SWAZILAND  GOVERNMENT

MINISTRY OF LABOUR AND SOCIAL SECURITY
DIRECTORATE OF INDUSTRIAL AND VOCATIONAL TRAINING –DIVT
APPRENTICESHIP JOB TRAINING GUIDE
TRADE: ELECTRICIAN

FIRST-YEAR

Apply and maintain safety rules and regulations – Unit ID: EE201

Element 1: Locate potential hazards in the work area

Performance Criteria

1.1 Potential hazards are identified and removed, reduced, or reported.

1.2 Consequences of exposure to hazardous substances and hazards are known.

1.3 A health and safety plan is adhered to.

1.4 Protective clothing requirements are identified and protective clothing is used.

1.5 All statutory requirements are met.

Element 2: Limit damage to persons or property in the case of an emergency

Performance Criteria

2.1 The location of fire extinguishers, hoses, and alarms is explained.

2.2 Different fire extinguishers are identified and used as per worksite procedures.

2.3 Procedures for the identification of emergencies are known and followed.

2.4 Injuries involving individuals are reported promptly to the relevant persons.

Element 3: Follow procedures that apply to illness or injury in the work area

Performance Criteria

3.1 Procedures for reporting and recording are demonstrated.

3.2 A brief incident oral report is delivered to the immediate supervisor.

Apply basic entrepreneurship skills – Unit ID: EE 202

Element 1: Demonstrate basic knowledge of the characteristics of an entrepreneur

Performance Criteria

1.6 The terms entrepreneur and entrepreneurship are explained

1.7 Characteristics and traits of an entrepreneur are described.

1.8 The concept of social entrepreneurship is explained.

Element 2: Apply basic skills to generate a business idea

Performance Criteria

2.5 Business idea is generated using basic research skills.

2.6 A business idea is generated using brainstorming skills.

2.3 A business idea is generated using assessment tools in the business.

2.4 A basic SWOT analysis is conducted to test the viability of the generated

2.5 A business idea is improved through a review of the initial idea.

Element 3: Apply market research skills

Performance Criteria

3.1 Terms related to market research are described.

3.2 Conducting market research using a variety of methods is explained.

3.3 Basic market segmentation is conducted to identify a target group

Apply soldering and de-soldering techniques – Unit ID: EE203

Element 1: Plan to work on the task

Performance Criteria

1.9 Hand tools are identified and selected to meet job requirements, range of tools to be used are, side cutters; long nose pliers; a set of jewelers screwdrivers; wire stripper, solder sucker, wet sponge, soldering stand, safety glasses, and small files.

1.10 Appropriate hand tools are used safely to meet the requirements of the job according to worksite procedures.

1.11 Unsafe and faulty tools are identified and marked for repair or replacement according to to set procedures.

1.12 Applicable test equipment is selected and checked for functionality

Element 2: Prepare for soldering

Performance Criteria

2.7 Work area is inspected for safe working conditions and corrective action is taken where required.

2.8 Applicable soldering equipment is selected as per the required task.

2.9 Personal protective equipment is used as per legislation and worksite regulations or procedures.

2.10 Correct soldering material is selected as per the required task.

Element 3: Perform soldering

Performance Criteria

3.4 All connections are cleaned from any dirt or oxidation.

3.5 Tinning of connections is done according to the manufacturer's specifications.

3.6 Connections are soldered according to set specifications or and techniques.

Element 4: Perform de-soldering

Performance Criteria

4,1 heat is applied to the joint according to specifications.

4.2 The component is removed according to specifications.

4,3 The solder residue is removed according to specifications.

Element 4: Complete the work task

Performance Criteria

4.1 Work area is cleaned after completion of the task in line with housekeeping standards.

4.2 Waste materials are disposed of according to site-specific standards and procedures.

4.3 Reason for applying the disposal method is human safety and environmental management.

4.4 Hand tools are cared for, maintained and stored according to worksite procedures.

Communicate in an electrical environment – Unit ID: EE204

Element 1: Find and use available learning resources

Performance Criteria

1.13 Relevant learning resources are identified.

1.14 Learning resources are used effectively through the appropriate selection of information and acknowledgment of sources.

Element 2: Use learning strategies

Performance Criteria

2.11 Information is summarised and used for learning purposes.

2.12 Specific techniques are selected and applied.

2.3 relevant questions are asked.

2.4 Texts are read and or viewed for details.

2.5 Signed and/or spoken input is listened to and or viewed for details.

2.6 Learning takes place through communicating with others in groups or as individuals.

Element 3: Manage electrical occupational learning materials

Performance Criteria

3.1 Electrical occupational learning materials are organized for efficient use.

3.2 Layout and presentation of learning materials are understood and used.

3.3 Technical language and terminology are engaged with, and clarification is sought if needed.

Element 4: Plan and gather relevant information for a given context and purpose

Performance Criteria

4.1 Information gathering steps are planned and sequenced.

4.2 Information gathering techniques are applied.

4.3 Information is sifted for relevance.

4.4 Information is classified, categorized, and sorted.

4.5 Scope of information gathered is appropriate for the given context and purpose.

4.6 Conclusions are presented in the format specified.

Element 5: Function in a team

Performance Criteria

5.1 Active participation happens in group learning situations.

5.2 Responsibilities in the team are taken up and group work conventions are applied in learning situations.

5.3 Negotiating tech practiced.

5.4 Teamwork results in products or outcomes.

Element 6: Reflect on how characteristics of the workplace and occupational context affect learning

Performance Criteria

6.1 Sector and organization type is identified.

6.2 Features of the occupational environment are described and discussed.

6.3 ways these features affect learning processes and/or application of learning are described and discussed.

Demonstrate basic first aid – Unit ID: EE205

Element 1: Sustain a basic level of preparedness for health emergencies in the workplace

Performance Criteria

1.1The content of the relevant primary emergency care/kit is demonstrated by workplace regulations

1.2 The maintenance and storage of the relevant risk-based primary emergency care kit is described and demonstrated where relevant by workplace procedures

Element 2: Perform basic first aid
Performance Criteria

2.1 Demonstrate prevention of further injuries such as burns and shocks

2.2Demonstrate the principles of primary emergency care at the workplace

2.3 Personal protective devices and infectious disease prevention procedures are used

2.3A health and safety plan is adhered to.

2.4 Protective clothing requirements are identified and protective clothing is used.

Element 3: Limit damage to persons or property in the case of an emergency

Performance Criteria

3.1The location of fire extinguishers, hoses, and alarms is explained.

3.2Different fire extinguishers are identified and used correctly.

3.3Procedures for the identification of emergencies are known and followed promptly.

3.4 Injuries involving individuals are reported promptly to the relevant persons.

Element 4: Report the accident

Performance Criteria

4.1 A report about the accident is prepared.

4.3 The report is delivered to the immediate supervisor.

Demonstrate computer literacy skills – Unit ID: EE206

Element 1: Demonstrate an understanding of the principles of word processing

Performance Criteria

1.15 Word processing is defined in terms of its purpose and use.

1.16 Documents that can be produced using a word processor are provided, with relevant examples.

1.17 The benefits of using a word processor for producing documents are explained.

Element 2: Create, open and save documents

Performance Criteria

2.13 The word processing program is opened.

2.14 The parts of the word processor window are described in terms of their features and use.

2.3 A new document is created.

2.4 The document is saved with a specific name in a specific folder.

2.5 The document is closed.

2.6 An existing document is opened.

2.7 The word processing program is closed.

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Element 3: Produce a document from given text

Performance Criteria

3.1 A document is produced with the required data from given text.

3.2 A document is saved regularly to avoid loss of data.

3.3 A document is saved in a different format.

Element 4: Format a Document

Performance Criteria

4.1 A paragraph is manually formatted.

4.2 Text is manually formatted.

Element 5: Edit a Document

Performance Criteria

5.1 Data is inserted into a document.

5.2 Text is selected for manipulation and de-selected.

5.3 Text is manipulated.

5.4 The format of selected text is copied to other text.

5.5 Text located and replaced in a document.

Element 6: Check spelling and grammar in a document

Performance Criteria

6.1 Text is entered and corrected automatically while entering.

6.2 Text is checked for spelling and grammar and correctness based on judgement.

6.3 Words are added to the custom dictionary.

Element 7: Adjust the display characteristics

Performance Criteria

7.1 The page view mode is changed.

7.2 The document view is increased and decreased.

7.3 Toolbars are removed and added.

7.4 Ruler is viewed and removed.

7.5 Non-printing characters are displayed and removed.

Demonstrate knowledge of electrical fundamentals – Unit ID: EE207

Element 1: Explain the basic concepts of electricity

Performance Criteria

1.1 The principles of basic electrical circuits are explained in terms of a power source and a load.

1.2 The basic principles of voltage and current flow in an electrical circuit are explained in terms of the electron theory.

1.2Identify basic components according to their conductive and their resistive performance

Element 2: Explain the magnetic theory

Performance Criteria

2.1 Permanent magnet concept is explained in terms of the molecular structure of materials.

2.2 All five characteristics of magnetic lines of flux are explained in terms of magnetic theory.

2.3 The relationship between the magnetic field and current flow is explained in terms of movement, field strength, and conductor length within the magnetic field.

2.4 The electromagnet concept is explained in terms of magnetic lines of flux around a current-carrying conductor and cores.

Element 3: Explain the basic fundamentals of power generation and distribution

Performance Criteria

3.1 The production of electricity is explained with reference to pressure, heat, light, friction, magnetism, and chemical.

3.2 The conversion of resources into usable energy is explained with reference to coal, gas, nuclear, water, wind, and solar.

3.3 Generation of DC is explained in terms of a single loop in a magnetic field.

3.4 Generation of single-phase AC is explained in terms of a single loop in a magnetic field.

Element 4: Apply and explain electrical units and symbols

Performance Criteria

4.1 Electrical units and symbols are identified and applied in accordance with SI units.

4.2 The relationship between voltage, current, and resistance is explained and applied in terms of ohm's law.

4.3 Factors influencing resistance are explained in terms of material type, length, diameter, and temperature.

4.4 Power consumed by a simple resistive electrical circuit is calculated in terms of DC theory.

Element 5: Draw and interpret series, parallel, and series-parallel DC resistive circuits and calculate variables

Performance Criteria

5.1 Series, parallel and series-parallel circuits are drawn and interpreted according to instructions.

5.2 Resistance, voltage, current, and power variances are interpreted and calculated in series circuits according to instructions.

5.3 Resistance, voltage, current, and power variances are interpreted and calculated in parallel circuits according to instructions.

5.4 Resistance, voltage, current, and power variances are interpreted and calculated in series-parallel circuits according to instructions.

Draw and interpret basic engineering and electrical drawings – Unit ID: EE208

Element 1: Demonstrate an understanding of basic engineering drawings, sketches and material lists

Performance Criteria

1.1 Measurements and dimensions are explained

1.2 Basic line structure is explained.

1.3 Selected workpiece corresponds to engineering drawing.

1.4 Purpose of engineering drawings, sketches, electrical symbols, and material lists are explained.

Element 2 Basic engineering drawings, sketches, and electrical symbols are explained

2.1Select components from engineering drawings.

2.2Components from engineering drawings and electrical symbols are selected.

2.3Electrical symbols are displayed on an electrical installation drawing

2.4Sketches of different components are drawn.

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Fault find, repair, and maintain three phase circuits – Unit ID: 406 (Optional)

Element 1: Plan and prepare to fault-find three-phase electrical circuits.

Performance Criteria

1.1 Relevant information about the circuit is obtained

1.2 The extent of the fault is evaluated according to operational functionality.

1.3 Appropriate tools, PPE, and test equipment are selected.

Element 2: Find and repair faults on three-phase electrical circuits.

Performance Criteria

2.1 Sequence of operation is determined as per job instructions.

2.2 Applicable safety equipment is selected and used according to statutory requirements.

2.3 Applicable testing instruments and tools are selected according to the job and applicable statutory requirements.

2.4 Electrical plant operation is evaluated to identify possible causes of faults in accordance with the manufacturer`s specifications.

2.5 Applicable circuit drawings are interpreted according to possible causes of faults identified in relation to applicable circuit drawings to determine corrective action.

2.6 Ability to gather relevant information is done by making use of the logical method according to fault-finding techniques.

2.7 Fault-finding results are accurately recorded and reliably communicated according to work site procedures.

2.8 Faults are safely repaired according to work site procedures and statutory requirements.

2.9 Sequence of operation is analyzed and determined as per job instructions.

Element 3: Complete the work task.
Performance Criteria

3.1 Work area is cleared and cleaned on completion of the task according to housekeeping requirements.

3.2 Waste materials disposed of according to site-specific standards, procedures, and environmental policies.

3.3 Industrial electrical circuits re-commissioned on completion of task as per operational standards.

3.4 Quality checks conducted and corrective action taken where required as per quality standards.

3.5 Panel / enclosure doors, covers properly secured or locked to restrict unauthorised access as per safety standards.

3.6 Lockout devices and warning signs removed.

Inspect, test, and maintain, medium/high voltage transformers – Unit ID: EE407 (Optional)

Element 1: Plan to maintain medium/high voltage transformers

Performance Criteria

1.18 Planning is done in conjunction with outage scheduling and or maintenance programs.

1.19 Planning is integrated with other disciplines and associated equipment.

1.20 Planning is arranged according to equipment history reports and failure rate.

1.21 Planning is arranged according to plant availability and customer requirements and network stability.

1.22 Temporary electric supply from alternative sources is considered and identified and made available for use of equipment during maintenance where appropriate.

Element 2: Prepare to maintain medium/high voltage transformers

Performance Criteria

2.15 Ensure that the Transformer is isolated, earthed and safe ,to work on and that permits are received where necessary as per operating regulations.

2.16 Equipment, tools and personal protective equipment needed for maintenance is selected, inspected, and checked for functionality and safety prior to the commencement of tasks.

2.17 All components and material required for maintaining transformer is correctly identified, selected and available for use.

2.18 Test equipment is selected, inspected and checked for functionality and safety prior to maintenance tasks.

2.19 Appropriate drawings and documentation is obtained and made available prior to commencing maintenance task.

2.20 Work site/environmental hazards are identified and the appropriate action is taken in line with work site procedures (HIRA).

Element 3: Inspect, test, and maintain medium/high voltage transformers

Performance Criteria

3.7 Personal protective equipment is used and site-specific safety procedures are adhered to throughout maintenance.

3.8 The transformer is visually inspected and defects are recorded as per the inspection sheet/work instructions.

3.9 The transformer's insulating medium is sampled and tested as per applicable standards/procedures to determine insulation values, and core deterioration/internal faults, and corrective action is initiated where necessary.

3.10 Ensure that the transformer windings were electrically tested as per the relevant standards.

3.11 The transformer mechanisms, auxiliaries, and equipment are tested to ensure correct operation under manual and automatic conditions as per the manufacturers and site specifications.

3.12 The transformer mechanisms, auxiliaries, and equipment are maintained according to job procedures/maintenance manuals.

Element 4: Complete the work task

Performance Criteria

4.5 Transformer auxiliaries are restored, quality checks conducted after maintenance and corrective action taken where necessary as per maintenance procedures.

4.6 Tools and equipment used for maintenance is cleaned, checked for functionality and stored on completion of task.

4.7 Work area is cleaned after completion of task in line with housekeeping standards.

4.8 Waste/hazardous materials are deposed of, according to work site specific/environmental standards and procedures.

4.9 Completion of work is communicated and permit cleared as per operating regulations.
4.10 Documentation is completed and submitted according to data management procedures.

SECOND - YEAR

Install domestic wiring installations – Unit ID: EE209

Element 1: Plan and prepare to install, maintain or replace low voltage distribution boards, protection devices and components

Performance Criteria

1.23 Task instructions are obtained and interpreted as stated in the work instructions.

1.24 The relevant electrical distribution boards, protection devices and components to be installed or replaced are identified as per work place procedures and standards.

1.25 The correct personal protective equipment is identified as per work place procedures.

1.26 The correct cleaning equipment, solvents and materials are identified as per work place procedures.

1.27 The appropriate equipment to be worked on is identified and proper isolation and lock-out procedures is ensured for installation and maintenance.

Element 2: Maintain low voltage distribution boards, protection devices and components

Performance Criteria

2.21 Distribution board and panel enclosures are visually inspected for defects.

2.22 The correct cleaning equipment (e.g. blower, vacuum cleaner, etc), solvents (e.g. petrol; mentholated spirit; etc) and materials (such as waste rags; brushes; etc) are used as per work place procedures.

2.23 Damaged distribution board and panel enclosure components are repaired or replaced where necessary.

2.24 Protective devices and components are checked for loose connections or hot spots as per work place procedures.

2.25 The appropriate personal protective equipment is used as per work place procedures.

Element 3: Install or replace low voltage distribution boards, protection devices and components

Performance Criteria

3.13 Hazardous and sub-standard conditions are identified and addressed in a manner consistent with documented best practice.

3.14 The distribution board is mounted in accordance with specified requirements.

3.15 The protective devices and components are mounted and connected in accordance with specified requirements.

3.16 Supply cable is terminated and connected in accordance with specified requirements.

3.17 The supply cable, distribution board, protective devices and components are labelled in accordance with specified requirements.

Element 4: Conclude the maintenance of low voltage distribution boards, protective devices and components

Performance Criteria

4.11 All defects and suspected faults are recorded and reported in line with specified work site requirements.

4.12 Waste materials are disposed of as per safety and environmental standards.

4.13 The cleaning solvents are properly sealed and or closed and correctly stored to prevent hazardous fumes, substance spillage and fire risks.

4.14 Maintenance and installation documentation are completed in accordance with relevant procedures.

4.15 All defective components are disposed in accordance to work site procedures and standards.

Install electric single phase wire ways – Unit ID: EE210

Element 1: Plan to install electrical wire ways

Performance Criteria

1.28 Job instructions are obtained from supervisor or works co-ordinator

1.29 Specific wire ways, and materials are identified according to job and statutory requirements

1.30 Specified tools and materials are identified.

Element 2: Prepare to install electrical wire ways

Performance Criteria

2.26 Job instructions read and followed as per the instructions requirements.

2.27 Work area is inspected and prepared for installation as per the marked out layout, job instructions and work site standards.

2.28 Specified wire ways, and materials are selected according to given instructions

2.29 Specified type of tools are selected and checked for serviceability according to job and statutory requirements.

2.30 Personal protective equipment and clothing is selected for the job, as per work place requirements.

Element 3: Install wire ways

Performance Criteria

3.18 Wire ways are laid out according to instructions and pre-marked area.

3.19 Surfaces are prepared for the installation of wire ways as per job instructions.

3.20 Wire ways are marked out as per pre-determined measurements; cut; formed and/or bent according to planned requirements; obstacles; environment (structure); using appropriate tools and equipment in accordance with work place standards and statutory requirements.

3.21 All ends are de-burred

3.22 Wire ways are assembled and or joined and mounted according to planned and environmental (structure) requirements, in accordance with work place standards and statutory requirements.

3.23 Adhere to safety precautions and work place standards requirements ensuring the safety of oneself and others.

3.24 The metal wire ways are electrically continuous.

3.25 All metal joints are bonded and grounded.

Element 4: Complete wire ways

Performance Criteria

4.16 All end connections are fitted and tightened

4.17 Work is cleaned in accordance with housekeeping standards.

4.18 All tools are stored in correct place in accordance with work place practices.

4.19 Waste materials are deposed of, according to work site procedures, statutory requirements and environmental standards.

4.20 Documentation is completed and submitted to meet work site standards and procedures.

4.21 Completion of job is reported to immediate supervisor.

Install, join and terminate low voltage cables and conductors – Unit ID: EE211

Element 1: Plan to install, join and terminate low voltage cables and conductors

Performance Criteria

1.5 Cable and conductor equipment needed for installing, joining and terminating is checked for functionality, safety and availability for use on site.

1.6 Applicable safety equipment is selected and used according to work procedure requirements.

1.7 Job instructions are obtained and correctly carried out.

1.8 Applicable tools and electrical test instruments are selected according to job and applicable work procedure requirements.

1.9 Worksite is inspected for hazards and these are reported to immediate supervisor.

Element 2: Prepare to install, join and terminate low voltage cables and conductors

Performance Criteria

2.1 Point of installation, joining and termination is identified in accordance with work instructions.

2.2 Work area is demarcated according to statutory requirements.

2.3 Trenches, ducting and kick pipes are prepared and inspected according to work site requirements and applicable standards.

2.4 Pulling devices are positioned in ducting and kick pipes in accordance with job requirements.

2.5 Obstacles are identified and necessary precautions are taken in accordance with local authority and way-leaves.

Element 3: Install electrical cables

Performance Criteria

3.1 Electrical cables and conductors are installed, positioned and secured according to work site procedures and standard requirements.

3.2 Minimum prescribed tail lengths are left for termination or joining according to manufacturer's specifications and work site requirements.

3.3 Electrical cables and conductors are marked and numbered according to work site procedures and standard requirement.

3.4 Tools and equipment are used safely to meet the requirements of the job.

3.5 Personal protective equipment is used and site specific procedures are adhered to throughout the installing process.

Element 4: Join low voltage cables

Performance Criteria

4.1 Applicable tools and equipment are selected and used safely to meet the requirements of the job.

4.2 Cable cores are joined according to manufacturer's specifications and statutory requirements.

4.3 Joining of cables are completed as per manufacturer's specifications.

4.4 Continuity, insulation and mechanical tests are carried out on completed joint according to statutory requirements.

Element 5: Terminate electrical cables and conductors

Performance Criteria

5.1 Cable gland is positioned, secured and assembled according to manufacturer's specifications, work place requirements and standards

5.2 Cable ends are prepared are prepared for termination according to manufacturer's specifications, work place requirements and standards.

5.3 Electrical cables and conductors are made off and terminated according to work site procedures and standards or job requirements.

5.4 All termination connections are secured and tightened according to manufacturer's specifications and work site standards.

Element 6: Complete the work task.

Performance Criteria

6.1 Reinstate the terrain in accordance with work site procedures, environmental and customer requirements.

6.2 Work area is cleaned after completion of the task in accordance with work site procedures and housekeeping standards.

6.3 Waste materials are disposed of in accordance with safety standards and environmental requirements.

6.4 Necessary documentation is completed and submitted as per data management system requirements.

Use and maintain hand and power tools in electrical operations – Unit ID: EE212

Element 1: Identify and select electrical utilisation hand tools

Performance Criteria

1.31 The correct tools used for the cutting of materials are identified and selected as per manufacturer's description.

1.32 The correct tools used for the cutting of wires are identified and selected as per manufacturer's description.

1.33 The correct tools used for measuring are identified and selected as per manufacturer's description.

1.34 The correct tools used for loosening and fastening of bolts/nuts/couplings are identified and selected as per manufacturer's description.

1.35 Power tools are selected according to manufacturer's description and work requirement

Element 2: Inspect electrical hand and power tools for serviceability

Performance Criteria

2.31 Unsafe and faulty hand and power tools are identified and marked for repair/maintenance or replacement according to set procedures.

2.32 Chisel and or punch type tools heads are inspected for "mushroom" effect and withdrawn from use until maintained or replaced.

2.33 Cutter type tool cutting edges/griping edge are inspected for chips; ridges, sharpness and hand grip to ensure that it is serviceable.

2.4 Screw driver type tools are inspected for damage to tips or hand grips to ensure that they are serviceable.

2.5 Spanner type tools are inspected for damage or wear and tear to ensure that they are serviceable.

2.6 Adjustable spanner type tolls are inspected for damage or wear and tear to adjusting mechanism to ensure that they are serviceable.

2.7 Faulty tools are reported to supervisor

Element 3: Use electrical utilisation hand and power tools

Performance Criteria

3.1 The correct application of tools used to measure and mark out a range of materials as per manufacturer's specifications is demonstrated.

3.2 The correct application of tools used for cutting a range of materials as per manufacturer's specification is demonstrated.

3.3 The correct application of tools used to loosen or fasten a range of different types and sizes of nuts or bolts as per manufacturer's specification is demonstrated.

3.4 The correct application of tools used to loosen or fasten a range of different types and sizes of nuts or bolts as per manufacturer's specification is demonstrated.

3.5 The correct application of tools used to loosen or fasten a range of different types and sizes of nuts or bolts as per manufacturer's specification is demonstrated.

3.6 Hand eye co-ordination, when using a variety of different engineering tools, is displayed.

3.7 safety precautions are taken when using tools that could inflict injury on the user.

Element 4: Maintain and care of electrical utilisation hand and power tools

Performance Criteria

4.1 Chisel and or punch type tool heads with "mushroom effect" are grinded down to remove sharp edges to ensure that they can be used safely; then tips with burs or chips are grinded to make sharp, for effective use.

4.2 Flat Screw driver tips with burs or chips are filed and prepared to a manufacturer's specification ensuring that they are serviceable.

4.3 Adjustable spanners/tools adjusting/moving mechanism are lubricated to ensure free movement and serviceability.

4.4 Engineering files cutting edge are cleaned using wire brush to ensure serviceability.

4.5 Making type tools are sharpened to ensure serviceability.

4.6 Veneer calliper measuring tool adjustable device is lubricated to ensure serviceability and stored in a box or case.

4.7 Electrical Utilisation tools are coated with a thin layer of lubricant to prevent rusting and stored in a tool box or store room and kept free from moisture.

4.8 Power tools are cleaned according to manufacturer's specification

Repair and maintain electric appliances – Unit ID: EE213

Element 1: Plan to do fault finding and repair electrical appliances

Performance Criteria

1.36 Manuals and specifications for the appliance to be worked on are selected.

1.37 Manuals and specifications are interpreted according to specific task.

1.38 Component function is interpreted according to manufacturer's specifications.

1.39 Tools and test instruments to be used are selected according to specified task.

Element 2: Conduct fault finding and testing of electric appliances

Performance Criteria

2.34 Appliances are inspected for visible damages according to workplace specifications

2.35 Appliances are tested in a sequence as per fault finding procedures.

2.36 Faults are located and corrective action identified with the aid of manuals and specifications.

2.37 Faults, wear and tear are identified according to work site procedures.

Element 3: Repair electric appliances

Performance Criteria

3.26 Tools are selected to remove faulty components.

3.27 Components are selected and replaced according to manufacturer's specifications.

3.28 Appliances are checked for correct assembly according to maintenance procedures.

Element 4: Conclude electrical appliance repair

Performance Criteria

4.22 Each electric appliance continuity, and insulation resistance as per work procedures.

4.23 Repaired electric appliance is tested for correct operation according to manufacturer's specifications.

4.24 Appliance is cleaned before approving it for service.

4.25 Tools and test instruments are cleaned and stored according to statutory requirement.

Use test equipment for electrical measurements – Unit ID: EE215

Element 1: Demonstrate knowledge of test equipment for electrical measurements.

Performance Criteria

1.40 The operation of moving coil and moving iron meters is described in terms of component parts and fundamental principles of electromagnetism

1.41 Analogue test equipment is described in terms of their principles of operation, settings and their applications.

1.42 Digital test equipment is described in terms of their principles of operation, settings and their applications

1.43 Test equipment is identified physically or in pictorial displays.

1.44 Correct measurement connections are explained using sketches.

1.45 Consequences of incorrect use of test equipment are stated.

1.46 Measurement accuracy, errors and instrument calibration is described.

1.47 The principle and use of test leads in measurement of electrical circuits are described.

1.48 The description of maintenance and care for test equipment to ensure durability is given in accordance with industry practice.

Element 2: Select and prepare equipment to perform electrical tests

Performance Criteria

2.38 Circuits and/or component test requirements are identified.

2.39 Correct test equipment is selected in accordance with the measurement requirements.

2.40 Test equipment is checked for serviceability and applicable leads are fitted

2.41 Applicable function and range of measurement is selected in accordance with the measurement requirements.

2.42 Where applicable, calibration and/or zeroing is performed prior to measurements in order to validate readings.

Element 3: Use electrical test equipment to test circuits and components

Performance Criteria

3.29 Test points and polarity are determined.

3.30 Correct range scales are selected for the tests.

3.31 Test equipment is used consistent with manufacturer's instructions.

3.32 Measurements for required parameters are taken and percentage of errors calculated following standard practice and safety procedures.

3.33 The approximate tolerance for each measurement is stated according to standard practice.

3.34 Data sheets are used to identify component characteristics and generic equivalent components.

3.35 Results of measurements are recorded in accordance with standard procedures.

Element 4: Apply measuring techniques for various electrical quantities

Performance Criteria

4.26 Voltage, current and resistance measuring techniques are applied using test equipment.

4.27 Measurements of different waveforms, frequencies, and voltages using an oscilloscope are applied with examples.

4.28 Knowledge of the power supplies is applied for testing purposes.

4.29 Use of function generators in providing specific frequencies and waveforms is applied by means of signal measurements

Element 5: Maintain and handle test equipment in the approved manner

5.1 Test equipment is handled carefully.

5.2 Test equipment is set up consistent with safety procedures.

5.3 Test equipment is securely stored in dust-free, dry storage.

5.4 Test equipment is calibrated for accuracy checks as required by standard procedures.

Maintain medium/ high voltage switchgear – Unit ID: EE410 (Optional)

Range

Statutory requirements definition: statutory requirements may include but are not limited to OHS Act, Electricity act (2007), Mineral act, local Authority requirements, Manufacturers specifications and Work site procedures.

Permit system includes isolations, permits, lockout systems and workman register.

Maintenance of medium/high voltage switchgear is up to 400 kV within industry.

Medium/high switchgear consists of but not limited to cubicle, breakers and bus-bar housing.

Pre-maintenance test consists of: moveable mechanism speeds insulation and induction tests.

Switchgear maintenance consists of: contacts, moveable parts, bushes, rollers and springs.

Element 1: Plan to maintain medium/high voltage switchgear

Performance Criteria

1.1 Planning is done in conjunction with outage scheduling.

1.2 Planning is arranged according to equipment operating history reports and failure rate.

1.3 Planning is arranged according to operational procedures, standards and owner's equipment manual (OEM) specifications.

1.4 Planning is integrated with other disciplines and associated equipment. (Protection testing and monitoring, engineering, operating and control centres.)

1.5 Planning is aligned with maintenance programs.

1.6 Planning is arranged according to plant availability and customer requirements.

Element 2: Prepare for maintenance of medium/high voltage switchgear

Performance Criteria

2.1 Authorisation is obtained according to the plant permit system.

2.2 Medium/high voltage switchgear isolated and made safe to work on according to safety lockout procedure and industry specific regulations.

2.3 Medium/high voltage switchgear identified and establish type, required tools, equipment, components, and personal protective equipment are obtained prior to maintenance.

2.4 Equipment, test instruments, tools and personal protective equipment needed for maintenance selected, inspected, and checked for functionality and safety prior to commencement of tasks.

2.5 Medium/high voltage switchgear maintenance equipment and cleaning materials are selected and made available for task.

2.6 Work site safety hazards and aspects are identified and corrective action taken in line with work site procedures (HIRA).

2.7 Maintenance task instructions are obtained and interpreted, and sequence of operation determined and communicated to work team members.

Element 3: Maintain medium/high switchgear

Performance Criteria

3.1 Personal protective equipment used and site safety procedures are adhered to throughout maintenance.

3.2 Proper safety and lockout procedures are adhered to and permit to work is obtained.

3.3 Visual inspection and pre-maintenance tests are carried out and the full scope of work is established.

3.4 Maintenance and repairs are carried out according but not limited to operational procedures, standards, and OEM specifications.

3.5 Post maintenance tests are carried, this may include but not limited to , dielectric tests, speed test, contact resistance test, primary and secondary injection tests.

3.6 Switchgear and control mechanisms are cleaned according to site standards and procedures.

3.7 Maintenance reporting sheet and processes are documented and incorporated in reports.

3.8 Switchgear restored for service in line with manufacturer's specifications.

Element 4: Complete work task

Performance Criteria

4.1 Work area cleaned after completion of task to housekeeping standards.

4.2 Waste materials are disposed of according to site specific standards and procedures.

4.3 Tools and equipment are cleaned and returned for safekeeping in line with housekeeping requirements.

4.4 Reports and or documentation and drawings are updated and returned according to statutory requirements.

4.5 Completion of job reported according to statutory requirements.

Maintain and repair medium voltage AC rotating machines and control gear – Unit ID: EE411 (Optional)

Element 1: Prepare to maintain and repair medium voltage AC rotating machines and control gear

Performance Criteria

1.49 Job instructions are obtained and the sequence of the task is planned in accordance with accepted worksite procedures.

1.50 Test and measuring instruments equipment, hand tools and material are selected and examined according to task and worksite procedures.

1.51 Medium voltage AC machines and control gear are selected and tested according to statutory requirements.

1.52 Safety procedures are followed as per statutory requirements.

1.53 The required personal protective equipment is selected, examined and used in a manner that protects the individual in accordance with workplace procedures.

Element 2: Maintain and repair medium AC rotating machines and control gear

Performance Criteria

2.43 The worksite is examined for hazardous and sub-standard conditions and corrective action taken where necessary according to safe worksite procedures and critical task analysis.

2.44 Hazardous and associated risk directly related to the maintenance of medium voltage AC rotating machines and control gear is identified and addressed in accordance with specifications requirements.

2.45 Isolation and lockout procedures are adhered to according to medium voltage safe working practices and worksite requirements.

2.46 Medium voltage AC rotating machines and control gear are maintained according to instructions, worksite procedures and statutory requirements.

2.47 Safety equipment, procedures and environmental practices are followed before, during and after the maintenance and repair activities according to worksite procedures.

2.48 Tools are used to meet the job requirement.

Element 3: Test the medium voltage rotating machines and control gear for operation

Performance Criteria

3.36 Tools are used without injury to self and others according to job requirement.

3.37 Personal protective equipment is used in a manner that protects the individual in accordance with specified requirements.

3.38 Medium voltage AC rotating machine and control gear are tested according to electrical diagrams, worksite procedures and statutory requirements.

3.39 Connections are mechanically sound and electrical integrity is adhered to according to worksite procedures.

3.40 Hazards and risks directly related to the connecting of medium voltage AC machines and control gear is identified and addressed in accordance with worksite procedures.

3.41 Safety and environmentally practices are followed before, during and after maintenance and repair activities according to statutory and worksite requirements.

Element 4: Complete the work task

Performance Criteria

4.1 Test and measuring equipment and hand tools are cleaned and stored as per worksite requirements.

4.2 The workplace is cleaned to comply with specified housekeeping practices.

4.3 Report on work performed is completed and complies with specified requirements.

THIRD-YEAR

Understand basic electrical and electronic theory and components – Unit ID: EE301

Element 1: Understand and explain electronic theory in terms of current flow

Performance Criteria

1.54 The structure of the atom is drawn and explained within the context of basic electronic theory.

1.55 Free electrons are explained within the context of electron theory principles.

1.56 Conduction and different types of current is explained within the context of electronic theory principles.

1.57 Bonding processes between different molecule types are explained and lattice structure drawn.

1.58 Doping of intrinsic materials is understood and explained in terms of p-type and n-type semiconductor principles.

1.59 The effect of heat on semiconductor materials and conductors are explained with relation with its conductivity characteristics.

Element 2: Understand and explain the operation of basic electronic components

Performance Criteria

2.49 Different types, values, colour codes and symbols of resistors are listed and explained in relation with basic electronic theory and applications.

2.50 Different types, values and symbols of capacitors are listed and explained in relation with basic theory and applications.

2.51 Different types, values and symbols of inductors are listed and explained in relation with basic electronic theory and applications.

2.52 The combination and effect of different basic electronic components in one circuit is graphically illustrated and explained in relation with basic electronic theory and applications.

Element 3: Understand the operation of a P-N junction diode

Performance Criteria

3.42 The creation and biasing of a P-N junction is described and graphically illustrated within the context of semiconductor theory.

3.43 The effect of temperature on a P-N junction is described within the context of semi conductor theory.

3.44 Forward biasing and reverse biasing curves are drawn and described within the context of semiconductor theory.

3.45 Different types of specialised diodes are identified and described within the context of semiconductor theory.

Element 4: Understand the operation and function of power supplies.

Performance Criteria

4.1The operation of half wave rectifier techniques is explained with the aid of graphics.

4.2The operations of half wave and full wave rectifiers are explained with the aid of graphics.

4.3 A basic DC power supply consisting of a transformer and rectifiers are explained with the aid of graphics and the output voltage demonstrated with the aid of an oscilloscope.

4.4 Basic calculations of the voltages and currents around rectifier circuits are done in relation with full wave and half wave rectification and verified with the aid of an oscilloscope.

Element 5: Understand the operation and application of a transistor.

Range:

IGBT, MOSFETs, BJT, TRIACs, DIACs

Performance Criteria

5.1 Identify and explain operation principles of transistors.

5.2 The output and input characteristics for transistors are drawn and explained in terms of transistor theory.

5.3 The Quiescent point is defined in relation with transistor theory.

5.4 Basic load line calculations are carried out in relation with transistor theory.

5.5 The operation of transistor as a switch is explained with the aid of a circuit diagram.

5.6 The operation of a transistor as an amplifier is explained with and aid of circuit diagram.

Element 6: Understand the principles of opto - electronics and its applications

Performance Criteria

6.1 Operation of photo-emissive and photo-conductive devices are explained within the context of opto-electronic principles.

6.2 The characteristic curve for photo diode is drawn and the shape explained.

6.3 Difference between photodiodes and light emitting diodes are explained within the context of photovoltaic power systems.

6.4 The operation of solar cell is graphically illustrated and explained within the context of photovoltaic power systems.

6.5 The number of solar cells required to deliver a particular current and voltage is calculated within the context of photovoltaic power systems.

Carry out fault finding in an electrical system – Unit ID: EE302

Element 1: Plan and prepare to construct and maintain Low and Medium Voltage networks

Performance Criteria

1.10 Job instructions are obtained and the section of electrical network to be constructed/maintained is identified according to geographical/electrical network diagrams.

1.11 The scope of work is interpreted and a sequence of operation is planned according to construction and maintenance procedures.

1.12 Hazard Identification and Risk Assessment (HIRA) is carried out.

1.13 Isolation and earthing of the affected section of the network is arranged and work permits received according to operating regulations, job instructions/maintenance schedules or breakdown reports where applicable.

1.14 Appropriate tools, equipment and materials are identified, selected and checked for functionality to meet the requirements of the task and according to job and statutory requirements.

Element 2: Construct Low and Medium Voltage networks

Performance Criteria

2.1 Job instructions are received for the construction of the relevant new section of the network according to construction regulations, standards and procedures.

2.2 The required electrical hardware and equipment is checked for availability and conformance to job requirements, quality standards and specifications.

2.3 The electrical hardware and equipment is constructed according to applicable procedures or manufacturer's specifications.

2.4 The newly constructed electrical installation is inspected and tested to ensure that it is according to pre-commissioning requirements.

2.5 The necessary documentation is completed and submitted according to the pre-commissioning and handover procedures.

Element 3: Inspect, maintain and repair Low and Medium Voltage networks

Performance Criteria

3.1 Ensures that the affected section of the electrical reticulation network is isolated, earthed and work permit/worker's register is received for the affected section of the network according to operating procedures where necessary.

3.2 The work site conditions and affected electrical hardware/equipment are assessed for possible safety risks and preventative measures implemented according to safety risk assessment procedures.

3.3 The affected section of the electrical reticulation network is visually inspected prior to maintenance and repaired according prescribed maintenance procedures.

3.4 The electrical hardware and equipment is maintained, repaired or replaced according to applicable maintenance procedures or manufacturer's specifications.

3.5 The maintained or replaced electrical hardware and equipment is inspected and tested to ensure that it is operational according to manufacturer's requirements.

Element 4: Complete the work task

Performance Criteria

4.1 Work area is restored to serviceable condition according to statutory requirements

4.2 Completion of job is communicated, permit/worker's register cleared where necessary according to local reporting and operating procedures.

4.3 Ensure that the replaced, dismantled or excess hardware and equipment have been returned to the stores as per local asset management procedures.

4.4 Necessary documentation is completed and submitted to designated personnel.

4.5 Appropriate tools and safety equipment are cleaned and stored according to statutory requirements.

4.6 Documentation is completed accurately according to work site procedures.

Construct and maintain low and medium voltage overhead lines – Unit ID: EE303

Element 1: Plan and prepare to construct and maintain Low and Medium Voltage networks

Performance Criteria

1.15 Job instructions are obtained and the section of electrical network to be constructed/maintained is identified according to geographical/electrical network diagrams.

1.16 The scope of work is interpreted, and a sequence of operation is planned according to construction and maintenance procedures.

1.17 Hazard Identification and Risk Assessment (HIRA) is carried out.

1.18 Isolation and earthing of the affected section of the network is arranged and work permits received according to operating regulations, job instructions/maintenance schedules or breakdown reports where applicable.

1.19 Appropriate tools, equipment and materials are identified, selected and checked for functionality to meet the requirements of the task and according to job and statutory requirements.

Element 2: Construct Low and Medium Voltage networks

Performance Criteria

2.1 Job instructions are received for the construction of the relevant new section of the network according to construction regulations, standards and procedures.

2.2 The required electrical hardware and equipment is checked for availability and conformance to job requirements, quality standards and specifications.

2.3 The electrical hardware and equipment is constructed according to applicable procedures or manufacturer's specifications.

2.4 The newly constructed electrical installation is inspected and tested to ensure that it is according to pre-commissioning requirements.

2.5 The necessary documentation is completed and submitted according to the pre-commissioning and handover procedures.

Element 3: Inspect, maintain and repair Low and Medium Voltage networks

Performance Criteria

3.1 Ensures that the affected section of the electrical reticulation network is isolated, earthed and work permit/worker's register is received for the affected section of the network according to operating procedures where necessary.

3.2 The work site conditions and affected electrical hardware/equipment are assessed for possible safety risks and preventative measures implemented according to safety risk assessment procedures.

3.3 The affected section of the electrical reticulation network is visually inspected prior to maintenance and repaired according prescribed maintenance procedures.

3.4 The electrical hardware and equipment is maintained, repaired or replaced according to applicable maintenance procedures or manufacturer's specifications.

3.5 The maintained or replaced electrical hardware and equipment is inspected and tested to ensure that it is operational according to manufacturer's requirements.

Element 4: Complete the work task

Performance Criteria

4.1 Work area is restored to serviceable condition according to statutory requirements

4.2 Completion of job is communicated, permit/worker's register cleared where necessary according to local reporting and operating procedures.

4.3 Ensure that the replaced, dismantled or excess hardware and equipment have been returned to the stores as per local asset management procedures.

4.4 Necessary documentation is completed and submitted to designated personnel.

4.5 Appropriate tools and safety equipment are cleaned and stored according to statutory requirements.

4.5Documentation is completed accurately according to work site procedures.

Construct basic electrical and electronics circuits – Unit ID: 304

Element 1: Plan and prepare for the electrical installation to be done

Performance Criteria

1.60 Job instructions are interpreted and sequence of operations is determined according to the installation environment and the required task.

1.61 Tools, equipment and instruments are selected to meet the requirements of the task according to statutory and environmental requirements.

1.62 The documentation necessary to complete the task is obtained as per data management requirements.

1.63 Safety rules and regulations are followed as per statutory requirements and safe working procedures.

1.64 Environmental hazards and safety risks are identified according to environmental standards and safety risks analysis.

Element 2: Carrying out electrical installation

Performance Criteria

2.1 Hazard Identification and Risk Assessment (HIRA) is carried out

2.2 Components are assembled as per the given task

2.3 Statutory regulations and standards adhered to.

2.4 Integrity of connections is checked/verified

Element 3: Perform electrical tests on the installation

Performance Criteria

3.46 Installation is tested as per statutory requirements from SZNS SANS 10142 code.

3.47 Documentation is completed as per data management requirements.

3.48 Test instruments are used to obtain readings in accordance with statutory requirements.

3.49 Measurements obtained from the test are interpreted as per SZNS SANS 10142 requirements.

3.50 All safety precautions are observed and demonstrated during the test as per safe work procedures.

Element 4: Maintain electrical installations

Performance Criteria

4.1 All safety requirements are observed and demonstrated during maintenance as per safe working procedures.

4.2 All maintenance activities are carried according to specific procedures

Element 5: Complete the required task documentation

Performance Criteria

5.1 All personnel, tools, Instruments and excess equipment are removed from the installation according to work site procedures.

5.2 The work area is restored to its original condition on completion of the test and inspection procedures as per safety requirements.

5.3 The certificate of compliance completed according to SZNS SANS 10142 requirement.

5.4 The results of the inspection and test are communicated to all concerned according to reporting procedures.

5.5 A defect list is compiled and corrective action taken, if necessary, as per quality requirements.

Demonstrate basic understanding of programmable logic controllers (PLC) – Unit ID: EE305

Element 1: List and discuss the functions and applications of programmable logic controllers.

Range

This may include but not limited to minor repair on site, minor overhaul, repair and reconditioning, major overhaul and repair and complete reconditioning of components and ancillaries

Performance Criteria

1.65 The terms used to describe the functions of logic controllers are explained.

1.66 The basic functions and principles of operation of logic controllers are listed and explained.

1.67 Hardware components are identified and their functions explained.

1.68 The methods and programming languages are listed and explained.

1.69 The information required to program and commission a programmable logic controller is listed and discussed.

1.70 The applications of programmable logic controllers are listed and discussed.

1.71 The advantages and disadvantages of programmable logic controllers are listed and discussed.

Element 2: Demonstrate an understanding of the input/output peripherals for a programmable logic controller.

Performance Criteria

2.1 The various peripherals are defined and their function explained and discussed.

2.2 The various input and output peripherals are identified.

2.3 Hazards associated with the use of logic controllers are recognised and the necessary precautions are taken according to work site procedure.

2.4 The correct operation of the peripheral devices is verified.

2.5 The peripherals are correctly removed and replaced according to manufacturer's specification.

2.6 Personal safety procedures are demonstrated according to activity requirements.

Element 3: Demonstrate an understanding of the programming terminal (the interface).

Performance Criteria

3.1 Handheld or programming terminal is correctly connected to the controller.

3.2 Communication between the programmer and the processor is established.

3.3 The correct sequence is used to monitor the on-line program that resides in the processor.

3.4 Programming the logic controller by means of a PC, laptop or hand-held interface is demonstrated.

Element 4: Demonstrate an understanding of field devices interfaced to programmable logic controllers.

Performance Criteria

4.1 The correct field device is identified.

4.2 The field device is correctly connected to the appropriate peripheral.

4.3 The operation of the field device is verified.

4.4 Personal safety equipment is selected and used according to activity requirement.

Install and maintain electrical metering units, measuring instruments and control devices – Unit ID: EE306

Element 1: Demonstrate procedure and requirements to install electrical metering units and or measuring instruments and control devices

Performance Criteria

1.72 Documentation is identified and or acquired.

1.73 Job instructions are interpreted and sequence of operation is determined.

1.74 Applicable circuit, wiring and mounting diagrams are selected.

1.75 Meter units and or instruments and control devices are selected.

Element 2: Plan to install and connect electrical metering units and or measuring instruments with their related control devices

Performance Criteria

2.53 Instruments and control devices specifications are verified according to job specifications.

2.54 Metering units and or measuring instruments and control devices are mounted or installed according to job specifications.

2.55 Metering units and or measuring instruments and control devices are connected according to respective circuit diagrams.

2.56 Safety, housekeeping and environmental practices are followed before, during and after task.

Element 3: Maintain electrical metering units and or measuring instruments

Performance Criteria

3.51 Relevant maintenance procedures are carried out to ensure compliance to statutory and or workplace specifications.

3.52 Visual faults are identified and repaired to ensure compliance.
3.53 Actual and expected readings are compared for analysis and discrepancies reported or rectified.

3.54 Metering units and or measuring instruments are sealed according to specifications.

Element 4: Complete work activity

Performance Criteria

4.1Work area is cleared in accordance with specifications and or workplace requirements.

4.2 Tools and equipment are stored in accordance with workplace practice and or manufacturer's specifications.

4.3 Waste materials are disposed of as per workplace procedures, statutory requirements and environmental standards.

4.4 Documentation is completed in detail and submitted to meet worksite standards and procedures.

Install and maintain lighting systems – Unit ID: EE307

Element 1: Explain the requirements pertaining to maintaining lighting systems

Performance Criteria

1.76 The principle of operation of lamps and luminaire circuits are explained with reference to the type and manufacturer's specifications.

1.77 The purpose of maintaining lighting systems is explained.

1.78 The consequences of incorrect identification of lighting systems are given.

1.79 Fault finding method on a luminaire, in a lighting system that does not emit light is explained.

1.80 The factors causing loss of light emitting by lamps is explained.

1.81 The effect of relevant poisonous, toxic and dangerous materials on the human body is explained.

1.82 Consequences of damaging, or damaged luminaire with regards to the ingress protection rating of the luminaire are explained as per manufacturer's specifications, worksite procedures and standards.

Element 2: Prepare to maintain a lighting system

Performance Criteria

2.57 Relevant documentation is acquired.

2.58 Personal protective equipment is selected, examined and used in a manner that protects the individual.

2.59 Tools, material, work platforms and equipment are selected and transported to the worksite safely.

2.60 The worksite is examined for hazardous conditions and is addressed.

2.61 The lighting system to be maintained is identified.

2.62 The consequences of not preparing to maintain in line with specified requirements are explained with reference to personal and team safety, impact on the environment, production costs and lost time.

Element 3: Maintain lighting system

Performance Criteria

3.55 Hazards and risks directly related to maintaining lighting systems are identified.

3.56 The circuit is switched off, locked out and tested to ensure that it is dead.

3.57 The lighting systems are maintained according to manufacturer's specification and worksite procedures.

3.58 Safety, good housekeeping and environmental practices are followed before, during and after work.

Element 4: Prepare and test the maintained lighting systems for operation

Performance Criteria

4.1 The maintained lighting systems are tested to ensure compliance to the SANS 1-0142 writing code.

4.2The power is switched on and the operation of the maintained lighting systems is checked.

4.3 Tools, material, work platforms and equipment are cleaned, inspected and stored according to worksite procedures.

4.4 The relevant documentation is completed with the agreed time frame and as per worksite procedures.

Tender to secure a new venture – Unit ID: EE414 (Optional)

Element 1: Identify information sources of available business and new markets that can be accessed

Performance Criteria

1.83 Electronic and media sites are investigated for possible tenders

1.84 The printed media containing new business or calls for tenders for new business in are identified for own business context.

1.85 New markets are researched for potential tendering opportunities.

1.86 Other sources of information for tender opportunities are identified and investigated for own business opportunities.

Element 2: Tender documents are analysed for vability in the new venture context

Performance Criteria

2.63 Tenders for own business are identified with reasons why they suit own business.

2.64 The presentation methods and tender submissions procedures are explained with examples.

2.65 The business activity levels within a specific tender are recognised and limitations of own business capacity are specified in that context.

2.66 The internal and external factors of human resources capacity that impact on a specific tender are determined for own business.

Element 3: Calculation of costs, revenue and profit of a specific tender are carried out

Performance Criteria

3.59 Available costing methods are reviewed in relation to the tender specifications.

3.60 Product sand or services costs and prices applicable to the tender are calculated.

3.61 Internal factors impacting upon pricing decisions are identified and discussed in relation to the profitability of the tender.

3.62 External factors impacting upon pricing decisions are identified and discussed in relation to the profitability of the tender.

3.63 Variations in pricing decisions are calculated in terms of the impact on the break-even point.

3.64 Break-even point of the tender is determined for own business.

3.65 Profit mark-up is calculated and analysed for the tender.

3.66 Costing and pricing methods are reviewed to ensure it is as per application to tender specifications.

3.67 Expenses and revenue are classified and categorised for the specific tender.

3.68 Suppliers and new products are assessed in terms of potential contribution to profit securing the tender.

3.69 Competing products and or services are identified and considered in the tendering process.

Element 4: Complete tender documents

Performance Criteria

4.1 Tender documents are completed as per requirement.

4.2 Checks and balances are carried out on the costing and inputs into the document.

4.3 Dates and times of submitting tenders are adhered to.

Interpret basic financial statements – Unit ID EE415 (Optional)

Element 1: Analyse the basic elements of an income and expenditure statement

Performance Criteria

1.87 The purpose of an income and expenditure statement is explained and an indication is given of how often these statements are required for two case studies.

1.88 Sources of income and expenditure are identified for three different kinds of financial statements.

1.89 Sources of income and expenditure are explained with reference to an income and expenditure statements.

1.90 Three income and expenditure are examined and evaluated in terms of financial viability of the enterprise.

Element 2: Analyse the basic elements of a balance sheet

Performance Criteria

2.67 The purpose of a balance sheet is explained and an indication is given of how often a balance sheet is necessary for two case studies.

2.68 A balance sheet is analysed and evaluated in terms of equity or financial net worth.

2.69 The concept of an asset is explained and the assets in a balance sheet are classified in terms of fixed and current assets.

2.70 The concept of an asset is explained and the liabilities in a balance sheet are classified in terms of long term and current assets.

2.71 Balance sheets for an entity are compared and evaluated in terms of performance over two years and a decision is made based on evidence in the balance sheet.

Element 3: Compile a personal assets and liabilities statements

Performance Criteria

3.70 A personal assets and liabilities statement is compiled based on own financial situation over the past year.

3.71 The situations when assets and liabilities statement are required are listed and an indication is given of the advantages of keeping such records.

Element 4: Use the evidence in financial statements to make a financial decision

Performance Criteria

4.1 The financial strengths and weaknesses of are analysed and suggestions are made of ways to improve income and reduce costs.

4.2 The concept of cost to income ratio is explained and suggestions are made on how to improve the ratio.

4.3 The relation between turnover, income, revenue, sales or earnings and profit is explained with examples.

4.4 The concept of cash flow is explained in terms of liquidity.

FORTH-YEAR

Install batteries – Unit ID: EE308

Element 1: Plan work task

Performance Criteria

1.91 Job instructions are interpreted and sequence of operation is determined according to standard worksite procedures.

1.92 Tools, equipment and materials are selected and checked to meet the requirement of the task.

1.93 Mechanical aids and handling equipment are obtained according to the job requirement.

1.94 Drawing and documentations are acquired in accordance with job requirement.

1.95 Personal protective equipment is selected in accordance with worksite procedures.

1.96 Battery is selected as per work instructions.

1.97 Affected parties are informed as per reporting procedures.

Element 2: Prepare work area

Performance Criteria

2.72 Work area is inspected and prepared according to statutory requirements.

2.73 Authorisation is obtained according to worksite procedures.

2.74 Safety of working area is ensured according to statutory requirements.

2.75 Personal protective equipment is used according to statutory requirement.

Element 3: Install and maintain batteries

Performance Criteria

3.72 Batteries and fixtures are positioned and secured in accordance with job instructions, specifications and statutory requirements.

3.73 Battery cells are filled with electrolyte in accordance with manufacturer's specifications.

3.74 Work is performed in accordance with safe work procedures.

3.75 Battery condition is checked for defects according to maintenance procedures.

3.76 Defective batteries or cells are reported and recorded, when necessary, according to worksite standards.

Element 4: Complete work

Performance Criteria

4.1 Work area is restored to serviceable condition as per statutory requirements.

4.2 Report, documentation and drawings are completed and returned according to worksite procedures.

4.3 Completion of task is reported according to worksite procedures.

4.4 Surplus materials are stored safely as per worksite procedures.

4.5 Disposal of scrap materials is disposed as per environmental requirement.

Install medium voltage transformers – Unit ID: EE309

Element 1: Plan to install Medium Voltage transformers

Performance Criteria

1.98 Tasks are interpreted and sequence of operation is determined according to job instructions.

1.99 Hazard Identification and Risk Assessment (HIRA) is carried out.

1.100 Drawings and documentation are acquired as per job requirements.

1.101 Tools and materials required for installing Medium Voltage transformers were identified and available for use according to job requirements.

1.102 Affected parties are liaised with and informed according to worksite procedures.

1.103 All mechanical aids for handling and/or lifting transformers are identified and arranged as per job requirements.

Element 2: Prepare to install Medium Voltage transformers

Performance Criteria

2.76 Point of installation is identified in accordance with work instructions, drawings and/or plans.

2.77 Work area and transformer are inspected and prepared for installation according to work site requirements.

2.78 Authorisation is obtained according to worksite procedures.

2.4 Working area is secured according to safety risk assessment requirements (barricades, tapes and warning signs).

2.5 Obstacles and safety hazards are identified and necessary precautions are taken according to safe work procedures.

Element 3: Install Medium Voltage transformers

Performance Criteria

3.1 The transformer is positioned according to work instructions and/or drawings.

3.2 The transformer is secured according to work instructions.

3.3 Terminations and connections are tightened according to manufacturer's specifications and all covers and guards are secured according to work place requirements and standards.

3.4 Tools and equipment are used safely to meet the requirements of the job.

3.5 Personal protective equipment is used and site specific procedures are adhered to throughout the installing process according to safe work procedures.

Element 4: Complete the installation of Medium Voltage transformers

Performance Criteria

4.1 The landscape is rebuilt and reinstated in accordance with work site procedures and housekeeping standards.

4.2 Work area is cleaned after completion of task in accordance with work site procedures and housekeeping standards.

4.3 Waste materials are disposed of in accordance with safety standards and environmental requirements.

4.4 Necessary documentation is completed and submitted as per local data management systems.

Install, maintain and repair photovoltaic system – Unit ID: EE310

Element 1: Install photovoltaic systems

Performance Criteria

1.1 Job instructions are obtained and the sequence of the task is planned in accordance with accepted worksite procedures.

1.2 Test and measuring instruments equipment, hand tools and material are selected and examined according to task and worksite procedures.

1.3 Safety procedures are followed as per statutory requirements.

1.4 The required personal protective equipment is selected, examined and used in a manner that protects the individual in accordance with workplace procedures.

1.5 Hazardous and associated risks directly related to the installation of photovoltaic systems are identified and addressed in accordance with specifications requirements and work site requirements.

1.6 Photovoltaic components are confirmed and tested according to statutory requirements.

1.7 Photovoltaic systems are installed according to worksite procedures and statutory requirements.

Element 2: Prepare to maintain a photovoltaic supplied system

Performance Criteria

2.1 Electrical layout and wiring diagrams are obtained as per job instructions.

2.2 Isolation points of industrial electrical circuits are identified as per circuit diagrams.

2.3 Isolation carried out safely as per worksite procedures.

2.4 Safe isolation of electrical circuits verified against job instructions and safe worksite procedures.

2.5 Safety and or security lockout systems applied according to worksite procedures and safety practices.

2.6 Warning signs are displayed as per worksite procedures.

Element 3: Maintain a photovoltaic system

Performance Criteria

3.1 Safety equipment is selected and used according to statutory requirements.

3.2 Testing instruments, tools, drawings, equipment, materials and components are selected according to job and statutory requirements.

3.3 Photovoltaic systems are correctly identified and selected according to schedule or work instruction.

3.4 Photovoltaic systems are safely maintained according to statutory requirements to prevent breakdowns and loss of operation or service.

Element 4: Fault Find and repair photovoltaic system

Performance Criteria

5.1 Sequence of operation is determined as per job instructions.

5.2 Safety equipment is selected according to statutory requirements.

5.3 Test instruments and tools are selected according to job instructions and statutory requirements.

5.4 Photovoltaic system operation is observed and circuit diagrams interpreted to identify possible causes of faults in accordance with manufacturer's specifications.

5.5 Fault finding is done by making use of methods according to fault finding techniques.

5.6 Fault finding results are recorded and reported according to worksite procedures.

5.7 Tools, equipment, materials and components to rectify faults are selected according to job requirements and worksite procedures.

5.8 Faults are safely repaired according to worksite procedures and statutory requirements.

Element 5: Complete the work

Performance Criteria

5.1 Work area is cleaned on completion of the task according to housekeeping requirements.

5.2 Waste materials disposed of according to site specific standards, procedures and environmental policies.

5.3 Photovoltaic systems are re-commissioned on completion of task as per worksite procedures.

5.4 Quality checks conducted and corrective action taken where required as per worksite procedures.

5.5 Lockout devices and warning signs are removed.
5.6 Job cards and or work orders and check sheets are completed and maintenance reports are submitted as per worksite procedures.

Install, maintain and repair low-voltage AC rotating machines and control gear – Unit ID: EE311

Element 1: Plan and prepare for the work task

Performance Criteria

1.104 Job instructions are obtained and the sequence of the task is planned in accordance with accepted worksite procedures.

1.105 Test and measuring instruments equipment, hand tools and material are selected and examined according to task and worksite procedures.

1.106 Low voltage AC machines and control gear are selected and tested according to statutory requirements.

1.107 Safety procedures are followed as per statutory requirements.

1.108 The required personal protective equipment is selected, examined and used in a manner that protects the individual in accordance with workplace procedures.

Element 2: Install low voltage rotating machines and control gear

Performance Criteria

2.7 The worksite is examined for hazardous and sub-standard conditions and corrective action taken where necessary according to safe worksite procedures and critical task analysis.

2.8 Hazardous and associated risk directly related to the installation of low voltage rotating machines and control gear is identified and addressed in accordance with specifications requirements.

2.9 Single phase AC rotating machines and control gear are installed according to worksite procedures and statutory requirements.

2.10 Three phase AC rotating machines and control gear are installed according to worksite procedures and statutory requirements.

2.11 Tools are used to meet the job requirement.

Element 3: Connect low voltage rotating machines and control gear

Performance Criteria

5.9 Tools are used without injury to self and others according to job requirement.

5.10 Personal protective equipment is used in a manner that protects the individual in accordance with specified requirements.

5.11 Single phase AC rotating machines and control gear are connected according to electrical diagrams, worksite procedures and statutory requirements.

5.12 Three phase AC rotating machines and control gear are connected according to electrical diagrams, worksite procedures and statutory requirements.

5.13 Connections are mechanically sound and electrical integrity is adhered to according to worksite procedures.

5.14 Hazards and risks directly related to the connecting of low voltage AC machines and control gear are identified and addressed before, during and after in accordance with worksite procedures.

5.15 Safety and environmentally practices are followed before, during and after maintenance and repair activities according to statutory and worksite requirements.

Element 4: Maintenance of low voltage AC rotating machines and control gear

Performance Criteria

4.1 Ensures that the affected section of the electrical reticulation network is isolated, earthed and work permit/worker's register is received for the affected section of the network according to operating procedures where necessary.

4.2 The work site conditions and affected electrical hardware/equipment are assessed for possible safety risks and preventative measures implemented according to safety risk assessment procedures.

4.3 The affected section of the electrical low voltage AC machine is visually inspected prior to maintenance and repaired according prescribed fault-finding procedures.

4.4 Pre-maintenance tests are carried out and recorded according to worksite and statutory requirements.

4.5 The electrical hardware and equipment is maintained, repaired or replaced according to applicable maintenance procedures or manufacturer's specifications.

4.5 The maintained or replaced electrical hardware and equipment is inspected and tested to ensure that it is operational according to manufacturer's requirements.

4.6 Safety precautions/procedures are followed before, during and after inspection and maintenance of the low voltage AC rotating machines or equipment

4.5 Final testing is carried out and documentation is completed in according with specified requirements.

4.6 Non-conformances are identified and rectified in accordance to accepted best practices.

Element 5: Complete the work

Performance Criteria

5.1 Tools, material and equipment used are dealt with in accordance with specified requirements.

5.2 The workplace is cleaned to comply with specified housekeeping practices.

5.3 Report on work performed is complete and complies with specified requirements.

Install, test, and maintain single and three-phase domestic and commercial installations – Unit ID: E312

Element 1: Plan and prepare for the electrical installation to be done

Performance Criteria

1.109 Job instructions are interpreted and sequence of operations is determined according to the installation environment and the required task.

1.110 Tools, equipment and instruments are selected to meet the requirements of the task according to statutory and environmental requirements.

1.111 The documentation necessary to complete the task is obtained as per data management requirements.

1.112 Safety rules and regulations are followed as per statutory requirements and safe working procedures.

1.113 Environmental hazards and safety risks are identified according to environmental standards and safety risks analysis.

Element 2: Carrying out electrical installation

Performance Criteria

2.1 Hazard Identification and Risk Assessment (HIRA) is carried out

2.2 Components are assembled as per the given task

2.3 Statutory regulations and standards adhered to.

2.4 Integrity of connections is checked/verified

Element 3: Perform electrical tests on the installation

Performance Criteria

5.16 Installation is tested as per statutory requirements from SZNS SANS 10142 code.

5.17 Documentation is completed as per data management requirements.

5.18 Test instruments are used to obtain readings in accordance with statutory requirements.

5.19 Measurements obtained from the test are interpreted as per SZNS SANS 10142 requirements.

5.20 All safety precautions are observed and demonstrated during the test as per safe work procedures.

Element 4: Maintain electrical installations

Performance Criteria

5.6All safety requirements are observed and demonstrated during maintenance as per safe working procedures.

5.7All maintenance activities are carried according to specific procedures

Element 5: Complete the required task documentation

Performance Criteria

6.1All personnel, tools, Instruments and excess equipment are removed from the installation according to work site procedures.

6.2The work area is restored to its original condition on completion of the test and inspection procedures as per safety requirements.

6.3The certificate of compliance completed according to SZNS SANS 10142 requirement.

6.4The results of the inspection and test are communicated to all concerned according to reporting procedures.

6.5A defect list is compiled and corrective action taken, if necessary, as per quality requirements.

Maintain and repair the electric fence system – Unit ID: EE313

Element 1: Plan and Prepare to maintain electric fence system

Performance Criteria

2.5 Authorisation is obtained according to high voltage permit system.

2.6 Documentation is obtained according to work site procedures.

2.7 All materials required for maintenance are selected and obtained according to work site procedures.

2.8 Tools and test instruments are identified and selected to meet the requirements of the task.

2.9 All statutory requirements are being met.

Element 2: Inspect and clean electric fence system

Performance Criteria

2.12 Printed circuit boards and enclosures are inspected for cleanliness; faulty components and defects are recorded.

2.13 Electric fence components are inspected for defects according to manufacturer's specification and defects are recorded.

2.14 Electric fence conductors and terminations are inspected for hot and loose connections, discoloured connections and defects are recorded.

2.15 Electric fence system components are inspected for sustainable alarm conditions and defects are recorded.

Element 3: Repair, replace and rectify defects on electric fence system

Performance Criteria

5.21 Appropriate tools are used to meet the requirements of the task according to statutory requirements.

5.22 All faulty components are identified.

5.23 Identified faulty components are removed and replaced with correct specification components in line with manufacturer's specifications and safety standards.

5.24 Modules are calibrated according to manufacturer's specifications.

Element 4: Re-commission and complete work on electric fence system

Performance Criteria

4.1 Appropriate tools are used to meet the requirements of the task according to statutory requirements.

4.2 Electric fence is inspected according to drawings.

4.3 Module settings and alarms are verified according to manufacturer's specifications.

4.4 Electric fence operation and functionality are tested for correct operation according to manufacturer's specification and deviations are repaired and reported.

4.5 Appropriate tools and test instruments are cared for and stored according to work site procedures.

4.6 Completion of the task is reported according to work site procedures.

Maintain and repair medium voltage AC rotating machines and control gear – Unit ID: EE314

Element 1: Prepare to maintain and repair medium voltage AC rotating machines and control gear

Performance Criteria

2.10 Job instructions are obtained and the sequence of the task is planned in accordance with accepted worksite procedures.

2.11 Test and measuring instruments equipment, hand tools and material are selected and examined according to task and worksite procedures.

2.12 Medium voltage AC machines and control gear are selected and tested according to statutory requirements.

2.13 Safety procedures are followed as per statutory requirements.

2.14 The required personal protective equipment is selected, examined and used in a manner that protects the individual in accordance with workplace procedures.

Element 2: Maintain and repair medium AC rotating machines and control gear

Performance Criteria

2.16 The worksite is examined for hazardous and sub-standard conditions and corrective action taken where necessary according to safe worksite procedures and critical task analysis.

2.17 Hazardous and associated risk directly related to the maintenance of medium voltage AC rotating machines and control gear is identified and addressed in accordance with specifications requirements.

2.18 Isolation and lockout procedures are adhered to according to medium voltage safe working practices and worksite requirements.

2.19 Medium voltage AC rotating machines and control gear are maintained according to instructions, worksite procedures and statutory requirements.

2.20 Safety equipment, procedures and environmental practices are followed before, during and after the maintenance and repair activities according to worksite procedures.

2.21 Tools are used to meet the job requirement.

Element 3: Test the medium voltage rotating machines and control gear for operation

Performance Criteria

5.25 Tools are used without injury to self and others according to job requirement.

5.26 Personal protective equipment is used in a manner that protects the individual in accordance with specified requirements.

5.27 Medium voltage AC rotating machine and control gear are tested according to electrical diagrams, worksite procedures and statutory requirements.

5.28 Connections are mechanically sound and electrical integrity is adhered to according to worksite procedures.

5.29 Hazards and risks directly related to the connecting of medium voltage AC machines and control gear is identified and addressed in accordance with worksite procedures.

5.30 Safety and environmentally practices are followed before, during and after maintenance and repair activities according to statutory and worksite requirements.

Element 4: Complete the work task

Performance Criteria

4.1 Test and measuring equipment and hand tools are cleaned and stored as per worksite requirements.

4.2 The workplace is cleaned to comply with specified housekeeping practices.

4.3 Report on work performed is completed and complies with specified requirements.

Join and terminate medium voltage cables – Unit ID: EE409 (Optional)

Element 1: Plan to join and terminate Medium Voltage cables

Range

Materials may include but are not limited to Medium Voltage cables, solid or stranded conductors, glands, lugs, ferrules, insulation, various metals and jointing and termination kits.

Tests on medium voltage cables are limited to phasing, continuity, short circuit, earth resistance, and high resistance.

Statutory requirements include but are not limited to OHS Act, SZNS SANS, Authority requirements, manufacturer's specifications and worksite procedures.

Specialised tools to be used for Medium Voltage cable joints and terminations may include but not limited to blow torch, hydraulic cable cutters/crimpers and special joining kits as per joining and termination requirements.

Medium Voltage cables may include but are not limited to lead sheath (paper insulated), PVC, XPLE and PILC types.

Performance Criteria

2.15 Task details are determined according to fault reports or instructions.

2.16 Appropriate drawings and documentation are acquired in accordance with job specifications.

2.17 Materials are selected according to job requirements.

2.18 Applicable test equipment is selected and checked for functionality.

2.19 Appropriate tools are selected according to job requirements.

2.20 Relevant parties are liaised with and notified according to worksite procedures.

Element 2: Prepare the Medium Voltage cable and work area

Performance Criteria

2.22 The correct cable is identified and selected according to drawings and reticulation diagrams.

2.23 Isolation of the circuit is confirmed and permit is obtained according to operating regulations and worksite procedures if required.

2.24 The cable to be worked on is confirmed to be at zero potential and made safe as per safety standards, procedures and work requirements.

2.25 Safety of the work area is ensured according to statutory requirements and safe work procedures (barricading/shoring).

Element 3: Join, terminate and test for completeness of Medium Voltage cable

Performance Criteria

5.31 Applicable tools and equipment are selected and used safely to meet the requirements of the job.

5.32 Cable ends are discharged, visually phased and prepared for joining or terminating according to work and kit instructions.

5.33 Cable cores are joined or terminated according to work instructions and standards.

5.34 The cable joint or termination is tested for completeness as per work instructions and standards.

Element 4: Complete the work task

Performance Criteria

4.30 The work permit is cleared according to operating regulations and worksite procedures if required.

4.31 Work area is restored in accordance with relevant environmental standards.

4.32 Applicable tools and equipment are cleaned and stored according to statutory requirements.

4.33 Documentation is completed and submitted according to data management procedures.

Test and inspect a three-phase industrial/commercial installation – Unit ID: EE412 (Optional)

Element 1: Plan the electrical installation tests to be done

Range

Three phase commercial and or industrial installations may include but not limited to office buildings, factories, shops and townhouse complexes and such, where the supply to the premises is three phase in both rural and urban environments.

Test equipment may include but not limited to multi-meters, insulation tester, clip on ammeter, impedance testing equipment, earth leakage testing devices, earth electrode resistance testing equipment, continuity testers, phase rotation meters and any others appropriate to three phase industrial and or commercial installations.

Inspection documents may include but not limited to, check lists, records, installation schedules, electrical drawings, plans and circuit diagrams.

Performance Criteria

2.21 Job instructions are interpreted and sequences of operations are determined according to the installation environment and the required task.

2.22 Tools, equipment and instruments are identified and selected to meet the requirements of the tasks according to statutory and environmental requirements.

2.23 The documentation necessary to complete the task obtained as per data management requirements.

2.24 The safety rules and regulations regarding the task understood according to statutory requirements and safe work procedures.

2.25 Environmental hazards and safety risks are identified according to environmental standards and safety risk analyses.

Element 2: Inspect the electrical installation

Performance Criteria

2.26 The installation inspected for compliance according to statutory and environmental requirements.

2.27 Documentation for the type of installation completed as per data management system requirements.

2.28 Non-compliant components within the installation are identified and understood in relation with the wiring code requirements.

2.29 All safety requirements are observed during the inspection as per industry standards.

Element 3: Test the electrical installation

Performance Criteria

5.35 Permission obtained to carry out task as per local authorisation procedures.

5.36 Installation tested according to the statutory requirements from the wiring code.

5.37 Documentation completed as per data management system requirements.

5.38 Test instruments used competently to obtain meaningful readings.

5.39 The measurements obtained from the test understood and demonstrated in context with the wiring code specifications.

5.40 All safety precautions are observed and demonstrated during the test as per safe work procedures.

Element 4: Complete the required test and inspection documentation.

Performance Criteria

4.34 All personnel, tools, instruments and access equipment are removed from the installation as per safe work site and safe work procedures.

4.35 The work area restored to its original condition and safe for use as per industry requirements.

4.36 The results of the inspection and test are communicated and processed as per data management system requirements.

4.37 A report and where necessary, a defect list is compiled on the inspection and test as per industry requirements.

FIFTH-YEAR

Repair and maintain electrical power tools and appliances – Unit ID: EE315

Element 1: Plan to repair and maintain electric power tools

Performance Criteria

2.26 Job instructions are interpreted and frequency or sequence of operation is determined.

2.27 Engineering tools are selected to meet the requirements of the task and according to statutory requirements.

2.28 Safety procedures related to job requirement and worksite procedures are obtained.

2.29 Hazard Identification and Risk Assessment is carried out.

Element 2: Prepare to repair and maintain electric power tools

Performance Criteria

2.30 All necessary tests instruments are selected and checked for functionality and calibration validity as per manufacturer's specifications.

2.31 Manufacturer's manuals, drawings and diagrams are selected as per job requirements.

2.32 Fixed power tools to be repaired or maintained is isolated and locked out according to safety, statutory requirements, and worksite procedures.

2.33 Work area is prepared for fault testing, repairs or maintenance on portable or fixed power tools according to worksite procedures.

2.34 Personal protective equipment is selected, examined and used in a manner that protects the individual and others within the worksite.

Element 3: Testing and fault finding is carried out on electrical power tools

Performance Criteria

5.41 Test equipment is used safely during fault finding as per worksite standards and procedures.

5.42 Power tools are stripped to carry out further internal testing and fault finding.

5.43 Manufacturer's manuals, drawings and diagrams are interpreted or used during fault finding and analysis.

5.44 Faulty components are identified for repair or replacement as per manufacturer's specifications.

5.45 Supply leads are checked for damage

Element 4: Repair and maintain electric power tools

Performance Criteria

4.1 Faulty components are removed for repairs or replacement as manufacturer's requirements.

4.3 Fixed power tools are inspected and checked, for wear and tear as per manufacturer's specifications.

4.4 Portable power tools are inspected and checked, for wear and tear as per manufacturer's specifications.

4.5 Supply leads are replaced or repaired, if necessary, as per SANS 10142 requirements.

Element 5: Complete repairs and maintenance to electric power tools

Performance Criteria

5.1 Safety, good housekeeping, and environmental practices are followed before, during and after performance.

5.2 Hand tools and test instruments are cleaned and safely stored as per worksite procedures.

5.3 Waste materials and faulty components are disposed of according to environmental requirements.

5.4 All documentation and reports are completed as per worksite procedures.

Use and care for electrical measuring and testing instruments – Unit ID: EE316

Element 1: Fixed electrical measuring instruments are identified and read.

Performance Criteria

2.30 Job instructions are interpreted and sequence of operation determined.

2.31 Fixed electrical measuring instruments identified according to worksite procedures.

2.32 Unsafe and faulty measuring instruments are identified visually and marked for repairs.

2.33 Fixed electrical measuring instruments are read and readings recorded as per worksite procedures.

Element 2: Select portable electrical measuring instruments

Performance Criteria

2.35 Job instructions are interpreted and sequence of operation is determined.

2.36 Instruments are checked for calibration validity.

2.37 Portable measuring instruments are selected to meet safety and job requirements.

2.38 Unsafe and faulty test instruments are identified and marked for repair or replacement.

2.39 Portable electrical measuring instruments is checked for operation and functionality.

Element 3: Use and interpret portable electrical measuring instruments readings

Performance Criteria

3.1 Measuring instruments are set up for the application.

3.2 Results are recorded as per worksite procedures.

3.3 Results are analysed as per worksite procedures and manufacturer's specifications.

3.4 Conclusions are drawn and corrective action taken based on the analysed results as per worksite procedures.

Element 4: Care for portable electrical measuring instruments

4.1 Electrical measuring instruments are handled in accordance with their specifications.

4.2 Electrical measuring instruments are applied to circuits and equipment when testing as per manufacturer's specifications.

4.3 Multimeters are set up for the function and scale of measurement in accordance with manufacturer's specifications.

4.4 Measuring instruments are placed and stored in accordance with manufacturer's specifications and worksite procedures.

Apply the principles of energy saving – Unit ID: EE401 (Optional)

Range:

Energy saving devices refer to but are not limited to lights, refrigerators, batteries, cabling, etc.

Element 1: Understand and select energy saving devices.
Performance Criteria

2.34 Energy saving devices are identified, selected and described as per specified requirements.

2.35 The potential saving introduced by each type of device is explained with reference to the different types, models, and design specifications.

2.36 The potential saving introduced by each type of device is quantified with reference to the different types, models, and design specifications.

Element 2: Understand the importance of system design.
Performance Criteria

2.1 The principles of energy savings are explained as per specified requirements.

2.2 Energy losses in the system through incorrect selection of system components is explained as per environmental and energy efficiency policies.

2.3 Energy losses in the system through incorrect selection of cabling are explained with reference to the consequences of inefficient operation.

2.4 The most efficient system components are identified and described as per local applications.

2.5 The correct cable sizes are determined and the reason for its selection explained as per local application requirements.

Element 3: Carry out electrical energy audit.

Performance Criteria

2.40 The ratings of appliances are determined and explained as per audit requirements.

2.41 The period of use of an appliance is estimated and explained as per audit requirements.

2.42 The energy consumption of each appliance is determined in kilowatt-hours as per audit requirements.

2.43 An energy audit table is compiled, and the total energy consumption determined as per audit requirements.

2.44 Findings and recommendations are made based on the energy audit table.

Element 4: Implement power factor correction.

Performance Criteria

4.1 The principles of phase shift are explained as per specified requirements.

4.2 The effects of capacitive loads and inductive loads on phase shift are explained as per AC theory principles.

4.3 Power factor correction devices are identified and described as per industry applications.

4.4 The power factor of installation is determined as per AC theory principles.

4.5 The correct capacitor rating for the optimum power factor is calculated as per standards and local requirements.

4.6 The principles behind step controllers are understood and described as per installation and energy management policies.

4.7 Power factor correction is implemented as per energy management policies.

Element 5: Complete work task

Performance Criteria

5.1 Work area is cleaned after completing the task according to housekeeping standards.

5.2 Waste materials are disposed of according to workplace requirement and or environmental procedures or policies.

5.3 Tools and equipment are cleaned and stored as per worksite procedures.

5.4 Documentation is completed and submitted as per worksite procedures.

Carry out work on energised low and medium voltage networks – Unit ID: EE402 (Optional)

Element 1: Prepare to work on energised low and medium voltage networks

Range

The range of this unit standard includes, but is not limited to insulated gloving and tapping method used in energised low and medium voltage substations/lines.

Maintenance of but not limited to overhead and underground network, protection panels, switch rooms, transformers, motor control centres.

Dropout fuse base unit, isolating links and air-break switches; insulators (pin and straining); poles and cross-arms; line hardware; Jumpers; repair of Jumper and fraying conductors; repair and replacement of earth conductors; Crimping of conductors; installation of stays and stay insulators; tree trimming; service connections; removal and replacement of re-closer and sectionalisers; pole top inspection; rectification of basic insulation levels.

Safety equipment include but are not limited to approved and relevant line covers/blankets, work at height protective equipment (includes full body harness, safety-and work positioning lanyards, rescue equipment and rope grab systems), safety glasses, rubber gloves/sleeves, ladders, platforms, insulating sticks, overhauls, hard hats, safety shoes and arc flash protective clothing.

Lifting equipment may include but, are not limited to aerial devices, pedestal mounted ladders, nylon strap hoists, rope blocks and lifting tackle.

Test equipment for work on energised circuits may include, but are not limited to multi-meters, ammeters, insulation resistance testers, infra-red detectors voltage detectors and stick testers.

Performance Criteria

2.37 Job instructions are obtained and the section of electrical network to be inspected/maintained/repaired is identified according to geographical/electrical network diagrams.

2.38 Task instructions are correctly interpreted and a sequence of operation is planned.

2.39 Handout of the affected section of the network is arranged according to job instructions/maintenance schedules or breakdown reports where necessary.

2.40 Applicable hand tools and safety equipment is inspected for availability and functionality prior to use.

2.41 Insulated/insulating equipment for work on energised circuits is inspected, defects are corrected and transported in accordance with energised work standards and procedures.

Element 2: Carry out work on energised low and medium voltage networks
Performance Criteria

2.40 Handout of the affected section of the network is received according to job instructions/maintenance schedules or breakdown reports where necessary.

2.41 Pre-task risk assessment is carried out.

2.42 Hazard Identification and Risk Assessment (HIRA) is carried out and permit is obtained from relevant authorities.

2.43 Work area/structure configuration is assessed to identify the specific tools and equipment required for the effective and safe execution of the task.

2.44 Maintenance/repairs on low and medium voltage networks are carried out in accordance with the relevant live work standards/work procedures.

2.45 Safety precautions/procedures are followed before, during and after inspection and testing of installation.

Element 3: Complete the work task

Performance Criteria

3.1 The affected section of the network is handed back to the Control Officer according to operating regulations for low and medium voltage systems.

3.2 Tools insulated/insulating equipment s inspected, cleaned and stored in accordance with relevant standards and procedures.

3.3 Appropriate lifting equipment/machines are inspected, cleaned and stored according to statutory requirements and relevant standards/procedures.

3.4 Documentation is completed and submitted according to data management procedures.

Issue certificate of compliance for domestic, commercial and industrial installation – Unit ID: EE403 (Optional)

Element 1: Plan work task

Performance Criteria

2.42 Job instructions are interpreted and a sequence of operations is determined.

2.43 Appropriate tools, equipment and instruments are identified and selected to meet the requirements.

2.44 Correct documentation necessary to complete the task is acquired

2.45 Applicable safety rules and regulations are identified for application.

Element 2: Conduct visual inspection of the installation

Performance Criteria

3.1 Installation is inspected to ensure conformance to statutory requirements.

3.2 Relevant documentation is completed to accurately reflect the features of the installation.

3.3 Inspection observations are consistent with the relevant standards.

3.4 Compliance with Occupational Health and Safety Act is verified.

3.5 Compliance with SZNS SANS 10142-1/2 is verified.

Element 3: Test the installation

Performance Criteria

3.1 Permission is obtained to carry out task according to instructions.

3.2 Installation is tested according to requirements.

3.3 Relevant documentation is completed to capture the features of the installation.

3.4 Appropriate test instruments are used to acquire relevant readings.

3.5 The values of test readings are recorded and analysed for conformance.

3.6 Compliance with Occupational Health and Safety Act is assured.

Element 4: Complete work task

Performance Criteria

4.38 Site specific safety procedures are adhered to throughout testing and inspecting procedures.

4.39 Work area is restored to original condition.

4.40 Applicable documentation is completed according to statutory requirements.

4.41 Relevant parties informed of outcome of verification.

Job completion is reported and documents/certificates submitted to the authority.

Demonstrate an understanding of programmable logic controllers – Unit ID: EE404 (Optional)

Element 1: Demonstrate an understanding of the input/output peripherals.

Performance Criteria

2.46 The correct peripheral is identified (input/output, discrete, digital, analogue, intelligent).

2.47 The manuals/specifications and drawings are selected according to the peripheral.

2.48 Hazards associated with the use of are recognised and necessary precautions taken according to work site procedures.

2.49 The correct operation of the peripheral device must be demonstrated.

2.50 The peripherals are correctly removed and replaced according to manufactures specifications.

Element 2: Demonstrate an understanding of field devices interfaced to programmable logic controllers.

Performance Criteria

2.46 The correct field device is identified (pushbuttons, limits, level, pressure devices).

2.47 The operation of the field device is verified.

2.48 The field device is correctly connected to the appropriate peripheral.

2.49 Personal safety equipment is selected according to activity requirement.

Element 3: Demonstrate an understanding of the processor in a programmable logic controller.

Performance Criteria

5.46 The functions of the indicator lights of the processor are explained.

5.47 The battery of the processor is correctly identified, removed & replaced according to manufactures specifications.

5.48 Faults are correctly diagnosed by utilising the indicator lights.

5.49 The processor mode switch is correctly identified and utilized according to the task instruction

5.50 Communication status indicators are correctly identified and the status correctly explained.

Element 4: Demonstrate an understanding of the back plane and power supply of a programmable logic controller.

Performance Criteria

4.1 Placement of the programmable logic peripherals and processor on the back plane are correct according to the address structure of the back plane.

4.2 Correct addressing modes are selected on the back plane for the peripheral modules selected.

4.3 Correct insertion of the power supply is carried out according to manufactures specifications.

4.4 Correct connections for redundant power supply have been made.

Element 5: Demonstrate understanding of programmable process communication

Performance Criteria

5.1. Handheld or programming terminal must be correctly connected to the processor.

5.2. Communication between the programmer and the processor must be established.

5.3 The correct sequence must be used to monitor on-line the programme that resides in the processor.

5.4 Demonstrate understanding of the functioning of basic instructions in a PLC system.

5.5 Opening procedures for programmable software for computer based systems and/or industrial programmers are carried out.

5.6 Updating existing program of a controller is carried out.

Element 6: Design process and or machine control solutions using PLCs

Performance Criteria

Range: hardware components include but not limited to, PCs, PLCs, sensors, actuators, HMIs

6.1Demonstrate understanding of information required to program and commission a programmable logic controller.

6.2Hardware components are connected based on the application.

6.3Methods and programming languages are selected and applied.

6.4Instructions are written, and simulations are carried out.

6.5Troubleshooting using software and PLC indicator lights is carried out.

Element 7: Complete work task

Performance Criteria

6.1Work area is cleaned after completing the task according to housekeeping standards.

6.2 Waste materials are disposed of according to workplace requirement and or environmental procedures or policies.

6.3Tools and equipment are cleaned and stored as per worksite procedures.

6.4Documentation is completed and submitted as per worksite procedures.

Design and construct a three-phase circuits – Unit ID: EE405 (Optional)

Element 1: Design a three-phase Circuit diagram.

Performance Criteria

1.1 Instructions are interpreted according to work site procedures.

1.2 Symbols used conform to certified engineering standards.

1.3 The function of each component is understood and described correctly.

1.4 Circuit diagrams are designed neatly and symmetrically according to instructions.

1.5 Circuit diagrams are evaluated for functionality according to instructions.

Element 2: Construct three phase circuits.

Performance Criteria

2.1 Relevant components are obtained according to the designed circuit diagram.

2.2 Components are installed and correctly connected according to designed circuit diagram.

2.3 Circuit is correctly connected to the power supply according to statutory requirements.

2.4 The circuit is evaluated to ensure correct operation and shortcomings addressed according to instructions.

Element 3: Complete the work task.

Range

Written data, records, electronic data, test or inspection reports

Performance Criteria

3.1 Work area is cleaned in accordance with house-keeping standards.

3.2 Ensure that tools are stored in their correct place in a accordance with work place practices and manufacturers specifications.

3.3 Waste materials are disposed of according to work site procedures and statutory requirements and environmental standards.

3.4 Documentation is completed in detail and submitted to meet work site standards and procedures.

Produce business plans for a new venture – Unit ID: EE413 (Optional)

Element 1: Identify, gather and analyse the relevant information needed to compile a plan for a new business venture

Performance Criteria

2.51 The purpose and importance of a business plan is discussed in terms of its contribution to a successful business.

2.52 The different elements of a successful business plan are listed and described with examples.

2.53 Information on the resources needed and procedures to be followed to achieve the plan is compiled.

2.54 The industry specific and legal requirements for own venture are identified and explained in terms of how they will affect the venture.

Element 2: Formulate an ethical framework for the operational plans of a venture

Performance Criteria

2.50 Legislation and relevant regulations relating to the type of venture are identified for use in drawing up a code of ethics for the business.

2.51 Non-statutory regulations applicable to the sector are identified and used for use in drawing up a code of ethics for the business

2.52 Codes of conduct that are used by similar organizations in the sector are evaluated and elements identified for inclusion in an ethical framework for the business.

2.4 Social and ethnic considerations are identified for inclusion in the ethical framework of a new venture.

2.5 Personal values are identified for modifying an ethical framework for a new venture.

2.6 An ethical framework and codes of ethics and conduct are drawn up for the new venture.

Element 3: Establish and prioritise business, financial and/or operations goals and objectives for a new venture

Performance Criteria

3.1 Personal objectives are clearly articulated and aligned to the plans of own venture.

3.2 Business objectives are analysed and specific goals formulated to achieve objectives set for own business.

3.3 A vision statement of a new venture is compiled to represent goals and objectives set out for own venture.

3.4 Specific short- and long-term goals are formulated allowing flexibility for possible changing circumstances.

3.5 Possible contribution to community and regional growth objectives are identified and considered.

3.6 Cultural values and beliefs of prospective employees and expected consumers are incorporated into the plans of own venture.

Element 4: Design and present business, financial and/or marketing plans based on a budget for a new venture

Performance Criteria

4.1 The business of the venture is introduced and described based on research and analyses of competitors.

4.2 Structure and layout of the business plan is designed to be compatible with the nature of own venture.

4.3 Marketing and promotion of the own venture is concisely presented in the business plan.

4.4 Finance requirements for the business are stated in the business plan.

4.5 The projected income and expense items for own venture are tabulated in the business plan.

4.6 The costs, risks and proposed infrastructure of the operations plan is presented in the business plan of own venture.

4.7 Relevant documentation is compiled to support the business plan.

4.8 Business plan information is presented in relevant and clear format.

4.9 Procedures to present the business plan for own venture to a financier is explained.

Manage work time efficiently – Unit ID: EE416 (Optional)

Element 1: Demonstrate understanding of the concept "time management in a 24 hour day world.

Performance Criteria

2.55 The different concepts used in the external environment to measure are listed.

2.56 The concept time management is explained in the learner's own words.

2.57 The importance of time management in the work environment is debated.

Element 2: Describe the difference between urgent and important prioritising daily activities

Performance Criteria

2.53 Typical daily activities in the workplace are listed and ranked according to urgency and importance.

2.54 The listed activities are used to plan a typical day in the workplace.

Element 3: Estimate time spent on a task and draw up a general day, week and month planner to manage time effectively

Performance Criteria

3.1 Estimated time spent on each task is allocated to different activities.

3.2 A general day, week and month planner is drawn up.

3.3 Provision is made for unexpected incidents and crises management.