Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

WIROS401

OPERATING SPRINKLER IRRIGATION SYSTEM

OPERATE SPRINKLER IRRIGATION SYSTEM

Competence

RQF Level:4

Learning Hours

70

Credits: 7

Sector: Agriculture and food processing

Trade: Water and Irrigation

Module Type: Specific

Curriculum: TVET Certificate IV in Water and Irrigation

1200

Issue Date: August,2023

<table>
<tr><td>Purpose statement</td><td colspan="5">This module describes the skills, knowledge and attitude required to operate sprinkler irrigation system. At the end of this module, learners will be able to perform pre-start checks for sprinkler irrigation system, start up and inspect the sprinkler irrigation system, shut down the system based upon irrigation indicators. 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 drainage, rain water harvesting, in-situ rain water harvesting and ground water harvesting related acivities under minimum supervision</td></tr>
<tr><td>Learning assumed to be in place</td><td colspan="5">N.A</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 project and presentation</td><td>20%</td></tr>
<tr><td>Individual project /Work</td><td>50%</td></tr>
<tr><td colspan="3"></td><td colspan="2">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competence and Performance Criteria

Elements of competence	Performance criteria
1. Perform pre-start checks for sprinkler irrigation system	1.1. The availability and operational status of water, power, fuel, and lubricants are ensured through systematic checking, with a focus on their presence, and verification of the operational condition of the control system.
	1.2. During pump priming, valves and flow controls are systematically opened and closed.
	1.3. The proper calibration of pressure and flow testing equipment is carried out.
2. Start up and inspect the sprinkler irrigation system	2.1. The pumping system is systematically started up in accordance with the operations manual.

	2.2. All malfunctions, leaks, and blockages are properly corrected and repaired in accordance with technical procedures.
	2.3. The pressure at the headworks and control valves is properly checked according to design specifications.
	2.4. The distributed water is properly checked for even coverage over the targeted areas with minimal wastage and run-off.
3. Shut down the system based upon irrigation indicators	3.1. Efficient water application is performed for sufficient time to achieve required soil moisture levels in accordance with the irrigation schedule, environmental considerations, and weather conditions.
	3.2. Sprinkler irrigation system components are promptly shut down in sequence according to the manufacturer's specifications.
	3.3. Drainage needs are regularly checked in accordance with technical procedures.
	3.4. Irrigation activities are regularly recorded and reported according to supervisor instructions.

Course content

Learning outcomes	At the end of the module the learner will be able to: 1. Perform pre-start checks for sprinkler irrigation system 2. Start up and inspect the sprinkler irrigation system **3.** Shut down the system based upon irrigation indicators
Learning outcome 1: Organize resources for installation of sprinkler irrigation system	Learning hours: 20
Indicative content	
✓ Irrigation water quality and quantity ✓ Type of lubricants ✓ Types of fuel ✓ Power sources ✓ Types of valves and their technical specifications	

- ✓ Priming process of pump
- ✓ Water hummer phenomenon in pumping systems
- ✓ Static and dynamic pressure concepts
- ✓ Pressure measuring devices:
  - Pressure gauge
  - Pressure regulator
- ✓ Flow measurement devices (flow meters)

Resources required for the learning outcome	
Equipment	• Tractor, Steel Rule, Feeler gauge, Engineer's square, Divider spring joint, Drift punch copper, Pick punch, Drill electric hand, Air Compressor, Centre punch, Chisels Cross cut, Chisel cold, Hand reamer adjustable, Cross peen Hammer, Mallets (Wooden/plastic), Ball peen Hammer, Electric arc welding set portable, Horses and wheel choke, Hydraulic jack , T bar and ratchet, Chain and Pulley block, Work bench with 4 bench vices 12 cm jaw, Harrow, Plough, Seed Drill, Land Leveller
Materials	• Oil can, Grease Gun Hand/Pneumatic
Tools	Hand files, Taps and Dies complete set in a box (metric) with handle, Ring spanner, Spanner adjustable (pipe wrench), Hydrometer, Torque wrench, Set of Screw driver, Divider spring joint, Scriber, Drift punch copper, Hacksaw frame adjustable, Allen Key set of 12 pieces, Hand vice, Spanner (adjustable), Spanner D E, Tachometer, Spanners socket of 8 with handles, Hand reamer adjustable
Facilitation techniques	• Brainstorming, group discussion and oral presentation • Watching of audio visual, similation • Practical exercise
Formative assessment methods	• Written assessment • Oral question • Performance assessment

Learning outcome 2: Assemble spans for moving center pivot	**Learning hours: 30**
Indicative content	

- ✓ Pumps operating procedures
- ✓ Malfunction checklist of sprinkler irrigation network
- ✓ Pipes repairing techniques
- ✓ Cause of leaks in sprinkler irrigation network:
  - Incorrect connection
  - Excessive pressure
  - Excessive temperatures
  - Pipes of poor quality
  - Pipe corrosion and/or rust
- ✓ Cause of blockage in sprinkler irrigation network:
  - Biological clogging of sprinkler heads
  - Chemical precipitates clogging
  - Physical clogging
  - No line flushing
  - Equipment operation specification
  - Criteria for equipment assembling
  - Assembling methods and techniques
  - Disassembling methods and techniques
  - Examination equipment parts in operation
- ✓ Pressure measuring devices:
  - Pressure gauge
- ✓ Pressure regulator
- ✓ Types of valves
- ✓ Water distribution efficiency
- ✓ Water distribution uniformity
- ✓ Types of sprinkler heads
- ✓ Technical specification of sprinkler heads

Resources required for the indicative content	
Equipment	Tractor, Steel Rule, Feeler gauge, Engineer‟s square, Divider spring joint, Drift punch copper, Pick punch, Drill electric hand, Air Compressor, Centre punch, Chisels Cross cut, Chisel cold, Hand reamer adjustable, Cross peen Hammer, Mallets (Wooden/plastic), Ball peen Hammer, Electric arc welding set portable, Horses and wheel choke, Hydraulic jack , T bar and ratchet, Chain and Pulley block,

	Work bench with 4 bench vices 12 cm jaw, Harrow, Plough, Seed Drill, Land Leveller
Materials	Oil can, Grease Gun Hand/Pneumatic
Tools	Hand files, Taps and Dies complete set in a box (metric) with handle, Ring spanner, Spanner adjustable (pipe wrench), Hydrometer, Torque wrench, Set of Screw driver, Divider spring joint, Scriber, Drift punch copper, Hacksaw frame adjustable, Allen Key set of 12 pieces, Hand vice, Spanner (adjustable), Spanner D E, Tachometer, Spanners socket of 8 with handles, Hand reamer adjustable
Facilitation techniques	• Brainstorming, group discussion and oral presentation • Watching of audio visual, similation • Practical exercise
Formative assessment methods	• Written assessment • Oral question • Performance assessment

Learning outcome 3: Complete assembly of sprinkler component	Learning hours: 20
Indicative content	
✓ Soil moisture content ✓ Irrigation schedule: Crop water need Irrigation duration Irrigation frequency ✓ Irrigation water efficiency ✓ Sprinkler irrigation system components: Head control unity Water carrier system: Main line Sub main line Control valves	

- Flush valves
- Water distribution system:
- Laterals
- Risers
- Sprinkler head
- Fittings and accessories

✓ Shut down pumping unit procedures

✓ Necessity of drainage

✓ Drainage methods:

- Surface drainage
- Sub-surface drainage

✓ Main Components of a drainage system

✓ Overwatering plant symptoms

✓ Moisture reading before and after irrigation

✓ Irrigation activities checklist schedule

✓ Report formats

Resources required for the indicative content	
Equipment	Tractor, Steel Rule, Feeler gauge, Engineer‟s square, Divider spring joint, Drift punch copper, Pick punch, Drill electric hand, Air Compressor, Centre punch, Chisels Cross cut, Chisel cold, Hand reamer adjustable, Cross peen Hammer, Mallets (Wooden/plastic), Ball peen Hammer, Electric arc welding set portable, Horses and wheel choke, Hydraulic jack , T bar and ratchet, Chain and Pulley block, Work bench with 4 bench vices 12 cm jaw, Harrow, Plough, Seed Drill, Land Leveller
Materials	Oil can, Grease Gun Hand/Pneumatic
Tools	Hand files, Taps and Dies complete set in a box (metric) with handle, Ring spanner, Spanner adjustable (pipe wrench), Hydrometer, Torque wrench, Set of Screw driver, Divider spring joint, Scriber, Drift punch copper, Hacksaw frame adjustable, Allen Key set of 12 pieces, Hand vice, Spanner (adjustable), Spanner D E, Tachometer, Spanners socket of 8 with handles, Hand reamer adjustable
Facilitation techniques	• Brainstorming, group discussion and oral presentation • Watching of audio visual, similation • Practical exercise

Formative assessment methods	• Written assessment • Oral question • Performance assessment

Integrated/Summative assessment

Integrated situation

A cooperative named COCAS operated within the Nasho irrigation scheme, situated in the Kirehe District's Mpanga Sector. In this scheme, three water organizations (WUOs) have been established to cultivate maize and beans in alignment with market demands. However, the cooperative faces significant challenges due to inadequate operation of the sprinkler irrigation infrastructure. This deficiency arises from a lack of skills in irrigation system management, resulting in reduced maize yields. Consequently, the cooperative intends to employ an experienced irrigation technician who will assume responsibility for overseeing the operation of sprinkler irrigation facilities within their scheme.

The technician is expected to carry out the following tasks:

- ✓ Conduct pre-start checks for the sprinkler irrigation system.
- ✓ Initiate and inspect the sprinkler irrigation system.
- ✓ Implement system shutdown based on irrigation indicators.

Equipment	• Pump • Motor •
Tools	• Anti-hammer tank • pressure gauge • Flow meter • Technical manual • Tool box • Pipes

	• Fittings • Tensiometer • Valves • Sprinkler head
Materials/ Consumables	• Water • Fuel • Lubricant • Power

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1. Perform pre-start checks for sprinkler irrigation system	1.1. The availability and operational status of water, power, fuel, and lubricants are ensured through systematic checking, with a focus on their presence, and verification of the operational condition of the control system.	Assessment Indicator 1: The systematic nature of checking for the availability of water, power, fuel, and lubricants is evaluated based on established protocols and frequency.			3
		Assessment Indicator 2: The thoroughness of checking for the presence of required resources (water, power, fuel, lubricants) is assessed to ensure they are readily available.			3
		Assessment Indicator 3: The verification of the operational status of water, power, fuel, and lubricants is evaluated to confirm their readiness for use.			3
	1.2. During pump priming, valves and flow controls are systematically opened and closed.	Assessment Indicator 1: The systematic nature of opening and closing valves and flow controls during pump priming is evaluated based on adherence to established procedures.			3
		Assessment Indicator 2: The accuracy of valve and flow control manipulation is assessed to ensure they are appropriately managed during the pump priming process.			3
		Assessment Indicator 3: The coordination of valve and flow control actions in accordance with			3

		the pump priming sequence is evaluated for proper synchronization.			
	1.3. The proper calibration of pressure and flow testing equipment is carried out.	Assessment Indicator 1: The accuracy of calibration procedures for pressure and flow testing equipment is evaluated to ensure precise measurements.			3
		Assessment Indicator 2: The adherence to established calibration methods and intervals is assessed to confirm proper equipment maintenance.			3
		Assessment Indicator 3: The effectiveness of calibration processes in achieving accurate pressure and flow measurements is evaluated.			3
2. Start up and inspect the sprinkler irrigation system	2.1. The pumping system is systematically started up in accordance with the operations manual.	Assessment Indicator 1: The adherence to the systematic startup procedure of the pumping system is evaluated, ensuring proper initialization.			3
		Assessment Indicator 2: The accuracy of startup actions based on the operations manual is assessed, confirming proper execution.			3
		Assessment Indicator 3: The alignment of the startup sequence with the instructions provided in the operations manual is evaluated for consistency.			3
	2.2. All malfunctions, leaks, and blockages are properly corrected and repaired in accordance with technical procedures.	Assessment Indicator 1: The effectiveness of corrective actions for malfunctions, leaks, and blockages is assessed, ensuring successful resolution.			3
		Assessment Indicator 2: The adherence to technical procedures for correcting and repairing issues is evaluated to ensure proper application.			3
		Assessment Indicator 3: The accuracy of identified issues and their subsequent resolution in accordance with technical guidelines is assessed.			3

	2.3. The pressure at the headworks and control valves is properly checked according to design specifications.	Assessment Indicator 1: The accuracy of pressure checks at the headworks and control valves is evaluated based on their alignment with design specifications.			3
		Assessment Indicator 2: The adherence to the designated process for pressure checking, as per design specifications, is assessed for proper execution.			3
		Assessment Indicator 3: The alignment of pressure measurement results with design requirements is evaluated to ensure functionality.			3
	2.4. The distributed water is properly checked for even coverage over the targeted areas with minimal wastage and run-off.	Assessment Indicator 1: The accuracy of water coverage checks is evaluated to ensure even distribution over targeted areas.			3
		Assessment Indicator 2: The assessment of water wastage and run-off is conducted to determine the success of minimizing resource loss.			3
		Assessment Indicator 3: The alignment of water distribution results with the goal of even coverage and minimal wastage is evaluated.			3
3. Shut down the system based upon irrigation indicators	3.1. Efficient water application is performed for sufficient time to achieve required soil moisture levels in accordance with the irrigation schedule, environmental considerations, and weather conditions.	Assessment Indicator 1: The effectiveness of water application is evaluated based on the achievement of desired soil moisture levels as per established targets.			3
		Assessment Indicator 2: The alignment of water application duration with requirements specified in the irrigation schedule, environmental factors, and prevailing weather conditions is assessed.			3
		Assessment Indicator 3: The systematic consideration of environmental and weather variables in determining water application duration and timing is evaluated.			3

	3.2. Sprinkler irrigation system components are promptly shut down in sequence according to the manufacturer's specifications.	Assessment Indicator 1: The timeliness of shutting down sprinkler irrigation system components is evaluated based on their alignment with established protocols.			3
		Assessment Indicator 2: The adherence to the correct shutdown sequence of sprinkler irrigation system components as per manufacturer's specifications is assessed.			3
		Assessment Indicator 3: The accuracy of component shutdown actions in accordance with prescribed manufacturer guidelines is evaluated.			3
	3.3. Drainage needs are regularly checked in accordance with technical procedures.	Assessment Indicator 1: The consistency of drainage checks is evaluated based on their alignment with established schedules and technical protocols.			
		Assessment Indicator 2: The accuracy of drainage assessments conducted in line with technical procedures is assessed.			3
		Assessment Indicator 3: The adherence to established protocols for checking drainage needs on a regular basis is evaluated.			3
	3.4. Irrigation activities are regularly recorded and reported according to supervisor instructions.	Assessment Indicator 1: The consistency of recording irrigation activities is evaluated based on their alignment with established documentation schedules.			3
		Assessment Indicator 2: The accuracy and completeness of recorded information about irrigation activities are assessed.			3
		Assessment Indicator 3: The timely reporting of irrigation activities based on supervisor instructions is evaluated.			4
Total marks					100

Percentage Weightage	100%
Minimum Passing line % (Aggregate): 70%	

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