Professional qualification of construction contractors

# Competency profile

## 15.9 – Contractor – Small refrigeration systems

Régie du bâtiment
Québec

This document was produced with the collaboration of the team of competency assessment advisors (Direction de la qualification) of the Régie du bâtiment du Québec.

In this document, the masculine gender is used without discrimination and solely for the sake of brevity.



Changes to the content may be made at any time.

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# Introduction

Successful candidates may act as guarantors for construction work included in subclass 15.9 - Contractor – Small refrigeration systems.

This competency profile is based on the scope of application of the *Building Act*, as well as on Section (21-22-23 or 24) of the *Regulation respecting the professional qualification of contractors and owner-builders*.

# Subclass definition

**15.9 - Contractor – Small refrigeration systems**

This subclass authorizes construction work that is not reserved exclusively for master pipe-mechanics relating to air-conditioning refrigeration systems with a cooling capacity not exceeding 20 kW and a refrigerant of group A1, A2 or a mixture of both, according to the classification in the table on refrigerants and charges of the *Mechanical Refrigeration Code*, CSA B-52, published by the Canadian Standards Association.

It also authorizes construction work relating to the heating and air conditioning devices of a pulsed air system, whose capacity does not exceed 40 kW and that use a refrigerant referred to in the first paragraph, provided that the contractor also holds the appropriate subclass 15.1, 15.1.1, 15.7 or 15.8.

In addition, this subclass authorizes construction work relating to the heating and air conditioning devices of a hydronic system, whose capacity does not exceed 40 kW and that use a refrigerant referred to in the first paragraph, provided that the contractor also holds the appropriate subclass 15.4 or 15.4.1.

Lastly, it authorizes similar or related construction work.

# Module 1 – DEFINITIONS AND TYPES OF SYSTEMS

## Elements of competency covered in this module:

1. Define concepts and terms related to small air conditioning systems
2. Describe the characteristics and operating principles of various small air conditioning systems

## Module 1 – DEFINITIONS AND TYPES OF SYSTEMS

| Elements of competency | Skills required |
|---|---|
| **1. Define concepts and terms related to small air conditioning systems** | 1.1. Define the types of small air conditioning systems (direct and indirect systems) |
| | 1.2. Distinguish between split and monoblock systems, and between parallel and single systems |
| | 1.3. Define the types, groups and properties (boiling temperatures, latent heat, toxicity, stability, usage characteristics, etc.) of refrigerants used in small air conditioning systems: A1 and A2 |
| | 1.4. Define the components of a refrigeration system: condenser, fan, evaporator, compressor, etc. |
| | 1.5. Describe the accessories, controls and piping associated with small air conditioning systems: accumulator, thermostat, fitting, tank, filter, expansion valve, actuator, drier, pump, etc. |
| | 1.6. Define the various tools needed to install and maintain a small air conditioning system: refrigerant recovery unit, pressure gauge, vacuum analyzer, vacuum pump, acidity test, etc. |
| | 1.7. Define the various physical principles that have an impact on the installation and maintenance of small air conditioning systems: saturation, overheating, sub-cooling, pressure, energy, temperature, density and volume of a body, types of heat, etc. |
| | 1.8. Define the units of measurement associated with small air conditioning systems: KW, Btu/h, EER, etc. |
| **2. Describe the characteristics and operating principles of** | 2.1. Explain the operation of a compression refrigeration circuit (heating, cooling and |

| Elements of competency | Skills required |
|---|---|
| **various small air conditioning systems** | defrosting) and the function of its main components (compressor, condenser, evaporator, etc.) |
| | 2.2. Explain the operating principles of different compressors: piston, rotary, scroll, etc. |
| | 2.3. Describe the operating principles of various small air conditioning systems (rooftop unit, heat pump, etc.) and their scope of application |
| | 2.4. Describe the characteristics of different types of components (including piping and controls) and accessories for small air conditioning systems and their scope of application |
| | 2.5. Explain the concept of comfort as it relates to air-conditioning systems and the elements that affect it (humidity, air supply, temperature, location of components, etc.) with a view to energy efficiency |

# Module 2 – LEGISLATIVE, NORMATIVE AND REGULATORY FRAMEWORK

## Elements of competency covered in this module:

3. Situate work on small air conditioning systems with respect to the normative and legislative framework

## Module 2 – LEGISLATIVE, NORMATIVE AND REGULATORY FRAMEWORK

| Elements of competency | Skills required |
|---|---|
| **3. Situate work on small air conditioning systems with respect to the normative and legislative framework** | 3.1. Identify the organizations (and their compliance standards) that affix their marks to small air conditioning system components (CSA, ULC, WH, etc.) |
| | 3.2. Identify and define the scope of the *Québec Construction Code, Chapter I – Building* and the *National Building Code of Canada: 1995* (amended) (NRC) in relation to work on small air conditioning systems |
| | 3.3. Explain the scope of the standard applicable to work in relation to small air conditioning systems (CSA B-52) |
| | 3.4. Define the scope of municipal regulations governing the installation of small air conditioning systems (capacity of waterborne equipment, decibel level) |
| | 3.5. Explain the scope of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards as they apply to small air conditioning system installation work |
| | 3.6. Explain when the *Energy Conservation Act* (E-1.1) and the *Regulation respecting energy conservation in new buildings* (E-1.1, r.1) apply to small air conditioning system work |
| | 3.7. Explain the impact of small air conditioning systems on the environment (greenhouse effect and ozone layer) and the application of protective measures(*Environment Quality Act* [R.S.Q., c. Q-2], *Regulation respecting halocarbons* [c. Q-2, r.15.01], etc.) |

| Elements of competency | Skills required |
|---|---|
| | 3.8. Explain the role of Natural Resources Canada's Office of Energy Efficiency and the Agence d'efficacité énergétique of the Ministère des Ressources naturelles du Québec in connection with work on small air conditioning systems |
| | 3.9. Define the scope of the *Regulation respecting hazardous materials* (Q-2, r.15.2) for work on small air conditioning systems |
| | 3.10. Explain the application of the Workplace Hazardous Materials Information System (WHMIS) in relation to small air conditioning systems |

# Module 3 – PLANS, SPECIFICATIONS AND ESTIMATES

## Elements of competency covered in this module:

4. Read and interpret plans and drawings for small air conditioning systems
5. Read and interpret the divisions of specifications associated with small air conditioning systems
6. Estimate the work involved in small air conditioning systems

## Module 3 – PLANS, SPECIFICATIONS AND ESTIMATES

| Elements of competency | Skills required |
|---|---|
| **4. Read and interpret plans and drawings for small air conditioning systems** | 4.1. List the types of plans for small air conditioning systems |
| | 4.2. Locate the space to be air conditioned and the components of small air conditioning systems on a plan |
| | 4.3. Interpret the symbols used for small air conditioning systems |
| | 4.4. Locate, read and interpret the main dimensions and annotations associated with small air conditioning systems |
| | 4.5. Locate, read and interpret cross-sections and details associated with small air conditioning systems |
| | 4.6. Read and interpret general notes and tables associated with small air conditioning systems |
| **5. Read and interpret the divisions of specifications associated with small air conditioning systems** | 5.1. Identify the divisions and sections associated with small air conditioning systems in specifications |
| | 5.2. Interpret information associated with small air conditioning systems in the general terms of specifications |
| | 5.3. Interpret information associated with small air conditioning systems in specifications |
| **6. Estimate the work involved in small air conditioning systems** | 6.1. Evaluate air conditioning requirements, taking into account the context (surface area, volume, use, fenestration, heat, etc.) |
| | 6.2. Produce calculations to assess the required thermal load (thermometry) |
| | 6.3. Choose the right small air conditioning system for a project without plans and specifications |

| Elements of competency | Skills required |
|---|---|
| | 6.4. Prepare the quantity survey[1] for system installation (number of components, etc.) |
| | 6.5. Determine required resources (labour, equipment, materials) and productivity rate for the work |
| | 6.6. Check availability, delivery times and costs of materials with suppliers |
| | 6.7. Ensure that the work proposed complies with appropriate standards |
| | 6.8. Complete, check and submit the bid (including the bid bond) |

[1] Prepare the quantity survey: measure the structure and calculate the quantities of materials required.

## Module 4 – STANDARDS AND EXECUTION OF WORK

### Elements of competency covered in this module:

7. Plan and organize work in relation to small air conditioning systems
8. Manage the execution of setting up small air conditioning systems
9. Start up small air conditioning systems
10. Inspect, repair and maintain small air conditioning systems
11. Ensure health and safety in connection with work on small air conditioning systems

## Module 4 – STANDARDS AND EXECUTION OF WORK

| Elements of competency | Skills required |
|---|---|
| **7. Plan and organize work in relation to small air conditioning systems** | 7.1. Determine the logical order of execution of work for small air conditioning systems |
| | 7.2. Order and receive materials required for small air conditioning systems |
| | 7.3. Ensure availability of services required for installation of refrigeration systems (power supply, drain) |
| | 7.4. Explain the importance of properly coordinating the interface (common boundaries) between the various disciplines on the site |
| **8. Manage the execution of setting up small air conditioning systems** | 8.1. Deliver and move materials and equipment at the work site |
| | 8.2. Locate the various components of the systems to be installed |
| | 8.3. Determine the actual refrigerant charge required for a system |
| | 8.4. Provide work tools and communicate safe ways of using them |
| | 8.5. Make sure workers understand plans, sketches and installation steps |
| | 8.6. Explain welding techniques and methods for small air conditioning systems |
| | 8.7. Resolve technical, coordination and other difficulties as work progresses |
| | 8.8. Control quality during construction and once installation is complete |
| | 8.9. Make sure all air conditioning system components are connected (control panel, regulation, power supply, etc.) |

| Elements of competency | Skills required |
|---|---|
| | 8.10. Ensure that no unauthorized modifications are made to the integrity of the walls, fire separations and structure |
| | 8.11. Explain overpressure requirements (types of protection, etc.) |
| | 8.12. Explain installation methods for different systems (ducted or ductless, monoblock, etc.) |
| | 8.13. Ensure that the elements comply with standards, manufacturer's recommendations, and/or plans and specifications |
| **9. Start up small air conditioning systems** | 9.1. Establish a system start-up procedure (taking manufacturer's specifications into account) |
| | 9.2. Ensure that the system is drained, dried and free of leaks before charging with refrigerant |
| | 9.3. Adjust system charge with refrigerant if necessary |
| | 9.4. Ensure the required tests, trials and calibration |
| | 9.5. Explain the system's operating rules to the owner or the owner's representative and hand over the associated manuals |
| **10. Inspect, repair and maintain small air conditioning systems** | 10.1. Explain how to perform tests and checks (leak detection, oil level, condition, etc.) |
| | 10.2. Maintain and replace defective components as required |
| | 10.3. Ensure the transport, storage and recovery of refrigerant |
| **11. Ensure health and safety in connection with work on small air conditioning systems** | 11.1. Name the risks associated with work on small air conditioning systems (height, high pressure, welding, gas, oil, etc.) |
| | 11.2. Explain the precautions to be taken when working on small air conditioning systems |

| Elements of competency | Skills required |
|---|---|
| | 11.3. Identify the risks associated with transporting and handling hazardous materials and the precautions to be taken |