



Republic of Rwanda
Ministry of Education



RTB | RWANDA
TVET BOARD

PRESSURIZED IRRIGATION SYSTEM MAINTENANCE

WIRPS301

Maintain pressurized irrigation system

Competence

RQF Level: 3

Learning Hours



Credits: 4

Sector: Agriculture and food processing

Trade: Water and irrigation

Module Type: Specific

Curriculum: AFPWIR 3001- TVET Certificate III in water and irrigation

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Purpose statement	This module describes the skills, knowledge and attitude required to maintain pressurized irrigation system. At the end of this module, learners will be able to carry out pre- and post-season maintenance, carry out routine maintenance activities on pressurized irrigation system, maintain pressurized irrigation system components, remove and replace damaged pipes and fittings of pressurized irrigation system. Qualified learners deemed competent to this competency may work alone or with others on routine tasks in marshland, hillside, small scale irrigation, garden, greenhouses, agricultural land, rain water harvesting, In situ rain water harvesting and ground water harvesting related activities under minimum supervision.					
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. Carry out pre- and post-season maintenance	1.1 Pre-seasonal equipment for effective operation is properly prepared in accordance with design specifications and enterprise standards.
	1.2. Pressurized irrigation components are carefully flushed, cleaned and closed down in accordance with designed specifications and enterprise standards.
	1.3. Sprinkler irrigation system is frequently checked to ensure that it is in good condition and operating efficiently.
	1.4 Water source, pumping unit, main and lateral pipelines, riser pipes, sprinkler heads, nozzles and drip lines are regularly

	<p>inspected to ensure their good operating conditions.</p> <p>1.5 Accessories like reducers, elbows, valves, tees, regulators, gauges and filters are regularly inspected to ensure their good operating conditions.</p> <p>1.6 Leakages of irrigation network are properly identified to maintain the working pressure and water delivery</p>
2 Carry out routine maintenance activities on pressurized irrigation system	<p>2.1. All maintenance activities are properly carried out according to the maintenance program and the manufacturer’s specifications.</p> <p>2.2. Filters are regularly cleaned before every irrigation to minimize the difference in pressure between the inlet and the outlet of the filter</p> <p>2.3. Leaks, operating faults are timely inspected in according to the system functionality</p>
3. Maintain pressurized irrigation system components	<p>3.1. Maintenance activities are properly carried out in accordance with enterprise standards and technical specifications.</p> <p>3.2. Air valves is regularly checked for proper functioning of the system</p> <p>3.3. Fittings are regularly inspected for wear or blockage and replaced appropriately according to enterprise guidelines</p> <p>3.4. Pump engine is timely oiled and greased according to the duration of pumping operation</p> <p>3.5. Laterals are properly moved to ensure that the sprinklers and drippers are not damaged.</p> <p>3.6. Overhead reservoir, fertilizers tank, filters, riser pipes, nozzles and drip lines are regularly cleaned in order to ensure proper functioning according to the irrigation system</p>
4. Remove and replace damaged pipes and fittings of pressurized irrigation system	<p>4.1. Clogged emitters and drippers are properly cleaned and repaired to ensure proper functioning of the system.</p> <p>4.2. Damaged materials are carefully removed and replaced according to manufacturer's specifications.</p>

	4.3. Maintenance activities are regularly recorded and reported in accordance with enterprise standards.
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Course content

Learning outcomes	<p>At the end of the module the learner will be able to:</p> <ol style="list-style-type: none"> 1. Carry out pre- and post-season maintenance 2. Carry out routine maintenance activities on pressurized irrigation system 3. Maintain pressurized irrigation system components 4. Remove and replace damaged pipes and fittings of pressurized irrigation system
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Learning outcome 1: Carry out pre- and post-season maintenance	Learning hours: 10
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Indicative content

- Preparation of pre-seasonal equipment
 - ✓ Checking the status of irrigation equipment
 - ✓ Preparation and selection of materials, tools and equipment to be used
- Flushing, cleaning and closing of pressurized irrigation components
 - ✓ Maintenance required for pressurized irrigation method
 - ✚ Drip irrigation maintenance
 - ✚ Sprinkler irrigation maintenance
 - ✚ Center pivot irrigation maintenance
 - ✓ Types of cleaning materials:
 - ✚ Detergents, acid cleaners, alkaline cleaners, solvent cleaners, polishes
 - ✓ Cleaning methods for pressurized irrigation system:
 - ✚ Flushing Lines, chlorination, acidification, polishing
 - ✓ Technical procedures of cleaning, repairing, replacement and reassembling of drip and sprinkler components
- Checking the Sprinkler/drip irrigation system
 - ✓ Sprinkler irrigation efficiency
 - ✓ Drip irrigation efficiency
 - ✓ Irrigation uniformity
- Inspection of Water source, pumping unit, main and lateral pipelines, riser pipes,

sprinkler heads, nozzles and driplines <ul style="list-style-type: none"> ✓ Irrigation water quality and quantity ✓ Pump operation procedures ✓ Inspection items <ul style="list-style-type: none"> ✚ Pump/ moto pump, submersible motor, electrical valve, electrical motor reduction, fluid coupling, diesel engine, gas turbine ✓ Pump problems, causes and appropriate countermeasures ✓ Reduction gear problems, causes and appropriate Countermeasures ✓ Motor problems, causes, and appropriate countermeasures ✓ Pipes and fittings malfunctions ✓ Maintenance of pipe network and emitters ✓ Handling of sprinkler heads <ul style="list-style-type: none"> • Inspection of accessories like reducers, elbows, valves, tees, regulators, gauges and filters • Identification of irrigation network leakage to maintain the working pressure and water delivery <ul style="list-style-type: none"> ✓ Malfunctions checklist of Sprinkler and drip irrigation network ✓ Causes of leaks in a sprinkler and drip irrigation network: <ul style="list-style-type: none"> ✚ Incorrect connections of pipes joints, excessive high pressure, excessive temperatures, poor quality of pipes, blockages 	
Equipment	Drip irrigation system, Pumps , Pumps accessories, motor, sprinkler irrigation kit
Materials	Technical manual, maintenance manual ,Personal Protective Equipments (PPE), Water, PPE, Maintenance manual, DVD Player
Tools	tool box, Tube cutters
Facilitation techniques	<ul style="list-style-type: none"> • Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	<ul style="list-style-type: none"> • Written assessment • Oral presentation • Performance assessment • Project based assessment

Learning outcome 2: Carry out routine maintenance activities on pressurized irrigation system

Learning hours: 10

Indicative content

- Carry out the all maintenance activities
 - ✓ Flushing irrigation pipeline
 - ✓ Maintenance procedures
- Cleaning filters before every irrigation to minimize the difference in pressure between the inlet and the outlet of the filter
 - ✓ Types of filters
 - ✓ Filtration procedures
 - ✚ Inspect screen and disk filters periodically, cleaning filters, clean accumulated particles and debris, chlorination, acidification.
 - ✓ Backwashing the system
 - ✓ Steps to backwash filters
 - ✚ Open the Backwash Valve, Close the outlet valve, Open the bypass valve, Close the inlet valve
- Inspection of Leaks, operating faults in according to the system functionality
 - ✓ Problems associated with low distribution Uniformity
 - ✚ Leakages (fittings, hose adapters), Excessive water flow
 - ✓ Causes of leaks in a sprinkler/drip irrigation network
 - ✓ Techniques to maintain irrigation system pipes
 - ✚ Plugging, replacing, adjusting
- Oiling and greasing pump engine
- Moving properly the laterals.

Resources required for the indicative content

Equipment	Screen filter, Disk filter, sand filter, drip/sprinkler irrigation kit, propeller meter
Materials	Pipes, Fittings, Water, Clothes, Soft nylon brush, PPE, Maintenance manual
Tools	Tool box
Facilitation techniques	<ul style="list-style-type: none"> • Demonstration and simulation • Individual and • group work

	<ul style="list-style-type: none"> • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	<ul style="list-style-type: none"> • Written assessment • Oral presentation • Performance assessment • Project based assessment

Learning outcome 3: Maintain pressurized irrigation system components	Learning hours: 10
Indicative content	
<ul style="list-style-type: none"> • Carryout the maintenance activities ✓ Daily maintenance of pump engine/ pump motor ✚ Check engine, check radiator coolant, Grease slow moving parts, Tight bolts and nuts ✓ Periodic maintenance of pump engine/ pump motor: ✚ Change engine oil, change oil filter, check air filter ✓ Process of flushing the entire irrigation pipe system ✚ Flushing velocity ✚ Flushing frequency • checking the Air valves for proper functioning of the system ✓ Types of air valves ✓ Function of air valve • Inspection offittings for wear or blockage and replaced appropriately according to enterprise guidelines <ul style="list-style-type: none"> ✓ Leakage from coupler or fittings, ✓ causes of leakage ✓ Leakage remedies • Oiling and greasing pump engine <ul style="list-style-type: none"> ✓ Types of oils ✓ Types Greases ✓ Specification and use of oil and grease for pump engine • Moving the laterals to ensure that the sprinklers and drippers are not damaged. <ul style="list-style-type: none"> ✓ Disassembling methods of sprinkler and drip irrigation ✓ Assembling methods of sprinkler and drip irrigation • Clean the overhead reservoir, fertilizers tank, filters, riser pipes, nozzles and drip lines 	

✓ Cleaning procedures for pressurized irrigation

Resources required for the indicative content

Equipment	Pump engine/ source of energy, pump, moto pump, irrigation kit, Pressure gauge
Materials	Pumps, Technical manual, Filters, PPE, Water, Greases, Oil , Books, Main pipes, Technical manual, Filters, Pipes, Valves, Emitters, Irrigation system accessories, Water source, Fittings, Cleaning products, Sub main pipelines, Hydrants, Manifolds, Lateral lines, Teflon tape
Tools	Sprinkler control valve key, Hacksaw, Tool box, Steel sprinkler valve key, Standard crimping tools, cutters and strips, PVC pipe ratcheting cutters, Wire stripper and cutters
Facilitation techniques	<ul style="list-style-type: none">• Demonstration and simulation• Individual and group work• Practical exercise• Individualized• Trainer guided• Group discussion
Formative assessment methods	<ul style="list-style-type: none">• Written assessment• Oral presentation• Performance assessment• Project based assessment

Learning outcome 4: Remove and replace damaged pipes and fittings of pressurized irrigation system

Learning hours: 10

Indicative content

- cleaning and repairing of clogged emitters and drippers
 - ✓ General principles regarding maintenance of drip and sprinkler irrigation system
 - ✓ Maintenance of the pipes, fittings, filters and clogged emitters
 - ✓ Cause of clogging in drip and sprinkler irrigation system
 - ✓ Processes to clean clogged drippers and emitters
- Removing and replacing damaged materials.
 - ✓ Pipe disassembling and reassembling techniques
 - ✓ Types of risers, nozzles, drippers and sprinkler heads and their connection techniques
- Recording and reporting of maintenance activities
 - ✓ Irrigation data recording techniques
 - ✓ Report format

Resources required for the indicative content

Equipment	Irrigation system kit, pumping station
Materials	PPE, Maintenance manual, Emitters, Cleaning products, Flip chart, Books, Technical manual, Water, Pipes
Tools	tool box
Facilitation techniques	<ul style="list-style-type: none"> • Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	<ul style="list-style-type: none"> • Written assessment • Oral presentation • Performance assessment • Product based assessment • Project based assessment

Integrated/Summative assessment

Integrated situation

KABOKU is a model cooperative in NYAGATARE District, MATIMBA Sector, and RWENTANGA Cell. It mainly grows vegetables and cereals. The cultivated area covers 900 Hectares located in MATIMBA and MUSERI Sectors, the pressurized irrigation system: sprinkler and drip irrigation system.

The total seasonal income of its production is about 120,000,000,000 Rwandan francs. In the last agricultural season, A, its production has reduced to 10,000,000 because of the lack of basic maintenances within irrigation scheme. Actually, the cooperative is seeking to solve the problem, yet, it would like to recruit an experienced technician to in pressurized irrigation maintenance.

The task should meet the following specification

- Carrying out pre- and post-season maintenance
- Carry out routine maintenance activities on pressurized irrigation system
- Maintain pressurized irrigation system components

Task must be completed within 6 hours

Resources

Tools	Pipes, Pipe Connector Fittings, Flow control devices, Filters
Equipment	Fertigation equipment, Water emitters, Automation equipment, Operation equipment, Water -lifting devices.
Materials/ Consumables	Detergents, Acid cleaners, alkaline cleaners, Solvent cleaners, Polishes

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
Learning	1.1. Pre-	Ind.1 select Irrigation equipment			1

<p>outcome 1: Carry out pre- and post-season maintenance</p> <p>(25%)</p>	<p>seasonal equipment for effective operation is properly prepared in accordance with design specifications and enterprise standards.</p>	Ind.2 select Cleaning materials			1
		Ind.3 select Cleaning methods			1
		Ind 4maintenance(repair/ replace and resembling)			2
	<p>1.2. Pressurized irrigation components are carefully flushed, cleaned and closed down in accordance with designed specifications and enterprise standards.</p>	Ind.1choose maintenance method			1
		Ind.2 selection of cleaning materials			1
		Ind.3 Cleaning method used			1
		Ind4:Cleaning/repair/replacement and resembling			1
	<p>1.3. Sprinkler irrigation system is frequently checked to ensure that it is in good</p>	Ind1 check pressure			1
		Ind2 check uniformity and efficiency			1
		Ind3 Normal wear and tear			1
		Ind4 Routine visual inspection			1

	condition and operating efficiently.				
	1.4 Water source, pumping unit, main and lateral pipelines, riser pipes, sprinkler heads, nozzles and driplines are regularly inspected to ensure their good operating conditions.	Ind1 water quality and quantity			2
		Ind2 Check pumping station			1
		Ind3 Inspection items			1
	1.4. Accessories like reducers, elbows, valves, tees, regulators, gauges and filters are regularly inspected to ensure their good operating conditions.	Ind1 Check gear problems			1
		Ind2 Repair/replacement of pipeline			1
		Ind3 Checking pipe malfunctions			1
		Ind4 Checking fittings malfunctions			1
	1.5. Leakages of irrigation network are properly	Ind1 Malfunctions checklist of Sprinkler and drip irrigation network			1
		Ind2 Cause of leak for sprinkler/drip irrigation kit			1

	identified to maintain the working pressure and water delivery				
Learning outcome 2: Carry out routine maintenance activities on pressurized irrigation system (25%)	2.1. All maintenance activities are properly carried out according to the maintenance program and the manufacturer's specifications.	Ind.1 Flushing of pipeline			3
		Ind.2 inspection and repairing for damage			3
		Ind.3 opening valve and drain water			3
		Ind.4 Check and fix emitters problems			2
	2.2. Filters are regularly cleaned before every irrigation to minimize the difference in pressure between the inlet and the outlet of the filter	Ind.1 check status of filter(sand, disk, screen)			2
		Ind.2 filtration			3
		Ind.3 backwashing system			2
		Ind.4: Backwash filters			2
	2.4 Leaks, operating faults are timely inspected in accordance to the system functionality	Ind.1 Checking for low distribution uniformity			1
		Ind.2 Causes of leaks in irrigation network			1
		Ind.3 Maintain irrigation system pipes(plugging, replacing, adjusting)			3
	Learning outcome3: Maintain pressurized	3.1. Maintenance activities are properly carried out in accordance	Ind.1 check engine oil, radiator coolant, oil filter, air filter		
Ind.2 Grease slow moving parts					2
Ind.3 Tight bolts and nuts					2

irrigation system components (25%)	with enterprise standards and technical specifications.	Ind4 flushing velocity and frequency			2
	3.2. Air valves is regularly checked for proper functioning of the system	Ind.1 Checking air valve			2
		Ind.2 Locating air valve along the pipeline			1
		Ind.3 Function of air valve			1
	3.3. Fittings are regularly inspected for wear or blockage and replaced appropriately according to enterprise guidelines	Ind1Check for fitting wear/blockage			1
		Ind2Check the cause of wear/blockage			1
		Ind3 repair/replacement			2
	3.4. Pump engine is timely oiled and greased according to the duration of pumping operation	Ind1engine oil used			1
		Ind2 grease used			1
		Ind3 time for oiling/greasing			1
		Ind4 oiling and or greasing			1
	3.5. Laterals are properly moved to ensure that the sprinklers and drippers are not damaged.	Ind1check for status of pipes			1
		Ind2 Reassembling techniques of sprinkler/drip irrigation system			1
		Ind3 Disassembling techniques of sprinkler/drip irrigation system			1
	3.6. Overhead	Ind1 Select the cleaning method			1

	reservoir, fertilizers tank, filters, riser pipes, nozzles and driplines are regularly cleaned in order to ensure proper functioning according to the irrigation system	Ind2 clean item			1
		Ind3 disinfect it			1
		Ind4 Dispose liquid waste			1
Learning outcome 4: (25 %) Remove and replace damaged pipes and fittings of pressurized irrigation system	4.1 Cleaning and repairing of clogged emitters and drippers	Ind1 Cleaning method used			2
		Ind2 Flushing Lines			2
		Ind3 Polishing			3
		Ind4 Repairing			3
	4.2 Removing and replacing damaged materials.	Ind1 identification of damaged material			2
		Ind2 removal			2
		Ind3 repair/replacement			3
		Ind4 Resembling			2
	4.3 Recording and reporting of maintenance activities.	Ind1 Technical data recording of irrigation components damages			3
		Ind2 Filling report format			2
Ind3 final report				3	
Total marks		100			
Percentage Weightage		100%			
Minimum Passing line % (Aggregate): 70%					

References

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