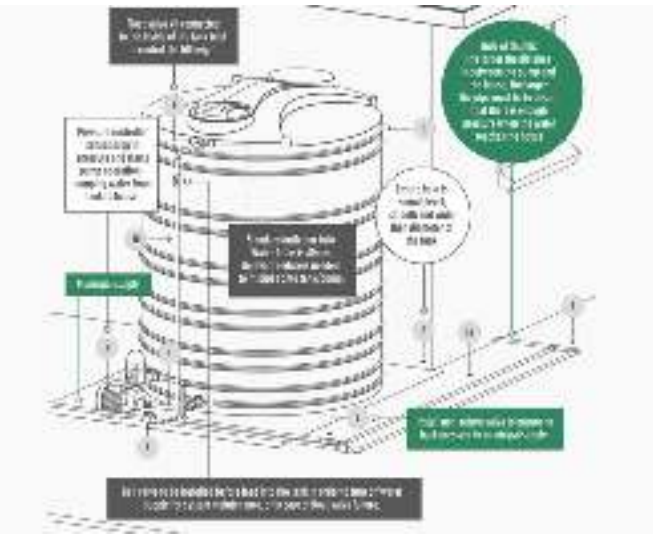
Plumbing Installation Level III

Based on October, 2023, Curriculum Version 2



Module Title: - Connecting and Installing Storage Tanks to Domestic Water Supply

Module code: EIS PLI3 M06 1023

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Acronym's

FRP _____ fiberglass-reinforced plastic

OHS _____ Occupational health and safety

PPE _____ personal protective equipment

QA _____ Quality assurance

ASTs _____ Aboveground storage tanks

USTs _____ Underground storage tanks

NDT _____ Non-destructive testing

SOP _____ standard operating procedures

Table of Contents

Introduction to the Module

The Connecting and installing storage tanks to a domestic water supply helps to know the Basic concepts of storage tank, Installation requirements, Install and test storage tank in plumbing installation field. This module cover skill, knowledge and attitude required to Connecting and installing storage tanks to a domestic water supply.

This module is designed to meet the industry requirement under the plumbing installation work occupational standard, particularly for the unit of competency: **Connecting and installing storage tanks to a domestic water supply This module covers the units**:

- Basic concepts of storage tank
- Installation requirements
- Install and test storage tank

Learning Objective of the Module

- Explain Basic concepts of storage tank
- Identify Installation requirements
- Installing and testing storage tank

Module Instruction

For effective use these modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the "LAP test" given at the end of each unit and
5. Read the identified reference book for Examples and exercise

Unit one: Basic concepts of storage tank

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

- Introduction of storage tank
- Occupational health and safety requirements
- Quality assurance requirements
- Tools, equipment and Materials
- Work place preparation

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

- Explain storage tank
- Follow safety (OHS) requirements
- Identify quality assurance requirements
- Select and check tools, equipment and Materials
- Prepare Work place

1.1. Introduction of storage tanks

Storage tanks are large containers designed to store and hold a wide range of substances, including liquids, gases, and granular materials. They play a crucial role in various industries and applications, such as:

Water Supply: Storage tanks are used to store and supply water for domestic, municipal, and industrial purposes. They ensure a continuous and reliable source of clean water for communities and facilities.

Oil and Gas: In the oil and gas industry, storage tanks are used to store crude oil, refined products, and natural gas. They are essential for managing the production and distribution of these valuable resources.

Chemical Industry: Chemical storage tanks are designed to safely store a wide range of chemicals, including hazardous and non-hazardous materials. These tanks are vital for manufacturing and processing operations.

Agriculture: Farmers use storage tanks for storing fertilizers, pesticides, and water for irrigation. These tanks aid in efficient crop management and agricultural practices.

Pharmaceuticals: Pharmaceutical companies use specialized storage tanks for the safe and controlled storage of raw materials, chemicals, and finished products.

Food Industry: Storage tanks are employed for the storage of food products, including liquid ingredients, such as milk and juice, and dry goods, like grains and flour.

Storage tanks come in various shapes, sizes, and materials, depending on the substance they are designed to store and the specific requirements of the industry.

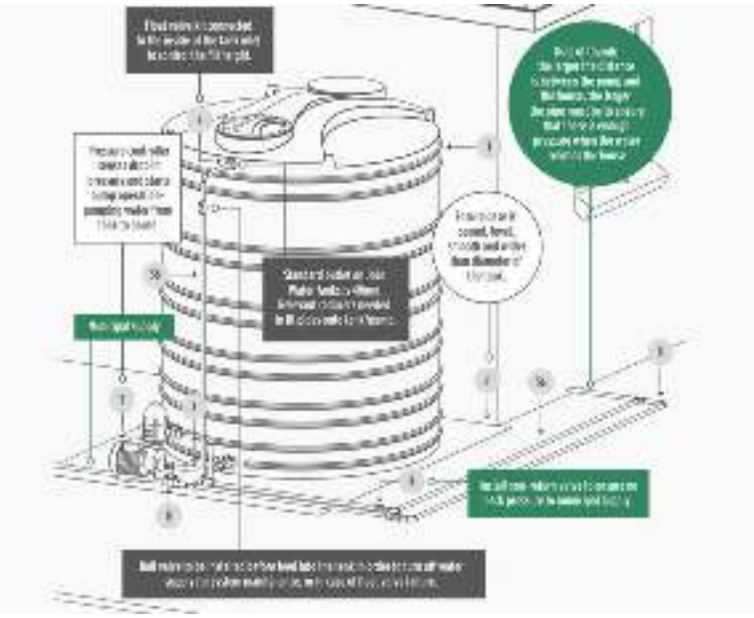

Figure 1-1 storage tank

1.1.1. Types of Storage Tanks:

Storage tanks come in various types based on several factors, including shape, location, purpose, and construction material. Here's a breakdown of these categories:

Based on shape

- Cylindrical: Cylindrical tanks are the most common type of storage tank. They are efficient in terms of material usage and can store a large volume of liquid in a relatively small space.
- Spherical: Spherical tanks are stronger than cylindrical tanks and can withstand higher pressures. They are also more efficient in terms of heat transfer, which makes them ideal for storing liquids that need to be kept at a specific temperature.
- Rectangular: Rectangular tanks are less efficient in terms of material usage than cylindrical or spherical tanks, but they are often used for storing small volumes of liquid or for liquids that need to be stored in a specific configuration.

Based on location:

- Aboveground: Aboveground storage tanks are the most common type of storage tank. They are relatively easy to install and maintain.
- Underground: Underground storage tanks are used to store liquids that are flammable or hazardous. They are less visible than aboveground tanks and are less likely to be damaged by accidents or vandalism.

Based on purpose:

- Water storage tanks: Water storage tanks are used to store water for drinking, irrigation, or firefighting purposes.
- Oil storage tanks: Oil storage tanks are used to store crude oil, refined petroleum products, or vegetable oils.
- Gas storage tanks: Gas storage tanks are used to store natural gas or other gases.
- Chemical storage tanks: Chemical storage tanks are used to store a variety of chemical products, such as acids, bases, and solvents.

Based on construction material:

- Steel: Steel storage tanks are the most common type of storage tank. They are strong, durable, and versatile. Steel tanks can be used to store a wide variety of liquids, including water, oil, gas, and chemicals.
- Concrete: Concrete storage tanks are also very strong and durable. They are often used to store large volumes of water or other liquids. Concrete tanks are also resistant to corrosion, making them ideal for storing corrosive liquids.
- Plastic: Plastic storage tanks are lightweight and easy to transport. They are also resistant to corrosion. Plastic tanks are often used to store water, chemicals, and food products.
- Fiberglass: Fiberglass storage tanks are strong and lightweight. They are also resistant to corrosion. Fiberglass tanks are often used to store water, chemicals, and petroleum products.

The type of storage tank that is best for a particular application will depend on a variety of factors, including the type of liquid being stored, the desired storage capacity, the budget, and the available space.

Here are some examples of storage tanks based on construction material and their applications:

- Steel:
  - Water storage tanks
  - Oil storage tanks
  - Gas storage tanks
  - Chemical storage tanks
- Concrete:
  - Large water storage tanks
  - Wastewater storage tanks
  - Agricultural storage tanks
- Plastic:
  - Portable water tanks
  - Chemical storage tanks
  - Food storage tanks
- Fiberglass:
  - Underground water storage tanks
  - Chemical storage tanks
  - Petroleum storage tanks

When choosing a storage tank, it is important to consider the specific needs of the application. The type of liquid being stored, the desired storage capacity, the budget, and the available space are all important factors to consider.

Common types of domestic water storage tanks:

Water Heater Tanks:

- These tanks are designed to heat and store hot water for domestic use, such as bathing, washing dishes, and laundry.
- Common types include electric, gas, and solar water heater tanks.
- Insulation is often incorporated to maintain water temperature.

Cold Water Storage Tanks:

- These tanks store and supply cold water to the household.

- They are typically made of materials like plastic or fiberglass and are often used in conjunction with a pressure system.

Pressure Tanks:

- Pressure tanks are used in well water systems to provide consistent water pressure to the house.
- They use compressed air to maintain pressure in the system, ensuring a steady flow of water.

Rainwater Harvesting Tanks:

- These tanks collect and store rainwater for various non-potable uses like irrigation, flushing toilets, and outdoor cleaning.
- They can be above-ground or underground and vary in size.

Septic Tanks:

- Septic tanks are used to treat wastewater from the household, separating solids from liquids.
- The liquid effluent is then leached into the soil through a drain field.

Cisterns:

- Cisterns are larger tanks used to store rainwater or well water for potable and non-potable use.
- They are often used in areas with limited access to municipal water supplies.

Bladder Tanks:

- Bladder tanks are used for temporary or emergency water storage, such as in RVs, boats, or during construction.
- They have a flexible bladder inside the tank that expands as it's filled with water.

Pressure Accumulation Tanks:

- These tanks are used in pressurized water systems to reduce the cycling of pumps by absorbing excess pressure.

- They help maintain consistent water pressure in the system.

Open Tanks (Non-Pressurized):

- Open tanks are often used for storing non-potable water, such as for gardening or livestock.
- They lack pressure systems and are typically open to the atmosphere.

Hydro pneumatic Tanks:

- These tanks are used in larger residential or commercial water systems to maintain water pressure.
- They combine water and air to create a cushion of pressure.

Expansion Tanks:

- Expansion tanks are used in closed-loop hot water systems to accommodate thermal expansion and prevent pressure buildup.
- They protect against damage to pipes and fixtures.

Buffer Tanks:

- Buffer tanks are used in hydronic heating systems to store heated water and improve system efficiency by reducing short cycling.

The choice of domestic water storage tank depends on factors such as the type of water (hot or cold), the source of water (municipal supply, well, rainwater), the intended use (potable or non-potable), and the specific requirements of the household or building. Proper sizing, maintenance, and compliance with local codes and regulations are essential considerations when selecting and using domestic water storage tanks.

1.1.2. Importance of storage tanks

The importance of storage tanks in domestic water supply refers to the significant roles these containers play in storing and distributing water to homes, enhancing water availability, pressure regulation, emergency preparedness, and overall water supply reliability.

In addition, there are some additional importance of storage tanks in domestic water supply tips that you may want to consider:

Continuous Water Supply:

- Storage tanks ensure a consistent and uninterrupted water supply to households, even during times of low water pressure or when the main water source is temporarily unavailable. This helps maintain daily routines and ensures a reliable source of clean water.

Water Pressure Regulation:

- Storage tanks help regulate water pressure within the plumbing system. They store water at a higher elevation and can deliver it at the desired pressure to ensure effective water usage, especially in multi-story buildings.

Emergency Water Supply:

- Storage tanks act as a backup during emergencies, such as power outages or system failures. Having a reserve of water can be crucial during disasters, ensuring that residents have access to clean water for drinking, sanitation, and firefighting.

Peak Demand Handling:

- Storage tanks accommodate variations in water demand, especially during peak usage hours. They provide an additional supply source to meet increased water needs, such as during morning showers or meal preparations.

Reduced Energy Costs:

- When integrated with pumps and gravity-based systems, storage tanks can optimize energy usage. Water can be pumped into the tank during off-peak hours when electricity rates are lower and used during peak hours when rates are higher, leading to cost savings.

Water Quality Maintenance:

- Properly designed storage tanks can help maintain water quality by preventing stagnation and the growth of harmful microorganisms. This is particularly important in regions with varying water quality or where water treatment facilities may struggle to meet demand.

Ease of Maintenance:

- Regular maintenance and inspection of storage tanks are more convenient than maintaining an entire water distribution network. This ensures the longevity and functionality of the water supply system.

Water Conservation:

- Storage tanks encourage water conservation practices by enabling rainwater harvesting and graywater reuse. This helps reduce water consumption, lower utility bills, and minimize the environmental impact.

Pressure Equalization:

- In areas with fluctuating water pressure, storage tanks can stabilize the pressure within the plumbing system, preventing damage to appliances and pipes caused by sudden pressure changes.

Improved Fire Protection:

- Storage tanks with sufficient capacity can be connected to fire suppression systems, providing a reliable source of water for firefighting in residential and commercial buildings.

Sustainable Water Management:

- Storage tanks support sustainable water management practices by storing and distributing rainwater, which can reduce the strain on municipal water resources and contribute to environmental conservation.

Reduction of Peak Loads on Utilities:

- During peak demand periods, storage tanks reduce the load on water treatment plants and distribution systems, helping utilities manage their resources more efficiently.

Overall, storage tanks are essential components of domestic water supply systems, enhancing water availability, reliability, and quality while contributing to water conservation and sustainability efforts. They are especially valuable in ensuring that households have access to safe and dependable water, even under challenging conditions.

1.1.3. Materials Used in Domestic Water Tanks

A. Plastic (Polyethylene or Polypropylene)

Polyethylene and polypropylene are thermoplastic materials known for their durability, corrosion resistance, and relatively low cost. They are widely used in the manufacturing of domestic water storage tanks.

Plastic tanks are commonly used for both above-ground and underground cold water storage. They are lightweight, easy to install, and resistant to rust and corrosion. Polyethylene tanks, in particular, are popular for rainwater harvesting systems and as septic tanks.

B. Fiberglass

Fiberglass tanks are made of layers of fiberglass-reinforced plastic (FRP) composite material. This material is known for its strength, corrosion resistance, and longevity.

Fiberglass tanks are commonly used for underground water storage due to their resistance to soil corrosion. They are also used for above-ground cold water storage. Fiberglass tanks are relatively lightweight, making them easier to transport and install.

C. Stainless Steel:

Stainless steel tanks are constructed from corrosion-resistant steel alloy with a high chromium and nickel content. This material is prized for its durability, strength, and resistance to rust.

Stainless steel tanks are often used for hot water storage. They are known for their ability to withstand high temperatures and maintain water quality. Stainless steel hot water storage tanks are common in residential and commercial applications, where hygiene and longevity are important.

The choice of material for a domestic water tank depends on factors such as the type of water to be stored (cold or hot), the location of the tank (above-ground or underground), budget considerations, and local regulations. Each material has its advantages and disadvantages, and selecting the appropriate material ensures the tank's longevity and suitability for its intended purpose.

1.1.4. Tank Capacity and Sizing

Tank capacity and sizing are crucial considerations when selecting a domestic water storage tank. Here's more information on these two aspects:

Determining Household Water Needs:

1. **Assessment:** To determine the appropriate tank size, it's essential to assess the household's water usage patterns. Consider factors such as the number of occupants, daily water consumption per person, and the specific water uses (e.g., bathing, cooking, laundry, irrigation).
2. **Seasonal Variations:** Account for seasonal variations in water demand. For example, water usage may increase during the summer for outdoor activities like gardening or filling swimming pools.
3. **Fixtures and Appliances:** Consider the number and type of fixtures and appliances that consume water in the household, as different fixtures have varying flow rates.

4. **Water Quality:** In areas with poor water quality, households may require larger tanks to store treated water for consumption.

Choosing the Right Tank Size:

1. **Sufficient Capacity:** The selected tank should have sufficient capacity to meet the household's daily water needs without running empty too quickly. Ensure that the tank can store enough water to cover periods of high demand.
2. **Consider Local Regulations:** Check local building codes and regulations, as they may specify minimum requirements for domestic water storage capacity based on factors like occupancy and intended use.
3. **Balance Space and Cost:** Balancing the available space for tank installation and budget constraints is important. Larger tanks require more space and can be more expensive, so it's essential to find a size that fits both your needs and your property.
4. **Reserve Capacity:** It's advisable to have some reserve capacity in the tank to account for unexpected events or emergencies, such as power outages or water supply interruptions.
5. **Consult a Professional:** When in doubt, consult a plumbing professional or engineer who can help calculate the ideal tank size based on your specific household requirements.

1.1.5. Storage tank quality

The quality of a storage tank is of paramount importance to ensure its functionality, durability, and safety. Quality considerations encompass various aspects related to the design, materials, manufacturing, and maintenance of the tank. Here are some key factors that contribute to storage tank quality:

Material Selection: The choice of materials for constructing the tank is crucial. Tanks can be made from various materials, including steel, concrete, fiberglass, plastic, and stainless steel. The material must be compatible with the substance being stored, and it should resist corrosion, chemical reactions, and environmental factors.

Design and Engineering: The tank's design should adhere to industry standards and engineering principles. Factors such as structural integrity, load-bearing capacity, and stress analysis must be considered. Proper design ensures that the tank can withstand internal and external forces.

Welding and Fabrication: If the tank is assembled through welding or fabrication, the quality of workmanship is vital. Welds and seams should be free from defects, and the tank's construction should meet or exceed applicable welding standards.

Coating and Linings: Protective coatings and linings can be applied to the interior and exterior surfaces of the tank to prevent corrosion and contamination. Quality coatings and linings must be used to ensure long-term durability.

Inspection and Testing: Tanks should undergo rigorous inspections and testing during and after manufacturing. Non-destructive testing methods, such as radiographic testing and ultrasonic testing, can reveal hidden flaws or weaknesses.

Installation: Proper installation is critical to a tank's performance. It should be positioned on a stable foundation, securely anchored, and connected to the plumbing system with appropriate fittings and seals.

Quality Control and Standards: Adherence to industry standards and quality control measures is essential. Regulatory bodies often set specific standards for the construction and operation of storage tanks.

Maintenance and Repair: Regular maintenance is vital for tank longevity. Inspections, cleaning, and preventive maintenance help identify and address issues before they become major problems. Quick response to any detected defects is crucial.

Environmental and Safety Compliance: Tanks should meet environmental and safety regulations, including containment measures to prevent leaks and spills that could harm the environment or pose safety hazards.

Manufacturer's Reputation: The reputation and track record of the tank's manufacturer or supplier play a significant role in assessing its quality. Reputable manufacturers tend to produce higher-quality tanks and offer better support.

Material Compatibility: Ensuring that the tank material is compatible with the stored substance is essential. For instance, certain chemicals may corrode or react with specific tank materials, leading to quality issues and safety concerns.

In summary, the quality of a storage tank is a complex interplay of material selection, design, manufacturing, installation, and ongoing maintenance. High-quality tanks are essential to prevent environmental damage, safety risks, and costly downtime. Compliance with industry standards and best practices is essential for maintaining storage tank quality.

Selecting the right tank size is crucial to ensure a reliable and consistent water supply. An adequately sized tank provides convenience and peace of mind, while an undersized tank may lead to water shortages and inconvenience.

1.1.6. Tank Design and Shape

Shape Considerations

Cylindrical Tanks: have a round, cylindrical shape and are commonly used for water storage.

- Advantages of Cylindrical Tanks
  - Strength: Cylindrical tanks are very strong and can withstand high pressures. This makes them ideal for storing a variety of materials, including liquids, gases, and solids.
  - Efficiency: Cylindrical tanks are very efficient in terms of space utilization. They can store a large volume of material in a relatively small footprint.
  - Cost-effectiveness: Cylindrical tanks are relatively inexpensive to manufacture and install.
  - Versatility: Cylindrical tanks can be used for a variety of applications, including storage, transportation, and processing.
- Disadvantages of Cylindrical Tanks
  - Susceptibility to corrosion: Cylindrical tanks are susceptible to corrosion, especially if they are made of metal. This can reduce their lifespan and make them unsafe to use.
  - Difficult to clean: Cylindrical tanks can be difficult to clean, especially if they are large or have a complex design.

- Not suitable for all applications: Cylindrical tanks are not suitable for all applications. For example, they are not ideal for storing materials that need to be kept at a specific temperature.

Overall, cylindrical tanks are a versatile and cost-effective storage solution for a variety of materials. However, it is important to be aware of their potential disadvantages, such as their susceptibility to corrosion and difficulty to clean.

Examples: Many residential and commercial water tanks are cylindrical, such as those used for cold water storage and rainwater harvesting.

Rectangular Tanks have a box-like shape with flat sides and right angles.

- Advantages of rectangular tanks:
  - More efficient use of space: Rectangular tanks can be stacked or placed side by side to maximize space utilization.
  - Easier to transport: Rectangular tanks are typically easier to transport than cylindrical tanks due to their flat sides.
  - More versatile: Rectangular tanks can be used for a wider variety of applications than cylindrical tanks, such as storing liquids, solids, and gases.
  - More affordable: Rectangular tanks are typically more affordable than cylindrical tanks due to their simpler design.
- Disadvantages of rectangular tanks:
  - Less structurally sound: Rectangular tanks are less structurally sound than cylindrical tanks, especially when subjected to high pressures.
  - More prone to leaks: Rectangular tanks are more prone to leaks at the corners and seams.
  - More difficult to clean: Rectangular tanks are more difficult to clean than cylindrical tanks due to their sharp corners and edges.

Overall, rectangular tanks are a good option for applications where space efficiency, cost, and versatility are important considerations. However, they are not as structurally sound or leak-resistant as cylindrical tanks, and they can be more difficult to clean.

there are some additional things to consider when choosing between rectangular and cylindrical tanks:

- Capacity: Rectangular tanks are generally available in a wider range of capacities than cylindrical tanks.
- Material: Rectangular tanks can be made from a variety of materials, including concrete, steel, and plastic. Cylindrical tanks are typically made from steel or concrete.
- Application: Rectangular tanks are often used for storing water, chemicals, and other liquids. Cylindrical tanks are often used for storing oil, gas, and other flammable materials.

Examples: Rectangular tanks are less common in residential settings but may be used when space constraints or architectural considerations are a factor.

Location Considerations

Above-Ground: Above-ground tanks are installed on or above the ground surface and are more accessible for maintenance and inspection.

- Advantages of above-ground tanks:
  - Easier to install and maintain: Above-ground tanks are easier to install and maintain than underground tanks. They are also more accessible, making it easier to inspect and repair them.
  - Less expensive: Above-ground tanks are typically less expensive than underground tanks.
  - More versatile: Above-ground tanks can be used to store a wider variety of materials than underground tanks. For example, above-ground tanks can be used to store flammable materials, which is not recommended for underground tanks.

- Safer: Above-ground tanks are generally considered to be safer than underground tanks. This is because they are less likely to leak or rupture, and they are also easier to access in the event of a spill.

- Disadvantages of above-ground tanks:
  - Less aesthetically pleasing: Above-ground tanks can be less aesthetically pleasing than underground tanks. This is because they are visible from the surface.
  - More susceptible to weather damage: Above-ground tanks are more susceptible to weather damage than underground tanks. This includes damage from wind, rain, and snow.
  - More vulnerable to theft and vandalism: Above-ground tanks are more vulnerable to theft and vandalism than underground tanks. This is because they are more accessible.

Overall, above-ground tanks offer a number of advantages over underground tanks, including ease of installation and maintenance, lower cost, and greater versatility. However, they are also less aesthetically pleasing, more susceptible to weather damage, and more vulnerable to theft and vandalism.

Above-ground tank is the right choice for you will depend on your specific needs and circumstances. If you are looking for a tank that is easy to install and maintain, and that can be used to store a variety of materials, then an above-ground tank may be a good option for you.

Underground: Underground tanks are buried below the ground surface and are not visible.

- Advantages of underground tanks:
  - Safer: Underground tanks are less likely to be damaged by accidents or vandalism than above-ground tanks.
  - More durable: Underground tanks are typically made of durable materials, such as concrete or steel, which makes them more resistant to wear and tear.
  - More aesthetically pleasing: Underground tanks are hidden from view, which can improve the appearance of your property.

- Less susceptible to temperature fluctuations: Underground tanks are less susceptible to temperature fluctuations than above-ground tanks, which can help to protect the stored product.

- Disadvantages of underground tanks:
  - More expensive to install: Underground tanks are more expensive to install than above-ground tanks. This is because they require excavation and the installation of a backfill material, such as gravel or sand.
  - More difficult to maintain: Underground tanks are more difficult to maintain than above-ground tanks. This is because they are not easily accessible.
  - More susceptible to leaks: Underground tanks are more susceptible to leaks than above-ground tanks. This is because they are more likely to be exposed to moisture and corrosive chemicals.
  - Pose a greater environmental risk: If an underground tank leaks, it can contaminate the soil and groundwater. This can have a negative impact on the environment and human health.

Overall, underground tanks offer a number of advantages over above-ground tanks, including increased safety, durability, and aesthetic appeal. However, they are also more expensive to install and maintain, and they pose a greater environmental risk in the event of a leak.

Underground tank is the right choice for you will depend on your specific needs and circumstances. If you are considering installing an underground tank, be sure to weigh the pros and cons carefully and consult with a qualified professional.

Custom Shapes: In some situations, custom-shaped tanks may be designed to fit unique spaces or meet specific design requirements. Custom tank designs can be created to harmonize with architectural features or blend seamlessly into the environment.

Tank Material Compatibility

The design and shape of a tank may be influenced by the material used. Different materials may be better suited to specific shapes or structural designs.

Water Use Cases

The intended use of the stored water, whether it's for drinking, irrigation, or industrial purposes, may also influence tank design and shape decisions.

Professional Guidance

For complex installations or unique design requirements, consulting with professionals, such as engineers or architects, can help determine the most suitable tank design and shape.

The choice of tank design and shape depends on factors such as available space, structural considerations, aesthetic preferences, and the specific requirements of the water storage application. Proper selection ensures the tank is functional, efficient, and visually compatible with its surroundings.

1.2. Occupational health and safety requirements

Occupational health and safety (OHS) requirements for connecting and installing storage tanks to a domestic water supply include:

- Wearing appropriate personal protective equipment (PPE) is essential in various work environments to ensure the safety and well-being of individuals.

Explanation of the PPE items you mentioned:

Safety Glasses: Safety glasses, also known as safety goggles, protect the eyes from potential hazards such as flying debris, chemicals, or other objects that could cause eye injuries. They are a crucial piece of PPE in environments where eye protection is required.

Figure 1.0-2 Safety glasses

Gloves: Gloves come in various materials and types, each designed for specific purposes.

Some common types include:

- **Work Gloves:** These are general-purpose gloves used to protect hands from abrasions, cuts, and minor injuries.

Figure1.0-3 Work gloves

- **Chemical-Resistant Gloves:** Designed to protect against chemical exposure and prevent skin contact with hazardous substances.
- **Heat-Resistant Gloves:** Used in situations where there is a risk of burns or exposure to high temperatures.
- **Cut-Resistant Gloves:** Ideal for industries where there's a risk of cuts and lacerations, such as in construction and manufacturing.

The choice of gloves depends on the specific hazards present in the work environment.

Hard Hat: A hard hat, or safety helmet, is worn to protect the head from falling objects, impacts, and overhead hazards in construction and industrial settings. It also provides electrical insulation and may include attachments like face shields and earmuffs for additional protection.

Figure 1. 0-4 Head protection

Foot protection: Plumbers work in wet environments, so there's always a risk of slip-and fall injuries. Choose non-skid soled work boots with protective toes.

Figure 1.0-5 Foot protection

1.2.1. Potential hazards on installation of storage tanks

The installation of storage tanks, whether for domestic or industrial purposes, can pose various potential hazards. It's essential to be aware of these hazards and take appropriate safety measures to prevent accidents and ensure the well-being of workers and the environment.

Some potential hazards during the installation of storage tanks include:

Falling Hazards: Working at heights while installing or securing tanks can lead to falls. Ensure the use of proper fall protection equipment, such as guardrails, safety harnesses, and safety nets.

Chemical Exposure: Depending on the contents of the storage tank, there may be a risk of chemical exposure. Workers should use appropriate personal protective equipment (PPE) to minimize contact with hazardous substances.

Figure 1.0-6 Chemical exposure

Confined Spaces: Some tank installations involve confined spaces, which can present dangers like oxygen deficiency, toxic gases, or entrapment. Adequate training, monitoring, and ventilation are essential when working in confined spaces.

Collapse and Structural Failures: Poorly designed or constructed tanks can lead to structural failures and collapse. Ensure that tanks meet design and engineering standards and are installed on stable foundations.

Heavy Lifting: Handling and positioning large and heavy tanks require proper lifting equipment and techniques to avoid strains, musculoskeletal injuries, and equipment damage.

Electrical Hazards: Electrical equipment and wiring near tank installation sites can pose electrical shock hazards. Proper grounding and electrical safety measures are essential.

Here are some of the most common electrical hazards:

- Exposed wires: Exposed wires can cause electric shock if touched.
- Overloaded circuits: Overloaded circuits can cause fires and electric shocks.
- Faulty equipment: Faulty equipment, such as power cords and outlets, can cause electric shocks and fires.
- Wet conditions: Water and electricity do not mix. Wet conditions can increase the risk of electric shock.
- Improper grounding: Improper grounding can increase the risk of electric shock.

Here are some safety tips for avoiding electrical hazards:

- Be aware of your surroundings: Be aware of the electrical hazards in your area. Identify any exposed wires, overloaded circuits, or faulty equipment.
- Use caution when working with electricity: Always follow safety procedures when working with electricity. This includes using the correct tools and equipment, and turning off the power before working on electrical equipment.
- Have electrical work done by a qualified electrician: If you are not qualified to work on electricity, have electrical work done by a qualified electrician.

Flammable Atmospheres: Tanks containing flammable substances may create a risk of fire or explosion. Implement fire prevention measures, such as safe storage of flammable materials and anti-static equipment.

Here are some of the most common flammable gases and vapors:

- Acetone
- Acetylene
- Ammonia
- Benzene
- Butane
- Ethanol
- Gasoline
- Hydrogen
- Methane
- Natural gas
- Propane
- Toluene

Flammable atmospheres can be dangerous because they can ignite and cause fires or explosions. Fires and explosions can cause serious injuries or death, and they can also damage property.

Here are some safety tips for working in flammable atmospheres:

- Eliminate ignition sources: Eliminate all ignition sources from the area, such as flames, sparks, and hot surfaces.
- Ventilate the area: Ventilate the area to remove any flammable gases or vapors.
- Use personal protective equipment (PPE): Wear PPE to protect yourself from the hazards in the flammable atmosphere. This may include a respirator, safety glasses, gloves, and hard hat.

- Have a plan: Have a plan in place in case of a fire or explosion. This will help to minimize the damage and protect the safety of workers and the public.

If you encounter a flammable atmosphere, do not enter the area. Evacuate the area and call for help.

Here are some additional tips for staying safe around flammable atmospheres:

- Store flammable materials safely: Store flammable materials in a safe place, away from heat sources and ignition sources.
- Use caution when working with flammable materials: Always follow safety procedures when working with flammable materials. This includes using the correct tools and equipment, and working in well-ventilated areas.
- Have flammable materials inspected and tested regularly: Have flammable materials inspected and tested regularly to ensure that they are safe to use.

Hot Work Hazards: Cutting, welding, or other hot work activities near tanks can lead to fire hazards. Proper safety procedures, fire extinguishers, and hot work permits are necessary.

Crushing Hazards: The use of heavy equipment or cranes for tank placement can result in crushing hazards. Ensure safe operating procedures, and establish exclusion zones to prevent injuries.

Environmental Hazards: Spills or leaks of hazardous substances from tanks can result in environmental damage. Implement spill prevention and response measures and adhere to environmental regulations.

Vehicular Traffic: Tank installation sites near roads or areas with vehicular traffic pose the risk of accidents involving vehicles. Use traffic control measures and proper signage.

Material Handling: Improper handling of tank components, such as lids, valves, or fittings, can lead to injuries or damage. Training and equipment for safe material handling are crucial.

Noise Hazards: Equipment and machinery used during tank installation can produce high noise levels. Use hearing protection for workers exposed to loud noise.

Biological Hazards: Tanks that have been stored for extended periods can accumulate debris and potential biological hazards, such as mold or bacteria. Proper cleaning and disinfection may be necessary.

Inclement Weather: Adverse weather conditions like rain, wind, or extreme temperatures can pose safety risks during tank installation. Monitor weather forecasts and take precautions accordingly.

Utility Interference: Underground tanks may encounter utility lines, leading to gas, water, or electrical utility interference. Perform utility locates and proceed with caution.

Addressing these potential hazards involves risk assessment, proper safety training, the use of safety equipment, adherence to safety protocols, and regulatory compliance. Safety should always be a priority when installing storage tanks to minimize the risk of accidents and incidents.

In addition to these specific hazards, being aware of general safety practices and protocols, including emergency response procedures, is essential. It's important to undergo safety training, regularly assess workplace risks, and take appropriate preventive measures to create a safer work environment. Safety awareness and adherence to safety regulations are key to reducing accidents and protecting the well-being of workers.

- Take breaks regularly to avoid fatigue.
- If you are unsure about anything, ask for help from a qualified plumber or contractor.
- Follow all applicable safety procedures and regulations.

There are some specific OHS requirements for connecting and installing storage tanks:

- Make sure that the work area is well-lit and ventilated.
- Use proper lifting techniques when moving the storage tank.
- Be careful when working with electrical equipment.
- Take precautions to avoid exposure to chemicals, such as wearing gloves and a respirator.
- Clean up any spills or leaks immediately.

It is important to note that these are just general OHS requirements. The specific requirements may vary depending on the type of storage tank, the site conditions, and applicable codes and

regulations. It is always best to consult with a qualified plumber or contractor to get specific advice on the OHS requirements for your installation.

There are some additional tips for ensuring safety when connecting and installing storage tanks:

- Follow the manufacturer's instructions carefully.
- Use high-quality materials and equipment.
- Have the tank and pipe work inspected by a qualified plumber or contractor before using the system.
- Test the system regularly to make sure that it is working properly.

In addition, there are some additional safety tips that you may want to consider:

- Identify and assess all potential hazards before starting work. This includes hazards associated with the work environment, the tools and equipment being used, and the materials being handled.
- Implement appropriate control measures to mitigate the risks identified. This may include using PPE, engineering controls, or administrative controls.
- Monitor the work environment and the workers regularly to identify any new or emerging hazards.
- Provide workers with appropriate training and information on safe work practices.

1.3. Quality assurance requirements

Quality assurance requirements refer to the specific criteria, standards, processes, and procedures that must be met to ensure the quality and reliability of a product, service, or process. These requirements are established to achieve consistency, reliability, and adherence to standards, ultimately leading to the delivery of a high-quality product or service.

Quality assurance (QA) requirements for connecting and installing storage tanks to a domestic water supply include:

- Use high-quality materials and equipment that are approved for use with potable water.
- Follow the manufacturer's instructions carefully when installing the tank and pipe work.

- Have the tank and pipe work inspected by a qualified plumber or contractor before using the system.
- Test the system regularly to make sure that it is working properly.

There are some specific examples of QA requirements for connecting and installing storage tanks to a domestic water supply:

- The storage tank must be made of a material that is compatible with the water being stored.
- The storage tank must be properly sized to meet the needs of the household.
- The storage tank must be installed on a level and stable surface.
- The pipe work must be properly sized and installed to avoid leaks.
- The backflow prevention device must be properly installed and maintained.
- The system must be tested for leaks and proper operation before being used.

It is important to note that these are just some examples of QA requirements. It is always best to consult with a qualified plumber or contractor to get specific advice on the QA requirements for your installation.

Some additional tips for ensuring QA when connecting and installing storage tanks to a domestic water supply:

- Keep a record of all QA activities performed. This may include records of inspections, tests, and maintenance.
- Develop and implement a QA plan. This plan should outline the QA procedures that will be followed during the installation and operation of the system.
- Have the QA plan reviewed by a qualified plumber or contractor.

1.4. Tools, equipment and Materials

Tools, equipment, and materials refer to the physical items and resources used in various fields and industries to perform tasks, complete projects, or produce goods.

Here are definitions for each of these components:

1.4.1. Tools:

Tools are handheld or portable devices designed for specific tasks. They are used by individuals or workers to perform manual operations, manipulate objects, or create products. Tools can include items like hammers, screwdrivers, wrenches, saws, and drills, among many others.

Tools used to the installation of a storage tank:

Pipe wrench: This tool is used to grip and turn pipes and fittings. It has a strong jaw that can grip even slippery surfaces.

Figure1.6 Pipe wrench

Adjustable wrench: This tool is used to tighten and loosen nuts and bolts of different sizes.

Figure1.7 Adjustable wrench

Hacksaw: This tool is used to cut metal pipes and other materials.

Figure1.8 Hacksaw

Pipe cutter: This tool is used to cut plastic and copper pipes.

Figure1.9 Pipe cutter

Screwdriver: This tool is used to tighten and loosen screws.

Figure1.10 Screwdriver

Measuring tape: This tool is used to measure the length, width, and height of objects.

Figure1.11 Measuring tape

Level: This tool is used to ensure that the storage tank is level before it is connected to the water supply.

Figure1.9 Level

Hammer: This tool is used to drive nails into wood and to break up concrete.

Figure1.12 Hammer

Drill: This tool is used to drill holes in wood, metal, and concrete.

Figure1.13 Drill

Safety glasses: This safety gear is worn to protect the eyes from flying debris and sparks.

In addition to these tools, you may also need to use a crane or other lifting equipment to position the storage tank. You may also need to purchase insulation for the tank or a pump to distribute the water.

It is always best to consult with a qualified plumber or contractor to get specific advice on the tools and materials required for your installation.

1.4.2. Equipment

Equipment refers to larger, often more complex, mechanical or electrical machines, apparatus, or devices used to perform specific functions or tasks. These are typically not handheld but may include items like tractors, computers, manufacturing machines, medical devices, or construction equipment.

Equipment's used to the installation of a storage tank:

Ladder: A ladder is used to reach the top of the storage tank and to access the pipe work.

Scaffolding: Scaffolding is used to provide a safe platform for workers to work on when installing the storage tank and pipe work.

Crane or other lifting equipment: A crane or other lifting equipment is used to position the storage tank in its desired location.

It is important to note that not all installations will require all of this equipment. For example, if you are installing a small storage tank, you may not need to use scaffolding. However, it is always best to have the necessary equipment on hand in case you need it.

When choosing equipment, it is important to consider the following factors:

- The size and weight of the storage tank
- The location of the storage tank
- The site conditions
- Applicable codes and regulations

It is always best to consult with a qualified plumber or contractor to get specific advice on the equipment required for your installation.

Here are some additional safety tips for using equipment when installing a storage tank:

- Make sure that the equipment is in good condition and that it is rated for the weight of the load.
- Use the equipment as intended and follow the manufacturer's instructions carefully.
- Be aware of the potential hazards associated with using the equipment and take appropriate precautions.
- Always wear appropriate personal protective equipment (PPE), such as a hard hat, safety glasses, and gloves.

1.4.3. Materials

Materials are the physical substances or components used in construction, manufacturing, or other processes. These can be raw materials, such as wood, metal, or plastic, or finished products like concrete, chemicals, fabrics, or electronic components. Materials are transformed or assembled to create products or structures.

Materials used to the installation of a storage tank:

Storage tank: The storage tank is the main component of the system and is used to store the water. Storage tanks can be made of a variety of materials, such as plastic, metal, and concrete.

Pipe work and fittings: Pipe work and fittings are used to connect the storage tank to the water supply and to distribute the water to your home. Pipe work can be made of a variety of materials, such as plastic, metal, and copper.

Backflow prevention device: A backflow prevention device is required to prevent contaminated water from flowing back into the domestic water supply.

Concrete slab or other base: A concrete slab or other base may be necessary to provide a stable and level foundation for the storage tank.

Shims or other supports: Shims or other supports may be necessary to level the storage tank once it is in place.

In addition to these materials, you may also need to purchase insulation for the tank or a pump to distribute the water.

It is important to note that the specific materials required for your installation will vary depending on the type of storage tank, the site conditions, and applicable codes and regulations. It is always best to consult with a qualified plumber or contractor to get specific advice on the materials required for your installation.

Here are some additional tips for choosing materials for your storage tank installation:

- Use high-quality materials that are approved for use with potable water.
- Make sure that the materials are compatible with each other and with the existing water supply system.
- Consider the climate and weather conditions when choosing materials. For example, if you live in a cold climate, you may need to insulate the tank to prevent the water from freezing.
- Follow the manufacturer's instructions carefully when installing the materials.

1.5. Work place preparation

Refers to the activities and measures taken to create a safe, organized, and efficient environment in which the installation of storage tanks for domestic water supply can be carried out.

Work place preparation for connecting and installing storage tanks to a domestic water supply includes the following:

Choose a location for the tank: The tank should be located on a level surface and close to the water supply. It should also be in a location where it is accessible for maintenance.

Prepare the site: The site should be cleared of debris and leveled. You may also need to install a concrete slab or other base for the tank.

Gather the necessary tools and materials: This includes the storage tank, pipe work and fittings, a backflow prevention device, and any other necessary materials, such as insulation or a pump.

Turn off the water supply: This is important to prevent any leaks or spills.

Drain the existing water supply system: This can be done by flushing the faucets or by opening a drain valve.

Once the workplace has been prepared, you can begin the process of connecting and installing the storage tank.

There are some additional tips for work place preparation:

- Make sure that the workplace is well-lit and ventilated.
- Wear appropriate personal protective equipment (PPE), such as safety glasses, gloves, and a hard hat.
- Be aware of the potential hazards associated with the work, such as falls, electrocution, and exposure to chemicals.
- Take breaks regularly to avoid fatigue.
- If you are unsure about anything, ask for help from a qualified plumber or contractor.

Self-check 1

Name…… ID…… Date…….

***Instruction1*:** Choose the best answer from the given alternatives**.**

1. Which of the following choices relates to the Introduction of storage tank?

   A. Occupational health and safety requirements
   B. Quality assurance requirements
   C. Tools, equipment and materials
   D. Work place preparation

2. What do Quality assurance requirements pertain to?

   A. The introduction of storage tank
   B. Occupational health and safety requirements
   C. Tools, equipment and materials
   D. Work place preparation

3. What does Work place preparation involve?

   A. The introduction of storage tank
   B. Occupational health and safety requirements
   C. Quality assurance requirements
   D. Tools, equipment and materials

Instruction2: write **True** if the statement is correct and write **False** if the statement is incorrect.

1. Introduction of storage tank includes considerations for occupational health and safety requirements.
2. Quality assurance requirements are not relevant to the installation of storage tanks.
3. Work place preparation involves ensuring the availability of necessary tools, equipment, and materials.

Instructio3: Write Short Answer to the given Questions**.**

1. What is the purpose of introducing storage tank?
2. Why are occupational health and safety requirements important in the context of storage tank installation?
3. List and describe tools, equipment, and materials used for storage tank installation?

Unit two: Installation requirement

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

- Concept of installation requirement
- Checking materials and equipment
- Principles and concepts of work preparation
- Quantities

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

- Check materials and equipment
- Explain Sustainability principles and concepts of work preparation
- Calculate Quantities of required materials

2.1. Concept of installation requirement

The concept of installation requirements for installing domestic storage tanks involves a set of guidelines, specifications, and standards that must be followed to ensure the safe, efficient, and compliant installation of storage tanks for domestic water supply. These requirements encompass various aspects of the installation process to guarantee the integrity and functionality of the storage tank system.

Key components of this concept include:

1. **Location and Placement:** Determining the appropriate location for the storage tank and ensuring it is placed on a stable foundation that can support the tank's weight. This requirement considers factors like soil conditions and load-bearing capacity.
2. **Safety Measures:** Implementing safety measures to protect workers, the environment, and the surrounding community during the installation process. This may involve the use of safety barriers, personal protective equipment (PPE), and adherence to safety protocols.
3. **Regulatory Compliance:** Adhering to local, state, and federal regulations and obtaining any necessary permits for the installation. Compliance with building codes and environmental regulations is essential to avoid legal and safety issues.
4. **Material Selection:** Choosing the appropriate materials for the tank, supports, and piping that are compatible with the stored water and the installation environment. Materials should be corrosion-resistant and durable.
5. **Site Preparation:** Preparing the installation site by clearing the area of obstacles, marking utility lines, and addressing any potential hazards. This step ensures a safe and organized workspace.
6. **Foundation and Supports:** Providing a secure and level foundation for the storage tank and using the correct supports, such as stands or cradles, to hold the tank in place.
7. **Connection and Plumbing:** Properly connecting the storage tank to the domestic water supply system, including inlet and outlet piping, valves, and any necessary plumbing components.

8. **Testing and Quality Assurance:** Conducting pressure tests, leak tests, and other inspections to verify the tank's integrity and compliance with industry standards. This ensures that the installation is free from defects or weaknesses that could compromise the system.
9. **Documentation and Record-Keeping:** Keeping detailed records of the installation process, including test data, permits, and any compliance documentation. This documentation is important for future reference and regulatory purposes.
10. **Environmental Considerations:** Implementing measures to protect the environment, including spill containment, erosion control, and proper disposal of waste materials.
11. The concept of installation requirements aims to ensure that the installation of domestic storage tanks is carried out with the highest level of safety, quality, and compliance.

2.2. Checking materials and equipment

A very good safety habit to adopt is to conduct daily pre-operational checks of tools, equipment and machinery each day before you use them. Pre-operation checks are not only a good safety practice, they can also save you a lot of money in maintenance and downtime costs. If you find any problems during your pre-operational check, make sure you correct the problem before using the machine.

For example, before operating a machine it is important to;

- Walk around and look at all fluid levels such as engine oil, fuel, and hydraulic fluid.
- Look underneath the tractor; do you see any big leaks or puddles of fluid that have accumulated under the tractor.
- Look closely at the tires.
- Check the batteries to make sure they are securely held down, the connections are clean and the electrolyte level is good.
- As you are walking around, look for any obvious damage like cracked or broken parts, leaking or damaged hoses.
- Make sure that the steps are clean of any grease or mud that could cause you to slip.

- Check to see that the operator's platform or cab is free of any objects that could interfere with the operation of the tractor. If you have a cab tractor, keep the windows clean for good visibility.
- Properly adjust the seat for a comfortable position. Check the seatbelt to see if it is functioning.

2.2.1. Adjusting tools, equipment and machinery performance

Adjustments; various adjustments are required before starting machine operation. The machine is to be installed on clean level ground and is to be set according to task conditions. Any piece of equipment (including tools and furniture) identified as unsafe, either in normal day-to-day activities or during a safety inspection, must be promptly tagged using a tag out.

Then further action must be taken for repair or disposal.

Equipment identified as faulty should be disconnected and tagged, and appropriate service people contacted to arrange repair or replacement to improve the performance.

Think, plan and check

- Lockout procedure must be employed whenever a piece of equipment is being repaired and there is the possibility of that equipment being switched on without the knowledge of the repairer.
- Identify all parts of any equipment or system that needs to be shut down.
- Find the switches, valves or other devices that need to be switched off.
- Follow the correct procedure for the shutdown of equipment so you don't endanger anyone.

2.2.2. Plumbing Hand Tools

Being prepared for a job and having the right tools is crucial for the success of any project. This plumbing tools list is a great resource for any tools that are needed for any plumbing project.

Table 2.1. Tools for pipe work

Best plumbing tools for pipe work

Tubing Cutter	Mole grips	Press fitting systems
Hacksaw	Plumber's torch	Flashlight
Hole saw kit	Thread sealing tape	A bucket
Pipe and tube benders	Pliers	Ratcheting pipe threaded set
Plumber wrenches		Plumber drain cleaning tools
Pipe wrench	Faucet key	Plungers
Adjustable wrench	Torque wrench	Hand auger
Basin wrench	Internal pipe wrench	Snake machine
Plumbing safety tools		Drain inspection camera
Gloves , Goggles and Heat shields/ pads		Hydro jetting machines

Best plumbing tools for pipe work

Tubing Cutter: A tool used by plumbers to cut through plastic tubing, with each one having its own cutting range.

Figure 2.1. Tubing Cutter

Hacksaw: Plumbers typically carry hacksaws so that they can cut through a variety of items, including nuts, bolts, pipes, and screws. Make sure you keep spare blades around too!

Figure 2.2. Hole Saw

Hole saw kit: A hole saw is used to cut perfectly round holes in a variety of materials.

Mole grips: Used to hold metal parts in place during welding, such as when a plumber is using a plumber's torch to seal copper piping by soldering it.

Figure 2.3. Pipe Bender

Pipe and tube benders: A tool used to bend a range of piping and tubing instead of creating a fitting.

Pliers: These are used every day by plumbers. Easily tighten or loosen nuts and bolts that wrenches can't grab onto.

Figure 2.4. Plumber's Torch

Plumber's torch: A plumber's torch is a handheld tool used to apply heat to a precise area of piping, allowing you to seal new piping for installs and replacements.

Press fitting systems: Iron Pipe Size (IPS) press fitting systems enable plumbers to press a connection onto a pipe, resulting in a watertight connection or seal.

Flashlight: Plumbers are commonly required to go into dark spaces, such as basements, so having a flashlight handy is always a good idea.

Figure 2.5. Plumber's Tape

Thread sealing tape ("Plumber's Tape"): Thread sealing tape is used to patch or prevent leaks in piping.

A bucket: Even when the water is turned off in the home, there is still going to be some water leakage, so it's smart to keep a bucket around.

Ratcheting pipe threaded set: This tool allows you cut threads into pipe so that it can accept fittings when joining pipes together.

Pipe wrench: Plumbers use pipe wrenches to tighten and loosen nuts and fittings on pipes. Two of these are often used together, one for holding a pipe in place and the other for rotating a nut or fitting.

Figure 2.6. Adjustable Wrench

Adjustable wrench: Also known as an adjustable spanner or crescent is a tool used to loosen or tighten a nut or bolt.

Basin wrench ("Sink Wrench"): A T-shaped tool that plumbers use specifically on faucets.

Its unique design allows plumbers to turn fasteners in confined spaces that would otherwise be impossible to reach.

Faucet key: An X-shaped tool that plumbers use to open and close spigots and hillocks.

Torque wrench: A tool used to apply a specific torque to a nut or bolt.

Internal pipe wrench: Commonly used to remove old rusted fittings on galvanized pipe.

Protective Equipment for Plumbing work: Gear up to protect yourself on the job

Figure 2.7. PPE tools

Latex gloves like these worn under regular leather or canvas work gloves can help protect you from all manner of ugliness in drain lines.

Safety glasses and a hard hat are the two most common pieces of jobsite safety equipment you'll see.

Figure 2.8. Full PPE wears

Gloves, coveralls, respirators they all have their place on various jobsites and they're all great additions to your safety gear.

There are more dangerous trades firefighting and coal mining come to mind but plumbing presents a long list of potential hazards. This is true because jobs and job sites vary widely. Plumbers obviously face different risks in different work environments. Whether you are snaking a line, installing a water heater or soldering pipe on a multi-story apartment complex, a plumber, installer or contractor needs to think: safety first.

Make sure it works

Check the work truck for the presence of safety equipment and its condition worn-out or non-working equipment isn't of much use on the job. When new equipment is required, don't even think of taking the cheap way out. Invest in top-of the-line equipment. That's an investment in your own health and safety and that of employees or co-workers. Experts also advise keeping gear in top working order.

Choosing the right tools for the job also matters, such as those equipped for ground fault circuit interrupters when working in wet environments to reduce the risk of shock. Working with tools that aren't right for the job or that haven't been maintained also is bad practice.

Along with that, do regular on-site checks of how work is accomplished. You might spot any lapse in safe working habits and the need for a training session or refresher course. Whether you are a solo operator, small crew or sizeable operation, consider having an outside safety professional check out how you work and make any reparative suggestions.

2.3. Explain Sustainability principles and concepts of work preparation

Sustainability principles and concepts of work preparation based on the installation of storage tanks in domestic water supply systems include:

- Water conservation: Storage tanks can help to conserve water by storing rainwater or other water sources for later use. This can be especially beneficial in areas with limited water resources.
- Energy efficiency: Storage tanks can help to improve energy efficiency by reducing the need to pump water long distances. This can save energy and reduce greenhouse gas emissions.
- Reduced environmental impact: Storage tanks can help to reduce environmental impact by reducing the amount of storm water runoff that enters our waterways. This can help to improve water quality and protect wildlife.
- Improved public health: Storage tanks can help to improve public health by providing a reliable source of clean drinking water. This is especially important in areas with poor water quality or limited access to clean water.

2.3.1. Work preparation

When preparing to install a storage tank in a domestic water supply system, it is important to consider the following:

- The size and type of storage tank: The size and type of storage tank will depend on the specific needs of the household. Factors to consider include the number of people in the household, the average daily water consumption, and the availability of water resources.
- The location of the storage tank: The storage tank should be located in a location that is accessible for maintenance and inspection. It should also be located away from heat sources and ignition sources.
- The preparation of the foundation: The foundation for the storage tank should be level and solid. If the ground is soft or uneven, the tank may settle or tilt over time.
- The connection of the storage tank to the plumbing system: The storage tank should be connected to the plumbing system using proper fittings and valves. It is important to ensure that all connections are watertight.

2.3.2. Sustainability

There are a number of ways to make the installation of storage tanks in domestic water supply systems more sustainable. These include:

- Using recycled materials: The storage tank and other components of the water supply system can be made from recycled materials. This helps to reduce the environmental impact of the installation process.
- Using energy-efficient equipment: Energy-efficient pumps and other equipment can be used to reduce the energy consumption of the water supply system.
- Collecting rainwater: Rainwater can be collected from rooftops and stored in a storage tank for later use. This can help to reduce the reliance on municipal water supplies.
- Using native plants: Native plants can be planted around the storage tank to help reduce water consumption and improve water quality.

There are some specific examples of how to apply sustainability principles to storage tank installation:

- Use recycled or sustainable materials for the tank and pipe work.
- Minimize waste by cutting the pipe work to size accurately and by recycling any scrap metal.
- Prevent pollution by containing any spills or leaks.
- Conserve energy by using energy-efficient welding equipment and by turning off equipment when not in use.
- Select equipment that is energy-efficient, such as pumps and fans.
- Protect the environment by planting trees or shrubs around the tank site.

2.4. Determining Quantities of materials

In order to calculate the quantities of required materials, you will need to know the following:

- The type and size of the storage tank
- The length and diameter of the pipe work
- The type of welding and sealing materials required

Once you have this information, you can use the following formulas to calculate the quantities of required materials:

- Volume of the tank:
- Volume = $\pi r^2 h$

where:

- r is the radius of the tank
- h is the height of the tank

Length of the pipe work:

- Length = $L + 2\pi r$

where:

- L is the total length of the pipe work
- r is the radius of the pipe

Weight of the tank:

- Weight = Volume × Density

where:

- Density is the density of the material used to make the tank

Weight of the pipe work:

- Weight = Length × Density

where:

- Density is the density of the material used to make the pipe work

Once you have calculated the quantities of required materials, you can add a contingency of 10-20% to allow for any unexpected waste or damage.

It is important to note that these are just general guidelines. The specific requirements for calculating the quantities of required materials will vary depending on the type of storage tank and the site conditions. It is always best to consult with a qualified engineer or contractor to get specific advice.

Self-check 2

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

***Instruction1*:** Choose the best answer from the given alternatives**.**

1. Which of the following concepts is related to the installation requirement?

A. Checking materials and equipment

B. Principles and concepts of work preparation

C. Quantities

2. What is the purpose of checking materials and equipment?

A. Ensuring compliance with installation requirements

B. Preparing the work area for installation

C. Determining the quantities needed for installation

3. Which of the following concepts focuses on the principles and concepts of work preparation?

A. Installation requirement

B. Checking materials and equipment

C. Principles and concepts of work preparation

Instruction2: write **True** if the statement is correct and write **False** if the statement is incorrect.

1. True or False: The concept of installation requirement refers to the specifications and criteria that must be met during the installation process.
2. True or False: Checking materials and equipment is not important for ensuring successful installation.
3. True or False: Principles and concepts of work preparation involve determining the quantities of materials and equipment needed for installation.

Instructio3: Write Short Answer to the given Questions**.**

1. What does the concept of installation requirement encompass?
2. Why is checking materials and equipment important before installation?
3. What are some key principles and concepts involved in work preparation?

Operation sheet 3.1:

Operation Title: Determining Quantities of materials

Purpose: To Calculate Quantities of required materials used for storage tank installation.

Conditions or situations for the operations:

- Safe working area
- Properly operated tools and equipment
- Appropriate working cloths fit with the body

Equipment Tools and Materials:

- Calculator
- And other writing materials

Steps in doing the task

1. Calculate Quantities of required Storage Tank:
    - Type: Cylindrical
    - Radius (r): 2 meters
    - Height (h): 5 meters
    - Material Density: 800 kg/m³

2. Calculate Quantities of required Pipe Work:

- Length of Pipe Work (L): 10 meters
- Radius of Pipe (r): 0.1 meters
- Material Density for Pipe Work: 900 kg/m³

1. **Calculate Volume of the Tank.**

- Volume = $\pi r^2 h$
- Volume = $\pi \times (2 \text{ meters})^2 \times 5 \text{ meters}$
- Volume ≈ 62.83 cubic meters

3. Calculate Length of the Pipe Work.

- ✓ Length = $L + 2\pi r$
- ✓ Length = $10 \text{ meters} + 2\pi \times 0.1 \text{ meters}$
- ✓ Length ≈ 10.63 meters

4. Calculate Weight of the Tank.

Weight = Volume × Density

Weight = 62.83 m^3 × 800 kg/m^3

Weight = 50,264 kg (or 50.264 metric tons)

5. Calculate Weight of the Pipe Work.

Weight = Length × Density

Weight = 10.63 meters × 900 kg/m^3

Weight = 9,567 kg (or 9.567 metric tons)

6. Calculate Adding Contingency.

You should add a contingency of 10-20% to account for any unexpected waste or damage. Let's use 15% as an example:

- Contingency for Tank = 15% of Tank Weight = 0.15 × 50,264 kg = 7,539.6 kg
- Contingency for Pipe Work = 15% of Pipe Work Weight = 0.15 × 9,567 kg = 1,435.05 kg

7. Calculate Final Quantities of Required Materials.

- Total Material for Tank = Weight of Tank + Contingency for Tank = 50,264 kg + 7,539.6 kg = 57,803.6 kg (or 57.804 metric tons)
- Total Material for Pipe Work = Weight of Pipe Work + Contingency for Pipe Work = 9,567 kg + 1,435.05 kg = 11,002.05 kg (or 11.002 metric tons)

These calculations provide you with clear estimates of the quantities of materials required for the cylindrical storage tank and the associated pipe work, including contingencies for unexpected factors. Always consult with experts and consider specific project requirements for precise calculations in real-world scenarios.

LAP Test:

Instruction: The test helps to ensure that the trains calculating Quantities of required materials.

Task1: Calculate the volume of the storage tank.

Task2: Calculate the quantities of each material needed.

Task3: Determine the materials needed to connect the storage tank to the domestic water supply system.

Task4: Calculate Add a contingency factor.

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Unit three: Install and test storage tank

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

- Storage tank and pipe work
- Installation of storage tanks
- Testing and Commissioning storage tank
- Recording test data

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

- Set out Storage tank and associated pipe work
- Install storage Tank, piping and materials
- Test and Commission storage tank
- Record test data

3.1. Setting out Storage tank and pipe work

A set out storage tank is a vessel that is used to store liquids or gases and is located outside of a building or structure. Set out storage tanks are used in a wide variety of applications, including water storage, chemical storage, oil and gas storage, food and beverage processing, and pharmaceutical manufacturing.

Set out storage tanks can be made from a variety of materials, including steel, plastic, and concrete. The type of material used depends on the specific application. For example, steel storage tanks are commonly used to store hazardous materials, while plastic storage tanks are commonly used to store water and other non-hazardous liquids.

Set out storage tanks are typically equipped with a variety of safety features, such as overfill prevention devices, pressure relief valves, and leak detection systems. These safety features help to protect the tank from damage and prevent the release of hazardous materials into the environment.

3.1.1. Benefits of using set out storage tanks

Increased storage capacity: Set out storage tanks can be used to store large volumes of liquids or gases. This can be beneficial for businesses and organizations that need to store large quantities of materials on site.

Reduced costs: Set out storage tanks can help to reduce costs by eliminating the need to transport materials and from off-site storage facilities.

Improved efficiency: Set out storage tanks can help to improve efficiency by providing a convenient and reliable source of materials for production or other operations.

Increased safety: Set out storage tanks can be equipped with a variety of safety features to protect the tank from damage and prevent the release of hazardous materials into the environment.

3.1.2. key considerations for designing and installing a set out storage tank system:

Site selection: The tank should be located in a well-ventilated area away from sources of ignition and other hazards.

Storage tank selection: The tank should be sized and constructed appropriately for the type of material being stored.

Pipe work design: The pipe work should be designed to withstand the pressure and temperature of the fluid being stored.

Demand considerations: are important when designing and installing a set out storage tank system. The following factors should be considered:

- **Peak demand:** The peak demand is the maximum rate at which water is withdrawn from the tank. This typically occurs during peak hours, such as in the morning and evening when people are getting ready for work or school.
- **Average demand:** The average demand is the total amount of water withdrawn from the tank divided by the time period over which it was withdrawn. This is typically lower than the peak demand, but it is still an important factor to consider when designing the system.
- **Future demand:** It is also important to consider future demand when designing a set out storage tank system. As the population grows and water use increases, the system will need to be able to meet the demands of the future.
- **Tank size:** The size of the tank will be determined by the peak and average demand, as well as the desired storage capacity.
- **Tank material:** The material of the tank will depend on the type of water being stored and the environmental conditions.
- **Tank location:** The tank should be located in a convenient and accessible location. It is also important to consider the impact of the tank on the surrounding environment.
- **Piping and valves:** The piping and valves used to connect the tank to the water supply and distribution system must be appropriately sized and rated.

3.1.3. Types of set out storage tanks

There are many different types of set out storage tanks depending on the specific application.

Some of the most common types include:

Aboveground storage tanks (ASTs): ASTs are the most common type of set out storage tank. They are typically made of steel, plastic, or concrete and can be used to store a wide variety of liquids and gases, including water, chemicals, oil and gas, and food and beverage products.

Figure 3.1 Aboveground storage tanks

Underground storage tanks (USTs): USTs are buried underground and are typically used to store hazardous materials, such as gasoline, diesel fuel, and heating oil. USTs must be specially designed and installed to prevent leaks and contamination of the soil and groundwater.

Figure 3.2 Underground storage tanks

Silos and grain bins: Silos and grain bins are tall, cylindrical structures that are used to store bulk materials, such as grain, fertilizer, and chemicals. Silos and grain bins are typically made of concrete or steel and are equipped with a variety of safety features, such as overfill prevention devices and dust collection systems.

Figure 3.3 Silos and grain bins tanks

Pressure vessels: Pressure vessels are designed to withstand high internal pressures and are used to store a variety of compressed gases, such as air, nitrogen, and oxygen. Pressure vessels are

typically made of steel and are equipped with a variety of safety features, such as pressure relief valves and rupture discs.

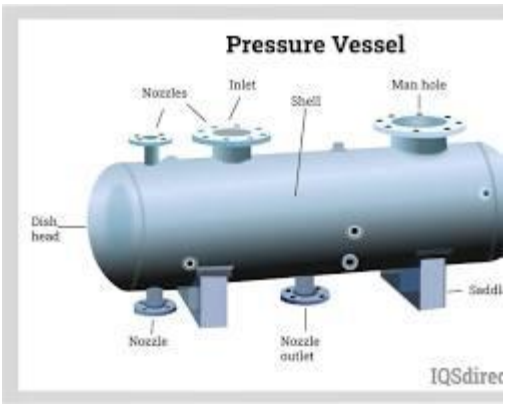


Figure 3.4 Pressure vessels tanks

Cryogenic tanks: Cryogenic tanks are designed to store liquids and gases at very low temperatures. Cryogenic tanks are typically made of stainless steel and are equipped with a variety of safety features, such as vacuum insulation systems and pressure relief valves.

Figure 3.5 Cryogenic tank

3.1.4. Components pipe work

The associated pipe work components for a set out storage tank include:

Pipes: The pipes are used to transport the fluid from the tank to other equipment, such as pumps, filters, and other storage tanks.

Valves: The valves are used to control the flow of fluid through the pipe work.

Fittings: The fittings are used to connect the pipes and valves together.

Flanges: The flanges are used to seal the joints between the pipes and fittings.

Gaskets: The gaskets are used to provide a watertight seal between the flanges.

Bolting: The bolting is used to secure the flanges together.

Hoses: Hoses are sometimes used to connect the pipes and valves together, especially in temporary or emergency situations.

Expansion joints: Expansion joints are used to absorb the expansion and contraction of the pipes due to temperature changes.

Sight flow glasses: Sight flow glasses are used to observe the flow of fluid through the pipe work.

Filters: Filters are used to remove impurities from the fluid.

Strainers: Strainers are used to remove large particles from the fluid.

Instruments: Instruments are used to monitor and control the system. This can include things like ***pressure gauges, temperature sensors, and level indicators***.

The specific pipe work components that are required will vary depending on the specific application. For example, a set out storage tank that is used to store hazardous materials will have different pipe work requirements than a set out storage tank that is used to store water.

It is important to note that all pipe work components must be properly designed, installed, and maintained to ensure the safety and reliability of the system.

3.1.5. Applications of set out storage tanks and associated pipe work

Set out storage tanks and associated pipe work are used in a wide variety of applications, including:

Water storage: Set out storage tanks are commonly used to store water for municipal, industrial, and agricultural purposes. For example, water storage tanks are used to store water for drinking, irrigation, and firefighting.

Chemical storage: Set out storage tanks are used to store a variety of chemicals, including acids, bases, solvents, and other hazardous materials. For example, chemical storage tanks are used to store chemicals used in manufacturing, mining, and agriculture.

Oil and gas storage: Set out storage tanks are used to store crude oil, refined petroleum products, and natural gas. For example, oil and gas storage tanks are used to store fuel for power plants and transportation vehicles.

Food and beverage processing: Set out storage tanks are used to store a variety of food and beverage products, such as milk, juice, beer, and wine. For example, food and beverage processing tanks are used to store raw materials, intermediate products, and finished products.

Pharmaceutical manufacturing: Set out storage tanks are used to store a variety of pharmaceutical products, such as bulk chemicals, finished products, and waste materials. For example, pharmaceutical manufacturing tanks are used to store ingredients for drugs and vaccines, as well as the finished products themselves.

Other applications of set out storage tanks and associated pipe work include:

Wastewater treatment: Set out storage tanks are used to store wastewater before it is treated and discharged.

Firefighting: Set out storage tanks are used to store water and firefighting foam for use in firefighting operations.

Agriculture: Set out storage tanks are used to store water for irrigation, fertilizers, and pesticides.

Mining: Set out storage tanks are used to store water, mining chemicals, and other materials used in mining operations.

Construction: Set out storage tanks are used to store water, fuel, and other materials used in construction projects.

Set out storage tanks and associated pipe work are an essential part of many industries and businesses. They provide a safe and reliable way to store large volumes of liquids or gases.

3.1.6. Pipe supports and fixings

Pipe supports and fixings are essential components in plumbing and piping systems, ensuring the stability and integrity of pipes and preventing issues such as sagging, leaks, and damage. Here are some key aspects related to pipe supports and fixings:

Purpose: Pipe supports and fixings are designed to hold pipes in place, preventing movement, vibrations, and stresses that could lead to structural problems or damage to the pipes themselves. They maintain proper alignment and protect against sagging.

3.1.6.1. Pipe supports

Pipe supports are crucial components in plumbing and piping systems, designed to secure, elevate, and stabilize pipes, ensuring their proper alignment and functionality. They serve various purposes in plumbing and industrial applications, contributing to the overall integrity of the system.

Here are some common types and functions of pipe supports:

Hangers: These are devices that suspend pipes from structural elements like beams, walls, or ceilings. Hangers can be of various types, including clevis hangers, band hangers, and swivel ring hangers.

Clamps: Clamps are used to secure pipes to walls or other surfaces. They come in various designs, including split clamps and cushioned clamps for added protection.

Shoes: Pipe shoes support the weight of pipes at critical points such as where they pass through walls. They distribute the load and reduce stress on the pipe.

Rollers and Slides: These allow for controlled movement of pipes, particularly in response to thermal expansion and contraction.

Spring Hangers: Spring hangers provide support for pipes while accommodating vertical movement due to thermal expansion.

Material Selection: The material of pipe supports and fixings should be chosen based on factors such as the type of pipe, environmental conditions, and the substance being transported. Common materials include steel, stainless steel, and plastic.

Installation and Spacing: Proper installation is crucial to ensure the effectiveness of supports and fixings. Spacing between supports should be appropriate to prevent sagging, vibrations, and excessive stress on the pipes.

Load Capacity: Supports and fixings are designed to handle specific loads, and it's important to choose the right type and size based on the weight and size of the pipes they will be supporting.

Thermal Expansion: In systems where pipes are subjected to temperature changes, supports and fixings must accommodate thermal expansion and contraction to prevent bending or buckling.

Vibration Dampening: In some cases, where pipes may transmit vibrations, it's important to use supports and fixings with vibration-dampening properties to reduce noise and prevent damage to the system.

Compliance with Standards: Ensure that the supports and fixings used in plumbing systems comply with industry standards and regulations to maintain safety and performance.

Regular Inspection and Maintenance: Ongoing inspection and maintenance of pipe supports and fixings are important to identify and address issues early, preventing potential problems.

In summary, pipe supports and fixings are crucial components of plumbing and piping systems that help ensure the stability and integrity of pipes. Proper selection, installation, and maintenance of these components are essential for the long-term functionality and safety of the entire system.

3.1.6.2. Pipe fixings

Pipe fixings, also known as pipe fasteners or pipe supports, are essential components in plumbing and piping systems. They serve the purpose of securing, stabilizing, and maintaining the proper alignment of pipes, tubes, and other related components. Pipe fixings are crucial for the integrity and safety of these systems.

Here are some common types of pipe fixings:

Pipe Hangers and Supports: These are devices used to secure and support pipes. Pipe hangers can be attached to walls, ceilings, or other structural elements to prevent pipes from sagging or vibrating. They come in various types, including clevis hangers, J-hooks, and swivel ring hangers.

Pipe Clamps: Pipe clamps are used to secure pipes to walls, floors, or other surfaces. They come in various styles, such as split clamps, cushioned clamps, and one-hole clamps. Clamps help prevent movement and vibrations in the pipes.

Pipe Straps: Pipe straps are designed to secure pipes to framing members, such as wall studs or floor joists. They are commonly used for horizontal piping runs.

Pipe Insulation Supports: These are used to hold pipe insulation in place, helping to maintain temperature and prevent condensation on pipes.

Pipe Anchors: Pipe anchors are used to restrict the movement of pipes, especially during thermal expansion and contraction. They are typically used in situations where pipes are anchored to fixed points.

Clevis and Beam Clamps: These are used to secure pipes to beams or other overhead structures, often in industrial or commercial settings.

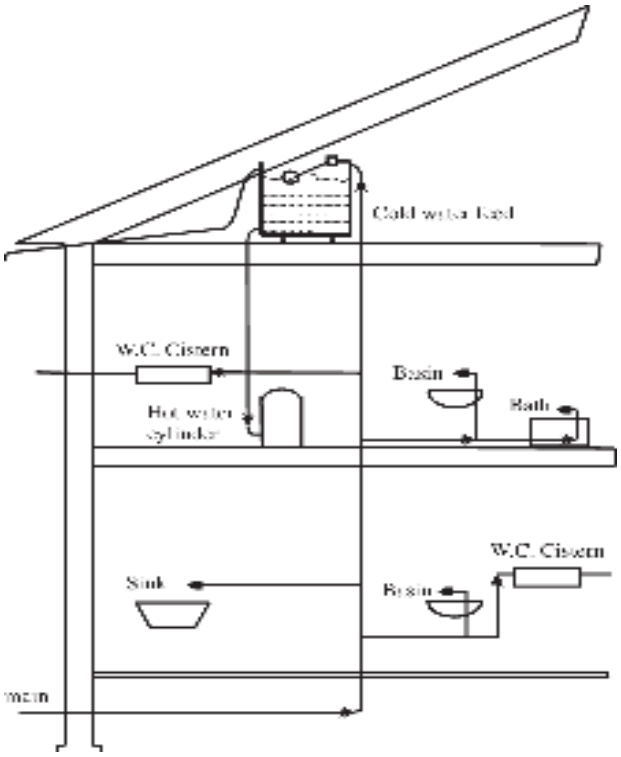
Flange Packs: Flange packs are used to create a secure and leak-resistant connection between a pipe and a flanged component, such as a valve or pump.

Stainless Steel Banding and Strapping: Stainless steel bands and strapping are used for a range of purposes, including securing pipes, supporting equipment, and repairing leaks.

Support Systems for Insulated Pipe: These support systems are designed to secure insulated pipes, providing a stable and insulated connection.

3.2. Installation of storage tanks

Installation of storage tanks involves the process of properly positioning and securing a storage tank within a designated area to ensure its safe and efficient operation. This process is critical for various applications, including domestic water supply, industrial storage, and the storage of hazardous materials.



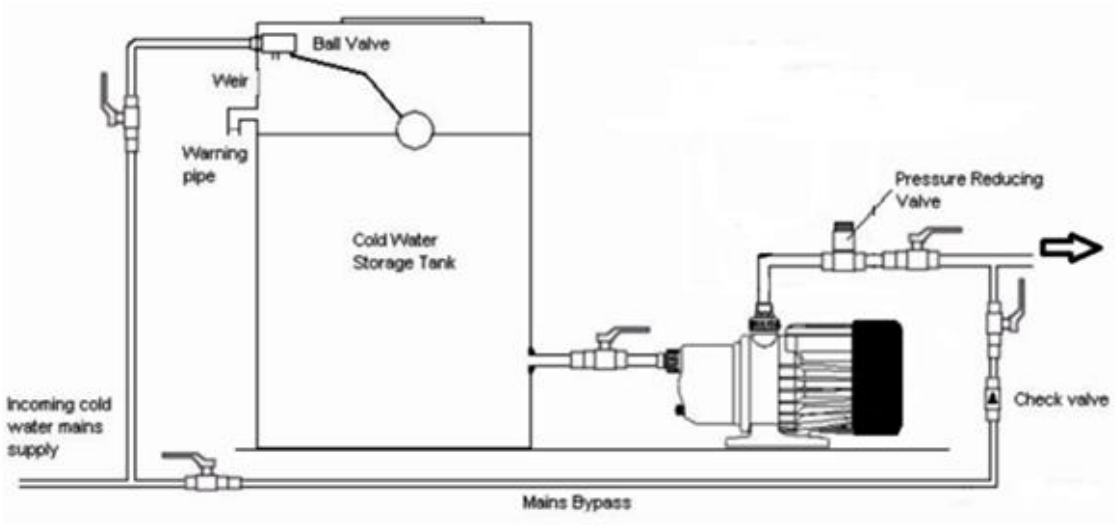


Figure 3.6 water storage tank

3.2.1. Rigging and hoisting techniques

The rigging and hoisting of a storage tank is a critical step in the installation process. It is important to use the appropriate lifting equipment and to follow safe procedures to avoid damaging the tank or injuring workers.

There are some general tips for rigging and hoisting storage tanks:

- Use a crane or other lifting equipment that has the capacity to safely lift the tank.
- Inspect the lifting equipment before use to make sure that it is in good condition.
- Use slings or other rigging equipment that is rated for the weight and size of the tank.
- Attach the slings to the tank at the manufacturer's designated lifting points.
- Level the tank before lifting it.
- Lift the tank slowly and carefully.
- Guide the tank into place using tag lines or other means.

Figure 3.7 Rigging and hoisting a storage tank

3.2.2. Storage Tank positioning and alignment

Storage tank positioning and alignment is important for ensuring the safety and reliability of the tank. The tank should be positioned on a level surface and should be aligned properly with the piping system.

Positioning: The storage tank should be positioned on a level surface. This will help to prevent the tank from sagging or tilting, which can lead to leaks and other problems.

The tank should also be positioned in a location that is accessible for maintenance and inspection. It should also be located away from heat sources and ignition sources.

Alignment: The storage tank should be aligned properly with the piping system. This will help to prevent leaks and other problems.

The tank should be aligned so that the inlet and outlet pipes are properly connected. The tank should also be aligned so that it is level with the piping system.

Once the tank is in place, it must be carefully positioned and aligned. This is to ensure that the tank is level and that the pipe work can be connected properly.

There are some tips for positioning and aligning storage tanks: -

- Place the tank on a level surface.
- Use shims or other supports to level the tank, if necessary.
- Align the tank so that the pipe work can be connected properly.
- Use a level to ensure that the tank is level in all directions.

3.2.3. Welding and sealing procedures

If the tank is made of multiple sections, the welds must be carefully made and sealed to prevent leaks. This is especially important for tanks that will be storing hazardous materials.

There are some tips for welding and sealing storage tanks:

- Follow the manufacturer's instructions carefully.
- Use a qualified welder to perform the welding.
- Use high-quality welding materials.
- Inspect the welds carefully for defects.
- Test the welds for leaks.

3.3. Testing and Commissioning storage tank

Testing and commissioning a domestic storage tank and associated pipe work is an important step to ensure that the system is safe and reliable. The following are some general guidelines for

testing and commissioning a domestic storage tank and associated pipe work system: The following are the four main stages of testing and commissioning:

3.3.1. Storage Tank testing

The tank testing stage involves testing the integrity of the tank to ensure that it is leak proof and can withstand the operating pressure and temperature.

The following tests are typically performed:

Hydrostatic testing: This involves filling the tank with water and pressurizing it to a level above the operating pressure. The tank is then inspected for any leaks.

Pneumatic testing: This involves filling the tank with air and pressurizing it to a level above the operating pressure. The tank is then inspected for any leaks.

Non-destructive testing (NDT): This involves using various NDT methods, such as ultrasonic testing, radiographic testing, and magnetic particle testing, to inspect the tank for any defects.

3.3.2. Pipe work testing

The pipe work testing stage involves testing the integrity of the pipe work to ensure that it is leak proof and can withstand the operating pressure and temperature.

The following tests are typically performed:

Hydrostatic testing: This involves filling the pipe work with water and pressurizing it to a level above the operating pressure. The pipe work is then inspected for any leaks.

Pneumatic testing: This involves filling the pipe work with air and pressurizing it to a level above the operating pressure. The pipe work is then inspected for any leaks.

Non-destructive testing (NDT): This involves using various NDT methods, such as ultrasonic testing, radiographic testing, and magnetic particle testing, to inspect the pipe work for any defects.

3.3.3. Instrumentation testing

The instrumentation testing stage involves testing the accuracy and calibration of the instrumentation used to monitor and control the system.

The following tests are typically performed:

Pressure gauges: Pressure gauges are tested to ensure that they are accurate and calibrated.

Temperature sensors: Temperature sensors are tested to ensure that they are accurate and calibrated.

Level indicators: Level indicators are tested to ensure that they are accurate and calibrated.

Other instrumentation: Other instrumentation, such as flow meters and safety devices, is also tested to ensure that it is operating properly.

3.3.4. System commissioning

The system commissioning stage involves testing the entire system to ensure that it operates safely and reliably.

The following tests are typically performed:

Functional testing: This involves testing the system to ensure that all of the components are operating properly and that the system can perform its intended function.

Safety testing: This involves testing the system's safety features to ensure that they are operating properly.

Alarm testing: This involves testing the system's alarms to ensure that they are operating properly.

Once the system commissioning stage is complete, the storage tank and associated pipe work is ready to be put into operation.

It is important to note that the specific testing and commissioning procedures that are required will vary depending on the specific type of storage tank and associated pipe work system. It is important to consult with a qualified engineer or other professional to develop a testing and commissioning plan that is appropriate for the specific system.

3.4. Recording Test Data:

Recording test data is a crucial step in ensuring the proper functioning and ongoing maintenance of the storage tank.

Data Collection: During the testing and commissioning phase gather data related to various parameters, such as tank pressure, temperature, fluid levels, and safety system performance.

Documentation: Create a comprehensive record of all test data, including measurements, observations, and any anomalies or issues encountered.

Logs and Reports: Maintain logs and reports that detail the test results, including dates, times, and any corrective actions taken.

Data Management: Store test data in an organized and accessible manner, either in hard copies or electronically, for future reference and analysis.

Compliance Records: Ensure that all test data and records are kept in compliance with relevant regulatory requirements.

Data Analysis: Periodically review the recorded data to identify trends or potential issues that may require maintenance or adjustments.

3.5. Operation and Maintenance:

Proper operation and maintenance are essential for the longevity and safety of a storage tank.

Operating Procedures: Develop and implement standard operating procedures (SOPs) for the safe and efficient operation of the storage tank. Train operators to follow these procedures.

Regular Inspections: Schedule routine inspections to check for signs of wear, corrosion, or damage on the tank, pipes, and associated equipment. Inspections should also include safety systems and alarms.

Preventive Maintenance: Establish a preventive maintenance plan that includes regular cleaning, lubrication, and replacement of components as needed. Follow the manufacturer's recommendations for maintenance intervals.

Emergency Response: Develop an emergency response plan that outlines procedures for handling spills, leaks, or other hazardous situations. Ensure that all personnel are trained in emergency protocols.

Safety Checks: Regularly test safety features such as pressure relief valves, venting systems, and overflow mechanisms to confirm they are in working order.

Fluid Analysis: If applicable, conduct periodic fluid analysis to monitor the quality and condition of the stored material. This can help detect contamination or degradation.

Corrosion Control: Implement corrosion control measures, such as coating or cathodic protection, to extend the life of the tank and prevent leaks.

Repairs and Upgrades: Promptly address any issues discovered during inspections, and make necessary repairs or upgrades to maintain the tank's integrity.

Training: Continuously provide training to operators and maintenance personnel to keep them up-to-date with best practices and safety protocols.

Documentation: Maintain a comprehensive record of all maintenance activities, including dates, tasks performed, and any replacement parts used.

Regulatory Compliance: Ensure that the storage tank continues to meet all relevant regulatory and safety standards.

Self-check 3

Name…… ID…… Date…….

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

***Instruction1*:** Choose the best answer from the given alternatives**.**

1. Which of the following tasks is associated with Storage tank and pipe work?
    A. Installing storage tanks in a designated location
    B. Testing and commissioning the storage tank
    C. Setting up and connecting storage tanks with pipe systems
    D. Recording test data
2. What does Testing and Commissioning storage tank involve?
    A. Installing storage tanks in a designated location
    B. Recording test data
    C. Testing the storage tank for safe operation and commissioning it
    D. Conducting ongoing maintenance activities on the storage tank
3. What is the purpose of Recording test data?
    A. Setting up and connecting storage tanks with pipe systems
    B. Documenting and keeping records of the testing process and results
    C. Testing the storage tank for safe operation and commissioning it
    D. Conducting ongoing maintenance activities on the storage tank

Instruction2: write **True** if the statement is correct and write **False** if the statement is incorrect.

1. Installation of storage tanks involves procedures for installing storage tanks in a designated location.

2. Operation and Maintenance involves ongoing activities to ensure the proper functioning and upkeep of the storage tank.
3. Testing and Commissioning storage tank includes documenting test data.

Instructio3: Write Short Answer to the given Questions**.**

1. What are the main tasks associated with Installation of storage tanks?
2. Why is it important to test and commission a storage tank before operation?
3. What types of activities are involved in Operation and Maintenance of a storage tank?

Operation sheet 3.1:

Operation Title: Storage Tank and Pipe Work

Purpose: To set out Storage tank and associated pipe work

Conditions or situations for the operations:

- Safe working area
- Properly operated tools and equipment
- Appropriate working cloths fit with the body

Equipment Tools and Materials:

- Measuring tools (such as tape measures, levels, and squares)
- Marking tools (such as chalk lines, spray paint, and markers)
- Cutting tools (such as saws, pipe cutters, and grinders)
- Hand tools (such as wrenches, hammers, and screwdrivers)

Steps in doing the task

1. Obtain and review the plans and specifications for the storage tank and pipe work installation.
2. Ensure that the storage tank and pipe work are compatible with the domestic water supply system.
3. Inspect the storage tank and pipe work for any damage or defects.

Quality Criteria: Assured performing of all the activities according to the procedures

Precautions:

- Wearing proper clothes, eye glass, glove
- Make working area hazard free
- Read and interpret manual which guide you how to use tools and equipment.

Operation sheet 3.2:

Operation Title: Install storage tanks

Purpose: To install and connect storage tanks

Conditions or situations for the operations:

- Safe working area
- Properly operated tools and equipment
- Appropriate working cloths fit with the body

Equipment, Tools and Materials:

- Measuring tools (such as tape measures, levels, and squares)
- Marking tools (such as chalk lines, spray paint, and markers)
- Cutting tools (such as saws, pipe cutters, and grinders)
- Hand tools (such as wrenches, hammers, and screwdrivers)

Steps in doing the task

1. Prepare the site for the storage tank installation. This may involve leveling the ground, pouring a concrete foundation, and installing a secondary containment system.
2. Position the storage tank on the prepared site and secure it in place.
3. Install the pipe work to the storage tank in accordance with the plans and specifications.
4. Insulate the storage tank and pipe work, if necessary.

Quality Criteria: Assured performing of all the activities according to the procedures

Precautions:

- Wearing proper clothes, eye glass, glove
- Make working area hazard free
- Read and interpret manual which guide you how to use tools and equipment.

Operation sheet 3.3:

Operation Title: Testing and commissioning storage tank

Purpose: To Testing and commissioning storage tank

Conditions or situations for the operations:

- Safe working area
- Properly operated tools and equipment
- Appropriate working cloths fit with the body

Equipment Tools and Materials:

- Pressure pump tester
- wrenches
- screwdrivers

Steps in doing the task

1. Perform a hydrostatic test on the storage tank to ensure that it is leak-proof.
2. Conduct a functional test of the storage tank and pipe work to ensure that they operate properly.
3. Commission the storage tank and put it into service.

Quality Criteria: Assured performing of all the activities according to the procedures

Precautions:

- Wearing proper clothes, eye glass, glove
- Make working area hazard free
- Read and interpret manual which guide you how to use tools and equipment.

Operation sheet 3.4:

Operation Title: Record test data.

Purpose: To Recording test data**.**

Conditions or situations for the operations:

- Safe working area
- Properly operated tools and equipment
- Appropriate working cloths fit with the body

Equipment Tools and Materials:

- Data sheets and checklists
- Pencils and erasers
- Digital camera or video recorder
- Pressure gauge
- Flow meter
- Thermometers
- Calibration tools

Steps in doing the task

Operation sheet 4: -Recording Test Data

1. Record all test data in a log book. This data should include the following information:
    A. Date and time of test
    B. Test method used
    C. Results of test
    D. Name and signature of tester

Quality Criteria: Assured performing of all the activities according to the procedures

Precautions:

- Wearing proper clothes, eye glass, glove
- Make working area hazard free
- Read and interpret manual which guide you how to use tools and equipment.

Operation sheet 3.5:

Operation Title: Operation and Maintenance:

Purpose: To Operation and Maintenance storage tank.

Conditions or situations for the operations:

- Safe working area
- Properly operated tools and equipment
- Appropriate working cloths fit with the body

Equipment Tools and Materials:

- Pressure pump tester
- wrenches
- screwdrivers
- sealant.

Steps in doing the task

1. Operate the storage tank in accordance with the manufacturer's instructions.
2. Inspect the storage tank and pipe work on a regular basis for any damage or defects.
3. Perform routine maintenance on the storage tank and pipe work as needed.

Quality Criteria: Assured performing of all the activities according to the procedures

Precautions:

- Wearing proper clothes, eye glass, glove
- Make working area hazard free
- Read and interpret manual which guide you how to use tools and equipment.

LAP Test:

Instruction: Use the given necessary templates, tools and materials to perform the following tasks.

Task1: Assess and Prepare site locating the optimal tank placement,

Task2: identify materials tools and equipment used for connecting and installing storage tanks.

Task3: Select the right tank type and size.

Task4: Install and Connect storage tank.

Task5: Test storage tank.

Task6: Maintain storage tank.

Reference

The following are some free reference books on the topics of connecting and installing storage tanks to a domestic water supply:

1. Installation and Maintenance Guide for Water Storage Tanks by AWWA
2. National Electrical Code by National Fire Protection Association (NFPA)
3. Plumbing Code by International Association of Plumbing and Mechanical Officials (IAPMO)
4. Testing and Commissioning of Water Storage Tanks by ASCE
5. Water Quality and Treatment: A Handbook on Drinking Water by American Water Works Association (AWWA)
6. Water Storage Tanks by American Society of Civil Engineers (ASCE)

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