Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

GENRM401

ELECTRICAL ROTATING MACHINES INSTALLATION

Install Electrical Rotating Machines

Competence

RQF Level: 4

Learning Hours 90

Credits: 9

Sector: Energy

Trade: Renewable Energy

Module Type: General

Curriculum: ENGREN4001-TVET Certificate lV in Renewable Energy

Issue Date: August 2023

<table>
<tr><td>Purpose statement</td><td>This module describes the skills, knowledge and attitude required to install electrical rotating machines. At the end of this module, learners will be able to Perform preliminary activities, assemble electrical rotating machine Components, operate electrical rotating machines and maintain electrical rotating machines.
Qualified learners deemed competent to this competency may work alone or with others on routine tasks.</td></tr>
<tr><td>Learning assumed to be in place</td><td>▪ Apply measurement and instrumentation in renewable energy</td></tr>
<tr><td>Delivery modality</td><td>
<table>
<tr><th>Training delivery</th><th></th><th>100%</th><th>Assessment</th><th></th><th>Total 100%</th></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="2"></td><td colspan="2">Summative Assessment</td><td>50%</td></tr>
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Elements of Competence and Performance Criteria

Elements of competence	Performance criteria
1. Perform preliminary activities	1.1. Tools, materials and equipment are correctly selected according to the requirements.
	1.2. Electrical rotating machine user manual/name plate is properly interpreted according to the manufacturer information's.

	1.3. Workplace is properly prepared according to the work to be done.
2. Assemble electrical rotating machine Components	2.1 Electrical rotating machines accessories are properly selected according to the installation requirements.
	2.2 Electrical rotating machine Components are correctly positioned /aligned according to the installation requirements.
	2.3 Electrical machines are correctly connected according to their mode of starting/manufacture information's
3. Operate electrical rotating machines	3.1.Electrical motor is correctly started according to mode of starting
	3.2.Electrical motor is correctly operated according to the operation requirements
	3.3.Electrical motor is correctly protected according to the standard calibration
4. Maintain electrical rotating machines.	4.1. Preventive maintenance is correctly conducted according plan activities.
	4.2 Corrective maintenance is perfectly done according to the technical requirements.
	4.3 Technical report is correctly elaborated according to the work done.

Course content

Learning outcomes	At the end of the module the learner will be able to:
	1. Perform preliminary activities 2. Assemble electrical rotating machines components 3. Operate electrical rotating machines components. 4. Maintain electrical rotating machines.

Learning outcome 1: Perform preliminary activities	Learning hours: 20
Indicative content	

- **Selecting of Tools, materials and equipment**
  - ✓ Introduction to Electrical rotating machines
    - Definition
    - Classification
    - Application/use
  - ✓ Tools
    - Types
    - applications/use
  - ✓ Equipment
    - types
    - Application/use
  - ✓ Materials
    - types

- application/use

- **Interpretation of electrical rotating machine user manual/name plate.**
  - ✓ Analyse the schematic diagrams of electrical rotating machines
    - Electrical symbols
    - Types of electrical drawings
  - ✓ user manual/name plate information's
  - ✓ Terminal board of machine
- **Workplace preparation**
  - ✓ Workplace clearing
  - ✓ Organise tools, materials and equipment safely

Resources required for the learning outcome	
Equipment	▪ Multimeter ▪ Ladder ▪ Drilling machine ▪ Electrical screw drivers ▪ PPEs ▪ Electrical motors
Materials	▪ Electrical Cables ▪ Connectors ▪ Cable clips ▪ Screws ▪ Insulation tapes ▪ Switches ▪ Cable glands ▪ Cable tires

	▪ Insulating (Rubber)
Tools	▪ Pliers ▪ Screwdrivers ▪ Electrical Tester ▪ Hacksaw ▪ Chisel ▪ Sprit Level ▪ Tape Measure ▪ Hammer ▪ Cordless Drill & Bits ▪ Insulating Sleeves ▪ Hard Hats ▪ Clothing ▪ Marker Pen ▪ Video ▪ Pictures
Facilitation techniques	▪ Group discussion ▪ Trainer guided ▪ Cooperative ▪ Brainstorming ▪ Research on internet ▪ Displaying pictures ▪ Demonstration by video
Formative assessment methods /(CAT)	▪ Written assessment ▪ Oral presentation ▪ Performance assessment

Learning outcome 2: Assemble electrical rotating machine's components	Learning hours:25

Indicative content

- **Selecting electrical rotating machine's accessories.**
  - ✓ Electrical accessories
  - ✓ Mechanical accessories
- **Aligning/ positioning electrical rotating machine components**
  - ✓ Identification of alignment/positioning requirements
  - ✓ Interpretation of machine drawing
  - ✓ Mounting of components
    - Layout out of machine components
    - fixing machine components
- **Connecting electrical rotating machines**
  - ✓ Types of terminal box configuration
    - Dc machines
    - Ac machines

Resources required for the learning outcome

Equipment	▪ Powered electrical screw driver, Multi-meter, Reverting machine, Electrical drilling machine, Electric grinder, Personal protective equipment(PPE), Contactors , ON/OFF push buttons, Rotary switch (multi position switch) Control switch, Load break switch, Electronic relays , Circuit breakers , Protection relays, Auto-transformers ,Power Rheostat, DC motor, Single-phase motor , Asynchronous motor, Synchronous motor, Overload protection equipment,

	Short-circuit protection equipment ,Surge protection Device
Materials	▪ Electrical Cables ▪ Insulation Tape ▪ Fixings ▪ Insulating (Rubber)
Tools	▪ Pliers' kits, Junior hack saw, Internet, Reference books ,Books ,internet ,Manuals ,Audio-visual position, Handout notes, Journals, Scraper, Electrical tools, , Flip chart, Marker pen, Video, Pictures, stripping plier, Side cutter plier, Combination plier, long nose plier, Electrician knife, measuring tape, Screw drives, Hammer, Spirit level, Crimping tools, Safety glass, Face shield, Safety shoes, gloves, Insulating sleeves, Hard hats, Flame-resistant (FR) clothing
Facilitation techniques	▪ Individual , group work, Practical exercise, Group discussion, brainstorming, Physical demonstration, simulation, Practical Workshops, Displaying picture, further research on internet, Brainstorming , Physical demonstration , Simulation , Practical Workshops , Displaying pictures , Further research on internet
Formative assessment methods /(CAT)	▪ written assessment ▪ Oral presentation ▪ Performance assessment ▪ Product based assessment

Learning outcome 3: Operate electrical Rotating Machines.	Learning hours: 35
Indicative content	
• **Starting methods of electrical machines**. ✓ DC motors starting ▪ Manual ▪ Automatic ▪ Semi-automatic ✓ Ac motor starting ▪ asynchronous motors starting ▪ synchronous motors starting ✓ Generators starting ▪ Dc generator ▪ AC generator • **Operate/control electrical machines** ✓ Switching on/off ✓ Braking of motors ✓ Speed control methods ✓ Safety consideration	
Resources required for the learning outcome	
Equipment	Powered Electrical screw driver, Multi-meter, Reverting machine, Electrical drilling machine, Electric grinder, Voltmeter , Ammeter ,Wattmeter , VAR-meter , VA-meter , Phase-meter , Ohmmeter , Thermometer, Tachometer, Power Rheostat , DC motor ,Single-phase motor , Asynchronous motor ,Synchronous motor, PPE , Overload protection equipment.
Materials	Electrical Cables, Connectors, Cable clips, Screws, insulation tapes ,Switches, Cable glands, Cable tires, Scraper, Marker pen, ON/OFF push

	buttons, Contactors, Rotary switch (multi position switch) , Control switch ,Load break switch ,Electronic relays, Auto-transformers , Power Rheostat , DC motor, Single-phase motor , Asynchronous motor , Synchronous motor , Rotary switch (multi- Control switch , Load break switch , Electronic relays, Circuit breakers, Short-circuit detector, Lubricant oil,
Tools	Pliers' kits, hack saw, Internet, Reference books, hand tools, Alignment tools.
Facilitation techniques	Individual , group work, Practical exercise, Group discussion, brainstorming, Physical demonstration, simulation, Practical Workshops, Displaying picture, further research on internet, individual and group work ,Practical exercise , Group discussion , Brainstorming ,Physical demonstration Simulation , Practical Workshops , Displaying pictures ,Further research on internet
Formative assessment methods /(CAT)	written assessment, Oral presentation, Performance assessment, Product based assessment

Learning outcome 4: Maintain Electrical rotating Machines.	**Learning hours: 10**

Indicative content

- **Conducting preventive maintenance.**
  - ✓ Planning and scheduling activities
  - ✓ Performing planned activities
- **Conducting corrective maintenance**
  - ✓ Identification of fault and faults roots
  - ✓ Rectify detected faults

- ✓ Testing

- **Technical report**
  - ✓ Recording information
  - ✓ Completing of report format
  - ✓ Submitting report

Resources required for the learning outcome	
Equipment	▪ Powered Electrical screw driver, Multi-meter, Contactors, ON/OFF push buttons, Rotary switch (multi position switch), Control switch, Load break switch, Electronic relays, Circuit breakers, Protection relays, Contactors, ON/OFF push buttons, Auto-transformers, Power Rheostat, DC motor, Contactors, ON/OFF push buttons, Rotary switch (multi position switch) motor ,Asynchronous motor ,Synchronous motor Rotary switch (multi- Control switch , Load break switch , Electronic relays , Circuit breakers - Protection relays - switch), Contactors ,ON/OFF push buttons, Auto-transformers ,Power Rheostat DC motor, Single-phase motor, Asynchronous motor , Synchronous motor , Rotary switch (multi position switch) , Control switch ,Load break switch, Electronic relays Variable speed drive , Circuit breakers - Protection relays ,PPE Overload protection equipment ,Short-circuit protection equipment, Surge protection Device , Motor
Materials	▪ Insulation Tapes ▪ Electrical Cable
Tools	▪ Electrical Tester

	▪ Pliers ▪ Screwdrivers Set ▪ Pliers Set ▪ Generators Tool Set
Facilitation techniques	▪ Individual ▪ Group Work ▪ Practical Exercise ▪ Group Discussion ▪ Brainstorming ▪ Physical Demonstration ▪ Simulation ▪ Practical Workshops ▪ Displaying Picture ▪ Further Research On Internet
Formative assessment methods /(CAT)	▪ Written Assessment ▪ Oral assessment ▪ Performance assessment ▪ Product based assessment

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