SECTION A							
QUALIFICATION DEVELOPER	**GABORONE UNIVERSITY COLLEGE OF LAW AND PROFESSIONAL STUDIES**						
TITLE	**CERTIFICATE V IN REFRIDGERATION AND AIR CONDITIONING**				**NCQF LEVEL**	**5**	
FIELD	**MANUFACTURING, ENGINEERING AND TECHNOLOGY**		**SUB-FIELD**		**MAINTENANCE**		
New qualification	✓		Review of existing qualification				
SUB-FRAMEWORK	General Education		TVET	✓	Higher Education		
QUALIFICATION TYPE	Certificate	✓	Diploma		Bachelor		
	Bachelor Honours		Master		Doctor		
CREDIT VALUE					**144**		

RATIONALE AND PURPOSE OF THE QUALIFICATION

In the year 2015 the by then The Ministry of Education and Skills Development launched a project dubbed Target 20 000. The project, which is part of the education ministry's five-year strategy, would help equip youth at tertiary institutions with industry skills. The ministry's mandate is to upscale unemployed youth not only on a regional level but also to allow them to compete on a global scale especially with the world shifting away from soft skills qualifications to more practical technical skill based courses. Speaking at the IPS&P conference in Gaborone back in the year 2015, Dr Unity Dow the then Minister of Education and Skills Development urged tertiary institutions with accredited programs in the areas of tourism, agriculture, construction, land servicing and emerging technologies to assist in achieving this project.

"Strengthening partnerships with local private and public tertiary institutions is the only way of ensuring that every one of our youths is skilled and positioned to play their role in this process," But regionally Botswana is still yet to establish itself as a global innovation hub in different facets of technology ranging from information technology to engineering, but beyond that the country is shifting its reliance from natural resources based economy to a more diverse conundrum. So in order to elevate this project the Gaborone

Universal College of Law and Professional Studies has embarked on a journey to answer to this need by offering a certificate in Refrigeration And Air-conditioning. As per the project's name, the ministry has targeted 20 000 students at these institutions. She said the youth released from schools into the market should possess the kind of thinking and technical skills that industries and government needed to transform the economy. The private sector through several forums through Botswana Institute of Engineers has always alluded to the fact that a large portion of the workforce in engineering from certificate to degree graduates. The outcry is that both private and public tertiary institutions have too many theory based technical personnel whether at certificate, diploma or degree level but cannot use their own hands skills to work. To address this Gaborone University College of Law And Professional studies in collaboration with Creso University from Zambia have introduced a certificate in Refrigeration and Air-conditioning. This course equips students with the knowledge and skills required for a career in refrigeration and air conditioning and its applications. When combined with enough on-the-job experience, the course can lead to you becoming a qualified refrigeration and air conditioning mechanic.

As a licensed refrigeration and air conditioning mechanic, you will assemble, install and repair industrial, commercial and domestic air conditioning and refrigeration systems. This could range from installing ducted air-conditioning in a family home to maintaining large walk-in refrigeration units for businesses needing mass food storage. This is a growing area of employment and job opportunities are expected to be very high over the next five years. Programs leading to this qualification tend to have a strong professional or career focus and holders of this qualification are normally prepared to enter a specific niche in the labor market. Furthermore the National Development plan 11 of Botswana and Vision 2016 mandate has aspirations of prosperity for all Batswana, Educated and Informed Nation is also seen as an important foundation and basis for enhancement of national productivity, innovation and competitiveness.

"An educated and informed nation readily adapts to the changing needs of its economy. The growth of the economy requires a focus on development of human resources and full utilization of their capacity in the nation building process. The private sectors, such as agriculture, tourism and services, are expected to become more active drivers of economic growth. "- NDP 11 2009 Carter. To address this, a survey conducted by the College and it demonstrated the need of technical cadres in the technology and industry field. Furthermore, the government has suffered enormous losses in terms of loss/delay of use of facilities and financial due to cost overruns. This has a direct linked to the quality and adequacy of supervision of

construction works. The addition of these cadres into the construction market will be a welcome development to the government.

In order to come up with the diploma programme, the College conducted a survey on the need of such cadre in the construction/environmental sphere. The survey involved staff from the following institutions:

- Consultancy
- Contracting
- Academic institutions
- Government (Department of Water Affairs; Water Utilities; Ministry of Local government and rural development; Ministry of Infrastructure, Science and Technology.

The above agreed that there is need to supplement the existing stock of technicians with a new batch of technicians who are more focused on the environment. This qualification provides the competencies to determine heat loads and select equipment for basic commercial refrigeration or residential air-conditioning applications. It includes regulatory requirements for purchasing and handling refrigerants.

PURPOSE

Graduates in possession of this qualification will be able to:

- Design, install and operation refrigeration and air-conditioning systems
- Test, repair and maintain system components

ENTRY REQUIREMENTS (including access and inclusion)

Junior certificate BGCSE school leavers seeking vocational skills refrigeration and air conditioning. Workers in the mechanical engineering sector who wish to enhance their refrigeration and air conditioning. Whilst there are no specific entry requirements for this qualification you will need to undergo an interview and assessment prior to acceptance on the course.

QUALIFICATION SPECIFICATION: SECTION B	
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
• Apply basic skills and knowledge on the use of computers and computer applications.	• Recognize logical and physical organization of a general-purpose computer. • Apply different word processing techniques such as creating, editing saving and retrieving a document. • Add special features to a document, working with blocks, indenting and aligning text • Draw up spread sheets commands to deduce formulas and other mathematical techniques • Use and maintain a personal computer's database and storage facilities. • Demonstrate knowledge and understanding of communication technology.
• Apply the operational principles, services, care, maintenance of heat exchangers and the technicalities of selecting common types used in refrigeration and air-conditioning	• Apply safety precautions involved in working with heat. • Heat engine with refrigeration or air conditioning plant. • Interpret data books and charts for applicable information in heat exchangers • Construct simple evaporator and condenser and practice fin-tube combinations. • Thorough knowledge in first aid application in air conditioning workshop accidents. • Demonstrate understating of the importance of air-conditioning in industrial and comfort applications • Assess a psychometric chart to determine the following: relative humidity, dew point temperature, humidity ratio, enthalpy per unit mass and specific volume • Describe fully the air cycle process • Adopt the importance of insulation in refrigeration and air-conditioning

	• Use various types of pipes used in refrigeration and air-condition e.g. Copper, aluminum and steel • Interpret installation drawing of pipes and ducts for air-conditioning and refrigeration work. • Operate precautionary measures to be taken while installing pipe and ducts.
• Inspect, use compressors, and assess the performance and capacity of reciprocating compressors.	• Demonstrate knowledge and understanding of the various types of compressors e.g. Hermetic, semi- hermetic and open types • Assemble and operate basic compressors • Assess the performance and capacity of reciprocating compressors. • Service simple compressor valves • Adopt methods of adjusting the safety devices of compressors • Demonstrate understanding of safety measures in using compressors • Care and maintain complex compressors.
• Apply appropriate workshop processes, techniques and tools to mark out and form projects in sheet metal work	• Apply workshop processes, techniques and tools to mark out, and form projects in • Apply the solders used for sheet metal projects • Produce finished metal projects. • Beat and forge metal sheets to desired shape. • Produce templates for the production of projects using a variety of materials from timber to metal sheets.
• Use the techniques and applications of air conditioning in automobiles	• Demonstrate understanding of working principles of a car air-conditioning system and the components of the system • Diagnose and rectify faults in car air-conditioning • Install and connect the components –compressor, condenser, receiver and evaporator • Carry out routine service chart for use in the service of air conditioning and refrigeration systems

• Apply the principles of basic (vapour) refrigeration cycle, identify actual refrigeration cycle and perform refrigeration maintenance and services procedure.	• Demonstrate knowledge of the basic components of a vapor compression refrigeration system and their functions • Use of steam tables in solving various refrigeration problems. • Carry out common maintenance/repair activities • Convert from one temperature scale to another using the appropriate relationships and formulae • Read pressure from a manometer using the formula: absolute pressure = gauge pressure + atmospheric pressure. • Demonstrate the inter-convertibility of units of mass • Care of the instruments for mass • Demonstrate understanding of principles of an absorption system • Diagnose faults within the absorption system by checking for leakage, control valve operation, condenser and evaporator performance • Use coal in heating generator for intermittent adsorption system
• Weld and cut all components of a refrigeration system using gas welding.	• Adopt all general safety precautions related to gas welding • Demonstrate understanding of gas welding processes /operations including the oxy-fuel gas cutting processes • Weld Together Basic Types Of Non-Ferrous And Ferrous Metal • Build up worn metallic shafts or surfaces • Test such as bend test, macro/micro examination, sulphur prints, mick and tee fillet test. • Rectify welded joints defects
• Acquire knowledge in the latest technology for adapting old equipment to new refrigerants.	• Recover, recycle and reclaim (RRR) as it affects refrigerants from dead refrigeration plants. • Apply Procedure for recovery, recycling and reclamation of cfcs • Adopt knowledge The cfcs and hcfcs and their equivalent HFC replacements • Install Controls

	• Demonstrate knowledge of basic principles of installation of refrigerant controls • Use the appropriate sizes of refrigerant controls for all systems.
• Inspect refrigerants, charge refrigerants and refill oils in refrigeration.	• Apply knowledge in the purpose of refrigerant in a refrigeration system • Reclaim refrigerant from dead systems • Apply types of refrigeration oil such as mineral oil, alkyl benzene and polyester and their appropriate refrigerants • Maintain the ozone friendly refrigerants as a replacement to the odds
• Set up business/practice rather than looking for employment and have the basic principles of setting up and running a business	• Demonstrate through knowledge in set up a construction company or firm • Demonstrate through knowledge in all the preliminary processes required when setting up business. • Assess and interpret different grades of construction and civil engineering projects. • Manage a business small scale construction company.

QUALIFICATION STRUCTURE: SECTION C			
FUNDAMENTAL COMPONENT Subjects / Units / Modules /Courses	**Title**	**Level**	**Credits**
	Communication Skills	5	6
	Computing and Information Fundamentals	5	14
	Chemistry	5	4
	Physics	5	4
	Mathematics I	5	7
	Mathematics II	5	7
	Entrepreneurship	5	6
CORE COMPONENT Subjects / Units / Modules /Courses	Fundamentals of HVAC/R	5	9
	HVAC/R Design, Installation & Maintenance	5	9
	Refrigeration Systems	5	7
	Heat Pump systems	5	9
	Workshop Practice	5	9
	Refrigerant Properties and Management	5	9
	Electrical Systems and Motors	5	9
	Residential and Industrial Air conditioning Systems	5	9
	Residential and Industrial Heating Systems	5	8
	Technical and Computer Aided Design	5	9
	Automobile Air Conditioning	5	9
	TOTAL CREDITS		144
Rules of combinations, Credit distribution			
FUNDAMENTAL COMPONENT – 48 credits **CORE COMPONENT –** 96 credits **ELECTIVE COMPONENT –** n/a **Total - 144 credits**			

ASSESSMENT AND MODERATION ARRANGEMENTS

Assessment

Assessment shall be conducted by BQA accredited assessors.

The assessment for this qualification shall comprise of both formative and summary assessments weighted according to institutional guidelines and policies. Both formative and summative assessment processes are accounted for to monitor progress during the qualification and to determine competence of the learners at the end of the qualification.

The formative assessment shall consist of contribute 60%.

Summative assessment shall make up the remaining 40%.

Moderation

Moderation shall be conducted by BQA accredited moderators.

RECOGNITION OF PRIOR LEARNING

There will be provision of RPL and CAT for award of the qualification using ETP RPL and CAT Policy in line with the National RPL Policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

LEARNING PATHWAYS

Vertically, learners may articulate to:

- Diploma in Mechanical Engineering
- Diploma in Electronics and Electrical Engineering

Horizontally to:

- Certificate V in Electronics
- Certificate V in Electrical Installation

EMPLOYMENT PATHWAYS

- Maintenance officer
- Site Foreman
- Refrigeration and air-conditioning technician
- Electrical technician
- Pipe fitter

QUALIFICATION AWARD AND CERTIFICATION

Upon successful completion of the stipulated 132 credits the learner will be awarded a qualification of ***Certificate V in Refrigeration and Air Conditioning***, (NCQF Level 5). The graduate will be issued a transcript and a certificate.

REGIONAL AND INTERNATIONAL COMPARABILITY

To establish comparability, benchmarking was conducted on two similar qualifications, one regionally and one internationally. The benchmarking was looking at title of the qualification, entry requirements, credits allocation, NQF level at country of origin and either exit level outcomes or modules. The table below shows how the proposed qualification compares to the ones benchmarked against.

Equip Africa Institute (Kenya) Certificate in Refrigeration & Air Conditioning

Though the modules were not indicated, exit level outcomes show that the qualification is similar to the proposed on as it is designed to equip an individual with competencies for installing, servicing, troubleshooting, and repairing air conditioning and refrigeration units.

Saskatchewan Polytechnic (Canada) Certificate in Refrigeration & Air Conditioning Certificate

The qualification is centred around the core of refrigeration and air-conditioning. It equips learners with knowledge and skills on basic refrigeration systems, cycles, and components, system installation, electrical control systems, graphics, math, hand tools, mechanical and electrical skills, refrigerants and refrigeration load calculation, safety system design, installation, operation and test and repair system components similar to the proposed qualification. It also has provision of assessment through **Prior Learning Assessment and Recognition (**PLAR) which is similar to assessing through Recognition of Prior Learning as in the proposed qualification. There is provision of Transfer Credit which is similar to the proposed qualification's Credit Accumulation and Transfer.

REVIEW PERIOD

5 years