

# National Occupational Skill Standard (NOSS)

**Occupational Title** : Refrigeration and Air Conditioning Mechanic

**Level** : 1

**Sector** : Mechanical

**Sub - Sector** : Refrigeration and Air Conditioning

**NOSS ID/NSCO ID** :

**ISCO NO** :



Council for Technical Education and Vocational Training

**NATIONAL SKILL TESTING BOARD**

Madhyapur Thimi-17, Sanothimi, Bhaktapur, Nepal

Developed: 27-09-2022 (11-06-2079)



2045

**DACUM Panel:**

<b>S. No.</b>	<b>Name</b>	<b>Designation</b>	<b>Organization</b>
1.	Mr. Ram Mohan Adhikari	Member	Basnet Ref and AC workshop, Pulchowk, Lalitpur
2.	Mr. Keshab Shrestha	Member	Lalitpur Valley College, Lalitpur
3.	Mr. Lekhnath Niraula	Member	Arun Ref. & Air Conditioning
4.	Mr. Ganesh Khatri	Member	Sai Baba Electrical Workshop
5.	Mr. Jang Bahadur Nemkul	Member	J.B.Refrigerator
6.	Mr. Niroj Bhakta Shrestha	Member	Chandra Electrical Workshop
7.	Mr. Ashok Kumar Lama	Member	Mahalaxmi Electrical Workshop
8.	Mr. Ramesh Maharjan	Member	Order Electrical Workshop

**DACUM Coordinator /Facilitator:**

Mr. Sagar Lamsal, CTEVT, Sanothimi, Bhaktapur

Mr. Suresh Bhaila, CTEVT, Sanothimi, Bhaktapur

**DACUM Workshop on May, 2008**



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2.	Mr. Jay Shrestha	Member	Super Electro-tech Solution,Gathaghar.
3.	Mr. Dipendra Shrestha	Member	Ref & Electrical Workshop, Balaju
4.	Mr. Prabesh Dangol	Member	Pingal Electrical Workshop, Lalitpur
5.	Mr. Keshab Shrestha	Member	LVC, Thaiba, Lalitpur
6.	Mr. Ram Mohan Adhikari	Member	Basnet Ref and AC workshop, Pulcowk, Lalitpur
7.	Mr. Bikash Shrestha	Member	JB Electrical, Kumaripati, Lalitpur
8.	Mr. Rajeeb Lama	Member	Lama Apex International, Kamalpokhari, Kathmandu
9.	Mr. Sudeeb Ranjit	Member	Lama Apex International, Kamalpokhari, Kathmandu
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**DACUM Workshop on May, 2008**



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4.	Mr. Buddha Krishna Manandhar	Member	Power and Airco Department NTC, Kathmandu
5.	Mr. Bal Purushottam Shakya	Member	Global Technical Institute Kalanki, Kathmandu
6.	Mr. Mohan KC	Member	Institute Of Engineering Pulchowk, Lalitpur
7.	Mr. Chabbi Bahadur Gurung	Member	Deputy Director National Skill Testing Board, Sanothimi, Bhaktapur
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**Recommended by Mechanical Technical Sub Committee: May 2008**



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**Recommended by Mechanical Technical Sub Committee: 16 January 2016 (02 Magh 2072)**



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**Recommended by Mechanical Technical Sub Committee: 27 September 2022 (11 Asoj 2079)**



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1	<b>Occupational Title: Refrigeration and Air Conditioning Mechanic</b> <b>Level: 1</b>
2	<b>Job Description:</b>  Refrigeration and Air Conditioning Mechanic L-1, performs general servicing of domestic refrigeration unit and air conditioning unit, and installs air conditioning unit.
3	<b>UNITS OF COMPETENCY:</b>  1. Perform general servicing of domestic refrigeration unit 2. Install domestic air conditioning unit 3. Perform general servicing of domestic air conditioning unit 4. Perform communication 5. Develop professionalism  <i><b>*Note: Units 4 and 5 are not for testing purpose.</b></i>
4	<b>Qualifying Notes/Prerequisites:</b> <ul style="list-style-type: none"> <li>• Physical Requirements: Sound health</li> <li>• Entry Requirements: As per NSTB rules</li> </ul> <b>Additional Information:</b> <ul style="list-style-type: none"> <li>• Assessment Types: Performance test only</li> <li>• Assessment Duration: 4 Hours (Single Competency) 5 to 6 hours (All Competency)</li> <li>• Recommended Group Size: 6 to 8 candidates</li> </ul>



5	<b>Unit No:1</b>		Unit code:	
	<b>Unit Title: Perform general servicing of domestic refrigeration unit</b>			
	<b>Elements of competency</b>	<b>Performance standards</b>		
	1.1 Prepare for servicing	1.1.1 <b>Personal protective equipment (PPE)</b> used in accordance with task requirement. 1.1.2 Tools, equipment, and materials are prepared as per task requirement. 1.1.3 Physical condition of refrigeration is checked and details recorded.		
1.2 Service and replace electrical components	1.2.1 <b>Electrical parameters</b> measured in <b>electrical circuit and components</b> and verified against wiring diagram. 1.2.2 Loose connection and faulty wiring repaired as per wiring diagram. 1.2.3 Manufacturer's specification of faulty electrical components checked and recorded. 1.2.4 Faulty electrical components replaced and sequentially fitted as per manufacturer's specification. 1.2.5 Unit operated and performance checked for <b>normal operation</b> .			
1.3 Service and replace mechanical components	1.3.1 Visual inspection performed for physical damage and leakage. 1.3.2 <b>foreign materials</b> cleared from condenser, evaporator, drain tray, and drain ports using appropriate <b>cleaning method</b> without damage. 1.3.3 <b>Mechanical components</b> serviced as per manufacturer's specification. 1.3.4 Loose connection tightened and leakage tested with dry Nitrogen (N <sub>2</sub> ). 1.3.5 Joints of copper tube de-brazed to remove faulty mechanical components without damaging other components. 1.3.6 Faulty mechanical components replaced and sequentially fitted as per manufacturer's specification.			





		<p>1.3.7 Joints of copper tube brazed by protecting the surrounding components and residue removed from joints.</p> <p>1.3.8 Leakage checked with dry Nitrogen.</p> <p>1.3.9 Unit operated and performance checked for normal operation.</p>
	1.4 Charge refrigerant	<p>1.4.1 System pressure tested with dry Nitrogen without exceeding the maximum head pressure, and leakage checked.</p> <p>1.4.2 System flushed with dry Nitrogen at pressure of 10-15 psi.</p> <p>1.4.3 System evacuated up to 500 microns.</p> <p>1.4.4 Refrigerant charged by weight as per manufacturer's specification.</p> <p>1.4.5 Charging line sealed appropriate <b>sealing technique</b>.</p> <p>1.4.6 Unit operated and performance checked for normal operation.</p>
	1.5 Prepare report	<p>1.5.1 All defects and problems are recorded as per industry norms.</p> <p>1.5.2 Servicing checklist is filled and submitted to supervisor.</p>
	1.6 Clean workplace	<p>1.6.1 Unused materials collected and stored in designated area.</p> <p>1.6.2 Tools and equipment cleaned, checked for damage and stored in designated area.</p> <p>1.6.3 Workplace cleaned neatly and waste disposed as per <b>3R's principle</b> in designated area.</p>
6	<p><b>Task Performance Requirements (Tools, equipment, and materials):</b></p> <ul style="list-style-type: none"> <li>Freezer, refrigerator, screwdriver set, open ended spanner, socket spanner set, Allen key, fin comb, wire stripper, pliers, wire stripper, phase tester, multimeter, measuring tape, steel ruler, file set, hacksaw, hammer, wrench, scissor, Nitrogen gas cylinder with regulator, pipe/tube cutter, electric air blower, vacuum pump, gauge manifold, flaring and swaging tool kit, electronic leak detector, water pressure gun, soldering</li> </ul>	



	<p>iron, de-soldering tool, oxy- acetylene brazing set, clamp-on ampere meter, drill machine set, reamer, torch, nozzle, weighing machine, refrigerant, thermometer, dust bin, dust pan, flare nuts, insulating materials, brazing rod, brazing flux, emery paper, brush, cleaning agent, cotton rag, lubricants, pen, paper, register, broom, first aid kit, and personal protective equipment (PPE).</p>
<p><b>7</b></p>	<p><b>Safety and Hygiene (Occupational Health and Safety):</b></p> <ul style="list-style-type: none"> <li>• Use personal protective equipment.</li> <li>• Safe handling of materials, tools and equipment.</li> <li>• Hazards involved in lifting Tools, equipment, and materials.</li> <li>• Unplug the refrigerator before servicing</li> <li>• Prevent from chemical, electrical and pressure related hazards.</li> <li>• Prevent from hazards involved in handling refrigerants.</li> <li>• Protect work area while working with Hydro carbon</li> <li>• Make sure the work area is well ventilated</li> <li>• Evacuate system before brazing and de-brazing</li> </ul>



8	Required Knowledge		
	Technical Knowledge	Applied Calculation	Graphical Information
	<ul style="list-style-type: none"> <li>• Tools, equipment, and materials               <ul style="list-style-type: none"> <li>○ Types</li> <li>○ Uses</li> <li>○ Safe handling</li> </ul> </li> <li>• Refrigeration               <ul style="list-style-type: none"> <li>○ Introduction</li> <li>○ Types</li> </ul> </li> <li>• Refrigerator and deep freezer               <ul style="list-style-type: none"> <li>○ Introduction</li> <li>○ Types</li> <li>○ Major electrical and mechanical components</li> <li>○ Function of electrical and mechanical components</li> <li>○ Dismantling and assembling process</li> <li>○ Servicing techniques</li> <li>○ Common faults/defects</li> <li>○ Testing and operation</li> </ul> </li> <li>• Electrical parameters</li> <li>• Wiring diagram and connection</li> <li>• Pressure temperature relationship of refrigerants</li> </ul>	<ul style="list-style-type: none"> <li>• Convert volume (cm<sup>3</sup>) to liters</li> <li>• Convert Centigrade to Fahrenheit and vice versa</li> <li>• Convert pressure to kilo pascal, mega pascal, micron, psi, and bar</li> </ul>	<ul style="list-style-type: none"> <li>• Read and interpret electric circuit and drawing</li> <li>• Read and interpret workshop manual</li> <li>• Read and interpret manufacturer's specification</li> </ul>



	<ul style="list-style-type: none"> <li>• Measurement units for pressure and temperature</li> <li>• Refrigerants <ul style="list-style-type: none"> <li>○ Introduction</li> <li>○ Type</li> <li>○ Leakage testing</li> <li>○ Evacuating</li> <li>○ Flushing</li> <li>○ Charging</li> <li>○ Storing technique</li> <li>○ Recovery</li> </ul> </li> <li>• Printed Circuit Board (PCB)</li> <li>• Gas welding, brazing and soldering</li> <li>• Refrigerants and environment impact</li> <li>• Record keeping and reporting</li> <li>• Waste management</li> <li>• Occupational health and safety rules and regulations</li> </ul>		
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9	<b>Assessment of Competency</b>				
<b>Unit: 1</b>					
<b>Unit Title: Perform general servicing of domestic refrigeration unit</b>					
<b>Candidate Details</b>			<b>Assessors Detail</b>		
Candidate's Name:			Assessors' Name		ID/License No:
Registration Number:			1.		
Symbol No:			2.		
Test Centre:			3.		
Test Date:					
Element of competency	Performance Standards	Standard Met	Standard Not Met	Evidence Type	Comments
1.1 Prepare for servicing	1.1.1 <b>Personal protective equipment (PPE)</b> used in accordance with task requirement.				
	1.1.2 Tools, equipment, and materials are prepared as per task requirement.				
	1.1.3 Physical condition of refrigeration is checked and details recorded.				
1.2 Service and replace electrical components	1.2.1 <b>Electrical parameters</b> measured in <b>electrical circuit and components</b> and verified against wiring diagram.				
	1.2.2 Loose connection and faulty wiring repaired as per wiring diagram.				
	1.2.3 Manufacturer's specification of faulty electrical				



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	<p>components checked and recorded.</p> <p>1.2.4 Faulty electrical components replaced and sequentially fitted as per manufacturer's specification.</p> <p>1.2.5 Unit operated and performance checked for <b>normal operation</b>.</p>				
<p>1.3 Service and replace mechanical components</p>	<p>1.3.1 Visual inspection performed for physical damage and leakage.</p> <p>1.3.2 <b>foreign materials</b> cleared from condenser, evaporator, drain tray, and drain ports using appropriate <b>cleaning method</b> without damage.</p> <p>1.3.3 <b>Mechanical components</b> serviced as per manufacturer's specification.</p> <p>1.3.4 Loose connection tightened and leakage tested with dry Nitrogen (N<sub>2</sub>).</p> <p>1.3.5 Joints of copper tube de-brazed to remove faulty mechanical components without damaging other components.</p> <p>1.3.6 Faulty mechanical components replaced and sequentially fitted as per manufacturer's specification.</p> <p>1.3.7 Joints of copper tube brazed by protecting the surrounding components and residue removed from joints.</p>				



	<p>1.3.8 Leakage checked with dry Nitrogen.</p> <p>1.3.9 Unit operated and performance checked for normal operation.</p>				
1.4 Charge refrigerant	<p>1.4.1 System pressure tested with dry Nitrogen without exceeding the maximum head pressure, and leakage checked.</p> <p>1.4.2 System flushed with dry Nitrogen at pressure of 10-15 psi.</p> <p>1.4.3 System evacuated up to 500 microns.</p> <p>1.4.4 Refrigerant charged by weight as per manufacturer's specification.</p> <p>1.4.5 Charging line sealed appropriate <b>sealing technique</b>.</p> <p>1.4.6 Unit operated and performance checked for normal operation.</p>				
1.5 Prepare report	<p>1.5.1 All defects and problems are recorded as per industry norms.</p> <p>1.5.2 Servicing checklist is filled and submitted to supervisor.</p>				
1.6 Clean workplace	<p>1.6.1 Unused materials collected and stored in designated area.</p> <p>1.6.2 Tools and equipment cleaned, checked for damage and stored in designated area.</p> <p>1.6.3 Workplace cleaned neatly and waste disposed as per <b>3R's principle</b> in designated area.</p>				



**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



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## Range Statement

Variable	Range
Personal protective equipment (PPE)	<p><i>May include but not limited to:</i></p> <ul style="list-style-type: none"> <li>• Helmet</li> <li>• Mask</li> <li>• Apron</li> <li>• Goggles</li> <li>• Gloves</li> <li>• Safety shoes</li> <li>• Ear plug</li> <li>• Welding face shield</li> </ul>
Electrical parameters	<p><i>May include but not limited to:</i></p> <ul style="list-style-type: none"> <li>• Voltage</li> <li>• Resistance</li> <li>• Continuity</li> <li>• Current</li> <li>• Capacitance</li> <li>• Voltage drop</li> <li>• Short circuit</li> <li>• Open circuit</li> </ul>
Electrical circuit and components	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Power supply</li> <li>• Electrical cable</li> </ul>



	<ul style="list-style-type: none"> <li>• Power plug and socket</li> <li>• Thermostat</li> <li>• Relay</li> <li>• Overload</li> <li>• Fan</li> <li>• Compressor terminals</li> <li>• Lamp, holder and door switch</li> <li>• Capacitor</li> <li>• Fuse</li> <li>• Timers</li> <li>• Defrost thermo switch</li> </ul>
Foreign materials	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Dust</li> <li>• Dirt</li> <li>• Hair</li> <li>• Debris</li> </ul>
Cleaning method	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Dusting</li> <li>• Vacuuming</li> <li>• Scrapping</li> <li>• Brushing</li> <li>• Air blowing</li> </ul>
Mechanical components	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Condenser</li> </ul>



	<ul style="list-style-type: none"> <li>• Evaporator</li> <li>• Filter</li> <li>• Filter dryer</li> <li>• Compressor</li> <li>• Capillary tube</li> <li>• Fan blade/motor</li> <li>• Door seal, hinge and heater</li> </ul>
Sealing technique	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Brazing</li> <li>• Flaring</li> <li>• Non-return valve</li> <li>• Lock ring system</li> </ul>
Normal operation	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Sound</li> <li>• Vibration</li> <li>• Leakage</li> <li>• Current</li> <li>• Temperature</li> <li>• Pressure</li> </ul>
3R's principle	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Reduce</li> <li>• Reuse</li> <li>• Recycle</li> </ul>



5	<b>Unit No:2</b>		<b>Unit code:</b>
	<b>Unit Title: Install domestic air conditioning unit</b>		
	Elements of competency	Performance standards	
	2.1 Prepare installation site	<p>2.1.1 <b>Personal protective equipment (PPE)</b> used in accordance with task requirement.</p> <p>2.1.2 Tools, equipment, and materials are prepared as per site condition and task requirement.</p> <p>2.1.3 Location for installing air conditioning unit is selected as per manufacturer's specification and client's requirement.</p> <p>2.1.4 Wall/Surface marked and holes prepared in marked location for pipes, wires and drain pipe in required dimension.</p> <p>2.1.5 <b>Supporting structures</b> is firmly fixed in marked location of interior/exterior wall.</p> <p>2.1.6 Power supply checked and electrical point with circuit breaker installed as per manufacturer's specification.</p>	
2.2 Install window AC	<p>2.2.1 Window unit unpacked and checked for physical damage.</p> <p>2.2.2 Window unit firmly positioned and levelled on supporting structures as per manufacturer's specification.</p> <p>2.2.3 <b>Sealing materials</b> applied around the window unit.</p> <p>2.2.4 Condensate drain line fixed with proper slope to ensure free drainage and to avoid water spillage.</p> <p>2.2.5 Electrical wiring checked and connected as per the wiring diagram.</p> <p>2.2.6 Window unit operated and performance checked as per manufacturer's specification.</p>		
2.3 Install split AC	2.3.1 Indoor and outdoor unit firmly positioned and levelled on supporting structures in		



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		<p>interior and exterior wall respectively as per manufacturer's specification.</p> <p>2.3.2 Refrigerant pipe lines insulated without exposing copper pipes and connected to outdoor unit and indoor unit.</p> <p>2.3.3 Refrigerant pipe lines pressure tested with dry Nitrogen, evacuated and charged with refrigerant as per manufacturer's specification.</p> <p>2.3.4 Condensate drain line fixed with proper slope to ensure free drainage and to avoid water spillage.</p> <p>2.3.5 Electrical wiring/connection checked and connected as per the wiring diagram.</p> <p>2.3.6 Service valves and joints checked for leakage.</p> <p>2.3.7 Pipes and cables are fixed with clamps.</p> <p>2.3.8 Holes completely sealed with sealing materials to prevent from hot air or insects.</p> <p>2.3.9 Operation of AC unit checked and adjusted according to manufacturer's specification.</p> <p>2.3.10 Installation report prepared as per industry norms.</p>
	2.4 Perform site clearance	<p>2.4.1 Unused materials are collected and stored in designated area.</p> <p>2.4.2 Tools and equipment are cleaned, checked for damage and stored in designated area.</p> <p>2.4.3 Worksite cleaned neatly and waste disposed as per <b>3R's principle</b> in designated area.</p>
6	<p><b>Task Performance Requirements (Tools, equipment, and materials):</b></p> <ul style="list-style-type: none"> <li>Air conditioner, vibration pad, chisel, marker, drill machine set, try square, measuring tape, bucket, water, bracket, angle frame, tube bender, power socket, power plug, circuit breaker, hacksaw, ladder, screwdriver set, open ended spanner, socket spanner set, Allen key, wire stripper, pliers, wire stripper, phase tester, multimeter, measuring tape, steel ruler, file set, hammer, wrench, scissor, Nitrogen gas cylinder</li> </ul>	



	<p>with regulator, pipe/tube cutter, electric air blower, vacuum pump, gauge manifold, flaring and swaging tool kit, electronic leak detector, water pressure gun, soldering iron, de-soldering tool, oxy- acetylene brazing set, clamp-on ampere meter, drill machine set, reamer, torch, nozzle, weighing machine, refrigerant, thermometer, dust bin, dust pan, broom, sand, cement, clamps, screw, nails, fin comb, flare nuts, brazing rod, brazing flux, insulating materials, emery paper, brush, cleaning agent, lubricants, cotton rag, soapy water, cotton rag, lubricants, pen, paper, register, broom, first aid kit and personal protective equipment (PPE)</p>
<p><b>7</b></p>	<p><b>Safety and Hygiene (Occupational Health and Safety):</b></p> <ul style="list-style-type: none"> <li>• Use personal protective equipment.</li> <li>• Safe handling of materials, tools and equipment.</li> <li>• Hazards involved in lifting Tools, equipment, and materials.</li> <li>• Prevent from chemical, electrical and pressure related hazards.</li> <li>• Prevent from hazards involved in handling refrigerants.</li> </ul>



8	Required Knowledge		
	Technical Knowledge	Applied Calculation	Graphical Information
	<ul style="list-style-type: none"> <li>• Tools, equipment, and materials:               <ul style="list-style-type: none"> <li>○ Types</li> <li>○ Uses</li> <li>○ Safe handling</li> </ul> </li> <li>• Location and methods of marking</li> <li>• Air Conditioner:               <ul style="list-style-type: none"> <li>○ Window and split AC</li> <li>○ Accessories, components and their types</li> <li>○ Function</li> <li>○ Types of refrigerants</li> <li>○ Types of oil</li> <li>○ Pressure test procedures</li> <li>○ System flushing procedures</li> <li>○ Evacuation procedures</li> <li>○ Charging procedures</li> <li>○ Electrical connections</li> <li>○ Operation procedure</li> <li>○ Performance testing procedures</li> </ul> </li> <li>• Handling of copper tube</li> </ul>	<ul style="list-style-type: none"> <li>• Convert measuring unit (SI, Metric and imperial)</li> </ul>	<ul style="list-style-type: none"> <li>• Read and interpret name plate</li> <li>• Read and interpret electric circuit and drawing</li> <li>• Read and interpret workshop manual</li> <li>• Read and interpret manufacturer's specification</li> </ul>



	<ul style="list-style-type: none"><li>• Electrical parameters</li><li>• Wiring diagram and connection</li><li>• Waste management</li><li>• Record keeping and documentation</li><li>• Occupational health and safety rules and regulations</li></ul>		
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9	<b>Assessment of Competency</b>				
<b>Unit: 2</b>					
<b>Unit Title: Install domestic air conditioning unit</b>					
<b>Candidate Details</b>			<b>Assessors Detail</b>		
Candidate's Name:			Assessors' Name		ID/License No:
Registration Number:			1.		
Symbol No:			2.		
Test Centre:			3.		
Test Date:					
Element of competency	Performance Standards	Standard Met	Standard Not Met	Evidence Type	Comments
2.1 Prepare installation site	2.1.1 <b>Personal protective equipment (PPE)</b> used in accordance with task requirement.				
	2.1.2 Tools, equipment, and materials are prepared as per site condition and task requirement.				
	2.1.3 Location for installing air conditioning unit is selected as per manufacturer's specification and client's requirement.				
	2.1.4 Wall/Surface marked and holes prepared in marked location for pipes, wires and drain pipe in required dimension.				
	2.1.5 <b>Supporting structures</b> is firmly fixed in marked location of interior/exterior wall.				



	2.1.6 Power supply checked and electrical point with circuit breaker installed as per manufacturer's specification.				
2.2 Install window AC	<p>2.2.1 Window unit unpacked and checked for physical damage.</p> <p>2.2.2 Window unit firmly positioned and levelled on supporting structures as per manufacturer's specification.</p> <p>2.2.3 <b>Sealing materials</b> applied around the window unit.</p> <p>2.2.4 Condensate drain line fixed with proper slope to ensure free drainage and to avoid water spillage.</p> <p>2.2.5 Electrical wiring checked and connected as per the wiring diagram.</p> <p>2.2.6 Window unit operated and performance checked as per manufacturer's specification.</p>				
2.3 Install split AC	<p>2.3.1 Indoor and outdoor unit firmly positioned and levelled on supporting structures in interior and exterior wall respectively as per manufacturer's specification.</p> <p>2.3.2 Refrigerant pipe lines insulated without exposing copper pipes and connected to outdoor unit and indoor unit.</p> <p>2.3.3 Refrigerant pipe lines pressure tested with dry Nitrogen, evacuated and charged with refrigerant as per manufacturer's specification.</p> <p>2.3.4 Condensate drain line fixed with proper slope to ensure</p>				



	<p>free drainage and to avoid water spillage.</p> <p>2.3.5 Electrical wiring/connection checked and connected as per the wiring diagram.</p> <p>2.3.6 Service valves and joints checked for leakage.</p> <p>2.3.7 Pipes and cables are fixed with clamps.</p> <p>2.3.8 Holes completely sealed with sealing materials to prevent from hot air or insects.</p> <p>2.3.9 Operation of AC unit checked and adjusted according to manufacturer's specification.</p> <p>2.3.10 Installation report prepared as per industry norms.</p>				
2.4 Perform site clearance	<p>2.4.1 Unused materials are collected and stored in designated area.</p> <p>2.4.2 Tools and equipment are cleaned, checked for damage and stored in designated area.</p> <p>2.4.3 Worksite cleaned neatly and waste disposed as per <b>3R's principle</b> in designated area.</p>				

**WT**- Written Test

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**DO** – Direct Observation

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## Range Statement

Variable	Range
Personal protective equipment (PPE)	<p><i>May include but not limited to:</i></p> <ul style="list-style-type: none"> <li>• Helmet</li> <li>• Mask</li> <li>• Apron</li> <li>• Goggles</li> <li>• Gloves</li> <li>• Safety shoes</li> <li>• Ear plug</li> <li>• Welding face shield</li> </ul>
Supporting structures	<p><i>May include but not limited to:</i></p> <ul style="list-style-type: none"> <li>• Bracket</li> <li>• Mounting plate</li> <li>• Hanger</li> <li>• Frame</li> </ul>
Sealing materials	<p><i>May include but not limited to:</i></p> <ul style="list-style-type: none"> <li>• Gasket</li> <li>• Rubber</li> <li>• Silicone</li> <li>• Foam</li> <li>• Plastic</li> <li>• Tape wrapping</li> </ul>



3R's principle	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"><li>• Reduce</li><li>• Reuse</li><li>• Recycle</li></ul>
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5	<b>Unit No:3</b>		<b>Unit code:</b>
	<b>Unit Title: Perform general servicing of domestic air conditioning unit</b>		
	Elements of competency	Performance standards	
	3.1 Prepare for servicing	3.1.1 <b>Personal protective equipment (PPE)</b> used in accordance with task requirement. 3.1.2 Tools, equipment, and materials are prepared as per task requirement. 3.1.3 Physical condition of air conditioning unit is checked and details recorded.	
3.2 Service and replace electrical components	3.2.1 <b>Electrical parameters</b> measured in <b>electrical circuit and components</b> and verified against wiring diagram. 3.2.2 Loose connection and faulty wiring repaired as per wiring diagram. 3.2.3 Manufacturer's specification of faulty electrical components checked and recorded. 3.2.4 Faulty electrical components replaced and sequentially fitted as per manufacturer's specification. 3.2.5 Unit operated and performance checked for <b>normal operation</b> .		
3.3 Service and replace mechanical components	3.3.1 Visual inspection performed for physical damage and leakage. 3.3.2 <b>foreign materials</b> cleared from <b>indoor unit and outdoor</b> unit using <b>appropriate cleaning method</b> without damage. 3.3.3 System pressure tested with dry Nitrogen and recorded. 3.3.4 <b>Mechanical components</b> serviced as per manufacturer's specification. 3.3.5 Loose connection tightened and leakage tested with dry Nitrogen. 3.3.6 Joints of copper tube de-brazed to remove faulty mechanical components without damaging other components. 3.3.7 Faulty mechanical components replaced and sequentially fitted as per manufacturer's		



	<p>specification.</p> <p>3.3.8 Joints of copper tube brazed by protecting the surrounding components and residue removed from joints.</p> <p>3.3.9 Leakage checked with dry Nitrogen and sealed tightly.</p> <p>3.3.10 Unit operated and performance checked for normal operation.</p>
3.4 Charge refrigerant	<p>3.4.1 System pressure tested with dry Nitrogen without exceeding the maximum head pressure, and leakage checked.</p> <p>3.4.2 System flushed with dry Nitrogen at pressure of 10-15 psi.</p> <p>3.4.3 System evacuated up to 500 microns.</p> <p>3.4.4 Refrigerant charged using specified type of gas by weight as per manufacturer's specification.</p> <p>3.4.5 Service valves and joints are checked for leakage.</p> <p>3.4.6 Unit operated and performance checked for normal operation.</p>
3.5 Prepare report	<p>3.5.1 All defects and problems are recorded as per industry norms.</p> <p>3.5.2 Servicing checklist is filled and submitted to supervisor.</p>
3.6 Clean workplace	<p>3.6.1 Unused materials are collected and stored in designated area.</p> <p>3.6.2 Tools and equipment are cleaned, checked for damage and stored in designated area.</p> <p>3.6.3 Workplace and window unit cleaned neatly and waste disposed as per <b>3R's principle</b> in designated area.</p>



6	<p><b>Task Performance Requirements (Tools, equipment, and materials):</b></p> <ul style="list-style-type: none"> <li>Window/split air conditioner, screwdriver set, open ended spanner, socket spanner set, Allen key, wire stripper, pliers, wire stripper, phase tester, multimeter, measuring tape, steel ruler, file set, hacksaw, hammer, wrench, scissor, Nitrogen gas cylinder with regulator, pipe/tube cutter, electric air blower, vacuum pump, gauge manifold, flaring and swaging tool kit, electronic leak detector, water pressure gun, soldering iron, de-soldering tool, oxy- acetylene brazing set, clamp-on ampere meter, drill machine set, air blower, torch, air blower, nozzle, weighing machine, refrigerant, thermometer, dust bin, dust pan, broom, fin comb, flare nuts, brazing rod, brazing flux, insulating materials, emery paper, brush, cleaning agent, cotton rag, lubricants, pen, paper, register, first aid kit and personal protective equipment (PPE).</li> </ul>
7	<p><b>Safety and Hygiene (Occupational Health and Safety):</b></p> <ul style="list-style-type: none"> <li>Use personal protective equipment.</li> <li>Safe handling of materials, tools and equipment.</li> <li>Hazards involved in lifting Tools, equipment, and materials.</li> <li>Prevent from chemical, electrical and pressure related hazards.</li> <li>Prevent from hazards involved in handling refrigerants.</li> <li>Protect work area while working with Hydro carbon</li> <li>Make sure the work area is well ventilated</li> <li>Evacuate system before brazing and de-brazing</li> </ul>





8	Required Knowledge		
	Technical Knowledge	Applied Calculation	Graphical Information
	<ul style="list-style-type: none"> <li>• Tools, equipment, and materials:               <ul style="list-style-type: none"> <li>○ Introduction</li> <li>○ Types</li> <li>○ Preparation</li> <li>○ Safe handling</li> </ul> </li> <li>• Air Conditioner:               <ul style="list-style-type: none"> <li>○ Window and split AC</li> <li>○ Components and their types</li> <li>○ Function</li> <li>○ Types of refrigerants</li> <li>○ Types of oil</li> <li>○ Pressure test procedures</li> <li>○ System flushing procedures</li> <li>○ Evacuation procedures</li> <li>○ Charging procedures</li> <li>○ Electrical connections</li> <li>○ Operation procedure</li> <li>○ Performance testing procedures</li> </ul> </li> <li>• Electrical parameters</li> </ul>	<ul style="list-style-type: none"> <li>• Convert Centigrade to Fahrenheit and vice versa</li> <li>• Convert pressure to kilo pascal, mega pascal, micron, psi, and bar</li> </ul>	<ul style="list-style-type: none"> <li>• Read and interpret electric circuit and drawing</li> <li>• Read and interpret workshop manual</li> <li>• Read and interpret manufacturer's specification</li> </ul>



	<ul style="list-style-type: none"> <li>• Servicing and maintenance of Air conditioner</li> <li>• Diagnosing and troubleshooting of domestic Air Conditioners</li> <li>• Gas welding</li> <li>• Brazing and de-brazing</li> <li>• Types of lubricant and their properties</li> <li>• Types of Insulation and their applications</li> <li>• Handling of copper tubes</li> <li>• Refrigerant <ul style="list-style-type: none"> <li>○ Types</li> <li>○ Evacuation</li> <li>○ Flushing</li> <li>○ Charging</li> <li>○ Storing technique</li> <li>○ Recovery</li> </ul> </li> <li>• Refrigerants and environment impact</li> <li>• Waste management</li> <li>• Recordkeeping and reporting</li> <li>• Occupational health and safety rules and regulations</li> </ul>		
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9	<b>Assessment of Competency</b>				
<b>Unit: 3</b>					
<b>Unit Title: Perform general servicing of air conditioning unit</b>					
<b>Candidate Details</b>			<b>Assessors Detail</b>		
Candidate's Name:			Assessors' Name		ID/License No:
Registration Number:			1.		
Symbol No:			2.		
Test Centre:			3.		
Test Date:					
Element of competency	Performance Standards	Standard Met	Standard Not Met	Evidence Type	Comments
3.1 Prepare for servicing	3.1.1 <b>Personal protective equipment (PPE)</b> used in accordance with task requirement.				
	3.1.2 Tools, equipment, and materials are prepared as per task requirement.				
	3.1.3 Physical condition of air conditioning unit is checked and details recorded.				
3.2 Service and replace electrical components	3.2.1 <b>Electrical parameters</b> measured in <b>electrical circuit and components</b> and verified against wiring diagram.				
	3.2.2 Loose connection and faulty wiring repaired as per wiring diagram.				
	3.2.3 Manufacturer's specification of faulty electrical				



	<p>components checked and recorded.</p> <p>3.2.4 Faulty electrical components replaced and sequentially fitted as per manufacturer's specification.</p> <p>3.2.5 Unit operated and performance checked for <b>normal operation.</b></p>				
<p>3.3 Service and replace mechanical components</p>	<p>3.3.1 Visual inspection performed for physical damage and leakage.</p> <p>3.3.2 <b>foreign materials</b> cleared from <b>indoor unit and outdoor</b> unit using <b>appropriate cleaning method</b> without damage.</p> <p>3.3.3 System pressure tested with dry Nitrogen and recorded.</p> <p>3.3.4 <b>Mechanical components</b> serviced as per manufacturer's specification.</p> <p>3.3.5 Loose connection tightened and leakage tested with dry Nitrogen.</p> <p>3.3.6 Joints of copper tube de-brazed to remove faulty mechanical components without damaging other components.</p> <p>3.3.7 Faulty mechanical components replaced and sequentially fitted as per manufacturer's specification.</p> <p>3.3.8 Joints of copper tube brazed by protecting the surrounding components and residue removed from joints.</p>				



	<p>3.3.9 Leakage checked with dry Nitrogen and sealed tightly.</p> <p>3.3.10 Unit operated and performance checked for normal operation.</p>				
3.4 Charge refrigerant	<p>3.4.1 System pressure tested with dry Nitrogen without exceeding the maximum head pressure, and leakage checked.</p> <p>3.4.2 System flushed with dry Nitrogen at pressure of 10-15 psi.</p> <p>3.4.3 System evacuated up to 500 microns.</p> <p>3.4.4 Refrigerant charged using specified type of gas by weight as per manufacturer's specification.</p> <p>3.4.5 Service valves and joints are checked for leakage.</p> <p>3.4.6 Unit operated and performance checked for normal operation.</p>				
3.5 Prepare report	<p>3.5.1 All defects and problems are recorded as per industry norms.</p> <p>3.5.2 Servicing checklist is filled and submitted to supervisor.</p>				
3.6 Clean workplace	<p>3.6.1 Unused materials are collected and stored in designated area.</p> <p>3.6.2 Tools and equipment are cleaned, checked for damage and stored in designated area.</p> <p>3.6.3 Workplace and window unit cleaned neatly and waste</p>				



	disposed as per <b>3R's principle</b> in designated area.				
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## Range Statement

Variable	Range
Personal protective equipment (PPE)	<p><i>May include but not limited to:</i></p> <ul style="list-style-type: none"> <li>• Helmet</li> <li>• Mask</li> <li>• Apron</li> <li>• Goggles</li> <li>• Gloves</li> <li>• Safety shoes</li> <li>• Ear plug</li> <li>• Welding face shield</li> </ul>
Electrical parameters	<p><i>May include but not limited to:</i></p> <ul style="list-style-type: none"> <li>• Voltage</li> <li>• Resistance</li> <li>• Continuity</li> <li>• Current</li> <li>• Capacitance</li> <li>• Voltage drop</li> <li>• Short circuit</li> <li>• Open circuit</li> </ul>
Electrical circuit and components	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Power supply</li> <li>• Electrical cable</li> </ul>



	<ul style="list-style-type: none"> <li>• Power plug and socket</li> <li>• Circuit breaker</li> <li>• Thermostat</li> <li>• Relay</li> <li>• Overload</li> <li>• Fan</li> <li>• Fan motor</li> <li>• Compressor terminals</li> <li>• Capacitor</li> <li>• Fuse</li> <li>• Switches</li> <li>• Valves</li> <li>• Transformer</li> </ul>
Normal operation	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Sound</li> <li>• Vibration</li> <li>• Leakage</li> <li>• Current</li> <li>• Temperature</li> <li>• Pressure</li> </ul>
Foreign materials	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Dust</li> <li>• Dirt</li> <li>• Hair</li> <li>• Debris</li> </ul>





	<ul style="list-style-type: none"> <li>• Corrosion</li> </ul>
Indoor unit and outdoor unit	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Heat exchanger</li> <li>• Drain tray</li> <li>• Drain pipe</li> <li>• Valves</li> <li>• Air filter</li> <li>• Fan and blower</li> </ul>
Cleaning method	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Dusting</li> <li>• Vacuuming</li> <li>• Scrapping</li> <li>• Brushing</li> <li>• Air blowing</li> <li>• Water pressure cleaning</li> <li>• Soapy water</li> </ul>
Mechanical components	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"> <li>• Heat exchanger</li> <li>• Air filter</li> <li>• Compressor (Only for servicing)</li> <li>• Capillary tube</li> <li>• Fan blade/motor</li> <li>• Service valve</li> <li>• Blower</li> </ul>



3R's principle	<p><i>May include but are not limited to:</i></p> <ul style="list-style-type: none"><li>• Reduce</li><li>• Reuse</li><li>• Recycle</li></ul>
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