Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

HOT WATER SYSTEM INSTALLATION

PLTHW 401

Install Hot water system

Competence

RQF Level: 4

Learning Hours 90

Credits: 9

Sector: Construction and Building Services

Trade: Plumbing Technology

Module Type: Specific

Curriculum: CBSPLT401- TVET Certificate 4 in Plumbing Technology

Issue Date: May,2023

<table>
<tr><td>Purpose statement</td><td colspan="6">This module describes the knowledge, skills, and attitude to be acquired by the learner to be able to perform hot water system pre-installation activities, perform water heater fixing activities, and perform post-connection activities. At the end of the module, the learner will be able to install a hot water system, to provide a consistent supply of heated water for various purposes/needs.</td></tr>
<tr><td>Learning assumed to be in place</td><td colspan="6">Basic technical drawing and AutoCAD, Installation of water distribution</td></tr>
<tr><td rowspan="6">Delivery modality</td><td colspan="2">Training delivery</td><td>100%</td><td colspan="2">Assessment</td><td>Total 100%</td></tr>
<tr><td colspan="2">Theoretical content</td><td>30%</td><td rowspan="4">Formative assessment</td><td>30%</td><td rowspan="4">50%</td></tr>
<tr><td colspan="2">Practical work:</td><td rowspan="3">70%</td><td rowspan="3">70%</td></tr>
<tr><td>• Group work and presentation</td><td>30%</td></tr>
<tr><td>• Individual work</td><td>40%</td></tr>
<tr><td colspan="3"></td><td colspan="2">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1.Perform pre-installation activities	1.1 Drawing is correctly interpreted based on types of system design
	1.2 Tools, materials and equipment are properly selected according to work to be done
	1.3 Hot water system installation data are adequately collected according to the system design
2.Perform water heater fixing activities	2.1. Work setting out is properly performed according to the drawing.
	2.2. Water heaters are appropriately mounted based on the system design
	2.3. Water heaters are properly connected to the piping system based on system design
	2.4 Pipe are properly supported based on the system design
	2.5. Water heaters are adequately tested according to testing methods

3. Perform post-connection activities	3.1. hot water system drawings correctly reviewed and updated as per reported changes.
	3.2. Training is properly carried out according system working principles
	3.3. Final report is accurately prepared based on type of Handover

Intended knowledge, skills and attitude.

Knowledge	Skills	Attitude
✓ Interpret hot water system design and layout drawing ✓ Understand water heater types ✓ sizing of Hot water system working operation ✓ describe hot water pipe layout ✓ describe hot water system setting procedure ✓ identify pipe selection considerations ✓ describe hot water system installation requirements ✓ describe fittings used in hot water draw off points ✓ identify tools and equipment used in hot water installation ✓ identify system maintenance procedure	✓ fix hot water supports ✓ Mounting water heaters ✓ connect hot water control valves ✓ Insulating hot water supply pipes ✓ Perform hot water pipe joining ✓ Install mixer taps ✓ Regulate hot water system settings ✓ Carry out hot water system testing ✓ Carrying out system repairing ✓ Assembling pipe sections	✓ Demonstrate punctuality during the implementation of design project ✓ Paying Attention system requirements and design guidelines ✓ Demonstrating positive behavior in resolving system raised issues ✓ Displaying problem solving skills in system related assignments handling ✓ Showing Adaptability to system design updates ✓ Manifesting patience to work pressure handling

Course content

Learning outcomes	At the end of the module the learner will be able to: 1. Perform pre-installation activities 2. Perform water heater fixing activities 3. Perform post-connection activities
Learning outcome 1: Perform Pre-installation activities.	**Learning hours: 25**

Indicative content

- **Drawing Interpretation:**
  - ✓ Identification of types of hot water drawings
- System design layout
- Detailed drawings

✓ Analysis of Hot water system supply symbols

- Hot Water Supply Symbols
- Valves and fitting symbols
- Fixture and Appliance symbols

- **Identification of Tools, materials and Equipment of hot water system installation:**

✓ Selection of Plumbing Tools

✓ Selection of Plumbing Materials

- Selection of Insulation materials
- Selection of Sealant materials
- Selection Fittings and pipes

✓ Selection of plumbing Equipment (Water heaters, Boilers, hot water tank , radiators, Circulation pumps)

- Types of water heaters (solar water heater, Gas heater, Electric water heater, heat pump)
- Water heater requirements

Resources required for the learning outcome

Equipment	Water heaters, Pressure tanks, Circulation pump, taps and valves (Mixers), Pressure regulators, Thermostat
Materials	Pipes, Fittings, Insulation materials ,Thread tapes, hemps, silicon ,soil solvent,
Tools	Adjustable wrenches ,Pipe cutters, Pliers ,Heat resistant gloves, Flaring tools
Facilitation techniques	Demonstration and simulation, Individually and group work, Practical exercises, Trainer guiding, Group discussion
Formative assessment methods /(CAT)	Written assessment, Oral presentation, Performance assessment, Product based assessment, Project based assessment

Learning outcome 2: Perform Water heater fixing activities	**Learning hours: 42**
Indicative content	

- **Performing work setting out.**

✓ Hot water system components allocation

✓ Hot water pipeline layout marking

- **Water heater mounting**

✓ Mounting Location

✓ Support brackets and hangers

✓ water heaters positioning

- **Connection of water heater to the piping system.**

✓ Types of hot water system (Centralized system, indirect, direct and combination system)

✓ Manufactures instructions

✓ Pipe and components connection

✓ System testing

- **Supporting the Hot Water Pipe**.

✓ Insulating the pipes

- ✓ Fixing Pipe hangers and clamps.
- **Testing water heater.**
- ✓ Leak test
- ✓ Pressure test
- ✓ Temperature test
- ✓ Flow test

Resources required for the learning outcome	
Equipment	Drilling machine, Arc welding machine, Power threading machine, Angle grinder, Clamping tool, Grooving tool, Pump, Water pump pressure, Leak tester, PPR Welding machine, Motor welding machine, Power generator, Heaters, Hydraulic press bender
Materials	Pipes, Fittings, Washers, Threaded rods, Welding rods, Seal tap, Fine yarn, Paper, Pencil, Bolts, Rubber, Cutting disk, Cables, Clips, Screws, Nails, Bolts
Tools	Set of standard, pen-end wrenches, Levels, Pipe Wrenches, Hack saw, Tape measure, Dies, Pliers, screw drivers, Tool Belt, Pipe vices, Hammer, Chain wrenches, PPE, Tester, Snips, Chisel, Chipping hammer, Club hammer
Facilitation techniques	Demonstration and simulation, Individually and group work, Practical exercises, Trainer guiding, Group discussion
Formative assessment methods /(CAT)	Written assessment, Oral presentation, Performance assessment, Product based assessment, Project based assessment

Learning outcome 3: Perform post connection activities	**Learning hours: 23**

Indicative content

- **Reviewing and updating drawing**
  - ✓ Types of water heater labels
  - ✓ Labelling points
  - ✓ Hot water labelling standards
- **Carrying out system operation training.**
  - ✓ Control system

- ✓ Operation procedures
- ✓ Maintenance procedures
- ✓ System safety procedures

- **Preparation of final report**
  - ✓ As built drawings
  - ✓ Hand over report
  - ✓ Project overview

Resources required for the learning outcome	
Equipment	Drilling machine, Arc welding machine, Power threading machine, Angle grinder, Clamping tool, Grooving tool, Pump, Water pump pressure, Leak tester, PPR Welding machine, Motor welding machine, Power generator, Heaters, Hydraulic press bender
Materials	Pipes, Fittings, Washers, Threaded rods, Welding rods, Seal tap, Fine yarn, Paper, Pencil, Bolts, Rubber, Cutting disk, Cables, Clips, Screws, Nails, Bolts
Tools	Set of standard, pen-end wrenches, Levels, Pipe Wrenches, Hack saw, Tape measure, Dies, Pliers, screw drivers, Tool Belt, Pipe vices, Hammer, Chain wrenches, PPE, Tester, Snips, Chisel, Chipping hammer, Club hammer
Facilitation techniques	Demonstration and simulation, Individually and group work, Practical exercises, Trainer guided Group discussion
Formative assessment methods /(CAT)	Written assessment, Oral presentation, Performance assessment, Product based assessment, Project based assessment

Integrated/Summative assessment 8 hours

Integrated situation

Mr Lebron is allergic to the cold water when bathing and that's why he wants a professional plumber to install a solar water heating system on top of Gabble roof

As a plumber, your requested to install a solar water heater and a backup water heater with in 8 hours

Instructions:

- ✓ Ensure that the pipe support material can handle high temperature.
- ✓ Make sure that all supply pipes are insulated
- ✓ Pipeline is to be made in Copper pipes of 15mm diameter
- ✓ Water source is at 5m from the building
- ✓ The height of roof is 2.5m

Resources

Tools	Set of standard, pen-end wrenches, Levels, Pipe Wrenches, Hack saw, Tape measure, Dies, Pliers, screw drivers, Tool Belt, Pipe vices, Hammer, Chain wrenches, PPE, Tester, Snips, Chisel, Chipping hammer, Club hammer
Equipment	Drilling machine, Arc welding machine, Power threading machine, Angle grinder, Clamping tool, Grooving tool, Pump, Water pump pressure, Leak tester, PPR Welding machine, Motor welding machine, Power generator, Heaters, Hydraulic press bender
Materials/ Consumables	Pipes, Fittings, Washers, Threaded rods, Welding rods, Seal tap, Fine yarn, Paper, Pencil, Bolts, Rubber, Cutting disk, Cables, Clips, Screws, Nails, Bolts

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	

1.Perform Pre-installation activities (25%)	**1.1** Drawing is correctly interpreted base on types of system design	Types of hot water drawings is identified			3
		System design layout is elaborated			3
		Plumbing symbols and legends are analysed			3
	1.2 Tools, materials and equipment are properly selected according to work to be done	Tools are selected			2
		Materials are selected			3
		Equipment are selected			3
		PPEs are used			2
	1.3 Hot water system installation data are adequately collected according to the system design	Data are collected			3
		Data are analysed			3
2. Perform water Heater fixing activities (60%)	**2.1.** Work setting out is properly performed according to the drawing.	Drawing is interpreted			4
		Site is prepared			2
		Pipes routes are determined			2
		Pipe trenches are set			2
	2.2. Water heaters are appropriately	Fixtures position is set			3

	mounted based on the system design	The types of water heater is selected			4
		Water heater is well mounted			4
	2.3. Water heaters are properly connected to the piping system based on system design	Storage tank is connected			4
		Piping system is connected to water heater			3
		Cold water inlet is connected			3
		Hot water outlet is connected			3
		Connections is verified			2
	2.4. Pipe are properly supported based on the system design	Pipes are insulated			2
		Pipe hangers and Clamps are fixed			2
		Pipes is tightened			3
		Time is respected			2
	2.5. Water heaters are adequately tested according to testing methods	Leak are tested			4
		Power is turned on			2
		Temperature is set			4
		Hot Water supply is tested			5
3. Perform post connection activities (25%)	**3.1.** Final drawing is well developed according to the as built development procedures	Drawing Necessary information is gathered			2
		Plumbing layout is revised			3
		Scale is chosen			2

		Symbols and abbreviations are used			3
		All components are labelled			3
		Title blocks and notes are added			2
	3.2. Training is properly carried out according system working principles	Safety precautions are elaborated			2
		Power and fuel sources are demonstrated			3
	3.3. Final report is accurately prepared based on type of Handover	Elements of technical report is identified			3
		Types of hand over is identified			2
Total marks					100
Percentage Weightage					110%
Minimum Passing line % (Aggregate):					70%

References :

1. Dunlop . (9/11/2014). *Hot Water Heater Piping Connections And Installation.* Toronto: Carson Dunlop Associates.

2. Ivan Verhaert, B. E. (November 2019). *A Methodology To Design Domestic Hot Water Production System Based On Tap Patterns.* Aalborg(DK): Conference: Clima 2016.

3. A. Bhatia. (2014). *Design Cosideration For Hot Water Plumbing .* NY , USA: Createspace Independent Publishing Platform .

4. Llic, Zoran S. (2017). *Hot Water Treatments.* Pristina: In Book: Novel Postharvest Treatments Of Fresh Produce. Doi:10.1201/9781315370149-9

5. Brooks, C. (2023, 05 22). Hot Water Systems. *Hot Water Systems*, 28.

6. RHEEM. (2023). *Hot Water Recirculating System .* Montgomery ,Alabama 36117: Rheem Sales Campany,INC.

7.Verhaert, I. (2019). *A Methodology To Design Domestic Hot Water Production Systems Bsed On Tap Patterns.* Aalborg (DK): Conference: Clima 2016