Plumbing Installation

Level III

Based on October 2023, Curriculum Version II

Module Title: Installing Control valve assemblies, Actuating devices, and Local alarms

Module code : EIS PLI3 M09 1023

Nominal duration: 70 Hours

Prepared by: Ministry of Labor and Skill

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Addis Ababa, Ethiopia

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Acknowledgment

Ministry of Labor and Skills wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts who donated their time and expertise to the development of this Teaching, Training and Learning Materials (TTLM).

Acronym

EIS	Ethiopian industrial standard
TTLM	Training and Learning Materials
PRV	Pressure Relief Valves
QA	Quality assurance
DCS	Distributed Control System
OSHA	Occupational safety and health agency
PPE	Personal Protective Equipment

Introduction to the Module

Welcome to the module on installing control valve assemblies, actuating devices, and local alarms. This module will provide you with the essential knowledge and skills needed to install these critical components safely and effectively. Throughout this module, you will learn about the importance of proper installation techniques, personal safety requirements, and environmental considerations when working with control valves, actuating devices, and local alarms.

This module covers:

- Installation Work preparation.
- Installation requirements
- System components Installation and testing

Learning Objective of the Module:

- Prepare for Installation Work
- Identify Installation requirements
- Install and test system components

Module Instruction

For effective use of this module, 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 at the end of unit.
4. Do the “LAP test” giver at the end of each unit and
5. Read the identified reference book for Examples and exercise.

Unit One: Installation Work preparation

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

- Control valve, actuating device and alarms
- Plans and specifications.
- personal and Environmental safety Requirements
- quality assurance requirement
- Tools and equipment's.
- Task Planning and sequencing.
- Work area preparation.

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

- Identify control valve, actuating device and alarms for firefighting system
- Obtain Plans and specifications.
- Identify personal and Environmental safety Requirements
- Identify and adhere quality assurance requirement
- Selected and checked Tools and equipment's.
- Plan and sequencing tasks
- Prepare work area

1.1 Control valve, Actuating device, and Alarms

Water supply is a critical component of firefighting systems as it provides the necessary water for fire suppression and control. Firefighting systems typically rely on a reliable and sufficient water supply to effectively combat fires.

Understanding the key components of firefighting systems is vital for designing, installing, and maintaining reliable fire protection measures.

1.1.1 Control valve

A control valve for a firefighting system is an essential component that helps regulate the flow of water or fire suppression agents within the system. Its primary purpose is to control and distribute the flow of water or other extinguishing agents to the appropriate areas during a fire emergency.

Table 1.1*:* types of control vales

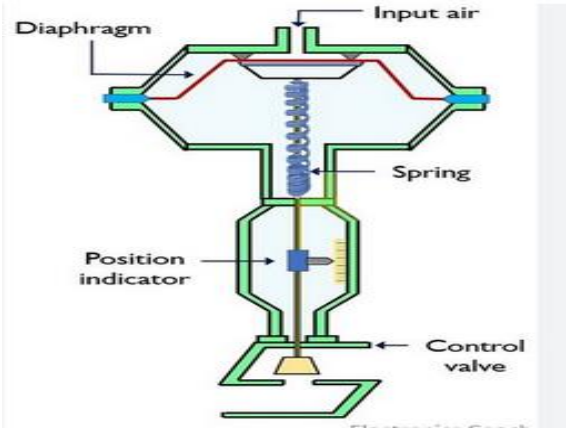
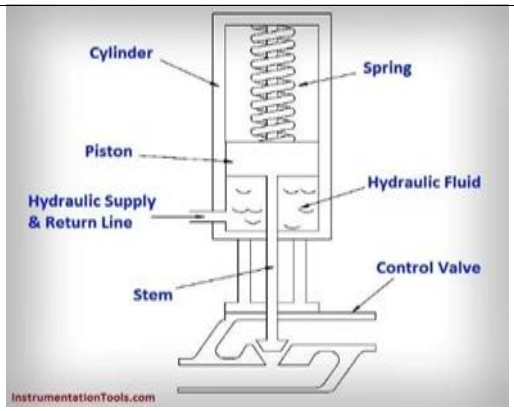
Gate Valves: Gate valves are used to start, stop, or regulate the flow of water in firefighting systems. They provide full flow when fully open and have a tight shut-off when closed.	
Butterfly Valves: Butterfly valves are control valves that use a rotating disc to control water flow. They are commonly used for on/off and throttling applications in fire protection systems.	
Check Valves: Check valves prevent the backflow of water or extinguishing agents. They feature a clapper mechanism that allows flow in one direction and closes to prevent backflow.	

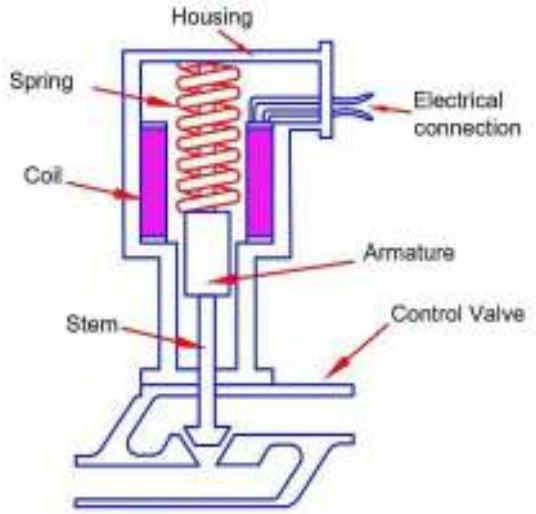
Pressure Reducing Valves: Pressure reducing valves regulate and reduce the water pressure in firefighting systems. They ensure that the pressure is maintained at the desired level for efficient and effective operation.	
Pressure Relief Valves (PRV): Pressure relief valves are designed to automatically relieve excess pressure in the system. They protect the system from over-pressurization and potential damage.	
Deluge Valves: Deluge valves are used in deluge fire suppression systems. They remain open and release water when triggered by a fire detection system, covering a large area with water simultaneously.	
Ball Valves: Ball valves use a rotating ball with a bore to control water flow. They offer quick and reliable on/off operation and are commonly used in fire protection systems.	

1.1.2 Actuating device

An actuating device for valves is a mechanism or system that is used to control the opening and closing of valves. It provides the necessary force or energy to operate the valve, allowing it to move and regulate the flow of fluids or gases in a pipeline or process system. There are several types of actuating devices commonly used for valves, including:

Table 1.2: types of actuators

Electric Actuators: These actuators use electric motors to generate the necessary torque or linear force to operate valves. They are often used in applications where precise control and automation are required.	
Pneumatic Actuators: Pneumatic actuators use compressed air or gas to create the force needed to operate valves. They are widely used in industrial applications due to their simplicity, reliability, and suitability for hazardous or explosive environments. Pneumatic actuators can be either rotary or linear, depending on the motion required for the valve.	
Hydraulic Actuators: Hydraulic actuators use hydraulic fluid to generate the force required for valve operation. They are commonly used in applications that require high force output or precise control. Hydraulic actuators can provide both rotary and linear motion.	

Manual Actuators: Manual actuators rely on manual force or operator intervention to operate valves. They can take the form of hand wheels, levers, or gear operators. Manual actuators are typically used for smaller valves or in situations where automation is not necessary or feasible.	
A solenoid valve actuator: is a component of a solenoid valve that controls the opening and closing of the valve. It is an electromechanical device that converts electrical energy into mechanical motion to operate the valve. The actuator is responsible for moving the valve's internal mechanism, such as a plunger or pivoted armature, to either allow or block the flow of fluid through the valve	

1.1.3 Alarms

Alarms are an essential component of firefighting systems and play a crucial role in alerting occupants, emergency responders, and building management to the presence of a fire or other emergencies. There are several types of alarms commonly used in firefighting systems. Here are a few examples:

- **Smoke Alarms:** Smoke alarms are designed to detect the presence of smoke, which is often an early indication of a fire. When smoke particles are detected, the alarm sounds, alerting occupants to the potential danger.
- **Heat Alarms:** Heat alarms are sensitive to changes in temperature and are triggered when a certain temperature threshold is exceeded. They are particularly useful in areas where smoke alarms may not be suitable due to high levels of dust, fumes, or other environmental factors.
- **Flame Detectors:** Flame detectors are specialized alarms that use optical sensors to detect the presence of flames. They are often used in environments where fires can occur without generating significant smoke or heat, such as chemical plants or aircraft hangars.
- **Manual Call Points:** Manual call points, also known as pull stations or fire alarm pull boxes, are devices that allow individuals to manually activate the fire alarm system. They are typically installed at various locations throughout a building and can be activated by pulling a lever or breaking a glass cover.
- **Sprinkler System Alarms:** In buildings equipped with automatic sprinkler systems, the activation of the sprinkler heads due to the presence of fire will often trigger an alarm. These alarms are designed to alert occupants and emergency responders while also notifying building management or a monitoring station.

1.2 Plans and specifications

A plan and specification is a detailed document that provides guidance and instructions for carrying out a project. The plan outlines the project's scope, timeline, and tasks, while the specifications define the technical requirements and standards to be followed. They ensure efficient execution, minimize errors, and ensure compliance with project goals and industry standards.

Installation of valves, actuators, and alarms for a firefighting system, the following information should be included:

Valve Installation:

- Location and quantity of valves to be installed.
- Type of valves (e.g., gate valves, butterfly valves) and their specifications (size, pressure rating, material).
- Valve schedule indicating the purpose and function of each valve.
- Details of valve accessories, such as valve actuators, control panels, and monitoring devices.
- Valve installation diagrams or drawings, showing the positions, orientations, and connections of the valves within the system.

Actuator Installation:

- Type of actuators to be installed (e.g., electric actuators, pneumatic actuators).
- Actuator specifications, including size, torque or thrust requirements, and compatibility with the valves.
- Mounting details and locations for the actuators.
- Actuator control and monitoring system, including control panels, wiring diagrams, and communication protocols.
- Integration details between the actuators and the fire alarm control panel or other control systems.

Alarm Installation:

- Type of fire alarm system to be installed (e.g., addressable, conventional).
- Location and quantity of fire alarm devices, such as smoke detectors, heat detectors, and manual call points.
- Alarm device specifications, including sensitivity, coverage area, and activation thresholds.
- Wiring diagrams and circuitry plans for connecting the alarm devices to the fire alarm control panel.

- Details of audible and visual alarm notification devices, including their locations and sound/visual output specifications.
- Integration details with other building systems, such as emergency communication systems.

The relevant authorities for obtaining plans and specifications for the installation of valves, actuators, and alarms for a firefighting system vary depending on your location.

Here are some common authorities that you need to contact:

- Local Fire Department: The local fire department is often responsible for enforcing fire safety regulations and approving firefighting system installations. They can provide guidance on the specific requirements and procedures for obtaining plans and specifications.
- Building Department: The building department or building regulatory authority may have jurisdiction over fire safety regulations and permits. They can provide guidance on compliance with building codes and any specific requirements related to firefighting systems.
- Industry Associations and Standards Organizations: Industry associations, such as the National Fire Protection Association
- Local Municipality or City Planning Department: The local municipality or city planning department may be involved in the permitting process for construction or renovations.

1.3 Personal and Environmental safety Requirements

Personal Protective Equipment (PPE) and environmental safety are paramount in ensuring the well-being and protection of individuals and the environment. Here are the requirements you should adhere to:

Personal Safety Requirements for Installers

- Training: Ensure that you have received proper training and have a good understanding of the equipment, installation procedures, and safety protocols.
- Personal Protective Equipment (PPE): Wear the appropriate PPE, including safety goggles, gloves, helmets, and protective clothing, to protect yourself from potential hazards.

- Lifting and Handling: Use proper lifting techniques and, when necessary, utilizes lifting equipment to prevent strains and injuries when moving heavy equipment.
- Lockout/Tag out: Follow lockout/tag out procedures to isolate energy sources and prevent accidental activation of equipment during installation.
- Hazardous Substances: Identify any hazardous substances involved in the installation process and handle them safely according to established safety regulations and guidelines.

Environmental Safety Requirements for Installers:

- Ventilation: Ensure that the installation area has adequate ventilation to prevent the buildup of toxic or flammable gases.
- Fire Safety: Adhere to fire safety regulations, including the availability and proper use of fire extinguishers. Store and handle flammable materials appropriately.
- Spill Containment: Take precautions to prevent and control spills of hazardous substances by using appropriate containment systems and absorbent materials.
- Environmental Compliance: Comply with local environmental regulations regarding waste disposal, emissions, and noise levels during the installation process.
- Equipment Placement: Position and secure the equipment properly to prevent accidental damage or environmental hazards.

Remember, these requirements may vary depending on specific industry standards, local regulations, and the nature of the installation project. Always consult applicable safety codes, guidelines, and seek guidance from safety professionals or experts to ensure a safe installation process.

1.4 Quality assurance requirement

Quality assurance (QA) is a systematic approach implemented to ensure that products, services, or processes meet specified quality standards. It involves activities and processes that focus on preventing defects, identifying, and addressing issues, and continuously improving quality throughout the entire lifecycle.

To ensure quality assurance during the installation of valves, actuators, and alarms for firefighting systems, consider the following requirements:

- Compliance with industry standards and codes.
- Use certified components from recognized testing laboratories.
- Maintain detailed documentation for traceability.
- Conduct thorough inspections and functional tests.
- Ensure trained and competent personnel.
- Proper integration into the overall system.
- Create accurate as-built drawings.
- Adhere to regulatory requirements and approvals.
- Perform performance and functional testing.
- Implement a planned maintenance program.

1.5 Tools and equipment's

Tools and equipment used in plumbing system installation are specialized for working with pipes, fixtures, and related components. These tools facilitate the proper assembly, installation, and maintenance of plumbing systems.

Here are some common tools and equipment used in plumbing system installation

- Pipe Wrenches: Used for gripping and turning pipes during installation and removal.
- Adjustable Wrenches: Used for tightening and loosening nuts and bolts of various sizes.
- Screwdrivers: Used for driving or removing screws.
- Pipe Cutters: Used for cutting pipes to the required length during installation.
- Pipe Threader: Used for creating threaded connections on pipes for proper fitting of valves and actuators.
- Pipe Flaring Tools: Used for flaring the end of pipes to create a secure connection with fittings.

- Pressure Gauges: Used to measure the pressure within the firefighting system and ensure it is within the desired range.
- Torque Wrenches: Used for applying accurate and consistent torque during the tightening of bolts and nuts.
- Pressure testing equipment: used to test leakage and pressure resistance testing .

It is important to select tools and equipment that are appropriate for the specific installation requirements and comply with safety standards. Additionally, ensure that the tools are in good working condition, properly calibrated, and regularly maintained to ensure accurate and reliable installation of firefighting system components.

1.6 Task Planning and sequencing

Task planning and sequencing for the installation of valves, actuators, and alarms in a firefighting system is crucial for:

- Efficiency and resource management.
- Mitigating risks and challenges.
- Facilitating coordination and collaboration.
- Ensuring compliance and quality assurance.
- Managing the project timeline and schedule.
- Facilitating documentation and record-keeping.

Here is a concise task planning and sequencing for the installation of valves, actuators, and alarms in a firefighting system:

1. Develop an Installation Plan.
2. Gather Materials and Equipment.
3. Prepare the Work Area.
4. Install Valves.
5. Install Actuators.
6. Install Alarms.
7. Test and Commission.

8. Document and Update As-Built Drawings.
9. Clean-up and Site Restoration.
10. Final Inspection and Acceptance.

Note: The specific tasks and sequencing may vary based on project requirements and regulations. Adapt the plan accordingly.

1.7 Work area preparation

Work area preparation for the installation of valves, actuators, and alarms in a firefighting system involves clearing the area of obstacles, ensuring adequate space, securing the area, providing proper lighting and ventilation, implementing safety measures, preparing tools and equipment, and reviewing installation plans. This process creates a safe and organized environment for efficient and accurate installations

Self-Check 1

Part-I: Choose the correct answer

1. A Valve designed to automatically relieve excess pressure in the system.

a. Butterfly Valves
c. Pressure Reducing Valves
b. Check Valves
d. Pressure Relief Valves

2. Valves prevent the backflow of water or extinguishing agents. They feature a clapper mechanism that allows flow in one direction and closes to prevent backflow.

a. Get valve
c. Check Valves
b. Pressure Reducing Valves
d. Pressure Relief Valves

3. An Actuators use compressed air or gas to create the force needed to operate valves.

a. Electric Actuators
c. Hydraulic Actuators
b. Pneumatic Actuators
d. Manual Actuators

Part-II: Match column A to B

Column A	**Column B**
1. Butterfly Valves	A. Alarm system when fire occur
2. Hydraulic Actuators	B. Use fluid to operate valve
3. Flame detector	C. Use disc to control water flow

Part-III: Answer the following questions accordingly.

1. List relevant authorities to obtaining plans and specifications for firefighting installation system.
2. List environmental safety requirement for firefighting installation system
3. List 5 tools and equipment to install valve and actuator.

Note: Satisfactory rating – above 75% Unsatisfactory - below 75%
You can ask your trainer for the copy of the correct answers.

Unit Two: Installation requirements

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

- System requirements
- Material quantity calculation
- Materials and Equipment Compliance

This guide will also assist you to attain the learning outcomes stated below. Specifically, upon completion of this learning guide, trainees will be able to:

- Identify System requirements
- Calculate material quantity
- Check Materials and equipment for compliance with standards

2.1 System requirements

In the Designing and implementing a firefighting installation, it is crucial to define clear system requirements to ensure the effectiveness and reliability of the system.

System requirements are identified from:

- Job Design Criteria: Evaluate specific requirements like flow rates, pressure levels, and control accuracy.
- Specifications: Review manufacturer's technical specifications for compatibility and performance.
- Standards and Regulations: Ensure compliance with safety, performance, and environmental standards.
- System Integration: Consider compatibility with existing control infrastructure and communication protocols.
- Maintenance and Support: Evaluate availability of technical support, spare parts, and ease of maintenance.

Example of a plan and specification for a control valve, actuator, and alarm system installation:

Project: Control Valve Assembly and Alarm System Installation

1. Job Design Criteria:
   - Required flow rate: 1000 gallons per minute (GPM)
   - Pressure range: 10 to 50 psi
   - Control accuracy: +/- 2%
   - Fluid: Water
   - Temperature range: 0 to 100 degrees Celsius
   - Environmental conditions: Indoor installation, non-hazardous area
2. Specifications:
   - Control Valve:
     - Type: Globe valve
     - Size: 6 inches
     - Material: Stainless steel

- Pressure rating: 6 bar
- End connections: Flanged

- Actuator:
  - Type: Pneumatic diaphragm actuator
  - Supply pressure: 20 to 100 psi
  - Air connection: 1/4"
- Alarm System:
  - Type: Local audible and visual alarm
  - Alarm indication: High pressure (> 50 psi)
  - Sound level: Minimum 80 dB
  - Visual indication: LED lights
  - Power supply: 24V DC

3. Standards and Regulations:
   - Adherence to OSHA safety regulations and guidelines for installation and operation
   - Compliance with local electrical and building codes for alarm system installation
4. System Integration:
   - Integration with existing Distributed Control System (DCS) using Modbus communication protocol
   - Providing feedback signals (e.g., position, pressure) to the DCS for monitoring and control purposes
   - Integration of alarm system with DCS for remote monitoring and annunciation
5. Maintenance and Support:
   - Availability of manufacturer's technical support for valve and actuator maintenance and troubleshooting
   - Spare parts availability for critical components
   - Maintenance schedule for routine inspection, calibration, and testing of the valve, actuator, and alarm system

From the above information installer can be identify system requirement for installing valve, actuator, and alarm device

2.2 Material quantity calculation

The quantities of materials required for the installation of valves, actuators, and alarm devices are typically calculated based on plans and specifications.

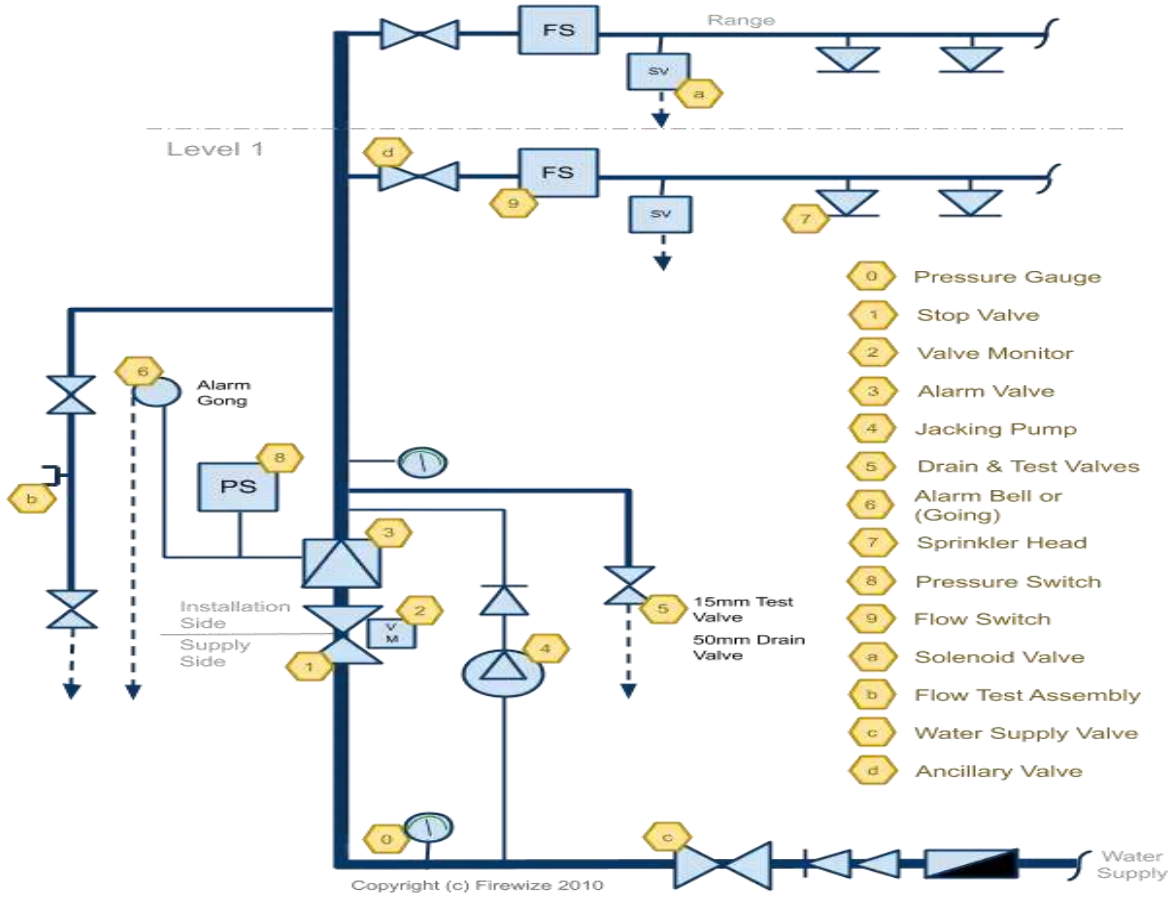


Figure 2.1: pipe lay out drawing

Here is a general process for calculating material quantities:

1. Review Plans and Specifications:
   - Carefully examine the project plans and specifications provided by the client or design team.
   - Identify the locations where valves, actuators, and alarm devices are to be installed.
2. Determine Valve Types and Sizes:

- Refer to the plans and specifications to identify the types and sizes of valves required for each location.

Note the specific valve specifications, such as valve type (e.g., ball valve, gate valve), size (e.g., 2 inches, 4 inches), and any additional features (e.g., flanged, threaded).

3. Identify Actuator Types and Sizes:
   - Determine the types and sizes of actuators needed to operate the valves specified in the plans. Consider the actuator specifications, such as actuation method (e.g., electric, pneumatic), torque or thrust requirements, and compatibility with the valve types.
4. Specify Alarm Device Types:
   - Note the types of alarm devices required for the project, such as visual alarms, audible alarms, or combination devices.
   - Consider the specifications for each alarm device, including the coverage area, sound level, visual indication, and any integration requirements.
5. Calculate Quantities:
   - Based on the information gathered from the plans and specifications, calculate the quantities of each component required.
   - Count the number of valves, actuators, and alarm devices needed for each location specified in the plans.
6. Consider Accessories and Mounting Hardware:
   - Consider any additional accessories or mounting hardware required for the installation.
   - This may include items like brackets, fittings, gaskets, fasteners, wiring conduits, or junction boxes.
7. Incorporate Spare Parts:
   - Consider including an appropriate quantity of spare parts for maintenance or future replacements.
   - Consult with manufacturers or industry guidelines to determine the recommended spare parts inventory.

2.3 Materials and Equipment Compliance

Material compliance in plumbing work refers to the adherence to regulations and standards regarding the materials used in plumbing systems. It involves ensuring that the materials, components, and installation methods used in plumbing projects meet specific requirements related to safety, durability, and environmental impact.

In the Installing of valves, actuators, and alarms for a firefighting system, it is necessary to ensure that the materials and equipment comply with relevant standards, regulations, and order forms. Additionally, they should be in an acceptable condition to ensure the effectiveness and reliability of the system. Here are the methods to check for compliance and acceptable condition:

1. Standards and Regulations:

- Familiarize yourself with the applicable standards and regulations for firefighting systems,
- Verify that the valves, actuators, and alarms meet the requirements specified in these standards.
- Ensure compliance with any local or regional codes and regulations related to firefighting systems.

2. Docket and Order Form:

- Review the docket and order form for the valves, actuators, and alarms.
- Confirm that the specified materials and equipment match the requirements outlined in the docket and order form.
- Check for any special instructions or additional requirements mentioned in the docket or order form.

3. Physical Inspection:

- Inspect the valves, actuators, and alarms for any visible damage, defects, or signs of wear.
- Ensure that all components are in proper working condition.
- Verify that the equipment is suitable for the intended application and environment.
- Check for proper labeling and markings on the equipment, including manufacturer information, model numbers, and ratings.

4. Documentation and Certification:

- Request documentation and certification from the manufacturer or supplier, confirming that the valves, actuators, and alarms comply with relevant standards and specifications.
- Verify that the documentation includes information such as product specifications, testing reports, and certifications from recognized testing laboratories.

Self-Check 2

Part-I: Choose the correct answer.

1. One of the following the source of information to get system requirement.
   a. Job Design Criteria c. Standard code
   b. Specification d. All
2. One of the following steps Ensure that all components are in proper working condition
   a. Physical inspection c. compared to order form
   b. Refer specification d. Request documentation
3. One of the following methods used to determine amount of valve for system installation
   a. Area method c. count from plan
   b. Volumetric method d. linear measurement

Part-III: Say true for right statement and false for wrong one

1. System requirement are identified from job design criteria
2. Determining size and type of materials are help to calculate amount of materials
3. Drawings are used to determine system requirements solely

Part-III: Answer the following questions accordingly.

1. Write the methods to check for compliance and acceptable condition\
2. Write the general process to calculate materials.
3. Write general system requirement for firefighting line installation.

Note: Satisfactory rating – above 75% Unsatisfactory - below 75%
You can ask your trainer for the copy of the correct answer.

Operation sheet 2.1: Calculate amount of material

Operation title: Calculating amounts of material for the given installation

Purpose*:* To know amounts of materials for installation work.

Equipment, Tools and Materials:

- Drawing
- Pen/pencil
- Paper
- Calculator
- Ruler

Steps in doing the task:

1. Obtain drawing from your instructor
2. Prepare estimation check list
3. Count amounts of valves and other device from drawing
4. Verify your calculation
5. Document your check list
    - ❖ Use the following drawing for calculation work

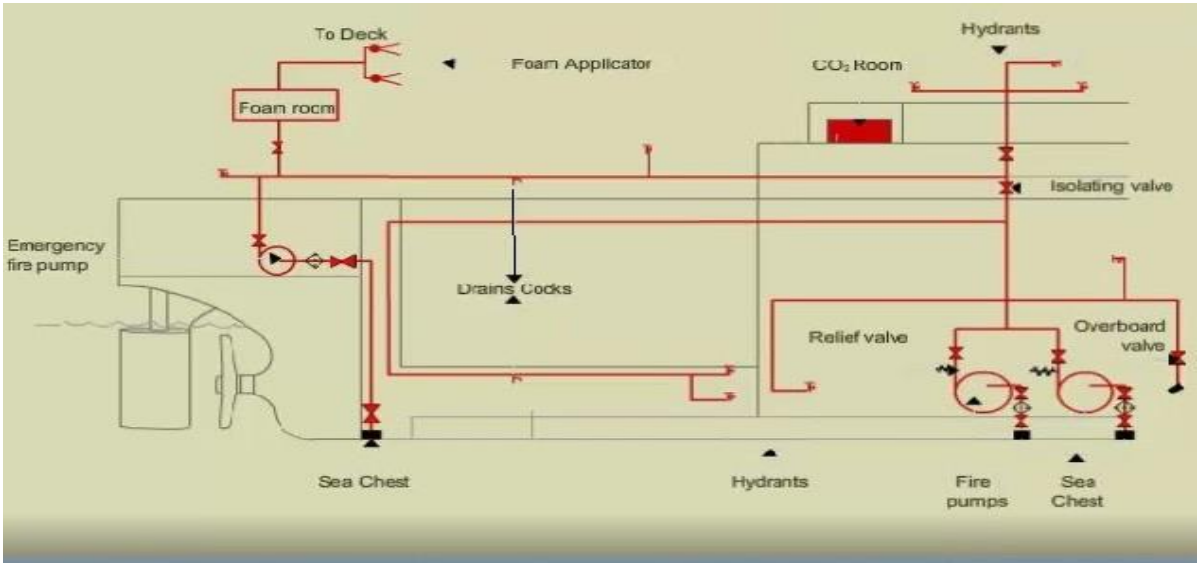


Figure 2.2: firefighting system pipeline drawing

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

Precautions: Use proper safety requirement

Lab Test 1

Instructions: Perform the following activity as required standard

Task 1: Collect necessary material and equipment for your work.

Task 2: perform calculation

Task 3: Finalize your work

Unit Three: System components Installation and testing

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

- Set out components
- Pipe supports and fixings installation
- control valve, actuating device, and alarms installation
- system testing and recording
- Work sites restore

This guide will also assist you to attain the learning outcomes stated below. Specifically, upon completion of this learning guide, trainees will be able to:

- Set out components in accordance with plans, specifications, and job instructions.
- Install Pipe supports and fixings
- Install control valve, actuating device, and alarms installation
- Test and record installation system
- Restore work site

3.1 Setting out components

Setting out is process of establishing the position, layout, and dimensions of various elements within a project. It involves transferring information from design drawings or plans onto the ground to guide the construction process accurately. Setting out is vital to ensure that each element is constructed in the right position and to the correct level.

Procedure for setting out firefighting system component

- Interpreting the design: The architectural or engineering drawings and specifications are carefully studied to understand the intended layout, dimensions, and levels of component.
- Establishing control points: Reference markers or benchmarks are set up on the site to provide accurate positioning and alignment guidance for various project elements.
- Transferring the design onto the site: Using the control points as a reference, the positions, dimensions, and levels of key project elements are marked on the site, ensuring accuracy and alignment with the design.
- Conducting quality control checks: Regular inspections and checks are performed to verify that the construction aligns with the design specifications, safety guidelines, and building codes.

3.2 Pipe supports and fixings installation

Pipe fixing and support are essential aspects of plumbing installations. Properly fixing and supporting pipes ensures their stability, prevents movement, and maintains the integrity of the plumbing system.

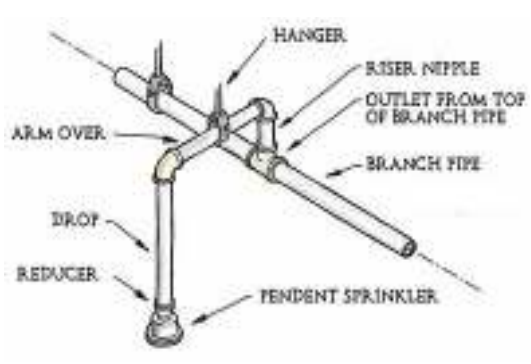
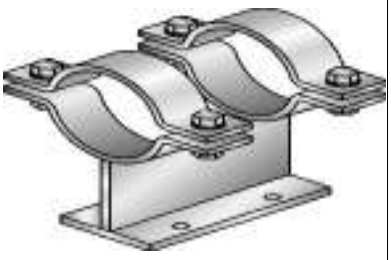


Figure 3.1: pipe support and hanger

3.2.1 Types of pipe support

Table 3.1: types of pipe support

Pipe Hangers: Pipe hangers are used to suspend pipes from ceilings, walls, or other structural elements. They provide support and prevent sagging or movement of the pipes.	
Pipe Clamps: Pipe clamps are used to secure pipes to walls, floors, or other surfaces. They provide stability and prevent movement or vibration of the pipes. Mostly its use for smaller pipe in size.	
Pipe Saddles: Pipe saddles are used to support pipes on horizontal surfaces such as beams or concrete slabs. They provide a stable base for the pipes and help distribute the weight evenly. Pipe saddles can be made of metal or plastic and are available in different sizes and designs.	
Pipe Shoes: Pipe shoes are used to support pipes on vertical surfaces such as walls or columns. They provide a secure attachment point for the pipes and help distribute the load. Pipe shoes can be made of metal or plastic and come in various shapes and sizes to accommodate different pipe sizes and materials.	
Pipe Guides: Pipe guides are used to control the movement and expansion of pipes. They are typically installed at fixed points along the pipe's length to prevent excessive movement or stress. Pipe guides can be made of metal or plastic and are available in different configurations such as roller guides, slide guides, and rigid guides.	

3.2.2 Pipe support installation procedure

The installation procedures for pipe support and fixing in plumbing typically involve several stages. Here is a general outline of the process:

- Pre-Installation:
  - Verify that all materials and documentation are correct and approved
  - Ensure that the areas for permanent installation are ready, accessible, and in suitable condition.
- Installation:
  - Examine the conditions at the job site to ensure proper arrangement and fit of the work
  - Coordinate the drawings and specifications to ensure the completeness of the required work
  - Verify measurements and dimensions at the job site and cooperate in the coordination and scheduling of the work
  - Install hangers, supports, clamps, and attachments to properly support the piping from the building structure
  - Use appropriate methods such as threaded rods to mount the piping to the hollow core slab
  - Group parallel runs of horizontal piping together for support
  - Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories
  - Adjust hangers to distribute loads equally on attachments
  - Provide grout under supports to bring piping and equipment to the proper level and elevations

3.3 Control valve, actuating device, and alarms installation

3.3.1 Control valve and actuating device installation

Proper installation of control valves and actuating devices is crucial for ensuring their optimal performance and longevity. Here are some best practices to follow during the installation process:

1. Pre-Installation Preparation:
   - Review the valve specifications and ensure it is suitable for the intended application.
   - Verify that the valve and its components are in good condition and free from any damage or defects.
   - Ensure you have the necessary tools and equipment for the installation process.
2. Valve Orientation and Positioning:
   - Determine the correct orientation of the valve based on the flow direction indicated by the arrow on the valve body.
   - Position the valve in a way that allows easy access for operation, maintenance, and repairs.
3. Flange Connection:
   - Clean the flange faces and remove any dirt, debris, or old gasket material.
   - Align the bolt holes on the valve flange with those on the pipeline flange.
   - Insert and tighten the bolts evenly, following the recommended torque specifications.
   - Use a new gasket suitable for the specific application and ensure it is properly seated between the flanges.
4. Piping Connection:
   - Connect the piping to the valve using appropriate fittings, such as threaded connections, welding, or flanged connections.
   - Ensure proper alignment and tightness of the connections to prevent leaks.
5. Actuator Installation (if applicable):
   - Follow the manufacturer's instructions for installing the actuator onto the valve.

- Align the actuator with the valve stem or shaft and secure it using the recommended mounting hardware.
- Make the necessary electrical or pneumatic connections according to the actuator's specifications.

3.3.2 Alarms installation

Installing a fire alarm system is crucial for the safety of a building and its occupants. Here is a step-by-step guide to help you with the installation process:

1. Determine the Requirements:

- Familiarize yourself with local fire codes and regulations to understand the specific requirements for fire alarm installation in your area.
- Assess the size and layout of the building to determine the number and placement of fire alarm devices needed.

2. Choose the Right Fire Alarm System:

- Select a fire alarm system that meets the requirements of your building and complies with applicable codes and standards.
- Consider factors such as the type of detection (smoke, heat, or combination), alarm notification methods (audible and visual), and any additional features required.

3. Plan the System Layout:

- Create a detailed plan indicating the location of fire alarm control panels, detectors, notification devices, and wiring routes.
- Ensure proper spacing and coverage of detectors based on manufacturer recommendations and code requirements.

4. Install Fire Alarm Control Panel:

- Mount the fire alarm control panel in a central location, preferably near the building entrance or security office.
- Connect the control panel to a reliable power source and ensure proper grounding.
- Follow the manufacturer's instructions for wiring and programming the control panel.

5. Install Fire Alarm Devices:

- Install smoke detectors, heat detectors, and other required devices according to the system layout plan.
- Mount smoke detectors on the ceiling or high on the walls, following manufacturer recommendations and code requirements.
- Place heat detectors in areas where smoke detectors are not suitable, such as kitchens or garages.
- Install notification devices, such as horns, strobes, or speakers, in appropriate locations to ensure audibility and visibility throughout the building.

6. Connect and Test the System:

- Connect all devices to the fire alarm control panel using the recommended wiring methods.
- Test the system to ensure proper communication between devices and the control panel.
- Conduct a comprehensive system test, including smoke and heat detector testing, alarm activation, and notification device functionality.

7. Train Building Occupants:

- Provide training to building occupants on fire alarm system operation, evacuation procedures, and the importance of fire safety.

3.4 System testing and recording

Pressure testing is an essential procedure for valve installation to ensure the integrity and reliability of the valve. It involves subjecting the valve to specific pressure conditions to verify its performance and identify any potential leaks or weaknesses. Here is a general procedure for pressure testing during valve installation:

1. Preparation:

- Ensure that the valve is installed, and all connections are secure.
- Close any isolation valves upstream and downstream of the valve being tested.
- Verify that the valve is in the closed position.

2. Hydrostatic Testing:

- Hydrostatic testing involves filling the valve and its associated piping with a liquid, typically water, and pressurizing it to a predetermined level.
- The pressure applied during hydrostatic testing should be at least 1.5 times the valve's pressure rating.
- Maintain the test pressure for a specified duration, typically 2-3 minutes, or as per the valve's specifications.
- During the test, inspect the valve and its connections for any signs of leakage or abnormal behavior.

3. Pneumatic Testing:

- Pneumatic testing involves pressurizing the valve and its associated piping with air or an inert gas, such as nitrogen.
- The pressure applied during pneumatic testing for seat testing is typically 1.1 times the maximum allowable pressure.
- Gradually increase the pressure to the specified level and hold it for the required duration.
- Inspect the valve and its connections for any signs of leakage or abnormal behavior.

4. Leak Detection:

- After applying the test pressure, carefully inspect the valve and its connections for any signs of leakage, such as visible leaks or pressure drop.
- Use appropriate leak detection methods, such as soap solution or leak detection spray, to identify any leaks.
- If any leaks are detected, address them promptly by tightening connections or replacing faulty components.

5. Documentation:

- Record the test pressure, duration, and any observations or findings during the pressure testing procedure.
- Maintain a comprehensive record of the pressure testing results for future reference and compliance purposes.

It is important to note that the specific pressure testing procedure may vary depending on the type of valve, its application, and applicable industry standards. Always refer to the manufacturer's instructions and relevant standards for detailed guidance on pressure testing procedures for specific valve installations.

3.5 Work sites restore

Worksite restoration after installation work is an important aspect of any construction or renovation project. It involves cleaning up the site, removing debris, and restoring the area to its pre-construction condition. Here are some key procedure and considerations for worksite restoration after installation work:

1. Debris Removal:

- Clear the worksite of any construction debris, including materials, tools, and equipment.
- Dispose of waste materials properly, following local regulations and guidelines.
- Remove any temporary structures or barriers that were used during the installation work.

2. Cleaning:

- Thoroughly clean the area, including floors, walls, and surfaces, to remove dust, dirt, and any construction-related residues.
- Use appropriate cleaning methods and products based on the type of surfaces and materials involved.
- Pay attention to hard-to-reach areas, corners, and crevices that may have accumulated debris.

3. Repairs and Restoration:

- Inspect the site for any damages or wear and tear caused during the installation work.
- Repair or replace any damaged structures, surfaces, or fixtures to restore them to their original condition.
- Ensure that all electrical, plumbing, or mechanical systems are functioning properly and safely.

4. Landscaping and Exterior Restoration:

- If the installation work affected the exterior of the building or surrounding landscape, restore these areas as well.
- Repair any damage to the exterior walls, windows, or doors.
- Restore landscaping features, such as lawns, gardens, or pathways, if they were disturbed during the installation work.

5. Final Inspection:

- Conduct a thorough inspection of the restored worksite to ensure that all restoration work has been completed satisfactorily.
- Check for any remaining debris, cleanliness issues, or safety hazards.
- Address any outstanding issues or concerns before considering the worksite fully restored.

Self-Check 3

Part-I: Choose the correct answer.

1. One of the following types of pipe support has a hinge.
   a. Saddle
   b. Clamp
   c. Pipe shoe
   d. Pipe hanger
2. One of the following pipe connection systems use bolt and nut to connect pipes
   a. Flange system
   b. Threaded system
   c. welding system
   d. Bell and spigot system
3. In which types of testing the pressure should be at least 1.5 times the valve's pressure rating.
   a. Pneumatic Testing
   b. Pneumatic Testing
   c. Smoke testing
   d. Gas testing

Part-II: Say true for right statement and false for wrong one

1. Valve and pipe installation pressure testing is held in uniform pressure rate for the given duration
2. Smoke detectors alarm is suitable to install in kitchens or garages.
3. Pressure testing is used to check leakage in the valve system

Part-III: Answer the following questions accordingly.

1. List and Explain valve installation procedure.
2. Write procedures to install pipe support.
3. How to restore work site after completion of work.

Note: Satisfactory rating – above 75% Unsatisfactory - below 75%
You can ask your trainer for the copy of the correct answers.

Operation sheet 3.1: Install valve

Operation title: Installation of Flange Valve

Purpose: To control the flow of fluids in pipeline system.

Equipment, Tools and Materials:

- Flange pipes
- Gaskets
- Bolts and nuts
- Flange clamps
- Screwdrivers
- Pipe Wrenches
- Measuring tape
- Level
- Pipe cutting and threading tools
- Safety equipment (gloves, safety glasses, etc)

Steps in doing the task:

6. Review the valve installation manual to understand the specific requirements for the flange valve being installed.
7. Inspect the flange valve for any visible damage or defects.
8. Clean the flange surfaces.
9. Install the appropriate gasket on the flange.
10. Position the flange valve between the flanges, aligning the bolt holes.
11. Insert the bolts through the bolt holes and secure them with nuts.
12. Tighten the bolts gradually and evenly in a crisscross pattern to ensure uniform pressure on the gasket.
13. Inspect the valve assembly for any leaks or misalignments.
14. Conduct a pressure test to ensure the valve operates correctly and can withstand the required pressure.
15. Verify that the valve opens and closes smoothly without any obstructions or binding

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

Precautions: Use proper safety requirement

Operation sheet 3.2: Valve installation

Operation title: Pressure reducing valve installation.

Purpose: To regulate pressure in pipe system.

Equipment Tools and Materials:

- Pressure reducing valve
- Threaded pipe and fittings
- Pressure gauge
- Tubing cutter
- O-rings
- Pipe Wrenches
- Measuring tape
- Level
- Safety equipment (gloves, safety glasses, etc)

Steps in doing the task:

1. Review the valve installation manual to understand the specific requirements.
2. Select the Installation Location from plan.
3. Prepare the Pipes for installation.
4. Install the PRV: Position the PRV in the selected location. Ensure the arrow on the valve body aligns with the direction of water flow.
5. Connect the Pressure Gauge: Install a pressure gauge downstream of the PRV to monitor and adjust the desired outlet pressure.
6. Secure and Support the PRV.
7. Turn on the Water Supply: Slowly open the main water supply valve to allow the water to flow through the PRV and into the plumbing system.
8. Test the Functionality: Once the water supply is restored, test the PRV by running water from various fixtures.

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

Precautions: Use proper safety requirement.

Operation sheet 3.3: Actuator installation

Operation title: Pneumatic actuator installation.

Purpose: To regulate pressure in pipe system.

Equipment Tools and Materials:

- Pneumatic actuator
- Threaded pipe and fittings
- Air supply system
- Actuator coupling
- Mounting hardware
- Pipe Wrenches
- Measuring tape
- Level
- Safety equipment (gloves, safety glasses, etc)

Steps in doing the task:

1. Review the valve and actuator installation manual to understand the specific requirements.
2. Clear the work area around the valve and actuator to ensure easy access.
3. Position the actuator on the valve stem or shaft and secure it using the appropriate mounting hardware.
4. Connect the air supply line to the actuator. Use appropriate fittings and connectors to ensure a secure and leak-free connection.
5. Once the installation is complete, test the actuator to ensure proper functioning. Apply air pressure to the actuator and observe its movement.
6. Once you are satisfied with the actuator's performance, secure any loose connections, and tidy up the work area.
9. Test the Functionality: Once the water supply is restored, test the PRV by running water from various fixtures.

Quality Criteria: Assured performing of all the activities according to the procedures.
Precautions: Use proper safety requirement.

Note: For more clarification of steps visit URLs state in reference

Lab Test 2

Instructions: Perform the following activity as required standard

Task 1: Collect necessary material and equipment for your work.

Task 2: Perform valve installation.

Task 3: Perform pressure valve installation.

Task 4: Perform pressure valve actuator installation.

Task 5: finalize your work

Reference

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