

Curriculum For Electric Motor Winder

(Certificate Level- 6 months)



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Overall objective of the course

To facilitate basic learners , having middle level qualification and those who have working experience without certification to get sufficient knowledge and improvement in their professional attitude.

Competencies gained after completion of the course

After successful completion of the course, the learners will get the following competencies in particular:

- The general communication skills, health and safety requirements at work place and also build the essential basic electrical knowledge to get familiarize with electrostatics and electromagnetic.
- Preliminary inspection and estimate preparation for electrical machine's winding and rewinding.
- Fault analysis, perform winding and conduct final testing/commissioning of wound / re-wound motors and generators.

Job Opportunities available immediately and in future

- Original Equipment manufacturers (Siemens, PEL, Climax, Heavy Electrical Complex etc).
- All medium and large scale Industries supported by Electrical Maintenance departments (PMTF, Pak Steel, HMC, PECO etc.).
- Besides of all above, the Certified Electric Motor Winder will set his own business by opening own workshop.

Overview about the program – Curriculum for Electric Motor Winder

| Module Title and Aim | Learning Units | Theory hours | Workplace hours |
|--|---|-----------------|------------------|
| <p>Module 1: Basic Concept of Electricity</p> <p>Aim: This module covers the competencies required to build the general communication skills, health and safety requirements at work place and also build the essential basic electrical knowledge to get familiarize with electrostatics and electromagnetics.</p> | <p>LU-1 Participate in work place communication</p> <p>LU-2 Work in a team environment</p> <p>LU-3 Practice occupational health and safety</p> <p>LU-4 Practice general workshop rules and regulations</p> <p>LU-5 Identify, use and care of tools and equipments</p> <p>LU-6 Draw and perform essential electric circuits</p> <p>LU-7 Understand basic electrical concepts and principles</p> <p>LU-8 Making Joints / Splices</p> <p>LU-9 Familiar with different types of electrical and mechanical faults in electrical machines</p> | <p>40 hours</p> | <p>160 hours</p> |

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| <p>Module 2: Inspection and Estimation</p> <p>Aim: This module covers the competencies required to inspect the electric machine to be re-wound by checking it for any visible damage, defect, missing accessories, valid warranty etc where applicable. Prepare reasonable and market based competitive estimation conforming to standards, regulations and acceptable to customers.</p> | <p>LU-1 Collect information from customer for machine defect.</p> <p>LU-2 Check the machine for fault diagnosis.</p> <p>LU-3 Prepare estimate for machine winding.</p> <p>LU-4 Obtain approval of estimate by customer</p> | <p>40 hours</p> | <p>160 hours</p> |
| <p>Module 3: Winding of Electric Motors/Generators</p> <p>Aim: This module covers all competencies required for testing, fault analysis / diagnosis and dismantling skill in electrical motors and generator by using specified hand tools, test instruments and machines. Preparation of winding diagram, know how about materials used in winding process, and to perform winding work according to existing data and standards. Carry out final inspection, testing and verify performance of re-wound machine by using standard measuring instrument to satisfy the customer. All work to be carried out confirming to safety precautionary measures for self, other, property and the machine itself.</p> | <p>LU-1 Check the machine physically and dismantle it to detect the actual fault.</p> <p>LU-2 Select tools and prepare material for rewinding</p> <p>LU-3 Carry out winding / rewinding of stator, rotor and armature.</p> <p>LU-4 Make connections carry out pre-assembly tests and assembly of machine.</p> <p>LU-5 Carry out final testing and commissioning of re-wound machine.</p> <p>LU-6 Record the test results and hand over the machine to customer.</p> | <p>80 hours</p> | <p>320 hours</p> |

Electric Motor Winder Curriculum Contents

Module 1 Title: Basic Concept of Electricity

Objective of the Module: Capable of building up the general communication skills, health and safety requirements at work place and know the essential knowledge of electricity.

Duration: Total :200 hours **Theory:** 40hours **Practice:** 160 hours

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|---|---|---|----------|--|----------------|
| LU1- Participate in work place communication | Participating in workplace communication | i. Obtain and convey workplace information ii. Participate in workplace meetings and discussions iii. Complete work related documents | 20 | <ul style="list-style-type: none"> • Relevant formats • Stationary | Class Room |
| LU2- Work in a team environment | Working in team environment | i. Identify and describe team role and responsibility ii. Describe role and work as a Team Leader member iii. Work as Team Leader iv. Work as Team member v. Effective and appropriate forms of communication vi. Protocols in reporting and using standard operating procedures | 30 | <ul style="list-style-type: none"> • Books of Communication skills | Class Room |
| LU3- Practice occupational health and safety | Practicing occupational health and safety | i. Safety precautions and practices ii. Work according to safety rules iii. Work according to WAPDA and General electrical rules iv. Identify risks and hazards v. Apply basic first aid including artificial | 30 | <ul style="list-style-type: none"> • IEEE Book of Electrician safety • WAPDA Safety Rules • BS Standard for Occupation, Health, Safety and environment (OSHE) | Class Room |

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| | | vi. respiration in case of electrical shock vii. Safety goggles and other protective devices viii. Using hand tools properly and safely ix. Care and maintenance of hand tools x. xi. | | <ul style="list-style-type: none"> • ISO Standard OSHE • First Aid Equipments • Fire Fighting Guide | |
| LU4- Practice general workshop rules and regulations | Practicing general workshop rules and regulations | i. Memorize workshop rules and regulations ii. List correct sequence of operation In the workshop and on- the- job iii. List tools required for the job iv. Working to safety regulations v. Elementary first aid in electrical shops | 20 | <ul style="list-style-type: none"> • Workshop Rules | Class Room |

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| LU5- Identify, use and care of tools and equipment. | Identifying, using and servicing measuring tools | <ol style="list-style-type: none"> i. Basic units of measurements ii. Identify and use measuring tools iii. Inside and outside calipers iv. Vernier caliper, and vises v. Micrometers and gauges vi. Drilling, filing, and soldering tools vii. Digital measuring instruments viii. Care and maintenance of measuring tools | 20 | <ul style="list-style-type: none"> • Workshop Rules • Inside and outside calipers • Vernier caliper, and vises • Micrometers and gauges • Drilling, filing, and soldering tools • Digital measuring instruments • Screw drivers • Wrenches • L-Keys, • Spanners, • Bearing Pullers • Knives/ insulation removers. • Line tester/ 2-Pole tester • Hand drill • Electric drill machines • Soldering iron, • Blow torch • Safety goggles • Bradawl • Mandrel | Class Room & Work place |
| | Identifying, using and servicing hand tools | <ol style="list-style-type: none"> i. Identifying and using different types of screw drivers ii. Identifying and using different types of pliers, wrenches, L-Keys, Spanners, Bearing Pullers iii. Using knives, and other insulation removers. iv. Using and servicing line tester 2-Pole tester v. Using and servicing hand drill and electric drill machines vi. Using and servicing different kinds of soldering iron, blow torch and safety goggles vii. Using bradawl and mandrel | 20 | | |

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| <p>LU6- Draw and perform basic electrical circuits</p> | <p>Drawing , prepare and Interpreting circuit diagrams.</p> | <ol style="list-style-type: none"> i. Common electrical symbols used for wiring diagrams and circuits ii. Basic concept of conductors, resistors, inductor and capacitor. iii. Draw and prepare one lamp controlled by single pole switch iv. Drawing of combination circuit v. Drawing of series and parallel circuits, and power circuit vi. Read simple drawing and sketches of simple layouts | <p>20</p> | <ul style="list-style-type: none"> • Stationary • Relevant Book | <p>Class Room & Work place</p> |
| <p>LU7- Understand basic electrical concepts and principles</p> | <p>Understanding basic electrical concepts and principles</p> <p>Understanding applied mathematics in electricity</p> <p>Applying math in electrical installations</p> | <ol style="list-style-type: none"> i. Basic concepts of electricity and its sources of generation ii. What is current, voltage and resistance, and their relationships iii. Direct and alternating current (AC) iv. Ohms Law and its relationship with voltage, current, and resistance v. Concepts and types of circuits vi. Magnetism and electro-magnetism <ol style="list-style-type: none"> i. The importance and application of applied mathematics in electrical works ii. Ohms Law and its application in measuring voltage, current and resistance <ol style="list-style-type: none"> i. Using Ohms Law in calculating voltage, current, and resistance or voltage drop ii. Calculating and measuring power consumption | <p>20</p> | <ul style="list-style-type: none"> • Stationary • Relevant Book | <p>Class Room & Work place</p> |

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|--|---|--|----|---|-------------------------|
| LU8- Making joints/splices | Making different type joint/splices | <ol style="list-style-type: none"> i. Different types of joints and their uses in electric wiring ii. Concept of conductors in wiring, their sizes and insulators iii. Marking and stripping the wire iv. Splicing the strands of wire v. Binding the spliced wire vi. Checking the splice/joint vii. Soldering the joint⁴ viii. Wrapping the splice with insulation tape | 20 | <ul style="list-style-type: none"> • Relevant Book • Soldering Iron /Soldering flux • Splicer • insulation tape & Enameled Wire | Class Room & Work place |
| LU9- Familiar with different types of electrical and mechanical faults in electrical machines | Familiarize with different types of electrical and mechanical faults in electrical machines | <ol style="list-style-type: none"> i. Types of Faults ii. Mechanical faults iii. Visual inspection iv. Physical inspection v. Electrical Faults vi. Visual inspection vii. Physical inspection viii. Electrical testing | 20 | <ul style="list-style-type: none"> • Relevant Book | Class Room |

Module 2 Title: Inspection and Estimation

Objective of the Module: Capable of Inspection for visible fault / defect and prepare estimate for winding / rewinding

Duration: Total :200 hours **Theory:** 40hours **Practice:** 160 hours

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|--|---|---|----------|---|---|
| LU 1- Collect Information from customer for machine defect, | Good communication skill and interaction with customers Know how about various types of faults occurred in electrical machines | i. Demonstrate professional behavior with customer according to local customs. i. Explain different types of faults in Electrical Machines ii. Enlist the type of faults / defect to be asked from customer. iii. Query for machine behavior as per customer observation | 50 hours | <ul style="list-style-type: none"> • Stationary • Manufacturers Specification • Machine Manual • Relevant Data. | Class Room and work place both are used for learning. |
| LU 2- Check the machine for fault diagnosis. | Fault diagnosis Technical writing skill and proper handling of machine | i. Check the machine for any visible damage, defect, missing components etc. ii. Test the machine for probable fault. i. Issue receipt / job card (which includes: showing make, model, serial number, accessories and warranty condition of machine). ii. Tag the machine with identification number and place it for necessary repair. | 50 hours | <ul style="list-style-type: none"> • Stationary • Manufacturer Specification • Machine manual • Set of basic electrical tools. • Digital / analog multi meter • Identification tag. • Job card • Cash memo • Machine warranty card | Class Room and work place both are used for learning. |
| | | | 50 hours | | |

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| LU 3- Prepare estimate for machine winding | <p>Familiarity with material required for winding.</p> <p>Familiarity with current market prices of required material.</p> <p>Cost estimation for rewinding/ repairing</p> <p>Can quote an estimate</p> | <p>i. Enlist type and gauge of winding wire.</p> <p>ii. Name the material required for winding (i.e, Insulation paper, varnish, cotton tapes, etc)</p> <p>i. Enlist the material market price for rewinding.</p> <p>i. Calculate total cost including over heads with profit margin</p> <p>i. Prepare quotation/ requisition for total cost of winding work.</p> | | <ul style="list-style-type: none"> • Price list of electrical items • Calculator • Stationary • Bill book • Cash memo | <p>Class Room and work place both are used for learning.</p> |
| LU 4- Obtained approval if estimate by customer | <p>Presentation of estimate to customer</p> <p>Understanding feedback from customer</p> <p>Acceptance of Estimate by customer</p> | <p>i. Prepare a standard format / template of estimate</p> <p>ii. Make entries of cost prices into standard format.</p> <p>i. Demonstrate to know the customer feedback</p> <p>i. Negotiate feasible estimate convenient to customer.</p> | <p>50 hours</p> | <ul style="list-style-type: none"> • Stationary • Calculator • Cash memo | |

Module 3 Title: Winding of Rotating Electrical Machines

Objective of the Module: Checking, Inspection, Dismantling, Winding / rewinding and final testing / commissioning of motors and generators..

Duration: Total :400 hours **Theory:** 80hours **Practice:** 320 hours

| Learning Unit | Learning Outcomes | Learning Elements | Duration | Materials Required | Learning Place |
|---|--|--|----------|---|--|
| LU1- Check the machine physically and dismantle it to detect the actual fault. | Knowledge about preliminary test to diagnose the fault | i. Read and interpret the name plate on machine ii. Carry out visual and manual inspection to observe the mechanical damage / defects iii. Check the burnt winding by smelling. | 60 hours | <ul style="list-style-type: none"> • Stationary • Digital /Analog Multimeter • Clamp on meter • Megger insulation tester • Set of screw drivers • Pliers • Magnifying glass • Clamping device • Marking tool • Hoist • Chain block • Bearing puller • Winding puller • Saw • snips • Personal protective equipment. | Class Room and work place both are used for learning |
| | Dismantling the machine | i. Dismantle the machine as per standard procedure and manufacturer instructions. ii. Collect winding data and prepare winding diagram. | | | |
| | Test and diagnose / detect the fault in winding parts and accessories of machines. | i. Check winding with specified measuring instrument to detect the fault. ii. Take readings and note down. iii. Check for faults in associated accessories as per manufacturer data and note down. | | | |
| | Data record keeping | iv. Check bearings, carbon brushes, rockers, sliping's etc , visually and using specified test instruments. i. Recording of detected Fault for proper repair. ii. Making Inventory of the material, items to be used for repair. | | | |

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| LU 2- Select Tools and prepare material for winding/ rewinding | <p>Understand Drawing and Diagram</p> <p>Selection of proper tools</p> <p>Preparation of material</p> | <p>i. Knowledge about Collection of technical information and winding data.</p> <p>ii. Draw winding diagram.</p> <p>i. Select specific tools.</p> <p>i. Prepare insulation and binding material.</p> <p>ii. Arrange winding wire of require gauge.</p> <p>iii. Prepare formers according to winding data.</p> <p>iv. Form coils on formers as per collect winding data.</p> | <p>60 hours</p> | <ul style="list-style-type: none"> • Stationary • Set of screw drivers • Pliers • Copper hammer • Wooden Mallet • Marking tool • File • Snips • Soldering / brazing & welding machine • Soldering flux • Brazing & welding rods. | <p>Class Room and work place both are used for learning</p> |
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| LU 3- Carry out winding/ rewinding of machine | Rewinding of stator | i. Cleaning of stator using specified tools. ii. Insert insulation material into slots. iii. Insert formed coils into slots properly. iv. All work to be carried out conforming to safety procedures | 70 hours | <ul style="list-style-type: none"> • Cleaning agent and material • Files • Strips • Saws • Winding machine • Hot air gun • Air compressor • Hydraulic /mech. press | Class Room and work place both are used for learning |
| | Rotor Repair | i. Clean the rotor with specified tools / material ii. Check the rotor iii. Carry out required servicing and repair as necessary iv. Carry out balancing of rotor | | | |
| | Rewinding of armature | i. Insert insulation material into slots after being cleaned. ii. Insulate and bind the prepared coils iii. Insert the formed coils into slots. | | | |
| | Rewinding of Field | i. Dismantle the field core ii. Remove the winding iii. Prepare the former and wind field coil, iv. Insulate and bind the coils v. Insert the formed coils. | | | |

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| LU 4- Make connections, carry out pre- assembly tests and assembly of machine | Making proper connections. | i. Check winding resistance and insulation level using specified test instruments. ii. Make connection of coil ends conforming to winding iii. Terminate coil ends then insulate, shape & bind as specified. | 70 hours | <ul style="list-style-type: none"> • Analog / Digital multimeter • Magger • Insulating foils • Soldering / brazing m/c • Solder flux • Copper wire • Binding taps • Cotton tape • Insulating varnish • Baking oven | Class Room and work place both are used for learning |
| | Pre-assembly testing | i. Check connections ii. Check winding continuity using specified test instrument | | | |
| | Machine Assembling | i. Apply insulating varnish to winding ii. Keep wound stator into baking oven and bake it up to recommended temperature iii. Carry out assembly of stator rotor and other parts. | | | |

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| <p>LU 5- Carry out final test of re-wound machine</p> | <p>Understand & perform, all type of tests, read and interpret the measurement.</p> <p>Testing of re-wound machines</p> | <ul style="list-style-type: none"> i. Visually inspect the machine after assembling. ii. Carry out static and dynamic balancing. iii. Check windings and terminals conforming to winding diagram iv. Check insulation resistance v. Check rotors free rotation and balance vi. Check winding vii. Take No load / load / locked rotor tests using specified test instrument viii. Check rotor speed using tachometer i. Testing the readings of current, voltage, frequency, at input and output side. These should conform to balanced standard values. | <p>70 hours</p> | <ul style="list-style-type: none"> • Analog/digital • Multimeter • Megger • Tachometer • Clamp on meter • Protective equipment • Used by electrician • Stationary | <p>Class Room and work place both are used for learning</p> |
| <p>LU 6- Record the test results & handover the machine to customers</p> | <p>Preparation of test result sheets</p> <p>Check rewind machine before the customer for satisfaction performance</p> | <ul style="list-style-type: none"> i. Test results entered in the relevant record sheet ii. Prepare test reports i. Check the machine performance before the customer. | <p>70 hours</p> | <p>Stationary</p> | <p>Class Room and work place both are used for learning</p> |

Electric Motor Winder Curriculum Assessment

Module 1 Title: Basic Concept of Electricity

Objective of the Module: Capable of building up the general communication skills, health and safety requirements at work place and know the essential knowledge of electricity.

Duration: Total :200 hours **Theory:** 40hours **Practice:** 160 hours

| Learning Units | Theory hours | Workplace hours | Recommended formative assessment | Recommended Methodology | Scheduled Dates |
|--|--------------|-----------------|--|--|-----------------|
| M1-LU1 Participate in work place communication | | | <ul style="list-style-type: none"> • Obtain and convey workplace information • Participate in workplace meeting and discussion • Complete work related documents | <ul style="list-style-type: none"> • Practical demonstration • Oral questioning | |
| M1-LU2 Work in a team environment | | | <ul style="list-style-type: none"> • Identify and describe team role and responsibility • Describe role and work as Team Leader member • Work as Team Leader • Work as Team member • Effective and appropriate forms of communication • Protocols in reporting and using standard operating procedures | <ul style="list-style-type: none"> • Oral questioning • Practical demonstration • Short questioning • Report | |

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| <p>M1-LU3 Practice occupational health and safety</p> | | | <ul style="list-style-type: none"> • Safety precautions and practices • Work according to safety rules • Work according to WAPDA and General electrical rules • Identify risks and hazards • Apply basic first aid including artificial respiration in case of electrical shock • Safety goggles and other protective devices • Using hand tools properly and safely • Care and maintenance of hand tools | <ul style="list-style-type: none"> • Practical demonstration • Oral questioning | |
| <p>M1-LU4 Practice general workshop rules and regulations</p> | | | <ul style="list-style-type: none"> • Memorize workshop rules and regulations • List correct sequence of operation In the workshop and on- the- job • 1.1.3. List tools required for the job • Working to safety regulations • Elementary first aid in electrical shops | <ul style="list-style-type: none"> • Oral questioning • Practical demonstration | |

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| <p>M1-LU5 Identify, use and service tools used by Motor Winder</p> | | | <ul style="list-style-type: none"> • Basic units of measurements • Identify and use measuring tools • Inside and outside calipers • Vernier caliper, and vises • Micrometers and gauges • Drilling, filing, and soldering tools • Digital measuring instruments • Care and maintenance of measuring tools • Identifying and using different types of screw drivers • Identifying and using different types of pliers, wrenches, L-Keys, Spanners, Bearing Pullers • Using knives, and other insulation removers. • Using and servicing line tester 2-Pole tester • Using and servicing hand drill and electric drill machines • Using and servicing different kinds of soldering iron, blow torch and safety goggles • Using bradawl and mandrel | <ul style="list-style-type: none"> • Oral questioning • Practical demonstration | |
| <p>M1-LU6 Draw circuit And perform basic electrical circuits</p> | | | <ul style="list-style-type: none"> • Common electrical symbols used for wiring diagrams and circuits • Basic concept of conductors, resistors, inductor and capacitor. • Draw and prepare one lamp controlled by single pole switch • Drawing of combination circuit • Drawing of series and parallel circuits, and power circuit • Read simple drawing and sketches of simple layouts | <ul style="list-style-type: none"> • Oral questioning • Practical demonstration | |

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|---|--|--|---|---|--|
| <p>M1-LU7 Understand basic electrical concept and principles</p> | | | <ul style="list-style-type: none"> • Basic concepts of electricity and its sources of generation • What is current, voltage and resistance, and their relationships • Direct and alternating current (AC) • Ohms Law and its relationship with voltage, current, and resistance • Concepts and types of circuits • Magnetism and electro-magnetism • The importance and application of applied mathematics in electrical works • Ohms Law and its application in measuring voltage, current and resistance • Using Ohms Law in calculating voltage, current, and resistance or voltage drop • Calculating and measuring power consumption | <ul style="list-style-type: none"> • Oral questioning • Practical Demonstration | |
| <p>M1-LU8 Making joints/splices</p> | | | <ul style="list-style-type: none"> • Different types of joints and their uses in electric wiring • Concept of conductors in wiring, their sizes and insulators • Marking and stripping the wire • Splicing the strands of wire • Binding the spliced wire • Checking the splice/joint • Soldering the joint • Wrapping the splice with insulation tape | <ul style="list-style-type: none"> • Oral questioning • Practical Demonstration | |

Supportive notes

- **Assessment context**

This module has to be assessed in the class as well as on the job.

- **Critical aspects**

Familiarity with basic concepts of electricity, communication skills, and safety practices and handling of tools

- **Assessment condition**

The candidate will have access to, all tools equipments, material and documentation required.

The candidate will be permitted to refer to the following documents:

- Relevant work place procedures
- Relevant products specifications
- Relevant drawing, manuals, codes, standard and reference material

The candidate will be required to:

- Orally, or by other methods of communications answer questions asked by the assessor
- Identify superiors who can be approached for the collection of competency evidence where appropriate

Present evidence of credit for any off job training related to this module

- **Resources required for assessment**

All the tools, instruments, equipments, machines and related material listed in the column “Material required” of this module

Module 2 Title: Inspection and Estimation

Objective of the Module: Capable of Inspection for visible fault / defect and prepare estimate for winding / rewinding

Duration: Total :200 hours **Theory:** 40hours **Practice:** 160 hours

| Learning Units | Theory hours | Workplace hours | Recommended formative assessment | Recommended Methodology | Scheduled Dates |
|---|--------------|-----------------|--|---|-----------------|
| M2-LU1 Collect Information from customer for machine defect,. | | | <ul style="list-style-type: none"> • Demonstrate professional behavior with customer according to local customs. • Enlist the types of faults/defects to be asked from customers. • Query for machine behavior as observed by customer. | <ul style="list-style-type: none"> • Practical demonstration / simulation • Oral questioning | |
| M2-LU2 Check the machine for fault diagnosis. | | | <ul style="list-style-type: none"> • Check the machine for any visible damage, defect, missing accessories etc. • Test the machine for probable fault. • Issue receipt/job card, showing make, model, serial number, accessories, warranty condition of machine. • Tag the machine with identification number and take it for winding. | Practical demonstration | |
| M2-LU3 Prepare estimate for machine winding | | | <ul style="list-style-type: none"> • List out type and gauge of winding wire. • Note down the other material (Insulation paper, varnish etc) required for winding • List out the market price of items needed for rewinding.. • Calculate total cost including over heads with profit margin • Prepare temporary bill for total cost of winding work. | <ul style="list-style-type: none"> • Practical demonstration • Oral questioning • Short answer questioning | |

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| M2-LU4 Obtained approval if estimate by customer | | | <ul style="list-style-type: none">• Prepare a standard format / template of estimate• Make entries of cost prices into standard format.• Demonstrate to know the customer feedback• Bargaining and adjustment in estimate convenient to customer. | Practical demonstration | |
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Supportive notes

- **Assessment context**

This module has to be assessed on the job or in a simulated environment.

- **Critical aspects**

Careful handling of equipments, courteous handling of customers, safety of self, equipment and others

The candidate should be able to prepare correct estimates and has knowledge of company/or enterprise procedures and policies on preparing estimates and current market prices of winding wire and other material used for rewinding work

- **Assessment condition**

The candidate will have access to, all tools equipments, material and documentation required.

The candidate will be permitted to refer to the following documents:

- Relevant work place procedures
- Relevant products specifications
- Relevant drawing, manuals, codes, standard and reference material

The candidate will be required to:

- Orally, or by other methods of communications answer questions asked by the assessor
- Identify superiors who can be approached for the collection of competency evidence where appropriate
- Present evidence of credit for any off job training related to this module

- **Resources required for assessment**

All the tools, instruments, equipments, machines and related material listed in the column “Material required” of this module

Module 3 Title: Winding of Rotating Electrical Machines

Objective of the Module: Checking, Inspection, Dismantling, Winding / rewinding and final testing / commissioning of motors and generators..

Duration: Total :400 hours **Theory:** 80hours **Practice:** 320 hours

| Learning Units | Theory hours | Workplace hours | Recommended formative assessment | Recommended Methodology | Scheduled Dates |
|--|--------------|-----------------|--|--|-----------------|
| <p>M3-LU1 Check the machine physically and dismantle it to detect the actual fault.</p> | | | <ul style="list-style-type: none"> • Read and interpret the name plate on machine • Carry out visual and manual inspection to observe the mechanical damage / defects • Check the burnt winding by smelling. • Dismantle the machine as per standard procedure and manufacturer instructions. • Collect winding data and prepare winding diagram. • Check winding with specified measuring instrument to detect the fault. • Take readings and note down. • Check for faults in associated accessories as per manufacturer data and note down. • Check bearings, carbon brushes, rockers, slip rings visually and using specified test instruments. • Detected fault should be noted down for proper repair. • Enlist the material, items required for repair. • Inform customer for necessary repair. | <ul style="list-style-type: none"> • Practical demonstration and short answer questioning | |

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| <p>M3-LU2 Select Tools and prepare material for winding/rewinding</p> | | | <ul style="list-style-type: none"> • Collect technical information and winding data. • . Prepare winding diagram as [per winding data. • Select tools specified for winding work • Prepare insulation and binding material • Arrange winding wire of require gauge. • Prepare formers according to winding data • Form coils on formers as per collect winding data. | <ul style="list-style-type: none"> • Oral questioning • Practical demonstration | |
| <p>M3-LU3 Carry out winding/rewinding of stator, rotor and armature</p> | | | <ul style="list-style-type: none"> • Clearing of stator using specified tools. • Insert insulation material into slots. • Insert formed coils into slots properly. • All work to be carried out conforming to safety procedures • Clean the rotor with specified tools / material • Check the rotor • Carry out required servicing and repair as necessary • Carry out balancing of rotor • Insert insulation material into slots after being cleaned.. • Insulate and bind the med coils • Insert the formed coils into slots | <ul style="list-style-type: none"> • Practical demonstration • Oral questioning • And Practical demonstration | |

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| <p>M3-LU4 Make connections, carry out pre-assembly tests and assembly of machine</p> | | | <ul style="list-style-type: none"> • Check winding resistance and insulation level using specified test instruments. • Make connection of coil ends conforming to winding • Terminate coil ends then insulate shape & bind as specified. • Check connections • Check winding continuity using specified test instrument • Carry out dry running, check performance and take remedial actions if necessary • Apply insulating varnish to winding • Keep wound stator into baking oven and bake it up to recommended temperature • Carry out assembly of stator rotor and other parts. | <ul style="list-style-type: none"> • Practical demonstration • Oral questioning and practical demonstration | |
| <p>M3-LU5 Carry out final testing & coming of re-wound machine</p> | | | <ul style="list-style-type: none"> • Visually inspect the machine after assembly. • Check windings and terminals conforming to winding diagram • Check insulation resistance • Check rotors free movement • Check armature • Take No load / load / locked rotor tests using specified test instrument • Check rotor speed using tachometer • Carry out static and dynamic balancing. • Start the tested re-wound machine and verify for satisfactory performance. • Note down the readings of current, voltage, frequency, at input and output side. These should conform to balanced standard values. | <p>Practical demonstration Oral questioning and practical demonstration</p> | |

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|--|--|--|---|---|--|
| M3-LU6 Record the test results & handover the machine to customers | | | <ul style="list-style-type: none"> • Test results entered in the relevant record sheet • Prepare test reports • Show and press cut the test result / reports • Demonstrate the machine performance. | <ul style="list-style-type: none"> • Report • Practical Demonstration | |
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Supportive notes

- **Assessment context**

This module has to be assessed in the class as well as on the job

- **Critical aspects**

The assessment must confirm that the candidate is able to use specified tools, instruments, follow sequential checking and testing methods. He/ She should be able to wind/rewind stators, rotors and armature of motors and generators to the required standards. He/ She should be able to test electrical machines after rewinding and verify whether they are functioning properly or otherwise

- **Assessment condition**

The candidate will have access to, all tools equipments, material and documentation including winding wire charts; manuals of measuring instruments, charts referred to IP codes and Class of insulations, material safety data.

The candidate will be permitted to refer to the following documents:

- Relevant work place procedures
- Relevant products specifications
- Relevant drawing, manuals, codes, standard and reference material

The candidate will be required to:

- Orally, or by other methods of communications answer questions asked by the assessor
- Identify superiors who can be approached for the collection of competency evidence where appropriate
- Present evidence of credit for any off job training related to this module

- **Resources required for assessment**

All the tools, instruments, equipments, machines and related material listed in the column “Material required” of this module