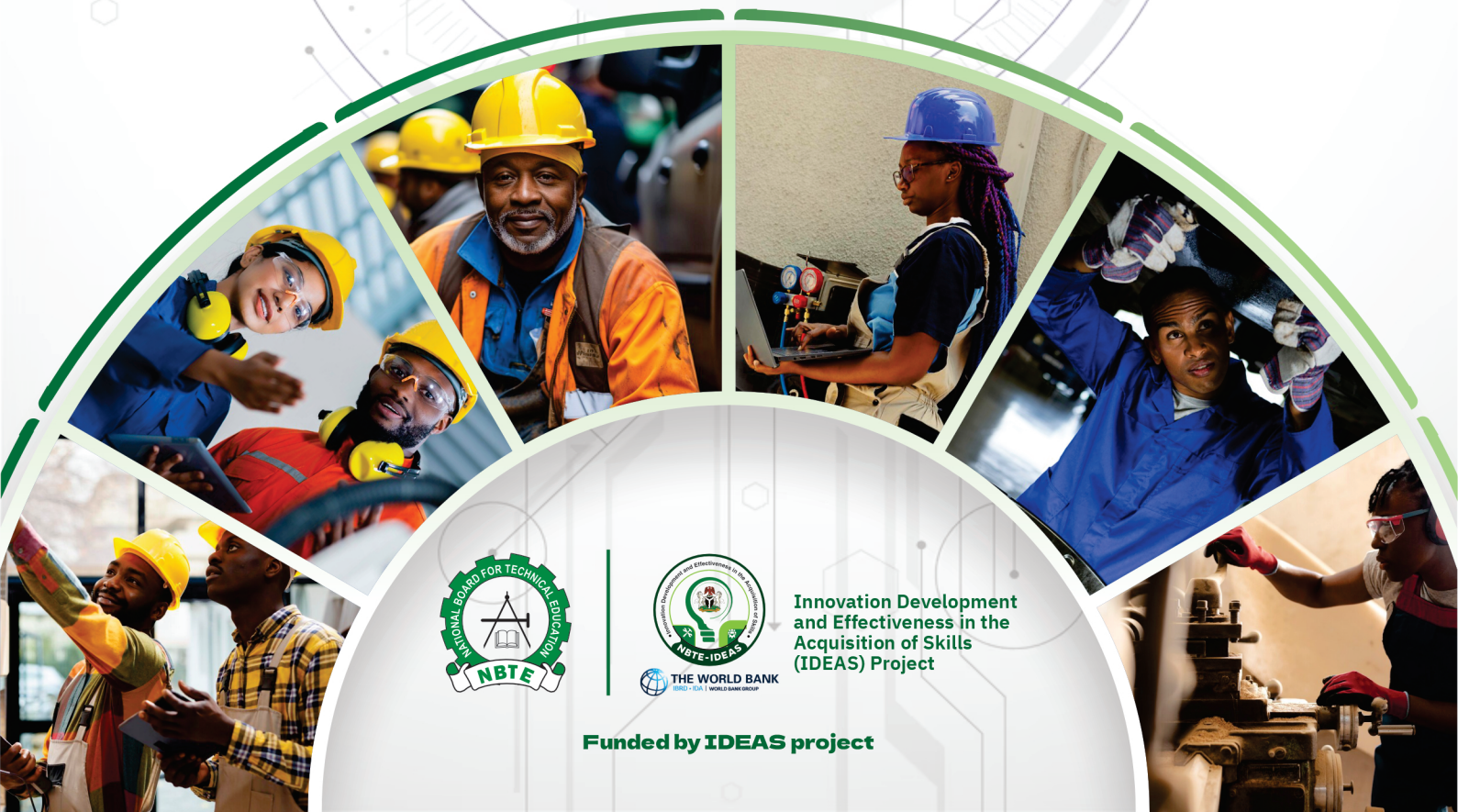
FEDERAL MINISTRY OF EDUCATION

National Skills Qualifications FOR REFRIGERATION AIR-CONDITIONING

LEVEL 1, 2 & 3

February, 2025



NATIONAL BOARD FOR TECHNICAL EDUCATION
NBTE

Innovation Development and Effectiveness in the Acquisition of Skills (IDEAS) Project

THE WORLD BANK

Funded by IDEAS project

National Board for Technical Education
Plot B, Bida Road, P.M.B. 2239, Kaduna, Nigeria

NATIONAL SKILLS QUALIFICATION

REFRIGERATION AND AIR - CONDITIONING

LEVELS 1-3

FEBRUARY 2025

Contents

NATIONAL SKILLS QUALIFICATION

REFRIGERATION AND AIR - CONDITIONING

LEVEL 1

FEBRUARY, 2025

NATIONAL SKILLS QUALIFICATIONS (NSQ)
Qualification: Refrigeration and Air-Conditioning

Qualification Purpose:
The purpose of the Qualification is to train a learner to be competent in installing, maintaining, and repairing Refrigerator and Air-conditioning (R&AC) systems.

Qualification Objectives: At the end of Qualification, learners should be able to:

1. Follow health and safety regulations, including the use of personal protective equipment (PPE).
2. Apply teamwork skills in a refrigeration and air-conditioning work environment.
3. Develop effective communication skills in professional and customer interactions.
4. Carry out pipework in refrigeration systems.
5. Perform basic maintenance, including evacuation and charging of refrigerants.
6. Identify and diagnose electrical faults in refrigeration and air-conditioning systems.
7. Repair basic electrical components in refrigeration units.

Level assessment requirements/evidence requirements:
There are eight compulsory units (Units 1, 2, 3, 4, 5, 6, 7 and 8) to enable the learner to qualify for Level 1 in **INSTALLATION MAINTENANCE AND REPAIRS OF REFRIGERATION AND AIR-CONDITIONING SYSTEMS.** Assessment must be carried out in a real workplace environment in which learning and human development are carried out. ***Simulation is not allowed*** as all evidence is to be obtained directly in the field.

Assessment methods to be used for this level include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Work product (WP)
5. Personal Statement (PS)
6. Assignment

NATIONAL S K I L L S QUALIFICATION

NSQ LEVEL1 REFRIGERATION AND AIR-CONDITIONING
(INSTALLATION MAINTENANCE AND REPAIRS)

MANDATORY UNITS

S/No	Reference Number	NOS Title	Credit Value	Guided Learning Hours	Remark
1	CON/RAC/001/L1	Understand Teamwork in Refrigeration and air-conditioning	1	10hrs	Mandatory
2	CON/RAC/002/L1	Communicate effectively in refrigeration and Air-conditioning work environment	2	20hrs	Mandatory
3	CON/RAC/003/L1	Understand Health and Safety in air-conditioning	2	20hrs	Mandatory
4	CON/RAC/004/L1	Understand Basic concept of Refrigeration and air-conditioning	3	30hrs	Mandatory
5	CON/RAC/005/L1	Carry out Pipework in Refrigeration and Air-conditioning	3	30hrs	Mandatory
6	CON/RAC/006/L1	Understand Evacuating and Charging in R&AC	3	30hrs	Mandatory
7	CON/RAC/007/L1	Diagnose Electrical faults, in R&AC.	3	30hrs	Mandatory
8	CON/RAC/008/L1	Repair Electrical faults, in R&AC.	4	40hrs	Mandatory
	TOTAL		21	210hrs	

NOTE: This is a 21-credit qualification; of which all 21 credits from mandatory units are compulsory. To achieve this qualification; Learners are required to achieve all the 21 mandatory credits units.

National Skills Qualification

CONSTRUCTION SECTOR

LEVEL1: REFRIGERATION AND AIR-CONDITIONING

Unit1: Understand Teamwork in Refrigeration and air-conditioning work environment

Unit Reference Number: CON/RAC/001/1
NSQ Level: 1
Credit Value: 1
Guided Learning Hours: 10hrs

Unit Purpose: This unit is designed to equip the learner with basic understanding of teamwork in refrigeration and air-conditioning work environment

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Other methods, assignments, case studies, essays, projects etc.

UNIT 01
Unit Title: Understand Teamwork in Refrigeration and Air-conditioning Work Environment
Level: 1
Credit Unit: 1
Guided Learning Hours: 10

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Establish Positive working relationships with colleagues	1.1	State the need for developing positive working relationships with colleagues									
	1.2	Explain the importance of relating to others that make them feel valued and respected.									
	1.3	Assist team members when required									
	1.4	Report to the personnel when a request for assistance falls outside the area of responsibility									
	1.5	Communicate information to colleagues about their own work that might affect others									
LO 2: Take responsibility within the team	2.1	State your own role and responsibilities within the team									
	2.2	Perform individual tasks in line with the team rules and regulations									
	2.3	Participate effectively in teamwork									
LO 3: Work in compliance with the policy of the organization	3.1	State organizational policy/code of practice for your organization.									
	3.2	Work in line with organizational standard									
	3.3	Use organizational Code of Practice to carry out tasks.									
	3.4	Explain the Organizational Code of Conduct									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

Unit 2: Communicate effectively in refrigeration and air-conditioning work environment

Unit Reference Number: CON/RAC/002/1
Level: 1
Credit Value: 2
Guided Learning Hours: 20hrs

Unit Purpose: This unit is designed to equip the learner to communicate effectively in the working environment.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Other methods; assignments, case study, essay, project, etc.

Unit 02: Communicate effectively in refrigeration and air-conditioning work environment

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Understand the use of Non-complex Communication Systems in a Work Environment	1.1	Use verbal means of communication.									
	1.2	Apply non-verbal means of Communication									
	1.3	Explain the use of simple verbs to Pass on the necessary information									
	1.4	Explain the use of non-verbal means to pass on necessary information e.g. body Language									
	1.5	Use symbols and signs appropriately									
LO 2: Identify the Sources of Information in a Work Environment	2.1	Identify sources of information in a work environment.									
	2.2	Explain how to relate to sources of Information									
	2.3	Use various information flow systems in Work environment									
	2.4	Use the information to avoid challenges in Work situations.									
	2.5	State procedures for reporting findings in the work environment									
LO 3: Know Communication in a Work Environment	3.1	Identify various communications Equipment in the work environment.									
	3.2	Use effectively various communications Equipment in the work environment.									
	3.3	Pass information effectively to the right Personnel									
	3.4	Pass information effectively using Symbols, signs and codes.									
	3.5	Obey instructions in line with the ethics of Work environment									

LO 4: Know how to communicate with others/Customers in Refrigeration and Air-Conditioning Work Environment	4.1	Explain customer relationship.									
	4.2	Explain how to receive jobs from customers for Refrigeration and air-conditioning work:									
	4.3	Explain the job specifications of the following specialties in refrigeration and air-conditioning: • Sales Engineer. • Application Engineer. • Maintenance Technician. Sheet Metal Experts. • Installers. • Oxy-acetylene Welding expert. • Pipe Work expert									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

Unit 3: Understand Health and Safety in Refrigeration and Air-Conditioning

Unit Reference Number: CON/RAC/003/1 NSQ Level: 1
Credit Value: 2
Guided Learning Hours: 20hrs

Unit Purpose: This unit is to equip the learner with the understanding of Health and Safety in refrigeration and air-conditioning in the work environment.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS)or Reflective Practice (RP)
5. Other methods; assignments, case study, essay, project etc.

Unit 3: Understand Health and Safety in Refrigeration and Air-Conditioning

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1:	1.1	Identify health safety and risks relevant to Refrigeration and Air-conditioning Air-conditioning									
Know Occupational health issues in Refrigeration and Air-conditioning	1.2	Explain occupational health and safety Standards									
	1.3	Identify necessary equipment in Occupational health and safety									
	1.4	Use occupational health and safety Equipment									
	1.5	Identify environmental hazards and risks									
LO 2: Know Protection issues in Refrigeration and Air-Conditioning Work.	2.1	Discuss environmental hazard									
		Identify tools/equipment used in mitigating environmental hazard									
	2.2	Explain Environmental hazards in Refrigeration and air-conditioning industry									
	2.3	Use tools/ equipment to mitigate environmental hazards mitigating									
	2.4	Explain air pollution and its risks in the R&AC environment									
		Explain methods used to avoid Environmental pollution									
LO 3:	3.1	Identify safety rules in the workplace.									
Know Personal safety	3.2	Explain safety tags and symbols.									
	3.3	Select personal protective equipment.									
	3.4	Describe selected personal protective equipment									
	3.5	Use personal protective									

		Equipment (PPE) correctly									
	3.6	Maintain clean working surroundings/ Environment									
LO 4:	4.1	Identify the location of first aid materials									
Know First aid	4.2	Select appropriate first-aid materials for defined situations									
	4.3	Describe first aid procedures for defined situations.									
	4.4	Service first aid materials at the workplace.									
	4.5	Apply first aid methods for defined Situations									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

National Skills Qualification
CONSTRUCTION SECTOR
LEVEL1: REFRIGERATION AND AIR-CONDITIONING

Unit04: Understand Basic concept of Refrigeration and air-conditioning

Unit Reference Number: CON/RAC/004/1
NSQ Level: 1
Credit Value: 3
Guided Learning Hours: 30hrs

Unit Purpose: This unit is designed to equip the learner with basic understanding of refrigeration and air-conditioning operations.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Assignment (ASS)

UNIT 04: Understand Basic concept of Refrigeration and air-conditioning

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref.PageNo.			
LO 1: Know the basic concept of refrigeration	1.1	Explain refrigeration									
	1.2	List types of refrigeration systems									
	1.3	Explain the classification of refrigeration									
	1.4	Define vapour compression system									
	1.5	Explain how the vapour Compression system works									
	1.6	Sketch the schematic diagram of the vapour Compression system									
LO 2: Know the basic terms of Air-conditioning	2.1	Define an air-conditioning system.									
	2.2	Describe types of air-conditioning systems									
	2.3	Explain the working principles of domestic Air-Conditioning system									
	2.4	Sketch the schematic diagram of the domestic air-conditioning system									
	2.5	Identify the major components of a domestic air-conditioning system									
LO 3: Know basic knowledge of refrigerant.	3.1	Define a refrigerant.									
	3.2	List the types of refrigerant									
	3.3	Explain the coding of refrigerants									
	3.4	Identify refrigerants according to Colour Coding									
	3.5	Explain refrigerants according to the number of Codes									
	3.6	State properties of are refrigerant									
LO 4: Know career opportunities in refrigeration and air-conditioning	4.1	Identify job opportunities in refrigeration and air-conditioning.									
	4.2	State the types of job specialties in Refrigeration and air-conditioning:									

	4.3	Explain the job specifications of the following specialities in refrigeration and air-conditioning: • Sales Engineer. • Application Engineer. • Maintenance Technician. • Sheet Metal Experts. • Installers. • Oxy-acetylene Welding expert. (Pipe Work expert)									
LO 5: OUTLINE THE MATERIALS USED IN THE FABRICATION OF REFRIGERATION PARTS.	5.1	Identify types of materials used for External body framework of refrigerator									
	5.2	Describe the types of materials used as Insulator in refrigerator									
	5.3	Explain the types of materials used for the internal body framework of our refrigerator									
	5.3	Define Compressor in the refrigeration system									
	5.2	Define condensers in the refrigeration system									
	5.3	Define evaporators in refrigeration System									
	5.4	Explain the types of pipes used in evaporators and condensers units of Refrigerators									
	5.5	Distinguish between pipes used in evaporators and condenser units of refrigerators									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

Unit 05: Carry out Pipe Works in Refrigeration

Unit Reference Number: CON/RAC/005/L1
NSQ Level: 1
Credit Value: 3
Guided Learning Hours: 30hrs

Unit Purpose: The purpose of this unit is to equip the learner with the knowledge and skills of application of Pipework in refrigeration

Unit assessment requirements /evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Work Product (WP)
6. Assignment (ASS)

UNIT05: Carry out Pipework in Refrigeration

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Know various types of pipes used in refrigeration and air-Conditioning	1.1	Identify types of pipes used in Refrigeration and air-conditioning									
	1.2	Select pipes using the diameter as Parameter									
	1.3	Select pipes based on functionality as a parameter									
	1.4	Select pipes based on material as a parameter									
LO 2: Know pipe-cutting and bending operations in refrigeration and air-conditioning.	2.1	Explain the types of tools used in the pipe-Cutting operations									
	2.2	Apply safety precautions associated with pipe-cutting operations									
	2.3	Describe different methods of pipe-Cutting operations									
	2.4	Select appropriate tools for pipe-cutting operations									
	2.5	Carry out pipe-cutting operations.									
	2.6	Apply safety precautions associated with Pipe bending operations									
	2.7	Describe the process of pipe bending using different methods									
	2.8	Select appropriate tools for pipe-bending operations									
	2.8	Carry out pipe-bending operation									

Lo 3: Apply Flaring Operation	3.2	Apply safety precautions associated with pipe flaring									
	3.1	Identify tools and equipment used in pipe Flaring									
	3.3	Describe the process of pipe flaring									
Lo 4:	4.1	Identify tools and equipment used in Swaging operations									

Apply Swaging Operation	4.2	Apply safety precautions associated with swaging operations									
	4.3	Describe the procedure followed in the pipe Swaging operation									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

Unit 06: Carry out Evacuation and Charging in R & AC

Unit Reference Number: CON/RAC/006/L1
NSQ Level: 1
Credit Value: 3
Guided Learning Hours: 30

Unit Purpose: Demonstrate the basic concept and procedure of evacuation and charging in refrigeration and air conditioning systems.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.
Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Practical Assessment (PA)
4. Witness Testimony (WT)
5. Personal statement (PS)or Reflective Practice (RP)
6. Work Product (WP)
7. Assignment (ASS).

UNIT 06: Carry out Evacuation and Charging in R & AC

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.				
LO 1: Understand Safety Procedures in Evacuation and Charging of Refrigerant	1.1	Explain the evacuation and charging of refrigerant										
	1.2	Identify the safety procedures in evacuation and charging processes.										
	1.3	Identify the PPE used in evacuation and charging operations.										
	1.4	Apply safety precautions involved in the evacuation and charging of refrigerant from the refrigeration system										
LO 2: Identify tools and Equipment used in evacuation and Charging Work.	2.1	Identify tools and equipment used for the evacuation of unwanted particles in Refrigeration system										
	2.2	Describe the function of each tool/equipment identified in 2.1 above										
	2.3	Identify tools and equipment used in Charging refrigerator										
LO 3: Describe the functions of Equipment used in Evacuation.	3.1	Describe the functions of vacuum pump										
	3.2	Describe the functions of a manifold gauge										
	3.3	Describe the correct setting of the vacuum Process										
	3.4	Perform evacuation process in Refrigerator										
LO 4: Demonstrate the process of Charging a Refrigerator	4.1	Describe the procedure of selecting refrigerant For particular refrigerator										
	4.2	Select tools/equipment to charge a refrigerator										
	4.2	Prepare to charge a refrigerator										
	4.3	Demonstrate the charging process in a refrigerator										

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

Unit 07: Diagnose of Electrical Faults in Refrigerator and Air-Conditioner.

Unit Reference Number: CON/RAC/008/L1
NSQ Level: 1
Credit Value: 3
Guided Learning Hours: 30hrs

Unit Purpose: This unit is designed to equip the learner with the knowledge and skills of diagnosing electrical faults in Refrigerators and Air-conditioners.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Work Product (WP)
6. Assignment (ASS).

UNIT 07: Diagnose Electrical Faults in Refrigerator and Air-Conditioner

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Understand Safety Procedures in Diagnosing Electrical Faults in R&AC	1.1	Explain safety precautions to be followed when tracing electrical faults									
	1.2	Explain the procedure to follow in selecting the right size of cable for a particular Air Conditioner.									
	1.3	Explain safety precautions to be followed when replacing a faulty relay									
	1.4	Describe the procedure to follow to identify a faulty capacitor									
	1.5	Explain the safety precautions involved in replacing a faulty capacitor									
LO 2: Identify Tools/ Equipment used in R&AC Electrical works	2.1	Identify tools/instruments for measuring electric current and voltage.									
	2.2	Identify tools/instruments used for testing the relay coil.									
	2.3	Identify the instrument used in the continuity test of a cable.									
	2.4	Identify the equipment/instrument used for cable jointing and termination.									
LO 3: Carryout Basic Troubleshooting of Electrical Faults in R&AC	3.1	Identify the fault of the compressor fan not starting while the compressor unit is starting.									
	3.2	Identify the fault of overload clicking sound and compressor not starting									
	3.3	Recognise the fault of the overload starts relay and capacitors.									
	3.4	Trace power supply fault in the Air-conditioner unit, and cut-offs.									
LO 4: Replace Faulty Electrical Part in R&AC	4.1	Describe methods of replacing or mending faulty electric cord wire									
	4.2	Remove a faulty capacitor and replace it									

		with a functioning one.									
	4.3	Describe the process involved in repairing an overloaded relay and/replacing with a new functioning one.									
	4.4	Describe the method of test-running the refrigerator after repairs									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

Unit 08: Repair Electrical Faults in Refrigerator and Air-Conditioner.

Unit Reference Number: CON/RAC/008/L1
NSQ Level: 1
Credit Value: 3
Guided Learning Hours: 30hrs

Unit Purpose: This unit is designed to equip the learner with the basic understanding of repairing identified electrical faults in Refrigerators and Air-conditioners.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Work Product (WP)
6. Assignment (ASS)

UNIT08: Repairing Electrical Faults in Fridges and Air-conditioner.

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Follow the Safety Procedure in Electrical Works	1.1	Demonstrate safety precautions to be followed when tracing electrical faults									
	1.2	Discuss the procedure to follow in selecting the right size of electrical wire for a particular Air Conditioner.									
	1.3	Demonstrate safety precautions in replacing a faulty relay									
	1.4	Demonstrate the procedure to follow to remove the faulty capacitor									
	1.5	Describe safety precautions involved in Replacing a faulty capacitor									
LO 2: Use Tools and Equipment in R&AC Electrical works	2.1	Measure electric supply voltage Using appropriate tools/instruments.									
	2.2	Test a relay coil using appropriate tools/instruments.									
	2.3	Test the continuity of a supply cable using appropriate tools/instruments.									
	2.4	Terminate cable using appropriate materials and tools/instruments.									
LO 3: Replace simple Faulty Electrical Part.	3.1	Replace/mend a faulty electric supply cable as may be required.									
	3.2	Replace the faulty capacitor of a given fridge or A/C as appropriate.									
	3.3	Replace the relay of a given Refrigerator or A/C as appropriate									
	3.4	Run a test of the replaced/repaired Electrical part.									

LO 4: **Test Run after Repairs in R&AC**	4.1	Describe the procedure to follow before testing the Refrigerator after maintenance work.									
	4.2	Test a refrigerator after maintenance work.									
	4.3	Describe the procedure to follow before testing the Air-conditioner after maintenance work.									
	4.4	Test run an Air-conditioner after repairs									
	4.5	Report findings/conditions in 4.2 and 4.4 above									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

NATIONAL SKILLS QUALIFICATION

REFRIGERATION AND AIR - CONDITIONING

LEVEL 2

FEBRUARY, 2025

GENEREAL INFORMATION

QUALIFICATION PURPOSE: This Qualification is designed to train learner to be competent in installing, maintaining, and repairing Refrigerator and Air-conditioning (R&AC) systems.

QUALIFICATION OBJECTIVES: At the end of **Level 2**, learner should be able to:

1. Demonstrate teamwork and communication skills for efficient workplace collaboration.
2. Apply safety measures in various R&AC tasks, including handling refrigerants and electrical components.
3. Diagnose faults in refrigeration and air-conditioning systems.
4. Perform installation, maintenance, and repairs on domestic air-conditioning units.
5. Carry out oxy-acetylene welding for refrigeration pipework.
6. Carry out refrigerant evacuation and recharging with an understanding of environmental safety.
7. Use diagnostic tools and equipment for fault detection and repair.
8. Apply technical and graphical instructions to complete refrigeration system installations.

NATIONAL SKILLS QUALIFICATION
CONSTRUCTION SECTOR
NSQ LEVEL 2: REFRIGERATION AND AIR-CONDITIONING (INSTALLATION MAINTENANCE AND REPAIRS)

MANDATORY UNITS

Unit	Unit Reference Number	Unit Title	Credit Value	Guided Learning Hours
1	CON/RAC/001/2	Understand Teamwork in refrigeration and Air-conditioning work Environment	1	10hrs
2	CON/RAC/002/2	Communicate effectively in refrigeration and Air- conditioning work Environment	3	30hrs
3	CON/RAC/003/2	Work Safely in Refrigeration and Air-Conditioning Work Environment	3	30hrs
4	CON/RAC/004/2	Understand Concept of Refrigeration and Air-Conditioning	3	30hrs
5	CON/RAC/005/2	Carry out Refrigerant Evacuation and Charging in R&AC	3	30hrs
6	CON/RAC/006/2	Diagnose and Repair Electrical faults in R&AC.	4	30hrs
7	CON/RAC/007/2	Troubleshoot in Refrigeration & AC	4	40hrs
8	CON/RAC/008/2	Carry out Oxy-acetylene Welding Work in R&AC	3	30hrs
9	CON/RAC/009/2	Install and Maintain Domestic air conditioner	6	60hrs
TOTAL			33	330

NOTE: This is a 24-credit qualification, to achieve this qualification; Learners are required to achieve 11 credits from mandatory units and 6 credits from the optional units. Each Credit is equivalent to approx. 10 Guided Learning Hours (GLH). The Total Learning Hours will therefore consist of the GLH *plus* the independent learning hours of the candidate, which is generally 50%–150% of the GLH. ***The actual Total Learning Hours for each Credit will then be a minimum of 15 hours***

Qualification Purpose: This qualification is to equip the learner with the Basic concept of Refrigeration and Air Conditioning and also to prepare the learner for troubleshooting, ox-acetylene welding, Installation and maintenance in Refrigeration and air conditioning.

GENERAL GUIDE

Unit title	Provides a clear explanation of the content of the unit.
Unit number	The unique number assigned to the unit.
Unit reference	The unique reference number given to each unit at qualification approval by NBTE
Unit level	Denotes the level of the unit within the National Vocational Qualification framework NSQF.
Unit credit value	The value that has been given to the unit based on the expected learning time for an average learner. 1 credit = 10 learning hours
Unit aim	Provides a brief outline of the unit content.
Learning outcome	A statement of what a learner will know, understand or be able to do, as a result of a process of learning.
Assessment criteria	A description of the requirements a learner must achieve to demonstrate that a learning outcome has been met.
Unit assessment guidance	Any additional guidance provided to support the assessment of the unit.
Unit guided learning hours	The average number of hours of supervised or directed study time or assessment required to achieve a qualification or unit of a qualification.

National Skills Qualification

Construction Sector

Level 2: Refrigeration and Airconditioning

Unit 001: Understand Teamwork in refrigeration and Air- conditioning work Environment
Unit Reference Number: CON/FW/001/L2
NSQ Level: 2
Credit Value: 1
Guided Learning Hours: 10hrs

Unit Purpose: This unit is designed to equip the learner with basic understanding of teamwork in refrigeration and air-conditioning work environment.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Assignment (ASS)

UNIT 001: Understand Teamwork in refrigeration and Air- conditioning work Environment

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
L01: ***Know Positive Working Relationship with Colleagues***	1.1	Identify the need for developing positive working relationships with colleagues									
	1.2	Recognise the importance of relating with other people in a way that makes them feel valued and respected.									
	1.3	Assist team members when required.									
	1.4	Communicate information to colleagues about their work that might affect others.									
	1.5	Report to the personnel when a request for assistance falls outside the area of responsibility									
L02: ***Know Responsibility within the Team***	2.1	Recognize own roles and responsibilities within the team									
	2.2	Perform individual tasks in line with the team rules and regulations.									
	2.3	Participate effectively in teamwork									
L03: ***Comply with the Policy of the Organization***	3.1	Explain the Organizational Code of Conduct									
	3.2	Use Organizational Code of Practice									
	3.3	Work in line with Organizational Standards									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

NATIONAL SKILLS QUALIFICATION

CONSTRUCTION SECTOR

LEVEL2: REFRIGERATION AND AIR-CONDITIONING

Unit 002: Communicate effectively in refrigeration and Air- conditioning work Environment

Unit Reference Number: CON/RAC/002/L2
NVQ Level: 2
Credit Value: 3
Guided Learning Hours: 30hrs

Unit Purpose: This unit is to equip the learner with knowledge and skills to communicate effectively in the working environment.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. ***Simulation is not allowed*** in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Assignment (ASS)

UNIT 002: Communicate effectively in Refrigeration and Air-Conditioning Working Environment

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Understand the use of non-complex communication systems in a work environment	1.1	Identify various sources of information within refrigeration and air-conditioning Industry									
	1.2	Recognize solving problems using Appropriate information									
	1.3	Use signs, symbols and Recording information in the workplace									
	1.4	Explain the importance of Communication in the work environment									
LO 2: Know how to pass on relevant information	2.1	Pass on information Effectively									
	2.2	Recognize written Instructions									
	2.3	Explain technical and graphics instructions									
LO 3: Use Non-complex communication systems in a work environment	3.1	Use non-verbal means to Pass on the necessary information									
	3.2	Describe the use of non-verbal means to pass on necessary information e.g. body Language									
	3.3	Interpret symbols and signs Appropriately									
LO 4: Identify sources of information in a work environment	4.1	Locate the source of information in Organization and work environment									
	4.2	Relate appropriately with the source of Information									
	4.3	Use various information flow systems in Work environment									
	4.4	Use the information to avoid challenges in Work situation									
	4.5	Describe procedures in reporting Findings in the work environment									
	4.6	Identify the sources of information in									

		Work environment									
LO 5: Use of Effective Communication Equipment in The Work Environment	5.1	Select Communication equipment in Work environment in line with standards									
	5.2	Use Communication equipment in the work environment in line with standards									

Learners Signature:	**Date:**
Assessors Signature:	**Date:**
IQA Signature (if sampled)	**Date:**
EQA Signature (if sampled)	**Date:**

National Skills Qualification

CONSTRUCTION SECTOR

LEVEL2: REFRIGERATION AND AIR-CONDITIONING

Unit 003: Work Safely in Refrigeration and Air-Conditioning Work Environment
Unit Reference Number: CON/RAC/003/2
NVQ Level: 2
Credit Value: 3
Guided Learning Hours: 30HRS

Unit Purpose: This unit is to equip the learner with the knowledge and skills to comply with Health and Safety requirement in refrigeration and air-conditioning in the work environment.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. ***Simulation is allowed*** in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Work Product (WP)

UNIT 003: Work Safely in Refrigeration and Air-Conditioning Work Environment

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: UNDERSTAND THE IMPORTANCE OF PERSONAL HEALTH AND HYGIENE	1.1	Explain the importance of wearing clean, neat and appropriate Personal Protective Equipment in the work environment.									
	1.2	Always Work safely, complying with health and safety and other relevant regulations and guidelines. (Nigerian Factory Health and Safety Act of 2015)									
	1.3	Get any cuts, grazes and wounds treated by an appropriate and qualified person, in the workplace									
	1.4	Report illness and infection promptly to Appropriate persons									
	1.5	Explain the importance of maintaining good Personal hygiene									
	1.6	Explain your responsibility under the (Nigerian Factory Health and Safety Act of 2015) as it relates to your occupation									
	1.7	Explain how to follow general rules on Hygiene must be followed.									
	1.8	Identify correct Personal Protection Equipment such as Head Protection, Foot Protection, Face and Eye Protection, Hand and Body protection And regulatory protection.									
	1.9	Describe how to deal with cuts, grazes and wounds and why it is important to Do so.									
LO 2: UNDERSTAND SAFETY AND SECURITY IN THE	2.1	Explain the importance of working in healthy, safe and secure workplace									

WORKPLACE	2.2	Explain how to report accidents or near accidents quickly and accurately to Appropriate personnel.									
	2.3	Describe Pollution control and disposal of waste with organic and inorganic Waste disposal methods									
LO 3: WORK IN SAFE AND SECURE WORK ENVIRONMENT	3.1	Identify any hazards or potential hazards And act appropriately									
	3.2	State where information about health and safety in your workplace can be Obtained									
	3.3	Describe the types of hazards in the workplace that may occur and how to Deal with them									
	3.4	State hazards that can be dealt with personally and those that should be Reported to appropriate personnel									
	3.5	Identify risk elements in your work Environment									
	3.6	Describe organizational security Procedures and why these are important									
	3.7	Follow procedures for raising awareness of hazards									
	3.8	Explain how to warn other people about Hazards.									
	3.9	Explain why accidents and near accidents should be reported and who they should be reported to									
LO 4: UNDERSTAND EMERGENCY PROCEDURES	4.1	Describe types of emergencies that may happen in the workplace and how to deal with them									
	4.2	Identify where to find first-aid equipment and who the registered first-Aider is in the workplace									
	4.3	Explain safe lifting and handling Techniques that should be followed									

	4.4	Explain other ways of working safely, Relevant to one position and why they are important									
	4.5	Describe organizational emergency procedures									
	4.6	State possible causes for fire in Work place.									
	4.7	Describe how to minimize the possibility of Fire in the workplace									
	4.8	Explain where to find alarms and how to Set them off									
	4.9	Explain why a fire should never be approached unless it is safe to									
	4.10	Explain the importance of following fire Safety rules.									
	4.11	State the importance of reporting all usual or non-routine incidents to the appropriate Personnel									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

NATIONAL SKILLS QUALIFICATION

CONSTRUCTION SECTOR

LEVEL 2: REFRIGERATION AND AIR-CONDITIONING

Unit 004: Understand the Concept of Refrigeration and air-conditioning

Unit Reference Number: CON/RAC/004/L2
NSQ Level: 2
Credit Value: 3
Guided Learning Hours: 30hrs

Unit Purpose: This is to equip the learner with the knowledge and skills to understand refrigeration and air-conditioning systems.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment where learning and human development are carried out. ***Simulation is not allowed*** in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Work Product (WP)
6. Other methods (OM), assignments, case studies, essays, projects, etc.

UNIT 004: Understand the Concept of Refrigeration and air-conditioning

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Distinguish Refrigeration systems	1.1	Explain refrigeration cycle									
	1.2	Enumerate types of refrigeration systems									
	1.3	Discuss the Vapour compression system									
	1.4	Explain the operation of vapour Compression system									
	1.5	Sketch the schematic diagram of the vapour Compression system									
LO 2: Know Process of Air-conditioning	2.1	Describe the Operations of the air-conditioning system.									
	2.2	Differentiate the types of air-conditioning systems									
	2.3	Identify the working principles of domestic Air-Conditioning system									
	2.4	Identify the major components of a domestic air-conditioning system									
LO 3: Know Identification of Refrigerants.	3.1	Explain Refrigerants.									
	3.2	Outline the types of refrigerants									
	3.3	Distinguish the Colour coding of refrigerants									
	3.4	Identify refrigerants according to Colour Coding									
	3.5	Explain refrigerants according to the number of Codes									
	3.6	Outline the properties of are refrigerant									
LO 4: Know the Career Opportunities in Refrigeration and	4.1	Identify job opportunities in refrigeration and air-conditioning.									
	4.2	State the types of job specialties in Refrigeration and air-conditioning:									

Air-Conditioning	4.3	Explain the job specifications of the following specialities in refrigeration and air-conditioning: • Sales Engineer. • Application Engineer. • Maintenance Technician. • Sheet Metal Experts. • Installers. • Oxy-acetylene Welding expert. (Pipe Work expert)									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

NATIONAL SKILLS QUALIFICATION
CONSTRUCTION SECTOR
LEVEL 2: REFRIGERATION AND AIR-CONDITIONING

Unit 005: Carry out Refrigerant Evacuation and Charging in R&AC

Unit Reference Number: CON/RAC/005/L2
NSQF Level: 2
Credit Value: 3
Guided Learning Hours: 30

Unit Purpose: This unit is designed to provide learners with the knowledge and skills of Refrigerant Evacuation and Charging in refrigeration and air conditioning systems.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS)or Reflective Practice (RP)
5. Work Product (WP)
6. Assignment (ASS)

UNIT 005: Carry out Refrigerant Evacuation and Charging in R&AC

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Understand Safety Procedures in Evacuation and Charging of Refrigerant	1.1	Explain refrigerant evacuation and charging in R & AC									
	1.2	Demonstrate safety procedures in evacuation and charging processes.									
	1.3	Identify the PPE used in evacuation and charging operations.									
	1.4	Apply safety precautions involved in the evacuation and charging of refrigerant from the refrigeration system									
LO 2: Identify tools and Equipment used in evacuation and Charging Work.	2.1	Identify tools and equipment used for the evacuation of unwanted particles in Refrigeration system									
	2.2	Describe the function of each tool/equipment identified in									
	2.3	Identify tools and equipment used in Charging refrigerator									
	2.4	Identify refrigerant types according to Codes									
	2.5	State the difference in the materials identified in 2.4									
LO 3: Know the functions of Equipment used in Evacuation.	3.1	Describe the functions of the vacuum pump									
	3.2	Describe the functions of a manifold gauge									
	3.3	Describe the correct setting of the vacuum Process									
	3.4	Perform evacuation process in Refrigerator									
LO 4: Demonstrate the process of Charging a Refrigerator	4.1	Describe the procedure of selecting refrigerant									
	4.2	Select tools/equipment to charge a refrigerator									
	4.2	Prepare to charge a refrigerator									

	4.3	Demonstrate the charging process in a refrigerator									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

Unit 006: Diagnose and Repair of Electrical Faults in Refrigerator and Air-Conditioner.

Unit Reference Number: CON/RAC/006/L2
NSQ Level: 2
Credit Value: 3
Guided Learning Hours: 30hrs

Unit Purpose: This unit is designed to equip the learner with knowledge and skills of diagnosing electrical faults in Refrigerators and Air-conditioners, tools/equipment used and safety procedures in diagnoses of electrical faults.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Work Product (WP)
6. Assignment (ASS)

UNIT 006: Diagnose and Repair of Electrical Faults in R & AC.

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Know Diagnosing and Repairing Electrical Faults in R&AC	1.1	Explain safety precautions to be followed when tracing and repairing electrical faults									
	1.2	Explain the procedure to follow in selecting the right size of cable for a particular Air Conditioner.									
	1.3	Describe the safety precautions to be followed when replacing a faulty relay									
	1.4	Identify a faulty capacitor									
	1.5	Perform the replacement of a faulty capacitor									
LO 2: Use Tools/ Equipment used in R&AC Electrical works	2.1	Use appropriate tools/instruments for measuring electric current and voltage.									
	2.2	Use appropriate tools/instruments for testing the relay coil.									
	2.3	Use the instrument in the continuity test of a cable.									
	2.4	Use the equipment/instrument for cable joining and termination.									
LO 3: Troubleshooting of Electrical Faults in R&AC	3.1	Repair the fault of the compressor fan not starting while the compressor unit is starting.									
	3.2	Repair the fault of the overload clicking sound and the compressor not starting									
	3.3	Repair the fault of the overload starts relay and capacitors.									
	3.4	Repair the power supply fault in the Air-conditioner unit, and cut-offs.									
LO 4: Replace Faulty Electrical Parts in	4.1	Carry out a replacement or mending of a faulty electric cord wire									

R&AC	4.2	Remove a faulty electrical part and replace it with a functioning one.									
	4.3	Repair an overload relay and/or replace it with a new functioning one.									
	4.4	Test-run the refrigerator after repairs									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

NATIONAL SKILLS QUALIFICATION

CONSTRUCTION SECTOR

LEVEL2: REFRIGERATION AND AIR-CONDITIONING

Unit 007: Troubleshoot in Refrigeration & AC

Unit Reference Number: CON/RAC/007/L2

NSQ Level: 2
Credit Value: 4
Guided Learning Hours: 40

Unit Purpose: This unit is aimed at equipping the learner with the knowledge and skills of Troubleshooting and Repairs in Refrigeration & AC

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. ***Simulation is not allowed*** in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS)or Reflective Practice (RP)
5. Work Product (WP)

UNIT 007: Troubleshoot in Refrigeration & AC

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: DEMONSTRATE SAFETY IN TROUBLESHOOTING AND REPAIRS OF DOMESTIC REFRIGERATION	1.1	Describe safety precautions involved in troubleshooting domestic refrigerators (refrigeration and air conditioning)									
	1.2	Describe safety precautions involved in repairs of domestic refrigerator									
	1.3	Apply safety precautions involved in repairs of domestic refrigerator									
LO 2: SELECT TOOLS AND EQUIPMENT FOR TROUBLESHOOTING IN DOMESTIC REFRIGERATORS.	2.1	Identify tools and equipment used in carrying out fault diagnosis in Refrigerators									
	2.2	Identify materials and tools for carrying Out repairs of faults in refrigerators									
	2.3	Compare the advantages and disadvantages of different methods of fault finding in Refrigerators									
	2.4	Illustrate the procedure of fault finding in domestic refrigerators									
LO 3: CARRY OUT POSSIBLE FAULTS DIAGNOSES IN DOMESTIC REFRIGERATORS.	3.1	Trouble-shoot for electrical fault in Refrigerator									
	3.2	Trouble-shoot for mechanical fault in Refrigerator									
	3.3	Trouble-shoot for leakages in Refrigerator									
	3.4	Identify causes of faults associated with Domestic refrigerator									
LO 4: REPAIR OF ELECTRICAL FAULTS.	4.1	Carry out repairs on overload									
	4.2	Carry out repairs on the faulty relay									
	4.3	Carry out repairs on faulty									

		electric cord									
	4.4	Carryout repairs on faulty capacitor									
LO 5: KNOW THE PROCESS OF REPAIRS OF COMPRESSOR FAULTS	5.1	Rectify compressor Noise									
	5.2	Carry out repairs on low pumping of Compressor									
	5.3	Carryout repairs on short-circuit fault In compressor									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

NATIONAL SKILLS QUALIFICATION
CONSTRUCTION SECTOR

LEVEL2: REFRIGERATION AND AIR-CONDITIONING
Unit 008: Carry out Oxy-Acetylene Welding in Refrigeration and Air-conditioning

Unit Reference Number: CON/RAC/008/L2
NSQ Level: 2
Credit Value: 3
Guided Learning: 30Hours:

Unit Purpose: This unit is designed to equip learners with the knowledge and skills of Oxy-Acetylene Welding in R & AC

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. ***Simulation is not allowed*** in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Work Product (WP)
6. Assignment (ASS)

UNIT 008: Carry out Oxy-Acetylene Welding in Refrigeration and Air-conditioning

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: UNDERSTAND SAFETY IN OXY-ACETYLENE WELDING OPERATIONS.	1.1	Describe safety precautions involved in the movement and application of oxy-acetylene materials, e.g. hose, and Gauges									
	1.2	Explain the safety precautions involved in the storage and application of acetylene Cylinder.									
	1.3	Identify hoses, and pressure gauges used with oxygen and acetylene lines									
LO 2: KNOW THE MATERIALS USED IN OXY-ACETYLENE WELDING OPERATIONS.	2.1	Explain safety measures in gas mixing and Lighting of acetylene welding process									
	2.2	Distinguish between oxygen and Acetylene cylinders									
	2.3	Identify various parts and functions of nozzles.									
LO 3: CARRY OUT OXY-ACETYLENE WELDING OPERATIONS	3.1	Perform the process of releasing Acetylene from cylinder									
	3.2	Perform the process of mixing acetylene With oxygen before the welding operation									
	3.3	Apply the correct flame for welding Operation									
	3.4	Perform the welding operation.									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

National Skills Qualification
CONSTRUCTION SECTOR
LEVEL2: REFRIGERATION AND AIR-CONDITIONING

Unit 009: Install and Maintain Domestic air conditioner

Unit Reference Number: CON/RAC/009/L2 NVQ Level: 2
Credit Value: 6
Guided Learning Hours: 60hrs

Unit Purpose: This unit is designed to equip learner with the knowledge and skills of Installation and Maintenance of Domestic Air-conditioner

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment where learning and human development are carried out. ***Simulation is not allowed*** in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Work Product (WP)
6. Assignment (ASS)

UNIT 007: Install and Maintain Domestic Air-conditioners

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: UNDERSTAND SAFETY IN THE INSTALLATION OF A DOMESTIC AIR-CONDITIONING UNIT	1.1	Explain the safety precautions involved in the installation of the indoor unit (Evaporator) of a domestic Air-conditioner.									
	1.2	Explain the safety precautions involved in installation of the outdoor unit (Condenser/ compressor) of the domestic Air-conditioner									
	1.3	Describe the use of personal protective equipment during the installation of a domestic split air conditioning unit.									
LO 2: KNOW TOOLS AND EQUIPMENT USED IN THE INSTALLATION OF A DOMESTIC AIR-CONDITIONING UNIT.	2.1	List tools and equipment used in the installation of domestic air-conditioning Unit									
	2.2	Describe specific functions of the tools used in the installation of domestic air--Conditioning unit									
	2.3	Select appropriate tools and equipment for installation.									
LO 3: KNOW TOOLS AND EQUIPMENT USED IN THE MAINTENANCE OF A DOMESTIC AIR-CONDITIONING UNIT	3.1	Identify tools and equipment used in the maintenance of domestic air-Conditioning unit.									
	3.2	Describe specific functions of the tools used in the maintenance of domestic air-conditioning units.									
	3.3	Select appropriate tools and equipment for maintenance.									
LO 4: KNOW METHODS OF MAINTENANCE OF DOMESTIC SPLIT	4.1	Describe methods employed in the maintenance of the outdoor section of the split air-conditioning unit.									

AIR- CONDITIONING UNIT.	4.2	Describe methods employed in Maintenance of the indoor section of the split air-conditioning unit									
	4.3	Carry out maintenance using appropriate tools.									
LO 5: KNOW THE PROCESS OF DRILLING HOLE FOR THE INSTALLATION OF DOMESTIC AC	5.1	Select tools for drilling holes in the wall of the building before installation of air-conditioning unit									
	5.2	Describe safety measures observed in drilling the hole for the air-conditioning unit Installation									
	5.3	Carry out the drilling of holes for the installation of air-conditioning units									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

NATIONAL SKILLS QUALIFICATION

REFRIGERATION AND AIR - CONDITIONING

LEVEL 3

FEBRUARY, 2025

GENERAL INFORMATION

QUALIFICATION PURPOSE: This Qualification is designed to train learner to be competent in installing, maintaining, and repairing Refrigerator and Air-conditioning (R&AC) systems.

QUALIFICATION OBJECTIVES: At the end of Level 3, learners should be able to:

1. Apply occupational health, safety, and environmental protection in R&AC.
2. Demonstrate complex communication skills and technical documentation.
3. Exhibit leadership skills in team management and supervision.
4. Disassemble and assemble various air-conditioning systems, ensuring compliance with standards.
5. Conduct compressor lubrication, oil charging, and testing.
6. Manage Refrigerants in line with environmental safety
7. Troubleshoot and repair electrical and electronic control systems in R&AC equipment.
8. Interpret and implement circuit diagrams for refrigeration systems.
9. Fabricate sheet metal works for refrigeration unit installations.
10. Construct and maintain cold room refrigeration systems for industrial applications.

National Skills Qualification (NSQ) Table

CONSTRUCTION SECTOR

LEVEL 3- REFRIGERATION AND AIR-CONDITIONING (INSTALLATION AND MAINTENANCE REPAIRS)

MANDATORY UNITS

Unit	Unit Reference Number	Unit Title	Credit Value	Guided Learning Hours
1	CON/RAC/001/3	Apply occupational health, safety, and environmental protection in R&AC.	3	30
2	CON/RAC/002/3	Demonstrate complex communication skills and technical documentation.	2	20
3	CON/RAC/003/3	Exhibit leadership skills in team management and supervision.	2	20
4	CON/RAC/004/3	Disassemble and assemble various air-conditioning systems, ensuring compliance with standard	3	30
5	CON/RAC/005/3	Conduct compressor lubrication, oil charging, and testing.	3	30
6	CON/RAC/006/3	Manage Refrigerants in line with environmental safety	3	30
7	CON/RAC/007/3	Troubleshoot and repair electrical and electronic control systems in R&AC equipment.	4	40
8	CON/RAC/008/3	Interpret and implement circuit diagrams for refrigeration systems.	5	50
9	CON/RAC/009/3	Fabricate sheet metal works for refrigeration unit installations.	4	40
10	CON/RAC/010/3	Construct and maintain cold room refrigeration systems for industrial applications.	6	60
	TOTAL		35	350

GENERAL GUIDE

Unit title	Provides a clear explanation of the content of the unit.
Unit number	The unique number assigned to the unit.
Unit reference	The unique reference number given to each unit at qualification approval by NBTE.
Unit Level	Denotes the level of the unit within the National Vocational Qualification framework NSQF.
Unit credit value	The value that has been given to the unit is based on the expected learning time for an average learner. 1 credit = 10 learning hours
Unit aim	Provides a brief outline of the unit content.
Learning outcome	A statement of what a learner will know, understand or be able to do, as a result of a process of learning.
Assessment criteria	A description of the requirements a learner must achieve to demonstrate that a learning outcome has been met.
Unit assessment guidance	Any additional guidance provided to support the assessment of the unit.
Unit-guided learning hours	The average number of hours of supervised or directed study time or assessment required to achieve a qualification or unit of a qualification.

Unit 001: Apply occupational health, safety, and environmental protection in R&AC.

Unit Reference Number: CON/RAC/001/3
NSQ Level: 3
Credit Value: 3
Guided Learning Hours: 30

Unit Purpose:
This unit specifies the competencies required to demonstrate understanding of safe work practices. It involves learning about workplace safety, the correct use of signs, symbols, identifying and reducing risks of hazards in the work environment.

Unit assessment requirements/ evidence requirement:

Assessment must be carried out in a real workplace environment in which learning and human development are carried out.

Assessment methods to be used include:

1. Direct Observation (DO).
2. Written/Oral Question and Answer (QA).
3. Personal Statement
4. Work Product (WP)
5. Professional Discussion (PD)
6. Assignment

Unit 001: Apply occupational health, safety, and environmental protection in R&AC.

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: ***Demonstrate safe working Practices and Instructions***	1.1	Describe safe work practices and instructions.									
	1.2	Recognize safety signs and symbols.									
	1.3	Interpret safety signs and symbols correctly.									
	1.4	Observe safe work practices on given tasks.									
	1.5	Work following health and safety best practices.									
LO 2: ***Understand Safety, Hazards and risks in the workplace***	2.1	State types of hazards in the work environment.									
	2.2	Describe ways to avoid common hazards in the workplace									
	2.3	State methods in reducing the risk of hazards in the workplace.									
	2.4	Describe how to report potential hazards in the workplace									
LO 3: ***Know appropriate actions to take during accident/injuries***	3.1	Identify basic first aid equipment.									
	3.2	Explain the benefits of first aid equipment									
	3.3	State types of injuries commonly found in the workplace.									
	3.4	Identify serious injuries that require emergency response in the workplace.									
	3.5	State the steps to be taken following an accident									
	3.6	Identify own responsibilities in case of an emergency such as: • Identifying and switching off power supply sources • Carrying out artificial resuscitation methods • Calling for medical attention • Transferring the patient to the nearest medical facility									
	3.7	Identifying muster point									
	3.8	Identify locations of fire extinguishers in case of fire									

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
		outbreak									
	3.9	Describe methods of firefighting									
	3.10	Describe the Pull Aim Squeeze and Sweep (PASS) of fire extinguishers									
	3.11	Describe how to treat minor injuries and burns									
LO 4: Demonstrate safe work practices and a clean work environment	4.1	Identify safe access and exit routes in the work environment									
	4.2	Describe safe work practices and a clean work environment									
	4.3	Dispose of all wastes appropriately in designated waste facilities									
	4.4	State the advantages of using appropriate PPE while carrying out a task in the work environment									
	4.5	Select appropriate working tools for a given task to avoid hazard									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

Unit 002: Demonstrate complex communication skills and technical documentation.
Unit Reference Number: CON/RAC/002/3
NSQ Level: 3
Credit Value: 2
Guided Learning Hours: 20

Unit Purpose:

This unit specifies the competencies required to demonstrate good communication and interpersonal skills in the work environment.

Unit assessment requirements/ evidence requirements:

Assessment must be carried out in a real workplace environment in which learning and human development are carried out.

Assessment methods to be used include:

1. Direct Observation (DO).
2. Written/Oral Question and Answer (QA).
3. Personal Statement
4. Work Product (WP)
5. Professional Discussion (PD)
6. Assignment

Unit 002: Demonstrate complex communication skills and technical documentation.

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: ***Demonstrate good communication skills***	1.1	State reasons why good communication skills are important in Refrigeration and Air-Conditioning systems work environment									
	1.2	List ways to communicate effectively: • Upward • Downward • Horizontal									
	1.3	Explain the significance of patience and a mild demeanour while communicating with colleagues and clients									
	1.4	Describe how to communicate professionally.									
	1.5	State the need for respectful body language even when in a bad mood or while under pressure.									
LO 2: ***Demonstrate ability to follow documented instructions***	2.1	Read and accurately follow steps in installation manuals.									
	2.2	Explain mobile app documentation.									
	2.3	Read the information displayed on various Refrigeration and Air-Conditioning systems.									
LO 3: ***Demonstrate the ability to document information after commissioning of*** **Refrigeration and Air-Conditioning systems**	3.1	Determine information to be documented									
	3.2	Describe the scope of information needed to be documented.									
	3.3	Explain the importance of the documented information.									
	3.4	Document appropriate information accordingly									
	3.5	Report documented information to the appropriate authority									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

Unit 003: Exhibit leadership skills in team management and supervision.
Unit Reference Number: CON/RAC/003/3
NSQ Level: 3
Credit Value: 2
Guided Learning Hours: 20

Unit Purpose:
This unit is aimed to provide the learner, with the knowledge and skills required to develop team spirit and positive working relationships with fellow workers in the work environment.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment where learning and human development are carried out. **Simulation is not allowed** in this unit and level.

Assessment methods to be used include:

1. Direct Observation (DO).
2. Written/Oral Question and Answer (QA).
3. Personal Statement
4. Work Product (WP)
5. Professional Discussion (PD)
6. Assignment

Unit 003: Exhibit leadership skills in team management and supervision.

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: ***Develop Positive working relationships with colleagues in the work environment***	1.1	Explain the need for developing positive working relationships with colleagues in the work environment.									
	1.2	Explain the importance of relating with others in a way that makes them feel valued and respected.									
	1.3	Support team members when one's services are requested.									
	1.4	Report to the authorized personnel when the request is made for assistance falling outside one's area of responsibility.									
	1.5	Communicate information to colleagues about own work that might affect the performance of others									
	1.6	Supervise the team to ensure the roles and responsibilities of the team members are appropriate									
LO 2: ***Take responsibilities within the team***	2.1	Explain your role and responsibilities within the team for group work.									
	2.2	Carry out individual tasks in a given group assignment in line with the team's rules and regulations.									
	2.3	Participate actively in a given teamwork.									
	2.4	Give own report of a task carried out in a team.									
	2.5	Instruct team members and ensure compliance									
LO 3: ***Comply with the policies and regulations of the organization***	3.1	Carry out assigned tasks in a team in line with organizational standards									
	3.2	Use organizational code of practice for assigned jobs done in the team.									

LEARNING OBJECTIVE (LO) **The learner will:**		**PERFORMANCE CRITERIA** **The learner can:**	**Evidence Type**					**Evidence Ref. Page No.**			
	3.3	Obtain organizational code of conduct for own and team jobs.									
	3.4	Explain the importance of using organizational code of conduct for own and team jobs									
	3.5	List rules that guide the activities of the team									
	3.6	Report activities of the teamwork that may affect the organizational code of conduct to the higher authority.									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

Unit 004: Disassemble and Assemble Air –conditioning systems.
Unit Reference Number: CON/RAC/004/3
NSQ Level: 3
Credit Value: 3
Guided Learning Hours: 30

Unit Purpose:

This unit is aimed to provide the learner, with the knowledge and skills required to dissemble and assemble an air-conditioning system.

Unit assessment requirements/evidence requirements:

Assessment must be carried out in a real workplace environment where learning and human development are carried out. **Simulation is not allowed** in this unit and level.

Assessment methods to be used include:

1. Direct observation (DO)
2. Written/Oral Question and Answer (QA).
3. Personal Statement
4. Work Product (WP)
5. Professional Discussion (PD)
6. Assignment

UNIT 004: Disassemble and Assemble Air Conditioning System

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO1: ***UNDERSTAND DISMANTLING AN AIR-CONDITIONING UNIT***	1.1	Identify tools and equipment for dismantling operation									
	1.2	Demonstrate the procedure for the dismantling of the Air-conditioning system									
	1.3	Describe the safety measures to take while dismantling the Air-conditioner									
	1.4	Discuss how to recycle refrigerant properly.									
	1.5	Discuss how to service the different parts of the Air-conditioner after dismantling									
LO2: ***KNOW PARTIAL DISMANTLING OF AN AIR-CONDITIONING SYSTEM***	2.1	Explain partial dismantling									
	2.2	Identify the reason for the partial dismantling of the Air-conditioning system.									
	2.3	Identify the components to be dismantled for partial dismantling in air –conditioning system.									
LO3: ***KNOW ASSEMBLING OF AN AIR – CONDITIONING SYSTEM***	3.1	Explain safety precautions associated with assembling of air- conditioning system									
	3.2	Assemble four major components of Air-conditioning system i.e compressor, condenser, expansion valve, and evaporator									
	3.3	Describe the Steps to follow for assembling an air conditioning									
	3.4	Verify the wiring connection of the assembled air conditioning									
	3.6	Explain the laid down procedures to safeguard self, others and the environment.									
LO4: ***CARRY OUT POST-ASSEMBLING TESTS IN REFRIGERATION AND AIR-CONDITIONING***	4.1	Check for leaks in all pipe connection									
	4.2	Test – run the assembled components									
	4.3	Confirm if there are leakages									
	44	Inspect the operational condition and record findings									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

Unit 005: Carry out Compressor Lubrication Oil Charging and Testing.
Unit Reference Number: CON/RAC/005/3
NSQ Level: 3
Credit Value: 3
Guided Learning Hours: 30

Unit Purpose:

This unit is aimed to provide the learners, knowledge and skills required for Compressor Lubrication Oil Charging and Testing of air-conditioning systems.

Unit assessment requirements/evidence requirements:

Assessment must be carried out in a real workplace environment in which learning and human development are carried out. **Simulation is not allowed** in this unit and level.

Assessment methods to be used include:

1. Direct observation (DO)
2. Written/Oral Question and Answer (QA).
3. Personal Statement
4. Work Product (WP)
5. Professional Discussion (PD)
6. Assignment

UNIT 005: Carry out Compressor Lubrication Oil Charging and Testing

LEARNING OBJECTIVE (LO) **The learner will:**		**PERFORMANCE CRITERIA** **The learner can:**	**Evidence Type**					**Evidence Ref. Page No.**			
LO1: ***Demonstrate knowledge of refrigeration oil charging***	1.1	Explain the safety precautions involved in charging lubrication oil in the refrigeration system									
	1.2	Apply techniques in charging oil lubricant in refrigeration									
	1.3	Identify the instruments used for charging lubrication oil in refrigeration									
	1.4	Charge compressor lubrication oil									
LO2: ***Understand the types of refrigeration compressor oil***	2.1	Explain the types of lubrication oil in refrigeration system									
	2.2	Explain the splash method of lubrication oil in refrigeration									
	2.3	Explain the force feed method of lubrication oil in refrigeration									
	2.4	Identify factors to be considered when selecting lubrication oil									
LO3: ***Understand the knowledge of general properties of refrigeration lubrication oil***	3.1	Explain the general concept of refrigeration lubrication oil									
	3.2	Identify the physical properties of lubrication oil									
	3.3	Explain the chemical properties of lubrication oil									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

Unit 006: Manage Refrigerants in line with environmental safety.
Unit Reference Number: CON/RAC/006/3
NSQ Level: 3
Credit Value: 3
Guided Learning Hours: 30

Unit Purpose:

This unit is aimed to provide the learner, with the necessary knowledge and skills required to use and manage refrigerants in line with environmental safety.

Unit assessment requirements/evidence requirements:

Assessment must be carried out in a real workplace environment in which learning and human development are carried out. **Simulation is not allowed** in this unit and level.

Assessment methods to be used include:

1. Direct observation (DO)
2. Written/Oral Question and Answer (QA).
3. Personal Statement
4. Work Product (WP)
5. Professional Discussion (PD)
6. Assignment

UNIT 006: Manage Refrigerants in line with environmental safety

LEARNING OBJECTIVE (LO) **The learner will:**		**PERFORMANCE CRITERIA** **The learner can:**	**Evidence Type**					**Evidence Ref. Page No.**			
LO1: ***KNOW REFRIGERANTS, TYPES AND PROPERTIES***	1.1	Explain Refrigerants									
	1.2	Explain the properties of refrigerants									
	1.3	Explain the types of refrigerants									
	1.4	Explain the method of charging refrigerants									
	1.5	Carry out charging of refrigerants									
LO2: ***IDENTIFY REFRIGERANT EFFECT ON ENVIRONMENT***	2.1	Explain the Ozone layer									
	2.2	Explain the Ozone layer depletion potential									
	2.3	Explain the Ozone layer depletion									
	2.4	Explain the global warming potential									
	2.5	Explain the effects of refrigerants on Ozone layer depletion									
LO3: ***UNDERSTAND RECOVERY, RECYCLE AND RECLAIM OF REFRIGERANTS***	3.1	Explain the terms: • Recover • Recycle • And reclaim									
	3.2	Illustrate recovery procedures with a recovery machine									
	3.3	Carry out recovery work									
	3.4	Carry out recycle									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

Unit 007: Understand Electrical/Electronic Control Devices used in Refrigeration and Air Conditioning Work.
Unit Reference Number: CON/RAC/007/3
NSQ Level: 3
Credit Value: 4
Guided Learning Hours: 40

Unit Purpose:

This unit is aimed to provide the learner, the necessary knowledge and skills required for Electrical/Electronic Control Devices used in Refrigeration and Air conditioning Works.

Unit assessment requirements/evidence requirements:

Assessment must be carried out in real workplace environment in which learning and human development are carried out. **Simulation is not allowed** in this unit and level.

Assessment methods to be used include:

1. Direct observation (DO)
2. Written/Oral Question and Answer (QA).
3. Personal Statement
4. Work Product (WP)
5. Professional Discussion (PD)
6. Assignment

UNIT 007: Understand Electrical/Electronic Control Devices used in Refrigeration and Air conditioning Work.

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO1: ***HANDLE ELECTRICAL/ELECTRONICS CONTROL DEVICES, IN RAC WORK***	1.1	State the functions of the Electrical/Electronic control device									
	1.2	Differentiate between electrical devices and electronic control									
	1.3	Follow the safety precautions and manufacturer guide to repair or replace faulty components									
	1.4	Explain the steps to be followed in the installation and maintenance of electrical control devices in RAC systems									
LO2: ***KNOW SERVICING OF REFRIGERATION AND AIR-CONDITIONING SYSTEMS***	2.1	Ensure cleanliness of the entire electrical components of the refrigeration equipment.									
	2.2	Check the debris buildup on the entire electrical components.									
	2.3	Check the following electrical components: contactors, thermostat, coils, motor etc.									
	2.4	Ensure that the fan control is operating correctly.									
LO3: ***IDENTIFY ELECTRONIC DEVICES/COMPONENTS USED IN AIR CONDITIONING EQUIPMENT***	3.1	Explain electronics control devices in refrigeration and air conditioning									
	3.2	Identify microcontrollers in air conditioning equipment									
	3.3	Describe the following devices: temperature sensors and pressure sensors									
	3.4	Identify the function of humidity sensors in refrigeration and air conditioning									
O4: ***REPAIR ELECTRICAL COMPONENTS IN REFRIGERATION AND AIR CONDITIONING***	4.1	Carry out the installation of the thermostat									
	4.2	Carry out replacement of voltage transformer									
	4.3	Explain the function of the following devices: timer and counters									
	4.4	Carry out the replacement of the current transformer									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

Unit 008: Interpret circuit diagrams for refrigeration systems.
Unit Reference Number: CON/RAC/008/3
NSQ Level: 3
Credit Value: 5
Guided Learning Hours: 50

Unit Purpose:

This unit is aimed to provide the learner, the necessary knowledge and skills required to read circuit diagrams in refrigeration and air conditioning systems.

Unit assessment requirements/evidence requirements:

Assessment must be carried out in real workplace environment in which learning and human development is carried out. **Simulation is not allowed** in this unit and level.

Assessment methods to be used include:

1. Direct observation (DO)
2. Written/Oral Question and Answer (QA).
3. Personal Statement
4. Work Product (WP)
5. Professional Discussion (PD)
6. Assignment

UNIT 008: Interpret circuit diagrams for refrigeration systems.

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO1: ***IDENTIFY COMMON CIRCUIT DIAGRAMS IN REFRIGERATION AND AIR-CONDITIONING SYSTEM***	1.1	Explain the importance of circuit diagrams in refrigeration and air conditioning system									
	1.2	Understand symbols and conventions used in the circuit diagram									
	1.3	Outline types of circuit diagrams in refrigeration and air conditioning system									
	1.4	Interpret the circuit diagram of the refrigeration system									
LO2: ***KNOW EACH COMPONENT IN THE CIRCUIT DIAGRAM OF REFRIGERATION***	2.1	Explain the circuit diagram of a compressor									
	2.2	Explain the entire electrical circuit of a refrigerator									
	2.3	Describe the entire electrical circuit of an air conditioning									
	2.4	Describe the exploded circuit diagram of a thermostat									
	2.5	State the reason why a circuit diagram is important in refrigeration and air-conditioning									
LO3: ***APPLY CIRCUIT READING AND OBSERVATION***	3.1	Read the complete circuit of an air conditioning									
	3.2	Read the complete exploded diagram of the refrigerator									
	3.3	Interpret wiring and piping schematics for the refrigeration unit									
LO4: ***READ CIRCUIT DIAGRAM***	4.2	Identify signs a labeling on the circuit diagrams									
	4.2	Explain the circuit diagram and description									
	4.3	Describe procedures for understanding compressor capacity									
	4.4	Use circuit diagram to diagnose system malfunction									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

Unit 09: Fabricate sheet metal works for refrigeration unit installations.

Unit Reference Number: CON/RAC/009/L3
NSQ Level: 3
Credit Value: 4
Guided Learning Hours: 40hrs

Unit Purpose: This unit is to equip the learner with the knowledge and skills of fabrication of Sheet Metal Work in refrigeration and air conditioning systems.

Unit assessment requirements/evidence requirements:
Assessment must be carried out in a real workplace environment in which learning and human development are carried out. *Simulation is not allowed* in this unit and level.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Personal statement (PS) or Reflective Practice (RP)
5. Work Product (WP)
6. Assignment (ASS)

UNIT 09: Fabricate sheet metal works for refrigeration unit installations.

LEARNING OBJECTIVE(LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.				
LO 1: Carryout marking out in Sheet Metalwork	1.1	Identify types of measuring tools.										
	1.2	Identify types of marking-out tools.										
	1.3	Describe the procedure followed in Measurement and marking out										
	1.4	Select appropriate measuring tools										
	1.5	Carry out measurements and mark out of sheet metal										
LO 2: Demonstrate basic folding operation of sheet metals.	2.1	Identify tools and equipment for folding Operations of sheet metals										
	2.2	Apply safety precautions associated with Folding of sheet metals										
	2.3	Describe the procedure followed in folding sheet metals										
	2.4	Carryout folding of sheet metal										
LO 3: Carryout basic setting/ holding of sheet metal together with the pipe	3.1	Identify tools used in the cutting of sheet Metals										
	3.2	Apply safety precautions associated with setting/holding sheet metal together with pipe										
	3.3	Describe the procedure of riveting										
	3.4	Describe the procedure of cutting and holding										
	3.5	Cut material										
	3.6	Carryout holding of sheet metal with pipe										
LO 4: Understand the materials used in the fabrication of the body framework	5.1	Identify types of materials used for External body framework of refrigerator										
	5.2	List types of materials used as Insulator in refrigerator										
	5.3	Describe the types of materials used for Internal body framework of a refrigerator										

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled)	Date:
EQA Signature (if sampled)	Date:

Unit 010: Construct and maintain cold room

Unit Reference Number: CON/RAC/010/3
NSQ Level: 3
Credit Value: 6
Guided Learning Hours: 60

Unit Purpose:

This unit is aimed to provide the learner with the necessary knowledge and skills required for the construction of a cold room.

Unit assessment requirements/evidence requirements:

Assessment must be carried out in a real workplace environment where learning and human development are carried out. **Simulation is not allowed** in this unit and level.

Assessment methods to be used include:

1. Direct observation (DO)
2. Written/Oral Question and Answer (QA).
3. Personal Statement
4. Work Product (WP)
5. Professional Discussion (PD)
6. Assignment

UNIT 009: Construct and maintain cold room

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO1: ***KNOW COLD ROOM AND COLD STORAGE***	1.1	Explain the functions and importance of cold rooms in the refrigeration industry									
	1.2	State the key features of a cold room									
	1.3	Explain the major components of cold room									
LO2: ***KNOW THE PROCEDURES TO FOLLOW FOR THE CONSTRUCTION OF THE COLD ROOM AND COLD STORAGE***	2.1	Explain the difference between a cold room and cold storage									
	2.2	Identify various component of the cold room and their function									
	2.3	Explain how the construction of the cold room differs from the ordinary refrigeration system									
	2.4	State the step-by-step procedure for the construction of the cold room									
LO3: ***CARRYOUT CONSTRUCTION OF A COLD-ROOM***	3.1	Discuss the methods of building a cold room									
	3.2	Install evaporating unit									
	3.3	Install condensing unit									
	3.4	Install compressing unit									
	3.5	Construct a cold room									

Learners Signature:	Date:
Assessors Signature:	Date:
IQA Signature (if sampled):	Date:
EQA Signature (if sampled):	Date:

NOS DEVELOPMENT TEAM			
S/N	**NAME**	**ADDRESS**	**E-MAIL**
1.	Mal Muazu Musa Kallah QAA.		
2.	Dr. Musa Isa Matara IQAM		
3.	Rabiu Abubakar , R-COREN		

NOS CRITIQUE TEAM			
S/N	**NAME**	**ADDRESS**	**E-MAIL**
1.	Mal Muazu Musa Kallah QAA.		
2.	Dr. Musa Isa Matara IQAM		
3.	Rabiu Abubakar , R-COREN		

NOS VALIDATION 1 TEAM			
S/N	**NAME**	**ADDRESS**	**E-MAIL**
1.	Engr. Jaafar Garba	NBTE	jaafargarba2@gmail.com
2.	Nwankwo Tochukwu C.	NABTEB, EBONYI	tochmann1960@gmail.com
3.	Idris Shuaibu	DANMANI, KADUNA	ishuaibu163@gmail.com

NOS VALIDATION 2 TEAM			
S/N	**NAME**	**ADDRESS**	**E-MAIL**
1.	Engr. Salisu Lawan	NBTE, KADUNA	salisulataura@gmail.com
2.	Engr. Abdussalam Mamoon	Kaduna Polytechnic	abdmamoon2056@gmail.com

National Skills Qualifications

FOR

REFRIGERATION AIR-CONDITIONING

LEVEL 1, 2 & 3

Plot B, Bida Road, PMB 2239,Kaduna
ideasworldbankproject@nbte.gov.ng
Tel: +234 (0) 802 4728 042