well as the taste and odour of the water. Every 12 months, the carbon filter should be replaced as well.

RO membrane servicing - The RO purifier has a semi-permeable membrane that allows water to pass through while filtering out any other impurities. The RO membrane should be replaced every 1.5 to 2 years, depending on the TDS level in your water.

2. Sanitization and thorough cleaning

A complete water purifier tank cleaning must be done at least once a year.

Perhaps the easiest technique to keep a water purifier all ready is to have it cleaned one time per year. Subsequently, it has various interfacing pipes that carry water starting with one filtration stage and then onto the next. Sanitizing these pipes is to be done simultaneously as filer replacement.

If water is held for an extended period of time, there is a considerable risk of microbial contamination. The bad odour and taste are the first signs of microbial infection. As a result, it is critical that the water storage tank be emptied and refilled on a regular basis. That is why, if you are leaving the house for an extended period of time, you always recommend turning off the water purifier and emptying the storage tank. Because tank sanitization and cleaning may include some assembly and disassembly, it's better to have it done when you call for filter replacement or service.

3. Inspect for leakages

The technician should inspect for any leakage. If you do not correctly repair the leaks, they might cause serious damage. It may also result in unnecessary wastage of water. A complete water purifier service is always recommended.

The repair could be brought about by various elements, including inappropriately associated or broken lines, or a failing part. As a result, a professional inspection is required to identify the source of the leak and prevent further damage to the purifier.

4. Maintain a clean exterior

Apart from internal maintenance, the outside section of the water purifier must also be kept clean. Not only this will help to maintain your purifier as new, but it will also reduce the risk of water contamination. It gets contaminated through the exterior tap for dispensing water held in the storage tank. As a result, they both damage the faucet and the surrounding region. As part of the water purifier service, it is also critical that you keep the purifier's external surface as well as

the tap clean. A technician should remember to use a clean and dry cloth to clean the exterior of the water purifier and should not use any soap or detergent.

6.3.3 Standard Time schedule of Maintenance

For the routine service and maintenance of a purifier system table 6.1 may be followed as an standard time schedule.

Table 6.1 : Maintenance time schedule

Name of part	Action	Time schedule
Filters and the membrane	Replace and clean	Every 4 - 6 months
Sediment filter	Replace	Replace after 4-6 months
Carbon filter	Replace	Replace after 12 months
RO membrane	Replace	Replace after 1.5 to 2 year
RO water purifier tank cleaning	Cleaning	Once a year
Inspect for leakages	Inspection	Whenever observed leakage
Maintain a clean exterior	Cleaning	Once a month

6.3.4 More Tips for Effective Maintenance of the Water Purifier

Effective maintenance of the Water Purifier increases the life span of the cleaner, reduces the amount of care required to maintain the purifier, and reduces the chances of the purifier being damaged by extreme weather conditions. Here are some beneficiary tips for effective maintenance:

- Regularly changing the Water Filter is essential for the effective maintenance of the purifier.
- Clean your Water Filter at least once in two months or when the indicator light turns red to get the maximum benefit from it.
- To ensure effective and efficient maintenance of the Water Purifier, following the cleaning procedures mentioned in the manual is essential. The cleaning of the system helps remove dirt, particles, and other impurities that accumulate over time.

- Keep the Water Purifier away from direct sunlight to prevent oxidation of the system.
- Change the pre-filter of the Water Purifier if it becomes contaminated.
- Before starting the Water Purifier, ensure enough water pressure.
- Use vinegar to clean the system.
- Sanitize the water storage tanks.
- Make sure to clean and sanitize the pipes every two years.
- Replace and buy any new parts when necessary.

INTEXT QUESTIONS 6.1

1. The filter and membrane needs to be cleaned after _____ months.
2. The carbon filter required to be replaced after
   (a) 6 months
   (b) 1 year
   (c) 2 year
   (d) 3 year
3. The water purifier tank must be cleaned _____ a year.
4. Pipes of water purifier unit are to be sanitized every _____ years
5. If water is held for an extended period of time in the WPU there is a considerable risk of _____contamination.

6.4 IDENTIFICATION OF THE POTENTIAL FAULT WHILE CARRYING OUT ROUTINE MAINTENANCE IN THE INSTALLED WATER PURIFIER SYSTEMS.

Remembering that it's easier to prevent problems than to fix them later, a water purifier technician should check the various parts of the purifier during routine service to see how well they're working and how much longer they might last. They need to carefully watch and inspect the purifier's components. If they notice any of the symptoms listed in Table 6.2 while talking to the customer and inspecting the system, they should take the recommended actions.

Table 6.2: Fault and its Causes

S. No.	Fault	Causes
1	Occasionally Water Purifier stops working	• Power switch may be damaged • Electricity supply may be interrupted • Electrical wiring may be broken • SMPS (power supply adapter) may not be providing desired supply • The water supply valve may be chocked or closed • The water pressure may be less • The filters & membranes may be choked
2	Water Leakage	• May be some loose connections. • Teflon tape is not properly applied
3	Foul Odour or Bad Taste of Water	• Carbon filter may be damaged • Water storage tank needs to be cleaned.
4	Auto Shut-Off Failure	• Float valve or microswitch may be damaged
5	Low Water Flow or Storage tank takes more time to fill	• Few filters may be choked.
6	Vibrations or Noise	• The pipes &electric wires may not be tightly fixed • The water pump may be loosely tied with the unit. • The pump may be partially faulty.
7.	Excess amount of reject water	• RO membrane may be chocked
8.	RO machine works intermittently. Solenoid valve trips ON-OFF	• Water incoming pressure is not enough (5Psi). Replace the 1st front filter core of installed with water incoming pressure pump. If emergency, temporarily connect the low pressure switch (short circuit).

9.	Waste water drainage didnot stop even after machine stops for 2 minutes	• There are strange articles at the gate of incoming water. • Solenoid valve or the piston is blocked. Clean the gate piston or replace the solenoid valve.
10.	Motor runs but its not making enough pressure	• For pressure-adjusting type, adjust & calibrate the pressure adjusting knob. Clockwise turn for increasing pressure. Anti-Clockwise turn for reducing pressure. • Pressure pushing valve gate of pump head is blocked with strange articles or is accumulated with carbon lime. Clean or replace the check flow plate.
11.	RO machine is stops functioning	• Low pressure switch or high pressure switch does not start. • Transformer or motor break down.
12.	Waste water displacement is large without making pressure	• The gate of auto flush control is blocked with impurities or the piston is blocked. Clear the impurities and clean the piston or replaced the spring.
13.	Water incoming pressure is normal. RO pump runs but completely doesn't make pressure.	• Solenoid valve doesn't work.
14.	Water-making pressure is normal. But there is no pure water and waste water.	• Front active carbon filter core is blocked.
15.	Water-making pressure is normal but pure water is less or can't out	• RO Membrane is blocked.

The role of servicing or maintenance technician is more than just to carry out the routine maintenance or replacement of filters. He needs to identify the parts which are likely to be faulty and adversely affecting the functioning of the purifier.

Therefore technician must convey the customer about the status of the different parts and suggest replacement of them if required.

The technician is also expected to convey the parts available in the market to be replaced along with their price. It is also expected to convey the pros and cons of timely replacement of degraded parts so that the customer can take wise decision to get the replacement and proper maintenance work done.

The technician must also convey his own additional service/ labour charges for the work to be done well in advance. If it includes any warranty of the part then that must also be conveyed. And after replacement it is mandatory for the technician to operate the purifier system for reasonable period.

INTEXT QUESTIONS 6.2

1. If it is reported that that the water purifier often stop working, then which part may be faulty from the following:
   (a) Electrical supply
   (b) SMPS
   (c) Choked filter
   (d) Water supply valve
   (e) All of them
2. The water leakage problem may be caused by improper application of ……. Tape
3. The foul odour or bad taste of water may be caused by ..... filter.
4. Cause of Water-making pressure is normal, but there is no pure water and waste water is Front active carbon filter core is.....
5. Auto Shut-Off Failure may be due to damage of.....valve or.....

WHAT YOU HAVE LEARNT

- Importance of routine maintenance
- Time schedule of routine maintenance
- Types of faults in a typical water purifier
- Patential fault of the WPU and its causes.

TERMINAL QUESTIONS

1. Explain the meaning of routine maintenance of water purifier systems.
2. Differentiate between preventive and corrective maintenance.
3. Draft standard schedule of maintenance for a domestic water purifier system.
4. Prepare a preventive maintenance checklist.
5. Explain the possible causes if the water purifier systems stop working.
6. What steps you will take to check if water purifier system, if it stops working?

ANSWERS TO INTEXT QUESTIONS

6.1

1. 4 to 6
2. (b)
3. Once
4. Two
5. Microbial

2.2

1. (e)
2. Teflon
3. Carbon
4. Blocked
5. Float , Micro switch

Key Learning Outcomes

Being able to :

- Illustrate the significance of maintenance of a water purifier unit.
- Illustrate the time schedule of maintenance of various parts of WPU.
- Carry out routine the service of purification system by diagnosing potential fault and its causes.
- Illustrate the need of replacement of faulty part of water purification system to the customer.
- Successfully restore the system to its normal working condition.

7

TROUBLESHOOTING OF WATER PURIFIER SYSTEM

7.1 INTRODUCTION

In previous lesson you have learnt about the routine maintenance of water purifier, even after routine maintenance sometimes fault occurs in water purifier. Proper troubleshooting not only saves time and money but also increases the life span of water purifier.

In this lesson you will learn about the fault diagnosis and troubleshooting of water purifier.

7.2 LEARNING OBJECTIVE

After reading this lesson learner will be able to:

- Interact with customer about problem in water purifier unit.
- Identify the nature of the fault.
- Identify the faulty part responsible for the malfunctioning of the system.
- Distinguish between water purifier unit under warranty /out of warranty.
- Perform trouble shooting.
- Convince the client of repair estimate.
- Verify the proper functioning of the water purifier system.
- Provide customer satisfaction.

7.3 COMMON FAULTS IN WATER PURIFICATION SYSTEM

The continuous supply of drinking water is one of the basic needs of every household, institution or any other workplace of human being. The drinking of impure water led to a number of health problem and diseases.

After proper installation of a new water purification system it is expected to supply good quality drinking water whenever required. For this purpose initial routine maintenance is to be provided by the supplier at free of cost during the warranty period. Different suppliers offer different types of paid extended warranties or AMC. (Annual Maintanance Contract).

Like any other equipment the water purification system also need maintenance and service. Inspite of taking best care and preventive maintenance, the water purification system may stop functioning or not give satisfactory performance.Therefore, next we will discuss the troubleshooting.

7.3.1. Troubleshooting

When a water purification system either stop working or give undesirable output the technician is called for restoring the system to its normal working state.The technician is expected to repair or replace the faulty part and restore the system to the customer's satisfaction. This whole process of identification, location and repairing of the defect in the system and putting back the system to its normal operation is called Troubleshooting.

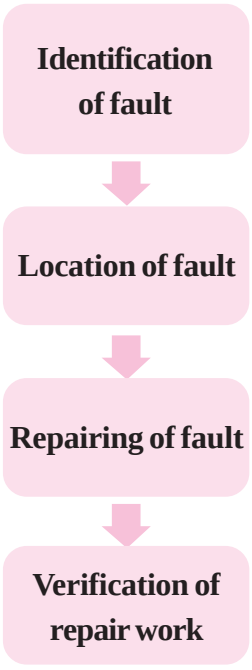


Figure 7.2 : Flowchart Explaining Troubleshooting Procedure

7.3.2 Common Faults in the Water Purifier Unit

The water purifiers, unlike most home and kitchen appliances need regular maintenance and servicing. It is very important to carry out regular maintenance of water purifier unit.

The maintenance and proper servicing of water purifiers are necessary for our health and the life of purifier. Inspite of taking best care of purifier several common problems do appear in water purifiers.

Following are the common functional water purifiers problems :

i) Water Purifier Not Working

The most common problem that arise is that the water purifier is working. In order to verify, these two questions need to be answered. First is if the water purifier's storage tank completely empty or not. Second is if there is even a single drop of water flowing from the purifier tap or not. And if the answer is that the water tank is empty and no water is coming from the tape then there is some issue and need to be inspected and resolved.

ii) Water Leakage

Water leakage from water purifiers system or within the unit is another common problem. Sometimes, a pool of water near water purifier is visible. The leakage within the system is highly risky as it may cause electrical short circuit. Need not to mention that wet and slippery floor in the kitchen or elsewhere is highly undesirable.

iii) Foul Odour or Bad Taste of Water

Normaly water obtained from a water purifier has no such foul odour or bad taste. But one can still feel a difference in the smell or taste while drinking the water. It is highly undesirable to serve the drinking water with unpleasant odour and taste due to improper functioning of components such as carbon granule filter of water purifier system.

iv) Auto Shut-Off Failure

When the water storage tank of the water purifiers unit fills over a defined level, then it automatically stop working, this is known as auto shut-off feature of water purifiers.

If the auto shut-off feature is not working properly then flow of water into the water purifier tank will not stop. This would result in water overflow from the storage tank. This is risky and can cause electrical short circuit.

v) Low Water Flow or Storage Tank Taking More Time to Fill

Similar to above sometime the water purifier unit takes an unusual long time to filling of the storage tank. This is another problem commonly found in the water purifier unit.

vi) Vibrations or Noise in RO Purifiers

Sometime water purifiers make vibrations and noise. This may result in panic and if not checked may cause failure of water purifier unit.

vii) Excess Amount of Reject Water

The R.O.water purifiers produce reject or waste water due to R.O. membrane choke. The purifier's reject water contains dissolved solids and is not fit for drinking. TDS concentration and salt that is present in the water are the reason behind this.

7.3.3 Causes of Faults in the Water Purifier Unit

In order to avoid faults and faithful availability of drinking water from water purifiers unit it is necessary to have sound knowledge of the reasons responsible for different kinds of faults. The causes of different types of faults are as follows :

i) Cause of Water Purifier Not Working:

The common cause for not working of water purifier are as follows :

- The power switch is off or get damaged internally.
- The electricity supply is not available.
- There may be fault with the wiring or the SMPS (power supply adapter).
- The solenoid valve may not be working.
- The water supply valve may be closed or chocked.
- The water pressure may be less.
- The filters & membranes may be choked.

ii) Cause of Water Leakage:

The main cause of water leakage is that the connectors of the pipes have loose connections, leading to the leaking of the water. The inappropriate or no application of teflon tape at junction also cause water leakage. Sometime because of excessive water pressure or tear and wear connectors get damaged and result in leakage.

iii) Cause of Foul Odour or Bad Taste of drinking Water:

The most common cause of the foul smell and bad taste is the presence of chlorine, and that is what smells. This may happen if the filters are not filtering the water properly especially the carbon filter. And thus, there is a usual smell and taste in the water. Sometime new carbon filter also add undesirable odour or bad taste in water if sufficient water is not drained out after replacement.

iv) Cause of Auto Shut-Off Failure:

If the water storage tank of the unit fills over a defined level and do not automatically stop the purification process then either float valve or microswitch get faulty. The floating valve may be jammed and not floating over the water in the tank. The microswitch connected with the floating valve may also be faulty and not performing proper switching.

v) Cause of Low Water Flow or Storage Tank Taking More Time to Fill:

Each filter in the RO purifier is made to filter out specific types and sizes of impurities. These filtered impurities get stuck on the filter and membrane surface. If the filters are not cleaned or replaced on time then these impurities form a stubborn layer on the filter surface blocking the flow of water. As a result water purifier unit take an unusually long time to fill the storage tank.

Such problem is common in areas where water quality is very poor (having high concentration of sediment and other physical impurities).

This problem may also arise because of improper working of the booster pump.

vi) Cause of Vibrations or Noise in RO Purifiers:

The main source of vibrations and noise in any water purifier is the pump. The pumps like any other water pump tend to become noisy over time because of the way they are designed to work. A pump has many parts, like bearings, that move at high speed to generate the required water pressure for RO purification.

The continuous movement and increase in friction take a toll on the health of these parts which makes them noisy and produces high vibrations.

The vibrations and noise can also emerge if the pump housing is not secured tightly.

Another common cause of vibrations and noise in RO purifiers is loose wires and connecting pipes. Connecting pipes between two filters should not be longer than what is required. All electric wires and connecting pipes should be properly secured using cable ties to minimize all vibrations.

It is also noticed that some vibrations occurs if recently filters have been changed. This is a temporary issue, the vibrations will automatically stop after a few hours.

7.4 TROUBLESHOOTING OF FAULT IN A WATER PURIFIER UNIT

After finding out the fault and understanding the root cause of the faults its time to repair the faults and bring the unit back to function. The solution of various types of faults are as follows :

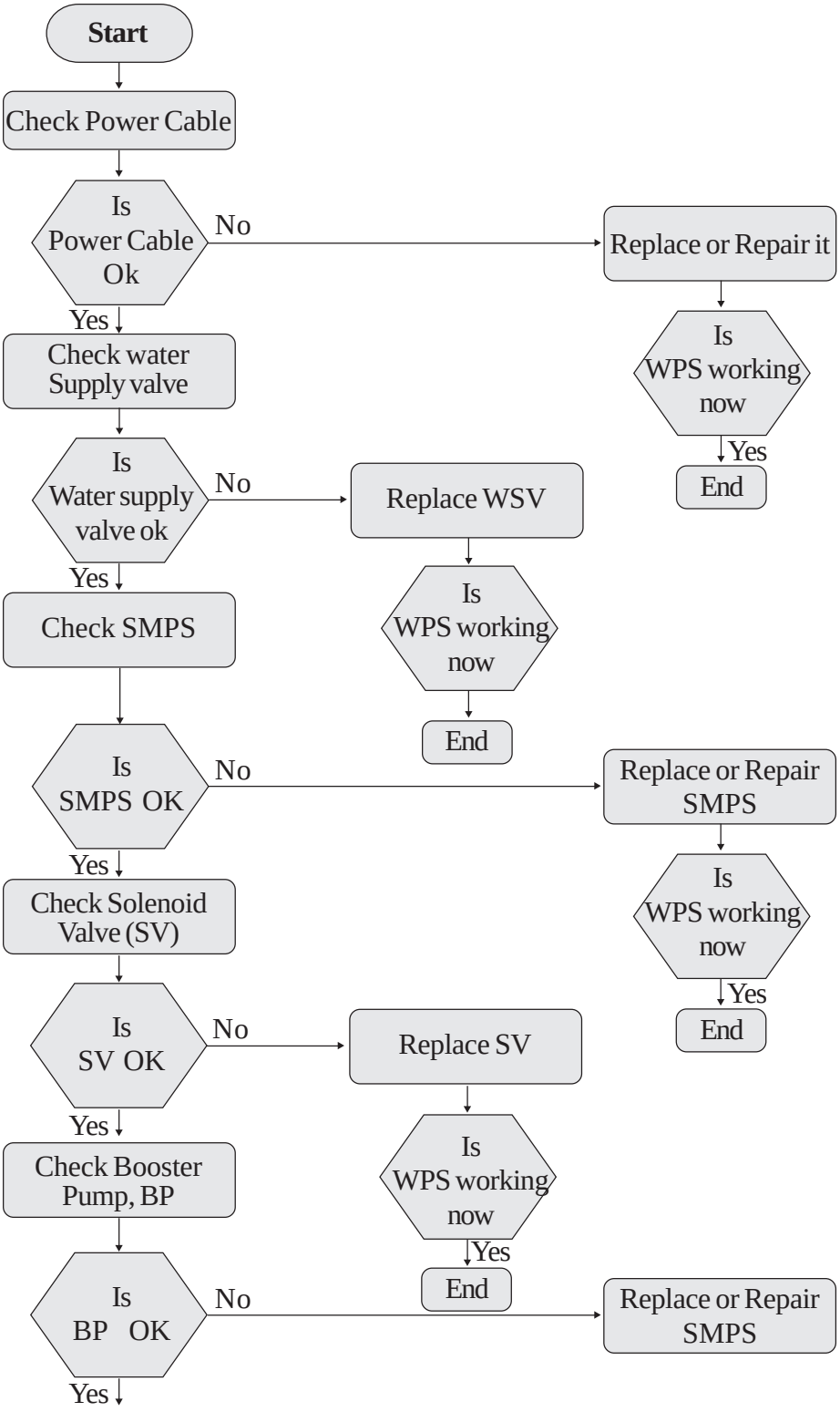
i. Solution of Non Working of Water Purifier

The problem of not working of purifier can be resolved in following way :

- If the power switch is damaged then replace it.
- If electricity supply is not available, ensure its supply
- Check the electrical wiring, if broken the properly connect them.
- If SMPS (power supply adapter) not providing desired supply, replace it.
- The solenoid valve may not be working, replace it.
- If the water supply valve closed or chocked, open it or clean it.
- If the water pressure is less then it must ensure sufficient water pressure.
- If the filters & membranes are choked, clean or replace them.

Troubleshooting of Water purifier system

The troubleshooting of a water purifier system is summarised in the following flowchart.



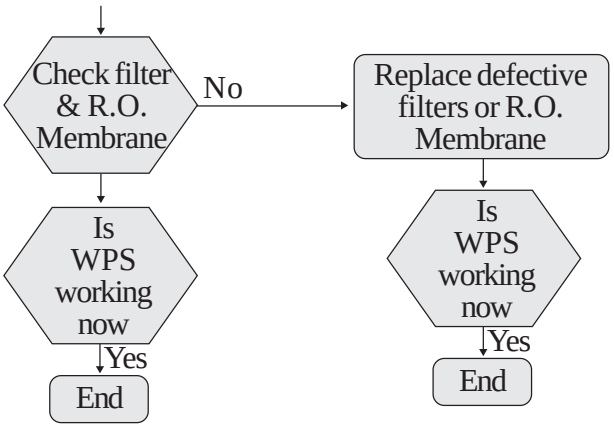


Figure 7.3 : Troubleshooting Procedure Flowchart

ii. Water Leakage

Solution of Water Leakage Problem: Since the main cause of water leakage is that the connectors of the pipes have loose connections, therefore all connections should be made properly. The teflon tape must be used at threated junctions to avoid water leakage. Sometime because of excessive water pressure or tear and wear connectors get damaged and result in leakage. In such cases old connectors may be replaced by new heavy connectors.

iii. Foul Odour or Bad Taste of Water

Solution of Foul Odour or Bad Taste of Water: The foul smell and bad taste appears in the water if the filters are not filtering the water properly especially the carbon filter. In order to get rid of this problem the filters need to be changed every 12 months.

The purified water may also develop some smell if it is left unutilized in the storage tank for a long period. The purified water should be discard if it is left in the storage tank for more than 15 days. The storage tank should also be thoroughly cleaned and sanitized at the time of service or filter replacement.

iv. Auto Shut-Off Failure

Solution of Auto Shut-Off Failure: When the water storage tank of the unit fills over a defined level, then it automatically stop the purification process.

If the auto shut-off feature is not working properly then the purifier would continuously work. This would result in water overflow from the storage tank. This is risky and can cause electrical short circuit.

The parts which are responsible for failure of automatic stop the purification process are float valve and micro switch get faulty. After inspection and confirmation of the faulty part, the faulty part must be replaced.

v. Low Water Flow or Storage Tank Taking More Time to Fill

Sometime the water purifier unit take an unusually long time to fill the storage tank. This is another problem commonly seen in the water purifier system.

Solution of Low Water Flow or Storage Tank Taking More Time to Fill: In case water purifier unit take an unusually long time to fill the storage tank then get the filters and membranes replaced. If problem persist then get the booster pump repaired or replaced.

vi. Vibrations or Noise in RO Purifiers

Solution of Vibrations or Noise in RO Purifiers: Since the main source of vibrations and noise in any water purifier is the pump hence it needs to be repaired or replaced if necessary. However before questioning the pump being cause of noise it must ensured that it is tightly fixed within body of the purifier.

It is to be ensured that connecting pipes between two filters should not be longer than what is required. All electric wires and connecting pipes should be properly fixed using cable ties to minimize all vibrations.

vii. Excess Amount of Reject Water

Solution of Excess Amount of Reject Water : There is no defined timeframe for when to change the RO membrane as it depends on the quality of input water. If the input water at any place has a high level of TDS then the RO membrane would need to be replaced sooner and vice-versa.

7.4.1 Troubleshooting of water purifier system

Table 7.3 Troubleshooting of water purifier system

S. No.	Problem	Solution
1.	Water Purifier Not Working	1. Check power switch, if damaged then replace it. 2. Check electricity supply, if not available, ensure its supply 3. Check the electrical wiring, if broken the properly connect them. 4. If SMPS (power supply adapter) not providing desired supply, replace it. 5. If the water supply valve is closed or chocked, open it or clean it. 6. If the water pressure is less then it must ensure sufficient water pressure. 7. If the filters & membranes are choked, clean or replace them.
2.	Water Leakage	Tight all loose connections. Use Teflon tape if required.
3.	Foul Odour or Bad Taste of Water	1. Check and replace Carbon filter. 2. Discard water if it is left in the storage tank for more than 15 days and clean it.
4.	Auto Shut-Off Failure	Check floats valve and microswitch. If not working smoothly replace them.
5.	Low Water Flow or Storage Tank Taking More Time to Fill	Check all filters one by one. The filters which are choked need to be cleaned or replaced
6.	Vibrations or Noise	1. Fix all connecting pipes &electric wires tightly 2. Check pump. If loose, fix it tightly with the unit. 3. If noise still continued, repair or replace the pump
7.	Excess Amount of Reject Water	Check RO membrane and replace it

To ensure the health & safety of your family and to keep your water purifier running in good condition for longer, you must take very good care of your water purifier.

INTEXT QUESTIONS 7.1

1. If the water purifier not working, then which part may be faulty
   (a) Electrical supply
   (b) SMPS
   (c) Choked filter
   (d) Any of them
2. The foul Odour or Bad Taste of Water can removed by
   (a) replace Carbon filter
   (b) cleaning the water tank
   (c) by replacing SMPS
   (d) a and b
3. If the auto-shut-off is not working properly then either ___ or _____ is faulty.
4. If the water purifier is producing vibrations or noise, then it is possible that
   (a) connecting pipes & electric wires are loose
   (b) The pump is not tightly fixed.
   (c) a or b
   (d) None of them
5. What is the remedy if water flow is low or storage tank taking more time to fill?

7.5 ESTIMATION AND REPAIR OF FAULTY COMPONENTS OF THE INSTALLED WATER PURIFIER UNIT.

Cost estimation of the faulty part and service charge

One of the very important parts of repair and troubleshooting is cost of repair. Considering the nature of fault, condition and age of the WPS, quality of the available supply water and daily requirement of drinking water technician is expected to give best advice to the customer.

The price of the faulty or degraded part of genuine/ original equipment manufacturer (OEM) and other market available compatible parts must be conveyed. Thereafter let the customer to do self cost analysis and take a own decision for the job to be done.

Depending upon the need and decision of the customer customised maintenance plan may also offered along with their reasonable cost.

The technician must follow the organisational practices, policies and ethics during the job.

7.5.1 Procedure for providing services to the customers

Servicing procedure involves identification of faulty part of the WPS, the technician must convey the customer about the different quality of spare parts available in the market along with their price. It is also expected to convey the pro and cons of the spare parts available. The customer must be well informed so that he can take wise decision to get the repair work done.

The technician must also convey his own service/ labour charges for the work to be done well in advance. If it includes any warranty of the part then that must also be conveyed.

Only after taking the consent of the costumer the technician is supposed to perform the replacement work. After repair/ replacement it is mandatory to operate the system for reasonable period.

The verification of the repair work is very important and must meet customer satisfaction. If verification process requires long waiting time for the technician(for example the technician says that the water should be used for after two times draining the tank), then technician must ensure the customer that if he goes after repairing of work and fault still persists he should do the job free of cost.

Steps of procedure to be followed:

- **Customer complaint registration-** Normally customer makes call to report the problem they are facing with their purifier unit. It is always desirable to allot a complaint registration number/ ticket no. for quick future reference.
- **Nature of Problem noted by customer care centre -** While attending a customer call it is mandatory to enquire and note down the precise nature of problem with the purifier unit.
- **Convey the visiting charges -** It is necessary to convey minimum visiting charges to be paid at time of registering complain and also the additional cost of spare parts if need to be replaced .

- **After consent visit the location at mutual agreed time-** It is always a good practice to reach the customer location on time. And if there is a delay or change in reaching time then that should be immediately
- **Check the documents of the unit warranty card /ACMC / AMC card and OW (out of warranty)-** Before initiating the job it is mandatory to check the warranty card /ACMC / AMC. (Annual Maintenance card).

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CUSTOMER'S NAME & ADDRESS

MODEL :

DATE OF INSTALLATION OR AMC :

TDS :

* (For R.O. Systems only)

* I/We agree to the.....terms and conditions of the Service Contract mentioned above of the receipt.

WARRANTY/CONTRACT DETAILS :

Customer's Signature

FROM _____ TO _____

PHONE NO. _____ FROM _____ TO _____

MOBILE NO. _____ FROM _____ TO _____

MOBILE NO. _____ FROM _____ TO _____

Visit Date	Visit Time	Purpose of Visit (Specify)	Parts Replaced, if any (Specify)	Amount Charged	Membrane Name & S.No.	Customer's Signature	Technician Signature

Figure 7.4 : Annual Maintenance card

- **Check / diagnose the onsite installed unit-** With due care proper diagnosis of water purifier unit is to be done.
- **Report the fault to the customer -** After identifying the fault, the faulty part must be shown to the customer.
- **Give detailed service estimate to the customer-** Convey the customer about the total estimated cost in simple language
- **After approval carry out the repair and replacement work-** Complete the repair task in the best possible manner.
- **Prepare final service bill to the customer-** service bill is very important as if the same problem again arise within short period then that need to be resolved free of cost.

- **Verification of repair work-** After completion of repair work then for the customer's satisfaction ensure him/her to do repair work free of cost if same fault repeat within 30 days.

Registration of complain Note down -
1. Nature of Problem
2. Address & Contact No.

↓

- Convey visiting charges
- Fix visiting day & Time

↓

At site - check warranty card / invoice

↓

Diagnose the problem & report the fault & its solution

↓

Convey total estimated cost

↓

Carry out repair/ replacement task & restore the normal functioning of unit

↓

Prepare & Provide Service Bill

↓

Verify the Repair/ Replacement task

↓

Make a feedback call after one week

Figure 7.4 : Flowchart for the procedure

INTEXT QUESTIONS 7.2

1. Is it necessary to ask for warranty card/ bill- invoice at the time of registering complain ? (Yes or No).
2. Is it necessary to convey minimum visiting charges to be paid at time of registering complain ? (Yes or No).
3. Is it necessary to convey the estimated cost of repair to the customer? (Yes or No).
4. Is it necessary to take consent of the customer before initiating repair work? (Yes or No).
5. Is it necessary to give final service bill to the customer? (Yes/ No)

WHAT YOU HAVE LEARNT

1. Identify the meaning of troubleshooting.
2. Identify the faults in the function of the water purification system.
3. Find out the causes of faults in water purification system.
4. Illustrate the need of replacement of faulty part of water purification system (case study).
5. Perform the repair/ replacement work properly.
6. Successfully bring back the system to its normal working condition.

TERMINAL QUESTIONS

1. What do you understand by troubleshooting?
2. Explain different types of faults which occurs in water purifier systems.
3. What will you do if water purifier systems is not working.
4. Explain how to register a customer complaint for the fault in water purifier systems.
5. Explain how to calculate and give budget estimation to the customer for the repair of water purifier systems.
6. Demonstrate the conversation between a customer and water purifier system technician related to registering complain.

ANSWERS TO INTEXT QUESTIONS

7.1

1. (d)
2. (a)
3. Float valve or Micro switch
4. (c)
5. Check and replace choked filters if any

7.2

1. No
2. Yes
3. Yes
4. Yes
5. Yes

Key Learning Outcomes

Being able to :

- Demonstrate effective communication skills to interact with customers and efficiently identify problems in a drinking water purifier system.
- Analyze and determine the nature of faults in a WPU by employing systematic diagnostic techniques.
- Accurately identify and isolate the specific faulty part responsible for the malfunctioning of the drinking water purifier system.
- Perform effective troubleshooting techniques to address identified faults and restore the proper functioning of the drinking water purifier system.
- Exhibit customer-centric attitudes and skills to provide a high level of customer satisfaction throughout the repair process.

8

PLANNING AND ADOPTING A SYSTEMATIC APPROACH

8.1 INTRODUCTION

Efficient wastewater purification is a critical aspect of environmental stewardship and sustainable resource management. As societies grapple with increasing water demands and the growing challenge of water pollution, it becomes imperative to adopt strategic approaches that minimize the environmental impact of wastewater treatment. One key aspect of this endeavor involves tailoring purification systems to the specific level of impurities present in the wastewater. This nuanced approach recognizes that not all wastewater is created equal, and a customized strategy can significantly enhance both the effectiveness of purification processes and the conservation of valuable resources. In this exploration, we delve into the importance of calibrating wastewater treatment methods based on the varying levels of impurities, aiming to strike a balance between environmental responsibility and efficient resource utilization.

8.2 LEARNING OBJECTIVE

After reading this lesson learner will be able to:

- Explain the importance of resource utilization.
- Discuss the environmental impact of inefficient resource usage in water purification industry.

8.3 SIGNIFICANCE OF EFFICIENT RESOURCE UTILIZATION IN WATER PURIFIER UNITS

Efficient resource utilization in water purification systems is of significant importance for several reasons:

Resource Conservation	Cost Savings	Environmental Impact	Water Scarcity Mitigation
Energy Efficiency	Flexibility	Safeguarding public health	Regulatory Compliance

In summary, efficient resource utilization in water purification systems not only contributes to cost savings and environmental protection but also plays a crucial role in ensuring a sustainable water supply, protecting public health, and meeting regulatory requirements. It is important for facing the challenges caused by water scarcity, climate change, and increasing global water demand.

8.4 RESOURCES INVOLVED IN WATER PURIFICATION SYSTEM

let's study in detail the various resources involved in water purification systems, including water, energy, filters, and maintenance components:

Water

Source Water: The raw water that is extracted from rivers, lakes, wells, or reservoirs and serves as the input for the treatment process.

Treated Water: The final product of the purification process, which is clean and safe for various uses, such as drinking, industrial processes, and irrigation.

Energy

Electrical Energy: Power is required for pumps, motors, and control systems to move and treat water. The energy demand can vary significantly depending on the size and complexity of the water treatment facility.

Chemicals: Beside filters used in domestic water purifier systems, chemicals are also used for treating water in commercial water purifier system.

Coagulants and Flocculants: These chemicals are added to raw water to facilitate the removal of suspended particles by causing them to clump together (coagulation) and form larger particles (flocculation).

Disinfectants: Chlorine, chloramines, ozone, and UV light are examples of disinfectants used to kill or inactivate harmful microorganisms.

pH Adjusting Chemicals: Acids or bases are used to control and optimize the pH levels of the water for various treatment processes.

Anti-scalants and Antifouling Agents: These chemicals help prevent scale formation and fouling in equipment like membranes and pipes.

Filters and Membranes

Sand Filters: Used for the physical removal of suspended particles and impurities from water.

Activated Carbon Filters: Effective at adsorbing organic compounds, chlorine, and other contaminants.

Membranes (e.g., Reverse Osmosis, Ultrafiltration): Employed for separating dissolved solids, microorganisms, and other pollutants from water.

Maintenance Components

Replacement Parts: Includes items like seals, gaskets, and valves that may wear out and need periodic replacement.

Cleaning Agents: Chemicals used for cleaning and maintaining equipment and membranes.

Lubricants: Essential for the proper functioning of pumps, motors, and moving parts in the treatment system.

Instrumentation: Sensors and monitors for measuring water quality parameters, such as turbidity, pH, and disinfectant levels, TDS and for ensuring the system operates within desired parameters.

Skilled Labour: Trained personnel are required for routine maintenance, inspections, and troubleshooting to ensure the system's reliability and efficiency.

Efficient management of these resources is critical for optimizing the performance of water purification systems. It not only reduces operational costs but also minimizes waste, conserves water, and contributes to the sustainability of water treatment processes. Additionally, resource-efficient practices help extend the lifespan of equipment and reduce the environmental impact associated with water purification.

8.4.1 Environmental Impact of Inefficient Resource Usage in Water Purification

Efficient resource usage in water purification not only reduces these environmental impacts but also helps water treatment facilities operate more cost-effectively, ensuring the sustainability of water supply systems and protecting public health and the environment.

Lower Operational Costs	Inefficient systems require less resources, such as energy and chemicals, leading to increased operational expenses for water treatment facilities.
Maintenance and Repairs	Inefficient systems often experience more frequent breakdowns and require extensive maintenance, leading to higher maintenance and repair costs.

8.4.2 Benefits of Optimal Utilisation of Resources

1. **Energy Efficiency**

   Lower Energy Bills: Energy-efficient practices reduce energy consumption, resulting in lower utility bills and operational costs.

   Reduced Carbon Emissions: Reduced energy usage leads to a lower carbon footprint, contributing to efforts to combat climate change.

2. **Water Conservation:**

   Extended Water Availability: Water conservation helps ensure a sustainable and reliable water supply, crucial for both human needs and ecosystems.

   Mitigation of Water Scarcity: In regions facing water scarcity, conservation practices are essential for managing this precious resource efficiently.

3. **Reduced Waste Generation**

   Less Waste Disposal Minimizing waste generation reduces the costs and environmental impact associated with waste disposal and landfill use.

   Resource Recovery: Some waste reduction efforts involve recycling or reusing materials, which can further save resources and costs.

4. **Longer Equipment Lifespan**

   Maintenance Savings: Proper resource management, such as regular equipment maintenance and cleaning, extends the lifespan of machinery and reduces replacement costs.

   Operational Reliability: Efficient resource utilization contributes to the reliability and performance of equipment and systems, reducing downtime and repair costs.

5. **Regulatory Compliance**

   Avoid Penalties: Many regulations and environmental standards require resource-efficient practices. Compliance avoids potential fines and legal issues.

6. **Competitive Advantage**

   Market Position: Demonstrating a commitment to sustainability can enhance a company's reputation and appeal to environmentally-conscious consumers and investors.

   Innovation: Embracing resource conservation often drives innovation, leading to the development of more efficient technologies and processes.

8.5 SELECTION OF WATER PURIFIER UNITS BASED ON THE SPECIFIC QUALITY OF WATER

Customizing water purifier units based on the specific quality of water at the workplace is essential for several important reasons.

There are various **technologies and filtration methods available to address specific water quality concerns based** on the contaminants or issues present in the water. Here are some common technologies and methods for addressing specific water quality concerns:

Bacterial Contamination

Chlorination: Chlorine is added to water to disinfect and kill bacteria, viruses, and other microorganisms.

Ultraviolet (UV) Disinfection: UV light is used to inactivate bacteria, viruses, and other pathogens in water.

Chemical Contaminants

Activated Carbon Filtration: Activated carbon adsorbs organic chemicals, including pesticides and solvents.

Reverse Osmosis (RO): RO membranes can remove a wide range of contaminants, including heavy metals, salts, and some organic compounds.

Ion Exchange: Ion exchange resins can remove specific ions like lead, calcium, and magnesium.

Coagulation and Flocculation: Chemicals are added to water to form flocs that capture and settle out contaminants for removal.

Advanced Oxidation Processes (AOPs): AOPs like ozone or hydrogen peroxide combined with UV can break down and remove various organic pollutants.

Nutrient Pollution

Biological Nutrient Removal (BNR): BNR processes use bacteria to remove nitrogen and phosphorus from wastewater before it enters natural water bodies.

Constructed Wetlands: Wetlands can be engineered to naturally remove nutrients from water through plant and microbial processes.

Dissolved Oxygen Depletion

Aeration: Aeration systems introduce oxygen into water to increase DO levels and support aquatic life.

Oxygenation: (In cases of severe hypoxia) Oxygen can be directly injected into water bodies to raise DO levels.

Radon

Aeration: Radon can be removed from water by exposing it to air, allowing the radon to escape.

Activated Carbon Filtration: Activated carbon filters can also remove radon.

Sulfate and Hydrogen Sulfide

Aeration: Aeration can help remove hydrogen sulfide gas by allowing it to escape into the air.

Chemical Precipitation: Chemicals can be added to water to precipitate sulfates.

TDS and Hardness

Ion Exchange: Ion exchange can reduce hardness by removing calcium and magnesium ions.

Distillation: Distillation can be used to remove TDS by boiling water and condensing the vapor.

Turbidity

Coagulation and Flocculation: These processes can be used to settle out suspended particles.

Filtration: Rapid sand filters or multimedia filters can remove particles causing turbidity.

pH value should be between 6.5 to 8.5

Chemical Adjustment: Acids or bases are added to water to adjust pH to acceptable levels.

Chlorine Residual

Dechlorination: Activated carbon filters or chemical dechlorination methods can remove excess chlorine.

It's important to note that the choice of technology or method depends on the specific water quality issue, the level of contamination, the water source, and the intended use of the water. Water treatment plants often employ a combination of these methods to address multiple contaminants and ensure safe and high-quality drinking water. Additionally, regular monitoring and testing are essential to determine the effectiveness of treatment and to make any necessary adjustments to maintain water quality within regulatory limits.

INTEXT QUESTIONS 8.1

1. What is the primary objective of efficient resource utilization in water purification systems?

   a) Maximizing water usage

   b) Minimizing resource wastage

   c) Increasing water temperature

2. What benefit does efficient resource utilization in water purification systems offer?

   a) Higher water pollution

   b) Lower operational costs

   c) Increased resource consumption

3. Which of the following is NOT a resource commonly used in water purification systems?

   a) Chemicals

   b) Electric Energy

   c) Heat

4. What resource is typically used for physical filtration in water purification?

   a) Solar energy

   b) Sand and gravel

   c) Wind power

5. Inefficient resource usage in water purification systems can lead to:

   a) Higher environmental impact

   b) Lower operational costs

   c) Reduced water quality

8.6 OPTIMAL USE OF ENERGY/ELECTRICITY AT WORK

8.6.1 Optimal use of Energy

Optimal use of energy in the water purifier industry is not only important for reducing operational costs but also for minimizing environmental impact and promoting sustainability. Here are some strategies and practices for achieving the optimal use of energy in this industry:

- **Energy-Efficient Technologies:** Invest in energy-efficient components and technologies. Use high-efficiency pumps, motors, and compressors in the purification process. Additionally, explore advanced filtration methods like reverse osmosis and UV purification, which can be more energy-efficient than traditional methods.
- **Energy Management Systems:** Implement energy management systems that monitor and control energy consumption in real-time. These systems can help identify areas where energy is being wasted and make automatic adjustments to optimize energy use.
- **Solar Power:** Consider incorporating solar panels or other renewable energy sources to power water purification processes. Solar energy can significantly reduce energy costs and greenhouse gas emissions associated with the operation of water purifiers.
- **Energy-Efficient Designs:** When designing new water purification systems or upgrading existing ones, prioritize energy efficiency. Ensure that the layout and configuration of the equipment minimize energy loss and reduce the need for excessive pumping or heating.

- **Variable Frequency Drives (VFDs):** Install VFDs on pumps and motors to adjust their speed based on the actual demand. This prevents overuse of energy during periods of low demand, leading to substantial energy savings.
- **Regular Maintenance:** Implement a comprehensive maintenance schedule for all equipment. Regular maintenance ensures that equipment operates at peak efficiency, reducing energy consumption and extending the lifespan of machinery.
- **Energy Audits:** Conduct regular energy audits to identify areas where energy efficiency can be improved. Engage with energy experts to assess your facility's energy performance and recommend improvements.
- **Employee Training:** Train your employees on energy-saving best practices. Encourage a culture of energy conservation within your organization. Employees should be aware of the impact of their actions on energy use.
- **Monitoring and Benchmarking:** Continuously monitor energy consumption and benchmark your facility's energy performance against industry standards. This will help you set targets for energy reduction and track progress over time.
- **Water Recovery:** Implement water recovery systems to recycle and reuse water wherever possible. Treating and purifying water typically requires a significant amount of energy, so reducing the amount of water that needs treatment can lead to energy savings.
- **Government Incentives:** Explore government incentives and subsidies for adopting energy-efficient technologies. In some regions, there may be financial incentives to encourage businesses to reduce their energy consumption.

By implementing these strategies and fostering a culture of energy efficiency within your organization, the water purifier industry can optimize energy use, reduce operational costs, and contribute to a more sustainable and environmentally friendly future.

8.6.2 Regular maintenance to enhance the lifespan of the system and minimize the need for frequent replacements

Regular maintenance is a fundamental practice to ensure the longevity and optimal performance of any system or equipment. By routinely inspecting, servicing, and addressing any potential issues, individuals and organizations can significantly extend the lifespan of their systems while simultaneously reducing the frequency of replacements. This proactive approach not only saves valuable resources but also minimizes downtime and disruptions caused by unexpected breakdowns. Regular maintenance serves as a

cost-effective investment in the reliability and efficiency of systems, reinforcing the principle that prevention is often more efficient and economical than reacting to problems as they arise. In essence, it's a responsible and prudent strategy to safeguard the integrity and longevity of any system, be it in the realm of technology, machinery, or infrastructure

8.6.3 Customization of the water purifier units

Customizing a water purifier unit is a pivotal step towards ensuring that the water we consume is of the highest quality, meeting our specific needs and preferences. In this process, selecting the appropriate filter types, capacities, and maintenance schedules plays a crucial role in achieving the desired water quality.

The first step in customizing a water purifier unit is to choose the **right filter types.** This decision hinges on the impurities present in the water supply. For instance, activated carbon filters excel at removing chlorine, odors, and organic contaminants, making them ideal for improving taste and odor. On the other hand, reverse osmosis filters are highly effective in removing heavy metals, salts, and microorganisms, providing a deeper level of purification. Selecting the right filter type ensures that the specific contaminants in your water source are effectively targeted, resulting in water that not only looks and tastes better but is also safer to consume.

The **capacity** of the water purifier is another critical factor. It should be tailored to your household's water consumption. A family with more members or higher water usage will require a larger capacity to ensure a continuous supply of clean water. Adequate capacity prevents the system from getting overwhelmed and maintains its efficiency, ensuring you always have access to purified water without any compromise.

Equally important is setting up a **maintenance schedule** that suits your lifestyle and usage. Regular maintenance, including filter replacement and system cleaning, is essential to keep the purifier operating at peak performance. Customize a schedule that aligns with your usage patterns and ensures that you never run the risk of consuming water that falls short of your desired quality standards.

In conclusion, customizing a water purifier unit is a proactive step towards safeguarding the quality of the water you consume daily. By carefully selecting filter types, capacities, and maintenance schedules, you can fine-tune the system to meet your unique requirements. This not only guarantees a consistent supply of pure, clean water but also contributes to your overall health and well-being, ensuring that you and your family can hydrate with confidence and peace of mind.

INTEXT QUESTIONS 8.2

1. What is a potential cost implication of inefficient resource usage in water purification?
   a) Reduced maintenance costs
   b) Increased energy savings
   c) Higher operational expenses
2. How does resource conservation benefit water purification systems?
   a) It reduces water pollution
   b) It decreases resource availability
   c) It increases operational costs
3. Which of the following is a benefit of conserving energy in water purification?
   a) Increased greenhouse gas emissions
   b) Lower operational costs
   c) Improved water quality
4. Why is it important to customize water purifier units?
   a) To match the interior decor
   b) To optimize performance for specific water conditions
   c) To increase energy consumption
5. What can customizing water purifier units help address?
   a) Resource efficiency
   b) Noise pollution
   c) Air quality

TERMINAL QUESTIONS

1. What are the key objectives of efficient resource utilization in water purification systems?
2. What are the different resources involved in water purification systems?
3. What are the environmental consequences and cost implications of inefficient resource usage in water purification systems?

4. What are some benefits of conserving resources in water purification systems?

5. Why is it important to customize water purifier units for specific applications or locations?

ANSWERS TO INTEXT QUESTIONS

8.1

1. b) Minimizing resource wastage
2. b) Lower operational costs
3. c) Heat
4. b) Sand and gravel
5. a) Higher environmental impact

8.2

1. c) Higher operational expenses
2. a) It reduces water pollution
3. b) Lower operational costs
4. b) To optimize performance for specific water conditions
5. a) Resource efficiency

Key Learning Outcomes

Being able to :

- Identify the various resources involved in water purification systems.
- Interpret environmental impact and cost implications of inefficient resource usage.
- Illustrate the benefits of conserving resources.
- Carry out customization of water purifier units.

9

USE OF TECHNOLOGY FOR WASTE MANAGEMENT

9.1 INTRODUCTION

There is a need to use technology driven solution to minimize the waste.In a water purifier unit mainly following waste is to be minimized or reutilized-: waste or reject water, parts of old water purifier unit and electricity.

Discarded water from a water purifier unit often referred to as "reject water" or "waste water," can be reutilized in various ways. To minimize water wastage a technician should suggest his/her customer to make more efficient use of the reject water. This lesson includes methods for utilizing discarded water from a purifier unit. Also energy efficiency in water purifier systems is significant due to rising electricity costs. This lesson also highlights energy-saving electrical components. In this lesson some technology-driven waste management solutions are introduced which can be adopted for disposing of discarded filters and non-biodegradable parts from water purifiers.

9.2 LEARNING OBJECTIVE

After reading this lesson learner will be able to:

- Understand the importance of reutilizing the reject water from water purifier unit.
- Explain the different methods to use waste water from the water purifier unit.
- Explain the process of disposal of waste parts of a water purifier unit as per the industry approved standards.

9.3 DIFFERENT METHODS FOR UTILIZATION OF DISCARDED WATER FROM A PURIFIER UNIT.

The rejected water from a water purifier should not be drained but it should be utilized in various ways as explained below:

1. **Plant Watering:**

   Use the discarded water to water indoor or outdoor plants. This is one of the most common and practical ways to reuse the water.

2. **Cleaning and Household Chores:**

   Utilize the reject water for cleaning tasks like mopping floors, washing cars, or flushing toilets. This reduces the demand on your main water supply.

3. **Pet's Water Bowl:**

   Rejected water can be given to your pets, such as dogs or cats, as drinking water. Ensure that the water is safe for them to consume.

4. **Cooking and Boiling:**

   Use the reject water for cooking, especially for boiling vegetables or pasta. It's safe for this purpose as long as the water quality is suitable.

5. **Dishwashing:**

   Use the waste water to pre-rinse dishes before loading them into the dishwasher(or manual cleaning with tap water). This can save a significant amount of water.

6. **Irrigation System:**

   Install a drip irrigation system in your garden and use the discarded water to irrigate your plants. This method is more water-efficient than traditional hose watering.

7. **Reserve for Emergency Use:**

   Store the rejected water in clean containers for emergency purposes, like for flushing toilets during water shortages.

8. **Household Cleaning Products:**

   Dilute the discarded water to create cleaning solutions. For instance, you can use it to make homemade cleaning products.

9. **Recharge Groundwater:**

   If local regulations allow it, you can consider directing the waste water to recharge groundwater or a nearby water body, but ensure it does not contain harmful contaminants.

10. Greywater System:

Implement a greywater system (Greywater is water that has been used for washing dishes, laundering clothes, or bathing) that collects and treats waste water from various household sources, including your water purifier, for use in non-potable applications. Greywater systems are more sophisticated and require proper design and maintenance.

11. Community or Local Initiatives:

If you're in a community setting, explore the possibility of collectively using discarded water for community gardens, cleaning public spaces, or other shared purposes.

12. Donation or Sharing:

Donate the discarded water to neighbours, especially if you live in an area with water scarcity issues.

Remember that the quality of the rejected water depends on your purifier unit and the source water quality. It's essential to ensure that the discarded water is safe for the intended purpose and doesn't contain contaminants that could be harmful. Also, be aware of local regulations and guidelines regarding the use of waste water.

9.4 ENERGY EFFICIENT ELECTRICAL PARTS

Now a days as electricity cost is increasing day by day, the necessity of using more efficient electrical parts such as transformer power supply which consumes more power may be replaced by SMPS (switch mode power supply) which is an electronic circuit hence uses less power. Booster pump of 5 star rating also uses less electrical power than conventional old booster pumps. It is pertinent to mention that power consumtion or 2 star rating electrical part will be more than 3,4 or 5 star rating electrical parts of water purifier unit. More stars means more efficient, when compared to other models of a similar size and features.

The more stars shown on the Energy Rating Label, the less energy the product will use and the more money you will save on your energy bills.

Most products are given between 1 and 6 stars.

The adoption of more energy efficient electrical parts will help to achieve effective resource utilization. You as a technician should keep yourself updated with the knowledge of energy efficient electrical parts of water purifier systems available in market so that you can modify old water purifier unit to more energy efficient water purifier unit.

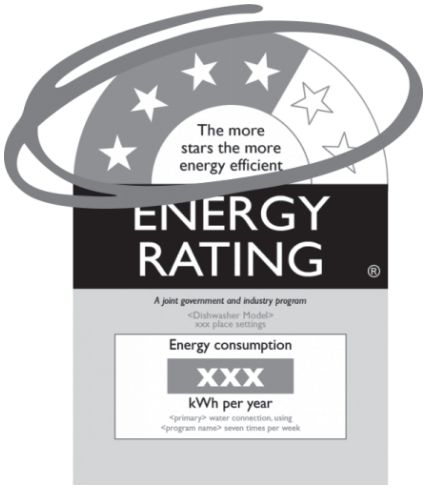

Figure 9.1 : Stars showing energy efficiency

INTEXT QUESTIONS 9.1

1. Name any two methods for utilizing discarded water from a purifier unit.
2. Is rejected water is safe for drinking? (Yes or No)
3. Rejected water from purifier cannot be used again.(True or False)
4. Watering the plants can be done by using rejected water?(True or False)
5. 5 star rating electrical part consumes more power than 2 star rating part. (True or False)

9.4 PROCESS OF WASTE DISPOSAL AS PER INDUSTRY APPROVED STANDARDS

In the previous section you have studied how to use the waste water from the water purifier in more effective ways. Now after maintenance and regular service the filters have to be replaced. It's a real problem how to dispose of these discarded filter and other non-biodegradable parts.

Plastic part of the filter can be recycled and the filter material if made from biodegradable material can be disposed off using the standard decomposing procedure i.e composting, landfills, recycling, incineration, and sewage treatment. Let us discuss various type of technology-driven waste management solutions.

Technology-driven waste management solutions have become increasingly important in our modern world to address the growing challenges of waste generation, disposal, and environmental sustainability. These solutions leverage various technologies to optimize waste collection, recycling, and disposal processes, making them more efficient

and environmentally friendly. Here are some technology-driven waste management solutions:

1. Smart Waste Bins:

Smart waste bins equipped with sensors can detect the level of waste and transmit data to waste collection teams, optimizing collection routes and reducing unnecessary pickups.

Figure 9.2 : Smart bin

2. Waste Sorting and Recycling Technologies:

Automated sorting and recycling technologies, such as conveyor belts, robotics, and AI, help separate recyclables from non-recyclables more efficiently in recycling facilities.

3. Waste-to-Energy (WtE) Plants:

These facilities use advanced technologies to convert non-recyclable waste into energy, such as electricity or heat, reducing the volume of waste in landfills and generating sustainable power.

4. Blockchain for Waste Tracking:

Blockchain technology can be used to create transparent and immutable records of waste movements, ensuring that waste is properly tracked, disposed of, or recycled, reducing the risk of illegal dumping.

5. Waste Analytics and Predictive Modeling:

Data analytics and machine learning can be employed to analyze historical data and predict waste generation patterns, allowing for better planning of waste collection and resource allocation.

6. Mobile Apps for Waste Collection:

Mobile apps enable users to schedule waste pickups, report issues, and access information on recycling and disposal, making it more convenient for residents to participate in waste management efforts.

7. Sensor Networks for Landfill Management:

IoT sensors placed in landfills can monitor factors like temperature, gas emissions, and groundwater quality, providing real-time data for better landfill management and environmental protection.

8. Composting Technologies:

High-tech composting systems can process organic waste into nutrient-rich compost more efficiently, reducing the environmental impact of organic waste disposal.

9. Drones for Waste Inspection:

Drones equipped with cameras and sensors can inspect waste sites, monitor landfill conditions, and detect illegal dumping activities.

10. Electronic Waste (E-Waste) Recycling:

Advanced technologies are used to disassemble and recycle electronic waste, safely recovering valuable materials like metals and reducing environmental hazards.

11. Biological Waste Treatment:

Technologies like anaerobic digestion and aerobic composting can efficiently process organic waste, reducing greenhouse gas emissions and producing valuable byproducts.

12. Reverse Vending Machines:

These machines reward users for recycling by offering incentives or discounts for returning empty bottles and containers, encouraging recycling.

13. Waste Reduction Apps:

Mobile apps and platforms offer tips and guidance on reducing waste through sustainable practices, helping individuals and businesses minimize their environmental footprint.

14. Waste-to-Resource Technologies:

Innovative solutions aim to convert waste materials into valuable resources, such as turning plastic waste into construction materials or converting food waste into biofuels.

Technology-driven waste management solutions are crucial for addressing the environmental and social challenges posed by increasing waste generation. These innovations can enhance resource efficiency, reduce pollution, and promote a more

sustainable approach to waste handling and disposal.

INTEXT QUESTIONS 9.2

Fill in the blank.

1. Smart dustbins are equipped with _____
2. Plastic part of filter can be _____
3. Plastic parts of filter are non- _____.
4. _____ can be used for waste inspection.
5. WtE stands for _____.

INTEXT QUESTIONS 9.3

1. What type of technology-driven waste management solution uses sensors to optimize waste collection routes?
2. Which technology converts non-recyclable waste into energy?
3. What technology can efficiently process organic waste, reducing greenhouse gas emissions?

WHAT YOU HAVE LEARNT

- There is a need to use technology driven solution to minimize the waste.
- In a water purifier unit mainly following waste is to be minimized or reutilized-: waste or reject water, parts of old WPU and electricity.
- Waste water from the WPU drainage can be utilized for various purpose other than direct drinking such as:Plant Watering, household cleaning, dishwashing, irrigation etc.
- The adoption of more energy efficient electrical parts will help to achieve effective resource utilization. The parts having 5-star rating are more energy efficient than no rating.
- Technology driven waste management solutions-:Smart Waste Bins, Waste Sorting and Recycling Technologies, Waste-to-Energy (WtE) Plants, Blockchain for Waste Tracking, Mobile Apps for Waste Collection, Sensor Networks for Landfill Management, Composting Technologies, Drones for Waste Inspection, Electronic Waste (E-Waste) Recycling etc.

TERMINAL QUESTIONS

1. Name various methods of utilising waste water from a water purifier unit and explain any one of them.
2. What are the various methods of waste management techniques based on latest technology.
3. Explain Grey water system.
4. Explain in brief waste to resource technologies.

ANSWERS TO INTEXT QUESTIONS

9.1

1. Plant watering and dish washing
2. No
3. False
4. True
5. False

9.2

1. Sensors
2. Recycled
3. Biodegradable
4. Drones
5. Waste to energy

9.3

1. Smart Waste Bins.
2. Waste-to-Energy Plants.
3. Technologies like anaerobic digestion and aerobic composting.

Key Learning Outcomes

Being able to :

- Illustrate the significance of minimizing the waste of Water Purification Units.
- Suggest various methods for utilizing wastewater from water purifier unit.
- Acquaint with different methods for disposing of waste parts of a water purifier unit in accordance with industry-approved standards.

10

MAINTAIN SAFETY AT WORKPLACE

10.1 INTRODUCTION

In today's rapidly evolving world, ensuring the safety and well-being of individuals is paramount, especially when it comes to the operation of essential systems such as water purifiers. It is crucial to recognize the importance of employing safety and precautionary measures during the operation of these water purification systems. This short guide aims to underscore the significance of adhering to safety guidelines to not only optimize the performance of water purifiers but also to safeguard the health and safety of those interacting with them. By adopting a proactive approach to safety, users can create a harmonious balance between technological advancements and the well-being of consumers of water purification systems.

10.2 LEARNING OBJECTIVE

After reading this lesson, learner will be able to:

- State the importance of maintaining high standards of health and safety.
- Elaborate the evacuation procedures for workers and visitors during emergencies
- Discuss the ways to summon medical assistance and emergency services during an emergency
- Discuss the importance of reporting health, safety, and accidents at the workplace.
- Identify a range of safety equipment (PPE).

10.3 SAFETY STANDARD NORMS

Safety standards can vary widely depending on the industry, product, or process they apply to. Some common safety standards include:

Occupational Safety and Health Administration (OSHA) Standards: In the United States, OSHA sets safety and health standards for workplaces. These standards cover a wide range of topics, including hazard communication, personal protective equipment (PPE), electrical safety, and more.

ISO 9001: ISO 9001 is an international standard for quality management systems. While it's not primarily a safety standard, it includes elements related to safety, such as risk management and continual improvement, that can help organizations enhance safety.

ISO 14001: ISO 14001 is an international standard for environmental management systems. It addresses environmental aspects and impacts, which can indirectly affect safety by reducing environmental risks.

ANSI/ASSE Z490.1: This American National Standard provides guidelines for developing, implementing, and managing an effective occupational safety and health management system (OSHMS).

NFPA Standards: The National Fire Protection Association (NFPA) develops standards related to fire safety, electrical safety, and more. For example, NFPA 70 (National Electrical Code) outlines electrical safety standards.

ASTM International Standards: ASTM develops standards for a wide range of materials, products, and processes. These standards can include safety-related specifications for various industries.

IEC Standards: The International Electrotechnical Commission (IEC) creates international standards for electrical and electronic equipment. These standards ensure the safety and compatibility of these products.

ANSI Standards: The American National Standards Institute (ANSI) publishes safety standards for a variety of industries and processes. These standards cover areas such as machine safety, fall protection, and more.

NIOSH Guidelines: The National Institute for Occupational Safety and Health (NIOSH) provides guidelines and recommendations for occupational safety and health, particularly in the context of worker safety.

10.4 SAFETY PRECAUTIONS TO BE TAKEN WHILE WORKING ON WATER PURIFICATION UNITS

Safety and precautions are crucial considerations when it comes to setting up both domestic and commercial water purifier systems. Failure to adhere to proper safety measures can result in health risks, equipment damage, and other problems. Here are some common safety and precautionary issues related to water purifier system setups in domestic and commercial settings:

1. **Electrical Safety**

   Problem: Many water purifier systems require electrical components such as pumps and UV lamps, which can pose electrical hazards if not installed correctly.

   Precaution: Ensure that the electrical connections are made by qualified technicians, use waterproof outlets, and regularly check for any exposed wires or damaged components.

2. **Water Contamination**

   Problem: Poorly installed or maintained systems can inadvertently introduce contaminants into the purified water.

   Precaution: Regularly inspect and replace filters and membranes, follow manufacturer guidelines for maintenance, and conduct water quality tests periodically.

3. **Chemical Exposure**

   Problem: Mishandling of cleaning and disinfection chemicals can lead to chemical exposure, which can be harmful.

   Precaution: Use appropriate personal protective equipment (PPE) when handling chemicals, strictly follow the manufacturer's instructions for chemical use, and store chemicals safely.

4. **Bacterial Growth**

   Problem: Stagnant water within the system or improper cleaning can promote bacterial growth.

   Precaution: Regularly flush the system, clean components, and disinfect as recommended by the manufacturer.

5. Pressure-related Hazards

Problem: High water pressure in commercial systems can pose a risk if not properly regulated.

Precaution: Install pressure-reducing valves and pressure relief devices to maintain safe operating pressures.

6. Leakage and Water Damage

Problem: Leaks in water purifier systems can lead to water damage to the surrounding area and equipment.

Precaution: Regularly inspect for leaks, use high-quality hoses and connectors, and place a drip tray or sensor alarm under the system.

7. Contaminated Inlet Water

Problem: If the inlet water source is contaminated, it can affect the efficiency of the purifier.

Precaution: Test the quality of the inlet water source and install pre-filtration systems if necessary.

8. Chemical Residue

Problem: Improper rinsing of chemicals during maintenance can leave chemical residues in the water.

Precaution: Thoroughly rinse and flush the system after any chemical treatments to ensure there are no residues left behind.

9. Improper Installation

Problem: Incorrect installation can lead to system inefficiency and safety risks.

Precaution: Have water purifier systems installed by certified technicians who follow manufacturer guidelines.

10. Regular Training and Education

Problem: Lack of knowledge among users and maintenance personnel can result in safety issues.

Precaution: Conduct regular training sessions for users and maintenance staff to ensure they understand the proper operation, maintenance, and safety procedures.

In both domestic and commercial settings, adhering to safety protocols and taking precautionary measures is essential to ensure the efficient and safe operation of water purifier systems while minimizing health risks and potential damage. Always refer to the manufacturer's guidelines and seek professional assistance when in doubt about safety practices.

10.5 RANGE OF SAFETY TOOLS AND EQUIPMENT

Working as a drinking water purifier technician involves handling various chemicals, equipment, and processes that may pose health and safety risks. Ensuring the safety of both the technician and the quality of the purified water is crucial. Here is a list of necessary safety tools and equipment for a drinking water purifier technician:

Personal Protective Equipment (PPE)

- Safety goggles or face shield to protect the eyes from chemical splashes.
- Chemical-resistant gloves to protect the hands from contact with chemicals.
- Lab coat or chemical-resistant coveralls to protect clothing.
- Chemical-resistant apron for additional protection.
- Respirator or mask with appropriate cartridges if working with hazardous gases or fumes.
- Steel-toed safety boots to protect the feet from falling objects and spills.

Eye Wash Station and Emergency Shower

- An accessible eye wash station for immediate eye rinsing in case of chemical exposure.
- An emergency shower to rinse the body in case of chemical spills or contamination.

First Aid Kit

- A well-equipped first aid kit to treat minor injuries or chemical exposure.

Chemical Storage and Handling Equipment

- Chemical storage cabinets or shelves to safely store and organize chemicals.
- Chemical-resistant containers for transporting and mixing chemicals.

- Spill containment kits and absorbent materials for quick response to chemical spills.

Fire Safety Equipment

- Fire extinguishers suitable for the types of fires that could occur in the workplace.
- Fire blankets for smothering small fires.

Ventilation and Respiratory Protection

- Adequate ventilation systems to ensure proper air circulation and prevent the buildup of harmful fumes.
- Respirators with appropriate filters for protection against airborne contaminants.

Instrumentation and Testing Equipment

- Water quality testing kits and meters to monitor the effectiveness of the purification process.
- pH meters, turbidity meters, chlorine analyzers, etc.

Tools and Equipment Maintenance

- Lockout/tagout equipment to safely isolate and maintain machinery.
- Hand tools for equipment maintenance and repair.

Safety Signs and Labels

- Proper signage to indicate hazardous areas, emergency exits, and safety instructions.

Training and Documentation

- Safety manuals, standard operating procedures (SOPs), and safety data sheets (SDS) for all chemicals used.
- Employee training programs on safe work practices and emergency procedures.

Emergency Communication

- Access to phones or communication devices for contacting emergency services or supervisors.

Personal Hygiene Facilities

- Handwashing stations or facilities for maintaining personal hygiene.

Protective Barriers and Guardrails

- Safety barriers and guardrails in areas where there is a risk of falling or tripping.

Hazardous Material Storage and Disposal

- Properly labeled hazardous waste containers for safe storage and disposal of waste chemicals.

Safety Inspection and Maintenance Records

- Maintain records of safety inspections, equipment maintenance, and employee training.

Emergency Response Plan

- Develop and regularly review an emergency response plan to address potential incidents.

INTEXT QUESTIONS 10.1

1. What is the correct process for reporting a safety-related issue at your workplace?

   a) Ignore it and hope it goes away

   b) Report it to your immediate supervisor or safety officer

   c) Share it on social media

   d) Keep it to yourself

2. Why is maintaining personal hygiene important at the workplace?

   a) To impress coworkers with your appearance

   b) To avoid being scolded by your boss

   c) To promote a healthy and safe work environment

   d) To save money on personal care products

3. Why is it crucial to follow safety protocols when using electrical household gadgets?

   a) To save energy

   b) To avoid getting caught by the boss

c) To prevent accidents and electrical shocks

d) To make gadgets last longer

10.6 PURPOSE AND USAGE OF WEARING APPROPRIATE PPE AT WORK PLACE

Personal protective equipment, or PPE, is the gear that guarantees users' fundamental health protection and safety. Any appliance or device intended to be worn by a person when exposed to one or more health and safety risks is considered PPE. PPE encompasses all attire and other work-related accessories created to act as a barrier against workplace risks, and its use necessitates user training and hazard awareness. Workers need to understand that the equipment just reduces the risk; exposure will still happen if the device breaks down. Equipment must be correctly fitted and kept in a clean, functional state to lower the likelihood of failure.

Figure 10.1 : Personal Protective Equipment

Employers are expected to do a risk assessment of the workplace to identify any potential dangers that call for the usage of head, eye, face, hand, or foot protection. Employers must choose PPE that is appropriately fitted to protect personnel from these hazards if hazards or the potential of hazards are discovered. Employees must get training prior to performing work that necessitates the use of PPE so they are aware of its limitations, how to wear it, when it is necessary, how to maintain it, and how to dispose of it.

10.7 HAZARDS DUE TO IMPROPER HANDLING OF TOOLS AND EQUIPMENTS

Improper handling of tools and equipment in various industries can lead to a wide range of hazards, potentially resulting in accidents, injuries, and damage to property. Here are some of the hazards that may occur due to the use of incorrect or improper tools and equipment:

Physical Injuries

Using tools that are not designed for a specific task can lead to physical injuries, such as cuts, abrasions, or puncture wounds.

Tools with damaged or worn-out parts, such as frayed cables or dull blades, can cause accidents, including slips, trips, and falls.

Electric Shock

Handling electrical tools and equipment with faulty wiring or insulation can result in electric shock or electrocution.

Using the wrong type of electrical plug or outlet can also pose electrical hazards.

Fire and Explosions

Inappropriate tools or equipment in flammable environments can lead to fires and explosions.

Tools that generate sparks or excessive heat may ignite nearby combustible materials.

Chemical Exposure

Using incorrect materials or equipment for handling hazardous chemicals can lead to chemical spills or leaks.

Inadequate personal protective equipment (PPE) can result in exposure to toxic substances or irritants.

Ergonomic Issues

Tools that are not ergonomically designed can cause repetitive strain injuries, muscle strains, and musculoskeletal disorders.

Improperly adjusted equipment can lead to discomfort and long-term health issues.

Noise and Vibration

Incorrect tools or equipment can generate excessive noise or vibration, leading to hearing loss or disorders like hand-arm vibration syndrome.

Falls and Collapses

Using improper scaffolding or ladders can result in falls from heights.

Equipment that is not adequately secured or stabilized can collapse, causing injuries or damage.

Material Contamination

In manufacturing or food processing, using incorrect tools or equipment can contaminate products with foreign materials, compromising safety and quality.

Production Delays

When incorrect or improper tools are used, it can slow down production processes, leading to missed deadlines and financial losses.

Environmental Impact

Using improper tools or equipment can result in environmental hazards, such as spills, leaks, or emissions of pollutants.

Legal and Regulatory Consequences

Non-compliance with safety regulations and standards due to the use of incorrect tools or equipment can lead to legal penalties, fines, and reputational damage for businesses.

To mitigate these hazards, it is crucial to provide proper training to workers, conduct regular equipment inspections, and ensure that the right tools and equipment are used for each specific task. Additionally, implementing safety protocols, providing adequate PPE, and promoting a safety-conscious culture can help prevent accidents and injuries resulting from the mishandling of tools and equipment.

10.8 SAFETY PROTOCOLS WHEN USING MATERIALS, TOOLS, AND EQUIPMENT

By taking the precautions listed below, you can lessen the likelihood of an accident.

1. **Inspect regularly** - Make sure your tools are in good shape by doing regular inspections.

2. **Wear gloves** - Always put on the proper personal protection gear.

3. **Carry with care**

   - Never lug equipment up a ladder.
   - Use a bag or lift them up in a bucket if you need to carry something up a height.

4. **Don't pocket sharp object**

   - Never carry instruments with pointy or sharp edges in your pocket.
   - Rather, transport them in a toolbox.

5. **Be aware of your surroundings** - When using tools, be mindful to those around you at all times.

6. **Use the right tools**

   - Use the appropriate tools at all times.
   - Never use a tool for something other than what it was designed for.
   - You run the chance of hurting yourself and breaking the tools.

7. **Follow instructions** - Use tools only in accordance with the manufacturer's instructions.

8. **Clean and return** - After using a tool, clean it up and put it back where it belongs—in storage.

9. **Oily hands are dangerous** - Never use oily or greasy hands while working.

10. **Protect your eyes** - Always safeguard your eyes.

To ensure safety and effectiveness for a water purifier technician. Here are guidelines to follow:

Training and Education

- Receive proper training on tool use, maintenance, and safety procedures.
- Familiarize yourself with specific water purification tools.

Personal Protective Equipment (PPE)

- Wear required PPE like safety goggles, gloves, and lab coat or uniform.

Tool Inspection

- Inspect tools before use for damage or defects.

Proper Storage

- Store tools in an organized manner to prevent damage.

Tool Handling

- Handle tools carefully to prevent damage and ensure safety.

Tool Maintenance

- Perform routine maintenance and replace damaged parts.

Chemical Handling

- Follow safety protocols when using chemicals.

Emergency Preparedness

- Know the location of emergency equipment and procedures.

Tool Use Guidelines

Follow manufacturer's instructions and exercise caution near water and electricity.

Team Communication

Coordinate with colleagues when working in a team.

Disposal of Hazardous Materials

Dispose of hazardous materials properly.

Documentation

Maintain accurate records of work and incidents.

Continuous Learning

Stay updated through training and professional development.

Report Issues

Report problems or damaged tools to your supervisor.

Additionally, when working with water purifiers

- Read and understand the manufacturer's instructions.
- Wear appropriate PPE.
- Turn off power and disconnect the water supply before maintenance.
- Use the right tools in good condition.
- Avoid chemical exposure, follow SDS guidelines.
- Regularly inspect for leaks and perform maintenance.
- Maintain a clean work area.
- Be cautious with electrical components.
- Ensure proper ventilation.
- Know emergency shut-off procedures.
- Provide training and have an emergency response plan.
- Follow local regulations and guidelines.

Prioritizing safety is essential when working with water purifiers to protect yourself and others from potential hazards.

10.9 BASIC FIRST AID TREATMENT

A brief overview of appropriate basic first aid treatments for common conditions like bleeding, minor burns, and injuries:

1. Bleeding

Step 1: Wash your hands thoroughly with soap and water.

Step 2: If available, put on disposable gloves to protect against infection.

Step 3: Apply direct pressure to the wound using a clean cloth, gauze, or your hand if nothing else is available.

Step 4: Elevate the injured area above the level of the heart if possible. This helps reduce blood flow to the wound.

Step 5: Maintain pressure until bleeding stops or use a sterile bandage to secure the dressing in place.

Step 6: If bleeding continues, do not remove the initial dressing. Instead, add more layers if needed.

Step 7: Once bleeding is under control, clean the area gently with mild soap and water.

Step 8: Apply an antibiotic ointment if available and cover the wound with a sterile dressing or adhesive bandage.

Step 9: Seek medical attention if bleeding is severe, doesn't stop after 15 minutes of continuous pressure, or if the wound is deep or caused by a puncture or animal bite.

2. Minor Burns

Step 1: Remove the source of heat or chemical causing the burn if it can be done safely.

Step 2: Cool the burn with cold running water for at least 10-20 minutes to minimize tissue damage.

Step 3: Do not use ice, as it can further damage the skin.

Step 4: Cover the burn loosely with a sterile non-stick bandage or clean cloth.

Step 5: Over-the-counter pain relievers like ibuprofen can help reduce pain and inflammation.

Step 6: Seek medical attention if the burn is deep, covers a large area, or is on the face, hands, feet, genitals, or major joints.

3. Injuries

Step 1: Ensure the safety of yourself and the injured person. Check for any immediate dangers.

Step 2: Call 102 or seek professional medical assistance for serious injuries, such as broken bones, head injuries, or severe trauma.

Step 3: If safe, keep the injured person still and comfortable, and reassure them.

Step 4: For minor injuries like sprains or strains, use the RICE method: Rest, Ice, Compression, and Elevation.

Step 5: Clean and cover open wounds with sterile dressings or clean cloth to prevent infection.

Step 6: Keep the injured area elevated to reduce swelling, if applicable.

Step 7: Apply a cold pack wrapped in a cloth to reduce pain and swelling.

Step 8: Administer over-the-counter pain relievers as appropriate for pain management.

Step 9: Monitor the injured person's condition and seek medical advice if necessary.

Remember that while these basic first aid steps can be helpful in many situations, it's essential to seek professional medical care for severe injuries or if you are uncertain about the appropriate treatment. Additionally, stay calm and focused when providing first aid assistance to others.

10.10 IMPORTANCE OF MAINTAINING HIGH STANDARDS OF HEALTH, SAFETY, AND SECURITY

Maintaining high standards of health, safety, and security is paramount for individuals, organizations, and society as a whole due to several important reasons:

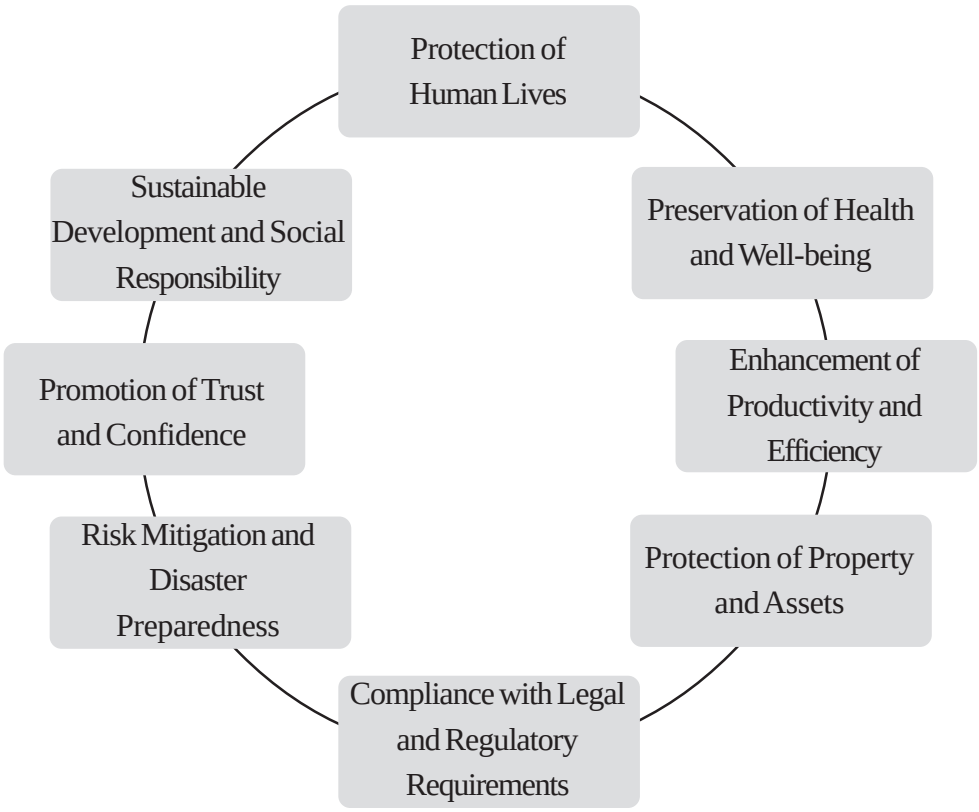

Figure: 10.2 Importance of maintaining high standards of health, safety, and security

1. **Protection of Human Lives:** High standards of health, safety, and security help prevent accidents, injuries, illnesses, and fatalities in workplaces, public spaces, and communities. Prioritizing safety measures saves lives and reduces human suffering.

2. **Preservation of Health and Well-being:** Ensuring a safe and healthy environment promotes physical and mental well-being among individuals. It reduces the risk of occupational hazards, exposure to harmful substances, and the spread of diseases, contributing to a healthier population.

3. **Enhancement of Productivity and Efficiency:** Safe and secure working environments foster a culture of productivity, efficiency, and innovation. Employees can focus on their tasks without fear of accidents or hazards, leading to higher job satisfaction, morale, and performance.

4. **Protection of Property and Assets:** Maintaining security standards helps protect property, assets, and infrastructure from theft, vandalism, sabotage, and other security threats. It safeguards investments and resources, minimizing financial losses and disruptions to operations.

5. **Compliance with Legal and Regulatory Requirements:** Adhering to health, safety, and security standards ensures compliance with laws, regulations, and industry norms. It helps organizations avoid legal liabilities, fines, penalties, and reputational damage resulting from non-compliance.

6. **Risk Mitigation and Disaster Preparedness:** High standards of health, safety, and security enable organizations to identify, assess, and mitigate risks effectively. They facilitate emergency preparedness, response, and recovery efforts in the event of natural disasters, accidents, or security incidents.

7. **Promotion of Trust and Confidence:** Demonstrating a commitment to maintaining high standards of health, safety, and security builds trust and confidence among employees, customers, investors, and other stakeholders. It enhances the reputation and credibility of organizations, leading to stronger relationships and increased loyalty.

8. **Sustainable Development and Social Responsibility:** Integrating health, safety, and security considerations into business operations reflects a commitment to sustainable development and social responsibility. It contributes to the well-being of communities, protects the environment, and supports long-term economic growth and prosperity.

Overall, maintaining high standards of health, safety, and security is essential for safeguarding human lives, promoting well-being, ensuring compliance, mitigating risks, and fostering trust and resilience in individuals, organizations, and societies. It requires a proactive approach, continuous improvement, and collaboration among stakeholders to create safe, healthy, and secure environments for everyone.

10.11 EVACUATION PROCEDURES FOR WORKERS AND VISITORS DURING EMERGENCIES

Evacuation procedures are essential for ensuring the safety of workers and visitors in the event of emergencies such as fires, natural disasters, or security threats. Here's an elaboration on evacuation procedures for workers and visitors:

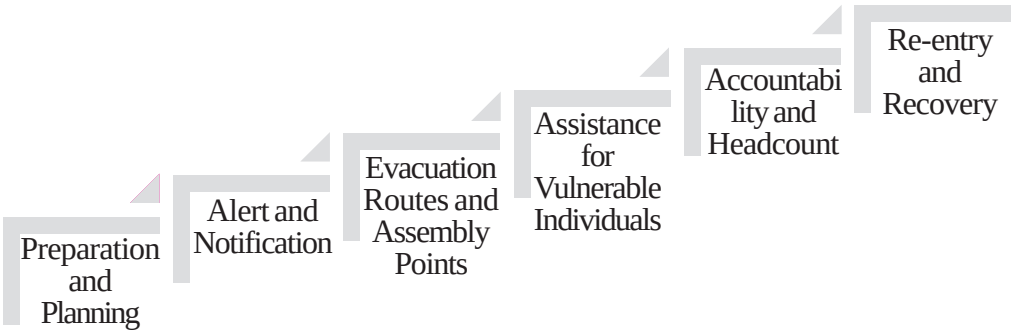

Figure: 10.3 Evacuation procedures during emergencies

1. Preparation and Planning:

- Before an emergency occurs, the organization should develop and document evacuation procedures. This includes identifying evacuation routes, assembly points, and procedures for alerting and communicating with employees and visitors.
- Regular drills and training sessions should be conducted to familiarize everyone with the evacuation procedures and ensure they know what to do in case of an emergency.

2. Alert and Notification:

- In the event of an emergency requiring evacuation, alarms, sirens, or other alert systems should be activated to notify everyone in the building.
- Clear and concise instructions should be communicated through various channels, such as intercom systems, text messages, or designated evacuation wardens, to ensure that workers and visitors are aware of the situation and know what actions to take.

3. **Evacuation Routes and Assembly Points:**

- Evacuation routes should be marked with signs and illuminated exit signs to guide workers and visitors to safety.
- Multiple evacuation routes should be available to accommodate different scenarios and prevent congestion or bottlenecks.
- Designated assembly points located at a safe distance from the building should be identified where workers and visitors can gather after evacuating. These assembly points should be easily accessible and well-known to everyone.

4. **Assistance for Vulnerable Individuals:**

- Special arrangements should be made to assist individuals with disabilities, injuries, or mobility issues during evacuation. This may include providing evacuation chairs, assigning buddies for assistance, or implementing specific procedures for their safe evacuation.
- Visitors should be made aware of evacuation procedures upon entry to the premises and provided with assistance if needed.

5. **Accountability and Headcount:**

- Evacuation procedures should include protocols for accounting for all workers and visitors to ensure that everyone has evacuated safely.
- Designated personnel, such as evacuation wardens or supervisors, should conduct headcounts at assembly points and report any missing persons to emergency responders.

6. **Re-entry and Recovery:**

- Once the emergency has been resolved and it is safe to do so, workers and visitors should be allowed to re-enter the building under the guidance of emergency responders or designated personnel.
- Post-evacuation debriefings and assessments should be conducted to identify any areas for improvement in evacuation procedures and make necessary adjustments.

By following these evacuation procedures, organizations can effectively ensure the safety and well-being of their workers and visitors during emergencies and minimize the risk of injuries or fatalities. Regular practice, communication, and coordination are key to successful evacuations.

10.12 WAYS TO SUMMON MEDICAL ASSISTANCE AND EMERGENCY SERVICES DURING AN EMERGENCY

Summoning medical assistance and emergency services promptly is critical in ensuring timely and effective response to medical emergencies. Here are several ways to summon medical assistance and emergency services when necessary:

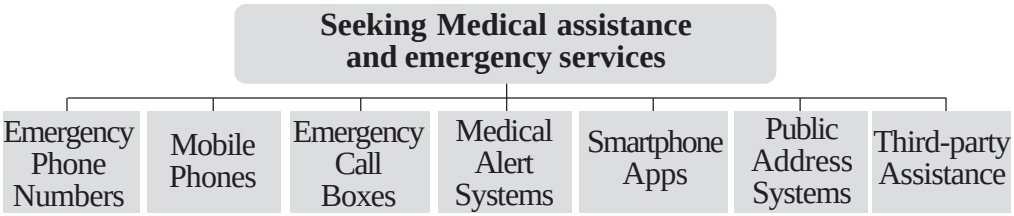

Figure: 10.4 Summoning medical assistance and emergency services

1. Emergency Phone Numbers:

In many countries, including India, emergency services such as ambulances, fire, and police can be contacted by dialling a specific emergency phone number. In India, the universal emergency number is 112, which connects callers to emergency services.

2. Mobile Phones:

Using a mobile phone to call emergency services is one of the quickest and most accessible ways to summon help. Keep emergency contact numbers saved in your phone's contacts list for easy access during emergencies.

3. Emergency Call Boxes:

In public places, emergency call boxes or telephones may be installed to allow individuals to directly contact emergency services without needing a mobile phone. These are often located in airports, train stations, universities, and other high-traffic areas.The same can be installed in the buildings where a large number of employees work.

4. Medical Alert Systems:

Medical alert systems, commonly used by elderly individuals or those with medical conditions, allow users to summon medical assistance with the press of a button. These systems are typically worn as a pendant or bracelet and connect the user to a monitoring centre that can dispatch help when needed.

5. Smartphone Apps:

There are smartphone apps available that allow users to quickly call for medical assistance and provide their location to emergency services. Some apps also include additional features such as first aid instructions or emergency contacts.

6. Public Address Systems:

In large facilities such as airports, shopping malls, or stadiums, public address systems can be used to broadcast emergency announcements and provide instructions for summoning medical assistance.

7. Third-party Assistance:

If you are unable to summon medical assistance yourself, ask someone nearby to call for help on your behalf. In public places, alerting staff or security personnel can also be an effective way to get medical assistance quickly. Alarms or other suitable devices could be used to alert the staff or administration about the possible danger.

It's important to remain calm and provide clear information about the nature of the emergency, the location, and any other relevant details when contacting emergency services. Training in basic first aid and CPR can also be valuable in providing immediate assistance while waiting for professional help to arrive.

INTEXT QUESTIONS 10.2

1. Why is it important to wear PPE?

   (a) Everything looks right because

   (b) Because it keeps the tools safe

   (c) Because it safeguards you

   (d) Because that is what your employer has instructed you to do.

2. What does PPE stand for?

   (a) Protective Preventative Equipment

   (b) People's Protective Equipment

   (c) Personal Preventative Equipment

   (d) Personal Protective Equipment

3. What are some examples of an employer's legal obligations in terms of health and safety?

   (a) Obtaining supplementary insurance for risky work

   (b) Limiting the number of employees that perform dangerous tasks to one

   (c) Providing safe systems of work for all employees

   (d) Charging staff to replace lost or damaged PPE

4. Which of the following would stop work-related injuries?

   (a) Keeping the workplace tidy

   (b) Keeping lighting to a minimum

   (c) Lifting heavy objects with a bent back

   (d) Wearing light clothing

5. Which of the following is an example of safe working?

   (a) Doing heavier-than-normal lifting

   (b) Maximizing the material load on hoisting equipment

   (c) Putting on safety glasses for every task

   (d) Working in area without ventilation.

6. First aid must be provided in every business to:

   (a) All persons over the age of 18

   (b) All staff

   (c) Only a certified first responder.

   (d) Health and safety officers only.

7. Which of the following claims is more likely to hurt the operator?

   (a) Wearing safety goggles or glasses

   (b) Keeping cutting tools sharp

   (c) Using a tool with loose handles

   (d) Choosing the proper instrument for the job

INTEXT QUESTIONS 10.3

1. Which of the following explains the Importance of maintaining high standards of health, safety, and security?

   a) It can help you protect Human Lives

   b) It can help you enhance Productivity and Efficiency

   c) It can help in Compliance with Legal and Regulatory Requirements

   d) All of these

2. Which of the following shows the right sequence of the evacuation procedure during emergencies?

   a) Preparation and Planning - Alert and Notification - Evacuation Routes and Assembly Points - Assistance for Vulnerable Individuals - Accountability and Headcount- Re-entry and Recovery

   b) Accountability and Headcount - Preparation and Planning - Alert and Notification - Evacuation Routes and Assembly Points - Assistance for Vulnerable Individuals - Re-entry and Recovery

   c) Re-entry and Recovery - Preparation and Planning - Alert and Notification - Evacuation Routes and Assembly Points - Assistance for Vulnerable Individuals - Accountability and Headcount

   d) Preparation and Planning - Accountability and Headcount- Re-entry and Recovery - Alert and Notification - Evacuation Routes and Assembly Points - Assistance for Vulnerable Individuals

3. Which of the following is the first step in the evacuation procedure during emergencies?

   a) Accountability and Headcount

   b) Evacuation Routes and Assembly Points

   c) Preparation and Planning

   d) Assistance for Vulnerable Individuals

Notes

4. Which of the following could be used as a way to summon medical assistance and the emergency services

   a) Mobile Phones

   b) Public Address Systems

   c) Third-party Assistance

   d) All of these

WHAT YOU HAVE LEARNT

Maintaining high standards of health, safety, and security is paramount for individuals, organizations, and society as a whole due to several important reasons which incudes the protection of Human Lives, Preservation of Health and Well-being, Enhancement of Productivity and Efficiency, Protection of Property and Assets, Compliance with Legal and Regulatory Requirements, Risk Mitigation and Disaster Preparedness, Promotion of Trust and Confidence, and Sustainable Development & Social Responsibility. It requires a proactive approach, continuous improvement, and collaboration among stakeholders to create safe, healthy, and secure environments for everyone.

Evacuation procedures are essential for ensuring the safety of workers and visitors in the event of emergencies such as fires, natural disasters, or security threats.By following these evacuation procedures, organizations can effectively ensure the safety and well-being of their workers and visitors during emergencies and minimize the risk of injuries or fatalities.

Summoning medical assistance and emergency services promptly is critical in ensuring timely and effective response to medical emergencies. Emergency Phone Numbers, Mobile Phones, Emergency Call Boxes, Medical Alert Systems, Smartphone Apps, Public Address Systems, and Third-party Assistance could be used for seeking Medical assistance and emergency services.

Reporting health, safety, and accidents is essential for preventing injuries, ensuring legal compliance, collecting valuable data, driving continuous improvement, engaging employees, managing risks, and demonstrating accountability and transparency.

TERMINAL QUESTIONS

1. Why do you think maintaining high standards of health, safety, and security is important for organisations?
2. Elaborate the evacuation procedures for workers and visitors during emergencies.
3. Discuss the ways to summon medical assistance and emergency services during an emergency
4. Discuss the importance of reporting health, safety, and accidents at the workplace
5. Why is it essential to report safety-related issues in the workplace?
6. Why is it important to maintain personal hygiene at the workplace?
7. Why should you follow safety guidelines when using electrical household gadgets?
8. What are some methods for recognizing workplace risks, and who should you inform about them?
9. What are some examples of emergency circumstances in the workplace, and how should they be handled?

ANSWERS TO INTEXT QUESTIONS

10.1

1. (b) Report it to your immediate supervisor or safety officer
2. (c) To promote a healthy and safe work environment
3. (c) To prevent accidents and electrical shocks

10.2

1. (c) Because it safeguards you
2. (d) Personal Protective Equipment
3. (c) Providing safe systems of work for all employees
4. (a) Keeping the workplace tidy
5. (c) Putting on safety glasses for every task.
6. (b) All staff
7. (c) Using a tool with loose handles

10.3

1. d) All of these
2. a) Preparation and Planning - Alert and Notification - Evacuation Routes and Assembly Points - Assistance for Vulnerable Individuals - Accountability and Headcount- Re-entry and Recovery
3. c) Preparation and Planning
4. d) All of these

Key Learning Outcomes

Being able to :

- Reporting and handling safety-related issues and process for maintaining hygienic standards at work
- Significance of housekeeping in maintaining a secure and safe workplace
- Explain the purpose and usage of wearing appropriate PPE like hair net, protective aprons, footwear, respirators, masks, etc. at work place
- Importance of maintaining personal hygiene by brushing teeth frequently, bathing daily, dressing well, eating healthfully, etc. and avoiding consumption of tobacco, paan, alcohol, smoking cigarettes, etc. at the workplace
- Importance of following guidelines and safety protocol while using and handling electrical household gadgets and following basic first aid procedure appropriately

GLOSSARY

- WPU - Water Purifier Unit.
- WP - Water Purifier.
- WPS - Water Purifier System.
- R O - Reverse Osmosis.
- i/p - Input.
- o/p - Output.
- LPH - Litre per hour.
- UV - Ultra Violet.
- UF - Ultra Filter
- S.S - Stainless Steel.
- HPS - High Pressure Switch.
- SMPS - Swich Mode Power Supply.
- MPa - Mega Pascal.
- STP - Stadard Temperature and Pressure.

EMPLOYABILITY SKILL WORKBOOK

To access Employability Skill Workbook Scan the below QR code or open the given link:

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