



TECHNICAL SAFETY BC

Safe technical systems. Everywhere.

CLASS B EXAM SYLLABUS

Gasfitter Class B Certificate of Qualification

Gas Safety Management
October 2018



Syllabus for the Class B Gas Fitter Certificate Examination

1. PREREQUISITES TO CHALLENGE THE CLASS B GAS FITTER CERTIFICATE OF QUALIFICATION EXAMINATION

An applicant for a class B gas fitter's certificate of qualification must meet the requirements of the *Safety Standards Act*, *Safety Standards General Regulation* and *Gas Safety Regulation*, and must:

- be the holder of an industry training credential in plumbing, steamfitting, refrigeration or sprinkler fitting,
- be a trainee in a gas fitting program recognized by a provincial safety manager,
- have held a gas utility certificate of qualification for at least 2 years, or
- have an equivalent combination of experience and training acceptable to a provincial safety manager and have attained the standing acceptable to a provincial safety manager in a gas fitting course and examination that have been approved by a provincial safety manager.

2. SCOPE OF THE CLASS B GAS FITTER CERTIFICATE OF QUALIFICATION

A class B gas fitter certificate of qualification entitles the holder to perform the installation or alteration of the following gas systems under an appropriate permit:

- an appliance with an input of 120 kW or less that displays a label or mark as follows:
 - a certification mark;
 - an approval mark issued under section 10 of the Act;
- piping and vents.

3. SUBJECT AREAS OF STUDY

Percentage (%) on Exam

3.1 APPLY TRADE KNOWLEDGE

18%

3.1.1 Codes, Regulations and Standards

- a. Utilize the CSA B149.1, Natural gas and propane installation code
- b. Apply the Safety Standards Act
- c. Apply the Safety Standards General Regulation
- d. Apply the Gas Safety Regulation
- e. Describe Safety Orders, Directives and Bulletins





- f. Utilize the CSA B149.2, Propane storage and handling code

3.1.2 Manufacturer and Supplier Documentation

- a. Describe documentation types
- b. List the information contained in manufacturer and supplier documentation
- c. Source manufacturer's documentation
- d. Use commissioning documentation for high efficiency furnaces and condensing boilers

3.1.3 Combustion Theory & Measuring Equipment

- a. Identify and describe the properties of natural gas and propane
- b. List the types of combustion analyzers
- c. Perform flue gas analysis
- d. Determine flue gas composition and efficiencies
- e. Apply combustion formulas

3.2 APPLY ELECTRICAL CONCEPTS

15%

3.2.1 Principles of Electricity and Electronics

- a. Analyze heating circuits for appliances with inputs that do not exceed 120 kW
- b. Use residential heating system wiring diagrams
- c. Describe types of circuits such as series, parallel and series-parallel
- d. Describe the sequence of operation for residential furnaces and hydronic heating systems
- e. Create a control narrative from a wiring diagram for a commercial hydronic system when the input does not exceed 120 kW

3.2.2 Canadian Electrical Code (CEC) and Regulations

- a. Utilize the CEC Part 1; Sections 0,2,4,8,10,12,14,16,26,28 Appendix B & D
- b. Apply the Electrical Safety Regulation

3.2.3 Single Phase Motor Theory

- a. List the types of single phase motors
- b. Describe the operation of a single phase motor
- c. Explain motor protection methods
- d. Describe the principles of operation for starter relays, capacitors and motor protectors in a single phase motor
- e. List the mechanical and electrical checks for a single phase motor





- f. Identify the causes of motor failure for single phase motors

3.2.4 Variable Frequency Drive (VFD) & Electronically Commutated Motor (ECM) Technology

- a. Describe VFD's and their application
- b. Describe the operation of a VFD and its protection and limitations
- c. Describe ECM's and their application
- d. Describe the operation of an ECM
- e. Adjust a VFD to manufacturer and system requirements
- f. Adjust an ECM to manufacturer and system requirements

3.2.5 Troubleshooting

- a. List common electrical faults
- b. Interpret electrical readings
- c. Troubleshoot residential heating system electrical circuits

3.3 APPLY CONTROLS AND INSTRUMENTATION TECHNOLOGY

15%

3.3.1 Communication and Networking Technology

- a. Identify wireless networks such as; Wi-Fi, ZigBee and Z-Wave for residential heating systems
- b. Identify basic network protocols for residential heating systems such as; HTTP, BACnet and ARP
- c. Describe types of cable connectors

3.3.2 Automation and Instrumentation Control Systems

- a. Describe the installation and operation of outdoor reset controls
- b. Describe multi-boiler hydronic heating system components.

3.3.3 Combustion Controls

- a. List the types of proportional mixers found on appliances with a maximum input of 120 kW
- b. Identify the setup requirements for combustion controls such as; fuel-air ratios and pressure

3.3.4 Flame Safeguards

- a. List the flame detector types and their application
- b. List the ignition system types and their application
- c. Describe flame safeguard systems and their sequence of operation
- d. Select flame safeguard system components





3.3.5 Safety and Operating Controls

- a. Describe the types of switches found on appliances with a maximum input of 120 kW including limits and interlocks
- b. List the types of switches and loads found on combustion safety circuits
- c. List the types of switches and loads found on operating control circuits
- d. Describe the installation and adjustment of operating controls found on residential appliances including furnaces, boilers, domestic water heaters, cooking equipment and fireplaces
- e. Explain relays and their operation
- f. Describe the installation and adjustment of operating controls found on appliances with a maximum input of 120 kW
- g. Install and setup a programmable thermostat

3.3.6 Mechanical Safety Devices

- a. Describe the types of mechanical safety devices such as; pressure relief, temperature relief, vacuum relief and safety valves
- b. Describe the application and installation of mechanical safety devices

3.4 INSTALL FUEL SYSTEMS

16%

3.4.1 Piping, Tubing and Components for Fuel Systems

- a. Identify the types of piping, tubing and hose permitted by the CSA B149.1 and B149.2 codes
- b. Design a gas piping or tubing installation utilizing the CSA B149.1 code
- c. List the types of manual and automatic valves and their installation requirements
- d. Describe the types of valve actuators
- e. Size piping and tubing systems
- f. Describe the sizing and installation of Corrugated Stainless Steel Tubing (CSST).

3.4.2 Gas Metering Devices

- a. List the types of gas meters
- b. Describe the operation of diaphragm and rotary gas meters
- c. Clock a gas meter to determine appliance input
- d. Interpret gas meter readings

3.4.3 Regulators

- a. Describe the purpose and operation of gas pressure regulators found in residential, commercial and institutional installations





- b. Adjust gas pressure regulators to manufacturer and system requirements
- c. State the manufacturer, code and regulatory installation requirements for gas pressure regulators
- d. Size regulators based on manufacturer's documentation and system requirements
- e. Commission a line pressure regulator

3.4.4 Propane Storage and Handling Systems

- a. Describe the types propane storage systems used to supply gas to residential and commercial appliances
- b. Describe cylinder/tank equipment and valves
- c. Select and confirm tanks and cylinders according to criteria such as storage capacity, Btuh load, design ambient temperature and certification
- d. Determine system components required
- e. Describe the "General requirements for propane and propane equipment" according to the CSA B149.2 code
- f. Describe the installation requirements for propane cylinder/tank storage systems as permitted by the CSA B149.1 and B149.2 codes
- g. Place and secure tanks and cylinders according to site and code requirements
- h. Place vehicle protection barricades in designated space according to code requirements

3.5 INSTALL VENTING AND AIR SUPPLY

8%

3.5.1 Venting Systems

- a. List the types and classification of venting material permitted for gas-fired appliances
- b. Design the installation of a venting system in accordance with the CSA B149.1 code
- c. Size category I venting systems
- d. Describe how type BH venting systems are sized

3.5.2 Air Supply Systems

- a. Describe the installation requirements for air supply systems according to the CSA B149.1 code
- b. Size passive air supply systems
- c. Describe the installation considerations for mechanical air supply systems





3.5.3 Draft Control Systems

- a. List the types of draft controls found on appliances with a maximum input of 120 kW
- b. Apply the CSA B149.1 code to the installation of draft control devices
- c. Explain the process to commission a barometric damper

3.5.4 Venting and Air Supply Principles

- a. Define the building as a system.
- b. Describe draft and how it is created
- c. List combustion air supply methods

3.6 INSTALL GAS-FIRED AND ALTERNATE FUEL EQUIPMENT 8%

3.6.1 Burners

- a. Describe types of burners such as atmospheric, mechanical, pre-mix, nozzle mix and low NOx
- b. Explain the operation of an atmospheric burner
- c. Size burner orifices
- d. Identify the installation requirements for atmospheric and mechanical burners

3.6.2 Appliances

- a. List the types of appliances found in residential, commercial and institutional facilities
- b. Plan the installation of gas fired appliances rated at 120 kW or less

3.6.3 Control Processes and Systems

- a. Determine hydronic heating system flow requirements
- b. Balance hydronic heating and forced air space heating systems
- c. Identify required return water temperatures
- d. Describe the application for mixing valves
- e. Determine supply water temperatures for residential hydronic heating systems
- f. Describe residential hydronic heat transfer units

3.6.4 Fuel Train Systems

- a. Explain the operation of gas valve trains for appliances rated at 120 kW or less





3.6.5 Alternate Fuel Appliances

- a. Describe the installation of dual-fuel appliances such as; oil-gas and propane-air mixes

3.6.6 Direct-Fired Make-Up Air

- a. Describe direct-fired make-up air systems
- b. List the sequence of operation for a direct-fired make-up air unit

3.7 TEST AND COMMISSION GAS-FIRED SYSTEMS

11%

3.7.1 Commissioning Fuel Delivery Systems

- a. List the testing procedures required for a gas piping system
- b. Identify the purging procedures for pipe under 4 inch diameter.
- c. State the purging procedures for pipe 4 inch diameter and larger

3.7.2 Start-Up Procedures

- a. List the factors to consider when starting up a system

3.7.3 Commissioning Gas-Fired and Alternate Fuel Systems

- a. Determine the commissioning requirements for gas fired appliances
- b. Commission a storage type water heater with a standing pilot and atmospheric burner
- c. Commission a high efficiency furnace
- d. Commission a condensing boiler

3.7.4 Convert Appliance Fuel Sources

- a. Detail the procedures to convert an appliance from propane to natural gas
- b. Detail the procedures to convert an appliance from natural gas to propane
- c. Detail the procedures to convert an appliance from oil to natural gas
- d. Detail the procedures to convert an appliance from oil to propane

3.7.5 Commissioning Report and Handover

- a. List the commissioning documentation required prior to appliance handover





3.8 SERVICE GAS-FIRED AND ALTERNATE FUEL SYSTEMS

8%

3.8.1 Gas Distribution Systems

- a. Inspect fuel delivery components
- b. Measure and record inlet and outlet pressures to ensure they are within manufacturers' specifications and code
- c. Identify damaged or defective components
- d. Check for leaks using electronic leak detectors and leak detection solutions
- e. Determine the procedures to repair a damaged gas distribution system including testing
- f. List the process to purge and re-gasify the system

3.8.2 Fuel Train Systems

- a. Perform the inspection of fuel train system such as; visual, electrical parameters, tightness of closure, regulator lockup and manifold pressure
- b. List items to consider when making a repair, such as; isolation, removing faulty components and returning to service

3.8.3 Burners

- a. Describe the procedures for servicing gas burners.
- b. Perform pilot turndown test to confirm smooth lighting of burners
- c. Inspect burner performance using a combustion test analyzer to verify air gas mix, combustion air volume, CO levels and stack temperature
- d. Clean and adjust burners

3.8.4 Regulators

- a. List items to consider when performing the inspection of a regulator, such as; static and operating inlet and outlet pressures and venting system operation
- b. List the procedures for repairing regulator such as; isolation, replacing components and confirming operation
- c. Service a regulator that is damaged or is not meeting system performance requirements

3.8.5 Appliances

- a. Describe the maintenance of gas-fired appliances with a maximum input of 120 kW
- b. Describe documentation such as maintenance reports, check sheets, log books and operating permits





- c. Describe sequence of operation to assist with troubleshooting
- d. Inspect venting, chimneys and air supply
- e. Inspect mechanical components such as switches, valves, dampers, fans, motors and air differential proving switches
- f. Check operation of flame detection system
- g. Check and measure spark electrode and gaps to ensure that it is set to manufacturers' specifications
- h. Test safety limits such as high limit, high and low water cut-offs, flow switches and high and low gas pressure switches to verify operation
- i. Verify condensate lines are clean and clear of debris
- j. Replace components such as belts, flame rods, filters and gaskets according to maintenance schedule
- k. Document repairs
- l. Monitor equipment performance to identify faults or erratic operation
- m. Select and use diagnostic tools such as manometers, draft gauges, combustion analyzers, multimeters and ammeters
- n. Verify replacement parts meet manufacturer's requirements and operate according to specifications
- o. Lock-out and tag-out system by isolating energy sources
- p. Remove and reassemble protective covers, shields and other components to access repair area

3.8.6 Ancillary Equipment

- a. Describe the servicing of ancillary equipment for residential heating boilers such as; pumps, zone valves, mixing valves, expansion tanks and pressure reducing valves

3.8.7 Propane Systems

- a. List the items that would require the repair or replacement of propane cylinders and tanks





3.8.8 Decommission Gas-Fired and Alternate Fuel Systems

- a. Lock-out and tag-out system by isolating energy sources
- b. Disconnect and terminate control wires and tubing
- c. Isolate, purge and cap gas supply according to gas code requirements
- d. Isolate and terminate electrical supply according to CEC requirements
- e. Remove and cap venting system
- f. Remove and cap distribution system such as piping and ductwork
- g. Isolate accessories from system and remove energy source to disable function
- h. Check for leaks to ensure that systems are safe
- i. Dispose of and recycle selected materials according to environmental acts, regulations and best practices

