



Bangladesh Technical Education Board
Agargaon, Shere Bangla Nagar, Dhaka

Transport Equipment Industry Sector Committee
Bangladesh

National Competency Standards
For
Refrigeration & Air Conditioning, NTVQF Level 4

Sponsored
By
The Project for Capacity Development Program of TTC, Chittagong

TABLE OF CONTENTS

	Page
A Introduction.....	3
B Proposed Bangladesh NTVQF with Job Classifications.....	5
C NTVQF level Descriptors.....	6
D Course structure.....	7
• GENERIC UNITS	8
○ GN4006A1 lead a small team.....	9
• OCUPATION SPECIFIC UNITS	12
○ TRARAC4029A1 Service and maintain automobile air conditioner.....	13
○ TRARAC4030A1 Service and Maintain package type air conditioner.....	19
○ TRARAC4031A1 Service and maintain Cassette type Air Conditioner.....	24
○ TRARAC4032A1 Service and maintain Air Handling Unit (AHU).....	29
○ TRARAC4033A1 Fabricate and install ducting and piping.....	33

INTRODUCTION

These Competency Standards were developed by the Technical Sub Committee (TSC) that was established under **The Project for Capacity Development Program of TTC, Rajshahi** which is implemented by KOICA (Korea International Cooperation Agency) funded by the Government of Korea. The rules of Skill Development Policy are maintained to develop the standards. The competency standards are the foundation on which new competency based curriculum will be developed that responds better to the needs of industry for skilled workers. The members of the TSC are primarily from industry but with representatives from BKTTC, Chittagong, TTC, Rajshahi and BKTTC, Dhaka. Persons who will successfully complete the new TVET programs based on these competency standards will receive a qualification in the new National Technical and Vocational Qualification Framework (NTVQF).

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Industry Skills Council

Date:

Bangladesh Technical Education Board (BTEB)

Date:

National Competency Standards for Refrigeration & Air Conditioning in the Transport Equipment Sector

Proposed Bangladesh NTVQF with Job Classifications

NTVQF Levels	Education Sectors			Job Classification
	Pre Vocation Education	Vocational Education	Technical Education	
NTVQF 6			Diploma in Engineering or Equivalent	Middle level Manager/ Sub Assistant Engineer etc.
NTVQF 5		National Skill Certificate 5 (NSC 5)		High Skilled Worker/Supervisor
NTVQF 4		National Skill Certificate 4 (NSC 4)		Skilled Worker
NTVQF 3		National Skill Certificate 3 (NSC 3)		Semi Skilled Worker
NTVQF 2		National Skill Certificate 2 (NSC 2)		Medium Skilled Worker
NTVQF 1		National Skill Certificate 1 (NSC 1)		Basic Skilled Worker
Pre-Voc 2	National Pre-Vocation Certificate in NPVC 2			Pre-Vocation Trainee
Pre-Voc 1	National Pre-Vocation Certificate in NPVC 1			Pre-Vocation Trainee

NTVQF level Descriptors

NTVQF level	Knowledge	Skill	Responsibility	Job Class
6	Comprehensive actual and theoretical knowledge within a specific study area with an awareness of the limits of that knowledge	Specialized and restricted range of cognitive and practical skills required to provide leadership in the development of creative solutions to defined problems	Manage a team or teams in workplace activities where there is unpredictable change . Identify and design learning programs to develop performance of team members.	Supervisor/Middle Level Manager/Sub Assistant Engr. Etc.
5	Very broad knowledge of the underlying. Concepts, principles, and processes in a specific study area	Very broad range of cognitive and practical skills required to generate solutions to specific problems in one or more study areas.	Take overall responsibility for completion of tasks in work or study. Apply past experiences in solving similar problems	Highly Skilled Worker/ Supervisor.
4	Very broad knowledge of the underlying. Concepts, principles, and processes in a specific study area	Range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying the full range of methods, tools, materials and information.	Take responsibility, within reason, for completion of tasks in work or study. Apply past experiences in solving similar problems	Skilled Worker
3	Moderately broad knowledge in a specific study area.	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools.	Work or study under supervision with some autonomy	Semi- Skilled Worker.
2	Basic underpinning knowledge in a specific study area	Basic skills required to carry out simple tasks	Work or study under indirect supervision in a structured context.	Medium Skilled Worker
1	Elementary understanding of the underpinning knowledge in a specific study area	Limited range of skills required to carry out simple tasks	Work or study under direct supervision in a structured context	Basic Skilled Worker
Pre-Voc 2	Limited general knowledge	Very limited range of skills and use of tools required to carry out simple tasks	Work or study under direct supervision in a structured context	Pre-Vocation Trainee
Pre-Voc 1	Extremely limited general knowledge	Minimal range of skills required to carry out simple tasks	Simple work or study exercises, under direct supervision in a clear, well defined structured context	Pre-Vocation Trainee

**Course Structure
for
REFRIGERATION AND AIR CONDITIONING (NTVQF LEVEL IV)**

Sl. No.	Unit Code and Title		UoC Level	Nominal Duration (Hours)
Generic - Compulsory (1 UoC required)				
1.	GN4006A1	Lead a small team	4	20
Occupation Specific – Compulsory (5 UoCs required)				
2	TRARAC4029A1	Service and maintain automobile air conditioner	4	90
3	TRARAC4030A1	Service and Maintain package type air conditioner	4	60
4	TRARAC4031A1	Service and maintain Cassette type Air Conditioner	4	30
5	TRARAC4032A1	Service and maintain Air Handling Unit (AHU)	4	40
6	TRARAC4033A1	Fabricate and install ducting and piping	4	80
Total Nominal Learning Hours				320

GENERIC UNIT

National Technical and Vocational Qualification Framework for Bangladesh

Unit of Competence

UNIT CODE & UNIT TITLE	GN100512A Lead small team
NOMINAL HOURS	20 hours
UNIT DESCRIPTOR	This unit covers the knowledge, skills, and attitude required to lead small team. It includes setting and maintaining team and individual performance standards.
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables
1. Provide team leadership	1.1 Work requirements are identified and presented to team members
	1.2 Reasons for instructions and requirements are communicated to team members
	1.3 Team members' queries and concerns are recognized, discussed and dealt with.
2. Assign responsibilities	2.1 Duties, and responsibilities are allocated having regard to the skills, knowledge and aptitude required to properly undertake the assigned task.
	2.2 Duties are allocated having regard to individual preference, domestic and personal considerations, whenever possible.
3. Set performance expectations for team members	3.1 Performance expectations are established based on client needs and according to assignment requirements.
	3.2 Performance expectations are based on individual team members duties and area of responsibility
	3.3 Performance expectations are discussed and
4. Supervised team performance	4.1 Monitoring of performance takes place against defined performance criteria and/or assignment instructions and corrective action taken if required
	4.2 Team members are provided with feedback , positive support and advice on strategies to overcome any deficiencies.
	4.3 Performance issues which cannot be rectified or addressed within the team are referenced to appropriate personnel.
	4.4 Team members are kept informed of any changes in the priority allocated to assignments or tasks which might impact on client/customer needs and satisfaction
	4.5 Team operations are monitored to ensure that employer/client needs and requirements are met.
	4.6 Follow-up communication is provided on all issues affecting the team
	4.7 All relevant documentation is completed.

Range of Variables

Variable	Range (May include but not limited to):
Work requirements	1.1. Client Profile 1.2. Assignment instructions
Team member's concerns	2.1. Roster 2.2. shift details
Monitor performance	3.1. Formal process 3.2. Informal process
Feedback	4.1. Formal process 4.2. Informal process Sandwich process
Performance issues	5.1. Work output 5.2. Work quality 5.3. Team participation 5.4. Compliance with workplace protocols 5.5. Safety 5.6. Customer service

Evidence Guide	
1. Critical aspects of Competency	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Maintained or improved individuals and/or team performance given a variety of possible scenario. 1.2 Assessed and monitored team and individual performance against set criteria 1.3 Represented concerns of a team and individual to next level of management or appropriate specialist and to negotiate on their behalf 1.4 Allocated duties and responsibilities, having regard to individual's knowledge, skills and aptitude and the needs of the tasks to be performed 1.5 Set and communicated performance expectations for a range of tasks and duties within the team and provided feedback to team members
2. Underpinning knowledge	<ul style="list-style-type: none"> 2.1 Company policies and procedures 2.2 Relevant legal requirements 2.3 How performance expectations are set 2.4 Methods of Monitoring Performance 2.5 Client expectations 2.6 Team member's duties and responsibilities
3. Underpinning skills	<p>Communication skills required for leading teams</p> <ul style="list-style-type: none"> 3.1 Informal performance counseling skills 3.2 Team building skills 3.3 Negotiating skills
4. Required Attitude	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Environmental concerns 4.3 Eagerness to learn 4.4 Tidiness and timeliness 4.5 Respect of peers and seniors in workplace
5. Resource implications	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 5.1 Workplace 5.2 Tools, equipment and facilities appropriate to processes or activity 5.3 Materials relevant to the proposed activity 5.4 Equipment and outfits appropriate in applying safety measures 5.5 Relevant drawings, manuals, codes, standards and reference material
6. Method of assessment	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> 6.1 Written test. 6.2 Demonstration 6.3 Oral Questioning/Interview
7. Context for assessment	<p>For certification competency should be assessed individually in the actual work place or simulated environment after completion of the module</p>
<p>Accreditation Requirements Training Providers must be accredited by Bangladesh Technical Education Board (BTEB), the national quality assurance body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of any national qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by BTEB.</p>	

OCCUPATION SPECIFIC UNITS

National Technical and Vocational Qualification Framework for Bangladesh Unit of Competence

UNIT CODE& TITLE	TRARAC4029A1 Service and maintain automobile air conditioner.
NOMINAL HOURS	90
UNIT DESCRIPTOR	This unit covers the knowledge, skill and attitude required maintenance and service automotive air conditioning Systems. It includes identification and confirmation of work requirement, Preparation for work, servicing of air conditioning systems and completion of work finalization processes, including clean-up and documentation.
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables
1. Prepare for maintenance of air conditioning system	1.1 Safe work practices is observed and personal protective equipment (PPE) worn as required for the work performed. 1.2 Necessary tools and equipment are identified and collected in accordance with work requirement. 1.3 Necessary materials are collected in accordance with work requirement. 1.4 Technical and/or calibration requirements for servicing sourced and support equipment identified and prepared 1.5 Dangers associated when handling the refrigerants is observed.
2. conduct test to identify fault	2.1 Air conditioning system components are checked using appropriate tools and techniques. 2.2 Amount of refrigerant is checked as per instruction manual 2.3 Damaged components and related electric wiring /ECU operating system are detected according to the standard procedures. 2.4 Test is completed without causing damage to any work-place property and vehicle. 2.5 Faults/defects are identified for repairing/servicing action based on checking.
3. Repair/service air conditioning system components	3.1 System performance tested and air conditioning service procedures determined. 3.2 Service of the system and components carried out in accordance with manufacturer's instruction without causing damage to any component or system 3.3 Replacements of components AC System are performed based on faults with identical components. 3.4 Refrigerant is recovered according to safe manner . 3.5 System is evacuated using high vacuum pump 3.6 Charging the Refrigerant is performed in accordance with standard procedure. 3.7 Final testing of auto air conditioning system is carried out to ensure the performance up to the unit standard .mentioned in the manual.
4. Clean and store equipment	4.1 Cleaning of equipment is performed in accordance with work place expectation 4.2 Waste materials are disposed off in accordance with work place requirements. 4.3 Tools and equipment are stored safely in appropriate location.

RANGE OF VARIABLES

VARIABLES	RANGE (May include but not limited to) :
PPE	1.1 Hand Gloves. 1.2 Safety Shoes. 1.3 Apron/Boiler suit 1.4 Goggles 1.5 Helmet
2. Tools and equipment	2.1 Hand tools <ul style="list-style-type: none"> • Wrench set • screw drivers • Pliers • Scraper • Assorted tool box 2.2 Cleaning equipment 2.3 Pressure testing equipment 2.4 Evacuation equipment. 2.5 Refrigerant recovery and/or recycling equipment 2.6 Gauge manifold set 2.7 Leak detector 2.8 Compressor pulley puller/special tool 2.9 Digital temperature meter 2.10 Anemometer. 2.11 Welding set 2.12 Nitrogen Cylinder
3. Materials	3.1 Refrigerant 3.2 Insulation Tape 3.3 Cotton waste 3.4 Auto Air conditioner charging kits 3.5 Refrigeration fittings 3.6 Copper tube 3.7 Welding filler rod 3.8 Welding flux 3.9 Lubricating oil. 3.10 Copper and brass fittings 3.11 Compressor oil 3.12 Dry nitrogen 3.13 Refrigeration system component connecting flexible pipe.

<p>4. Air-Conditioning System components</p>	<p>4.1 Compressor Assembly. 4.2 Evaporators/Cooling coil 4.3 Condenser Assembly 4.4 Condenser Fan Assembly. 4.5 Pipes and Hoses/LS/HS 4.6 AC Idler Pulley Assembly. 4.7 AC Belt 4.8 Auto Controller/AC ECU 4.9 AC Blower Motor 4.10 Compressor, magnetic clutch, armature plate 4.11 Operating switch 4.12 Electrical harness/Fuse & relays 4.13 Control circuit temperature component 4.14 Receiver, filter drier, sight glass, Receiver cum filter drier with sight glass 4.15 Expansion valve</p>
<p>5. Items of test</p>	<p>5.1 All AC system control switch/fuses/relays 5.2 Cooling performance 5.3 Engine Temperature 5.4 Blower performance 5.5 Air filter 5.6 Refrigerant Pressure 5.7 Condenser/radiator fan motor 5.8 AC compressor pulley belt tighten 5.9 Bad noise 5.10 Magnetic clutch auto engagement 5.11 Compressor oil leakage 5.12 Electric connection confirmation 5.13 Ac vacuum system performance 5.14 Leak test 5.15 Refrigerant hose pipes 5.16 Receiver drier 5.17 Re charge point 5.18 Expansion valve 5.19 Evaporator</p>
<p>6. Faults</p>	<p>6.1 Leaks of system 6.2 Compressor oil leakage 6.3 Magnetic clutch not works 6.4 Compressor Pressure low 6.5 Bearing damage 6.6 Condenser and evaporator fan not work</p>

	6.7 belt damage 6.8 Expansion valve blocked 6.9 Evaporator and condenser blocked 6.10 Filter blocked
7. Manuals	7.1 Maintenance Procedure Manual 7.2 Periodic Maintenance Data 7.3 Service Manual 7.4 User manual 7.5 Parts Checklist

EVIDENCE GUIDE

<p>1. Critical aspects of competency</p>	<p>Assessment requires evidence that the candidate :</p> <ul style="list-style-type: none"> 1.1 Observed safety procedures and requirements, in particular, the dangers associated with handling refrigerants. 1.2 Conducted inspection to find out faults of auto air-conditioning system 1.3 Conducted servicing/replacing the components of auto air-conditioning system 1.4 Performed final testing of auto air conditioning systems
<p>2. Underpinning knowledge</p>	<ul style="list-style-type: none"> 2.1 Refrigerant types and application 2.2 Dangers associated when working with refrigerants 2.3 Refrigerant recovery and recycling. 2.4 Air conditioning operating principle 2.5 Fundamental of electrical circuits 2.6 Inspection/testing procedure 2.7 Servicing procedures 2.8 Types of electrical controls 2.9 DC electrical power supply system 2.10 Vapor compression Refrigeration cycle 2.11 Pressure and temperature 2.12 Air velocity measurement system 2.13 Types of tools, testing & measuring instruments
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> 3.1 Identification of air conditioning components/types 3.2 Safe handling of tools, equipment and refrigerant. 3.3 Using relevant tools and equipment 3.4 Cleaning, testing, inspect and evaluate air conditioning components 3.5 Identifying faults in air conditioning components 3.6 Dismantling and reassembling air conditioning components for servicing 3.7 Applying the procedures of repairing/servicing with replacements components as required 3.8 Using the process of final testing repaired/serviced auto air conditioner. 3.9 Interpretation of sketches and manuals. 3.10 Checking power supply and correct fault. 3.11 Measuring voltage and current using electrical test. 3.12 Cutting, bending, swaging and flaring of tubes. 3.13 Welding and brazing. 3.14 Selection correct type of refrigerant. 3.15 Evacuating & charging of refrigeration systems 3.16 Detection and repairing of leaks. 3.17 Replacing system major components
<p>4. Required Attitude</p>	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety

	<p>4.2 Environmental concerns</p> <p>4.3 Tidiness and eagerness</p> <p>4.4 Respect of peers and seniors in workplace</p>
5. Resource implications	<p>The following resources MUST be provided:</p> <p>5.1 Workplace</p> <p>5.2 Material relevant to servicing air conditioning systems</p> <p>5.3 Equipment, hand and power tooling appropriate to inspecting and servicing air conditioning systems</p> <p>5.4 Equipment and outfits appropriate in applying safety measures</p> <p>5.5 Relevant drawings, manuals, standards and reference material</p>
6. Method of assessment	<p>Competency must be assessed through:</p> <p>6.1 Written Exam.</p> <p>6.2 Demonstration</p> <p>6.3 Oral Questioning/interview</p>
7. Context of assessment	<p>For certification competency should be assessed individually in the actual work place or simulated environment after completion of the module.</p>
<p>Accreditation Requirements</p> <p>Training Providers must be accredited by Bangladesh Technical Education Board (BTEB), the national quality assurance body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of any national qualification.</p> <p>Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by BTEB.</p>	

National Technical and Vocational Qualification Framework for Bangladesh

Unit of Competence

UNIT CODE & UNIT TITLE	TRARAC4030A1 Service and Maintain package type air conditioner
NOMINAL HOURS	60
UNIT DESCRIPTOR	This unit covers the knowledge, skill and attitude required to repair package type Air Conditioners. It includes preparing unit, tools and workplace, checking and identifying defects and repairing.
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables
1. Preparation for service and maintain of package type Air Conditioner	1.1 Safe work practices are observed and personal protective equipment (PPE) worn as required for the work to be performed.
	1.2 Necessary tools and equipment are identified in line with job requirements
	1.3 Necessary materials are selected as per job requirement
	1.4 Materials are cleaned and assembled for package type Air conditioner as per work standard.
2. Check and Identify faults	2.1 Systematic pre-testing procedure is observed in accordance with manufacturer's instruction.
	2.2 System defects / faults symptoms are identified using appropriate tools and equipment.
	2.3 Different feature are checked using recommended testing procedure
	2.4 Components of Electrical Circuit of Package type air conditioner are checked using recommended testing procedure
3. Servicing / Maintenance of package type air conditioner	3.1 Defective components of refrigeration system are replaced with identical or recommended appropriate equivalent ratings
	3.2 Control settings/adjustments are performed in conformity with service-manual specifications
	3.3 Air filter and evaporator fins are cleaned with cleaning agent
	3.4 System is evacuated using high vacuum pump.
	3.5 Refrigerant is recharged using specified type of refrigerant as per specification following safety practices.
	3.6 Unit is operated and checked to ensure satisfactory performance according to manufactures specifications
4. Clean and store of tools and equipment	4.1 Tools and equipment are maintained and cleaned as per instruction
	4.2 Work place is cleaned in accordance with environmental requirement
	4.3 Tools and equipment are stored safely in appropriate location according to standard workshop procedure.

Range of Variables

Variable	Range (May include but not limited to):
1. PPE	1.1 Hand gloves 1.2 Safety Shoes 1.3 Safety Goggles 1.4 Helmet 1.5 Mask 1.6 Apron 1.7 Safety belts and ropes
2. Tools	2.1 Pliers 2.2 Screwdriver 2.3 Wire stripper/crimper 2.4 Flaring tools set 2.5 Hammer 2.6 Steel wire brush 2.7 Wrenches 2.8 Tube bender 2.9 Reamer 2.10 Allen key set 2.11 Pulley puller 2.12 Soft brush
3. Equipment	3.1 Multi meter 3.2 Clamp on meter 3.3 Capacitor tester 3.4 Leak detectors 3.5 Magger 3.6 Gas welding equipment 3.7 Gauge manifold 3.8 Charging hose 3.9 Two stage Vacuum pump 3.10 Refrigerant recovery unit 3.11 Recovery cylinder 3.12 Air compressor nozzle 3.13 Air compressor 3.14 High pressure water pump 3.15 Air velocity meter 3.16 Digital thermometer 3.17 3-phase Motor control circuit 3.18 Phase sequence meter
4. Material	4.1 Process tube 4.2 Refrigeration fittings 4.3 Refrigerants

	<ul style="list-style-type: none"> 4.4 Copper tube 4.5 Welding filler rod 4.6 Welding flux 4.7 Filter dryer 4.8 Capillary tube 4.9 Expansion device 4.10 Lubricating oil. 4.11 Copper and brass fittings 4.12 Compressor oil 4.13 Dry nitrogen
5. Different feature	<ul style="list-style-type: none"> 5.1 Compressor oil 5.2 Duct pressure 5.3 Air flow 5.4 Water pressure 5.5 Grill temperature 5.6 Inlet-outlet water temperature Pressure 5.7 Fan RPM of cooling tower
6. Components of Electrical Circuit	<ul style="list-style-type: none"> 6.1 Motor starter 6.2 Temperature sensor 6.3 Fan motor 6.4 Selector switch 6.5 Solenoid valve 6.6 Compressor motor 6.7 Condensing fan 6.8 Cooling fan, 6.9 Pressure cut out (High and Low)
7. Components of refrigeration system	<ul style="list-style-type: none"> 7.1 Metering device (refrigerant flow controller), 7.2 filter / drier, pipes and fittings. 7.3 Compressor 7.4 Condenser, 7.5 Thermostatic expansion valve 7.6 Evaporator 7.7 Sight glass
8. Test & Checking	<ul style="list-style-type: none"> 8.1 Insulation 8.2 Resistance 8.3 Mechanical 8.4 Continuity 8.5 Leak 8.6 Suction & discharge pressure 8.7 cut out 8.8 Flow of refrigerant 8.9 Current drawn while running.

	8.10 Earth line test
	8.11 Current drawn on starting
	8.12 Voltage
	8.13 Compressor oil level check

Evidence Guide

<p>1. Critical aspects of Competency</p>	<p>Assessment requires evidence that the candidate:</p> <ol style="list-style-type: none"> 1.1 Applied safety rules and procedures 1.2 Selected appropriate processes, tools, materials and equipment based on job requirements 1.3 Checked to identify fault 1.4 Evacuated system using vacuum pump, 1.5 Recovered refrigerant and stored in recovery unit 1.6 Charged refrigerant is by weighing scale. 1.7 Repaired and serviced package type air conditioner 1.8 Ensured satisfactory performance of the of the system
<p>2. Underpinning knowledge</p>	<ol style="list-style-type: none"> 2.1 Refrigeration cycle 2.2 Single and 3 phase electrical power supply system 2.3 Types of tools, testing & measuring instruments 2.4 Type of refrigerants and their applications.. 2.5 Refrigerant recovery and recycling.
<p>3. Underpinning skills</p>	<ol style="list-style-type: none"> 3.1 Interpretation of sketches and manuals. 3.2 Checking power supply and correct fault. 3.3 Measuring voltage and current using electrical test. 3.4 Handling tools & equipment safely 3.5 Cutting, bending, swaging and flaring of tubes. 3.6 Welding and brazing. 3.7 Selection correct type of refrigerant. 3.8 Evacuating & charging of refrigeration systems 3.9 Detection and repairing of leaks. 3.10 Applying lifting and unloading technics
<p>4. Required Attitude</p>	<ol style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Environmental concerns 4.3 Tidiness and timeliness 4.4 Respect of peers and seniors in workplace
<p>5. Resource implications</p>	<p>The following resources MUST be provided:</p> <ol style="list-style-type: none"> 5.1 Workplace 5.2 Tools, equipment and facilities appropriate to processes or activity 5.3 Materials relevant to the proposed activity 5.4 Equipment and outfits appropriate in applying safety measures 5.5 Relevant drawings, manuals, codes, standards and reference material
<p>6. Method of assessment</p>	<p>Competency must be assessed through:</p> <ol style="list-style-type: none"> 6.1 Written test. 6.2 Demonstration 6.3 Oral Questioning/Interview
<p>7. Context for assessment</p>	<p>For certification competency should be assessed individually in the actual work place or simulated environment after completion of the module</p>
<p>Accreditation Requirements Training Providers must be accredited by Bangladesh Technical Education Board (BTEB), the national quality assurance body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of any national qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by BTEB.</p>	

National Technical and Vocational Qualification Framework for Bangladesh

Unit of Competency

UNIT CODE & UNIT TITLE	TRARAC4031A1 Service and maintain Cassette type Air Conditioner
NOMINAL HOURS	30
UNIT DESCRIPTOR	This unit covers the knowledge, skill and attitude required to repair Cassette type Air Conditioners using specified tools, test & measuring instruments. It includes preparing unit, tools and workplace, checking and identifying defects and repairing.
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables
1. Preparation for service and maintain Cassette type Air Conditioner	1.1 Safe work practices are observed and personal proactive equipment (<i>PPE</i>) worn as required for the work to be performed.
	1.2 Work instructions are interpreted to determine job requirements
	1.3 <i>Necessary tools and equipment</i> are identified in line with job requirements
	1.4 Materials are cleaned and assembled for package type Air conditioner as per work standard.
	1.5 <i>Necessary materials</i> are selected as per job requirement
2. Check and Identify fault	2.1 Systematic <i>Test and Checking</i> is observed in accordance with manufacturer's instruction.
	2.2 <i>Components of the Air-flow system</i> checked according to manufactures specifications to ensure correct performance
	2.3 System pressure tested with dry nitrogen using specified equipment following safety procedures.
	2.4 Motor terminals are checked using specified testing procedures
	2.5 Control settings/adjustments are checked in conformity with service-manual specifications.
	2.6 <i>Components of refrigeration</i> and <i>electrical / electronic circuit</i> are checked according to standard procedures.
	2.7 System defects/fault symptoms are identified and documented using appropriate tools and equipment.
3. Servicing / Maintenance of Cassette type air conditioner	3.1 Defective components are replaced with identical or recommended appropriate equivalent ratings
	3.2 Control settings/adjustments are performed in conformity with service-manual specifications
	3.3 Air filter and evaporator fins should be cleaned with approved <i>cleaning agent</i>
	3.4 System is evacuated using high vacuum pump and charge required refrigerant (if needed) according to manufacturer instructions.
	3.5 Refrigerant is charged using specified type of refrigerant by charging equipment to required specification following safety practices.
	3.6 Cleaning of unit is performed in accordance with standard procedures
	3.7 Unit is operated and checked to ensure satisfactory performance according to manufactures specifications
4. Clean and store of tools and equipment	4.1 Tools and equipment are maintained and cleaned as per instruction manual
	4.2 Work place is cleaned in accordance with environmental requirement
	4.3 Tools and equipment are stored safely in appropriate location according to standard workshop procedures.

Range of Variables

Variable	Range (May include but not limited to):
1. PPE	1.1 Hand gloves 1.2 Safety Shoes 1.3 Apron 1.4 Safety Goggles 1.5 Helmet 1.6 Mask 1.7 Safety belt and ropes
2. Tools	2.1 Pliers 2.2 Screwdriver 2.3 Wire stripper/crimper 2.4 Flaring tools set 2.5 Hammer 2.6 Steel wire brush 2.7 Assorted wrenches 2.8 Ratchet wrench 2.9 Tube bender 2.10 Reamer 2.11 Allen key set 2.12 Tube cutter 2.13 Pulley puller 2.14 Soft brush
3. Equipment	3.1 Multi meter 3.2 Clamp on meter 3.3 Capacitor tester 3.4 Leak detectors 3.5 Megger 3.6 Gas welding equipment 3.7 Gauge manifold 3.8 Charging hose 3.9 Charging station 3.10 Two stage Vacuum pump 3.11 Refrigerant recovery unit 3.12 Recovery cylinder 3.13 Air compressor nozzle 3.14 Air compressor 3.15 High pressure water pump 3.16 Air velocity meter 3.17 Digital thermometer 3.18 1-phase / 3-phase Motor control circuit 3.19 Phase sequence meter.
4. Material	4.1 Process tube 4.2 Refrigeration fittings 4.3 Refrigerants 4.4 Copper tube 4.5 Filler rod 4.6 Welding flux 4.7 Filter dryer/Feed device 4.8 Capillary tube / Expansion device 4.9 Lubricating oil. 4.10 Copper and brass fittings 4.11 Compressor oil

	4.12 Neutral detergent and water
5. Test and checking	5.1 Insulation resistance 5.2 Mechanical 5.3 Continuity 5.4 Leak 5.5 Suction & discharge pressure 5.6 Flow of refrigerant 5.7 Current drawn while running. 5.8 Current drawn on starting 5.9 Voltage
6. Components of the Air-flow system	6.1 4 Speed blower 6.2 Grill 6.3 Air filter 6.4 Air sewing system
7. Components of Electrical Circuit	7.1 Motor starter, 7.2 Temperature sensor 7.3 4-speed fan motor, 7.4 Selector switch, 7.5 Solenoid valve 7.6 Temperature sensor 7.7 Power transformer 7.8 Electronic control circuit. 7.9 Swing motor 7.10 Drain water pump 7.11 Magnetic contactor with overload protector
8. Components of refrigeration system	8.1 Metering device (refrigerant flow controller), filter / drier, pipes and fittings. 8.2 Compressor 8.3 Condenser, 8.4 Expansion valve 8.5 Evaporator

Evidence Guide

<p>1. Critical aspects of evidence</p>	<p>Assessment requires evidence that the candidate:</p> <ul style="list-style-type: none"> 1.1 Applied safety rules and procedures 1.2 Checked components of air conditioning and electrical / electronic circuit. 1.3 System is evacuated 1.4 Performed required refrigerant charging in accordance with manual 1.5 Completed repair work as per specifications 1.6 Repaired unit is tested before reinstallation 1.7 Cleaned workplace and stored tools and equipment in safe location
<p>2. Underpinning knowledge</p>	<ul style="list-style-type: none"> 2.1 Types of electrical controls 2.2 Effect of Hz. In cooling capacity 2.3 1-phase and 3-phase electrical power supply system and motor control 2.4 Different cleaning agent 2.5 Leak detection procedure, 2.6 Evacuation procedure , 2.7 Vapor compression Refrigeration cycle 2.8 Refrigerants used in cassette type air conditioner 2.9 Pressure and temperature measurement 2.10 Air velocity measurement 2.11 Air filter and fins cleaning agent solution
<p>3. Underpinning skills</p>	<ul style="list-style-type: none"> 3.1 Interpretation of sketches and manual 3.2 Checking 1-phase / 3-phase power supply and electrical motor controls. 3.3 Measuring voltage and current. 3.4 Using proper tools & equipment. 3.5 Cutting, bending, swaging and flaring of tube 3.6 Welding and brazing 3.7 Selecting correct type of refrigerant. 3.8 Detecting and repairing leaks. 3.9 Evacuation and charging refrigerants 3.10 Performance testing and adjustments of cassette type air conditioner done 3.11 Applying Leveling technics of cassette type air conditioner 3.12 Handling tool and equipment correctly and safely 3.13 Commissioning of cassette type air conditioner
<p>4. Required Attitude</p>	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Environmental concerns 4.3 Eagerness to learn 4.4 Tidiness and timeliness 4.5 Respect of peers and seniors in workplace
<p>5. Resource implications</p>	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 5.1 Workplace 5.2 Tools, equipment and facilities appropriate to processes or activity 5.3 Materials relevant to the proposed activity 5.4 Equipment and outfits appropriate in applying safety measures 5.5 Relevant drawings, manuals, codes, standards and reference material
<p>6. Method of assessment</p>	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> 6.4 Written test. 6.5 Demonstration 6.6 Oral Questioning/Interview
<p>7. Context for assessment</p>	<p>For certification competency should be assessed individually in the actual work place or simulated environment after completion of the module</p>

Accreditation Requirements

Training Providers must be accredited by Bangladesh Technical Education Board (BTEB), the national quality assurance body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of any national qualification.

Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by BTEB.

Unit of Competency

UNIT CODE & UNIT TITLE	TRARAC4032A1 Service and maintain Air Handling Unit (AHU)
NOMINAL HOURS	40
UNIT DESCRIPTOR	This unit covers the knowledge, skill and attitude required to repair Air Handling Unit using specified tools, test & measuring instruments. It includes preparing unit, tools and workplace, checking and identifying defects and repairing.
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables
1. Prepare for work.	1.1 Safe work practices are observed and personal protective equipment (PPE) worn as required for the work to be performed.
	1.2 Work instructions are interpreted to determine job requirements
	1.3 Necessary tools and equipment are identified in line with job requirements
	1.4 Necessary materials are selected as per job requirement
2. Check and Identify faults	2.1 Systematic Test and checking is observed in accordance with manufacturer's instruction.
	2.2 Components of the Air-flow system checked according to manufactures specifications to ensure correct performance
	2.3 Booster fan and rotary fan performance is checked according to the instruction
	2.4 Control settings/adjustments are checked in conformity with service-manual specifications.
	2.5 Components of refrigeration and electrical / electronic circuit are checked according to standard procedures
	2.6 System defects /fault symptoms are identified and documented using appropriate tools and equipment
3. Service / Maintain of Cassette type air conditioner	3.1 Defective parts/components are replaced with identical or recommended appropriate equivalent ratings
	3.2 Control settings/adjustments are performed in conformity with service-manual specifications
	3.3 Air filter and evaporator/cooling coil fins should be cleaned with specified cleaning agent
	3.4 Ducting and fabrication are done conformity with the drawing
	3.5 Pressure control switch, pressure gauge and temperature are checked
	3.6 Unit is operated and checked to ensure satisfactory performance according to manufactures specifications
4. Clean and store of tools and equipment	4.1 Tools and equipment are maintained and cleaned as per instruction manual
	4.2 Work place is cleaned in accordance with environmental requirement
	4.3 Tools and equipment are stored safely in appropriate location according to standard workshop procedures.

Range of Variables

Variable	Range (May include but not limited to):
1. PPE	1.1 Hand gloves
	1.2 Safety Shoes

	<ul style="list-style-type: none"> 1.3 Apron 1.4 Safety Goggles 1.5 Helmet 1.6 Mask
2. Tools	<ul style="list-style-type: none"> 2.1 Pliers 2.2 Screwdriver 2.3 Wire stripper/crimper 2.4 Hammer 2.5 Steel wire brush 2.6 Wrenches 2.7 Allen key set 2.8 Pulley puller 2.9 Soft brush
3. Equipment	<ul style="list-style-type: none"> 3.1 Multi meter 3.2 Clamp on meter/Capacitor Tester/Leak detectors 3.3 Magger 3.4 Gas welding equipment 3.5 Gauge manifold 3.6 Charging hose 3.7 Two stage Vacuum pump 3.8 Refrigerant recovery unit 3.9 Recovery cylinder 3.10 Air compressor nozzle 3.11 Air compressor 3.12 High pressure water pump 3.13 Air velocity meter 3.14 Digital thermometer 3.15 1-phase / 3-phase Motor control circuit
4. Material	<ul style="list-style-type: none"> 4.1 Refrigeration fittings 4.2 Refrigerants Copper tube 4.3 Welding filler rod 4.4 Welding flux 4.5 Expansion device 4.6 Lubricating oil. 4.7 Copper and brass fittings 4.8 Water coil cleaner
5. Test and checking	<ul style="list-style-type: none"> 5.1 Insulation resistance 5.2 Sheet metal breakage/ breakdown 5.3 Air leak 5.4 Filter leakage test 5.5 Air flow velocity 5.6 Humidity check 5.7 Booster fan check 5.8 Set and room temperature 5.9 Diffuser check 5.10 Water drainage system 5.11 Door gasket leakage 5.12 Damper motor 5.13 Air filter 5.14 Belt 5.15 Coupling
6. Components of the	<ul style="list-style-type: none"> 6.1 Speed blower

Air-flow system	6.2 Grill 6.3 Air filter 6.4 Air swing system
7. Components of the Unit	7.1 fan, 7.2 Damper. 7.3 Grill 7.4 Louver 7.5 Diffuser 7.6 Duct 7.7 Fresh air duct 7.8 Water pump 7.9 Heating and cooling coil 7.10 Acoustic insulation 7.11 Humidity control system 7.12 Condensate pans, 7.13 Gasket 7.14 Air filter and HEPA filter 7.15 Cooling fan 7.16 Belt pulley
8. Components of Electrical Circuit	8.1 Temperature sensor 8.2 Fan motor, 8.3 Solenoid valve 8.4 Pump motor 8.5 Electronic control circuit 8.6 Transformer
9. Defects	9.1 Air leakage, 9.2 Rusting, 9.3 Condensate drainage problems 9.4 Dirt accumulation on Air filter and fin 9.5 Damper malfunction 9.6 Actuator malfunction 9.7 Booster fan low speed

Evidence Guide

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Prepared the unit and required materials, tools equipment and workplace.
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	<ul style="list-style-type: none"> 1.2 Applied safety rules and procedure 1.3 Diagnosed faults of air handling units 1.4 Replaced defective parts/components with identical or recommended equivalent ratings 1.5 Repaired and serviced air handling units 1.6 Operated and checked Unit to ensure satisfactory performance 1.7 Maintained, cleaned and stored of tools and equipment
2. Underpinning knowledge	<ul style="list-style-type: none"> Different types of components of air handling units 2.1 Types of electrical controls 2.2 Single phase and 3-phase electrical power supply system and motor control 2.3 Vapor compression Refrigeration cycle 2.4 Type of refrigerants their properties and applications.
3. Underpinning skills	<ul style="list-style-type: none"> 3.1 Interpretation of sketches and manual 3.2 Measuring voltage, current and air velocity. 3.3 Using proper tools & equipment. 3.4 Cutting, bending, swaging and flaring of tube 3.5 Welding and brazing 3.6 Detecting and repairing leaks. 3.7 Checking vibration 3.8 Fabricating pipe 3.9 Applying testing and adjusting technic 3.10 Applying Leveling technic 3.11 Handling tool and equipment correctly and safely 3.12 Applying Commissioning technics
4. Required Attitude	<ul style="list-style-type: none"> 4.6 Commitment to occupational health and safety 4.7 Environmental concerns 4.8 Eagerness to learn 4.9 Tidiness and timeliness 4.10 Respect of peers and seniors in workplace
5. Resource implications	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 5.1 Workplace 5.2 Tools, equipment and facilities appropriate to processes or activity 5.3 Materials relevant to the proposed activity 5.4 Equipment and outfits appropriate in applying safety measures 5.5 Relevant drawings, manuals, codes, standards and reference material
6. Method of assessment	<p>Competency must be assessed through</p> <ul style="list-style-type: none"> 6.1 Written test. 6.2 Demonstration 6.3 Oral Questioning/Interview
7. Context for assessment	<p>For certification competency should be assessed individually in the actual work place or simulated environment after completion of the module</p>
<p>Accreditation Requirements Training Providers must be accredited by Bangladesh Technical Education Board (BTEB), the national quality assurance body, or a body with delegated authority for quality assurance to conduct training and assessment against this unit of competency for credit towards the award of any national qualification. Accredited providers assessing against this unit of competency must meet the quality assurance requirements set by BTEB.</p>	

National Technical and Vocational Qualification Framework for Bangladesh

Unit of Competency

UNIT CODE & UNIT TITLE	TRARAC4033A1 Fabricate and install ducting and piping
NOMINAL HOURS	80
UNIT DESCRIPTOR	This unit covers the knowledge, skill and attitude required to Install Pipe fitting; Ducting and Fabrication using specified tools, test & measuring instruments. It includes preparing unit, tools and workplace, checking and identifying defects and repairing.
ELEMENTS OF COMPETENCY	PERFORMANCE CRITERIA <i>Bold & Italic</i> terms are elaborated in the Range of Variables
1. Preparation for installation	1.1 Safe work practices are observed and personal protective equipment (<i>PPE</i>) worn as required for the work to be performed.
	1.2 Work instructions are interpreted to determine job requirements
	1.3 <i>Necessary tools and equipment</i> are identified in line with job requirements
	1.4 <i>Necessary materials</i> are selected and collected as per job requirement
2. Fabricate duct and Install Piping	2.1 Ducting material and piping are cut as per supplied drawing
	2.2 <i>Components</i> are assembled as per design.
	2.3 Insulation of piping / ducting is done in accordance with client requirement
	2.4 Cleaning of unit is performed to remove unwanted materials in accordance with standard procedures
	2.5 Unit is operated and <i>checked</i> to ensure satisfactory performance according to manufactures specifications
3. Clean and store of tools and equipment	3.1 Tools and equipment are maintained and cleaned as per instruction manual
	3.2 Work place is cleaned in accordance with environmental requirement
	3.3 Tools and equipment are stored safely in appropriate location according to standard workshop procedures.

Range of Variables

Variable	Range (May include but not limited to):
1. PPE	1.1 Chemical gloves 1.2 Safety Shoes

	<ul style="list-style-type: none"> 1.3 Apron 1.4 Safety Goggles 1.5 Helmet 1.6 Mask 1.7 Ear plug
2. Tools	<ul style="list-style-type: none"> 2.1 Pliers 2.2 Screw driver 2.3 Anvil 2.4 Hammer 2.5 Steel wire brush 2.6 Wrenches 2.7 Pipe bender 2.8 Reamer 2.9 Allen key set 2.10 Pipe cutter 2.11 Pulley puller 2.12 Wire brush 2.13 Wooden Hammer 2.14 Measuring tap 2.15 Steel rule 2.16 Scriber 2.17 Tin sniper 2.18 Interlocking joint pliers 2.19 Spark lighter 2.20 Try square 2.21 C-clamp 2.22 Divider 2.23 Inside calipers 2.24 Outside calipers 2.25 Ladder 2.26 Sprit Level 2.27 Level
3. Equipment	<ul style="list-style-type: none"> 3.1 Magger 3.2 Gas welding equipment 3.3 Pipe bender 3.4 Press machine 3.5 Rivet gun 3.6 Power drill machine 3.7 Pillar drill machine 3.8 Paint Spraying machine 3.9 Hand grinder 3.10 Pipe cutter 3.11 Pipe reamer 3.12 Sheet bending machine 3.13 Shearing machine 3.14 Fabric Machine
4. Material	<ul style="list-style-type: none"> 4.1 Sheet metal 4.2 Flange 4.3 Elbow 4.4 Reducer 4.5 Socket 4.6 Pipe

	<ul style="list-style-type: none"> 4.7 Rivet 4.8 Screw 4.9 Thermo cool 4.10 Glass wool 4.11 Insulating foam 4.12 Aluminum foil 4.13 Welding filler rod 4.14 Welding flux 4.15 T joint 4.16 MS angle bar 4.17 MS flat bar 4.18 Gasket 4.19 Couplings 4.20 Duct tape 4.21 Damper cloth 4.22 Royal bolt and plug
5. Components	<ul style="list-style-type: none"> 5.1 Booster fan, 5.2 Volume Control Damper. 5.3 Diffuser 5.4 Duct 5.5 Register 5.6 Vibration Isolator 5.7 Turning Vanes. 5.8 Air terminals. 5.9 Flange 5.10 Pipe fittings 5.11 Gate Valve 5.12 Check Valve
6. Test and checking	<ul style="list-style-type: none"> 6.1 Insulation resistance of fan motor 6.2 Sheet metal breakage/ breakdown 6.3 Air leakage 6.4 Filter leakage 6.5 Air flow velocity 6.6 Booster fan check 6.7 Diffuser check 6.8 Damper check

Evidence Guide

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Applied safety rules and procedures
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	<ul style="list-style-type: none"> 1.2 Fabricated components as per drawing 1.3 Insulated properly 1.4 Checked leveling 1.5 Checked assembled Components
2. Underpinning knowledge	<ul style="list-style-type: none"> 2.1 Type of ducting 2.2 Type of pipe joint. 2.3 Concept of ducting principles 2.4 Measurement of sheet metal for cutting 2.5 Measurement of air velocity 2.6 Method of reducing pressure losses in duct; 2.7 Controlling of air distribution 2.8 Principle of insulation;
3 Underpinning skills	<ul style="list-style-type: none"> 3.1 Identifying the common sheet and pipe 3.2 Measuring sheet and pipe 3.3 Identifying the difference between duct seams and joints. 3.4 Using bending machine 3.5 Using sheet and pipe cutting machine 3.6 Applying technic of Insulating material 3.7 Applying assembling technics of piping and ducting component
4 Required Attitude	<ul style="list-style-type: none"> 4.1 Commitment to occupational health and safety 4.2 Environmental concerns 4.3 Eagerness to learn 4.4 Tidiness and timeliness 4.5 Respect of peers and seniors in workplace
5 Resource implications	<p>The following resources MUST be provided:</p> <ul style="list-style-type: none"> 5.1 Workplace 5.2 Tools, equipment and facilities appropriate to processes or activity 5.3 Materials relevant to the proposed activity 5.4 Equipment and outfits appropriate in applying safety measures 5.5 Relevant drawings, manuals, codes, standards and reference material
6 Method of assessment	<p>Competency must be assessed through:</p> <ul style="list-style-type: none"> 6.7 Written test. 6.8 Demonstration 6.9 Oral Questioning/Interview
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