National Occupational Skill Standard (NOSS)

Occupational Title : **Electrical Motor Repairer**

Level : **2**

Sector : **Electrical**

Sub - Sector : **Electrical Machine Repair**

NOSS ID/NSCO ID :

ISCO NO :

Council for Technical Education and Vocational Training

NATIONAL SKILL TESTING BOARD

Madhyapur Thimi-17, Sanothimi, Bhaktapur, Nepal

Developed: 25-08-2025 (09-05-2082)

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The National Skills Standards
and
Test was developed on 1989

The National Occupational Skill Standard Developed by:

No	Name	Designation	Organization
1.	Er. Jayaiswer Man Pradhan	Coordinator	Electrical Technical Sub Committee National Skill Testing Board, Sanothimi, Bhaktapur
2.	Mr. Bhuvaneshor Dhungana	Member	National Skill Testing Board Sanothimi, Bhaktapur
3.	Mr. Surendra Shrestha	Member	Subi Electro Machinery Gaththaghar, Bhaktapur
4.	Ms. Indu Shahu	Member	Indu Electro Service Jadibuti, Kathmandu
5.	Mr. Raghubar Lal Joshi	Member	Balaju School of Engineering and Technology (BSET) Balaju, Kathmandu
6.	Mr. Anil Shrestha	Member	D. Aires Electricals & Refrigeration Pulchowk, Lalitpur
7.	Mr. Naresh Prasad Baidya	Member	Trem Organization and Solution New Baneshwor, Kathmandu
8.	Mr. Shiva Nanda Mishra	Member	National Skill Testing Board Sanothimi, Bhaktapur
9.	Mr. Dipak Sainju	Member Secretary	Electrical Technical Sub Committee National Skill Testing Board, Sanothimi, Bhaktapur
10.	Mr. Suresh Maharjan	Facilitator	Sr. Skill Testing Officer National Skill Testing Board, Sanothimi, Bhaktapur
11.	Mr. Surya Prasad Adhikari	Facilitator	Skill Testing Officer National Skill Testing Board, Sanothimi, Bhaktapur

Recommended by Electrical Technical Sub Committee: 28 June 2025 (14 Ashadh 2082)

1	**Occupational Title: Electric Motor Repairer** **Level: 2**
2	**Job Description:** Electric Motor Repairer L-2, repairs single phase motor, repairs three phase motor, and repairs universal motor
3	**UNITS OF COMPETENCY:** 1. Repair single phase motor 2. Repair three phase motor 3. Repair universal motor 4. Perform communication 5. Develop professionalism ***Note: Units 4 and 5 are not for testing purpose.***
4	**Qualifying Notes/Prerequisites:** • Physical Requirements: Sound health • Entry Requirements: As per NSTB rules **Additional Information:** • Assessment Types: Performance test only • Assessment Duration: 8:00 to 10:00 (Full competency only) • Recommended Group Size: 6 to 8 candidates

5	**Unit No: 1** **Unit Title: Repair single phase motor**	**Unit code:**
	Elements of competency	**Performance standards**
	1.1 Prepare tools, equipment and materials	1.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 1.1.2 Tools and equipment collected and checked for serviceability. 1.1.3 Faulty tools and equipment tagged and reported to supervisor. 1.1.4 Materials collected and arranged in workplace as per task requirements.
	1.2 Diagnose faults	1.2.1 Customer complaints and service history interpreted to identify possible faults. 1.2.2 Warranty card/seal checked and customer informed regarding warranty claims. 1.2.3 External conditions of ***single phase motor*** visually inspected for ***physical damage and failure***. 1.2.4 ***Electrical parameters*** measured and condition of motor determined. 1.2.5 Functional testing carried out and identified ***signs of malfunctions***. 1.2.6 Motor parts and winding connection inspected and tested for signs of malfunctions. 1.2.7 ***Faulty parts*** and winding connection identified based on symptoms, visual inspection, and test results. 1.2.8 Faults recorded and reported to concerned authority as per workplace procedure.
	1.3 Dismantle single phase motor	1.3.1 Motor disconnected from power source and motor marked for dismantle. 1.3.2 ***External components*** dismantled systematically as per manufacturer guidelines. 1.3.3 Components inspected, tested, and faulty components identified for repair or replacement.

	1.4 Estimate repair works	1.4.1 All the parts that need to be replaced is listed based on identified faults. 1.4.2 Cost of listed materials calculated based on market price. 1.4.3 Labour and service charge calculated as per workplace procedures. 1.4.4 Total repair and replace parts cost calculated, informed to customer, and take approval before commencing repair.
	1.5 Repair faulty parts	1.5.1 Repairable parts repaired as per manufacturer guidelines. 1.5.2 Non repairable parts replaced with new one with same specification. 1.5.3 Parts requiring lubrication lubricated as per manufacturer instructions. 1.5.4 Repaired/replaced parts tested and fitted into its original position. 1.5.5 Repaired motor verified with functional testing and checking its performance.
	1.6 Rewind motor	1.6.1 Motor ***nameplate data*** collected as per nameplate and original connection diagram. 1.6.2 Winding diagram copied and development diagram prepared. 1.6.3 Faulty winding removed without damaging core and insulation. 1.6.4 Number of turns noted and wire size measured. 1.6.5 Slots prepared and ***insulating materials*** inserted into the slot. 1.6.6 Coil prepared as per original coil size and inserted into slot as per winding diagram. 1.6.7 Coil lead connected as per winding diagram. 1.6.8 Coil head bound tightly and uniformly. 1.6.9 Resistance and insulation test carried out. 1.6.10 Motor assembled and pre functional test carried out to verify smooth operation.

		1.6.11 Baking and varnishing performed for mechanical strength and electrical insulation as per manufacturer instruction.
	1.7 Assemble single phase motor	1.7.1 Motor parts fitted to its original position as per marking and manufacture guideline. 1.7.2 Nut/bolt tightened for smooth rotation and stability. 1.7.3 Terminals connected to connector as per connection diagram. 1.7.4 Reassembled motor inspected visually correct fittings and alignment. 1.7.5 Functional test performed and electrical parameters measured.
	1.8 Clean workplace	1.8.1 Unused materials collected and stored in designated area. 1.8.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 1.8.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.
6	**Task Performance Requirements (Tools, Equipment and Materials):** • Induction motor, multi-meter, megger, clamp on meter, tachometer, screwdriver set, hammer, spanner set, line tester, socket spanner set, wire stripper, side cutter, nose plier, combination plier, continuity tester, circlip plier, adjustable wrench, Allen key, paper cutter, knife, scissor, puller, lubricants, vacuum, blower, crimping tools, cable shoe, anti-rust, vice plier, bench vice, bench, tool box, oven, insulation scriber or remover, winding machine, insulating materials, solder iron, soldering flux and lead, label sticker, impact screw driver set, grinder machine, magnifier, pen, pencil, note book, steel scale, hot air gun, heat shrink tube, thumb pull jack measuring tape, micro-meter/wire gauge plate, vernier caliper, oil can, rivet and rivet gun, center punch, tapping tools, drill machine with bit, testing board, storage trays/zip-lock bags, blow lamp, varnish, binding tape/ thread, PVC tape, electrical wires, winding wire, replacement components, cleaning cloth, broom, dust pan, dust bin, and personal protective equipment (PPE)	

7	**Safety and Hygiene (Occupational Health and Safety):** • Use personal protective equipment. • Safe handling of materials, tools and equipment. • Hazards involved in lifting tools, equipment and materials. • Prevent from electrical hazards. • Safe handling and disposal of debris. • Follow workplace safety guidelines.

8	Required Knowledge		
	Technical Knowledge	**Applied Calculation**	**Graphical Information**

	• Tools, equipment and materials
	  ○ Types
	  ○ Uses
	  ○ Safe handling
	  ○ Storage
	• Motor
	  ○ Introduction and application
	  ○ Construction
	  ○ Types
	  ○ Major components
	  ○ Working principle
	• Electrical single phase motor
	  ○ Introduction
	  ○ Types
	  ○ Parts
	  ○ Application
	  ○ Working principle
	• Electrical parameters
	  ○ Current
		• Perform unit conversion
		• Calculate current, voltage, resistance and power
			• Read and interpret connection and winding diagram
			• Read and interpret nameplate
			• Read and interpret manufacturer' instruction

	○ Voltage ○ Resistance ○ Capacitance ○ Inductance ○ Frequency ○ Power ○ Energy • Relationship between electrical parameters (Ohms law) • Earthing/grounding • Estimating and costing • AC and DC source and circuit • Basic electrical circuit: Open, close, short, series and parallel • Electrical symbols • Electrical components ○ Resistor ○ Inductor ○ Capacitor ○ Fuse ○ Switch ○ Indicator ○ Thermal switch		

	○ Governor/ centrifugal switch • Conductor and insulator • Power factor and its importance • Controlling and protective devices • Torque • Electrical wire and cable • Winding wire • Insulating and conducting materials • Classification of insulation • Calculate winding data • Winding terminology ○ Winding ○ Whole and half coil winding ○ Coil ○ Coil group ○ Coil per group ○ Coil head ○ Coil side ○ Coil throw ○ Throw coil ○ Coil connection		

	○ Group connection ○ Pole pitch ○ Pitch factor ○ Electrical degree ○ Degree per slot ○ Phase displacement ○ Turns ○ End turn ○ Coil lead ○ Distributed and concentric winding ○ Balanced and unbalanced winding ○ Single layer and double layer winding • Troubleshooting of electrical motor ○ Customer handling technique ○ Visual inspection and testing (Current, voltage, continuity, resistance, insulation, speed) ○ Common faults and possible cause ○ Dismantling and assembling process and techniques ○ Marking and tagging process ○ Soldering and de-soldering techniques ○ Technical documentation and reporting		

	• Cleaning and waste management • Concept of e-waste • Record keeping and documentation • Importance of first aid • Occupational health and safety rules and regulations		

9	Assessment of Competency					
	Unit: 1 **Unit Title: Repair single phase motor**					
	Candidate Details		**Assessors Detail**			
	Candidate's Name: Registration Number: Symbol No: Test Centre: Test Date:		Assessors' Name 1. 2. 3.		ID/License No:	

Element of competency	Performance Standards	Standard Met	Standard Not Met	Evidence Type	Comments
1.1 Prepare tools, equipment and materials	1.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 1.1.2 Tools and equipment collected and checked for serviceability. 1.1.3 Faulty tools and equipment tagged and reported to supervisor. 1.1.4 Materials collected and arranged in workplace as per task requirements.				
1.2 Diagnose faults	1.2.1 Customer complaints and service history interpreted to identify possible faults.				

	1.2.2 Warranty card/ seal checked and customer informed regarding warranty claims. 1.2.3 External conditions of ***single phase motor*** visually inspected for ***physical damage and failure***. 1.2.4 ***Electrical parameters*** measured and condition of motor determined. 1.2.5 Functional testing carried out and identified ***signs of malfunctions***. 1.2.6 Motor parts and winding connection inspected and tested for signs of malfunctions. 1.2.7 ***Faulty parts*** and winding connection identified based on symptoms, visual inspection, and test results. 1.2.8 Faults recorded and reported to concerned authority as per workplace procedure.				
1.3 Dismantle single phase motor	1.3.1 Motor disconnected from power source and motor marked for dismantle. 1.3.2 ***External components*** dismantled systematically as per manufacturer guidelines. 1.3.3 Components inspected, tested, and faulty components identified for repair or replacement.				

1.4 Estimate repair works	1.4.1 All the parts that need to be replaced is listed based on identified faults. 1.4.2 Cost of listed materials calculated based on market price. 1.4.3 Labour and service charge calculated as per workplace procedures. 1.4.4 Total repair and replace parts cost calculated, informed to customer, and take approval before commencing repair.				
1.5 Repair faulty parts	1.5.1 Repairable parts repaired as per manufacturer guidelines. 1.5.2 Non repairable parts replaced with new one with same specification. 1.5.3 Parts requiring lubrication lubricated as per manufacturer instructions. 1.5.4 Repaired/replaced parts tested and fitted into its original position. 1.5.5 Repaired motor verified with functional testing and checking its performance.				
1.6 Rewind motor	1.6.1 Motor ***nameplate data*** collected as per nameplate and original connection diagram. 1.6.2 Winding diagram copied and development diagram prepared.				

	1.6.3 Faulty winding removed without damaging core and insulation. 1.6.4 Number of turns noted and wire size measured. 1.6.5 Slots prepared and ***insulating materials*** inserted into the slot. 1.6.6 Coil prepared as per original coil size and inserted into slot as per winding diagram. 1.6.7 Coil lead connected as per winding diagram. 1.6.8 Coil head bound tightly and uniformly. 1.6.9 Resistance and insulation test carried out. 1.6.10 Motor assembled and pre functional test carried out to verify smooth operation. 1.6.11 Baking and varnishing performed for mechanical strength and electrical insulation as per manufacturer instruction.				
1.7 Assemble single phase motor	1.7.1 Motor parts fitted to its original position as per marking and manufacture guideline. 1.7.2 Nut/bolt tightened for smooth rotation and stability 1.7.3 Terminals connected to connector as per connection diagram. 1.7.4 Reassembled motor inspected visually correct fittings and alignment.				

	1.7.5 Functional test performed and electrical parameters measured.				
1.8 Clean workplace	1.8.1 Unused materials collected and stored in designated area. 1.8.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 1.8.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.				

WT- Written Test **OQ**- Oral Question **PT-** Practical Test **DO** – Direct Observation **SR**- Supervisor's report **SN**–Simulation

RP- Role Play **PG –**Photographs **VD**- Video **CT** – Certificates **TS** – Testimonials (Reward) **PP** – Product Produced

CS – Case Study

Range Statement

Variable	Range
Personal Protective Equipment	*May include but not limited to:* • Helmet • Hair net • Apron/Safety Jacket • Goggles • Gloves • Safety shoes • Mask • Anti-static wrist strap
Single phase motor	*May include but not limited to:* • Split phase motor • Capacitor start motor • Capacitor run motor • Capacitor start and capacitor run motor • Shaded pole motor
Physical damage and failure	*May include but not limited to:* • Crack • Broken • Burn marks • Melted • Missing parts • Loose parts/components • Cut

	• Wear and tear • Corrosion • Leakage
Electrical parameters	*May include but not limited to:* • Continuity • Current • Voltage • Resistance • Capacitance
Signs of malfunctions	*May include but not limited to:* • Speed • Low or high current • Abnormal sound • Spark • Overheating • Vibration • Smell
Faulty parts	*May include but not limited to:* • End cover/body • Bearing • Cable shoe • Capacitor • Impeller • Terminal connector • Cooling fan • Terminals • Coil

	• Seal • Circlip • Switch • Gear and gear box • Thermal switch • Governor/centrifugal switch
External components	*May include but not limited to:* • Fan cover • Cooling fan • Terminal box and connector • Motor housing • Mounting bolts • Governor/centrifugal switch • Pulley • Capacitor
Nameplate data	*May include but not limited to:* • Voltage • Current • Power • Frequency • RPM • Insulation class • Bearing size • Suction and discharge head • Capacitance
Insulating materials	*May include but not limited to:* • Insulation paper

	• Wedge • Sleeve
3R's principle	*May include but not limited to:* • Reduce • Reuse • Recycle

5	**Unit No: 2** **Unit Title: Repair three phase motor**	**Unit code:**

Elements of competency	Performance standards
2.1 Prepare tools, equipment and materials	2.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 2.1.2 Tools and equipment collected and checked for serviceability. 2.1.3 Faulty tools and equipment tagged and reported to supervisor. 2.1.4 Materials collected and arranged in workplace as per task requirements.
2.2 Diagnose faults	2.2.1 Customer complaints and service history interpreted to identify possible faults. 2.2.2 Warranty card/seal checked and customer informed regarding warranty claims. 2.2.3 External conditions of three phase motor visually inspected for ***physical damage and failure***. 2.2.4 ***Electrical parameters*** measured and condition of motor determined. 2.2.5 Functional testing carried out and identified ***signs of malfunctions***. 2.2.6 ***Faulty parts*** and wiring identified based on faulty symptoms, visual inspection, and test results. 2.2.7 Faults recorded and reported to concerned authority as per workplace procedure.
2.3 Dismantle three phase motor	2.3.1 Motor disconnected from power source and motor marked for dismantle. 2.3.2 External components dismantled systematically as per manufacturer guidelines. 2.3.3 Components inspected, tested, and faulty components identified for repair or replacement.
2.4 Estimate repair works	2.4.1 All the parts that need to be replaced is listed based on identified faults. 2.4.2 Cost of listed materials calculated based on market price.

		2.4.3 Labour and service charge calculated as per workplace procedures. 2.4.4 Total repair and replace parts cost calculated, informed to customer, and take approval before commencing repair.
	2.5 Repair faulty parts	2.5.1 Repairable parts repaired as per manufacturer guidelines. 2.5.2 Non repairable parts replaced with new one with same specification. 2.5.3 Parts requiring lubrication lubricated as per manufacturer instructions. 2.5.4 Repaired/ replaced parts tested and fitted into its original position. 2.5.5 Repaired motor verified with functional testing and checking its performance.
	2.6 Rewind motor	2.6.1 Motor ***nameplate data*** collected as per nameplate and original connection diagram. 2.6.2 Winding diagram copied and development diagram prepared. 2.6.3 Faulty winding removed without damaging core and insulation. 2.6.4 Number of turns noted and wire size measured. 2.6.5 Slots prepared and ***insulating materials*** inserted into the slot. 2.6.6 Coil prepared as per original coil size and inserted into slot as per winding diagram. 2.6.7 Coil lead connected as per winding diagram. 2.6.8 Coil head bound tightly and uniformly. 2.6.9 Resistance and insulation test carried out. 2.6.10 Motor assembled and pre functional test carried out to verify smooth operation. 2.6.11 Baking and varnishing performed for mechanical strength and electrical insulation as per manufacturer instruction.
	2.7 Assemble three phase motor	2.7.1 Motor parts fitted to its original position as per marking and manufacturer guideline.

		2.7.2 Nut/ bolt tightened for smooth rotation and stability. 2.7.3 Terminals connected to connector as per connection diagram. 2.7.4 Reassembled motor inspected visually correct fittings and alignment. 2.7.5 Functional test performed and electrical parameters measured.
	2.8 Clean workplace	2.8.1 Unused materials collected and stored in designated area. 2.8.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 2.8.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.
6	**Task Performance Requirements (Tools, Equipment and Materials):** • Three phase induction motor, multi-meter, megger, clamp on meter, tachometer, screwdriver set, hammer, spanner set, line tester, socket spanner set, wire stripper, side cutter, nose plier, combination plier, continuity tester, circlip plier, adjustable wrench, Allen key, paper cutter, knife, scissor, puller, lubricants, vacuum, blower, crimping tools, cable shoe, anti-rust, vice plier, bench vice, bench, tool box, oven, insulation scriber or remover, winding machine, insulating materials, solder iron, soldering flux and lead, label sticker, impact screw driver set, grinder machine, magnifier, pen, pencil, note book, steel scale, hot air gun, heat shrink tube, thumb pull jack, measuring tape, micro-meter/wire gauge plate, vernier caliper, oil can, rivet and rivet gun, center punch, tapping tools, drill machine with bit, testing board, storage trays/zip-lock bags, blow lamp, varnish, binding tape/ thread, PVC tape, electrical wires, winding wire, replacement components, cleaning cloth, broom, dust pan, dust bin, and personal protective equipment (PPE)	
7	**Safety and Hygiene (Occupational Health and Safety):** • Use personal protective equipment. • Safe handling of materials, tools and equipment.	

	• Hazards involved in lifting tools, equipment and materials. • Prevent from electrical hazards. • Safe handling and disposal of debris. • Follow workplace safety guidelines.

8	Required Knowledge		
	Technical Knowledge	**Applied Calculation**	**Graphical Information**

	• Tools, equipment and materials
	  ○ Types
	  ○ Uses
	  ○ Safe handling
	  ○ Storage
	• Motor
	  ○ Introduction and application
	  ○ Construction
	  ○ Types
	  ○ Major components
	  ○ Working principle
	• Electrical three phase motor
	  ○ Introduction
	  ○ Types
	  ○ Parts
	  ○ Application
	  ○ Working principle
	• Electrical parameters
	  ○ Current
		• Perform unit conversion
		• Calculate current, voltage, resistance and power
			• Read and interpret connection and winding diagram
			• Read and interpret nameplate
			• Read and interpret manufacturer' instruction

	○ Voltage ○ Resistance ○ Frequency ○ Power ○ Energy • Relationship between electrical parameters (Ohms law) • Earthing/grounding • Estimating and costing • AC and DC source and circuit • Basic electrical circuit: Open, close, short, series and parallel • Electrical symbols • Electrical components ○ Resistor ○ Inductor ○ Fuse ○ Switch ○ Indicator ○ Thermal switch • Conductor and insulator • Power factor and its importance • Controlling and protective devices		

	• Torque
	• Electrical wire and cable
	• Winding wire
	• Insulating and conducting materials
	• Classification of insulation
	• Calculate winding data
	• Winding terminology
	  ○ Winding
	  ○ Whole and half coil winding
	  ○ Coil
	  ○ Coil group
	  ○ Coil per group
	  ○ Coil head
	  ○ Coil side
	  ○ Coil throw
	  ○ Throw coil
	  ○ Coil connection
	  ○ Pole pitch
	  ○ Pitch factor
	  ○ Electrical degree
	  ○ Degree per slot		

	○ Phase displacement ○ Turns ○ End turn ○ Coil lead ○ Distributed and concentric winding ○ Balanced and unbalanced winding ○ Single layer and double layer winding • Troubleshooting of electrical motor ○ Customer handling technique ○ Visual inspection and testing (Current, voltage, continuity, resistance, insulation) ○ Common faults and possible cause ○ Dismantling and assembling process and techniques ○ Marking and tagging process ○ Soldering and de-soldering techniques ○ Technical documentation and reporting • Cleaning and waste management • Concept of e-waste • Record keeping and documentation • Importance of first aid • Occupational health and safety rules and regulations		

9	**Assessment of Competency**					
	Unit: 2 **Unit Title: Repair three phase motor**					
	Candidate Details		**Assessors Detail**			
	Candidate's Name: Registration Number: Symbol No: Test Centre: Test Date:		Assessors' Name 1. 2. 3.		ID/License No:	

Element of competency	**Performance Standards**	**Standard Met**	**Standard Not Met**	**Evidence Type**	**Comments**
2.1 Prepare tools, equipment and materials	2.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 2.1.2 Tools and equipment collected and checked for serviceability. 2.1.3 Faulty tools and equipment tagged and reported to supervisor. 2.1.4 Materials collected and arranged in workplace as per task requirements.				
2.2 Diagnose faults	2.2.1 Customer complaints and service history interpreted to identify possible faults.				

	2.2.2 Warranty card/seal checked and customer informed regarding warranty claims. 2.2.3 External conditions of three phase motor visually inspected for ***physical damage and failure***. 2.2.4 ***Electrical parameters*** measured and condition of motor determined. 2.2.5 Functional testing carried out and identified ***signs of malfunctions***. 2.2.6 ***Faulty parts*** and wiring identified based on faulty symptoms, visual inspection, and test results. 2.2.7 Faults recorded and reported to concerned authority as per workplace procedure.				
2.3 Dismantle three phase motor	2.3.1 Motor disconnected from power source and motor marked for dismantle. 2.3.2 External components dismantled systematically as per manufacturer guidelines. 2.3.3 Components inspected, tested, and faulty components identified for repair or replacement.				
2.4 Estimate repair works	2.4.1 All the parts that need to be replaced is listed based on identified faults. 2.4.2 Cost of listed materials calculated based on market price.				

	2.4.3 Labour and service charge calculated as per workplace procedures. 2.4.4 Total repair and replace parts cost calculated, informed to customer, and take approval before commencing repair.				
2.5 Repair faulty parts	2.5.1 Repairable parts repaired as per manufacturer guidelines. 2.5.2 Non repairable parts replaced with new one with same specification. 2.5.3 Parts requiring lubrication lubricated as per manufacturer instructions. 2.5.4 Repaired/ replaced parts tested and fitted into its original position. 2.5.5 Repaired motor verified with functional testing and checking its performance.				
2.6 Rewind motor	2.6.1 Motor ***nameplate data*** collected as per nameplate and original connection diagram. 2.6.2 Winding diagram copied and development diagram prepared. 2.6.3 Faulty winding removed without damaging core and insulation. 2.6.4 Number of turns noted and wire size measured.				

	2.6.5 Slots prepared and ***insulating materials*** inserted into the slot. 2.6.6 Coil prepared as per original coil size and inserted into slot as per winding diagram. 2.6.7 Coil lead connected as per winding diagram. 2.6.8 Coil head bound tightly and uniformly. 2.6.9 Resistance and insulation test carried out. 2.6.10 Motor assembled and pre functional test carried out to verify smooth operation. 2.6.11 Baking and varnishing performed for mechanical strength and electrical insulation as per manufacturer instruction.				
2.7 Assemble three phase motor	2.7.1 Motor parts fitted to its original position as per marking and manufacturer guideline. 2.7.2 Nut/ bolt tightened for smooth rotation and stability. 2.7.3 Terminals connected to connector as per connection diagram. 2.7.4 Reassembled motor inspected visually correct fittings and alignment. 2.7.5 Functional test performed and electrical parameters measured.				
2.8 Clean workplace	2.8.1 Unused materials collected and stored in designated area.				

	2.8.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 2.8.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.				

WT- Written Test **OQ**- Oral Question **PT-** Practical Test **DO** – Direct Observation **SR**- Supervisor's report **SN**–Simulation

RP- Role Play **PG –**Photographs **VD**- Video **CT** – Certificates **TS** – Testimonials (Reward) **PP** – Product Produced

CS – Case Study

Range Statement

Variable	Range
Personal Protective Equipment	*May include but not limited to:* • Helmet • Hair net • Apron/Safety Jacket • Goggles • Gloves • Safety shoes • Mask • Anti-static wrist strap
Physical damage and failure	*May include but not limited to:* • Crack • Broken • Burn marks • Melted • Missing parts • Loose parts/components • Cut • Wear and tear • Corrosion • Leakage
Electrical parameters	*May include but not limited to:* • Continuity • Current • Voltage

	• Resistance
Signs of malfunctions	*May include but not limited to:* • Speed • Low or high current • Abnormal sound • Overheating • Vibration • Smell
Faulty parts	*May include but not limited to:* • End cover/body • Bearing • Cable shoe • Impeller • Terminal connector • Cooling fan • Terminals • Coil • Seal • Circlip
External components	*May include but not limited to:* • Fan cover • Cooling fan • Terminal box and connector • Motor housing • Mounting bolt • Pulley

Nameplate data	*May include but not limited to:* • Voltage • Current • Power • Frequency • RPM • Insulation class • Bearing size • Suction and discharge head
Insulating materials	*May include but not limited to:* • Insulation paper • Wedge • Sleeve
3R's principle	*May include but not limited to:* • Reduce • Reuse • Recycle

5	**Unit No: 3** **Unit Title: Repair universal motor**	**Unit code:**
	Elements of competency	**Performance standards**
	3.1 Prepare tools, equipment and materials	3.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 3.1.2 Tools and equipment collected and checked for serviceability. 3.1.3 Faulty tools and equipment tagged and reported to supervisor. 3.1.4 Materials collected and arranged in workplace as per task requirements.
	3.2 Diagnose faults	3.2.1 Customer complaints and service history interpreted to identify possible faults. 3.2.2 Warranty card/seal checked and customer informed regarding warranty claims. 3.2.3 External conditions of universal motor visually inspected for ***physical damage and failure***. 3.2.4 ***Electrical parameters*** measured and condition of motor determined. 3.2.5 Functional testing carried out and identified ***signs of malfunctions***. 3.2.6 ***Faulty parts*** and wiring identified based on faulty symptoms, visual inspection, and test results. 3.2.7 Faults recorded and reported to concerned authority as per workplace procedure.
	3.3 Dismantle universal motor	3.3.1 Motor disconnected from power source and motor marked for dismantle. 3.3.2 ***External components*** dismantled systematically as per manufacturer guidelines. 3.3.3 Components inspected, tested, and faulty components identified for repair or replacement.
	3.4 Estimate repair works	3.4.1 All the parts that need to be replaced is listed based on identified faults. 3.4.2 Cost of listed materials calculated based on market price.

		3.4.3 Labour and service charge calculated as per workplace procedures. 3.4.4 Total repair and replace parts cost calculated, informed to customer, and take approval before commencing repair.
	3.5 Repair faulty parts	3.5.1 Repairable parts repaired as per manufacturer guidelines. 3.5.2 Non repairable parts replaced with new one with same specification. 3.5.3 Parts requiring lubrication lubricated as per manufacturer instructions. 3.5.4 Repaired/replaced parts tested and fitted into its original position. 3.5.5 Repaired motor verified with functional testing and checking its performance.
	3.6 Rewind field coil	3.6.1 Motor ***nameplate data*** collected as per nameplate and original connection diagram. 3.6.2 Winding diagram copied and development diagram prepared. 3.6.3 Faulty winding removed without damaging core and insulation. 3.6.4 Number of turns noted and wire size measured. 3.6.5 Slots prepared and ***insulating materials*** inserted into the slot. 3.6.6 Coil prepared as per original coil size and inserted into slot as per winding diagram. 3.6.7 Coil lead connected as per winding diagram. 3.6.8 Coil head bound tightly and uniformly. 3.6.9 Resistance and insulation test carried out. 3.6.10 Motor assembled and pre functional test carried out to verify smooth operation. 3.6.11 Baking and varnishing performed for mechanical strength and electrical insulation as per manufacturer instruction.
	3.7 Assemble universal motor	3.7.1 Motor parts fitted to its original position as per marking and manufacture guideline.

		3.7.2 Nut/bolt tightened for smooth rotation and stability. 3.7.3 Terminals connected to connector as per connection diagram. 3.7.4 Reassembled motor inspected visually correct fittings and alignment. 3.7.5 Functional test performed and electrical parameters measured.
	3.8 Clean workplace	3.8.1 Unused materials collected and stored in designated area. 3.8.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 3.8.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.
6	**Task Performance Requirements (Tools, Equipment and Materials):** • Universal motor, multi-meter, megger, clamp on meter, tachometer, screwdriver set, hammer, spanner set, line tester, socket spanner set, wire stripper, side cutter, nose plier, combination plier, continuity tester, circlip plier, adjustable wrench, Allen key, paper cutter, knife, scissor, puller, lubricants, vacuum, blower, crimping tools, cable shoe, thumb pull jack, anti-rust, vice plier, bench vice, bench, tool box, oven, insulation scriber or remover, winding machine, insulating materials, solder iron, soldering flux and lead, label sticker, impact screw driver set, grinder machine, magnifier, pen, pencil, note book, steel scale, hot air gun, armature tester/growler, heat shrink tube, measuring tape, micro-meter/wire gauge plate, vernier caliper, oil can, power supply cord, rivet and rivet gun, center punch, tapping tools, drill machine with bit, testing board, storage trays/zip-lock bags, blow lamp, varnish, binding tape/ thread, PVC tape, electrical wires, winding wire, replacement components, cleaning cloth, broom, dust pan, dust bin, and personal protective equipment (PPE)	
7	**Safety and Hygiene (Occupational Health and Safety):** • Use personal protective equipment. • Safe handling of materials, tools and equipment.	

	• Hazards involved in lifting tools, equipment and materials. • Prevent from electrical hazards. • Safe handling and disposal of debris. • Follow workplace safety guidelines.

8	Required Knowledge		
	Technical Knowledge	**Applied Calculation**	**Graphical Information**

	• Tools, equipment and materials
	  ○ Types
	  ○ Uses
	  ○ Safe handling
	  ○ Storage
	• Motor
	  ○ Introduction and application
	  ○ Construction
	  ○ Types
	  ○ Major components
	  ○ Working principle
	• Electrical universal motor
	  ○ Introduction
	  ○ Types
	  ○ Parts
	  ○ Application
	  ○ Working principle
	• Electrical parameters
	  ○ Current
		• Perform unit conversion
		• Calculate current, voltage, resistance and power
			• Read and interpret connection and winding diagram
			• Read and interpret nameplate
			• Read and interpret manufacturer' instruction

	○ Voltage ○ Resistance ○ Frequency ○ Power ○ Energy • Relationship between electrical parameters (Ohms law) • Earthing/grounding • Estimating and costing • AC and DC source and circuit • Basic electrical circuit: Open, close, short, series and parallel • Electrical symbols • Electrical components ○ Resistor ○ Inductor ○ Capacitor ○ Fuse ○ Switch ○ Indicator ○ Thermal switch ○ Governor/ centrifugal switch • Conductor and insulator		

	• Power factor and its importance
	• Controlling and protective devices
	• Torque
	• Electrical wire and cable
	• Winding wire
	• Insulating and conducting materials
	• Classification of insulation
	• Calculate winding data
	• Winding terminology
	  ○ Winding
	  ○ Whole and half coil winding
	  ○ Coil
	  ○ Coil group
	  ○ Coil per group
	  ○ Coil head
	  ○ Coil side
	  ○ Coil throw
	  ○ Throw coil
	  ○ Coil connection
	  ○ Pole pitch
	  ○ Pitch factor		

	○ Electrical degree ○ Degree per slot ○ Phase displacement ○ Turns ○ End turn ○ Coil lead ○ Distributed and concentric winding ○ Balanced and unbalanced winding ○ Single layer and double layer winding • Troubleshooting of electrical motor ○ Customer handling technique ○ Visual inspection and testing (Current, voltage, continuity, resistance, insulation) ○ Common faults and possible cause ○ Dismantling and assembling process and techniques ○ Marking and tagging process ○ Soldering and de-soldering techniques ○ Technical documentation and reporting • Cleaning and waste management • Concept of e-waste • Record keeping and documentation		

	• Importance of first aid • Occupational health and safety rules and regulations		

9	Assessment of Competency					
	Unit: 3 **Unit Title: Repair universal motor**					
	Candidate Details		**Assessors Detail**			
	Candidate's Name: Registration Number: Symbol No: Test Centre: Test Date:		Assessors' Name 1. 2. 3.		ID/License No:	
Element of competency	**Performance Standards**		**Standard Met**	**Standard Not Met**	**Evidence Type**	**Comments**
3.1 Prepare tools, equipment and materials	3.1.1 ***Personal Protective Equipment (PPE)*** used in accordance with task requirements. 3.1.2 Tools and equipment collected and checked for serviceability. 3.1.3 Faulty tools and equipment tagged and reported to supervisor. 3.1.4 Materials collected and arranged in workplace as per task requirements.					
3.2 Diagnose faults	3.2.1 Customer complaints and service history interpreted to identify possible faults.					

	3.2.2 Warranty card/seal checked and customer informed regarding warranty claims. 3.2.3 External conditions of universal motor visually inspected for ***physical damage and failure***. 3.2.4 ***Electrical parameters*** measured and condition of motor determined. 3.2.5 Functional testing carried out and identified ***signs of malfunctions***. 3.2.6 ***Faulty parts*** and wiring identified based on faulty symptoms, visual inspection, and test results. 3.2.7 Faults recorded and reported to concerned authority as per workplace procedure.				
3.3 Dismantle universal motor	3.3.1 Motor disconnected from power source and motor marked for dismantle. 3.3.2 ***External components*** dismantled systematically as per manufacturer guidelines. 3.3.3 Components inspected, tested, and faulty components identified for repair or replacement.				
3.4 Estimate repair works	3.4.1 All the parts that need to be replaced is listed based on identified faults. 3.4.2 Cost of listed materials calculated based on market price.				

	3.4.3 Labour and service charge calculated as per workplace procedures. 3.4.4 Total repair and replace parts cost calculated, informed to customer, and take approval before commencing repair.				
3.5 Repair faulty parts	3.5.1 Repairable parts repaired as per manufacturer guidelines. 3.5.2 Non repairable parts replaced with new one with same specification. 3.5.3 Parts requiring lubrication lubricated as per manufacturer instructions. 3.5.4 Repaired/replaced parts tested and fitted into its original position. 3.5.5 Repaired motor verified with functional testing and checking its performance.				
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3.8 Clean workplace	3.8.1 Unused materials collected and stored in designated area.				

	3.8.2 Tools and equipment cleaned, lubricated, checked for damage and stored in designated area. 3.8.3 Workplace cleaned neatly and waste disposed as per ***3R's principle*** at designated area.				

WT- Written Test **OQ**- Oral Question **PT-** Practical Test **DO** – Direct Observation **SR**- Supervisor's report **SN**–Simulation

RP- Role Play **PG –**Photographs **VD**- Video **CT** – Certificates **TS** – Testimonials (Reward) **PP** – Product Produced

CS – Case Study

Range Statement

Variable	Range
Personal Protective Equipment	*May include but not limited to:* • Helmet • Hair net • Apron/Safety Jacket • Goggles • Gloves • Safety shoes • Mask • Anti-static wrist strap
Physical damage and failure	*May include but not limited to:* • Crack • Broken • Burn marks • Melted • Missing parts • Loose parts/components • Cut • Wear and tear • Corrosion • Leakage
Electrical parameters	*May include but not limited to:* • Continuity • Current • Voltage

	• Resistance
Signs of malfunctions	*May include but not limited to:* • Speed • Low or high current • Abnormal sound • Overheating • Vibration • Smell
Faulty parts	*May include but not limited to:* • End cover/body • Bearing • Bush • Cable shoe • Capacitor • Impeller • Terminal connector • Cooling fan • Terminals • Field coil • Seal • Circlip • Diode • Resistor
External components	*May include but not limited to:* • Fan cover

	• Cooling fan • Terminal box and connector • Motor housing • Mounting bolts
Nameplate data	*May include but not limited to:* • Voltage • Current • Power • Frequency • RPM • Insulation class • Bearing size
Insulating materials	*May include but not limited to:* • Insulation paper • Wedge • Sleeve
3R's principle	*May include but not limited to:* • Reduce • Reuse • Recycle