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| Programme | SBCS Assured Certificate in Advanced Plumbing |
| Course Title | Plumbing (Principles and Practice) |
| Guided Learning Hours | 120 |

Aims

This unit will provide the learner with a range of plumbing skills by combining both practical and theoretical training. Some of the topics covered include common plumbing processes, cold water systems, domestic hot water systems, sanitation, central heating systems and drainage systems. Assessment is undertaken through a combination of practical assignments and written examinations

Learning Outcomes

On completing this course successfully learners will be able to do the following:

1. Materials
2. Calculations and Setting out
3. Practical Skills
4. Communication and information technology
5. Alterations, repairs and planned maintenance

Indicative Content

1. Materials

Piping Materials: Identify and discuss the various types of piping materials and fittings currently used in plumbing installations. Emphasis should be placed on the type of materials used (iron, stainless steel, plastic) , methods of joining (compression, solvent, push fit, screw, welded, clamped and soldered) and their properties such as pressure rating, compressive strength, corrosion resistance, expansion and contraction; Match materials to various applications based on their properties and grades; State the effects of temperature on water systems; Distinguish between the various pipes and fittings used in plumbing.

Joining materials: Identify the types of solders and fluxes used in plumbing activities; Analyze each type based on its properties such as strength, compatibility to various materials, toxic and corrosive effects and state the applications for which it is best suited for use. Identify the types of tapes and jointing

compounds; Analyze each type based on its properties such as water resistance and temperature range and state the applications for which it is best suited for use.

Valves: Identify the various types of valves (gate, ball, check, stop) and describe with the aid of sketches how they operate; Analyze each type of valve based on its properties and state the application for which it is best suited.

Sanitary accessories and fittings: Describe the range of sanitary fixtures and appliances; Differentiate between fixtures for residential, commercial and institutional use; Explain the design features and materials used in the construction of sanitary fittings and fixtures.

Guttering and downpipes: Describe the types of materials used in the construction of downpipes and guttering and explain why these materials were selected.

State the technical properties of insulating and protective materials: Discuss the types of materials used in the manufacture of insulating and protective materials. Relate the properties of the material used to its application. Emphasis should be placed on exploring property characteristics such as density, water resistance, strength, flexibility, thermal resistance and environmental factors.

Water conservation and effluent waste disposal: Describe the environmental effects associated with effluent waste disposal and water supplies. Identify the methods available for conserving water in domestic water systems (Flush control valves, spray taps, dual flushing cisterns).

Water storage tanks: Describe the types for materials used in the construction of water tanks and explain why these materials were selected for the particular application.

2. Calculations and Setting out

Calculations:

- Quantity and cost of materials: Develop a price database for various plumbing materials, fittings and accessories based on current market prices from various local suppliers. Using blueprint drawings, produce a bill of materials and calculate the overall cost to complete a project.
- Using flow rate charts, calculate the size of pipes required for various plumbing installations such as for guttering and drainage, gas supplies and sewage and drainage systems.
- Flow of fluids: Using Chezy's formula and the box formula, calculate the flow rates of fluids flowing through pipes at full bore (water supply pipes) and half bore (drains, sewers). Calculate the difference in flow rates for fluids flowing through difference cross-sectional channels (rectangular, circular and V channels).
- Calculate partial volumes and weights.
- Calculate fall, run and grade.
- Perform calculations involving the expansion and contraction of pipework assemblies using variables such as temperature, material, size

Measuring and setting out: Explain the appropriate use and application of basic tools and equipment used in plumbing installation applications such as cold / hot water pipework, drainage, sewage and ventilation systems.

3. Practical Skills

Domestic Water Systems:

Using illustrations, plan and design a basic layout for a mains fed, hot and cold water system connected to a hot water heater. Prepare a materials list for the pipework systems and identify the location of all valves, taps and tanks on the water supply and distribution systems; Using the Thomas Box formula, explain how pipes are sized for hot water installations. Explain how insulation minimizes heat losses in the supply and storage of the hot water. All design considerations should be based on the standards outlined in the National Plumbing code (WASA regulations).

Using illustrations, plan and design a basic layout for a tank fed, hot and cold-water system connected to a hot water heater. Prepare a materials list for the pipework systems and identify the location of all valves, taps, pumps and tanks on the water supply and distribution systems; Identify types of pumps; Describe the operational parts of each type of pumps; All design considerations should be based on the standards outlined in the National Plumbing code (WASA regulations).

Water System Accessories: Describe the types and operating principles of various water heating devices. State the available sizes for plastic cold water tanks. Describe the proper procedure for load distribution when supporting a water tank, installed at ground level and at an elevated height.

Gas Supply and Distribution Systems: Distinguish between process piping and gas piping materials; Explain basic regulations and safety practices for the installation of a gas supply and distribution system and identify the various gas controls and safety devices required; Design a simple gas pipework system for a residential building to supply fuel for a stove and outline all the necessary fittings and accessories required. Explain the steps required to properly test and commission a domestic gas supply and distribution system. Emphasis should be placed on identifying the various types of tests (soundness / pneumatic), identifying the testing equipment required and explaining the commissioning procedures for determining adequate ventilation, functioning of the purge system and adjust the supply pressure.

Sanitary Pipework Systems: Describe the range of sanitary fixtures and appliances available and differentiate between fixtures for residential, commercial applications; Outline all plumbing code requirements for sanitary fixtures installation; Design simple layouts for the installation of various sanitary fixtures (sink, shower, bath, water closet etc.) for a residential and commercial building; Explain all safety rules for fixture installation;

Disposal Systems (Drainage, waste and ventilation): Outline the plumbing codes required for the installation of drainage, waste and ventilation pipework systems; Identify the various fittings, traps and vents required for installation and describe their functions; Describe with the aid of a sketch the design features of a fully vented single-pipe and a double-pipe system; Describe with the aid of a sketch the layout of a domestic rainwater system and outline all fittings and accessories required; Outline the functions of a building drain; Identify the different types of waste disposal systems; State the statutory requirements for a waste disposal system; Describe the design and operation of a soil and sewer

disposal system; Outline the design features for a septic tank and soak-away system; Explain the material requirements and pipe sizes for soil waste and ventilation systems.

Testing of Plumbing Systems: Perform pre-commissioning checks for a plumbing installation; Conduct air, water and smoke tests for various distribution systems to determine alignment, gradient and to identify faults; Apply the ball test and mirror test to a drainage system; Conduct operational testing of fixtures to determine the status of the filling and flushing systems for water closets and pressures and flow rates for valves; Explain the percolation test, Perform final quality inspections of all installations once completed.

4. Communication and information technology

Communicate information: Verbal and written reporting is undertaken where required; Information is selected and sequenced appropriately; Information about tasks, processes, events or skills are communicated effectively; Competency is demonstrated by the effective use of various methods of communication such as drawings, sketches, reports.

Sources of technical information: Identify different sources of technical information and include in a portfolio for further use. Information can be sourced for manufacture's specification documents, technical drawings, data sheets, charts, internet. National and international standards such as the Trinidad and Tobago Bureau of Standards document for Low voltage installation should be included.

Describe the use of various electronic and information technology systems for communication: Systems (word processor, fax, Internet, E-mail).

Identify the main functions of commonly used software applications packages: Packages (word processing (document production), spreadsheets (numerical analysis, manipulation), database (file creation, updating, searching, sorting), computer aided design (line drawings used for architecture/engineering/ construction)).

Word processing: Open a new file and enter text; Edit the contents of the document; Improve the appearance of the document; Save, print and closed the edited document.

5. Alterations, repairs and planned maintenance

Domestic Water Systems: Select the tools and materials used to assemble and install a cold-water pipework system; Explain the correct procedure and use of tools to cut, thread, join pipes of varying cross-sectional areas and lengths; Describe how to solder and braze pipes; Discuss the various faults which may occur in domestic water pipework systems particularly as it relates to vibration, circulation and air locks; Describe the principles of water circulation; Describe the procedure for repairing leaking joints and explain how the systems could be isolated and drained; Describe the process for installing a tankless water heater; State the electrical requirement for a tankless water heater; Describe the procedure for servicing valves and taps.

Gas Supply and Distribution systems: Identify the tools and materials used in gas pipework maintenance; Describe the procedure for detecting leaks in the system; Explain the procedure to isolate and undertake repairs of leaks in the system; State all safety precautions which must be adhered to when carrying out maintenance activities.

Sanitary Pipework Systems: Identify the tools and materials used in sanitary pipework maintenance; Describe the procedure for detecting leaks in the system; Explain the procedure to isolate and undertake repairs of leaks in the system; Describe the process required to repair a faulty trap seal; State all safety precautions which must be adhered to when carrying out maintenance activities.

Disposal Systems: Identify the tools and materials used in disposal pipework maintenance; Describe the procedure for detecting leaks in the system; Explain the procedure to isolate and undertake repairs of leaks in the system; Explain the steps required to service water closets; State all safety precautions which must be adhered to when carrying out maintenance activities.

Practical Competences

Candidates will be able to:

1. Installation of a tank and pump system.
2. Installation of an electric water heater.
3. Installation of a Lavatory basin
4. Conduct a percolation test.
5. Perform testing procedures on a hot and cold-water system.
6. Carry out the inspection and repair of domestic water pipework.
7. Repair leaking joints and explain how the systems could be isolated and drained.
8. Installation of a building drain
9. Carry out the inspection and repair of domestic sanitation pipework.
10. Repair leaking joints and explain how the systems could be isolated and drained.
11. Clear an obstruction in sanitation/drainage pipework.
12. Repair a faulty trap seal.
13. Repair valves and faucets.
14. Dismantle and service a water closet (WC).
15. Carry out the inspection of water storage tanks.
16. Modify existing pipework to add a new sanitary fitting.

Assessment Details

| Methods of Assessment | End of Term Examination |
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| Grading Mode | Numeric |
| Weighting % | 100 |
| Pass Mark% | 50 |
| Outline Details | <p>2½ hrs. Closed book examination.</p> <p>Learners must compile and maintain a portfolio of evidence to demonstration that all practical competences relating to the learning outcomes were successfully completed. Photographic evidence must be included, showing the learner participating in the various activities. The portfolio should also contain all assessor and internal verification reports</p> |