

INDUSTRIAL ELECTRICAL MAINTENANCE

ELTIM401

PERFORM INDUSTRIAL ELECTRICAL MAINTENANCE

Competence

RQF Level: 4

Learning Hours



50

Credits: 5

Sector: Energy

Trade: Electrical Technology

Module Type: Specific

Curriculum: ENGELT4001-TVET Level 4 in Electrical Technology

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Issued Date: May, 2023

Elements of Competency and Performance Criteria

Purpose statement	This module will help learners to acquire knowledge, skills and attitude in industrial electrical maintenance. Learners will be able to fit, maintain and testing of industrial electrical system. He / she will also be able to estimate the budget related to the industrial electrical maintenance.					
Learning assumed to be in place	Perform Industrial Technical Drawing, Install Industrial Electrical Control Circuits and Accessories.					
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	Performance criteria
1. Carry out troubleshooting of electrical systems	1.1 Tools, materials, and equipment are appropriately identified based on the types and use
	1.2 Personal Protective Equipment (PPE) are properly used based on safety precautions
	1.3 Work place is properly organized according to the arrangement method
	1.4 The electrical power system is properly troubleshot according to troubleshooting steps and technics
2. Repair defected electrical system component/devices	2.1 The Power supply is correctly adjusted in line with electrical power system parameters
	2.2. Control circuit faulty components are appropriately corrected according to the Control circuit components possible faults
	2.3 Power circuits faulty components are appropriately corrected according to the power circuits components possible faults

	2.4 Faulty Fixtures/appliances are appropriately corrected according to the electrical power system Fixtures/appliances possible faults
	2.5 Repairing report is properly elaborated in line with report elaboration process
3. Replace defected Electrical system components/Devices	3.1 The Power supply is correctly substituted in line with electrical power system parameters
	3.2 Control circuit faulty components are appropriately substituted according to the Control circuit components replacement procedures
	3.3 Power circuits faulty components are appropriately substituted according to the power circuits components replacement procedures
	3.4 Faulty Fixtures/appliances are appropriately substituted according to the electrical power system Fixtures/appliances replacement procedures
	3.5 Replacement report is properly elaborated in line with report elaboration process
4.Perform post-industrial electrical maintenance activities	4.1 Maintained electrical power system is correctly tested in line with testing procedure
	4.2 Workplace is properly rearranged according to the waste disposal procedures
	4.3 Cost is correctly estimated according to the cost estimation procedures

Intended Knowledge, Skills, and Attitude

Knowledge	Skills	Attitude
✓ Site management ✓ Technical drawing interpretation ✓ Safety precaution ✓ Local electrical codes and regulations ✓ Strong verbal communication ✓ Strong written communication ✓ Budget estimation ✓ Mathematical analysis ✓ Electrical circuit analysis ✓ Physics knowledge	✓ Problem solving skills ✓ Repairing skills ✓ Communication skills ✓ Computer skills ✓ Communication skills ✓ Troubleshooting skills ✓ Reporting skills ✓ Analytical skills ✓ Use of tools skills	✓ Honest ✓ Integrity ✓ Dignity ✓ Time management ✓ Confident ✓ Polite ✓ Self-motivated ✓ Time management

Course content

Learning outcomes	At the end of the module the learner will be able to 1. Carry out troubleshooting of electrical systems 2. Repair defected Electrical system component/ Device 3. Replace defected Electrical system component /Device 4. Clean the workplace
Learning outcome 1: Carry out troubleshooting of electrical systems	Learning hours: 10

Indicative content	
• Identification of tools materials and equipment ✓ Types of tools, materials and equipment ✓ Applications of tools, materials and equipment • Personal protective equipment on safety precautions ✓ Types of person protective equipment ✓ Use of personal protective equipment • Organization of the workplace ✓ Workplace arrangement method • Electrical power system troubleshooting ✓ Power supply troubleshooting steps and technics ✓ Control circuit troubleshooting steps and technics ✓ Power circuits troubleshooting steps and technics ✓ Fixtures/appliances troubleshooting steps and technics	
Resources required for the learning outcome	
Equipment	Ohmmeter, Multimeter, Voltmeter, Ammeter, PPE
Materials	Wires, Insulation tape, Boxes
Tools	Tester, Screw drivers set, Pliers set
Facilitation techniques	▪ Demonstration, ▪ Individualized, ▪ Trainer guided, ▪ Group discussion, ▪ Practical exercises,
Formative assessment methods / (CAT)	▪ Written assessment, ▪ Presentation, ▪ Product based assessment, ▪ Performance assessment

Learning outcome 2: Repair defected electrical system component/ devices		Learning hours: 25
Indicative content		
• Adjustment of the power supply ✓ Electrical power system parameters • Correction of Control circuit components faults ✓ Control circuit components possible faults • Correction of power circuit components faults ✓ Power circuit components possible faults • Correction of Fixtures/appliances faults ✓ Electrical power system Fixtures/appliances possible faults • Elaboration of report ✓ Repairing Report elaboration process		
Resources required for the learning outcome		
Equipment	Insulator tester, Multi meter, First aid kit, Personal Protective Equipment, printer, scanner	
Materials	Insulation tape, cables, wires, papers	
Tools	Screw Driver kit, Pliers Kit, electric knife, Spans Kit, Drawing pen	
Facilitation techniques	▪ Individual and group work, ▪ Practical exercise, ▪ Group discussion, ▪ Brainstorming, ▪ Physical demonstration, ▪ Simulation, ▪ Practical Workshops, ▪ Further research on internet	
Formative assessment methods /(CAT)	▪ Written assessment, ▪ Oral presentation, ▪ Performance assessment	
Learning outcome 3: Replace defected electrical system/components/devices		Learning hours: 10
Indicative content		

- **Replacement of the power supply**
 - ✓ power system parameters
- **replacement Control circuit faulty components**
 - ✓ Control circuit components replacement procedures
- **Replacement of power circuits faulty components**
 - ✓ power circuits components replacement procedures
- **replacement faulty Fixtures/appliances**
 - ✓ electrical power system Fixtures/appliances replacement procedures
- **Elaboration of report**
 - ✓ Replacement report elaboration process

Resources required for the learning outcome

Equipment	Insulator tester, Multi meter, First aid kit, Personal Protective Equipment
Materials	Insulation tape, cables, wires
Tools	Screw Driver kit, Pliers Kit, electric knife, Spans Kit
Facilitation techniques	▪ Individual and group work, ▪ Practical exercise, ▪ Group discussion, ▪ Brainstorming
Formative assessment methods I(CAT)	▪ Written assessment, ▪ Oral presentation, ▪ Performance assessment
Learning outcome 4: Perform post- industrial electrical maintenance activities	Learning hours:5

Indicative content

- **Testing maintained electrical power system**

- ✓ Industrial electrical power system testing procedures
 - ✚ Industrial electrical Control circuit testing procedures
 - ✚ Industrial electrical power circuits testing procedures
 - ✚ Industrial electrical Fixtures/appliances

- **Rearrangement of workplace**

- ✓ cleaning techniques of workplace
- ✓ cleaning tool, materials and equipment of workplace
- ✓ Waste disposal procedures
- ✓ waste disposal treatment method

- **Cost estimation**

- ✓ Elements of bill of quantity (BOQ)
- ✓ BOQ table

Resources required for the learning outcome

Equipment	Sponge, Vacuum cleaner, Mops, Buckets
Materials	Soap, water, vim
Tools	Dusters, Brushes, Broom, Dust bins, cleaning cloths
Facilitation techniques	• Individual and group work, • Practical exercise, • Group discussion, • Brainstorming,
Formative assessment methods I/(CAT)	• Written assessment, • Oral presentation, • Performance assessment

Integrated/Summative assessment

Integrated situation

UMURAVA HOTEL located in Gacuriro, Gasabo district is proposing maintenance of a three-phase induction motor coupled with pump for lifting water which has the following specification: 2850rpm, 50Hz, 1.5kw, 220/380V. Based on the information given by the motor's operator this motor is not working since morning because when you supply it on the power it does not pick up the full speed. You are asked to find the faults, possible causes and correct them, then after make a repair report within 4 hours.

Resources					
Tools		Combination pliers, Hammer, Screw drivers, Electrician knife, Allen keys			
Equipment		Digital multimeter, PPE, Tachometer, Air blowers			
Materials/ Consumables		Insulating tape, Ground wire, Power cable, Bolts, Screw			
Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1. Carry out troubleshooting of electrical systems	1.1 Tools, materials, and equipment are appropriately identified based on their types and use	Tools are well identified and used			1
		Materials are well identified and used			1
		Equipment is well identified and used			1
	1.2 PPE are properly used based to safety precautions	PPEs are well used			4
	1.3 Work place is properly organized according to the arrangement method	Work place is well arranged			3
	1.4 The electrical power system is properly troubleshot according to troubleshooting steps and technics	The electrical power system is well troubleshot			10
2. Repair defected electrical system component/ devices	2.1 The Power supply is correctly adjusted in line with electrical power system parameters	The Power supply is well adjusted			8
	2.2 Control circuit faulty components are appropriately corrected according to the control circuit components possible faults	Control circuit faults components are well corrected			8
	2.3 power circuits faulty components are appropriately corrected according to the	Power circuit faults components are well corrected			7

	power circuits components possible faults				
	2.4 faulty Fixtures/appliances are appropriately corrected according to the electrical power system Fixtures/appliances possible faults	Faulty fixtures/appliances are well corrected			7
	2.5 Repairing report is properly elaborated in line with report elaboration process	Report is well elaborated			5
3. Replace defected electrical system components/devices	3.1 The Power supply is correctly substituted in line with electrical power system parameters	The Power supply is well substituted			7
	3.2 Control circuit faulty components are appropriately substituted according to the Control circuit components replacement procedures	Control circuit faulty components are well substituted			8
	3.3 power circuits faulty components are appropriately substituted according to the power circuits components replacement procedures	power circuits faulty components are well substituted			8
	3.4. faulty Fixtures/appliances are appropriately substituted according to the electrical power system Fixtures/appliances replacement procedures	Faulty Fixtures/appliances are well substituted			7
	3.5 Replacement report is properly elaborated in line with report elaboration process	Replacement report is well elaborated			5
4. Perform post-industrial electrical maintenance activities	4.1 Maintained electrical power system is correctly tested in line with testing procedure	1 Maintained electrical power system is well tested			5
	4.2 Workplace is properly rearranged according to the waste disposal procedures	Workplace is well rearranged			2

	4.3 Cost is correctly estimated according to the cost estimation procedures	Cost is well estimated			3
Total marks		100			
Percentage Weightage		100%			
Minimum Passing line % (Aggregate):		70%			

List of abbreviations

1. **TVET**: technical vocation and education training
2. **RQF**: Rwanda Qualification Framework
3. **RTB**: Rwanda TVET Board
4. **PPE**: Person Protective Equipment
5. **CAT**: Continuous Assessment Test
6. **NA**: Not applicable
7. **BOQ**: Bill of Quantity

References

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2. AC motor starting and projection systems, Schneider electronics
3. <https://www.google.com/search?q=https%3A%2F%2Fwww.google.com%2Fsearch+Types+of+tools+materials+and+equipment.&biw>.
4. <https://www.google.com/search?q=%EF%83%BC%09Applications+of+tools%2C+materi+als+and+equipment>.
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9. <https://www.google.com/search?q=%EF%83%BC%09electrical+power+system+parame+ters&biw>
10. <https://www.datamyte.com/complete-guide-to-writing-maintenance-report/>
11. <https://www.google.com/search?q=power+system+prameters&oq=power+system+pram+eters&aqs=chrome>.
12. <https://electrical-engineering-portal.com/troubleshooting-an-open-circuit-faults-in-the-control-circuit>
13. <https://fixitclub.com/electrical-repairs/electrical-system-repair/>
14. <https://www.google.com/search?q=%EF%83%BC+Repairing+Report+elaboration+proce+ss&oq>
15. <https://www.google.com/search?q=%EF%83%BC+Industrial+electrical+power+system+t+esting+procedures&oq>
16. <https://www.google.com/search?q=%EF%83%BC+cleaning+techniques+of+workplace&oq>
17. <https://www.google.com/search?q=%EF%83%BC+cleaning+tool%2C+materials+and+e+quipment+of+workplace&oq=%EF%83%BC%09cleaning+tool%2C+materials+and+equi+pment+of+workplace&aqs>
18. <https://www.google.com/search?q=%EF%83%BC+waste+disposal+treatment+method&oq>

19. <https://www.google.com/search?q=%EF%83%BC+Waste+disposal+procedures&oq>
20. [https://www.google.com/search?q=%EF%83%BC+Elements+of+bill+of+quantity+\(BOQ&oq](https://www.google.com/search?q=%EF%83%BC+Elements+of+bill+of+quantity+(BOQ&oq)
21. <https://www.google.com/search?q=%EF%83%BC+BOQ+table&oq>

Glossary

Activity: Activities include releases, events, and deployment plans that you develop, start, and complete with the product

Learning outcomes: Statements that indicate what learners will know or be able to do as a result of a learning activity. Learning outcomes are usually expressed as knowledge, skills, or attitudes.

Learning hours: Number of hours required to acquire the competency, including the time allocated to evaluation, which is estimated between 5 and 10% of the total learning time of the competency

Knowledge: means the result of the adoption of information through the learning process. Knowledge is a set of facts, principles, theories and practices related to area of work or study. In CBE context lifelong learning knowledge is described as theoretical and / or factual

Skills: are the ability to apply knowledge and use the principle of “know how” to perform a specific task and to solve the problem. In the context of the CBE Framework, skills are defined as cognitive (involving the use of logical, intuitive and creative thinking), practical (including physical skill and use of methods, materials, devices and instruments) and social skills

electromagnetic circuit: An electromagnet is a type of magnet in which the magnetic field is produced by an electric current

rotating machines: a machine with a rotating component that transfers energy to a fluid or vice versa

Electric motor (rotating machine): An electric motor is a device for converting electrical energy into mechanical energy in the form of rotation. In an electric motor, the moving part is called the rotor and the stationary part is called the stator

Electrical Machine: An electrical machine is a device which converts mechanical energy into electrical energy or vice versa. Electrical machines also include transformers (static machine), which do not actually make conversion between mechanical and electrical form but they convert AC current from one voltage level to another voltage level

Winding: A winding is one or more turns of wire that forms a continuous coil through which an electric current can pass.

open circuit: A circuit in which the continuity is broken due to which the electric current cannot flow is known as the open circuit. In an open circuit, the current flowing is zero, thus no power dissipates from an open circuit

Magnetic core: The magnetic core is a specific design of magnetic material in a particular shape that possesses high magnetic permeability. It is employed to confine and guide the magnetic fields in electrical, electromechanical, and magnetic devices

Control circuit: is a special type of circuit used to control the operation of a completely separate power circuit

Power circuit: is defined as any circuit used to carry electricity that operates a load

Insulator: Materials that do not allow electricity to pass through them are called insulators. Insulators oppose electric current and so they are used as a protection from the dangerous effects of electricity. Examples of insulators are glass, air, wood, plastic and rubber

Credit: The acknowledgement that a person has satisfied the requirements of a module.

Assessment criteria: Statements which describe performances and place them in context with sufficient precision to allow valid and reliable assessment.

Assessment: A process of gathering and judging evidence in order to decide whether a person has attained a standard of performance

Power supply is an electrical device that supplies electric power to an electrical load

Insulator: Materials that do not allow electricity to pass through them are called insulators. Insulators oppose electric current and so they are used as a protection from the dangerous effects of electricity. Examples of insulators are glass, air, wood, plastic and rubber