PROGRAM OUTLINE

Domestic/Commercial Gasfitter B
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www.itabc.ca

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DOMESTIC/COMMERCIAL GASFITTER B
PROGRAM OUTLINE

APPROVED BY INDUSTRY
2012

Developed by
Industry Training Authority
Province of British Columbia
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Section 1
INTRODUCTION
Domestic/Commercial Gasfitter B
Foreword

The revised Domestic/Commercial Gasfitter B Program Outline is intended as a guide for instructors, apprentices, and employers of apprentices as well as for the use of industry organizations, regulatory bodies, and provincial and federal governments. It reflects updated standards based on British Columbia industry and instructor subject matter experts.

Practical instruction by demonstration and student participation should be integrated with classroom sessions. Safe working practices, even though not always specified in each operation or topic, are an implied part of the program and should be stressed throughout the apprenticeship.

The Program Outline includes the minimum shop requirements needed to support instructors.

The Program Outline was prepared with the advice and assistance of the Domestic/Commercial Gasfitter B Review Committee and will form the basis for further updating of the British Columbia Domestic/Commercial Gasfitter B Program and learning resources by the Construction Industry Training Organization (CITO) on behalf of the Industry Training Authority (ITA).

Each competency is to be evaluated through the use of written examination. The individual must achieve a minimum final grade of 70% in order to be successful in each level. The types of questions used on these exams must reflect the cognitive level indicated by the learning objectives and the learning tasks listed in the related competencies.

Achievement Criteria are included for those competencies that require a practical component. The intent of including Achievement Criteria in the Program Outline is to ensure consistency in training across training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the individual’s ability to apply the theory to practice. It is important that these performances be observable and measureable and that they reflect the skills spelled out in the competency as those required as competent journeyperson. The conditions under which these performances will be observed and measured must be clear to the individual as well as the criteria by which the individual will be evaluated. The individual must also be given the level of expectation of success.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

SAFETY ADVISORY

Be advised that references to the WorkSafe BC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation (the current Standards and Regulation in BC can be obtained on the following website: http://www.worksafebc.com). Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.
Introduction

Acknowledgements

The Program Outline was prepared with the advice and direction of an industry steering committee convened initially by the Construction Industry Training Organization (CITO). Members include:

- Rob Bradbury
- Gary Eamor
- Jamie Good
- Sedwend Sandhu
- Gord Schlechtleipner
- Brian Sweet
- Larry Wear
- Brian Zinn

Industry Subject Matter Experts retained to assist in the development of Program Outline content:

- Rick Vanier
- Rob Bradbury
- Brian Sweet
- Gary Eamor

The Industry Training Authority would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the training requirements of the Gasfitter occupation.
This Program Outline has been developed for the use of individuals from several different audiences. The table below describes how each section can be used by each intended audience.

<table>
<thead>
<tr>
<th>Section</th>
<th>Training Providers</th>
<th>Employers/ Sponsors</th>
<th>Apprentices</th>
<th>Challengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Credentialing Model</td>
<td>Communicate program length and structure, and all pathways to completion</td>
<td>Understand the length and structure of the program</td>
<td>Understand the length and structure of the program, and pathway to completion</td>
<td>Understand challenger pathway to Certificate of Qualification</td>
</tr>
<tr>
<td>OAC</td>
<td>Communicate the competencies that industry has defined as representing the scope of the occupation</td>
<td>Understand the competencies that an apprentice is expected to demonstrate in order to achieve certification</td>
<td>View the competencies they will achieve as a result of program completion</td>
<td>Understand the competencies they must demonstrate in order to challenge the program</td>
</tr>
<tr>
<td>Training Topics and Suggested Time Allocation</td>
<td>Shows proportionate representation of general areas of competency (GACs) at each program level, the suggested proportion of time spent on each GAC, and percentage of time spent on theory versus practical application</td>
<td>Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application</td>
<td>Understand the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application</td>
<td>Understand the relative weightings of various competencies of the occupation on which assessment is based</td>
</tr>
<tr>
<td>Program Content</td>
<td>Defines the objectives, learning tasks, high level content that must be covered for each competency, as well as defining observable, measurable achievement criteria for objectives with a practical component</td>
<td>Identifies detailed program content and performance expectations for competencies with a practical component; may be used as a checklist prior to signing a recommendation for certification (RFC) for an apprentice</td>
<td>Provides detailed information on program content and performance expectations for demonstrating competency</td>
<td>Allows individual to check program content areas against their own knowledge and performance expectations against their own skill levels</td>
</tr>
</tbody>
</table>
### Introduction

<table>
<thead>
<tr>
<th>Section</th>
<th>Training Providers</th>
<th>Employers/ Sponsors</th>
<th>Apprentices</th>
<th>Challengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training Provider Standards</td>
<td>Defines the facility requirements, tools and equipment, reference materials (if any) and instructor requirements for the program</td>
<td>Identifies the tools and equipment an apprentice is expected to have access to; which are supplied by the training provider and which the student is expected to own</td>
<td>Provides information on the training facility, tools and equipment provided by the school and the student, reference materials they may be expected to acquire, and minimum qualification levels of program instructors</td>
<td>Identifies the tools and equipment a tradesperson is expected to be competent in using or operating; which may be used or provided in a practical assessment</td>
</tr>
</tbody>
</table>
Section 2

PROGRAM OVERVIEW

Domestic/Commercial Gasfitter B
CROSS-PROGRAM CREDITS

Individuals who hold the credentials listed below are entitled to receive partial credit toward the completion requirements of this program

None
**Program Overview**

**Occupational Analysis Chart**

**DOMESTIC/COMMERCIAL GASFITTER B**

**Occupation Description:** “Domestic/Commercial Gasfitter” means a person who installs, tests, maintains and repairs propane and/or natural gas lines, appliances, equipment and accessories in residential and commercial premises.

<table>
<thead>
<tr>
<th>USE SAFE WORK PRACTICES</th>
<th>Control Workplace Hazards</th>
<th>Use Information in the OHS Regulation and WCB Standards</th>
<th>Use WHMIS</th>
<th>Use Personal Protective Equipment</th>
<th>Practice Fire Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A1</td>
<td>A2</td>
<td>A3</td>
<td>A4</td>
<td>A5</td>
</tr>
<tr>
<td>1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>USE TOOLS AND EQUIPMENT</th>
<th>Use Hand Tools</th>
<th>Use Portable Power Tools</th>
<th>Use Stationary Power Tools</th>
<th>Use Pressure Measuring Equipment</th>
<th>Use Oxy Acetylene Equipment</th>
<th>Use Ladders and Platforms</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>B1</td>
<td>B2</td>
<td>B3</td>
<td>B4</td>
<td>B5</td>
<td>B6</td>
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</table>

<table>
<thead>
<tr>
<th>ORGANIZE WORK</th>
<th>Use Mathematics and Science</th>
<th>Use Drawings and Specifications</th>
<th>Use Codes, Regulations and Standards</th>
<th>Use Manufacturer and Supplier Documentation</th>
<th>Plan a Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>C1</td>
<td>C2</td>
<td>C3</td>
<td>C4</td>
<td>C5</td>
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<tr>
<td></td>
<td>1</td>
<td>1, 2</td>
<td>1, 2</td>
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<td>2</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>INSTALL AND SERVICE FUEL SYSTEMS</th>
<th>Describe the Gas Delivery System</th>
<th>Install Piping and Tubing Systems</th>
<th>Describe and Interpret Gas Meters</th>
<th>Install and Service Regulators</th>
<th>Install and Service Propane Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>D1</td>
<td>D2</td>
<td>D3</td>
<td>D4</td>
<td>D5</td>
</tr>
<tr>
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<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1, 2</td>
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<tr>
<td>Program Overview</td>
<td></td>
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<tr>
<td><strong>INSTALL VENTING AND AIR SUPPLY</strong></td>
<td></td>
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<tr>
<td><strong>E</strong></td>
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<td></td>
</tr>
<tr>
<td>Install Venting Systems</td>
<td>Install Air Supply Systems</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>E1</td>
<td>E2</td>
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<tr>
<td>2</td>
<td>2</td>
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<td></td>
</tr>
<tr>
<td><strong>INSTALL AND SERVICE GAS EQUIPMENT</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>F</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Install and Service Burners</td>
<td>Install and Service Appliances</td>
<td>Perform Combustion Analysis</td>
<td>Describe Heating and Cooling Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>F2</td>
<td>F3</td>
<td>F4</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>INSTALL AND SERVICE CONTROLS AND SAFEGUARDS</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>G</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use the Principles of Electricity and Electronics</td>
<td>Use the Principles of Gas Controls</td>
<td>Install and Service Gas Controls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1</td>
<td>G2</td>
<td>G3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2</td>
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<td></td>
</tr>
</tbody>
</table>
## Training Topics and Suggested Time Allocation

### Domestic/Commercial Gasfitter B – Level 1

<table>
<thead>
<tr>
<th>Line</th>
<th>Topic</th>
<th>% of Time</th>
<th>Theory</th>
<th>Practical</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>Use Safe Work Practices</td>
<td>7%</td>
<td>90%</td>
<td>10%</td>
<td>100%</td>
</tr>
<tr>
<td>A1</td>
<td>Control Workplace Hazards</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>Use Information in the OHS Regulation and WCB Standards</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3</td>
<td>Use WHMIS</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>Use Personal Protective Equipment</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>Practice Fire Prevention</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>Use Tools and Equipment</td>
<td>27%</td>
<td>55%</td>
<td>45%</td>
<td>100%</td>
</tr>
<tr>
<td>B1</td>
<td>Use Hand Tools</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>Use Portable Power Tools</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>Use Stationary Power Tools</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>Use Pressure Measuring Equipment</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B5</td>
<td>Use Oxy Acetylene Equipment</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B6</td>
<td>Use Ladders and Platforms</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7</td>
<td>Use Rigging and Hoisting Equipment</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>Organize Work</td>
<td>47%</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>C1</td>
<td>Use Mathematics and Science</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>Use Drawings and Specifications</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>Use Codes, Regulations and Standards</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>Use Manufacturer and Supplier Documentation</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>D</strong></td>
<td>Install and Service Fuel Systems</td>
<td>19%</td>
<td>95%</td>
<td>5%</td>
<td>100%</td>
</tr>
<tr>
<td>D1</td>
<td>Describe the Gas Delivery System</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2</td>
<td>Install Piping and Tubing Systems</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D5</td>
<td>Install and Service Propane Systems</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Total Percentage for Domestic/Commercial Gasfitter B Level 1

| | 100% |

The composite level mark is to consist of 63% theory and 37% practical. The final exam will count for 20% of the theory mark.
### Training Topics and Suggested Time Allocation

**Domestic/Commercial Gasfitter B – Level 2**

<table>
<thead>
<tr>
<th>Line</th>
<th>Topic</th>
<th>% of Time</th>
<th>Theory</th>
<th>Practical</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td><strong>Organize Work</strong></td>
<td>18%</td>
<td>80%</td>
<td>20%</td>
<td>100%</td>
</tr>
<tr>
<td>C2</td>
<td>Use Drawings and Specifications</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>Use Codes, Regulations and Standards</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>Plan a Project</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td><strong>Install and Service Fuel Systems</strong></td>
<td>12%</td>
<td>92%</td>
<td>8%</td>
<td>100%</td>
</tr>
<tr>
<td>D1</td>
<td>Describe the Gas Delivery System</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D3</td>
<td>Describe and Interpret Gas Meters</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>D4</td>
<td>Install and Service Regulators</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>D5</td>
<td>Install and Service Propane Systems</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td><strong>Install Venting and Air Supply</strong></td>
<td>17%</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>E1</td>
<td>Install Venting Systems</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>Install Air Supply Systems</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td><strong>Install and Service Gas Equipment</strong></td>
<td>37%</td>
<td>80%</td>
<td>20%</td>
<td>100%</td>
</tr>
<tr>
<td>F1</td>
<td>Install and Service Burners</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>Install and Service Appliances</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td>Perform Combustion Analysis</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F4</td>
<td>Describe Heating and Cooling Systems</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td><strong>Install and Service Controls and Safeguards</strong></td>
<td>16%</td>
<td>90%</td>
<td>10%</td>
<td>100%</td>
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<tr>
<td>G1</td>
<td>Use the Principles of Electricity and Electronics</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td>G2</td>
<td>Use the Principles of Gas Controls</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G3</td>
<td>Install and Service Gas Controls</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

**Total Percentage for Domestic/Commercial Gasfitter B Level 2** 100%

The composite level mark is to consist of 80% theory and 20% practical. The final exam will count for 30% of the theory mark.
Section 3

PROGRAM CONTENT

Domestic/Commercial Gasfitter B
Level 1

Domestic/Commercial Gasfitter B
Line (GAC): A USE SAFE WORK PRACTICES
Competency: A1 Control Workplace Hazards

Objectives
To be competent in this area, the individual must be able to:
- Describe workplace hazards.
- Manage workplace hazards.
- Demonstrate emergency procedures.
- Describe non-emergency injury reporting procedures.
- Describe how worksite safety policies are established.

<table>
<thead>
<tr>
<th>LEARNING TASKS</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Describe the short term hazards in the gas fitting industry</td>
<td>• Excavations</td>
</tr>
<tr>
<td></td>
<td>• Working around heavy equipment</td>
</tr>
<tr>
<td></td>
<td>• Sharp objects</td>
</tr>
<tr>
<td></td>
<td>• Ladders</td>
</tr>
<tr>
<td></td>
<td>• Work platforms</td>
</tr>
<tr>
<td></td>
<td>• Confined space</td>
</tr>
<tr>
<td></td>
<td>• Electrical</td>
</tr>
<tr>
<td></td>
<td>• Lockout procedures</td>
</tr>
<tr>
<td></td>
<td>• Compressed gas</td>
</tr>
<tr>
<td></td>
<td>• Explosive material (dust)</td>
</tr>
<tr>
<td></td>
<td>• Lifting</td>
</tr>
<tr>
<td></td>
<td>• Procedures</td>
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<tr>
<td></td>
<td>• Personal apparel</td>
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<tr>
<td></td>
<td>• Clothing</td>
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<td></td>
<td>• Health and beards</td>
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<tr>
<td></td>
<td>• Jewellery</td>
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<tr>
<td></td>
<td>• Housekeeping</td>
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<td></td>
<td>• Horseplay</td>
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<tr>
<td></td>
<td>• Respect for others safety</td>
</tr>
<tr>
<td></td>
<td>• Constant awareness of surroundings</td>
</tr>
<tr>
<td></td>
<td>• Safe attitude</td>
</tr>
<tr>
<td></td>
<td>• Management of hazards</td>
</tr>
<tr>
<td>2. Describe the long term hazards in the gas fitting industry</td>
<td>• Respiratory disease</td>
</tr>
<tr>
<td></td>
<td>• Repetitive strain injuries</td>
</tr>
<tr>
<td></td>
<td>• Management of hazards</td>
</tr>
</tbody>
</table>
3. Describe the safety precautions required when working at elevations
   - Wind
   - Floor openings
   - Guard rails
   - Safety lines
   - Weather
   - Stressed cables

4. Describe emergency procedures
   - Emergency shutoffs
   - Fire control systems
   - Eye wash facilities
   - Emergency exits
   - Emergency contact/phone numbers
   - Outside meeting place
   - Disaster meeting place

5. Describe non-emergency injury reporting procedures
   - First aid facilities
   - Reports

6. Describe how a workplace safety policy is established
   - Process
     - Hazard assessment
     - Conditions
     - Meeting requirements
       - Tool box
     - Reporting hazards and incidents
     - Reporting injuries
     - Investigations
     - Committees
     - Employee orientation
     - First-aid
     - Hearing
     - Records and statistics
     - Lock-out
     - Non-compliance procedures
   - Minimum standards
     - Act and Regulations
7. Describe lock-out and tag-out procedures
   - Understanding of system operation
   - Components requiring lock-out
   - Identification requirements
   - Situations where lock-out is required
   - Lock-out equipment
     - Chains
     - Tags
     - Locks
   - Fabrication of isolation devices
     - Blind flanges
     - Spades

Achievement Criteria

Performance  The learner will lock-out mechanical and electrical equipment.

Conditions   The learner will be given:
   - Single and multiple lock-out equipment
   - Motor control centre
   - Disconnect
   - Valve

Criteria     The learner will score 70% or better on a rating sheet that reflects the following criteria:
   - Safety
   - Proper procedure used
   - Sequence
   - Confirmation of lockout
Line (GAC): A USE SAFE WORK PRACTICES
Competency: A2 Use Information in the OHS Regulation and WCB Standards

Objectives
To be competent in this area, the individual must be able to:
• Use the parts of the Occupational Health and Safety Regulation that apply to the Gas Fitting Worker’s workplace.

LEARNING TASKS
1. Use terms used in the Workers Compensation Act
2. Describe the general duties of employers, employees and others
3. Describe the Workers Compensation Act requirements for the reporting of accidents
4. Describe the “Core Requirements” of the Occupational Health and Safety Regulation

CONTENT
• Definitions
• Part 2, Division 3, Sections 115-124 of the Act
• Part 1, Division 5 Sections 53 and 54 of the Act
• Definitions
• Application
• Rights and Responsibilities
  • Health and safety programs
  • Young worker orientation
  • Contractor’s safety policy manuals
  • Investigations and reports
  • Workplace inspections
  • Right to refuse work
• General Conditions
  • Building and equipment safety
  • Emergency preparedness
  • Preventing violence
  • Working alone
  • Ergonomics
  • Illumination
  • Indoor air quality
  • Smoking and lunchrooms
Program Overview
Level 1

5. Apply the “General Hazard Requirements” of the Occupational Health and Safety Regulation

- Chemical and biological substances
- Substance specific requirements
- Noise, vibration, radiation and temperature
- Personal protective clothing and equipment
- Confined spaces
- De-energization and lockout
- Fall protection
- Tools, machinery and equipment
- Ladders, scaffolds and temporary work platforms
- Cranes and hoists
- Rigging
- Mobile equipment
- Transportation of workers
- Traffic control
- Electrical safety
Program Overview
Level 1

Line (GAC): A USE SAFE WORK PRACTICES
Competency: A3 Use WHMIS

Objectives
To be competent in this area, the individual must be able to:
• Describe the purpose of the Workplace Hazardous Materials Information System (WHMIS) Regulations.
• Read material safety data sheets (MSDS).
• Interpret the contents of a WHMIS label.
• Apply WHMIS regulations.

LEARNING TASKS

1. State the legislation that requires suppliers of hazardous materials to provide MSDS’s and label products as a condition of sale and importation

2. State the purpose of the Workplace Hazardous Materials Information System (WHMIS)

3. Describe the key elements of WHMIS

4. Describe the responsibilities of suppliers under WHMIS

5. Describe the responsibilities of employers under WHMIS

CONTENT
• Hazardous Product Act
• Controlled Products Regulations
• Ingredient Disclosure List
• Hazardous Materials Information Review Act
• Hazardous Materials Information Review Regulations
• Protection of Canadian workers from the adverse effects of hazardous materials through minimizing the economic impact on industry and the disruption of trade
• Recognition of rights
  o Workers
  o Employers
  o Suppliers
  o Regulators
• Material safety data sheets (MSD’S)
• Labelling of containers of hazardous materials
• Worker education programs
• Provide
  o MSDS’s
  o Labels
• Provide
  o MSDS’s
  o Labels
  o Work education programs in the workplace
6. Describe information to be disclosed on a MSDS

- Hazardous ingredients
- Preparation information
- Product information
- Physical data
- Fire or explosion
- Reactivity data
- Toxicological properties
- Preventive measures
- First-aid measures

7. Identify symbols found on WHMIS labels and their meaning

- Compressed gases
- Flammable and combustible materials
- Oxidizing materials
- Poisonous and infectious materials
  - Material Causing Immediate and Serious Toxic Effects
  - Biohazardous Infectious Materials
- Corrosive Materials
- Dangerously Reactive Materials

8. Apply WHMIS regulations as they apply to hazardous materials used in the shop

- Use, storage and disposal of shop materials
Program Overview
Level 1

Line (GAC): A USE SAFE WORK PRACTICES
Competency: A4 Use Personal Protective Equipment

Objectives
To be competent in this area, the individual must be able to:
• Select and use personal protective equipment.

LEARNING TASKS

1. Describe personal protective equipment requirements
   • Safety footwear
   • Eye protection
   • Ear protection
   • Head protection
   • Respiratory protection
   • Clothing
   • Fall protection
   • High visibility clothing

2. Use personal protective equipment
   • Selection
   • Purpose
   • Operating procedures
   • Training requirements
   • Inspection
   • Maintenance
   • Storage
Line (GAC): A USE SAFE WORK PRACTICES
Competency: A5 Practice Fire Prevention

Objectives
To be competent in this area, the individual must be able to:
• Prevent and identify various classes of fires.
• Select appropriate fire extinguishers for the class of fire and environmental condition.

LEARNING TASKS

1. Describe the conditions necessary to support a fire
   • Air
   • Fuel
   • Heat

2. Describe the classes of fires according to the materials being burned
   • Class A
   • Class B
   • Class C
   • Class D
   • Class K
   • Symbols and colors

3. Apply preventative fire safety precautions when working near, handling or storing flammable liquids or gases, combustible materials and electrical apparatus.
   • Hot work permit (site specific)
   • Handling and storage of flammable materials
   • Symbols
   • Fuels
     o Diesel
     o Gasoline
     o Propane
     o Natural Gas
   • Ventilation
     o Purging
   • Lubricants
   • Oily rags
   • Combustible metals
   • Aerosols

4. Describe the considerations and steps to be taken prior to fighting a fire
   • Warning others and fire department
   • Evacuation of others
   • Fire contained and not spreading
   • Personal method of egress
   • Training
5. Describe the procedure for using a fire extinguisher

- Extinguisher selection
- P.A.S.S
  - Pull
  - Aim
  - Squeeze
  - Sweep
Line (GAC): B  USE TOOLS AND EQUIPMENT
Competency: B1  Use Hand Tools

Objectives
To be competent in this area, the individual must be able to:
• Select hand tools appropriate to gas fitting processes.
• Use hand tools.
• Inspect and maintain hand tools.

LEARNING TASKS

1. Describe hand tools used in the trade
   • Cutting tools
   • Measuring and marking tools
   • Bracing and securing tools
   • Hammering tools
   • Levelling tools
     o Pitch levels
   • Wrenches and pliers
   • Screwdrivers
   • Chiselling tools
   • Squaring tools
   • Threading tools
   • Flaring tools
   • Tubing benders

2. Use hand tools
   • Types
   • Parts
   • Purpose/Users
   • Procedures/Operations
   • Safety
   • Adjustment
   • Inspection
   • Maintenance
   • Storage
Line (GAC): B USE TOOLS AND EQUIPMENT
Competency: B2 Use Portable Power Tools

Objectives
To be competent in this area, the individual must be able to:
• Select portable power tools appropriate to gas fitting processes.
• Use portable power tools.
• Inspect and maintain power tools.

LEARNING TASKS

1. Describe portable power tools
   • Types
     o Electric
     o Pneumatic
     o Powder actuated tools
   • Certification requirements
   • Cutting tools
   • Grinding and abrasive tools
   • Threading tools
   • Drilling and boring tools
   • Specialty tools
     o Fusion tools
     o Power crimpers
   • Accessories

2. Use portable power tools
   • Types
   • Parts
   • Purpose/Uses
   • Procedures/Operations
   • Safety
   • Adjustment
   • Inspection
   • Maintenance
   • Storage
Line (GAC): B USE TOOLS AND EQUIPMENT
Competency: B3 Use Stationary Power Tools

Objectives
To be competent in this area, the individual must be able to:
- Select stationary power tools appropriate to gas fitting processes.
- Use shop equipment.
- Inspect and maintain shop equipment.

LEARNING TASKS

1. Describe stationary power tools
   - Cutting tools
   - Grinding and abrasive tools
   - Threading tools
   - Drilling and boring tools
   - Specialty tools
   - Accessories

2. Use stationary power tools
   - Types
   - Parts
   - Purpose/Uses
   - Procedures/Operations
   - Capacities
   - Safety
   - Adjustment
   - Inspection
   - Minor maintenance
   - Storage
Line (GAC): B
Competency: B4 Use Pressure Measuring Equipment

Objectives
To be competent in this area, the individual must be able to:
• Describe pressure measuring tools.
• Use pressure measuring tools.

LEARNING TASKS

1. Describe pressure measuring tools
   • Manometers
     ○ Types
     ○ Filing
     ○ Fluids
       • Mechanical gauges
     ○ Analog
     ○ Digital
     ○ Standard
     ○ Compound

2. Use manometers and mechanical gauges
   • Gauges
     ○ Standing line pressures
       Operating line pressures
     ○ Gauge pressures
       Absolute pressures
     ○ Conversion between different pressures
     ○ Pressure tests
     ○ Leak detection
Line (GAC): B USE TOOLS AND EQUIPMENT
Competency: B5 Use Oxy Acetylene Equipment

Objectives
To be competent in this area, the individual must be able to:
• Select oxy acetylene equipment appropriate to gas fitting processes.
• Use oxy acetylene equipment.
• Inspect and maintain oxy acetylene equipment.

LEARNING TASKS

1. Describe oxy acetylene equipment
   • Parts
     o Oxygen cylinders
     o Acetylene cylinders
     o Regulators
     o Gauges
     o Spark arrestors
     o Torches
   • Safety devices

2. Describe cutting and brazing techniques
   • Selection
   • Procedure
   • Limitations
   • Inspection

3. Use oxy acetylene equipment
   • Safety
   • Transportation of Dangerous Goods Legislation
   • Ventilation
   • Flammable material recognition
   • Types
   • Parts
   • Purpose/Uses
   • Procedures/Operations
     o Setup
     o Take down
     o Tip Selection
     o Alloy selection
     o Flux selection
   • Adjustment
   • Inspection
   • Minor maintenance
   • Storage
Program Overview
Level 1

**Achievement Criteria:**

**Performance**
Select oxy acetylene equipment appropriate to gas fitting processes.

**Conditions**
The learner will be given:
- Materials
- Specifications

**Criteria**
The learner will score 70% or better on a rating sheet that reflects the following criteria:
- Accuracy
- Appearance
Program Overview
Level 1

Line (GAC): B  USE TOOLS AND EQUIPMENT
Competency: B6  Use Ladders and Platforms

Objectives
To be competent in this area, the individual must be able to:
• Describe ladders and elevated platforms.
• Select and use ladders and platforms.

LEARNING TASKS

1. Describe ladders and elevated platforms
   - Types
     o Ladders
     o Platforms
     o Lifts
   - Uses
   - Safety
   - Fall Protection
   - Hazard recognition
   - Government regulations

2. Use ladders and elevated platforms
   - Selection
   - Operating Procedures
   - Limitations
   - Securing
   - Inspection
   - Maintenance
   - Storage
Line (GAC): B USE TOOLS AND EQUIPMENT  
Competency: B7 Use Rigging and Hoisting Equipment

Objectives
To be competent in this area, the individual must be able to:
• Describe hoisting, lifting and rigging equipment.
• Tie knots, bends and hitches.
• Select and use hoisting, lifting and rigging equipment.

LEARNING TASKS

1. Describe the principles of lifting and hoisting

2. Describe hoisting, lifting and rigging equipment

3. Describe lifting and hoisting communication

CONTENT

• Mechanical advantage
• Balance points

• Lifting and Hoisting
  o Cranes
  o Boom trucks
  o Loaders
  o Tirfors
  o Come-alongs
  o Tuggers
  o Chain falls

• Accessories
  o Slings/chokes
  o Shackles
  o Chains
  o Tag lines
  o Rope types
  o Spreader bars
  o Snatch blocks
  o Turnbuckles
  o Softeners

• Types
  o Hand signals
  o Communication with the operator
  o Communication with others

• Purpose/meaning
4. Tie knots, bends and hitches

- Types
  - Half hitch
  - Timber hitch
  - Rolling hitch
  - Clove hitch
  - Figure of eight
  - Reef knot
  - Sheet bend
  - Bowline
  - Bowline on a bight
  - Trucker’s hitch

- Purposes
- Limitations

5. Use hoisting, lifting and rigging equipment

- Safety
- Certification requirements
- Estimation of weights
- Equipment capacities
- Equipment selection
- Lifting location
- Operating procedures
- Communication/hand signals
- Securing of loads
- Equipment inspection
- Equipment maintenance
- Equipment storage
- Disposal procedures

Achievement Criteria

<table>
<thead>
<tr>
<th>Performance</th>
<th>The learner will set-up and lift loads.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conditions</td>
<td>The learner will be given:</td>
</tr>
<tr>
<td></td>
<td>• Two point lifts</td>
</tr>
<tr>
<td></td>
<td>• Three point lifts</td>
</tr>
<tr>
<td>Criteria</td>
<td>The learner will score 70% or better on a rating sheet that reflects the following criteria:</td>
</tr>
<tr>
<td></td>
<td>• Safety</td>
</tr>
<tr>
<td></td>
<td>• Proper equipment use</td>
</tr>
</tbody>
</table>
**Line (GAC):** C  **ORGANIZE WORK**  
**Competency:** C1  **Use Mathematics and Science**

**Objectives**
To be competent in this area, the individual must be able to:
- Use mathematics and science to solve problems in the Domestic/Commercial Gasfitter B trade.

**LEARNING TASKS**

<table>
<thead>
<tr>
<th>Task</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Add, subtract, multiply and divide whole numbers, fractions, decimals and percentages</td>
<td>Whole numbers, fractions, decimals, percentages</td>
</tr>
<tr>
<td>2. Transpose formulas</td>
<td>Processes</td>
</tr>
<tr>
<td>3. Use formulas to calculate area</td>
<td>Circles, cylinders, squares, rectangles, triangles</td>
</tr>
<tr>
<td>4. Use formulas to calculate volumes</td>
<td>Cylinders, rectangular tanks, square tanks</td>
</tr>
<tr>
<td>5. Use formulas to calculate capacity</td>
<td>Imperial gallons, US gallons, Litres</td>
</tr>
<tr>
<td>6. Perform conversions</td>
<td>Length, Volume, Capacity, Area, Mass, Weight</td>
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<td>Heat energy</td>
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<td>Temperature</td>
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<td>Fahrenheit, Centigrade, Kelvin, Rankin</td>
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<td>Pressure</td>
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<td>Absolute, Gauge</td>
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<tr>
<td>7. Use the Pythagorean theorem of right angles</td>
<td>Hypotenuse, side opposite, side adjacent</td>
</tr>
</tbody>
</table>
8. Calculate piping measurements
   - Terms
     - Thread allowance
     - Fitting allowance
     - End to end
     - End to centre
     - Centre to centre
     - Face to face
     - End to back
     - Back to back
     - Socket depth
   - Calculations
   - Grades
   - Elevations
   - Benchmarks

9. Calculate offsets using the applicable trigonometric function
   - Sine, cosine, tangent

10. Calculate the required measurements for a parallel piping offset
    - Equal spread
    - Rolling
    - Jumper

11. Define the properties of matter
    - Substances
      - Elements
      - Compounds
      - Mixtures
    - States (Phases)
      - Solids
      - Liquids
      - Gases
    - Changes of state
      - Physical
      - Chemical
    - Density
      - Table of densities
    - Relative densities
    - Tensile strength
    - Ductility
    - Malleability
    - Elasticity
    - Conductivity
    - Tenacity
    - Total force
12. Use Pascal’s theory of pressure and force
   - Pounds
   - Pounds per square inch
   - Pascal’s
   - Inches of water column

13. Describe factors that affect fluid flow in a piping system
   - Laminar flow
   - Turbulent flow
   - Specific gravity
   - Size
   - Piping material
   - Fittings

14. Describe the factors that affect volumes and pressures and velocities
   - Boyle’s Law
   - Charles Laws
   - Combined Gas Law
   - Bernoulli’s principle

15. Calculate the expansion and contraction of various materials due to heating and cooling
   - Ferrous
   - Non-ferrous
   - Thermoplastic

16. Define methods of heat transfer
   - Conduction
   - Convection
   - Radiation

17. Perform heat load calculations
   - Sensible, latent & specific heat
   - British thermal unit
   - Watts

18. Characteristics of hydrocarbon gases
   - Chemistry
   - Heat value
   - Specific gravity
   - Flow characteristics
   - Ignition and flame temperatures
   - Flame speeds
   - Odourant
Program Overview
Level 1

Line (GAC): C  ORGANIZE WORK
Competency: C2  Use Drawings and Specifications

Objectives
To be competent in this area, the individual must be able to:
• Use drafting tools.
• Use drafting symbols, lettering and line conventions.
• Convert between isometric and orthographic projections.
• Interpret information found on a set of drawings.

LEARNING TASKS

1. Describe drafting tools and materials
   • Drawing boards
   • T-squares
   • Triangles
   • Protractors
   • French curves
   • Pencils
   • Erasers and shields
   • Scale rulers
   • Compasses
   • Dividers
   • Templates

2. Use scale rulers to determine actual dimensions from a piping diagram
   • Scale rulers

3. Apply piping symbols currently used in the gas fitting trade
   • Tees
   • Flanges
   • Elbows
   • Valves
   • Anchors
   • Brackets

4. Apply lettering and dimensioning for piping diagrams
   • Hidden lines
   • Object lines
   • Border lines
   • Center lines
   • Dimension lines
   • Extension lines
   • Phantom lines
5. Describe drawing projections
   • Isometric
   • Orthographic
   • Oblique
   • Views

7. Use tools to sketch irregular shapes
   • Templates
   • Compasses
   • Spines

8. Read drawings and specifications
   • Legends
   • Imperial and metric units
   • Plot plans
   • Sectional drawings
   • Detail drawings
Line (GAC): C  ORGANIZE WORK
Competency: C3 Use Codes, Regulations and Standards

Objectives
To be competent in this area, the individual must be able to:
- Identify codes and standards encountered in the gas fitting trade.
- Identify various environmental agencies that affect the gas fitting trade.

LEARNING TASKS

1. Identify code, standards and organizations affecting the gas fitting trade

CONTENT
- CSA B149.1
- CSA B149.2
- CSA B149.3
- Safety Standards Act
- Safety Standards General Regulation
- Gas Safety Regulation
- Electrical Safety Regulation
- American National Standards Institute (ANSI)
- American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- American Society of Mechanical Engineers (ASME)
- American Society of Testing and Materials (ASTM)
- Boiler Pressure Vessel Regulation/Act
- National Standards of Canada (CAN)
- Canadian Commission of Building and Fire Codes (CCBFC)
- Canadian General Standards Board (CGSB)
- Canadian Standards Association (CSA)
- National Building Code of Canada (NBC)
- National Fire Protection Association (NFPA)
- Underwriters’ Laboratories of Canada (ULC)
- Municipal bylaws:
  - Permits
- Leadership in Energy and Environmental Design (LEED)
- Testing Agencies
2. Describe where the various codes and standards are encountered with the gas fitting trade
   - Planning
   - Installation
   - Maintenance

3. Describe the B149.1 Gas Code
   - Layout
   - Sections
   - Contents
   - Index
   - Annexes
   - Tables
   - Definitions
   - Scope
   - Revisions

4. Interpret Sections of the B149.1 Gas Code
   - Scope
   - Reference Publications
   - Definitions
   - General
   - Piping and Tubing Systems, Hose, and Fittings

5. Use the Gas Regulations
   - Gas Safety Act
   - Gas Safety Regulations
   - Permits
   - Notification of Completion
   - Approvals
   - Variations to the National Gas Code
   - Bulletins and Directives
Line (GAC): C  ORGANIZE WORK
Competency: C4 Use Manufacturer and Supplier Documentation

Objectives
To be competent in this area, the individual must be able to:
- Describe documentation encountered in the gas fitting trade.
- Use information contained in manufacturer and supplier documentation.
- Use the internet to source manufacturer’s documentation.

LEARNING TASKS | CONTENT
--- | ---
1. Describe the documentation encountered in the gas fitting trade | • Tools and equipment documentation
• Material Safety and Data Sheets
• System component documentation
• Proprietary product documentation
• Certification agencies
2. Use information contained in manufacturer and supplier documentation | • Installation instructions and requirements
• Operation and maintenance manuals
• Product specifications
• Warranty information
3. Use the internet to source manufacturer’s documentation | • Manufacturer’s web-sites
• Search engines
Program Overview
Level 1

Line (GAC): D

Competency: D1 Describe the Gas Delivery System

Objectives

To be competent in this area, the individual must be able to:

• Describe the parts of a natural gas delivery and distribution system.
• Describe the parts of a propane delivery and storage system.

LEARNING TASKS

1. Describe the parts of a natural gas fuel delivery system.

   • Utility provider
     o Gas well
     o Compressor station
     o City gate station
     o District regulator station
     o Distribution regulator
     o Gas main
     o Gas service
     o Service stop (valve)
     o Service regulator
     o Meter
   • Consumer
     o Gas supply or building line
     o Branch line
     o Drop line
     o Riser
     o Drip or dirt pocket
     o Extension
       • Gas pressures
         o High
         o Low

2. Describe the parts of a propane gas system.

   • Vapour distribution
   • Liquid distribution
   • Storage
Program Overview
Level 1

Line (GAC): D

INSTALL AND SERVICE FUEL SYSTEMS

Competency: D2 Install Piping and Tubing Systems

Objectives
To be competent in this area, the individual must be able to:
• Select piping and tubing for gas installations.
• Install gas piping and tubing.

LEARNING TASKS

1. Describe piping, tubing and hoses

2. Describe joining piping and tubing

3. Describe valves

CONTENT

- Types
  o Black iron pipe
  o Copper tubing
  o PE gas piping
  o Corrugated stainless steel tubing
  o Hoses

- Schedules and grades
- Pressure ratings
- Nominal sizes
- Protective coatings
- Cathodic protection
- Identification markings

- Safety
- Methods
  o Welding
  o Threading
  o Flaring
  o Compression fittings
  o Brazing
- Procedure
- Tools
- Fittings

-Types
  o Plug valves
  o Butterfly
  o Ball valves
  o Needle valves

- Construction
- Operation
- Pressure markings and ratings
4. Describe supports
   - Types
   - Construction
   - Uses
   - Seismic
   - Protective materials
     - Types
     - Purpose
   - Spacing
   - Inserts and fasteners
   - Installation procedures

5. Install piping, tubing and hoses
   - Types
   - Methods
   - Size
   - Pressures
   - Identification
   - Procedures
   - Fittings
   - Valves
   - Pressure reducing valves/Regulators
   - Prohibited practice
   - Location limitations
   - Structural penetrations
     - Fire stopping
   - Outlets
   - Drip or dirt pockets
   - Between buildings
   - Concealment
   - In concrete
   - Underground
   - Support
   - Tools
   - Testing
   - Purging
6. Describe residential and commercial gas pipe installation

- Code requirements
- Pressures
  - Low Pressure
  - 2 psig (14 kPa)
  - High Pressure
- Pipe/tube sizing
  - Appliance Rating
  - Distance
  - Allowable pressure drop
  - Piping or tubing type
  - Type of gas
  - Fittings
- Hanger spacing
- Leak testing
  - Rough in
  - After appliance connection
- Leak repair
- Valve tightness of closure testing and repair
- Purging
  - Air with gas
  - Gas with inert gasses
- Pressure measurement
  - Standing
  - Operating
  - Manifold
  - Differential
  - Drop
- Pressure adjustment
  - Gas line
  - Manifold
- Appliance connection
  - Approved hose
  - Flexible metallic hose
  - Connectors
7. Install piping, tubing and hoses

- Methods
- Size
- Pressures
- Identification
- Procedures
- Fittings
- Valves
- Prohibited practice
- Location limitations
- Outlets
- Drip or dirt pockets
- Between buildings
- Concealment
- In concrete
- Underground
- Support
- Protection
- Tools
- Testing
  - Prior to appliance connection
  - After appliance connection
- Purging
  - Under 4 inch
  - 4 inch and larger

**Achievement Criteria**

**Performance**
The individual will construct a gas pipe installation.

**Conditions**
The individual will be given:
- Shop space and materials
- Tools and test equipment

**Criteria**
The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Safety
- To code
- Pipe selection
- Assembly
- Testing procedures
- Leak free
Program Overview
Level 1

Line (GAC): D  INSTALL AND SERVICE FUEL SYSTEMS
Competency: D5  Install and Service Propane Systems

Objectives
To be competent in this area, the individual must be able to:
- Describe the requirements for the installation of propane storage cylinder systems.
- Install propane storage cylinder systems.

LEARNING TASKS

1. Install propane cylinder systems

CONTENT
- Code requirements
- Sizing
  - Load factors
- Temperature effects on pressure
- Filled capacity effect on vapourization rate
- Cylinder sizing
  - Determine vapourization capacity of cylinders at various temperatures, colours, humidity and filled capacities
- Describe cylinder clearances from building
  - Openings
  - Air intakes
  - Doors
  - Windows
  - Flue termination
  - Drier vents
- Installation procedures
- Regulator placements
- Safety relief valves
  - Pressures
  - Location of discharge outlets
  - Calculations of rate of discharge
- Maintenance
- Valves and accessories for vapour withdrawal applications
  - Description
  - Operation
  - Maintenance
- Valves and accessories for liquid withdrawal applications
  - Description
  - Operation
  - Maintenance
Program Overview
Level 1

- Excess flow valves

- Valves and accessories for filling applications
  - Description
  - Operation
  - Maintenance

- Filling density at standard temperature
- Filling capacity by weight
- Vehicle impact protection
- Vehicle access for filling storage tanks
- Filling safety
- Emergency procedures
Level 2

Domestic/Commercial Gasfitter B
Line (GAC): C ORGANIZE WORK
Competency: C2 Use Drawings and Specifications

Objectives
To be competent in this area, the individual must be able to:
• Describe electrical diagrams.
• Sketch and interpret electrical diagrams.

LEARNING TASKS

1. Describe electrical diagrams
   • Types
     o Ladder
     o Schematic
     o Pictorial
     o Block
   • Purpose/Uses
   • Symbols
   • Numbering

2. Sketch electrical diagrams
   • Ladders
   • Schematics

3. Describe the sequence of operation for electrical circuits
   • Ladders
   • Schematics

Achievement Criteria
Performance The individual will convert between the ladder and schematic wiring diagrams.
Conditions The individual will be given:
• A ladder or schematic wiring diagram
• Sketching tools
• Paper
Criteria The individual will score 70% or better on a rating sheet that reflects the following criteria:
• Correct use of symbols, lines and numbering
• Accuracy
• Completeness
Line (GAC): C ORGANIZE WORK
Competency: C3 Use Codes, Regulations and Standards

Objectives
To be competent in this area, the individual must be able to:
- Identify code rules and regulations applicable to the Level B Domestic/Commercial Gasfitter certification.
- Interpret code rules and regulations applicable to the Level B Domestic/Commercial Gasfitter certification.

LEARNING TASKS

1. Interpret Sections of the B149.1 Gas Code
   - Scope
   - Reference Publications
   - Definitions
   - General
   - Pressure Controls
   - Piping and Tubing Systems, Hose, and Fittings
   - Installation of Specific Types of Appliances
   - Venting Systems and Air Supply for Appliances
   - Natural Gas Compressors and Cylinders

2. Use the Canadian Electrical Code Part 1
   - Sections required for Domestic/Commercial Gasfitters
     - 0,2,4,8,10,12,14,16,26,28

Achievement Criteria
Performance The individual will use codes and standards in the application of shop projects.
Conditions The individual will be given:
- Projects
- Codes and Standards
Criteria This would be reflected in the appropriate shop competencies.
Program Overview
Level 2

Line (GAC): C ORGANIZE WORK
Competency: C5 Plan a Project

Objectives
To be competent in this area, the individual must be able to:
• Layout gas line for a residential or small commercial building.
• Determine project requirements for installing a gas line for a residential or small commercial building.

LEARNING TASKS

1. Layout, size and sketch a project
   • As per code requirements
   • Dimensioning
   • Appliances

2. Compile a material list
   • Pipe and tubing
   • Fittings
   • Regulators
   • Valves
   • Supports
   • Quantities

3. Identify tools and equipment
   • Hand tools
   • Power tools
   • Consumables

Achievement Criteria

Performance
The individual will develop a materials list from a set of drawings.

Conditions
The individual will be given:
• Set of drawings and specifications
• Materials
• Instructions

Criteria
The individual will score 70% or better on a rating sheet that reflects the following criteria:
• Complete
• Accurate
Line (GAC): D  INSTALL AND SERVICE FUEL SYSTEMS
Competency: D1  Describe the Gas Delivery System

Objectives
To be competent in this area, the individual must be able to:
• Describe the parts of a natural gas delivery and distribution system.
• Describe the parts of a propane delivery and storage system.

LEARNING TASKS
1. Review Level 1

CONTENT
• Parts of a natural gas fuel delivery system
• Parts of a propane gas system.
Line (GAC): D INSTALL AND SERVICE FUEL SYSTEMS
Competency: D3 Describe and Interpret Gas Meters

Objectives
To be competent in this area, the individual must be able to:
• Describe the operation of gas meters.
• Read gas meters and calculate heat flow rates.

LEARNING TASKS

1. Describe gas meters
   • Types
     o Low pressure propane
     o Low pressure natural gas
     o Pressure factor metering
     o Positive displacement
     o Non-positive displacement
   • Principles of operation
     o Positive displacement
   • Capacity
   • Pressure compensation
   • Reading
     o Test dials
   • Clocking

2. Use calorific values of fuel and meter readings to determine input
   • Calorific values
   • Clocked flow rates
   • Calculated inputs
   • High altitude installations

Achievement Criteria
Performance
The individual will clock a gas appliance.

Conditions
The individual will be given:
• Appliance connected to meter
• Manufacturer’s specifications for the appliance
• Tools and equipment

Criteria
The individual will score 70% or better on a rating sheet that reflects the following criteria:
• Correct meter reading
• Consumptions rates in imperial and metric units
• Interpretation of the manufacturer’s name plate data
• Conversion of volume consumption to heat flow consumption
• Corrective measures
Line (GAC): D  INSTALL AND SERVICE FUEL SYSTEMS
Competency: D4 Install and Service Regulators

Objectives
To be competent in this area, the individual must be able to:
• Describe the purpose and operation of gas pressure regulators.
• Select, install and adjust gas pressure regulators.
• Service gas pressure regulators.

LEARNING TASKS

1. Describe pressure regulators

CONTENT

- Types
  - Appliances
  - Line pressure
  - Service
  - Direct operated
  - Zero governors
  - Lever operated
  - Propane
    - First stage
    - Second stage
- Operating elements
  - Loading
  - Measuring
  - Restricting
- Parts
  - Pressure relief
- Operating principles
  - Droop
  - Lock-up
  - Set point
  - Critical flow
- Applications
- Sizing tables
  - Flow rate
  - Pressure drop
- Maintenance
- Troubleshoot
- Freeze ups
2. Describe regulator venting
   - Vent attachments
     o Lines
     o Limiting orifices
     o Surge arrestors
   - Sizing
   - Orientation
   - Termination

3. Install pressure regulators
   - Code requirements
   - Procedures
   - Gas pressure readings upstream and downstream of each regulator

4. Service pressure regulators
   - Pressure testing
   - Procedures for adjusting
   - Verification of correct operation of all safety features
   - Manufacturer’s recommendations
   - Troubleshooting
     o Obstructed vents
     o Foreign material between seat and disc
     o Corrosion
     o Outlet gas pressure too high
     o Outlet gas pressure too low
     o Slow response
     o Not retaining outlet pressure
     o Propane freeze ups
   - Repair and replacement
   - Lockout procedures
   - Safety

**Achievement Criteria**

**Performance**
The individual will troubleshoot a regulator.

**Conditions**
The individual will be given:
- Gas pressure regulator connected to an appliance
- Tools and equipment

**Criteria**
The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Verification of factory settings
- Droop
- Lock-up
- Inlet pressure
- Manifold pressure
Line (GAC): D INSTALL AND SERVICE FUEL SYSTEMS
Competency: D5 Install and Service Propane Systems

Objectives
To be competent in this area, the individual must be able to:
• Describe the requirements for the installation of propane storage cylinder systems.
• Install propane storage cylinder systems.

LEARNING TASKS
1. Review Level 1

CONTENT
• Install propane cylinder systems
  o Code requirements
  o Sizing
  o Temperature effects on pressure
  o Filled capacity effect on vapourization rate
  o Cylinder sizing
  o Describe cylinder clearances from building
  o Installation procedures
  o Regulator placements
  o Safety relief valves
  o Maintenance
  o Valves and accessories for vapour withdrawal applications
  o Valves and accessories for liquid withdrawal applications
  o Valves and accessories for filling applications
  o Filling density at standard temperature
  o Filling capacity by weight
  o Vehicle impact protection
  o Vehicle access for filling storage tanks
  o Filling safety
  o Emergency procedures
Line (GAC): E  INSTALL VENTING AND AIR SUPPLY
Competency: E1 Install Venting Systems

Objectives
To be competent in this area, the individual must be able to:
• Size and install venting systems for gas appliances rated for up to and including 400 MBH.

LEARNING TASKS
1. Describe gas appliance venting

CONTENT
• Purpose
• Venting action
  o Natural draft
  o Mechanical draft
• Direct venting
• Types
  o A
  o B
  o Single wall
  o L
  o BW
  o BH
  o Chimney liner
• Appliance categories
• Materials
• Application
• Temperature rating
• Parts of a venting system
• Problems
  o Spillage
  o Condensation
  o Causes
  o Solutions
• Draft control devices
  o Applications
  o Installation procedures
  o Draft hoods
  o Barometric dampers
• Thermally operated flue dampers
• Electrically operated flue dampers
2. Describe mechanical draft appliances
   - Types
   - Parts
   - Operation
   - Applications
   - Fan sizing limitations
   - Fan location
     - Natural draft
     - Induced draft
     - Forced draft
   - Code requirements

3. Install venting systems for gas appliances up to and including 400 MBH
   - Code and manufacturer requirements
   - Installation procedures
     - Terminations
     - Support
     - Fire stopping
     - Location
   - Building construction
     - Tightness and ventilation
   - Sizing
     - Vent connectors
     - Vents
     - Chimney
   - Clearance
     - Clearance reductions
   - Height
   - Length
   - Appliance gas input rating
   - More than one appliance
   - Chimney area conversions
     - Round to square
     - Square to round

4. Install direct vented flues
   - Description
   - Operation
   - Code and manufacturer requirements
   - Termination clearances
     - Building construction
     - Fresh air intakes
     - Regulator and meter sets
Line (GAC): E INSTALL VENTING AND AIR SUPPLY
Competency: E2 Install Air Supply Systems

Objectives
To be competent in this area, the individual must be able to:
• Describe and install air supply systems.

LEARNING TASKS
1. Describe gas appliance air supply requirements
   • Purpose
     o Combustion air
       − Primary air
       − Secondary air
       − Excess air
     o Dilution air
     o Ventilation air
   • Buildings as a system
     o Negative air pressure
       • Openings and ducts
     o Terminations

2. Determine combustion air requirements for gas appliances installations with a combined input of up to and including 400 MBH
   • Code requirements
   • Building envelope and construction
   • Category of the appliance
   • Draft control
   • Air requirement calculations
     o Combustion
     o Ventilation
     o Flue gas dilution
   • Table selection
   • Grills and louvers
     o Types
     o Sizing
     o Free area calculations
   • Air ducts
     o Length
     o Size
3. Determine combustion air requirements for gas appliance installations with a combined input exceeding 400 MBH

- Code requirements
- Dilution air requirements
- Air requirement calculations
  - Combustion
  - Ventilation
  - Flue gas dilution
- Calculations
- Grills and louvers
  - Types
  - Sizing
  - Free area calculations
- Air ducts
  - Length
  - Size

4. Install air supply

- Code requirements
- Structural penetrations
- Sealing
- Opening and ducts
  - Terminations
- Wind conditions
- Length
- Supply by mechanical means
Program Overview  
Level 2

Line (GAC): F  INSTALL AND SERVICE GAS EQUIPMENT  
Competency: F1 Install and Service Burners

Objectives
To be competent in this area, the individual must be able to:
• Describe burners for gas fired appliances rated at less than or equal to 400 MBH.
• Install and adjust burners for gas fired appliances rated at less than or equal to 400 MBH.

LEARNING TASKS
1. Describe combustion equipment
   • Terminology
   • Flammability
     o Range of flammability
     o Upper limit of flammability
     o Lower limit of flammability
     o Ignition temperature
   • Gas Properties
     o Rate of flame propagation
     o Flashback
     o Turndown ratio
   • Combustion Air
     o Primary
     o Secondary
     o Excess
   • Flame Characteristics
     o Aerated
       – Oxidizing
       – Carbonizing
       – Neutral
     o Non-aerated

2. Describe atmospheric burners
   • Terminology
   • Characteristics
   • Types
     o Main burners
     o Pilot burners
   • Parts
   • Operation
   • Application
3. Describe mechanical burners
   - Terminology
   - Characteristics
   - Types
   - Parts
   - Air adjustment
   - Operation
   - Applications
   - Start-up procedures

4. Describe burner orifices
   - Types
     o Plug
     o Cap
     o Adjustable
   - Sizing
     o Tables
     o Calculations
     o Drilling

5. Install and adjust burners
   - Codes
   - Approval agencies
   - Rating plates
   - Manufacturers’ documentation
   - Start up procedure
   - Use test equipment
   - Manifold pressure
     o Measurement
     o Adjustment
   - Burner input calculations
     o Port loading
     o Clocking
   - Altitude compensation
     o High altitude de-rating
   - Flame characteristics
   - Perform flue gas analysis
   - Troubleshooting procedures
   - Fault correction

6. Install pilots
   - Purposes of a pilot
   - Position relative to main burner
   - Position relative to thermocouples
Program Overview
Level 2

Line (GAC): F INSTALL AND SERVICE GAS EQUIPMENT
Competency: F2 Install and Service Appliances

Objectives
To be competent in this area, the individual must be able to:
• Describe the installation requirements for gas fired appliances rated at less than or equal to 400 MBH.
• Install and adjust gas fired appliances rated at less than or equal to 400 MBH.

LEARNING TASKS

1. Describe gas fired appliances

   - Types
     - Boilers
     - On-demand water heaters
     - Direct fired make-up air heaters
     - Direct vent appliances
     - Fireplaces
     - Furnaces
     - Infrared heaters
     - Radiant tube heaters
     - Ranges and/or Commercial cooking equipment
     - Rooftop units
     - Unit heaters
     - Water heaters
     - Gas fired refrigerators
   - Characteristics
   - Applications
   - Approval agencies

2. Describe installation requirements

   - Impact of type of building construction on installation requirements
   - Altitude rating requirement
   - Code and Regulation requirements
   - Manufacturers’ requirements
     - Rating plate requirements
   - Appliance sizing
   - Site preparation
   - Clearances
   - Installer’s responsibilities
3. Install and commission appliances

- Set up
- Code requirements
- Testing
  - Air flow
    - Temperature rise
    - Circulation
    - External static pressure
    - Safety and limits
- Purging and flushing
- Check electrical and air supply
- Clocking for gas consumption rate
- Orifice sizing
- Gas pressure measurement
- Instructions to the consumer

Achievement Criteria

Performance  The individual will commission a gas appliance to manufacturer and code requirements.

Conditions  The individual will be given:

- Appliance connected to a meter
- Tools and equipment

Criteria  The individual will score 70% or better on a rating sheet that reflects the following criteria:

- Manufacturer’s specifications
- Code requirements
- Commissioning sequence
Line (GAC): F INSTALL AND SERVICE GAS EQUIPMENT
Competency: F3 Perform Combustion Analysis

Objectives
To be competent in this area, the individual must be able to:
• Describe the combustion analysis process for gas fired appliances rated up to and including 400 MBH.
• Perform combustion analysis and adjust equipment for maximum efficiency.

LEARNING TASKS

1. Describe the chemical process of combustion
   • Methane
   • Propane
   • Chemical equations
     o Theoretical
     o Complete
     o Incomplete

2. Describe combustion analysis in appliances up to and including 400 MBH
   • Related factors
   • Efficiency
   • Adjustments
     o Primary air
     o Secondary air
     o Excess air
     o Dilution air
   • Methods for testing and adjusting
     o Manifold pressure
     o Gas consumption
     o Primary air
     o Secondary air
     o Excess air
   • Types of analyzers
     o Calibration
     o Readings
   • Liabilities
   • Calculating volume of excess air
   • Flue gas temperature measurement
   • Efficiency determination
   • Optimizing efficiency
3. Perform combustion analysis

- Percentage of oxygen in the flue gas
  - Carbon dioxide relationship
- Carbon monoxide measurements
- Flue gas temperature
- Determine excess air flowing through the combustion chamber
- Appliance efficiency
- Combustion efficiency
- Troubleshoot
- Corrective measures to achieve maximum efficiency
- Check and/or adjust draft
Program Overview
Level 2

Line (GAC):       F INSTALL AND SERVICE GAS EQUIPMENT
Competency:       F4 Describe Heating and Cooling Systems

Objectives
To be competent in this area, the individual must be able to:
• Describe the operation of hydronic heating systems.

LEARNING TASKS
1. Describe hydronic heating systems

CONTENT
• Purpose
• Operation
• Piping components
• Piping system configurations
• Heating and cooling generating equipment
  o Boilers
  o Heat pumps
  o Heat exchangers
  o Solar panels
• Basic controls
• Transfer units
• Safety considerations
Program Overview
Level 2

Line (GAC): G INSTALL AND SERVICE CONTROLS AND SAFEGUARDS
Competency: G1 Use the Principles of Electricity and Electronics

Objectives
To be competent in this area, the individual must be able to:
- Describe the principles of direct and alternating current circuits.
- Describe the principles of magnetism.

LEARNING TASKS

1. Describe principles of electricity
   - Safety
   - Electron theory
   - Circuit components
     - Sources of electricity
       - Loads
     - Controls
   - Terminology
     - Electromotive force
     - Current
     - Resistance
       - Power
     - Conduction
   - Units
     - Volt
     - Ampere
       - Ohm
       - Watt
     - Volt-ampere
   - Ohm’s law
   - Watt’s law
     - Effects of changing voltage, current or resistance on power
   - Series, parallel, series/parallel
   - Polarity
   - Direct current principles
   - Alternating current principles

2. Describe principles of magnetism
   - Characteristics of magnetic lines of force
   - Factors affecting the strength of a magnetic field
   - Electromagnetism
   - Coils and solenoids
Achievement Criteria

Performance  The individual will construct a series circuit.

Conditions  The individual will be given:
- Wire
- Switches
- Load
- Power source

Criteria  The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Accuracy
- Completeness

Achievement Criteria

Performance  The individual will construct a parallel circuit.

Conditions  The individual will be given:
- Wire
- Switches
- Load
- Power source

Criteria  The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Accuracy
- Completeness
Program Overview  
Level 2

Line (GAC): G INSTALL AND SERVICE CONTROLS AND SAFEGUARDS  
Competency: G2 Use the Principles of Gas Controls

Objectives
To be competent in this area, the individual must be able to:
• Describe the principles of operation for gas controls on appliances rated less than or equal to 400 MBH.

LEARNING TASKS

<table>
<thead>
<tr>
<th>TASK</th>
<th>CONTENT</th>
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</table>
| 1.   | Describe non electric controls  
   | • Thermal expansion of solids, liquids and gases  
   | • Hydraulic  
   |   | o Temperature sensing  
   |   | o Remote dial  
   | • Bi-metallic  
   |   | o Rod and tube  
   | • On-off control  
   | • Modulating control  
   | • Thermostatic control valve  
   | • Seismic  
   | • Fire suppression system valves  
| 2.   | Describe electric control circuits  
   | • Transform circuits  
   | • Fan circuits  
   | • Control circuits  
   | • Safety circuits  
   | • Pump circuits  
   | • Heating/cooling units  
   | • Ignition circuits  
   | • Vent damper circuits  
   | • Air supply circuits  
   | • Forced vent draft fans  
| 3.   | Describe electric control components  
   | • Operating controls  
   | • Limit and safety controls  
   | • Combustion safety controllers  
   | • Ignition systems  
   | • Gas valves  
   | • Relays  
   |   | o Types  
   |   |   | − Time delay  
   |   |   | − Single contact  

Program Overview
Level 2

4. Describe control modules

- Ignition control modules
  - Intermittent pilot
  - Direct spark ignition
  - Hot surface ignition
- Fan timers
- Integrated appliance controls
Line (GAC): G 
Competency: G3 
INSTALL AND SERVICE CONTROLS AND SAFEGUARDS
Install and Service Gas Controls

Objectives
To be competent in this area, the individual must be able to:
• Describe the installation requirements for gas controls used on appliances rated up to and including 400 MBH.
• Install and adjust gas controls on appliances rated up to and including 400 MBH.

LEARNING TASKS
1. Wire controls for appliances up to and including 400 MBH
   • Installation
   • Limits and safety controllers
   • Gas valves
   • Ignition systems
   • Transformers
   • Matching controls to the appliance
   • Wiring to manufacturer’s specifications
   • Flame rods
   • Thermostats
     o Wiring

2. Test and service controls for appliances up to and including 400 MBH
   • Operational checks
   • Set point adjustments
   • Set and adjust calibration
   • Lockout
   • Troubleshooting
     o Electrical controls
     o Mechanical controls
   • Repair and/or replacement
Program Overview
Level 2

Achievement Criteria

Performance  The individual will wire and test control circuits for an appliance up to and including 400 MBH.

Conditions  The individual will be given:
- Appliance
- Components and wiring materials
- Test equipment
- Wiring/schematic diagrams

Criteria  The individual will score 70% or better on a rating sheet that reflects the following criteria:
- Wiring
- Description of sequence of operation
- Sequence of operation is correct
- Component testing
- Testing
- Interpretation of test data
Section 4

TRAINING PROVIDER STANDARDS
Facility Requirements

Classroom Area
- Minimum 22 square feet per student
- Comfortable seating and tables suitable for learning
- Compliance with the local and national fire code and occupational safety requirements
- Meets applicable municipal zoning bylaws for technical instruction and education facilities
- Overhead and multimedia projectors with a projection screen
- Whiteboard with marking pens and erasers
- Lighting controls to allow easy visibility of the projection screen while allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating/Air conditioning for comfort all year round
- The acoustics in the room must allow the students to be able to hear the instructor

Lab Requirements
- Minimum 8 foot ceiling in lab areas

Shop Area
- Minimum 3000 square feet of shop area including a tool crib and work stations
- Minimum 10 foot ceiling height in shop areas
- Adequate heating, lighting, ventilation (including make up air), drainage and water supply
- Refuse and recycling bins for used shop materials
- First-aid equipment
- Shops will support practical requirements as outlined in the program outline
- Shop facilities will support:
  - Gas fitting practical training

Student Facilities
- Adequate eating area as per WorkSafeBC requirements (4.84 OHS Regulation and Guidelines)
- Adequate washroom facilities as per WorkSafeBC requirements (4.84 OHS Regulation and Guidelines)

Instructor Office Space
- Adequate office space for student consultation
- Desk and filing space
- Computer
- Internet access
- Printer
- Adequate storage facilities for material and training aids
- Access to photocopier
- Telephone
Tools and Equipment

Required Shop (Facility) Tools Required for Levels 1 and 2

**Power Tools**
- Air compressor and accessories
- Band saw
- Bench grinder
- Chop saw
- Circular saw
- Cordless drills
- Drill press
- Mini grinder
- Portable band saw (hack saw)
- Powder-actuated tools
- Power drills
- Power hole saw
- Power threading machine
- Reciprocating saw
- Rotary hammer drill
- Task lighting equipment

**Cutting and Joining Equipment**
- Half round file
- Flaring tools
- Hand operated oiler
- Oxy acetylene equipment
- Pipe cutter
- Pipe reamer
- Pipe vise
- Pipe stand
- Pipe threader
- Pipe vise
- Power vise
- Tube bender
- Tube cutter

**Testing and Measuring Equipment**
- Calculator
- Compressor
- Computer
- Drafting equipment
- Electronic Flue gas analyzer
- Electronic leak detector
- Draft gauge
- Hand pump and accessories
- Hydrostatic pump and gauge (manual and power)
- Laser level
- Manometers
- Measuring tape and markers
- Multimeter
- Scale ruler

**Hoisting, Rigging and Access Tools and Equipment**
- Come-a-longs and Tirfors
- Ladders
- Lifting eyes
- Rope/cable
- Shackles
- Slings and chokers
- Snatch blocks
Standard Tools

- Adjustable wrench
- Ball-peen hammer
- Broom
- Caulking gun
- Chalk line
- Chisels
- Claw hammer
- Combination wrench
- Drywall saw
- Files
- Flashlight
- Hacksaw
- Hand saw
- Hex Keys (set)
- Hole saw
- Knife
- Levels
- Pick
- Pipe wrench
- Pliers (lineman, needle nose, water pump, channel lock)

Personal Protective and Safety Equipment

- Eye wash kit
- Face shield
- Fire blanket
- Fire extinguisher
- First aid kit
- Gloves (industrial rubber)
- Hard hat
- Hearing protection

- Plumb bob
- Pry bars
- Punch
- Ratchet
- Rubber mallet
- Scratch awl
- Screwdrivers (complete set)
- Shovel
- Sledgehammer
- Socket set (imperial and metric)
- Square
- Striker
- T square
- Tap and die sets
- Threading hand dies
- Tin snips (set)
- Torque wrench
- Tri-square
- Utility brushes
- Wire brushes
- Lock-out devices
- Overalls
- Rubber boots
- Dust mask
- Safety boots
- Safety glasses/goggles
- Safety harness, lanyard and life line
Reference Materials

Required Reference Materials

- CAN/CSA B149.1 current
- CAN/CSA C22.1 current

NOTE:
This list of Reference Materials is for training providers. Apprentices should contact their preferred training provider for a list of recommended or required texts for this program.
Instructor Requirements

Occupation Qualifications
The instructor must possess one of the following:
- Technical Safety BC Certificate of Qualification Gasfitter “B” Examination
- Certificate must be equal or greater than the level of instruction

Work Experience
Instructor must possess a minimum of 5 years experience working in the industry as a Class B Gasfitter. This experience requirement may be varied based on:
- Type of experience and scope of exposure to the industry
- Other related credentials
- Specialized experience

Additional Credentials and Experience
The instructor must possess or be working towards a minimum of one of the following:
- Instructor Diploma or equivalent
- Bachelor’s Degree in Education
- Master’s Degree in Education