Professional qualification of construction contractors

Competency profile

16 - Owner-builder – Electrical

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 16 - Owner-builder – Electrical.

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

16 - Owner-builder – Electrical

Except for demolition work, this subclass authorizes construction work on an electrical installation to which Chapter V of the *Construction Code*, introduced by the *Regulation to amend the Construction Code* approved by the decree 961-2002 of August 21, 2002, applies and that is reserved exclusively for electrical contractors.

It also authorizes construction work relating to fixtures permanently connected to the electrical installation, if it is governed by Chapter V of the *Construction Code* and if it is not specifically governed by another subclass and construction work in subclasses 13.2 and 17.1.

Lastly, it authorizes related construction work.

Module 1 – DEFINITIONS AND TYPES OF SYSTEMS

Elements of competency covered in this module:

1. Define concepts and terms related to an electrical installation
2. Define and explain concepts and terms related to fire alarm systems
3. Describe the characteristics and operating principles of various fire alarm systems
4. Describe the characteristics of electrical equipment

Module 1 – DEFINITIONS AND TYPES OF SYSTEMS

Elements of competency	Skills required
1. Define concepts and terms related to an electrical installation	1.1. Define “low voltage” and “high voltage”
	1.2. Define “current,” “voltage,” “power,” “resistance,” “capacitance,” etc.
	1.3. Define concepts relating to demand factors permitted by the Code
	1.4. Define concepts relating to conductors, branches and feeders
	1.5. Define the concepts of “grounding” and “bonding”
	1.6. Define concepts relating to electrical installation (infrastructure)
	1.7. Define concepts relating to lighting systems
	1.8. Define concepts relating to electrical heating
	1.9. Define concepts relating to electrical equipment (motive power, etc.)
	1.10. Define terms associated with emergency power sources
	1.11. Explain the classification of circuits
	1.12. Explain the classification of hazardous locations
2. **Define and explain concepts and terms relating to instrumentation and control fire alarm systems**	2.1. Define “fire alarm system” and one-way or two-way (regular and emergency) “voice communication system”
	2.2. Define “central alarm and control station” for a high-rise building
	2.3. Define “visual signal device,” “audible signal device,” “manual fire alarm” and “annunciator”

Elements of competency	Skills required
	2.4. Define concepts and distinguish between different types of fire detectors, such as “smoke detectors,” “heat detectors” and “air duct smoke detectors”
	2.5. Define concepts and distinguish between “alarm signal,” “alert signal,” “supervisory signal” and “trouble signal”
	2.6. Define concepts and differentiate between different types of devices such as “transceivers,” “safety devices” and “monitoring devices”
	2.7. Explain the difference between a “smoke alarm” and a “smoke detector”
	2.8. Define concepts associated with the installation of a fire alarm system: power source, different types of circuits (class A circuit, class B circuit, input circuit, etc.)
	2.9. Identify the units of measurement associated with fire alarm systems (dBA, mm, m² and ºC)
3. **Describe the characteristics and operating principles of various fire alarm systems**	3.1. Define and explain the operation of the most common fire alarm system designs on the market (conventional (input and output circuits), addressable (data links) and semi-addressable (combination of input circuits and support devices))
	3.2. Explain the operating modes of fire alarm systems and their applications, as prescribed by *Chapter I – Building* of the *Québec Construction Code* (single signal and double signal, according to the type of occupancy)
	3.3. Explain the different types of voice communication systems, how they work and indicate their scope of application
	3.4. Describe the types of components in a fire alarm system (devices and control stations) and their characteristics (performance, etc.)

Elements of competency	Skills required
	3.5. Describe the types of cable prescribed by current regulations for installation of a fire alarm system and their scope of application based on the context (combustible, non-combustible and high-rise buildings)
	3.6. Describe the various approved cables for fire alarm system installation and specify their characteristics (FT-1 @ FT-4, FAS, etc.)
	3.7. Describe and identify the scope of application of the various signalling devices used in fire alarm systems
	3.8. Describe and explain the features of normal and emergency power sources to which fire alarm systems can be connected (distribution circuits, accumulators and generators)
	3.9. Name the types of "central alarm and control station" for high-rise buildings and describe their operation
4. **Describe the characteristics of electrical equipment**	4.1. Differentiate between conductors by name
	4.2. Distinguish between different types of connections (Triangle, Star, etc.) and networks
	4.3. Distinguish between different electrical boxes and equipment
	4.4. Identify protective device characteristics
	4.5. Distinguish between different types of transformers

Module 2 – LEGISLATIVE, NORMATIVE AND REGULATORY FRAMEWORK

Elements of competency covered in this module:

5. Situate electrical installation work with respect to current legislation and regulations
6. Situate electrical installation work with respect to the various codes and standards in force
7. Situate work related to fire alarm systems with respect to current regulations, codes and standards
8. Situate work related to instrumentation and control systems with respect to current regulations, codes and standards
9. Situate work related to other systems with respect to current regulations, codes and standards

Module 2 – LEGISLATIVE, NORMATIVE AND REGULATORY FRAMEWORK

Elements of competency	Skills required
5. Situate electrical installation work with respect to current legislation and regulations	5.1 Explain the regulations of the Building Act (R.S.Q. c B-1.1) that apply to electrical installation work
	5.2 Explain the roles and responsibilities of the designer and trade contractors regarding compliance of work with plans, specifications and standards (R.S.Q. c. B-1.1)
	5.3 Explain the scope of application of the *Master Electricians Act* (R.S.Q., c. M-3)
	5.4 Distinguish between “contractor” and “owner-builder”
	5.5 Explain the rights of the electrical guarantor for a builder-owner
	5.6 Determine workforce qualification requirements
	5.7 Explain when the Act respecting workforce vocational training and qualification (R.S.Q., c. F-5) applies
6. Situate electrical installation work with respect to the various codes and standards in force	6.1 Describe the links between the various codes and standards specific to electrical installation work and the *Québec Construction Code* (R.S.Q. c. B-1.1, r.0.01.01) (structure)
	6.2 Identify and define the parts and sections of the *Québec Construction Code* (R.S.Q. c. B- 1.1, r.0.01.01) that apply to electrical installation work
	6.3 Outline the scope of the various codes and standards applicable to electrical installation work (materials, building types, etc.)

Elements of competency	Skills required
	6.4 Identify the approval bodies that affix their marks to electrical products
	6.5 List the licences required for contractors and builder-owners who carry out electrical installation work, and name the organizations that issue them
7. Situate work related to fire alarm systems with respect to current regulations, codes and standards	7.1 Know how to recognize the organizations that affix their approval marks to fire alarm system components to guarantee compliance (ULC, CSA, ULc)
	7.2 Recognize the scope of *Chapter I – Building* of the *Québec Construction Code* in relation to fire alarm system installation work
	7.3 Master the principles of cross-referencing and/or referencing other regulations when a mention to this effect appears in the *Québec Construction Code, Chapter I – Building*. *(Canadian Electrical Code - Part I*,18th edition, CAN/ULC-S524, etc.)
	7.4 Identify the various standards applicable to work on fire alarm systems and indicate their scope (installation standards, such as CAN/ULC-S524, S537, S536)
8. Situate work related to instrumentation and control systems with respect to current regulations, codes and standards	8.1 Recognize the scope of *Chapter I – Building* of the *Québec Construction Code* with regard to work on instrumentation and control systems
	8.2 Recognize the scope of the *Canadian Electrical Code* with regard to work on instrumentation and control systems
	8.3 Recognize the scope of work performed by each licensee (master electricians, ventilation, refrigeration, lifts, controlled access, etc.)

Elements of competency	Skills required
	8.4 Name the organizations and/or programs that set standards in terms of instrumentation and control (ASHRAE, LEED, AQME, etc.)
9. Situate work related to other systems with respect to current regulations, codes and standards	9.1 Recognize the scope of *Chapter I – Building* of the *Québec Construction Code* in relation to work on other systems
	9.2 Recognize the scope of the *Canadian Electrical Code* in relation to work on other systems
	9.3 Recognize the scope of work performed by each licensee (master electricians, ventilation, refrigeration, lifts, controlled access, etc.)

Module 3 – READING PLANS AND SPECIFICATIONS

Elements of competency covered in this module:

10. Read and interpret electrical installation schematics and plans
11. Read and interpret fire alarm system schematics and plans
12. Read and interpret instrumentation and control system schematics and plans
13. Read and interpret schematics and plans referring to other systems (telephony, telecommunications, intrusion alarm, etc.)
14. Read and interpret the divisions of specifications associated with electrical installation
15. Read and interpret the divisions of specifications associated with fire alarm systems
16. Read and interpret the divisions of specifications associated with instrumentation and control systems
17. Read and interpret the divisions of specifications associated with other systems (telephony, telecommunications, intrusion alarm, etc.)
18. Adapt drawings and plans to reflect as-built work

Module 3 – READING PLANS AND SPECIFICATIONS

Elements of competency	Skills required	
10. Read and interpret electrical installation schematics and plans	10.1	Locate electrical installation elements on a plan
	10.2	Explain the meaning of the main symbols used in electrical installation schematics and plans
	10.3	Locate, read and interpret the main dimensions and annotations associated with electrical installations
	10.4	Locate, read and interpret details associated with electrical installations
	10.5	Read and interpret general notes and tables associated with electrical installations
	10.6	Prepare the quantity survey[1]
11. Read and interpret fire alarm system schematics and plans	11.1	Locate the different fire alarm system elements on a plan
	11.2	Explain the meaning of the main symbols used for schematics and plans for fire alarm systems
	11.3	Locate, read and interpret the main dimensions and annotations associated with fire alarm systems
	11.4	Locate, read and interpret details associated with fire alarm systems
	11.5	Read and interpret general notes and tables associated with fire alarm systems
	11.6	Prepare the quantity survey
12. Read and interpret diagrams and plans of	12.1	Locate the various components of instrumentation and control systems on a plan

Elements of competency	Skills required	
instrumentation and control systems	12.2	Explain the meaning of the main symbols used in diagrams and plans of instrumentation and control systems
	12.3	Locate, read and interpret the main dimensions and annotations associated with instrumentation and control systems
	12.4	Locate, read and interpret details associated with instrumentation and control systems
	12.5	Read and interpret general notes and tables associated with instrumentation and control systems
	12.6	Prepare the quantity survey
13. Read and interpret diagrams and plans referring to other systems (telephony, telecommunications, intruder alarms, etc.)	13.1	Locate the various elements referring to other systems on a plan
	13.2	Explain the meaning of the main symbols used in schematics and plans relating to other systems
	13.3	Locate, read and interpret the main dimensions and annotations associated with other systems
	13.4	Locate, read and interpret details associated with other systems
	13.5	Read and interpret general notes and tables associated with other systems
	13.6	Prepare the quantity survey
14. Read and interpret the divisions of specifications associated with electrical installation	14.1	Define the divisions and sections of specifications associated with electrical installation
	14.2	Interpret information associated with electrical wiring methods in specifications (section 016100)

Elements of competency	Skills required
	14.3 Interpret information associated with sources of electricity in specifications (section 016200)
	14.4 Interpret information associated with transmission and distribution networks in specifications (section 16300)
	14.5 Interpret information associated with low-voltage distribution networks in specifications (section 16400)
	14.6 Interpret information associated with lighting in specifications (section 16500)
15. Read and interpret the divisions of specifications associated with fire alarm systems	15.1 Identify the divisions and sections of specifications associated with fire alarm systems
	15.2 Interpret information associated with detection and alarm systems in specifications (13850)
16. Read and interpret the divisions of specifications associated with instrumentation and control systems	16.1 Define the divisions and sections of specifications associated with instrumentation and control systems
	16.2 Interpret information associated with building automation and control systems in specifications (13800)
17. Read and interpret divisions of specification associated with other systems (telephony, telecommunications, intruder alarms, etc.)	1.1 Define the divisions and sections of specifications associated with instrumentation and control systems
	1.2 Interpret information associated with communication, sound and video systems in specifications (sections 16700 and 16800)
18. Adapt drawings and plans to reflect as-built work	18.1 Identify the information required in an as-built drawing or plan
	18.2 Adapt basic drawings and plans to reflect as-built work

Elements of competency	Skills required
	18.3 Explain the approval process for as-built plans and drawings
	18.4 Ensure that as-built plans and drawings comply with appropriate standards

Module 4 – STANDARDS AND EXECUTION OF WORK

Elements of competency covered in this module:

19. Manage the execution of electrical connection work
20. Manage the execution of work on electrical installations (infrastructure)
21. Manage the execution of lighting system installation work
22. Manage the execution of work specific to an electric heating system
23. Manage the execution of work specific to electrical equipment
24. Manage the execution of work specific to emergency electrical power sources
25. Ensure quality control of electrical installation work
26. Ensure health and safety on work sites involving electrical installation work

Module 4 – STANDARDS AND EXECUTION OF WORK

Elements of competency	Skills required	
19. Manage the execution of electrical connection work Section 6 of *Chapter V – Electricity* of the *Québec Construction Code* Section 36 of *Chapter V – Electricity* of the *Québec Construction Code*	19.1	Know the scope of Section 6 of *Chapter V – Electricity* of the *Québec Construction Code*
	19.2	Explain the requirements for securing overhead service entrance conductors
	19.3	Describe the requirements for terminating service entrance conductors
	19.4	Describe the requirements for switchgear and protective equipment
	19.5	Determine wiring requirements for overhead and underground service lines
	19.6	Explain installation requirements for meters and transformers
	19.7	Explain the requirements for installing switchgear, control and protection devices for high-voltage installations
	19.8	Name the steps involved in connecting electrical installations, depending on the situation
20. Manage the execution of electrical connection work Sections 4, 8, 10, 12, 14, 26 and 36 of *Chapter V – Electricity* of the *Québec Construction Code*	20.1	Determine the “demand factor” of an installation according to building type
	20.2	Specify the voltage drop requirements for an installation
	20.3	Determine the maximum loads permitted in a service entrance, feeder or branch, depending on the situation
	20.4	Determine the minimum permissible current in a service entrance, feeder or branch, depending on the situation
	20.5	Explain grounding and bonding requirements

Elements of competency	Skills required
	20.6 Explain grounding and bonding methods in low-voltage installations
	20.7 Explain grounding and bonding methods for high-voltage installations
	20.8 Explain the appropriate wiring methods for a low-voltage installation depending on the situation
	20.9 Specify pipework requirements and specifications
	20.10 Determine the maximum number of conductors allowed in pipelines
	20.11 Determine the type of fitting required depending on the situation
	20.12 Explain installation requirements for boxes, enclosures and outlets
	20.13 Calculate box fill volume
	20.14 Explain the wiring methods for a high-voltage installation depending on the situation
	20.15 Apply the requirements concerning overcurrent protection
	20.16 Identify situations requiring ground fault protection
	20.17 Distinguish between the use of different protective devices
	20.18 Explain installation requirements for control devices
	20.19 List the protective devices required in a high-voltage installation

Elements of competency	Skills required	
	20.20	Explain the requirements for installing control devices in high-voltage installations
	20.21	Name the requirements for installing electrical outlets in a given situation
	20.22	Describe the requirements for installing a transformer
	20.23	Determine the required wiring size for feeding transformers
	20.24	Name the requirements concerning transformer protection
	20.25	Explain methods of grounding and bonding transformers
	20.26	Describe the requirements for installing capacitors
	20.27	Determine the size of the conductors feeding the capacitors
	20.28	Name the requirements for capacitor overcurrent protection
	20.29	Explain grounding methods for capacitors by bonding
21. Manage the execution of lighting system installation work Sections 4, 8, 30 and 34 of *Chapter V – Electricity* of the *Québec Construction Code*	21.1	Explain the installation requirements for lighting equipment
	21.2	Describe wiring methods for lighting fixtures according to the situation
	21.3	Name the requirements for electric discharge lighting installations
	21.4	List the conditions under which recessed light fixtures can be installed
	21.5	Name the requirements for installing outdoor lighting systems

Elements of competency	Skills required	
	21.6	Explain installation features specific to sign and contour lighting systems
22. Manage the execution of work specific to an electric heating system Section 62 of *Chapter V – Electricity* of the *Québec Construction Code*	22.1	Calculate the heating demand factor according to the situation
	22.2	Explain the wiring method according to the type of heating appliance to be installed
	22.3	List overcurrent protection requirements for electric heaters
23. Manage the execution of work specific to electrical equipment Sections 4, 38, 40 and 42 of *Chapter V – Electricity* of the *Québec Construction Code*	23.1	Calculate the demand factor for switchgear according to the situation
	23.2	Determine the nominal size of the conductors supplying a building's electrical equipment
	23.3	Name the wiring methods specific to each type of electrical equipment
	23.4	List the overcurrent protection requirements specific to each type of switchgear
	23.5	Describe methods of grounding and bonding electrical equipment
	23.6	Describe the control requirements specific to each type of motor or switchgear
24. Manage the execution of work specific to emergency electrical power sources Sections 28 and 46 of *Chapter V – Electricity* of the *Québec Construction Code*	24.1	Describe wiring methods specific to emergency power sources
	24.2	Name the materials permitted for electrical wiring (3.1.5.17, 3.1.5.18, and 3.1.5.19)
	24.3	List the characteristics of areas where emergency lighting is required (3.2.7.3 and 9.9.11.3)

Elements of competency	Skills required
	24.4 List the characteristics of emergency power sources for lighting (3.2.7.4)
	24.5 List the characteristics of emergency power sources for technical installations (3.2.7.9)
	24.6 Verify compliance with plans and standards by using the code applicable to electrical installation
25. Ensure quality control of electrical installation work	25.1 Determine the tests and trials to be carried out on materials used in electrical installation work
	25.2 Solve problems in the execution of electrical installation work (solutions, schedule, etc.)
26. Ensure health and safety on work sites involving electrical installation work	26.1 Ensure application of lock-out procedures
	26.2 Ensure compliance with the *Safety Code* (R.S.Q., c. B-1.1, r.0.01.01.1)
	26.3 Ensure the use of appropriate tools during work