



Republic of Rwanda
Ministry of Education



RTB | RWANDA
TVET BOARD

INSTALLATION OF WATER DISTRIBUTION NETWORKS

PLTWD401

Install Water Distribution Networks

Competence

RQF Level: 4

Learning Hours



Credits: 10

Sector: Construction and Building Services

Trade: Plumbing Technology

Module Type: Specific

Curriculum: CBSPLT4001- TVET CERTIFICATE 4 In Plumbing Technology

Copyright: © Rwanda TVET Board, 2023

Issue Date: May, 2023

Purpose statement	This module describes the knowledge, skills, and attitude to be acquired by a learner in order to perform water distribution networks pre- installation activities, perform connection activities and perform post connection activities. At the end of the module the learner will be able to interpret network drawings, carry out water distribution network piping and perform system maintenance.						
Learning assumed to be in place	Basic technical drawing and AutoCAD						
Delivery modality	Training delivery			100%	Assessment		Total 100%
	Theoretical content			30%	Formative assessment	30%	50%
	Practical work:			70%		70%	
	• Group work and presentation	30%					
	• Individual work	40%					
				Summative Assessment		50%	

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Perform pre-installation activities	1.1. Drawing is correctly interpreted base on types of water distribution networks.
	1.2. Tools, materials and equipment are properly selected according the water distribution networks.
	1.3. Water distribution connection installation data are adequately collected according to the water Demand to be supplied
2.Perform connection	2.1. Work setting out is properly performed according to the drawing
	2.2. Trenching is correctly carried out based on pipe sizes

activities	2.3. Pipes are correctly laid according to the system design
	2.4. Pipes are properly connected according to network layout
	2.5. Pipes are properly supported based on system design
	2.6 water distribution line is adequately tested according to testing methods
3. Perform post-connection activities	3.1. water distribution network drawings are 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
✓ Describe hydraulic principles ✓ Understand types of water distribution networks ✓ Interpret water distribution network design and layout drawing ✓ describe water distribution pipe layout ✓ identify pipe selection considerations ✓ identify tools and equipment used in water distribution ✓ identify system maintenance procedure	✓ big sized pipe laying ✓ Assembling distribution pipeline connections ✓ Marking and Locating distribution network component's location ✓ Perform network control valve connection ✓ Perform pipe line supporting ✓	✓ Displaying problem solving skills in system related assignments handling ✓ Showing Adaptability to system design updates ✓ Manifesting patience to work pressure handling ✓ Demonstrate punctuality during the implementation of design project ✓ Paying Attention system requirements and design guidelines ✓ Demonstrating positive behavior in resolving system raised issues

Course content

Learning outcomes	At the end of the module the learner will be able to: 1. Perform pre-installation activities 2. Perform connection activities 3. Perform post-connection activities
Learning outcome 1: Perform pre-installation activities	Learning hours: 20
Indicative content	
• Interpretation of plumbing drawing based on water distribution network. ✓ Plumbing symbols. ✓ Pipes and fittings (Valves, Flanged tee, Flanged adapter, water meter) ✓ Inspection chambers (air release valves, wash out valves) ✓ Different types of drawings to the water distribution network. ✚ Longitudinal profile ✚ Topographic map • Selection of Tools, materials and equipment ✓ Plumbing tools ✓ Plumbing equipment (PPE, Pipe connection equipment) ✓ Materials selection criteria • Data collection in water distribution ✓ Source of water ✓ Climate condition ✓ Pressure of water ✓ water demand	

Resources required for the learning outcome	
Equipment	PPEs, tire fort machine, hand drilling machines, grinding machines, butt welding machine, HDPE and PPR welding machine, power threading machine, shearing machine, power hacksaw, hydraulic press bending machine, rolling machine, folding machine, angle grinder, sander machine, power drilling machine, DC/AC Welding machine, Oxy-acetylene welding machine, GPS.
Materials	Pipes, sealants, Pipe fittings (flange tees, flange adapter, valves), wall plugs, screws, hemp (fine yens), thread seal tape.
Tools	Hacksaw, pipe wrenches, pipe vices, a set of dies, screw drivers, spanners, PPR scissors, snips, pipe cutter, calibrated (tape measure, vernier caliper, try square, combination square, spirit level), pliers, plumb bob, tongs, clamps. internet, books.
Facilitation techniques	Demonstration and simulation, individual and group work, practical exercise, individualized, trainer guided, group discussion.
Formative assessment methods /(CAT)	Written assessment, Oral presentation, Performance assessment, Product based assessment, Project based assessment.

Learning outcome 2: Perform connection activities.	Learning hours: 53
Indicative content	

- **Setting out of water distribution network**
 - ✓ Marking (pegging the workplace)
- **Trenching**
 - ✓ Site clearing
 - ✓ Methods of trench
 - ✚ Straight trench
 - ✚ Sloped trench
 - ✚ Benched trench
 - ✚ Bell- bottom trench
 - ✚ Chiselling
- **Pipe laying**
 - ✓ Types of pipes
 - ✓ Types of pipe joints
 - ✚ Threads joint
 - ✚ Welded joints (butt welded joint, socket joints)
 - ✚ Grooved joint
 - ✚ Flanged joints
 - ✓ Types of water distribution system
 - ✚ Dead end system
 - ✚ Grid iron system
 - ✚ Ring system or circular system
 - ✚ Radial system
- **Pipe connection**
 - ✓ Types of connection
 - ✚ Socket connection
 - ✚ Flanged connection
 - ✚ Saddle connection
- **Pipes support**
 - ✓ Types of pipes support

 Pipes backfilling

 Trust block

 Anchor block

 Clamps

✓ Pipe support procedure

- **Water distribution test**

✓ Leak test methods

 water Pressure test

 Smoke test

 Air compressor

✓ Water Pressure test

 Hydro-static pressure test

 Pneumatic test

✓ Flow test

 Flushing

Resources required for the learning outcome

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 detector, electro-fusion machine, motor welding machine, butt welding machine, power generator, hydraulic press bender, hydraulic press bending machine, tool belt
Materials	Pipes, fittings, washers, threaded rods, welding rods, seal tap, fine yarn, paper, pencil, bolts, sand, rubber, cutting disk, cables, clips, screws, nails, bolts, saddle clip
Tools	Set of standard open-end wrenches, levels, pipe wrenches, hack saw, tape measure, dies, pliers, screw drivers, pipe vices, hammer, chain wrenches, tester, water pump plier, chipping hammer, club hammer

Facilitation techniques	Demonstration and simulation, videos or films, photos, sketching, practical exercise, measuring, 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: 20
Indicative content	
• Review and updated drawing of water distribution network. ✓ As built drawing • Training to the water distribution networks ✓ System component ✓ System operation ✓ Water meter reading ✚ Types of water meter ✚ Installation of water meter • Final report ✓ 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, electro-fusion machine, motor welding machine, butt welding

	machine, power generator, hydraulic press bender, hydraulic press bending machine, tool belt
Materials	Pipes, fittings, washers, threaded rods, welding rods, seal tap, fine yarn, paper, pencil, bolts, sand, rubber, cutting disk, cables, clips, screws, nails, bolts, saddle clip
Tools	Set of standard open-end wrenches, levels, pipe wrenches, hack saw, tape measure, dies, pliers, screw drivers, pipe vices, hammer, chain wrenches, tester, water pump plier, chipping hammer, club hammer
Facilitation techniques	Demonstration and simulation, videos or films, photos, sketching, practical exercise, measuring, group discussion
Formative assessment methods /(CAT)	Written assessment, oral presentation, performance assessment, product-based assessment, project-based assessment.

Integrated/Summative assessment

Integrated situation

One of the schools in Bugesera District has a water shortage problem but there is a main water network in 500 meters from the school, as a professional plumber you're tasked to perform a new water connection to that school in order to address the stated problem of water properly.

Instructions:

- The main water network is of 63mm diameter pipe.
- Position of control valve is installed at 2m from the tank.
- Task is to be performed within seven (7) hours

Resources					
Tools		Set of standard open-end wrenches, Levels, Pipe Wrenches, Hack saw, Tape measure, Dies, Pliers, screw drivers, Pipe vices, Hammer, Chain wrenches, Tester, Water pump plier, chipping hammer, Club hammer.			
Equipment		Drilling machine, Arc welding machine, Power threading machine, Angle grinder, excavator machine, trencher excavator, clamping tool, grooving tool, Pump, Water pump pressure, Leak tester, Electro-fusion machine, Motor welding machine, Butt welding machine, Power generator, Hydraulic press bender, Hydraulic press bending machine, Tool Belt			
Materials/ Consumables		Pipes, Fittings, Air release valve, wash out valves, control valves, water meter, Washers, threaded rods, welding rods, Seal tap, Fine yarn, Paper, Pencil, Bolts, Sand, Rubber, Cutting disk, Cables, Clips, Screws, Nails, Bolts, Saddle clip.			
Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1. Perform pre-installation activities (20%)	1.1. Drawing is correctly interpreted base on types of water distribution networks.	1. pipe symbols are well interpreted			2
		2. Pipe fittings are properly interpreted			1
		3. Air release valves location			1

		are well interpreted			
		4. Washout valve locations are well interpreted			1
		5. Longitudinal profile are interpreted			2
	1.2. Tools, materials and equipment are properly selected according the water distribution networks.	1. PPEs are well selected			1
		2. PPEs are well used			1
		3. Tools are well selected			1
		4. Tools are well used			1
		5. Equipment are well selected			1
		6. Equipment are well used			1
		7. Materials are well selected			1
	1.3. Water distribution connection installation data are adequately collected according to the	1. water tank is well connected			1
		2. the data of connection are well collected			2

	types of water Demand to be supplied	3. The diameter of pipes are well selected according to the water pressure			1
		4. Types of water demand is well supplied			1
2.Perform connection activities (60%)	2.1. Work setting out is properly performed according to the drawing	1. The workplace is well prepared			3
		2. Tools are clearly cleaned			2
		3. Tools are well stored			2
		4. The workplace is well marked			2
	2.2. Trenching is correctly carried out based on pipe sizes	1. The trenches are excavated properly			5
		2. The trench is well done			2
		3. The trenches are well excavated according to the size of pipes			4
		1. The pipes are well joined			6

	2.3. Pipes are properly connected according to network layout	2. The pipes connections are laying correctly			5
	2.4. Pipes are correctly laid according the system design	1. Laying is well done			4
		2. Distribution is well done			4
	2.5. Pipe are properly supported based on system design	1. The pipes are well fixed			3
		2. The procedures are well done			3
	2.6. water distribution line is adequately tested according to testing methods	1. Leak test is well performed			5
		2. Water pressure is well performed			5
		3. Flow test is well performed			5
3. Perform post-connection activities (20%)	3.1. water distribution network drawings are correctly reviewed and updated as per reported changes.	1. Review drawing is well done			5
		2. Updated drawing is well done			5
	3.2. Final report is accurately prepared based on type of Handover	1. The report is correctly prepared			5

	3.3. Final drawing is well developed according to the as built development procedures	1. Drawing is well developed			5
Total marks		100%			
Percentage Weightage		100%			
Minimum Passing line % (Aggregate):		70%			

References

1. Apha. (2013). *Distribution system Regulations*. Washington: American Water works Associations.
 2. College of the Canyons. (23/05/2023). *Water Distribution Systems and Operations* . califonia: ZTC Text book.
 3. Jeffrey A. Gilbert . (2020). *Practical Design of water distribution system*. U S: Meadow Estates Drive.
 4. Osama Mohammed Amin, Mohammad Zaher Akkad. (2021). *Designing of Water distribution System*. Miskolc , Salahaddin: Multidisziplinaris Tudományok.
 5. University of Southern California. (2021). *Distribution System Water Quality*. US California: University of southern califonia.
-
-