



COMPETENCY BASED CURRICULUM (DOMESTIC REFRIGERATION AND AIR CONDITIONING)

CERTIFICATE-2



Published by Technical Trainers Training and Resource Center
 Department of Workforce Planning and Skills Development
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 Thimphu

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 Department of Workforce Planning and Skills Development

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FOREWORD

Bhutan has seen a gradual increase in the requirement of skilled workers in recent years due to growth of industries. However, supply of skilled workforce that are responsive to the needs of the industry has not been able to keep in pace with the industry demand. Since the skilled workers are crucial ingredient for socio-economic development of the country, it is important to have adequate number of trained and certified workers. With growing industries, the “Domestic Refrigeration and Air Conditioning Technician” are not only the most significant occupation but also have high demand in the labour market. In an effort to meet the skilled human resources requirement in the area of ICT, it is imperative to deliver training based on Competency Based Training system in Domestic Refrigerator and Air Conditioning to ensure quality and adequate number of workforces in this sector.

To this end, the Department of Workforce Planning and Skills Development is pleased to present the revised edition of Competency Based Curriculum for Domestic Refrigeration and Air Conditioning BQF-C2 course developed based on National Competency Standards (NCS) and using standard curriculum development guidelines. Since it is an outcome of a more participatory process of curriculum development, it is expected to provide training delivery with reformed approaches having its content being directly related to labour market needs, focusing on imparting of skills and assessment based on industry work standards. We believe that the Competency Based Curriculum will help in bridging the skill gap between industry’s needs and training institutes thereby enhance the employability of the technical graduates.

The Department acknowledges the valuable contributions made by institutes, officials, and experts from relevant industries who were involved in the design and development of this curriculum. As it is a dynamic document which may require revision based on the needs of the changing labour market, the Department look forward to receiving valuable feedbacks from the institutes and the industries to further improve and refine the curriculum

The Department hope that this document will help advance Competency Based Learning in most of the TVET Institutions.



SANGAY DORJI
(Director)

Department of Workforce Planning and Skills Development

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COMPETENCY PROFILE

Trade: Domestic Refrigeration and Conditioning

Competency Area	Sub- Competency Area	Competencies/Tasks 			
A. Apply Fundamentals of RAC	A1. Perform electrical and electronic practices	A1.01 Use PPE	A1.02 Construct series circuit	A1.03 Construct parallel circuit	A1.04 Measure voltage
		A1.05 Measure current	A1.06 Measure resistance	A1.07 Test capacitor	A1.08 Test diode
		A1.09 Test transistor	A1.10 Perform electronic soldering	A1.11 Check contactor	A1.12 Check relay and overload protector
		A1.13 Perform circuit continuity test	A1.14 Test mini/small transformer		
	A2. Perform mechanical workshop practices	A2.01 Prepare workpiece	A2.02 Perform gas welding	A2.03 Perform Arc welding	
	A3. Perform RAC workshop practices	A3.01 Perform copper tube cutting	A3.02 Perform copper tube flaring	A3.03 Perform copper tube swaging	A3.04 Perform copper tube bending
		A3.05 Perform copper tube brazing	A3.06 Perform copper tube pinching	A3.07 Perform copper tube piercing	
B. Carry Out Servicing of Domestic Refrigerator	B1. Prepare for servicing of Domestic Refrigerator	B1.01 Identify required tools and equipment	B1.02 Identify required materials	B1.03 Prepare estimation and costing	
	B2. Perform servicing of Domestic Refrigerator	B2.01 Replace thermostat	B2.02 Replace defrost timer	B2.03 Replace defrost components	B2.04 Replace compressor

		B2.05 Replace fan motor	B2.06 Service PCB	B2.07 Recover refrigerant	B2.08 Perform flushing
		B2.09 Replace filter drier	B2.10 Service condenser	B2.11 Service evaporator	B2.12 Perform vacuuming
		B2.13 Recharge refrigerant	B2.14 Service digital temperature controller		
	B3. Troubleshoot Domestic Refrigerator	B3.01 Diagnose electrical faults	B3.02 Diagnose mechanical faults	B3.03 Perform leak test	B3.04 Prepare report
C. Carry out installation of domestic heat pump/air conditioner	C1. Prepare for installation of domestic heat pump/air conditioner	C1.01 Conduct site inspection	C1.02 Perform estimation and costing	C1.03 Prepare installation layout	
	C2. Perform installation of domestic heat pump/air conditioner	C2.01 Install indoor unit	C2.02 Install outdoor unit	C2.03 Perform leak test	
	C3. Perform commissioning of domestic heat pump/air conditioner	C3.01 Check air circulation	C3.02 Perform physical inspection	C3.03 Prepare report	
D. Carry out servicing of domestic Heat pump/air conditioner and	D1. Prepare for servicing of air conditioner	D1.01 Identify required tools and equipment	D1.02 Identify required materials	D1.03 Prepare costing and estimation	
	D2. Perform servicing of Heat pump/air	D2.01 Perform pump down/recovery	D2.02 Service Printed Circuit Board (PCB)	D2.03 Service indoor unit	D2.04 Service outdoor unit

Automotive air conditioner	Conditioner				
	D3. Perform servicing of automotive air conditioner	D3.01 Replace controller	D3.02 Recover refrigerant	D3.03 Replace condenser fan motor	D3.04 Replace expansion valve
		D3.05 Replace receiver drier	D3.06 Replace condenser	D3.07 Service cabin AC unit	D3.08 Replace compressor
		D3.09 Perform vacuuming	D3.10 Charge refrigerant	D3.11 Replace service valve	D3.12 Replace hoses
	D4 Troubleshoot air conditioner and Automotive air conditioner	D4.01 Diagnose electrical faults	D4.02 Diagnose mechanical faults	D4.03 Perform leak test	

COURSE INFORMATION

COURSE TITLE	Domestic Refrigeration and Air Conditioning
LEVEL	BQF Certificate Level 2
COURSE OBJECTIVE	Upon completion of Domestic Refrigeration and Air Conditioning BQF-C2, the trainee will be able to: • Apply fundamentals of RAC • Carry out servicing of domestic refrigerator • Carry out installation of domestic heat pump/air conditioner • Carry out servicing of domestic heat pump/air conditioner and automotive air conditioner
COURSE DESCRIPTION	This course is designed to provide learners the knowledge, skills and attitude to become competent domestic Refrigeration and Air Conditioning technician in accordance with industry standards. Upon completion of this course, the graduates will be able to work in industries where they can perform duties like applying fundamental of RAC, carrying out servicing of domestic refrigerator, installation & servicing of domestic heat pump/air conditioner and automotive air conditioner To obtain the qualification of domestic Refrigeration and Air Conditioning BQF-C2, all learning outcomes prescribed for this qualification must be achieved.
TOTAL DURATION	1277 Hours
TRAINING PROPORTION	1:12 (Practical) 1:20 (Theory)
ENTRY REQUIREMENT	Completed Class VIII and must be 16 years old and above
TRAINER QUALIFICATION	• Must have undergone Training of Trainers-Technical Instruction and Pedagogy • Must have a minimum qualification of diploma in mechanical/electrical OR HVAC NC3 with minimum two years of working experience • Should have good moral character • Must have at least 3 years job/industry experience if institute hires a guest lecturer from the industry

COURSE OUTLINE

Sl. No	Subject /Module	Duration (Hours)	Content Competencies (Mapped)
1.	Core modules	397	CC
2.	OJT	420 (3 months)	CC
3.	Applied Dzongkha	42	SS
4.	ICT	68	SS
5.	Applied Mathematics	60	SS
6.	Technical English	82	SS
7.	Entrepreneurship	70	SS
8.	Occupational Health and Safety (OHS)	34	ES
9.	Sustainable Consumption and Production (SCP)	36	ES
10.	Professional Ethics	68	PD
11.	Assessment	70	
	Total Course Duration	1277	

Note: (*) This curriculum contains core modules which cover main competencies of domestic Refrigerator and Air Conditioning BQF-C2 and OJT component. There are separate curricula for subjects/modules for delivery of soft skills, professional development & values and environmental concern & safety. In order to achieve the qualification of domestic Refrigerator and Air Conditioning BQF-C2, the subjects and modules listed must be accomplished as per the credit hours provided.

Content Competencies:

CC-Core Competencies

SS-Soft Skills

PD-Professional Development and Values

ES-Environmental concern and Safety

COURSE STRUCTURE FOR CORE COMPETENCIES

Training Modality	Module Title	Learning outcomes	Nominal Duration (Hours)
1. Institute Training	1.1 Applying fundamental of RAC	1.1.1 Perform electrical and electronic practices 1.1.2 Perform mechanical workshop practices 1.1.3 Perform RAC workshop practices	112
	1.2 Carrying out servicing of domestic refrigerator	1.2.1 Prepare for maintenance of domestic refrigerator 1.2.2 Perform maintenance of domestic refrigerator 1.2.3 Troubleshoot domestic refrigerator	113
	1.3 Carrying out installation of domestic air conditioner	1.3.1 Prepare for installation of air conditioner 1.3.2 Perform installation of air conditioner 1.3.3 Perform commissioning of domestic air conditioner	53.5
	1.4 Carrying out servicing of domestic heat pump/ air conditioner and automotive air conditioner	1.4.1 Prepare for servicing of domestic heat pump/air conditioner and automotive air conditioner 1.4.2 Perform maintenance of air conditioner 1.4.3 Perform maintenance of automotive air conditioner 1.4.4 Troubleshoot air conditioner and automotive air conditioner	118.5

2. On the Job Training	2.1 Carrying out servicing of domestic refrigerator	2.1.1 Prepare for servicing of domestic refrigerator 2.1.2 Perform servicing of domestic refrigerator 2.1.3 Troubleshoot domestic refrigerator	420
	2.2 Carrying out installation of domestic air conditioner	2.2.1 Prepare for installation of air conditioner 2.2.2 Perform installation of air conditioner 2.2.3 Perform commissioning of domestic air conditioner	
	2.3 Carrying out servicing of domestic heat pump/ air conditioner and automotive air conditioner	2.3.1 Prepare for servicing of domestic heat pump/air conditioner and automotive air conditioner 2.3.2 Perform maintenance of air conditioner 2.3.3 Perform maintenance of automotive air conditioner 2.3.4 Troubleshoot air conditioner and automotive air conditioner	

ASSESSMENT AND CERTIFICATION

ASSESSMENT

Diagnostic assessment of each skill will be conducted to identify areas where trainees may require additional support or intervention. This assessment will also evaluate their existing knowledge, skills, and understanding prior to a specific learning experience or unit of study. Methods such as pre-tests, concept mapping, KWL charts, and observations of student work will be utilized.

Formative assessment for every module and learning outcome will be conducted through assignments, project works, continuous assessment, demonstration of practical skills/observations, oral questioning and written test.

Summative assessment after completion of each national certificate level will be conducted by TVET Quality Council, Bhutan Qualifications and Professional Certification Authority (BQPCA), MoESD as per the National Competency Standards and Guidelines for National Assessment and Certification System, provided the course is accredited with TVET Quality Council, Bhutan Qualifications and Professional Certification Authority, MoESD.

CERTIFICATION

On successful completion of every module, the institute will award a certificate of achievement to the trainees. The TVET Quality Council, Bhutan Qualifications and Professional Certification Authority, MoESD will award a BQF Certificate to the trainees upon the successful completion of BQF Certificate level assessment.

COURSE DELIVERY

1. Modular
2. Demonstration
3. Lecture
4. Discussion
5. Industrial visits
6. Project based learning
7. Problem based learning

RESOURCES

Tools

- Pliers, screwdriver set, soldering iron, neon tester, voltage (inductance) tester, allen key set, hacksaw, measuring tape, file, punching tool, hammer, drill bit, clamp, tongs, lighter, chipping hammer, wire brush, tube cutter, flaring tool, tube expander, swaging tool set, reamer/deburring tool, copper tube bender, brazing torch, pinching tool, piercing tool, wire stripper, calculator, crimping tool, flame deflector, capillary tube cutter, hollow saw, concrete hole saw, adjustable wrench, spanner set, recovery cylinder, quick coupler, valve core key and socket set

Equipment

- An electrical circuit board, bench vice, drilling machine, ladder, grinding machine, oxygen and acetylene gas cylinder set, arc welding machine, angle grinder, steel rod cutter, mini transformer (RAC circuit), computer, refrigerator, recovery cylinder, recovery machine, dry nitrogen gas cylinder set, vacuum pump, indoor and outdoor

air-conditioning unit, brazing equipment set, blower, and a car equipped with an AC system

Instruments

- multimeter, measuring tape, clamp meter, weighing scale, pressure regulator, manifold gauge, leak detector, spirit level, thermometer, micron gauge, and a drive belt tension gauge

Materials

- wires, insulation tape, switches, plug tops, lamp holders, lamps, capacitors, diodes, transistors, soldering flux, soldering lead, marking cloth, contactors, relays, hacksaw blades, coolant, markers, filler rods, electrodes, MS plates, drill bits, grinder blades, gas regulators, hoses, nozzles, oxygen, acetylene gas, gas torches, steel rod cutter blades, overload protectors, copper tubes, flaring nuts, brazing rods, flux, propane gas, notebooks, pens, manufacturers' catalogs, compressor relays, thimbles, thermostats, defrost timers, defrost heaters, bi-metals, thermal fuses, fan motors, fan blades, filter driers, dry nitrogen, capillary tubes, emery paper, condenser coils, evaporators, process tubes, soap solutions, digital temperature controllers, refrigerants, papers, PVC dowels, PVC insulation, flare nuts, outdoor clamps, saddle clamps, CPVC pipes and fittings, CPVC glue, cable ties, screws, weatherproof wrapping tape, controllers, condenser fans, expansion valves, O-rings, receivers, blower motors, compressors, AC drive belts, and magnetic clutches.

PPE

- Safety gloves, safety boots, workshop dress, Safety mask, welding screen, safety goggles, safety helmet, safety harness, respiratory mask, ear muff, safety vest and hair net

Learning materials

- Reference books
- Hand-outs
- Audio visuals
- Competency Based Learning materials (CBLM)

Infrastructure and training facilities

- **Theory classroom size:** Minimum of 1 square meter per person
- **Practical Workshop size:** Minimum of 2.25 m² per student. Variables must be considered dependent upon type of skills being taught and the number of students being participated at one time.

**MODULE INFORMATION: DOMESTIC REFRIGERATION AND AIR CONDITIONING
BQF CERTIFICATE 2**

MODULE 1: APPLYING FUNDAMENTALS OF RAC

MODULE INFORMATION

Occupation	Domestic Refrigeration and Air Conditioning Technician
Competency Area	Apply fundamentals of RAC
Module Title	Applying fundamentals of RAC
Module Code	7127- L2-M1
Module Description	This module is structured to provide learners the knowledge, skills and right attitude required to perform electrical & electronics practices, mechanical workshop practices and RAC workshop practices
Nominal Duration	112 Hours
Certificate Level	Certificate Level 2
Pre-requisite	Completed class VIII
Learning Outcome	1. Perform electrical & electronic practices 2. Perform mechanical workshop practices 3. Perform RAC workshop practices

Module Title	Applying fundamentals of RAC		
Module Code	7127-L2-M1		
Learning Outcome 1	Perform electrical and electronic practices		
Duration	Theory:12.5 hours	Practical: 23 hours	Total: 35.5hours
Assessment Criteria	• PPE is used as per the standard procedure • Series circuit is constructed as per the standard procedure • Parallel circuit is constructed as per the standard procedure • Voltage is measured as per the standard procedure • Current is measured as per the standard procedure • Resistance is measured as per the standard procedure • Capacitor is tested as per the standard procedure • Diode is tested as per the standard procedure • Transistor is tested as per the standard procedure • Electronic soldering is performed as per the standard procedure • Contactor is checked as per the standard procedure • Relay and overload protector is checked as per the standard procedure • Circuit continuity is tested as per the job requirement following standard procedure • Mini transformer is tested as per job requirement following standard procedure		
Content	A1.00 Introductory knowledge • Overview of course • Trends and scope of RAC technician A1.01 Using PPE Knowledge • Introduction to PPE • Types of PPE and their uses • Importance of wearing PPE at work site Skills • Observation skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste		

	A1.02 Constructing series circuit Knowledge • Introduction to basic electrical symbols • Introduction to conductor, insulator and semi-conductor • Definition of series circuit • Types of circuit • Characteristics of series circuit • Characteristics of AC and DC circuit • Application of series circuit • Ohm's Law • Introduction to multimeter and its usage • Types of multimeter (Analog, digital and clamp meter) Skills • Using multimeter • Interpreting circuit diagram • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of wire A1.03 Constructing parallel circuit Knowledge • Definition of parallel circuit • Characteristics of parallel circuit • Application of parallel circuit • Difference between series and parallel circuit Skills • Using multimeter • Interpreting circuit diagram • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious
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	• Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of wire A1.04 Measuring voltage <i>Knowledge</i> • Definition of voltage • Unit of voltage <i>Skills</i> • Interpreting circuit diagram • Using multimeter • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.05 Measuring current <i>Knowledge</i> • Definition of current • Unit of current • Concept of current flow • Importance of selecting clamp meter range <i>Skills</i> • Interpreting circuit diagram • Using clamp meter • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources
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	• Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.06 Measuring resistance <i>Knowledge</i> • Definition of resistance • Unit of resistance • Factors affecting the resistance • Definition of resistor • Purpose of resistor • Types of resistors • Colour coding of resistor and its calculation • Usage of resistor in RAC circuit <i>Skills</i> • Interpreting colour coding table • Using multimeter • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensure connections are neat and tight. A1.07 Testing capacitor <i>Knowledge</i> • Definition of capacitor • Types of capacitors • Unit of capacitance • Usage of capacitor in RAC circuit <i>Skills</i> • Using multimeter • Numeracy skills • Analytical skills
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	• Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper discharge of capacitor A1.08 Testing diode <i>Knowledge</i> • Function of diode • Types and symbols of diodes • Characteristics of diode • Usage of diode in RAC circuit <i>Skills</i> • Using multimeter • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.09 Testing transistor <i>Knowledge</i> • Function & symbol of transistor • Type of transistors • Characteristics of transistors • Usage of transistor in RAC circuit <i>Skills</i> • Using multimeter • Numeracy skills • Analytical skills • Communication skills
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	<i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.10 Performing electronic soldering <i>Knowledge</i> • Purpose of soldering • Purpose of flux • Types of soldering lead and its sizes <i>Skills</i> • Using soldering iron • Observation skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.11 Checking contactor <i>Knowledge</i> • Function of contactor • Types of contactor • Operation of contactor • Usage of contactor in RAC circuit <i>Skills</i> • Using multimeter • Observation skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources
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	• Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.12 Checking relay and overload protector <i>Knowledge</i> • Function of relay and overload protector • Types of relay and overload protector • Application of relay and overload protector in RAC <i>Skills</i> • Using multimeter • Observation skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.13 Performing circuit continuity test <i>Knowledge</i> • Purpose of continuity test • Application of continuity test <i>Skills</i> • Using multimeter • Observation skills • Numeracy skills • Analytical skills • Communication skills • Using of clamp meter <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment
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	• Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A1.14 Testing mini/small transformer Knowledge • Function of transformer • Types of transformers • Faraday's Law of Electromagnetic Induction • Application of transformer in RAC circuit • Methods of testing transformer Skills • Using multimeter • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning materials • CBLM/Reference materials • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Tools • Pliers, screwdriver set, soldering iron, neon-tester, voltage tester (inductance tester), allen key set and wire stripper Equipment • Electrical circuit board and mini transformer (RAC circuit)

	Instruments • Multi-meter and clamp meter Materials • Wires, insulation tape, switch, plug top, lamp holder, lamp, capacitor, diode, transistor, soldering flux, soldering lead, markin cloth, contactor, relay and overload protector PPE • Safety gloves, safety boots, safety goggles, workshop dress and Safety mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Applying fundamentals of RAC		
Module Code	7127- L2-M1		
Learning Outcome 2	Perform mechanical workshop practices		
Duration	Theory: 6 hours	Practical: 40 hours	Total: 46 hours
Assessment Criteria	• Workpiece is prepared as per the standard procedure • Gas welding is performed as per the standard procedure • Arc welding is performed as per the standard procedure		
Content	A2.01 Preparing workpiece Knowledge • Importance of proper cutting position • Types of metal sheet • Purpose of grinding • Types of grinding machine • Types of blade • Types of file and its functions • Types of drilling machine • Types of drill bit • Purpose of applying coolant Skills • Using hacksaw • Using angle grinder • Using steel rod cutter • Using file • Using drilling machine • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A2.02 Performing gas welding Knowledge • Definition of gas welding • Purpose of oxygen and acetylene gas • Difference between oxygen and acetylene gas • Function of welding torch, nozzle, and filler rod		

	• Definition of gas regulator • Types of regulators • Operation of regulator • Types of nozzles • Types of flame and its adjustment • Function of flashback arrestor • Application of gas welding • Properties of filler rod Skills • Flame setting skills • Oxygen and Acetylene gas handling skills • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A2.03 Performing arc welding Knowledge • Definition of arc welding • Components of arc welding • Working principle of arc welding • Types of arc welding • Importance of maintaining arc length • Purpose of electrodes • Specification of electrodes and its current setting • Application of arc welding Skills • Operating welding machine • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity
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	• Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring correct current setting while welding
Learning Conditions	Learning materials • CBLM/Reference materials • Hand-outs • Audio visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Library • IT Lab • Workshop Tools • Hacksaw, measuring tape, file, punching tool, hammer, drill bit, clamp, tong, pliers, lighter, chipping hammer and wire brush Equipment • Bench vice, drilling machine, grinding machine, oxygen & acetylene gas cylinder set, arc welding machine, angle grinder and steel rod cutter Instrument • Measuring tape Materials • Hacksaw blade, coolant, marker, filler rod, electrode, MS plate, drill bit, grinder blade, gas regulator, hose, nozzle, oxygen, acetylene gas, gas torch and steel rod cutter blade PPE • Safety gloves, welding screen, safety boots, safety goggles, workshop dress, apron, ear muff and Safety mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice

	• Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Applying fundamentals of RAC		
Module Code	7127-L2-M1		
Learning Outcome 3	Perform RAC workshop practices		
Duration	Theory: 4.5 hours	Practical:26 hours	Total: 30.5hours
Assessment Criteria	• Tube is cut as per job requirement following standard procedures • Tube is flared as per the job requirement following standard procedure • Cu tube is swaged as per the job requirement following standard procedure • Copper tube is bent as per the job requirement following standard procedure • Tube brazing is performed as per job requirement following standard procedure • Copper tube is pinched as per the job requirement following standard procedure • Copper tube is pierced as per the job requirement following standard procedure		
Contents	A3.01 Performing copper tube cutting Knowledge • Definition of copper tube • Properties and purpose of using copper tube • Advantages of copper tube • Specification of copper tube and its application • Methods of copper tube cutting Skills • Using tube cutter • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.02 Performing copper tube flaring Knowledge • Definition of flaring • Purpose of flaring • Types of flaring tool • Calculation of flare projection		

	<i>Skills</i> • Using flaring tool • Observation skills • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.03 Performing copper tube swaging <i>Knowledge</i> • Definition of swaging • Purpose of swaging • Types of swaging tool • Calculation of swage projection <i>Skills</i> • Using tube expander • Usage swaging tool • Observation skills • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.04 Performing copper tube bending <i>Knowledge</i> • Purpose of tube bending • Types of copper tube bender <i>Skills</i> • Using copper tube bender
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	• Observation skills • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.05 Performing copper tube brazing <i>Knowledge</i> • Definition of brazing • Purpose of brazing • Purpose of using flux • Types of brazing rod • Types of brazing torch <i>Skills</i> • Using brazing torch • Observation skills • Analytical skills • Communication skills <i>Attitude, Safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring appropriate heating while brazing A3.06 Performing copper tube pinching <i>Knowledge</i> • Definition of tube pinching • Purpose of tube pinching <i>Skills</i> • Using pinching tool • Observation skills • Analytical skills
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	• Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste A3.07 Performing copper tube piercing <i>Knowledge</i> • Definition of tube piercing • Purpose of piercing tube <i>Skills</i> • Using piercing tool • Observation skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning materials • CBLM/ Reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Tools • Tube cutter, measuring tape, flaring tool, tube expander, swaging tool set, reamer/deburring tool, copper tube bender, brazing torch, lighter,

	pinching tool, plier and piercing tool Equipment • Oxygen and acetylene gas cylinder set Materials • Copper tube, marker, flaring nut, brazing rod, flux and propane gas PPE • Safety gloves, safety boots, safety goggles, workshop dress and safety mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

MODULE 2: CARRYING OUT SERVICING OF DOMESTIC REFRIGERATOR

MODULE INFORMATION

Occupation	Domestic Refrigeration and Air Conditioning Technician
Competency Area	Carry out servicing of domestic refrigerator
Module Title	Carrying out servicing of domestic refrigerator
Module Code	7127-L2-M2
Module Description	This module is structured to provide the learners with knowledge, skills and right attitude required to prepare for servicing of domestic refrigerator, perform servicing of domestic refrigerator and troubleshooting
Nominal Duration	113 Hours
Certificate Level	Certificate Level 2
Pre-requisite	Completed Module: 7127-L2-M1
Learning Outcome	1. Prepare for servicing of domestic refrigerator 2. Perform servicing of domestic refrigerator 3. Troubleshoot Domestic Refrigerator

Module Title	Carrying out servicing of domestic refrigerator		
Module Code	7127-L2-M2		
Learning Outcome 1	Prepare for servicing of domestic refrigerator		
Duration	Theory:8.5 hours	Practical: 4.5 hours	Total:13 hours
Assessment Criteria	• Appropriate tools and equipment are identified as per job requirement following standard procedure • Appropriate materials are identified as per job requirement following standard procedure • Estimation and costing are prepared as per job requirement following standard procedure		
Contents	B1.00 Introductory Knowledge • Definition of refrigeration system • Basic thermodynamics cycle • Types of refrigeration system • Components of refrigeration system • Application of refrigeration system • Definition and formation of Ozone layer • Definition of Ozone Depleting Substance (ODS) • Types of Ozone Depleting Substance (ODS) • Effect of ODS on Global warming and Ozone Layer B1.01 Identifying required tools and equipment Knowledge • Types of hand tools and power tools • Function of hand tools and power tools Skills • Interpreting manufacture's catalogue • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B1.02 Identifying required materials Knowledge • Introduction to RAC material • Purpose of RAC materials		

	<i>Skills</i> • Interpreting manufacture's catalogue • Observation skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B1.03 Preparing estimation and costing <i>Knowledge</i> • Definition of estimation and costing • Purpose of estimation and costing <i>Skills</i> • ICT skills • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning materials • CBLM/ Reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop

	Tools • Calculator Equipment • Computer Materials • Notepad, pen/pencil and manufacture's catalogue PPE • Safety gloves, safety helmet, safety boots, safety goggles, safety mask and workshop dress
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out servicing of domestic refrigerator		
Module Code	7127-L2-M2		
Learning Outcome 2	Perform servicing of domestic refrigerator		
Duration	Theory: 19 hours	Practical: 65 hours	Total: 84 hours
Assessment Criteria	- Thermostat is replaced as per the job requirement following standard procedure - Defrost timer is replaced as per the job requirement following standard procedure - Defrost components are replaced as per the standard procedure - Compressor is replaced as per the job requirement following standard procedure - Fan Motor is replaced as per the job requirement following standard procedure - PCB is serviced as per job requirement following standard procedures - Refrigerant is recovered as per the job requirement following standard procedure - Flushing is performed as per the job requirement following standard procedure - Filter dryer is replaced as per the job requirement following standard procedure - Condenser is serviced as per the job requirement following standard procedure - Evaporator is serviced as per the job requirement following standard procedure - Vacuuming is performed as per the job requirement standard procedure - Refrigerant is recharged as per the job requirement following standard procedure - Digital temperature controller is replaced as per the job requirement following standard procedure		
Contents	B2.01 Replacing thermostat Knowledge - Definition of refrigerator - Types of refrigerator - Components of refrigerator - Function of thermostat - Types of thermostat - Operation of thermostat - Symptoms and causes of defective thermostat Skills - Using multimeter - Interpreting diagram - Observation skills - Analytical skills		

	• Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper removal of panel cover B2.02 Replacing defrost timer <i>Knowledge</i> • Definition of timer • Purpose of timer • Types of timer • Operation of timer • Symptoms and causes of defective timer <i>Skills</i> • Using multimeter • Interpreting circuit diagram • Observation skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.03 Replacing defrosts components <i>Knowledge</i> • Definition of defrost heater • Function of defrost heater • Types of defrost heater • Definition of bi-metal • Function of bi-metal • Types of bi-metal • Operation of bi-metal • Definition of thermal fuse
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	• Function of thermal fuse • Symptoms and causes of defective defrost heater, bi-metal and thermal fuse Skills • Using multimeter • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.04 Replacing compressor Knowledge • Definition of compressor • Function of compressor • Types of compressor • Working principle of compressor • Symptoms and causes of defective compressor Skills • Using multimeter • Using swaging tool • Interpreting circuit diagram • Observation skills • Analytical skills • Numeracy skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper disconnection of wire • Ensuring proper removal of overload protector and relay
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	B2.05 Replacing fan motor Knowledge • Function of fan motor • Operation of fan motor Skills • Using multimeter • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.06 Servicing Printed Circuit Board (PCB) Knowledge • Definition of PCB • Components of PCB and their function Skills • Using multimeter • Numeracy skills • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.07 Recovering refrigerant Knowledge • Definition of refrigerant • Types of refrigerant • Properties of refrigerant • Purpose of refrigerant recovery
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	• Components of recovery machine • Purpose of recovery cylinder • Effects of refrigerant on environment Skills • Using recovery machine • Using manifold gauge • Using weighing scale • Observation skills • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of hoses B2.08 Performing flushing Knowledge • Purpose of flushing • Purpose of using nitrogen gas for flushing Skills • Using manifold gauge • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.09 Replacing filter drier Knowledge • Function of filter drier and strainer • Function of capillary tube
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	• Symptoms and causes of choked filter drier • Symptoms and causes of choked capillary tube <i>Skills</i> • Using brazing torch • Using capillary tube cutter • Observation skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.10 Servicing condenser <i>Knowledge</i> • Definition of condenser • Function of condenser • Types of condenser <i>Skills</i> • Using brazing torch • Observation skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.11 Servicing evaporator <i>Knowledge</i> • Definition of evaporator • Function of evaporator • Types of evaporator <i>Skills</i> • Using brazing torch
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	• Observation skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.12 Performing vacuuming <i>Knowledge</i> • Definition of vacuuming • Purpose of vacuuming • Types of vacuum pump • Importance of checking vacuum pump oil level • Properties of vacuum pump oil <i>Skills</i> • Using manifold gauge • Using vacuum pump • Using micron-gauge • Observation skills • Communication skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of hoses B2.13 Recharging refrigerant <i>Knowledge</i> • Definition of frost bite • Refrigerant pressure chart • Chemical properties of refrigerant • Effect of Green House Gas (GHG) • Symptoms and causes of contaminated refrigerant
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	<i>Skills</i> • Using digital weighing machine • Using manifold gauge • Observation skills • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B2.14 Servicing Digital Temperature Controller <i>Knowledge</i> • Purpose of Digital Temperature Controller • Operation of Digital Temperature Controller • Types of Digital Temperature Controller • Parameter setting of Digital Temperature Controller <i>Skills</i> • Using multi-meter • Interpreting circuit diagram • Observation skills • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring to connect the circuit as per the circuit diagram
Learning Conditions	Learning materials • CBLM/Reference materials • Hand-outs • Audio-visuals

	• Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Tools • Screwdriver set, tube cutter, swaging tool, tube bender, plier, tester, wire stripper, crimping tool, brazing torch, flame deflector, capillary tube cutter and lighter Equipment • Refrigerator, recovery cylinder, recovery machine, oxygen and acetylene gas cylinder, dry nitrogen gas cylinder set and vacuum pump Instruments • Multimeter, clamp meter, weighing scale and manifold gauge Materials • Compressor relay, wires, insulation tape, thimble, overload protector, thermostat, defrost timer, defrost heater, bi-metal, thermal fuse, fan motor, fan blade, capacitor, markin cloth, pen, notepad, compressor, flux, filter drier, brazing rod, dry nitrogen, capillary tube, copper tube, emery paper, condenser coil, evaporator, process tube, soap solution, propane gas, digital temperature controller and refrigerant PPE • Working dress, safety gloves, safety boots, respiratory mask, workshop dress and safety mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out servicing of domestic refrigerator		
Module Code	7127-L2-M2		
Learning Outcome 3	Troubleshoot domestic refrigerator		
Duration	Theory: 2.5 hours	Practical: 13.5 hours	Total:16 hours
Assessment Criteria	- Electrical faults are diagnosed as per job requirement following standard procedure - Mechanical faults are diagnosed as per job requirement following standard procedure - Leak test is performed as per job requirement following standard procedure - Report is prepared as per the job requirement following standard procedure		
Contents	B3.01 Diagnosing electrical faults Knowledge - Electrical components of refrigerator - Signs and symbol of electrical components - Electrical circuit diagram - Symptoms and causes of electrical faults Skills - Using multimeter - Interpreting circuit diagram - Interpreting manufacturers manual - Observation skills - Analytical skills - Numeracy skills - Communication skills Attitude, safety and environmental concern - Being time conscious - Being efficient in using resources - Having work ethics and integrity - Having patience - Proper handling of tools, materials and equipment - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste B3.02 Diagnosing mechanical faults Knowledge - Mechanical components of refrigerator - Symptoms and causes of mechanical faults Skills - Using manifold gauge - Using multimeter - Interpreting circuit diagram		

	• Interpreting manufacturers manual • Observation skills • Analytical skills • Numeracy skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste B3.03 Performing leak test <i>Knowledge</i> • Purpose of leak test • Importance of maintaining specified nitrogen gas pressure • Causes and remedies of leakage <i>Skills</i> • Using manifold gauge • Observation skills • Communication skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper connection of hoses B3.04 Preparing report <i>Knowledge</i> • Purpose of preparing report • Importance of documentation and record keeping <i>Skills</i> • ICT skills • Record keeping skills • Analytical skills • Communication skills
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	<i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning materials • CBLM/ Reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Tools • Screwdriver set, pliers, calculator and neon tester Equipment • Refrigerator and nitrogen gas cylinder Instruments • Multimeter, pressure regulator, manifold gauge and leak detector Materials • Paper, markin cloth, nitrogen gas, soap solution, manufacturers manual, pen, notepad and pencil PPE • Safety gloves, safety boots, safety goggles, safety harness, workshop dress and safety mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning

	• Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

MODULE 3: CARRYING OUT INSTALLATION OF DOMESTIC HEAT PUMP/AIR CONDITIONER

MODULE INFORMATION

Occupation	Domestic Refrigeration and Air Conditioning Technician
Competency Area	Carry out installation of domestic heat pump/air conditioner
Module Title	Carrying out installation of domestic heat pump/air conditioner
Module Code	7127-L2-M3
Module Description	This module is structured to provide the learners with knowledge, skills and right attitude required to prepare for installation of domestic heat pump/air conditioner, perform installation of domestic heat pump/air conditioner and commissioning of domestic heat pump/air conditioner
Nominal Duration	53.5 Hours
Certificate Level	Certificate Level 2
Pre-requisite	Completed Module: 7127-L2-M2
Learning Outcome	1. Prepare for installation of domestic heat pump/air conditioner 2. Perform installation of domestic heat pump/air conditioner 3. Perform commissioning of domestic heat pump/air conditioner

Module Title	Carrying out installation of domestic heat pump/air conditioner		
Module Code	7127-L2-M3		
Learning Outcome 1	Prepare for installation of domestic heat pump/air conditioner		
Duration	Theory: 5.5 hours	Practical: 4 hours	Total: 9.5 hours
Assessment Criteria	• Site inspection is conducted as per the job requirement following standard procedure • Estimation and costing is prepared as per job requirement following standard procedure • Installation layout is prepared as per the job requirement following standard procedure		
Contents	C1.01 Conducting site inspection Knowledge • Definition of Air Conditioner (AC) • Types of AC • Operation of AC • Definition of humidity • Purpose of site selection • Calculation of cooling/heating load Skills • Numeracy skills • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C1.02 Preparing estimation and costing Knowledge • Purpose of estimation and costing Skills • ICT skills • Numeracy skills • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious		

	• Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C1.03 Preparing installation layout Knowledge • Purpose of preparing installation layout • Location and position of indoor and outdoor unit Skills • Using drilling machine • Using spirit level • Using hollow saw • Interpreting drawing • Observation skills • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning materials • CBLM/ Reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Tools • Calculator, drill bit set, hollow saw, hammer, screwdriver set and concrete hole saw

	Equipment • Drilling machine, ladder and computer Instrument • Measuring tape and spirit level Materials • Pen, pencil, notepad, marker, screws and dowels PPE • Safety gloves, safety boots, safety harness, safety belt, workshop dress, ear muff and Safety mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out installation of domestic heat pump/air conditioner		
Module Code	7127-L2-M3		
Learning Outcome 2	Perform installation of domestic heat pump/air conditioner		
Duration	Theory: 3 hours	Practical: 36.5 hours	Total: 39.5 hours
Assessment Criteria	- Indoor unit is installed as per the job requirement following standard procedure - Outdoor unit is installed as per the job requirement following standard procedure - Leak test is performed as per the standard procedure		
Contents	C2.01 Installing indoor unit Knowledge - Function of indoor unit - Components of indoor unit and its functions - Importance of insulating pipes and power cable Skills - Interpreting drawing - Observation skills - Analytical skills - Communication skills Attitude, safety and environmental concern - Being time conscious - Being efficient in using resources - Having work ethics and integrity - Having patience - Proper handling of tools, materials and equipment - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste C2.02 Installing outdoor unit Knowledge - Function of outdoor unit - Components of outdoor unit and its functions - Types of refrigerant - Refrigerant charge calculation for extended copper tube Skills - Interpreting drawing - Numeracy skills - Observation skills - Analytical skills - Communication skills Attitude, safety and environmental concern - Being time conscious - Being efficient in using resources		

	• Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C2.03 Performing leak test Knowledge • Purpose of leak test • Function of service valve • Methods of leak testing • Importance of vacuuming Skills • Using vacuum pump • Using leak detector • Using manifold gauge • Observation skills • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning materials • CBLM/Reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Tools • Pliers, hacksaw, hole saw, tube cutter, flaring tool set, swaging tool, screwdriver set, allen key set, tube bender, calculator, deburring tool,

	adjustable wrench and spanner set Equipment - Indoor & outdoor AC unit, ladder, brazing equipment set, drilling machine and vacuum pump Instruments - Manifold gauge, measuring tape and leak detector Materials - Drawing, weather proof wrapping tape, copper tube, PVC dowels, PVC insulation, insulation tape, flare nut, out door clamp, saddle clamp, CPVC pipe and its fittings, CPVC glue, cable tie, screws, markin cloth, hacksaw blade, pen, brazing rod, propane gas pencil and notepad PPE - Safety gloves, safety boots, safety helmet, safety harness, workshop dress and safety mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: - Lecture - Interactive discussion - Demonstration - Industrial training/attachment - Guided practice - Group activity - Individual practice - Problem based learning - Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: - Practical demonstration/observation - Oral/viva-voce - Written test - Assignment - Project work

Module Title	Carrying out installation of domestic heat pump/air conditioner		
Module Code	7127-L2-M3		
Learning Outcome 3	Perform commissioning of domestic heat pump/air conditioner		
Duration	Theory: 1.5 hours	Practical: 3 hours	Total: 4.5 hours
Assessment Criteria	• Air circulation is checked as per job requirement following standard procedure • Physical inspection is performed as per the standard procedure • Report is prepared as per the job requirement following standard procedure		
Contents	C3.01 Checking air circulation Knowledge • Purpose of checking air circulation • Importance of checking suction, discharge and standing pressure Skills • Observation skills • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste C3.02 Performing physical inspection Knowledge • Purpose of physical inspection Skills • Observation skills • Communication skills • Analytical skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste		

	C3.03 Preparing report Knowledge • Purpose of preparing report Skills • ICT skills • Record keeping skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning materials • CBLM/ reference materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Library • IT lab • Workshop Tools • Calculator Equipment • AC unit and computer Instruments • Clamp meter and thermometer Materials • Paper, pen and pencil PPE • Safety gloves, safety boots, safety helmet, workshop dress and safety mask
Instructional Methodologies	The trainer shall use <i>inter alia</i> , the following instructional methods: • Lecture

	• Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

MODULE 4: CARRYING OUT SERVICING OF HEAT PUMP/DOMESTIC AIR CONDITIONER AND AUTOMOTIVE AIR CONDITIONER

MODULE INFORMATION

Occupation	Domestic Refrigeration and Air Conditioning Technician
Competency Area	Carry out servicing of domestic heat pump/air conditioner and automotive air conditioner
Module Title	Carrying out servicing of domestic air conditioner and automotive air conditioner
Module Code	7127-L2-M4
Module Description	This module is structured to provide learners the knowledge, skills and right attitude required to prepare for maintenance of AC, perform maintenance of AC, perform maintenance of automotive Air Conditioner and troubleshoot domestic AC
Nominal Duration	118.5 Hours
Certificate Level	Certificate Level 2
Pre-requisite	Completed Module: 7127-L2-M3
Learning Outcome	1. Prepare for servicing of Air Conditioner 2. Perform servicing of Air Conditioner 3. Perform servicing of automotive Air Conditioner 4. Troubleshoot domestic Air Conditioner

Module Title	Carrying out servicing of domestic heat pump/air conditioner and automotive air conditioner		
Module Code	7127- L2-M4		
Learning Outcome 1	Prepare for servicing of Air Conditioner		
Duration	Theory: 1.5 hours	Practical: 3 hours	Total: 4.5 hours
Assessment Criteria	• Appropriate tools and equipment are identified as per job requirement following standard procedure • Appropriate materials are identified as per job requirement following standard procedure • Estimation and costing is prepared as per job requirement following standard procedure		
Content	D1.01 Identifying required tools and equipment Knowledge • Types of hand tools and power tools • Function of hand tools and power tools Skills • Interpreting manufacture's catalogue • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D1.02 Identifying required materials Knowledge • Usage of materials Skills • Interpreting manufacture's catalogue • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment		

	• Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D1.3 Preparing estimation and costing Knowledge • Purpose of estimation and costing Skills • ICT skills • Observation skills • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning materials • CBLM/ Reference materials • Hand-outs • Audio Visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Information Technology (IT) lab • Library • Workshop Equipment • Computer Tools • Calculator Materials • Notepad, pen and manufacture's catalogue PPE • Safety gloves, safety boots, safety goggles, safety mask, safety vest and workshop dress

Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out servicing of domestic heat pump/air conditioner and automotive air conditioner		
Module Code	7127- L2-M4		
Learning Outcome 2	Perform servicing of domestic heat pump/air conditioner		
Duration	Theory: 3.5 hours	Practical: 17 hours	Total: 20.5 hours
Assessment Criteria	- Pump down/recovery is performed as per the job requirement following standard procedure - PCB is serviced as per the job requirement following standard procedure - Indoor unit is serviced as per the job requirement following standard procedure - Outdoor unit is serviced as per the job requirement following standard procedure		
Content	D2.01 Performing pump down/recovery Knowledge - Definition of pump down - Purpose of pump down Skills - Using manifold gauge - Using recovery machine - Observation skills - Analytical skills - Numeracy skills - Communication skills Attitude, safety and environmental concern - Being time conscious - Being efficient in using resources - Having work ethics and integrity - Having patience - Proper handling of tools, materials and equipment - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste - Ensuring to turn off the power supply and close suction side service valve as soon as the pressure drops to zero D2.02 Servicing PCB Knowledge - Function of PCB - Components of PCB - Purpose of servicing PCB Skills - Using multimeter - Observation skills - Numeracy skills		

	• Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D2.3 Servicing indoor unit <i>Knowledge</i> • Periodic maintenance of indoor unit • Symptom, causes and remedies of faulty indoor unit <i>Skills</i> • Interpreting circuit diagram • Using clamp meter • Using manifold gauge • Using brazing torch • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D2.4 Servicing outdoor unit <i>Knowledge</i> • Periodic maintenance of outdoor unit • Symptoms, causes and remedies of faulty outdoor unit <i>Skills</i> • Interpreting circuit diagram • Using recovery machine • Using manifold gauge • Using brazing torch • Using clamp meter • Observation skills
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	- Numeracy skills - Analytical skills - Communication skills Attitude, safety and environmental concern - Being time conscious - Being efficient in using resources - Having work ethics and integrity - Having patience - Proper handling of tools, materials and equipment - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste
Learning Conditions	Learning materials - CBLM/ Reference materials - Hand-outs - Audio visuals - Reference books - Manuals Learning facilities and infrastructure - Classroom with adequate facilities - Library - IT Lab - Workshop Tools - Pliers, hacksaw, tube cutter, flaring tool set, swaging tool, screwdriver set, allen key set, tube bender, deburring tool, adjustable wrench, recovery cylinder and spanner set Equipment - Indoor & outdoor AC unit, ladder, brazing equipment set, blower, recovery machine and vacuum pump Instruments - Manifold gauge, measuring tape and leak detector Materials - Drawing, weather proof wrapping tape, PVC dowels, PVC insulation, insulation tape, flare nut, out door clamp, saddle clamp, CPVC pipe and its fittings, CPVC glue, cable tie, screws, markin cloth, hacksaw blade, pen, brazing rod, propane gas pencil and notepad PPE - Safety gloves, safety boots, safety harness, safety helmet, workshop dress and safety mask
Instructional	The trainer shall use <i>inter alia</i> , the following instructional methods:

Methodologies	• Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out servicing of domestic heat pump/Air Conditioner and automotive air conditioner		
Module Code	7127- L2-M4		
Learning Outcome 3	Perform servicing of automotive air conditioner		
Duration	Theory: 13 hours	Practical: 65 hours	Total: 78hours
Assessment Criteria	• Controllor is replaced as per the job requirement following standard procedure • Refrigerant is recovered as per the job requirement following standard procedure • Condenser fan motor is replaced as per the job requirement following standard procedure • Expansion valve is replaced as per the job requirement following standard procedure • Receiver drier is replaced as per the job requirement following standard procedure • Condenser is replaced as per the job requirement following standard procedure • Cabin AC unit is serviced as per the job requirement following standard procedure • Compressor is replaced as per the job requirement following standard procedure • Vacuuming is performed as per the job requirement following standard procedure • Refrigerant is charged as per the job requirement following standard procedure • Service valve is replaced as per the job requirement following standard procedure • Hoses are replaced as per the job requirement following standard procedure		
Content	D3.01 Replacing controller Knowledge • Refrigeration cycle of automotive air conditioning • Components and its function of automotive air conditioning • Function of controller • Types of controller Skills • Using multimeter • Observation skills • Numeracy skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources		

	• Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.02 Recovering refrigerant <i>Knowledge</i> • Purpose of refrigerant recovery <i>Skills</i> • Using recovery machine • Using manifold gauge • Using weighing scale • Observation skills • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.03 Replacing condenser fan motor <i>Knowledge</i> • Function of condenser fan motor • Symptoms, causes and remedies of faulty condenser fan motor <i>Skills</i> • Interpreting circuit diagram • Using multi-meter • Observation skills • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment
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	• Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste • Ensuring proper removal of connectors D3.04 Replacing expansion valve <i>Knowledge</i> • Function of expansion valve • Types of expansion valve • Operation of expansion valve • Symptoms, causes and remedies of faulty expansion valve <i>Skills</i> • Using manifold gauge • Using recovery machine • Observation skills • Communication skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.05 Replacing receiver drier <i>Knowledge</i> • Function of receiver drier • Construction of receiver drier • Symptoms, causes and remedies of faulty receiver drier <i>Skills</i> • Using manifold gauge • Using recovery machine • Observation skills • Communication skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations
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	• Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.06 Replacing condenser Knowledge • Function of condenser • Symptoms, causes and remedies of faulty condenser Skills • Using recovery machine • Using manifold gauge • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.07 Servicing cabin AC unit Knowledge • Function of evaporator • Function of air filter • Function of blower motor • Symptoms, causes and remedies of faulty cabin AC unit Skills • Using multi-meter • Using manifold gauge • Using recovery machine • Observation skills • Analytical skills • Communication skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	D3.08 Replacing compressor <i>Knowledge</i> • Function of compressor • Function of magnetic clutch • Construction and operation of magnetic clutch and compressor • Symptoms, causes and remedies of faulty compressor and magnetic clutch • Function of drive belt • Purpose of adjusting drive belt <i>Skills</i> • Using multi-meter • Using drive belt tension gauge • Using recovery machine • Numeracy skills • Analytical skills • Communication skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.9 Performing vacuuming <i>Knowledge</i> • Function of vacuum pump • Purpose of vacuuming <i>Skills</i> • Using manifold gauge • Using micron gauge • Using vacuum pump • Observation skills • Communication skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations
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	• Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.10 Charging refrigerant <i>Knowledge</i> • Type of refrigerant used in automotive air conditioning • Importance of maintaining refrigerant quantity • Importance of maintaining required engine rpm <i>Skills</i> • Using manifold gauge • Using weighing scale • Observation skills • Communication skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D3.11 Replacing service valve <i>Knowledge</i> • Function of service valve • Symptoms, causes and remedies of faulty service valve <i>Skills</i> • Using manifold gauge • Communication skills • Analytical skills <i>Attitude, safety and environmental concern</i> • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
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	D3.12 Replacing hoses Knowledge • Function of hose • Purpose of O-ring Skills • Using recovery machine • Using manifold gauge • Communication skills • Analytical skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning materials • CBLM / Reference Materials • Hand-outs • Audio visuals • Reference books • Manuals Learning facilities and infrastructure • Classroom with adequate facilities • Library • IT Lab • Workshop Tools • Screwdriver set, Allen key set, quick coupler, valve core key, socket set, spanner set, pliers and wrench set Equipment • Car equipped with AC system, recovery cylinder set, recovery machine and vacuum pump Instruments • Multimeter, micron gauge, weighing scale, drive Velt tension gauge and manifold gauge Materials • Controller, markin cloth, pen, notepad, condenser fan, motor, expansion valve, O-ring, refrigerant, receiver drier, evaporator, blower, blower motor, compressor, AC drive belt, magnetic clutch, AC hose,

	soap solution and service valve PPE • Safety gloves, safety boots, safety goggles, workshop dress and respiratory mask
Instructional Methodologies	The trainer shall use <i>inter alia</i> , the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i> , the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

Module Title	Carrying out servicing of domestic heat pump/air conditioner and automotive air conditioner		
Module Code	7127-L2-M4		
Learning Outcome 4	Troubleshoot domestic heat pump/air conditioner and automotive air conditioner		
Duration	Theory: 2.5 hours	Practical: 13 hours	Total: 15.5 hours
Assessment Criteria	- Electrical faults are diagnosed as per the job requirement following standard procedure - Mechanical faults are diagnosed as per the job requirement following standard procedure - Leakage test is performed as per the job requirement following standard procedure		
Contents	D4.01 Diagnosing electrical faults Knowledge - Symptoms, causes and remedies of electrical faults Skills - Using multimeter - Interpreting circuit diagram - Observation skills - Analytical skills - Numeracy skills - Communication skills Attitude, safety and environmental concern - Being time conscious - Being efficient in using resources - Having work ethics and integrity - Having patience - Proper handling of tools, materials and equipment - Ensuring to follow OHS rules and regulations - Ensuring appropriate use of PPE - Ensuring proper disposal of waste D4.02 Diagnosing mechanical faults Knowledge - Symptoms, causes and remedies of mechanical faults Skills - Observation skills - Analytical skills - Numeracy skills - Communication skills Attitude, safety and environmental concern - Being time conscious - Being efficient in using resources - Having work ethics and integrity		

	• Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste D4.03 Performing leak test Knowledge • Purpose of leak test • Symptoms, causes and remedies of leakage Skills • Using manifold gauge • Using brazing torch • Observation skills • Communication skills • Analytical skills Attitude, safety and environmental concern • Being time conscious • Being efficient in using resources • Having work ethics and integrity • Having patience • Proper handling of tools, materials and equipment • Ensuring to follow OHS rules and regulations • Ensuring appropriate use of PPE • Ensuring proper disposal of waste
Learning Conditions	Learning materials • CBLM/ Reference Materials • Hand-outs • Audio-visuals • Reference books • Manuals Learning facilities and infrastructures • Classroom with adequate facilities • Library • IT lab • Workshop Tools • Screwdriver set, pliers, adjustable wrench and tester Equipment • Car equipped with AC, domestic heat pump/AC and dry nitrogen gas cylinder set

	Instruments • Multimeter, clamp meter, pressure regulator, manifold gauge, leak detector and micron gauge Materials • Dry nitrogen gas and soap solution PPE • Safety gloves, safety boots, workshop dress and safety mask
Instructional Methodologies	The trainer shall use <i>inter alia</i>, the following instructional methods: • Lecture • Interactive discussion • Demonstration • Industrial training/attachment • Guided practice • Group activity • Individual practice • Problem based learning • Project based learning
Method of Assessment	The trainer shall use <i>inter alia</i>, the following assessment methods: • Practical demonstration/observation • Oral/viva-voce • Written test • Assignment • Project work

ON-THE-JOB TRAINING (OJT)

COURSE	Domestic Refrigerator and Air Conditioning BQF C2
DESCRIPTION	The trainee will be attached with relevant industries for OJT program. During the OJT, the trainees will be exposed to real life working environment where they are expected to develop technical skills and learn positive working attitudes including life skills.
OBJECTIVE	After completion of OJT, learners will be able to • Develop critical thinking, creativity, collaboration and communication skills • Develop information, media and technology literacy • Adopt flexible and productive working attitude • Develop leadership skills • Apply initiatives • Develop social skills • Adopt OHS practices • Carry out installation and configuration of computer system and devices • Carry out servicing of domestic refrigerator • Carry out installation of domestic air conditioner/heat pump • Carry out servicing of domestic air conditioner/heat pump • Carry out servicing of automotive air conditioning
DURATION	420 Hours

CONDITIONS FOR OPERATION OF OJT	• The institute shall select relevant and reliable industry for OJT attachment • The trainee shall be attached in Refrigerator and Air Conditioning related activity for at least 70% of the total OJT duration • The industry shall maintain daily attendance of the trainee • The trainee shall maintain OJT logbook as per the OJT guideline • The trainee is required to follow company's rule • The collaborating industry shall provide working facilities • The industry shall assess performance of trainees • The industry shall provide feedback in the logbook
EVALUATION	The industry shall evaluate the trainees on the trainee's performance through observation and use of logbook. The evaluation shall be done on the following aspects of trainees: ➤ Critical thinking ➤ Creativity ➤ Collaboration ➤ Communication ➤ Information literacy ➤ Media literacy ➤ Conversant to up-to-date technology ➤ Flexibility ➤ Leadership ➤ Initiative ➤ Productivity ➤ Social skills ➤ Core skills
REPORT	The trainee shall submit comprehensive report on OJT to the Institute

What is Competency-Based Curriculum (CBC)

- ✓ A competency-based curriculum is a framework or guide for the subsequent detailed development of competencies, associated methodologies, training and assessment resources.
- ✓ The CBC specifies the outcomes which are consistent with the requirements of the workplace as agreed through the industry or community consultations.
- ✓ CBC can be developed immediately when competency standards exist.
- ✓ When competency standards do not exist, curriculum developers need to clearly define the learning outcomes to be attained. The standard of performance required must be appropriate to industry and occupational needs through the industry/enterprise or specified client group consultations.

The CBC materials are available in both printed and electronic copies.

ANNEXURE

Annex I: Assessment Sample

Unit of competency	Drive Light Vehicle
Unit Code	8322-U4-L2
Module Title	Driving Light Vehicle
Module Code	8322-U4-L2-M1
Time Duration	45 min *
Problem or Project: Drive Light Vehicle	
Introduction: Perform pre-operating procedure before starting the vehicle. Drive light vehicle under different environment conditions following standard traffic rules and defensive driving techniques. Perform post operating procedure after parking the vehicle.	
Observation: (How will you be assessed as Competent?) Your performance will be assessed based on the following criteria: • Performance of pre and post operating procedure as per standard practices; • Application of standard procedure while starting the LMV; • Demonstrating the driving skills in different road condition using the system of vehicle control (SOVC); • Demonstrating your adherence to RSTA Rules, Defensive Driving; • The final outcome of your driving skills	
Note: For Assessor/Institute for preparation for assessment. Materials and Equipment for 1 candidate • LMV in good running condition with all necessary vehicle documents 2. Roles and responsibilities of assessors (before/during and after assessment) • Identify in advance the different road environment (rough road, town, simulated night and poor light condition, highway) • During assessment let the candidate demonstrate moving off, reversing, overtaking, and parking.	

Assessor/ Observation Check List

Unit of competency	Drive Light Vehicle		
Unit Code	8322-U4-L2		
Module Title	Driving Light Vehicle		
Module Code	8322-U4-L2-M1		
Problem/Project: Drive Light Vehicle	Psychomotor (Practical) domain level: P2		
Candidate's Name:			
Place of Assessment:		Date of Assessment:	
A. During the demonstration of skills did the candidate do following:	Marks allocated	Marks received	Remarks
1. Check mirror settings, fluid level, tire pressure and required documents.	4		
2. Start LMV according to the procedure of standard starting procedure (Cockpit Drill)	2		
3. Move off and steer LMV wearing seat belts and without stalling the engine*	3		
4. Reverse LMV safely without stalling the engine*	3		
5. Park LMV safely in the centre of given parking area following standard parking procedure	2		
6. Drive LMV on the highway according to the road conditions following the road safety signs.	2		
7. Drive LMV in towns according to the traffic signs and signals.	2		
8. Drive LMV on 4WD safely (if necessary and available)	1		
9. Giving pass and overtake the vehicle safely according to the road and weather condition *	3		
10. Stop LMV safely in a given area according to standard stopping procedure	1		
B. Is the job outcome correct in the following areas?			
Caused no accidents and damages to the vehicle.*	5		
Total marks obtained	28		
The Candidate's performance:	Satisfactory:		
	Not Satisfactory:		

Note: The questions marked with * are the critical questions which the trainees must be able to answer. Otherwise, they will be rated unsuccessful even if they perform well in the practical exam. The mark **P** is for the psychomotor domain level (P1- Simple Routine Assignment; P2- Questions related to Simple Routine Assignment and P3- Questions not related to Simple Routine Assignment)

Oral Questions checklist:

Unit of competency	Drive Light Vehicle			
Unit Code	8322-U4-L2			
Module Title	Driving Light Vehicle			
Module Code	8322-U4-L2-M1			
Problem/Project: Drive Light Vehicle				
Candidate's Name:				
Place of Assessment:		Date of Assessment:		
Questions (and its domain level) to be answered by the trainee / candidate:	Key Answer	Marks allocated	Marks obtained	Remarks
Why do you keep the vehicle in start mode for a few minutes before moving? (Verifying observations) (C1)				
In case of accidents who will you contact first? (contingency questions) (C2)				
While entering intersection, before how many seconds do you have to give signal? (verifying observations) (C3)				
Total Marks Obtained				
The candidate's performance was:		Satisfactory:		
		Not Satisfactory:		
Assessor's Name:		Signature:		

Note: The questions marked with C describes the cognitive level of the questions. C1- Remembering; C2- Functional Understanding and C3- Problem Solving.

Written questions checklist:

Unit of competency	Drive Light Vehicle		
Unit Code	8322-U4-L2		
Module Title	Driving Light Vehicle		
Module Code	8322-U4-L2-M1		
Problem/Project: Drive Light Vehicle			
Candidate's Name:			
Place of Assessment:		Date of Assessment:	
Questions (and its domain level) to be answered by the trainee/ candidate:	Key Answer	Marks Allocated	Marks Obtained
1. List down three types of parking. (Short Answer Question) (C1)	Angle, Straight and Parallel Parking	1	
2. All of the following are honking prohibited places EXCEPT : (C2) a. pedestrian crossing c. traffic jam b. public procession d. curves and bends (Multiple Choice Question)	d	2	
3. According to RSTA Regulations how much is the penalty for drunk driving? (C1)	Nu. 1750	1	
4. Match the following signs in column A with the indications in column B. (Matching Type) (C2) Column A 1.  2.  3.  Column B a. Give way b. Restriction End c. Compulsory Ahead d. Pedestrian Prohibited	1-c, 2-a, 3-d	3	
Total marks obtained			
The Candidate's performance was:	Satisfactory:		
	Not Satisfactory:		
Assessor's Name:		Signature:	
		Competent:	

The Candidate's overall result:	Not Yet Competent:	
Feedback to Candidate: (Provide feedback to the candidate on how they could improve – especially if they are not competent)		

I am satisfied with the way assessment was conducted: (Please include reasons if not satisfied) Candidate Name: Signature: Date:	YES	NO
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Assessor Name:

Signature:

Training Provider:

Date:

Annex II: Module Recognition

This is to verify that

Mr/Ms..... has completed module
on

Covering following learning outcomes:

1.
2.
3.

Instructor:

Head of the Department:

.....

.....

Signature: **Signature:**

Date: / / (dd/mm/yyyy)
.....(dd/mm/yyyy)

Date: / /

Head of the Institute:
(Institute)/Exam OC:

Trained

Assessor

.....

.....

Signature:

Signature:

Date: / ... / (dd/mm/yyyy)

Date: / /(dd/mm/yyyy)

Annex III: Lesson Plan
Lesson Plan

Course Title:		NC Level:
Module Code:		Duration:
Module Title:		
Learning Outcome:		
Skill/Task/Topic:		
Terminal Performance Objective:		
<i>(Note: Write narrative statement extracted from TPO of Task Sheet)</i>		
Enabling Objectives (Related knowledge): <i>By the end of the lesson learners will be able to:</i> - i) - ii) - iii)		
What (Content/Activity)	Who (T/L)	How (Methods/Media)
Duration (Min.)	Questions	
<i>Introduction:</i>		
<i>Main body</i>		
<i>Conclusion</i>		
Projects/Problems:		

Instructional Resources Plan				
Skills/Task/Topic:				
No. of Trainees:				
Sl. No.:	Instructional materials/resources	Specifications	Qty.	Remarks
Prepared by :		Signature	Date:	
Revised by:		Signature	Date:	
Approved by:		Signature	Date:	

Task sheet

TS-1/4: Practical Plan			
Course Title:		N C Level:	
Module code:		Duration:	
Module Title			
Learning outcome			
Skills/Task Title:		Task no:	
Terminal Performance Objective: <i>Given:</i> <i>Cue:</i> <i>Who:</i> <i>What:</i> <i>Within:</i> <i>How well:</i> - - -			
Enabling Objectives (Related Skills): <i>By the end of a lesson, the learners will be able to:</i> i) ii) iii) iv)			
Activities	Who (T/L)	How (methods/ media)	Duration
Project/Assignment:			

TS-2/4: Tool and Equipment required:						
Sl no.	Particulars	Specifications	Qty	Remarks		
Training Materials required:						
Sl no.	Particulars	Specifications	Qty.	Rate	Amount	Remarks
TS-3/4:Performance Guide						
Skill/Task:					Date:	
Directions: Use the following performances criteria to rate the learner. Check YES/NO to indicate whether the leaner performed each step as indicated or not?						
Sl. No:	Steps				Yes	No
Note: Critical steps: All * marked steps should be carried out very carefully.For a quality performance guide, all items should be checked "YES"						

TS-4/4: Instruction and Drawing

General Instructions for Trainees

- i)
- ii)
- iii)
- iv)

Drawing (if any)

Safety Precaution

- i)
- ii)
- iii)

Prepared by :

Signature

Date:

Revised By:

Signature

Date:

Approved by :

Signature

Date:

Annex IV: Course Plan
Institutes letter head and Logo
(Trade)YEAR PLAN- _____Semester_____ (Year)

Trade: NC Level:			Schedule																																Total Hour s														
Module Code	Module Title	Learning Outcome	Feb.				March				April				May				June				July				Aug.				Sept					Oct.				Nov.									
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4		1	2	3	4										
OJT																																																	
Assessment and Certification																																																	

Prepared by:
Date:

Verified & Approved by:

Monthly/Weekly Plan

Month:

Trade:

Trainer:

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 01							
Week 02							
Week 03							
Week 04							
Week 05							

Developed by:

Approved by:

Date

Annexure V: Time Distribution (Institute regular training)					
RAC BQF-C2					
Module Title	Learning outcomes	Tasks	Theory (Hours)	Practical (Hours)	Total (Hours)
A: Applying fundamentals of RAC	A1: Perform electrical and electronic practices	A1.00 Introductory knowledge	2	0	2
		A1.1 Use PPE	0.5	0.5	1
		A1.2 Construct series circuit	1	3	4
		A1.3 Construct parallel circuit	1	2	3
		A1.4 Measure voltage	0.5	1.5	2
		A1.5 Measure current	0.5	1.5	2
		A1.6 Measure resistance	1	3	4
		A1.7 Test capacitor	0.5	1.5	2
		A1.8 Test diode	0.5	1.5	2
		A1.9 Test transistor	0.5	1.5	2
		A1.10 Perform electronic soldering	1	3	4
		A1.11 Check contactor	0.5	1.5	2
		A1.12 Test compressor	1.5	2	3.5
		A1.13 Perform circuit continuity test	0.5	1	1.5
		A1.14 Test transformer	1	1.5	2.5
	Sub total		12.5	23	35.5
	A2: Perform mechanical workshop practices	A2.1 Prepare workpiece	2	4	6
		A2.2 Perform gas welding	2	18	20
		A2.3 Perform arc welding	2	18	20
	Sub total		6	40	46
	A3: Perform RAC workshop practices	A3.1 Perform tube cutting	1	2	3
		A3.2 Perform tube flaring	0.5	4	4.5
		A3.3 Perform tube swaging	0.5	4	4.5
		A3.4 Perform tube bending	0.5	2	2.5
		A3.5 Perform tube brazing	1	12	13
		A3.6 Perform tube pinching	0.5	1	1.5
		A3.7 Perform tube piercing	0.5	1	1.5
	Sub total		4.5	26	30.5
	Total Duration (A)		23	89	112
B: Carry out maintenance of domestic refrigerator	B1: Prepare for maintenance of domestic refrigerator	B1.00 Introductory knowledge	6	0	6
		B1.1 Identify tools and equipment	1	1.5	2.5
		B1.2 Select materials	0.5	1	1.5
		B1.3 Perform estimation and costing	1	2	3
	Sub total		8.5	4.5	13
	B2: Perform Maintenance of Domestic Refrigerator	B2.1 Replace thermostat	2	3	5
		B2.2 Replace timer	1.5	3	4.5
		B2.3 Replace defrost components	3	4	7
		B2.4 Replace compressor	2	12	14
		B2.5 Replace internal fan motor	0.5	2	2.5
		B2.6 Service PCB	1	2	3
		B2.7 Recover refrigerant	2	5	7
		B2.8 Perform flushing	0.5	3	3.5
		B2.9 Replace filter drier	1	6	7

		B2.10 Service condenser	1	6	7
		B2.11 Service evaporator	1	6	7
		B2.12 Perform vacuuming	0.5	2	2.5
		B2.13 Recharge refrigerant	1	6	7
		B2.14 Service digital temperature controller	2	5	7
	Sub total		19	65	84
	B3: Perform troubleshooting	B3.1 Diagnose electrical faults	1	3	4
		B3.2 Diagnose mechanical faults	0.5	6.5	7
		B3.3 Perform leak test	0.5	3	3.5
		B3.4 Prepare report	0.5	1	1.5
	Sub total		2.5	13.5	16
	Total Duration (B)		30	83	113
C: Carrying out installation of domestic air conditioner	C1: Prepare for installation of domestic air conditioner	C1.1 Perform site inspection	4	1	5
		C1.2 Perform estimation and costing	0.5	1	1.5
		C1.3 Prepare installation layout	1	2	3
	Sub total		5.5	4	9.5
	C2: Perform installation of domestic air conditioner	C2.1 Install indoor unit	1.5	18	19.5
		C2.2 Install outdoor unit	1	18	19
		C2.3 Perform leak test	0.5	0.5	1
	Sub total		3	36.5	39.5
	C3: Perform commissioning of domestic AC	C3.1 Check air circulation	0.5	1	1.5
		C3.2 Perform physical inspection	0.5	1	1.5
		C3.3 Prepare report	0.5	1	1.5
	Sub total		1.5	3	4.5
	Total Duration (C)		10	43.5	53.5
D: D. Carry out maintenance of domestic air conditioner and Automotive air conditioner	D1: Prepare for maintenance of air conditioner	D1.01 Identify required tools and equipment	0.5	1	1.5
		D1.02 Select required materials	0.5	1	1.5
		D1.03 Perform estimation and costing	0.5	1	1.5
	Sub total		1.5	3	4.5
	D2: Perform maintenance of air conditioner	D2.01 Perform pump down/recovery	0.5	3	3.5
		D2.02 Service Printed Circuit Board (PCB)	1	2	3
		D2.03 Service indoor unit	1	6	7
		D2.04 Service outdoor unit	1	6	7
	Sub total		3.5	17	20.5
	D3: Perform maintenance of automotive air conditioner	D3.1 Replace controller	2	5	7
		D3.2 Perform refrigerant recovery	0.5	6.5	7
		D3.3 Replace condenser fan motor	1	6	7
		D3.4 Replace expansion valve	1	6	7
		D3.5 Replace receiver drier	1	2	3
		D3.6 Replace condenser	1	12	13
		D3.7 Service cabin AC unit	1	2	3
		D3.8 Replace compressor	3	18	21
		D3.9 Perform vacuuming	0.5	1	1.5

		D3.10 Recharge refrigerant	1	4	5
		D3.11 Replace service valve	0.5	0.5	1
		D3.12 Replace hoses	0.5	2	2.5
	Sub total		13	65	78
	D4: Troubleshoot air conditioner and Automotive air conditioner	D4.1 Diagnose electrical faults	1	6	7
		D4.2 Diagnose mechanical faults	1	6	7
		D4.3 Perform leak test	0.5	1	1.5
	Sub total		2.5	13	15.5
	Total Duration (D)		20.5	98	118.5
	Grand Total Duration (hours)		83.5	313.5	397



For more information please contact:
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