Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

PLUMBING FACILITIES REPAIR AND MAINTAINANCE

PLTPF301

Maintain and Repair Plumbing Facilities

Competence

RQF Level: 3

Learning Hours

60

Credits: 6

Sector: Construction and Building Services

Trade: Plumbing technology

Module Type: Specific

Curriculum: CBSPLT302- TVET Certificate 3 in Plumbing Technology

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Purpose statement	This is a core module which describes the skills, knowledge and attitude to be acquired by a trainee to Repair and maintain plumbing facilities in respect to the standards and problems identified					
Leaning assumed to be in place	Safety, Health and environment at workplace; Plumbing Works Planning; Pipes Joining; Installation of House Drainage; Sanitary appliances installation; Install Domestic water supply.					
Delivery modality	**Training delivery**		**100%**	**Assessment**		**Total 100%**
	Theoretical content		30%	Formative assessment	30%	50%
	Practical work:		70%		70%	
	• Group project and presentation	20%				
	• Individual project /Work	50%				
			Summative Assessment			50%

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Ensure health and safety measures	**1.1** workplace hazards are properly identified according to the work
	1.2 PPEs are properly selected according to the wok
	1.3 Safety signs and signals properly interpreted according to the work
	1.4 Safety rules and regulations are properly described according to the work
2. Identify the failures (problems) in plumbing facilities	**2.1** Types of failures are adequately identified/classified
	2.2 Detection techniques of plumbing facilities failures are adequately identified
	2.3 Causes of plumbing failures are properly identified
	2.4 Methods of solving the problems are appropriately identified
3. Schedule for repairing and maintenance activities	**3.1** Levels/types of maintenance needs are clearly identified
	3.2 Schedule for repairing maintenance activities is properly prepared
	3.3 Activities workflow is appropriately elaborated
4. Select material tools and	**4.1** Materials are properly identified
	4.2 Tools are properly identified

equipment for repairing and maintenance of plumbing facilities	**4.3** Equipment are appropriately identified
5. Elaborate cost estimation for repairing and maintenance of plumbing facilities	**5.1** Cost of materials is properly prepared
	5.2 Expenses are adequately determined
	5.3 Labor cost is properly determined
6. Perform repairing and maintenance of plumbing facilities	**6.1** Plumbing facilities are properly repaired and maintained
	6.2 Drainage systems are properly repaired and maintained
	6.3 Water supply systems are properly repaired and maintained

Course content

Learning outcomes	**At the end of the module the learner will be able to:** **1.** Ensure health and safety measures **2.** Identify the failures (problems) in plumbing facilities **3.** Schedule for repairing and maintenance activities **4.** Select appropriate materials, tools, and equipment **5.** Elaborate on the cost estimation **6.** Perform repairing and maintenance of plumbing facilities

Learning outcome 1: Ensure health and safety measures	Learning hours: 5

Indicative content

- **Identification of workplace hazards: (Refer to**: RS ISO 45001, RS ISO 14001, RS 367**)**
  - ✓ Types of hazards
    - Safety hazards
    - Biological hazards
    - Physical hazards
    - Chemical hazards
    - Psychosocial hazards
  - ✓ workplace hazards information
  - ✓ workplace hazards inspection
  - ✓ Site cleanliness
  - ✓ Characterize the nature of identified hazards
  - ✓ Conduct incident investigations

- **Selection of PPEs types (Refer to** :RS ISO 20347)
  - ✓ PPE awareness and training
  - ✓ proper use of PPE

- **Interpretation of Safety signs and signals (Refer to:** RS ISO 3864-2)
  - ✓ Types of safety signs
    - ✓ Prohibition signs
    - ✓ Mandatory signs
    - ✓ Warning signs
    - ✓ Emergency signs
  - ✓ Types of safety signals
  - ✓ Safety signs and signals regulations

- **Description of Safety rules and regulations (Refer to** : RS 354)
  - Workplace information
  - General safety rules
  - Safety datasheet

Resources required for the learning outcome

Equipment	Helmets, Goggles', Gloves, Overall, Overcoat, Safety shoes, Masks, Kneepads, projector, air compressor, computer, white/black board
Materials	Safety posts, marker pen/chalks, papers, duster,
Tools	First aid tool kit, internet, books, brush, blooms , moppers, rungs.
Facilitation techniques	Lectures, Demonstration and simulation, Individual and group work, Practical exercise, Individualized, Trainer guided, Group discussion.
Formative assessment methods	Written assessment, Oral presentation, Performance assessment, Product based assessment, Project based assessment.

Learning outcome 2: Identify the failures in plumbing facilities	**Learning hours: 10**

Indicative content

- **Identification of types of failures**
  - ✓ Failure in pipe lines
  - ✓ Dampness in bathrooms
  - ✓ Damp in wall due to pipe connections
  - ✓ Blockage of house drainage lines
  - ✓ Failure in transmission main
  - ✓ Plumbing leaks
  - ✓ Types of damages.
  - ✓ Plumbing Inspections
  - **Identification of methods in solving failures (Refer to :**RS 273)
  - ✓ Replacement method
  - ✓ Roding method
  - ✓ Screening method
  - ✓ Heating method
  - ✓ Flushing method
  - ✓ Sealing method
- **Identification of detection techniques of failure in plumbing facilities (Refer to:** RS ISO 24516-2).

- ✓ Hydrostatic /pressure testing after pipeline erection and leak detection during service
- ✓ Infrared after pipeline erection and leak detection during service
- ✓ laser technology after pipeline erection and leak detection during service
- ✓ Test and calibration of water meter
- ✓ Leak detection tools
- ✓ Tools and testing instruments
- ✓ Physical leakage test

- **Description of cause of failure in Plumbing facilities based on work**
  - ✓ Rupture
  - ✓ Excessive pressure
  - ✓ Low quality of materials
  - ✓ Bad workmanship
  - ✓ Environmental conditions
  - ✓ Water meter trouble

Resources required for the learning outcome	
Equipment	PPEs, Leak detectors, drain auger, Hydro-jet machine, Rodding stick machine (drain snake), computer, projector, white/blackboard,
Materials	Thread Tape, Simple fittings, Solvent Cement (Tangit), Acoustic soda, marker pen/chalks, papers, duster, water meter
Tools	Pipes wrenches, Screw drivers, digging tools, Hacksaw, Adjustable spanners, Rachet spanners, internet and books.
Facilitation techniques	Lectures, Demonstration and simulation, Individual and group work, Practical exercise, Individualized, Trainer guided, Group discussion
Formative assessment methods	Written assessment, Oral presentation, Performance assessment, Product based assessment, Project based assessment

Learning outcome 3 : Schedule for repairing and maintenance activities	Learning hours: 10
Indicative content	
• **Determination of Types of maintenance activities (Refer to:** RS 273) ✓ Proactive/planned maintenance ✓ Reactive/unplanned maintenance • **Preparation of schedule for repairing and maintenance activities (Refer to:** RS 273, RS ISO 24516-2) ✓ Repair and maintenance activities ✓ Priority of activities ✓ Preparation of worksheet ✓ Sequences of activities • **Elaboration of Activities workflow** ✓ Types of work plan ✓ Types of work monitoring	
Resources required for the indicative content	
Equipment	Computer, Printer, Telephone, Calculator, projector, white/black board
Materials	Papers, notebook, marker pen/chalks, duster.
Tools	Pens, Pencil, internet, books
Facilitation techniques	Lectures, Demonstration and simulation, Individual and group work, Practical exercise, Individualized, Trainer guided, Group discussion
Formative assessment methods	Written assessment, Oral presentation, Performance assessment, Product based assessment, Project based assessment

Learning outcome 4: Select appropriate materials, tools and equipment	Learning hours: 10
Indicative content	

- **Identification of the materials (Refer to: RS ISO 4427-1)**
  - ✓ Definition of terminologies
  - ✓ classification of type of pipes
  - ✓ Specification of pipes and fittings required
  - ✓ Specification spare parts

- **Selection of tools**
  - ✓ Identification of tools
  - ✓ Classification of tools required
  - ✓ Inspection of the tools conditions

- **Selection of equipment**
  - ✓ Identification of equipment
  - ✓ Inspection of equipment conditions
  - ✓ Determination of quantity

Resources required for the learning outcome	
Equipment	PPEs, Computer, ipad, Telephones, Drilling machines, white/black board, projector, pressure gauge, PPR /Welding machine, dies stocks, threading machine, wheel barrow
Materials	Screws, bits, sealants, pipes, fittings, Epoxy putty, Pipe putty, Acoustic Soda, water, marker pen/chalks, papers, duster, appliances, cement, sand.
Tools	Pipe Cutter, measuring tapes, marking tools, Plunger, Drain stick, screw driver, internet, books, tape measure, hack saw, pipe wrench, spirt level, spanners, hammer, spade, trowel, hoes, pic axles
Facilitation techniques	Lectures, Demonstration and simulation, Individual and group work, Practical exercise, Individualized, Trainer guided, Group discussion
Formative assessment methods	Written assessment, Oral presentation, Performance assessment, Product based assessment, Project based assessment

Learning outcome 5: Elaborate the cost estimation	Learning hours: 10
Indicative content	

- **Preparation of materials cost.**
  - ✓ Materials listing
  - ✓ Materials specification
  - ✓ Quantities calculation
  - ✓ Materials pricing

- **Expenses are adequately determined**
  - ✓ Transport
  - ✓ Communication
  - ✓ Taxes

- **Labour cost is properly determined**
  - ✓ Labour needs identification
  - ✓ Working rate
  - ✓ Labour hours
  - ✓ Labour wages

Resources required for the indicative content	
Equipment	Computer, Printer, Calculator, Punching, projector, white/black board, telephone
Materials	Papers, Notebook, marker pen/chalks, papers, duster.
Tools	Books, Pens, Stapler, internet.
Facilitation techniques	Lectures, Demonstration and simulation, Individual and group work, Practical exercise, Individualized, Trainer guided, Group discussion
Formative assessment methods	Written assessment, Oral presentation, Performance assessment, Product based assessment, Project based assessment

Learning outcome 6: Perform repairing and maintenance of plumbing facilities	**Learning hours: 15**
Indicative content	

- **Preparation of workplace (Refer to:** RS 367, ISO 7078:, ISO 80000-1, RS ISO 14001, Rwanda building code page 575,ISO14015)
  - ✓ Take measurements
  - ✓ Remove all obstacles
  - ✓ Protection of properties around
- **Description of maintenance steps (Refer to:** RS 273)
  - ✓ Collect tools and materials
  - ✓ Stop the water flow
  - ✓ Clean the surfaces of facility
  - ✓ Fixation of the problem
  - ✓ Test the work
- **Perform repairing and maintenance (Refer to :** RS 273, RS ISO 24516-2)
  - ✓ Reparation of facility
  - ✓ Replacing the facility
  - ✓ Maintaining the facility

Resources required for the indicative content	
Equipment	PPEs, Drilling machines, white/black board, pressure gauge, PPR /Welding machine, dies stocks, threading machine, Calibrated wheel barrow, Hydro-Jet Machine, Hot guns
Materials	Plumbing fittings, Tangit, Thread tape, Screws, bits, sealants, pipes, Epoxy putty, Pipe putty, Acoustic Soda, water, marker pen/chalks, duster, appliances, cement, sand
Tools	Drain Auger, Roding sticks (Drain Snakes), Plungers, pipe wrenches, screw drivers, Hacksaws, Hammer, Pipe Cutter, marking tools, internet, books, tape measure, spirt level, spanners, spade, trowel, hoes, pic axles
Facilitation techniques	Lectures, Demonstration and simulation, Individual and group work, Practical exercise, Individualized, Trainer guided, Group discussion

Formative assessment methods	Written assessment, Oral presentation, Performance assessment, Product based assessment, Project based assessment

Integrated/Summative assessment 6

Integrated situation

The management of University of Rwanda head office located in Kigali city is having plumbing problems in different components from the main building i.e., drainpipes are not draining wastewater as usual, bathroom taps, and valves are not operating, water does not reach the storage tank, due to all those problems estates manager has advised to close some areas until when these problems are solved. But in this building there some classrooms where students use the same bathrooms hence causing congestion in the bathrooms. In this regards, University of Rwanda is looking for someone to identify problems and their proposed solution, prepare the cost estimation for materials to solve the problems, elaborate work plan for repairing and maintaining this facility. As a professional plumber University of Rwanda has proposed you to carry out the maintenance of the above-mentioned facilities within 6 hours by applying all safety and health measures to avoid and health effect after work.

Resources

Tools	Rodding sticks, pipe wrenches, Adjustable spanners, Hammer, Screw drivers
Equipment	Rodding machines, Drilling machines, Grinders, Hacksaw
Materials/ Consumables	Pipes (both water supply and drainage), Fittings, thread tape, tangit

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
Learning outcome 1:	1.1. workplace hazards are properly	Ind.1 Slippery area marked			1
		Ind.2 Safety signs			1

(10%)	identified according to the work	respected			
		Ind.3 Safety measures applied			1
	1.2. PPEs are properly selected according to the wok	Ind.1 Gloves worn			1
		Ind.2 overall worn			1
		Ind.3 face mask worn			1
		Ind.4 helmet worn			1
		Ind.5 goggles worn			1
		Ind.6 safety boot worn			2
Learning outcome 2: **(16%)**	2.1. Types of failures are adequately identified/classified	Ind.1 Leakage identified			3
		Ind.2 Blockage identified			3
	2.2. Methods of solving the problems are appropriately identified	Ind.1 Physical method used			3
		Ind.2 Chemical method used			2
		Ind.3 Cleaning done			3
		Ind.4 Epoxy putty used			2
Learning outcome 3: (8%)	3.1. Schedule for repairing and maintenance activities	Ind.1 Activities listed			3
		Ind.2 Workflow respected			3
		Ind.3 Time well managed			2
Learning outcome 4: (20%)	4.1. Materials are properly described	Ind.1 Sealants used			2
		Ind.2 Pipes used			2
		Ind.3 fittings used			2
	4.2. Tools are properly identified	Ind.1 Hack saw identified			2
		Ind.2 Adjustable spanner identified			2
		Ind.3 Drain Snakes identified			2
		Ind.4 Pipe wrench identified			2

	4.3. Equipment are appropriately identified	Ind.1 PPR welding machine identified			2
		Ind.2 Drilling machine identified			2
		Ind.3 Power threading machine identified			2

Learning outcome 5: (18%)	5.1 Cost of materials is properly prepared	Ind.1 Specification of materials elaborated			2
	5.2 Expenses are adequately determined	Ind.1 Transport			2
		Ind.2 Communication			2
		Ind.3 Taxes			2
	5.3 Labor cost is properly determined	Ind.1 Labor			2
		Ind.2Needs identification			2
		Ind.3 Working rate			2
		Ind. 4 Labor hours			2
		Ind.5 Labor wages			2
Learning outcome 6: (28%)	6.1 Drainage systems are properly repaired and maintained	Ind.1 Clogged drains maintained			3
		Ind.2 Damaged parts replaced			3
	6.2 Sanitary appliances are properly repaired and maintained	Ind.1 Lavatory maintained			3
		Ind.2 Urinals maintained			3
		Ind.3 WC maintained			3
	6.3 Water supply systems are properly repaired and maintained	Ind.1 Pressure checked			3
		Ind.2 Water tank repaired			3
		Ind.3 Water leakage fixed			3

		Ind.4 Float valve replaced			4
Total marks					**100**
Percentage Weightage					**100%**
Minimum Passing line % (Aggregate): 70%					

References:

1. Paton, Nic. 2008, 'Senior Managers Fail to Show Competence in Health and Safety' Occupational Health, Vol. 60, Iss. 3; p. 6
2. Hale A, Ytehus I, 2004, 'Changing requirements for the safety profession: roles and tasks', Journal of Occupational Health & Safety – Australia and New Zealand
3. De Vekey RC (2001). Bricks blocks and masonry made from aggregate concrete: Part 2 – APPEarance and environmental aspects, BRE Digest 460, Part 2.
4. S. K. Duggal,Building materials , ,2008,Third revised version ISBN (13) : 978-81-224-2975-6
5. Swamee, P.K., and Sharma, A.K. (1990a). Design of water supply pipe network. ISBN 978-0-470-17852-2 (cloth)
6. www.nationalbimlibrary.com/en/sanitary-appliance-systems/
7. www.scribd.com/presentation/121610820/Sanitary-Appliances
8. www.designingbuildings.co.uk/wiki/Types_of_sanitary_appliances
9. C.J. Smith and B. Curry, Practical Plumbing, Macmillan Publishers Ltd, 1998
10. BCA Academy, Building Construction Supervisors Safety, Singapore, January, 2008
11. Building and Construction Authority, Plumbing and Pipefitting, STHO, 2006
12. A.L. Townsend, Plumbing 1, The Anchor Press Ltd, Tiptree, Essex, 1969
13. RS ISO 45001: Occupational health and safety management systems — Requirements with guidance for use
14. RS ISO 15874-2: Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 2: Pipes
15. RS ISO 15874-3: Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 3: Fittings
16. RS ISO 15874-5: Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 5: Fitness for purpose of the system
17. RS ISO 4427-1: Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 1: General specifications

18. RS ISO 4427-2: Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 2: Pipes
19. RS ISO 4427-3: Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 3: Fittings
20. RS ISO 4427-5: Plastics piping systems — Polyethylene (PE) pipes and fittings for water supply — Part 3: Fittings
21. Rwanda building code 2019
22. RS 238-1: Water supply — Part 1: Requirements for systems
23. RS 238-2: Water supply — Part 2: Requirements for components
24. RS 273: Sanitary appliances — Selection, installation and maintenance — Code of practice