Professional qualification of construction contractors

# Competency profile

## 1.9 - Contractor – Building mechanicals

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

The person who passes the exam can act as a guarantor for construction work included in subclass 1.9 - Contractor – Building mechanicals.

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

**1.9 - Contractor – Building mechanicals**

Subject to the second paragraph of article 6 of this regulation, this licence subclass authorizes construction work on a building's mechanical systems, equipment for public use, or civil engineering works such as heating, ventilation, refrigeration, plumbing, and fire protection works and their control systems, as well as insulation and emergency electrical power work.

It also authorizes construction work included in a subclass of Schedule III but not authorized in the first paragraph, when said work is part of a project relating to a building's mechanical systems, equipment intended for public use, or civil engineering works.

Finally, 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 building mechanicals
2. Describe the characteristics of building mechanicals equipment and systems and their control systems

# Module 1 – DEFINITIONS AND TYPES OF SYSTEMS

| Elements of competency | Skills required |
|---|---|
| **1. Define concepts and terms related to building mechanicals** | 1.1. Define pressure, condensation and power |
| | 1.2. Define energy efficiency, comfort and building automation (centralized control) |
| | 1.3. Define terms associated with HVAC: heat transfer types, nozzle, boiler, water heater, distribution duct and other types of duct *(Québec Construction Code, Chapter I, Building*), air conditioned space, warm-air furnace and space-heating appliance, plenum, connecting pipe, airtight system, fuel, distribution, transfer, etc. |
| | 1.4. Define plumbing terms: source, distribution, sanitary system, pump, valve, air chamber, expansion joint, pipe support, fitting, sanitary and storm drain, oil line, diesel generator, etc. |
| | 1.5. Define fire protection terms such as breeching, flue and other types of ducts, fire-resistance rating, detectors, flame-spread rating, flash point, fire damper, etc. |
| | 1.6. Define terms associated with thermal insulation: permeability, vapour barrier, thermal insulation, loose-fill insulation, batt insulation, blown-in insulation, reflective insulation, etc. |
| | 1.7. Define terms associated with electricity: alternating and direct current, volt, volt-ampere, kilowatt, transmission, distribution, accumulator, synchronizer, etc. |
| | 1.8. Define terms associated with safety systems, instrumentation, regulation and control: |

| Elements of competency | Skills required |
|---|---|
| | telephone network, probe, actuator, controller, signals, etc. |
| | 1.9. Identify the units of measurement associated with the various building mechanicals systems |
| **2. Describe the characteristics of building mechanicals equipment and systems and their control systems**<br><br>**Large buildings, small buildings and civil engineering works** | 2.1. Name the various materials (and their characteristics) used in a residential building's mechanical systems |
| | 2.2. Name the various types of instrumentation, regulation and control systems, and describe how they work |
| | 2.3. Identify ways of insulating pipes and ducts |
| | 2.4. Describe the different air conditioning systems and their main components |
| | 2.5. Describe the different heating systems and their main components |
| | 2.6. Describe the main components of a plumbing system |
| | 2.7. Describe the various fire protection systems and their main components, for building mechanicals work |
| | 2.8. Describe the main components of a power system |
| | 2.9. Compare the advantages of different equipment in relation to a building's mechanical systems |

# Module 2 – LEGISLATIVE, NORMATIVE AND REGULATORY FRAMEWORK

## Elements of competency covered in this module:

3. Situate building mechanicals work in relation to current laws and regulations
4. Situate building mechanicals work in relation to the various codes and standards in force

## Module 2 – LEGISLATIVE, NORMATIVE AND REGULATORY FRAMEWORK

| Elements of competency | Skills required |
| --- | --- |
| **3. Situate building mechanicals work in relation to current laws and regulations** | 3.1. Explain the regulations of the *Building Act* (R.S.Q. c B-1.1) that apply to building mechanicals work |
| | 3.2. Explain the roles and responsibilities of the designer, general contractors and trade contractors regarding compliance with plans, specifications and standards (R.S.Q. c. B-1.1) |
| | 3.3. Explain when the *Act respecting the Régie de l'énergie* (R.S.Q. c. R-6.01) applies to building mechanicals work |
| | 3.4. Explain when the *Energy Conservation Act* (R.S.Q. c. E-1.1) and the *Regulation respecting energy conservation in new buildings* apply to mechanical systems work (R.S.Q. c. E-1.1, r.1) |
| | 3.5. Explain when the *Environment Quality Act* (R.S.Q., c. Q-2) and the *Regulation respecting wastewater disposal systems for isolated dwellings* (R.S.Q., c. Q-2, r.8) and the *Regulation respecting the quality of drinking water* (R.S.Q., c. Q-2, r.18.1.1) apply to building mechanicals work |
| | 3.6. Explain when the *Act respecting occupational health and safety* (R.S.Q., c. S-2.1) applies to building mechanicals work (WHMIS, pressurized cylinders, freon, propane tanks, fuel, benzene, open-flame work, etc.) |
| | 3.7. Explain when the *Regulation respecting the quality of the work environment* (R.S.Q. c. S-2.1, r.15) applies to building mechanicals |
| | 3.8. Explain when the *Act respecting pressure vessels* (R.S.Q., c. A-20.01) and the *Regulation* |

| Elements of competency | Skills required |
|---|---|
| | *respecting pressure vessels* (R.S.Q., c. A-20.01, r.1.1) apply to building mechanicals work |
| | 3.9. List the licences required for specialized building mechanicals contractors and the limits of intervention for specialized contractors |
| | 3.10. Identify the competency cards required for the workforce to carry out building mechanicals work |
| **4. Situate building mechanicals work in relation to the various codes and standards in force** | 4.1. Identify the organizations that affix their marks to electrical and fire protection products to guarantee compliance (CSA and ULC) |
| | 4.2. Identify and define the parts and sections of the *Québec Construction Code* that apply to building mechanicals work |
| | 4.3. Identify the various installation standards applicable to building mechanicals work (CSA, NFPA, ASHRAE and others) |
| | 4.4. Outline the scope of the various codes and standards that apply to building mechanicals work (materials, building types, etc.) |
| | 4.5. Explain when building mechanicals work must take municipal regulations into account |
| | 4.6. Describe the links between the various codes and standards specific to building mechanicals work and the *Québec Construction Code* (organizational structure) |
| | 4.7. Identify the main energy efficiency programs in force in Quebec |
| | 4.8. Explain LEED certification and other environmental standards such as halocarbons, CFCs, etc. |
| | 4.9. Explain the Novoclimat program |

# Module 3 – READING PLANS AND SPECIFICATIONS

## Elements of competency covered in this module:

5. Read and interpret building mechanicals drawings and plans
6. Interpret information relating to building mechanicals in specifications

## Module 3 – READING PLANS AND SPECIFICATIONS

| Elements of competency | Skills required |
|---|---|
| **5. Read and interpret building mechanicals drawings and plans** | 5.1. Locate mechanical components on a plan |
| | 5.2. Explain the meaning of the main symbols used for building mechanicals drawings and plans |
| | 5.3. Locate, read and interpret the main dimensions and annotations associated with building mechanicals components |
| | 5.4. Locate, read and interpret cross-sections and details associated with building mechanicals components |
| | 5.5. Read and interpret general notes and tables associated with building mechanicals components |
| | 5.6. Prepare the quantity survey[1] (HVAC,[2] plumbing, fire protection, insulation, electricity, instrumentation, regulation and control) |
| **6. Interpret information relating to building mechanicals in specifications**<br><br>**(1995 17-division normative specifications with reference to the new 2004 49-division specifications)** | 6.1. Define the divisions and sections of construction specifications associated with building mechanicals |
| | 6.2. Interpret information relating to building mechanicals work in the general terms and division 01 of specifications |
| | 6.3. Interpret information relating to drilling in specifications in relation to building mechanicals work (geothermal energy) |
| | 6.4. Interpret information relating to HVAC and insulation in specifications |
| | 6.5. Interpret information relating to electricity in specifications |

[1] Prepare the quantity survey: measure the structure and calculate the quantities of materials required.
[2] Heating, ventilation, air conditioning.

| Elements of competency | Skills required |
|---|---|
| | 6.6. Interpret information relating to plumbing in specifications |
| | 6.7. Interpret information relating to fire protection in specifications |
| | 6.8. Interpret information relating to instrumentation, regulation and integrated control in specifications |
| | 6.9. Interpret information relating to emergency electrical power in specifications |
| | 6.10. Define the divisions and sections of construction specifications associated with building mechanicals |

# Module 4 – STANDARDS AND EXECUTION OF WORK

## Elements of competency covered in this module:

7. Plan and organize building mechanicals work
8. Manage the execution of heating, ventilation and refrigeration work
9. Manage the execution of plumbing work
10. Manage the execution of fire protection work
11. Manage the execution of electrical power work
12. Ensure quality control of building mechanicals work
13. Ensure health and safety on building mechanicals work sites

## Module 4 – STANDARDS AND EXECUTION OF WORK

| Elements of competency | Skills required |
|---|---|
| **7. Plan and organize building mechanicals work** | 7.1. Calculate the costs (initial and operating) of the various mechanical systems in a small building (in order to advise on the choice according to a given budget) |
| | 7.2. Explain the importance of properly coordinating the interface (common boundaries) between the various disciplines on the site |
| | 7.3. Describe the pre- and post-construction stages of building mechanicals work |
| | 7.4. Determine the logical order of execution of building mechanicals work |
| | 7.5. Ensure that the required authorizations and permits for building mechanicals work are obtained |
| | 7.6. Describe the characteristics of mechanical engineering projects that require plans and specifications |
| | 7.7. Explain the process for modifying mechanical plans |
| | 7.8. Ensure that subcontractors comply with climate-related standards (2.2) |
| **8. Manage the execution of heating, ventilation and refrigeration work** | 8.1. Hire an appropriately licensed subcontractor |
| | 8.2. Provide adequate clearance for ducts in mechanical systems work on small buildings |
| | 8.3. Explain the requirements for air conditioning refrigeration systems and equipment (6.2.10) |
| | 8.4. Explain the requirements for radiators and convectors in small buildings (9.33.7) |
| | 8.5. Explain ventilation requirements for crawl spaces in a small building (9.18.3) |

| Elements of competency | Skills required |
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| | 8.6. Explain the requirements for ventilating an attic space (roof space) in a small building (9.19) |
| | 8.7. Explain the requirements for airtightness systems (9.25.3) (in relation to a mechanical effect) |
| | 8.8. Explain the difference between heating season and non-heating season ventilation requirements for a dwelling in a small building (9.32.2 and 3) |
| | 8.9. Explain the requirements for depressurization protection of a small building (9.32.3.8) |
| | 8.10. Explain the requirements for ventilation ducts in a small building (9.32.3.10) |
| | 8.11. Explain the requirements for heat recovery ventilators in a small building (9.32.3.11) |
| | 8.12. Explain the requirements for outside air intakes and return air intakes in a small building (9.32.3.12) |
| | 8.13. Explain the requirements for air duct networks for heating and air conditioning systems for a dwelling in a small building (9.33.6) (materials, cladding, thickness of distribution ducts, installation, clearances, air vents, etc.) |
| | 8.14. Explain piping requirements for heating and cooling systems in a small building (9.33.8) (materials, insulation, clearance, protection) |
| | 8.15. Explain the requirements for the installation of air cooling equipment in a small building (9.33.9) |
| | 8.16. Ensure that openings comply with firewall standards and that the integrity of firewalls is preserved |
| | 8.17. Ensure structural integrity |

| Elements of competency | Skills required |
|---|---|
| | 8.18. Ensure that devices are installed according to manufacturer's specifications |
| | 8.19. Ensure that ventilation ducts vent to the outside and are the right size |
| | 8.20. Ensure that the fan has the necessary capacity to meet the standards |
| | 8.21. Ensure that ventilation duct joints are watertight |
| | 8.22. Ensure that pipes and ducts are insulated, if necessary |
| | 8.23. Ensure that balances correspond to the correct flow rates |
| | 8.24. Ensure that installed components (conduits, pipes, etc.) do not fall off in the event of structural movement |
| **9. Manage the execution of plumbing work** | 9.1. Hire an appropriately licensed subcontractor |
| | 9.2. Explain when a crawl space in a small building is considered heated (9.18.1.3) |
| | 9.3. Explain the requirements for crawl space access openings in a small building (9.18.2) |
| | 9.4. Explain the requirements for the number of sanitary facilities in a small building (9.31.4) (depending on use and number of people) |
| | 9.5. Explain the requirements for water heaters in a small building (9.31.6) (temperature, installation, coil, etc.) |
| | 9.6. Ensure that openings comply with firewall standards and that the integrity of firewalls is preserved |
| | 9.7. Ensure structural integrity |
| | 9.8. Ensure waterproofing of the work |

| Elements of competency | Skills required |
|---|---|
| | 9.9. Ensure that the pipe flow slopes in the same direction |
| | 9.10. Ensure that plumbing work is in compliance with plans and specifications |
| **10. Manage the execution of fire protection work** | 10.1. Hire an appropriately licensed subcontractor |
| | 10.2. Explain how to achieve the required flame-spread rating (9.10.3.1, note A9.10.3.1 or Appendix D) |
| | 10.3. Explain the requirements for the use of combustible conduits, piping, plumbing fixtures, wires and cables, elevator cables and piping in small buildings (9.10.9.7) |
| | 10.4. Explain the requirements for technical installations in fire separations and other fire-resistant assemblies in a small building (9.10.9.2) (sealing, non-combustibility, electrical wiring, conduits, piping, etc.) |
| | 10.5. Explain the requirements for the types of fire alarm systems that can be installed in a small building (9.10.17) (depending on use, number of people, number of floors and sprinkler system) |
| | 10.6. Explain alarm signal audibility requirements (maximum audibility in the sleeping room, maximum audibility near the device, signal audibility loss criteria) |
| | 10.7. Distinguish a smoke alarm from a smoke detector |
| | 10.8. Explain the requirements for installing a fire detector (9.10.17 and 10.9.3.2) |
| | 10.9. Explain smoke alarm installation requirements (9.10.18 and 10.9.3.2) (types, power supply, places where they are required) |

| Elements of competency | Skills required |
|---|---|
| | 10.10. Explain fire protection requirements for crawl spaces in a small building (9.18.7) |
| | 10.11. Explain fire detection and alarm system requirements for existing buildings undergoing conversion (10.3.2.4) |
| | 10.12. Ensure that openings comply with firewall standards and that the integrity of firewalls is preserved |
| | 10.13. Ensure structural integrity |
| | 10.14. Check protection for pipes and wires in a small building (9.10.15) |
| | 10.15. Check installation of alarm system (site closure) for a small building (9.10.17.6) |
| | 10.16. Check sprinkler system installation (3.2.5.13 and 14 and 15 16) (number, etc.) |
| **11. Manage the execution of electrical power work** | 11.1. Use subcontractors with the appropriate licence |
| | 11.2. Verify compliance with plans and applicable standards using codes applicable to electrical work |
| | 11.3. Check that the opening around the electrical service conduit penetrating the building envelope is sealed |
| | 11.4. Check the integrity of the vapour barrier behind outlet boxes installed on exterior walls |
| | 11.5. Ensure that emergency circuits are connected to the emergency power source |
| | 11.6. List the characteristics of areas where emergency lighting is required in a small building (9.9.11.3) |
| | 11.7. Ensure proper ventilation of the combustion chamber (air exchange and heat release) |

| Elements of competency | Skills required |
|---|---|
| | 11.8. Ensure that openings comply with firewall standards and that the integrity of firewalls is preserved |
| | 11.9. Ensure structural integrity |
| **12. Ensure quality control of building mechanicals work** | 12.1. List ways to ensure quality control of building mechanicals work |
| | 12.2. Define the tests and trials carried out on materials used in building mechanicals work |
| | 12.3. Identify those responsible for the various stages of quality control of building mechanicals work |
| | 12.4. Solve problems in the execution of building mechanicals work (solutions, schedule adjustments, etc.) |
| **13. Ensure health and safety on building mechanicals work sites** | 13.1. Identify the hazardous products used in building mechanicals work (ammonia, pressurized cylinders, freon, fuel, benzene, open-flame work, etc.) |
| | 13.2. Identify precautions to be taken with hazardous products (storage, use) |
| | 13.3. Identify the risks of accidents that can occur during building mechanicals work (welding, gas, electricity, explosion, fire, water, improperly stored equipment, etc.) and how to prevent them |