

Area of Interest: Construction and Skilled Trades

## Refrigeration and Air Conditioning Systems Techniques - Apprenticeship

Ontario College Certificate

Program Code: 0500X01FWO

24 Weeks

Ottawa Campus

### Our Program

**Make becoming a journeyman the next step in your Refrigeration and Air Conditioning career.**

Applicants to the Refrigeration and Air Conditioning Systems Techniques - Apprenticeship Algonquin College Certificate program must:

- be currently employed in the trade
- be formally registered as apprentices with Ministry of Labour, Training and Skills Development (MLTSD)
- have a valid Offer of Classroom Training from the MLTSD that includes your Ministry Client ID and approved Class Number

Eligibility is determined by the Ministry of Labour, Training and Skills Development.

The Refrigeration and Air Conditioning Systems Techniques - Apprenticeship trade is a compulsory trade in Ontario and requires Certification. To practice outside of Ontario, a Red Seal Endorsement is required. Typically, air conditioning and refrigeration mechanics may hold other trade licenses, such as a Certificate of Qualification as a Gas Technician.

To learn more about apprenticeships, visit <http://ontario.ca/page/skilled-trades> for detailed information.

### For Registered Apprentices:

This 24-week program fulfills the in-class requirements for your apprenticeship. The overall program is divided into three 8-week sessions where you attend class and labs for 30 hours per week and then return to work to further your skills and experience for 8 to 12 months.

During your labs you learn about:

- thermodynamics
- heat transfer
- fluid mechanics
- thermofluids
- psychrometrics
- electromagnetism
- mechanical cooling cycles and components
- electricity and installation procedures
- pneumatics
- hydronics

- construction health and safety

At the end of this program, you qualify to write the exam to receive your federal Red Seal Certification to work across Canada in the Refrigeration and Air Conditioning Systems Mechanic trade and your Certificate of Qualification to work in Ontario. Once qualified, you can enter the industry as a journeyman.

### **SUCCESS FACTORS**

This program is well-suited for students who:

- Enjoy working with their hands, constructing and repairing mechanical and electrical equipment.
- Have good spatial comprehension and mechanical aptitude.
- Have an aptitude for math and applied science.
- Have strong communication skills, both verbal and written.
- Enjoy logic based decision making.
- Are willing to work at heights, in confined spaces and out-of-doors in all conditions.
- Can work independently.
- Seek variety in their career.
- Enjoy challenges, problem solving and innovation.
- Enjoy working in a commercial or industrial environment.

### **Employment**

Graduates are apprentices and mechanics employed as building systems and/or field service technicians, installers, designers, consultants, entrepreneurs, sales representatives, and parts counter clerks with a variety of employers, such as residential, commercial and industrial air conditioning and refrigeration contractors, subcontractors, engineering and design firms, research labs and museums, manufacturers, and government agencies and public utilities. It is very common for air conditioning and refrigeration mechanics to hold other trade licenses, specifically a Certificate of Qualification as a gas technician.

### **Learning Outcomes**

The graduate has reliably demonstrated the ability to:

- Relate effectively to refrigeration and air conditioning supervisors, coworkers, and customers.
- Work safely and in accordance with all applicable acts, regulations, legislation, and codes to ensure personal and public safety.
- Solve routine refrigeration and air conditioning problems and perform calculations by applying the fundamentals of mathematics and physics.
- Read, develop, and interpret various drawings and utilize the information to follow the proper sequence of operations for refrigeration, air conditioning systems, and associated components.
- Assist in the installation and start-up operations of refrigeration and air conditioning systems under the supervision of a certified technician.
- Identify strategies for ongoing personal and professional development, that will lead to enhanced work performance and career opportunities, and keep pace with industry changes.
- Identify various cooling system mechanical and electrical failures as related to cooling or heating cooling combination systems in residential, industrial, commercial, and institutional

- Identify various cooling system mechanical and electrical failures as related to cooling or heating cooling combination systems in residential, industrial, commercial, and institutional settings.
- Select and use refrigeration and air conditioning hand tools and operate and test equipment for their intended purposes.

### Program of Study

Level: 01	Courses	Hours
ACR1410	Introduction to Electricity and Controls for AC and R	72.0
ACR1412	AC and R System Operation and Components	72.0
ACR1413	AC and R Piping Installation	48.0
ACR1711	AC and R System Installation and Maintenance	48.0
Level: 02	Courses	Hours
ACR1420	Electricity and Controls for AC and R Systems	72.0
ACR1421	AC and R Science and Blueprints	48.0
ACR1422	Installation of AC and R Systems and Components	120.0
Level: 03	Courses	Hours
ACR1430	Electricity and Electronics for HVAC	96.0
ACR1431	HVACR Systems and Thermofluids	96.0
ACR1432	HVACR Design, Distribution and Blueprints	48.0

### Fees for the 2023/2024 Academic Year

Tuition Fees: \$400 per level.

Incidental Fee: \$150 per level.

Information Technology Fee: \$43.86 per level.

Apprentices are responsible for supplying their own textbooks as required. Books and supplies can be purchased at the campus store. Expenses total approximately \$1000 for each in-school level.

Students are responsible for parking and locker fees, if applicable.

All students are responsible to supply their own personal protective equipment (such as CSA-approved safety footwear, non-tinted protective eyewear, hearing protection, gloves, hard hat, fire-resistant coveralls) as required in each lab environment.

### Admission Requirements for the 2024/2025 Academic Year

#### College Eligibility

- Ontario Secondary School Diploma (OSSD) or equivalent; OR
- Mature Student status (19 years of age or older and without a high school diploma at the start of the program).

**Program Eligibility**

- Prospective students must be registered apprentices with the Ministry of Labour, Training and Skills Development and must be a member in good standing with Skilled Trades Ontario (STO).
- Eligibility is determined by the Ministry of Labour, Training and Skills Development.

**Admission Requirements for 2023/2024 Academic Year****College Eligibility**

- Ontario Secondary School Diploma (OSSD) or equivalent; OR
- Mature Student status (19 years of age or older and without a high school diploma at the start of the program).

**Program Eligibility**

- Prospective students must be registered apprentices with the Ministry of Labour, Training and Skills Development and must be a member in good standing with Skilled Trades Ontario (STO).
- Eligibility is determined by the Ministry of Labour, Training and Skills Development.

**Application Information****REFRIGERATION AND AIR CONDITIONING SYSTEMS TECHNIQUES - APPRENTICESHIP**  
**Program Code 0500X01FWO**

Registration for Apprenticeship programs takes place through the Ministry of Labour, Training, and Skills Development.

For further information, contact:

Ministry of Labour, Training, and Skills Development  
347 Preston Street 3rd Floor, Suite 310  
Ottawa, ON K1S 3H8

<https://www.ontario.ca/page/start-apprenticeship>

Telephone: 613-731-7100

Toll-free: 1-877-221-1220

**Contact Information****Program Coordinator(s)**

- Trevor Root, <mailto:roott@algonquincollege.com> , 613-727-4723, ext. 2464

**Course Descriptions****ACR1410 Introduction to Electricity and Controls for AC and R**

Electricity forms the power source and control method of a typical air conditioning and refrigeration (AC and R) system. The apprentice learns the fundamentals of electrical and electromagnetic operation, including the use and measurement of voltage, current, resistance and capacitance in both theoretical and applied settings. The apprentice also develops a theoretical understanding of power and inductance. The knowledge is applied to the operation of single phase motors, heaters and related auxiliary components. The apprentice becomes proficient at identifying safety and operation controls and how they relate to a control system. The apprentice also studies the creation and use of wiring diagrams, including schematic, ladder and pictorial types. Theoretical concepts are explored through the use of lectures and research assignments and then applied in a lab through equipment disassembly, and the use of simulators and test equipment.

Prerequisite(s): none

Corequisite(s): none

**ACR1412 AC and R System Operation and Components**

The complexity of installing and servicing ACR systems requires an understanding of the four crucial mechanical components and a multitude of auxiliary components. The apprentice learns the key concepts behind an electro-mechanical vapour compression refrigeration system. The apprentice also learns key concepts of physics and thermodynamics as they relate to ACR, including thermal energy, pressure-temperature relationships, changes of operating state, as well as pressure and vacuum measurements and application. Typical system pressures and temperatures and the application of various refrigerants and lubricants are a key focus. The theoretical concepts are explored through the use of lectures and research assignments and then applied in a lab through equipment disassembly, and the use of simulators and test equipment.

Prerequisite(s): none  
Corerequisite(s):none

**ACR1413 AC and R Piping Installation**

Brazing and soldering are the common techniques for installing and modifying flow components and piping in ACR systems. The apprentice learns the safe use of air-acetylene and oxy-acetylene torches as they relate to ACR. The process of igniting, adjusting and extinguishing torches is covered, as well as hot work safety and preparation. Soldering and brazing of copper are key focuses, using both copper phosphorus and high silver brazing alloys. The apprentice demonstrates the ability to braze copper tubing to trade standard. The skills learned are transferrable to any air-fuel or oxy-fuel process. The apprentice also learns correct techniques for system pressure testing, evacuating and leak detection.

Prerequisite(s): none  
Corerequisite(s):none

**ACR1420 Electricity and Controls for AC and R Systems**

Troubleshooting and repair in the field of ACR requires an in-depth knowledge of electrical principles and application. The apprentices learn the science behind the operation of electric motors, capacitors and motor starting accessories, as well as the practical skills required to install, service, specify and replace electrical and electro-mechanical components. Installation and troubleshooting of electrical and electronic components in industrial, commercial, institutional and residential refrigeration and air conditioning systems are examined. The theoretical concepts are explored through the use of lectures and research assignments and then applied in a lab through equipment disassembly, and the use of simulators and test equipment.

Prerequisite(s): none  
Corerequisite(s):none

**ACR1421 AC and R Science and Blueprints**

A skilled tradesperson working in the ACR field must be able to select and verify the application and capacity of equipment. Conditions and requirements for storage, preservation and production of products, as well as comfort applications are examined. The use of sketches, blueprints and plans as they relate to the design, construction and service of ACR systems and entire buildings, are examined. The fundamentals behind application, sizing and design of standard and custom systems are studied. The apprentice demonstrates the ability to verify the capacity of an existing refrigeration system. The science of pressure-enthalpy diagrams, calculations and their application is studied. Fundamental skills are developed through lectures and assignments, and supplemented by measurements and calculations performed in the lab.

Prerequisite(s): none  
Corerequisite(s):none

**ACR1422 Installation of AC and R Systems and Components**

Proper techniques are critical to a high quality ACR installation. Apprentices learn high level skills in the installation of major and minor ACR components. Sizing and selection of components and

entire systems is covered in depth. System pressure testing, evacuation and charging are all examined. The use of material handling equipment, hoisting and rigging practices including crane use, signaling and load lifting, and the moving and setting of loads form a key component of this course. The apprentice demonstrates competency in selecting and applying slings, shackles, hooks, chain, wire rope and other material handling equipment. Discussion and lectures are used to explain methods and techniques, and lab work is a focus. Apprentices demonstrate the ability to perform high quality work, safely, while demonstrating the skills to move heavy loads properly. Typical operating pressures and temperatures are investigated.

Prerequisite(s): none  
Corerequisite(s):none

### **ACR1430 Electricity and Electronics for HVAC**

Electricity and its various applications, through either electrical, electro-mechanical or electronic methods is central to every ACR system. Apprentices continue to expand their knowledge of single and three phase motors including compressors and fans. Electrical control system terminology and pneumatic control components are discussed. Troubleshooting of control circuits is covered. Apprentices learn to identify and describe electronic control systems including input/output sensors and electronic controllers. Methods of communicating with and programming control systems and energy conservation methods and strategies are examined. The knowledge required is developed through a blend of classroom instruction, including lectures and assignments, as well as time spent wiring, verifying, energizing and measuring electrical equipment in the lab.

Prerequisite(s): none  
Corerequisite(s):none

### **ACR1431 HVACR Systems and Thermofluids**

Understanding the science behind the common term "air conditioning" requires an understanding of the principles involved in heat transfer and the condensation of humidity. Typical ACR systems are examined; apprentices learn the operation of heat pump systems, lithium bromide absorption systems, cooling towers and related accessories. Refrigerant piping methods and installation requirements are covered. Shaft alignment procedures and control system operations are discussed. Apprentices also learn the terms used in psychrometrics. Participants construct and analyze psychrometric diagrams to determine the operating parameters of air conditioning systems. Fundamental skills are developed through lectures and assignments, and supplemented by measurements and calculations performed in the lab.

Prerequisite(s): none  
Corerequisite(s):none

### **ACR1432 HVACR Design, Distribution and Blueprints**

The ability to examine a schematic, diagram, drawing, plan or blueprint, and quickly ascertain the location and specifications of equipment, piping and wiring or other components is a key ability of skilled tradespeople. Apprentices learn to interpret building drawings, and sources of building heat gain and loss are discussed. Apprentices learn the layout and components of air distribution systems. The operation, application and servicing of blowers and fans are discussed. Air filtration, ventilation and indoor air quality requirements are covered. Apprentices learn the concepts of sizing ACR systems for comfort cooling applications. The bulk of the learning comes from classroom assignments, research projects and lectures. The proper application of the required skills is proven through the examination and creation of drawings in both the classroom as well as the lab environment.

Prerequisite(s): none  
Corerequisite(s):none

### **ACR1711 AC and R System Installation and Maintenance**

Service and installation skills are foundational to a career in ACR. Environmental issues related to trade, codes, acts and regulations are examined. The selection and use of general and specialized hand and power tools and measurement instruments are covered. The apprentice learns procedures for the inspection and maintenance of ACR systems, including charging and recovering

refrigeration. Codes and regulations are examined through lectures and research assignments.

Prerequisite(s): none  
Corerequisite(s):none