Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

POWER PROTECTION SYSTEMS INSTALLATION

ELTPS301

INSTALL POWER PROTECTION SYSTEMS

Competence

RQF Level: 3

Learning Hours 90

Credits: 9

Sector: Energy

Trade: Electrical Technology

Module Type: Specific

Curriculum: ENGELT3001- Level 3 in ELECTRICAL TECHNOLOGY

Issue Date: April 2022

Purpose statement	This module describes the skills, knowledge and attitude required to install electrical power protection system. At the end of this module, learners will be able to analyze protection system according to the types of load, install protective devices, install earthling system, and install lightening arrestors system. Qualified learners deemed competent to this competency may work alone or with others on routine tasks in various places such as home buildings, shops, warehouses, supermarket, hospitals, pharmacies, banks, schools, garage, market, home, churches, and hotels under minimum supervision.
Learning to be assumed in place	SHE, Electrical drawing, Basics of electricity and electronic, Bench work applied to electricity

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. Explain protective devices	1.1. Loads are properly identified based on their types
	1.2. Total load current is accurately calculated in line with the rated power and voltage.
	1.3. Rate of protective devices is correctly determined in line with their fusing factor.
	1.4. Protective devices are properly chosen in line with the load to be protected
2. Install distribution board and Connect protective devices	2.1. Distribution boards are correctly selected based on their types
	2.2. Power supply is identified in line with feeding position
	2.3. Distribution board are properly fixed based on fixing standard.
	2.4. Lighting devices to be protected are correctly identified in line with their connections

	2.5. Lighting protection devices are effectively connected based on protection standards
	2.6. Power sockets protective devices are correctly connected based on the system protection requirements
	2.7. Protective devices are properly labelled in line with their functions
3. Create earthing protection system	3.1. Earthing protection is properly described based on their types
	3.2. Tools, materials and equipment for earthing are properly selected based on the installation to be earthed
	3.3. Installation of earthing system is installed in accordance to their types
	3.5. Insulation resistance tester is used properly in accordance to the standard value
	3.6. Earth wire is properly connected to the consumer control unit in accordance to the connection standard
	3.7. Complete power system protection is properly checked based on system requirements
4. Install surge arrestor and lightening arrestors system	4.1. Appropriate selection of materials, tools and equipment in accordance with the installation to be done
	4.2. selection of lightening arrestor system based on the area to be protected
	4.3. Proper installation of surge and lightening arrestor system in accordance with electrical installation standards
	4.4. lightening arrestor system is properly checked in accordance with electrical installation standards
	4.5. Tools, materials and equipment are appropriately arranged in the working place according to their types
5. Develop as-built-in report	4.6. The main parts of content are identified in line with industrial requirements
	5.2. The contents of as built in report are properly determined in line with the real current situation of installation.
	5.3. The as built-in report is correctly elaborated in line with reporting procedures.

Learning outcomes	At the end of the module the learner will be able to: 1. Explain protective devices 2. install distribution board and Connect protective devices 3. Create earthing protection system 4. Install surge arrestor and lightening arrestors system 5. Develop as-built-in report
Learning outcome 1: Explain protective devices	**Learning hours: 15**

Indicative content

- **Description Loads**
  - ✓ Types of electrical loads
  - ✓ Electrical load characteristics
  - ✓ Application of different electrical load
- **Load current calculation**
  - ✓ Calculation of the Rating current
  - ✓ Cable carrying capacity
- **Rate of protective devices**
  - ✓ Protective device calculation
  - ✓ current rating of a circuit protective device
  - ✓ Fusing factor
- **Protective devices selection**
  - ✓ Types of electrical fault
  - ✓ Types of protection devices
  - ✓ Rated capacity of protective device

Resources required for the learning outcome

Equipment	Personal protective equipment
Materials	Resistance, Inductor, Capacitor ,Pen , Calculator machine, Cables, Fuse MCB , MCCB ,RCD ,RCCB ,SPD
Tools	Screw driver, pliers, striping plier
Facilitation techniques and learning activities	• Group discussion • Trainer guided

	• Practical exercises
Formative assessment methods	• Written assessment • Performance assessment

Learning outcome 2: Install distribution board and connect protective device	**Learning hours: 20**
Indicative content	
• **Materials, tools and equipment** ✓ Hand tools and power tool ✓ Materials ✓ Equipment • **Selection of Distribution boards** ✓ Types of distribution board ✓ Nature of distribution board ✓ Number of ways • **Identification Power supply** ✓ Types of power supply ✓ Specification of power supply • **Fixing of Distribution board** ✓ Placement of distribution board ✓ Steps for fixing distribution board • **Connection of Protection device** ✓ Connection techniques ✓ Labelling Protective devices	
Resources required for the indicative content	
Equipment	Personal protective equipment, Protective goggles, ladder, Overall, Approved safety glasses, Corrective shoes, Protective gloves, Helmet, Eye wash
Materials	Cables, Fuse ,MCB ,RCD ,RCCB ,SPD, Consumer control unit, Screws, Wall plug
Tools	Screw driver, pliers, striping plier
Facilitation techniques and learning activities	• Practical exercise • Trainer guided • Demonstration • Individual work •
Formative assessment methods	• Written assessment • Performance based assessment • Product based assessment

Learning outcome 3: Create earthing protection system	Learning hours: 20
Indicative content	
• **Description of Earthing protection** ✓ Types of Electrical Earthing ✓ Components of earthing system • **Selection of Tools, materials and equipment** ✓ Equipment ✓ Hand tool ✓ Power tools ✓ Materials • **Installation of earthing system** ✓ Checking soil status ✓ Connection of earth copper rods ✓ Methods for measuring earth resistance ✓ Improvement of earthing resistance ✓ Connection of earth wire to the consumer control unit • **Measurement of insulation resistance**	
Resources required for the indicative content	
Equipment	Multimeter, phase sequence taster , megohm meter, multifunction taster, polarity checker plug, clamp on meter
Materials	Junction box, wires, protection device, electrical connectors
Tools	Drilling machine, electrical screw driver, measuring tape, combination plier, long nose plier, side cutter plier, striping plier
Facilitation techniques and learning activities	• Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment , • Oral presentation , • Performance based assessment , • Product based assessment ,

	• Project based assessment

Learning outcome 4: Install surge protective devices and lightening arrestors system	**Learning hours: 20**
Indicative content	
• **Surge protective devices connection** ✓ Types of surge protective devices ✓ Connection techniques of Surge protective devices ✓ Testing • **Install lightening arrestor** ✓ Types of lightning systems ✓ Main part of lightning systems ✓ Calculation of protection radius ✓ Mounting of air terminal / lightning rod ✓ Creation of lightning arrestor's ground system ✓ Check lightening arrestor system	
Resources required for the indicative content	
Equipment	Multimeter, phase sequence taster , megohm meter, multifunction taster, polarity checker plug, clamp on meter
Materials	Junction box, wires, protection device, electrical connectors
Tools	Drilling machine, electrical screw driver, measuring tape, combination plier, long nose plier, side cutter plier, striping plier
Facilitation techniques and learning activities	• Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment • Oral presentation • Performance based assessment • Product based assessment • Project based assessment

Learning outcome 5:Develop as-built-in report	Learning hours: 15
Indicative content	
• **Main parts of report** • **Report format** • **Elaboration of content**	
Resources required for the indicative content	
Equipment	Multimeter, phase sequence taster , megohm meter, multifunction taster, polarity checker plug, clamp on meter
Materials	Junction box, wires, protection device, electrical connectors
Tools	Drilling machine, electrical screw driver, measuring tape, combination plier, long nose plier, side cutter plier, striping plier
Facilitation techniques and learning activities	• Demonstration and simulation • Individual and group work • Practical exercise • Individualized • Trainer guided • Group discussion
Formative assessment methods	• Written assessment • Oral presentation • Performance based assessment • Product based assessment • Project based assessment

Integrated/Summative assessment (For specific module)

Integrated situation

KAMANZI Director of EGECOR Company Ltd has a building of 12mx10m of length and width located in Muhanga district, Shyogwe sector where thunders are frequent. The building has 5rooms, 2 bathrooms 1 living room and 1 dining room without protection means. It is equipped with:

- 4 fluorescent lamps of 40W,220V,50Hz each
- 5 down lights of 26W,220W,50Hz each
- 1 freezer of 300W, 220V,50Hz,
- 2 fridges of 200W,220V,50Hz,
- Radio 25w 220v 50Hz
- and T.V 70w 220V 50Hz

Each room has 2 socket outlets whereby freezer and fridges are connected in the corner of dining room. TV and radio are connected living room.

You as Electrician installer, you are called upon to install the power system protection of the above mentioned building following the following requirement specifications:

- Lamps and socket outlets will be protected separately
- Each room will be protected separately
- Lamps and socket outlets are earthed
- The building should be protected by the lightning arrestor.

All materials, tools and equipment's are provided.

The task must be completed in 6 hours.

Resources

Tools	Tools: Long nose pliers, Cutting pliers, Ground tester, Flat screw drivers, Spirit level, Tape measure and Star screw drivers.
Equipment	Lightning arrestor, Multimeter, Cramp-on meter, Phase tester. Crimping tool and PPE.
Materials/ Consumables	Insulation tape, Clips

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
Learning outcome 1: **Explain protective devices** **(20%)**	1.1. Loads are properly identified based on their types	Resistive Loads are properly identified			3
		Capacitive Loads are properly identified			3
		Inductive Loads are properly identified			3
	1.2. Total load current is accurately calculated in line with the rated power and voltage.	Load current is accurately calculated			3
		rated power and voltage is accurately calculated			3
	1.3. Rate of protective devices is correctly determined in line with their fusing factor.	Rate of protective devices is correctly determined			3
	1.4. Protective devices are properly chosen in line with the load to be protected	Protective devices are properly chosen			2
Learning outcome 2: **Fix distribution board and Connect protective devices (20%)**	2.1. Materials, tools and equipment Appropriately selected in accordance with the installation to be done	Materials, tools and equipment Appropriately selected			5
	2.2. Lighting protection devices are effectively connected based on protection standards	Lighting protection devices are effectively connected			4

	2.3. Power sockets protective devices are correctly connected based on the system protection requirements	Power sockets protective devices are correctly connected			3
	2.4. Protective devices are properly labeled in line with their functions	Protective devices are properly labeled			3
Learning outcome 3: **Create earthing protection system (30%)**	3.1. Description of Earthing protection	Earthing protection is properly described			2
		Components of earthing system are identified			2
	3.2. Selection of Tools, materials and equipment	Tools, materials and equipment are properly selected			1
	3.3. Installation of earthing system	Checking soil status			4
		Connection of earth copper rods			8
		Methods for measuring earth resistance			8
		Improvement of earthing resistance			5
	3.4. Measurement of insulation resistance	insulation resistance is effectively measure			4
Learning outcome 4: Install surge arrestor and lightening arrestors system (20%)	4.1. Surge protective devices connection	Types of surge protective devices are properly described			2
		Tools, materials and equipment for earthing are properly selected			2
		Connection techniques of Surge protective devices are appropriately applied			4
		Surge protective devices connection is correctly tested			2

	4.2. Install lightening arrestor	Types and main parts of lightning systems are identified			1
		protection radius is correctly calculated			4
		air terminal / lightning rod is properly mounted			8
		Creation of lightning arrestor's ground system			5
		Check lightening arrestor system			2
Learning outcome 5. Develop as-built-in report **(10%)**	5.1. The contents of as built in report are properly determined in line with the real current situation of installation	The contents of as built in report are properly determined			4
	5.2. The as built-in report is properly elaborated in reference to the implemented electrical design	The as built-in report is properly elaborated			3
	5.3. As built-in report is correctly submitted in line with reporting procedures	As built-in report is correctly submitted			3
Total marks					**100**
Percentage Weightage					**100%**
Minimum Passing line % (Aggregate): 70%					

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