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Introduction

This Study Guide has been developed by the Newfoundland and Labrador Department of Advanced Education and Skills, Apprenticeship and Trades Certification Division, to assist apprentices and trade qualifiers as they prepare to write the Interprovincial (IP) Red Seal Exam. IP Exams are available for all Red Seal trades. For a list of Interprovincial trades please refer to the Department of Advanced Education and Skills website:

www.ed.gov.nl.ca/app/trades.html

Some of the specific goals of this guide are:

- to help you understand the skills and knowledge that might be covered on the exam
- to help you identify your strengths and weaknesses
- to provide organization and structure for a course of study
- to provide a list of resources to help you with your study plan
- to support and supplement the teaching and learning process

This study guide outlines the theoretical portion of the program. The intent is not to replace technical training provided under the guidance of instructors. Rather, it is a tool to be used in conjunction with formal training.
Exam Process

Before the Exam
You must contact the nearest Apprenticeship and Trades Certification Divisional office to make request to write the IP Red Seal exam (See Appendix A for a list of regional offices). Upon approval, the Program Development Officer will notify you of your eligibility to write the exam, and provide you with scheduling information.

During the Exam
You must bring:

- personal identification such as a photo or signature ID or valid Newfoundland and Labrador driver’s license
- your notification letter

The following will be provided:

- a calculator (see Appendix B for calculator information)
- all other items required such as pencils, scrap paper, etc.

Important Note:
Personal cell phones, calculators, or other electronic equipment are NOT allowed into the exam room. If you do bring them, they will be stored away and returned to you when you have completed the exam.

After the Exam
Results will be mailed to you approximately seven to ten days after completion of the exam. All necessary instructions and information will be provided in the results letter.

The percentage mark you obtained will be provided. You will also be given a section by section breakdown, showing how many questions were in each section, as well as the number of questions in each section you completed successfully.

If you are successful in obtaining a 70% or more on your exam, you will be issued a Newfoundland and Labrador Certificate of Qualification with a Red Seal endorsement.
Exam Format

All IP Red Seal exams are written in multiple-choice format. Each exam has between 100 and 150 questions. A multiple choice question consists of a stem (a complete question) followed by four options (A, B, C, D). The stem contains all the information necessary to answer the question. The options consist of the one correct answer and three “distracters.” Distracters are incorrect. (See Appendix C for a sample answer sheet).

IP Red Seal exams contain three types of questions:

Level 1  Knowledge and Recall
Questions at this level test your ability to recall and understand definitions, facts, and principles.

Level 2  Procedural and Application
Questions at this level test your ability to apply your knowledge of procedures to a new situation.

Level 3  Critical Thinking
Questions at this level test your ability to interpret data, solve problems and arrive at valid conclusions.

On the following pages, examples of each of the three types of questions are provided.

Level 1 Examples:

1. When constructing a walk-in freezer box, where is the installation of the vapor barrier present?

   A. Inside on the coldest side.
   B. Outside on the warmest side.
   C. Around door sill only.
   D. Only required in floor and ceiling construction.
2. What is an indication of a plugged metering device?
   A. High suction pressure.
   B. High suction gas superheat.
   C. No condenser subcooling.
   D. High discharge gas temperature.

3. What is the principal function of the expansion tank in a hot water system?
   A. It allows the volume of the water in the system to change to maintain working pressure.
   B. It collects the air in the system, thus preventing air lock of the system while in operation.
   C. It provides the necessary space for the air required in the system.
   D. It acts as a safety chamber in case of over firing of the boiler.

Level 2 Examples:

1. What amperage capacity should the supply wiring be rated for a refrigerated fixture which has a 208V power supply and the following loads?
   - 4 Evaporator fan motors rated at 9 W each
   - 2 Defrost heaters rated at 6 A each
   - 6 Fluorescent lights rated at 40 W each
   - 1 strip mullion heater rated at 3 A
   A. 15 A.
   B. 20 A.
   C. 30 A.
   D. 40 A.
2. When testing a compressor motor winding with a megger, what reading would indicate a good clean system?

A. 2000 megaohms.
B. 0.0002 megaohms.
C. Zero megaohms.
D. Infinity.

3. Which three instruments are required to check the calibration of an enthalpy control on the economizer of a rooftop air conditioning unit?

A. Voltmeter, ammeter and ohmmeter.
B. Manometer, Pitot tube and thermometer.
C. Draft gauge, manometer and thermometer.
D. Thermometer, sling psychrometer and ultimate.

Level 3 Examples:

1. What is the minimum required sleeve size when installing a 50 mm (2 in.) nominal pipe with 38 mm (1 ½ in.) insulation through a 200 mm (8 in.) concrete block exterior wall?

A. 50 mm/2 in.
B. 100 mm/4 in.
C. 150 mm/6 in.
D. 200 mm/8 in.
2. What is the cooling capacity of a water chiller operating with a 4.4°C (40°F) evaporating temperature, return water temperature of 10°C (50°F) and a 7.2°C (45°F) supply water temperature if the water flow rate is measured at 682.5 L/min (150 gal./min)?

A. 87 000 W/ 300 000 Btu/h.
B. 109 875 W/ 375 000 Btu/h.
C. 131 850 W/ 450 000 Btu/h.
D. 153 825 W/ 525 000 Btu/h.

3. When diagnosing the motor windings of a hermetic compressor, the following values are noted:

Common-to-start: 18Ω
Start-to-run 21Ω

What should the common-to-run value be?

A. 3Ω.
B. 18Ω.
C. 21Ω.
D. 39Ω.

Source of Questions:
www.red-seal.ca/tr.1d.2ecsleta.3l@-eng.jsp?tid=202&fid=37
Exam Content

Understanding the *National Occupational Analysis* (NOA)

The NOA is a document used for Red Seal trades that describes the knowledge, skills and abilities required by a fully competent tradesperson working in that trade. The content for the IP Red Seal exam is based on the NOA. The NOA is an excellent tool to use as you study for the Red Seal exam. NOAs can be found at [www.red-seal.ca](http://www.red-seal.ca).

NOA material is organized into major content areas called **BLOCKS**. The blocks are further broken down into **TASKS** and **SUB-TASKS**.
NOA Pie Chart

The NOA Pie Chart presents the block percentages in the form of a pie chart which tells you the approximate number of questions from each block. For example, 14% of the questions on the Refrigeration and Air Conditioning Mechanic Exam will be based on Block A.

Refrigeration and Air Conditioning Mechanic

<table>
<thead>
<tr>
<th>Block Titles</th>
<th>Block A</th>
<th>Occupational Skills</th>
<th>Block D</th>
<th>Commissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block B</td>
<td>Installation Planning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block C</td>
<td>Installation</td>
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<tr>
<td>Block D</td>
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<tr>
<td>Block E</td>
<td></td>
<td></td>
<td>Maintenance and Service</td>
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</table>
### Exam Breakdown

The **Refrigeration and Air Conditioning Mechanic** IP Red Seal Exam has 125 questions. The following table shows a breakdown of the approximate number of questions that come from each NOA block. It is important to note that the number of questions can change at any time. When you are ready to write your exam you may contact your regional office to verify the number of questions (See Appendix A).

<table>
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<tr>
<th>Block A</th>
<th>Occupational Skills</th>
<th># of Questions</th>
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<tbody>
<tr>
<td><strong>Task 1</strong></td>
<td>Uses and maintains tools and equipment</td>
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</tr>
<tr>
<td><strong>Task 2</strong></td>
<td>Organizes work</td>
<td></td>
</tr>
<tr>
<td><strong>Task 3</strong></td>
<td>Performs routine trade activities</td>
<td></td>
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</tbody>
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<thead>
<tr>
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<th>Installation Planning</th>
<th># of Questions</th>
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</thead>
<tbody>
<tr>
<td><strong>Task 4</strong></td>
<td>Plans installation of heating, ventilation and air conditioning, and refrigeration systems</td>
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</tr>
<tr>
<td><strong>Task 5</strong></td>
<td>Plans installation of control systems</td>
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<table>
<thead>
<tr>
<th>Block C</th>
<th>Installation</th>
<th># of Questions</th>
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<tr>
<td><strong>Task 6</strong></td>
<td>Installs heating, ventilation and air conditioning, and refrigeration systems</td>
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<tr>
<td><strong>Task 7</strong></td>
<td>Installs control systems</td>
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<thead>
<tr>
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<th>Commissioning</th>
<th># of Questions</th>
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<tbody>
<tr>
<td><strong>Task 8</strong></td>
<td>Commissions heating, ventilation and air conditioning, and refrigeration systems</td>
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<tr>
<td><strong>Task 9</strong></td>
<td>Commissions control systems</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Block E</th>
<th>Maintenance and Service</th>
<th># of Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 10</strong></td>
<td>Maintains heating, ventilation and air conditioning, and refrigeration systems</td>
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</tr>
<tr>
<td><strong>Task 11</strong></td>
<td>Services heating, ventilation and air conditioning, and refrigeration systems</td>
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</tr>
<tr>
<td><strong>Task 12</strong></td>
<td>Maintains control systems</td>
<td></td>
</tr>
<tr>
<td><strong>Task 13</strong></td>
<td>Services control systems</td>
<td></td>
</tr>
</tbody>
</table>

| **Total**        |                          | 125             |
NOA Sub-tasks

The following NOA Task Profile Checklist outlines the blocks, tasks and sub-tasks for your trade. The IP Red Seal exam is written to test your knowledge and abilities regarding the sub-tasks in the NOA. This chart can be used to review your current knowledge. You can review by placing a checkmark (√) next to those you understand fully.

Place your focus on those you do not understand and study them until you are comfortable with the material. Think of possible questions in that particular content area.

The NOA also contains a list of “supporting knowledge and abilities” for each sub-task. They are the skills and knowledge you must have to perform a sub-task. The supporting knowledge and abilities identified under each sub-task will be very helpful as you review. The list can be found in the NOA for your trade.
# Task Profile Checklist

**Based on 2014 NOA**

**Refrigeration and Air Conditioning Mechanic**

## Block A: Occupational Skills

### □ Task 1: Uses and Maintains Tools and Equipment

- Maintains hand tools
- Maintains portable and stationary power tools
- Maintains brazing and soldering equipment
- Maintains recovery and recycling equipment
- Maintains evacuation tools and equipment
- Maintains charging tools and equipment
- Maintains diagnostic and measuring tools and equipment
- Uses access equipment
- Uses rigging, hoisting and lifting equipment
- Uses personal protective equipment (PPE) and safety equipment
- Uses computers

### □ Task 2: Organizes Work

- Interprets codes, regulations and procedures
- Interprets blueprints and specifications
- Uses documentation and reference material
- Communicates with others
- Plans job tasks and procedures
- Maintains safe work environment
### Block A: Occupational Skills (Cont’d)

#### Task 3: Performs Routine Trade Activities

- Prepares work site
- Handles materials and supplies
- Installs fasteners, brackets and hangers
- Performs lock-out, tag-out and isolation procedures
- Applies sealants and adhesives
- Performs internal electrical wiring of systems
- Performs field wiring of systems
- Uses refrigerants, gases and oils

### Block B: Installation Planning

#### Task 4: Plans Installation of Heating, Ventilation and Air Conditioning, and Refrigeration Systems

- Verifies heating, ventilation and air conditioning, and refrigeration system parameters and requirements
- Selects heating, ventilation and air conditioning, and refrigeration components, equipment and accessories
- Determines location of components, equipment and accessories
- Selects insulation
- Performs piping, flow controls and accessories take-off

#### Task 5: Plans Installation of Control Systems

- Verifies control system parameters and requirements
- Performs control system take-off
- Performs control system initial layout
### Block C: Installation

#### Task 6: Installs Heating, Ventilation and Air Conditioning, and Refrigeration Systems

- Confirms layout
- Assembles heating, ventilation and air conditioning, and refrigeration components, equipment and accessories
- Places heating, ventilation and air conditioning, and refrigeration components, equipment and accessories
- Installs piping and tubing
- Performs leak test on system
- Evacuates system
- Applies holding charge

#### Task 7: Installs Control Systems

- Places control system components
- Connects system wiring and control tubing

### Block D: Commissioning

#### Task 8: Commissions Heating, Ventilation and Air Conditioning, and Refrigeration Systems

- Performs pre start-up checks for heating, ventilation and air conditioning, and refrigeration systems
- Starts up heating, ventilation and air conditioning and refrigeration systems
- Completes system charge
- Sets up primary and secondary heating, ventilation and air conditioning and refrigeration system components

#### Task 9: Commissions Control Systems

- Performs start-up checks for control systems
- Verifies/sets operating parameters
<table>
<thead>
<tr>
<th>Task 10: Maintains Heating, Ventilation and Air Conditioning, and Refrigeration Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Tasks</td>
</tr>
<tr>
<td>☐ Inspects heating, ventilation and air conditioning and refrigeration systems</td>
</tr>
<tr>
<td>☐ Tests heating, ventilation and air conditioning and refrigeration system components and accessories</td>
</tr>
<tr>
<td>☐ Performs predictive and preventative maintenance on heating, ventilation and air conditioning, and refrigeration systems</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Task 11: Services Heating, Ventilation and Air Conditioning, and Refrigeration Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-Tasks</td>
</tr>
<tr>
<td>☐ Trouble-shoots heating, ventilation and air conditioning, and refrigeration systems</td>
</tr>
<tr>
<td>☐ Repairs heating, ventilation and air conditioning, and refrigeration systems</td>
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<tr>
<th>Task 12: Maintains Control Systems</th>
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<tr>
<td>Sub-Tasks</td>
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<tr>
<td>☐ Inspects control systems</td>
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<td>☐ Tests control systems</td>
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<tr>
<td>☐ Performs preventative maintenance on control systems</td>
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<td>☐ Calibrates operating and safety controls</td>
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<tr>
<th>Task 13: Services Control Systems</th>
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<tbody>
<tr>
<td>Sub-Tasks</td>
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<tr>
<td>☐ Trouble-shoots control systems</td>
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<tr>
<td>☐ Repairs control systems</td>
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Create a Study Plan

As you prepare for your exam, it is important to plan a schedule. The following two tables will help you stay on track.

The first table is a "Weekly Study Plan." In this table list the areas you will focus your study for each day. You should include items you need to review as well as items you need to study. Remember, more time will be needed for study in areas you find difficult, whereas you may only require review in areas you are more familiar with. As you work through the NOA sub-task list you can start to fill in this table.

The second table is a "Study Time Table." It is important to create a study schedule where you determine the best days of the week and times of day for you to study.

Print several copies of these tables and fill out for each week of study. It is important to stick to your study schedule.
# Weekly Study Plan for Week of: ____________________________

<table>
<thead>
<tr>
<th></th>
<th>Area of Study 1</th>
<th>Area of Study 2</th>
<th>Area of Study 3</th>
<th>Area of Study 4</th>
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</table>
Resources - Websites

Study information can be drawn from a variety of sources. A sample list of study materials (websites and books) is provided below. These and other helpful resources may be found in a local college bookstore, on the internet, or at your place of employment. You may also be able to borrow them from an apprentice or journeyperson in your trade.

### Study Strategies and Exam Preparation Guide

The *Study Strategies & Exam Preparation Guide* is meant to be used in conjunction with this study guide. It provides direction and information on such areas as study habits, test preparation and test taking techniques.


### Plan of Training (POT)

A *Provincial Plan of Training* details the full scope of learning for a particular occupation, including both technical training competencies and industry experiences necessary to write an IP Red Seal exam (and complete the requirements for Red Seal Certification), or to write a provincial examination. The Plan of Training is based on the NOA.

POT Website: [www.ed.gov.nl.ca/app/plans.html](http://www.ed.gov.nl.ca/app/plans.html)

### Red Seal Website

**National Occupational Analysis** - The NOA is a document used for Red Seal trades that describes the knowledge and abilities required by a fully competent tradesperson working in that trade. The content for the IP exam is based on the NOA.

Red Seal Website: [www.red-seal.ca](http://www.red-seal.ca)

### Refrigeration and Air Conditioning Mechanic PRACTICE Exam

This is **NOT** an IP exam. This is a practice exam provided by the Inter-provincial Standards Red Seal Program. It was developed using similar question types to that of a Red Seal exam. The exam is intended to be used for self-assessment in preparation for writing an IP Exam.

Practice Exam Website:  
[www.red-seal.ca/tr.1d.2ecsdeta.3l@-eng.jsp?tid=202&fid=37](http://www.red-seal.ca/tr.1d.2ecsdeta.3l@-eng.jsp?tid=202&fid=37)

### Glossary of Terms

The Red Seal website also lists a Glossary of Terms which will be helpful in preparing for your IP exam!  
[www.red-seal.ca/tr.1d.2n.4adeta.3l@-eng.jsp?tid=202&fid=412](http://www.red-seal.ca/tr.1d.2n.4adeta.3l@-eng.jsp?tid=202&fid=412)
Resources – Book List

The books listed below are sorted according to NOA blocks as referenced throughout this study guide. You can use this list to help you obtain information on specific topics. It is not necessary to use these books specifically, as you may find others that will be equally beneficial.

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<thead>
<tr>
<th>Book</th>
<th>Block A</th>
<th>Block B</th>
<th>Block C</th>
<th>Block D</th>
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<tr>
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<td>✓</td>
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<tr>
<td>Refrigeration &amp; Air Conditioning Technology, 4th edition</td>
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<td>Practical Problems in Mathematics for Heating and Cooling Technicians, 4th edition</td>
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<td>Blueprints and Plans for HVAC, 3rd edition</td>
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<td>BTU Buddy</td>
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<td>Understanding Electricity and Wiring Diagrams, 1st edition</td>
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<td>Guide to the HVAC/R Certification and Competency Tests, 2nd edition</td>
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If you wish to obtain any of the resources listed above, here is the reference information:

- Mechanical Refrigeration Code B52-05, Canadian Standards Association, 2005, Product ID 2018325
- BTU Buddy, ISBN 978-1428324282
Disclaimer
Various external resources (websites, textbooks) have been listed in this study guide to assist an individual in preparing to write an IP Red Seal Exam. This does not mean the Department of Advanced Education and Skills, Newfoundland and Labrador endorses the material or that these are recommended as the best resources. There may be other resources of equal or greater value to an individual preparing for an IP Red Seal exam. The Department of Advanced Education and Skills has no control over the content of external textbooks and websites listed, and no responsibility is assumed for the accuracy of the material.

Conclusion

We hope this guide has provided you with some useful tools as you prepare for your IP Red Seal exam. If you have any questions regarding your IP Red Seal exam please contact your regional office (see Appendix A for a list of regional offices).

We appreciate your comments and feedback regarding the usefulness of this study guide. If you have any comments or suggestions, we welcome your feedback. The feedback form at the end of this guide can be used for this purpose.
Appendix A: Regional Offices

If you have any questions regarding your IP Red Seal exam, please contact one of the following regional offices:

Department of Advanced Education and Skills
Apprenticeship and Trades Certification Division
Toll Free: 1-877-771-3737
www.ed.gov.nl.ca/app/

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<th>Corner Brook</th>
<th>Grand Falls-Windsor</th>
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<tbody>
<tr>
<td>1-3 Union Street</td>
<td>42 Hardy Avenue</td>
</tr>
<tr>
<td>Aylward Building, 2nd Floor</td>
<td>Grand Falls-Windsor, NL</td>
</tr>
<tr>
<td>Corner Brook, NL A2H 5M7</td>
<td>A2A 2J9</td>
</tr>
<tr>
<td>Telephone: (709) 637-2366</td>
<td>Telephone: (709) 292-4215</td>
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<tr>
<td>Facsimile: (709) 637-2519</td>
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<th>Clarenville</th>
<th>St. John’s</th>
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<td>45 Tilley’s Road</td>
<td>P.O. Box 8700</td>
</tr>
<tr>
<td>Clarenville, NL</td>
<td>1170 Topsail Road</td>
</tr>
<tr>
<td>A5A 1Z4</td>
<td>Mount Pearl, NL A1B 4J6</td>
</tr>
<tr>
<td>Telephone: (709) 466-3982</td>
<td>Telephone: (709) 729-2729</td>
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<tr>
<td>Facsimile: (709) 466-3987</td>
<td>Facsimile: (709) 729-5878</td>
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<tr>
<td>163 Hamilton River Road</td>
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<tr>
<td>Bursey Building</td>
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<tr>
<td>Happy Valley – Goose Bay, NL</td>
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<tr>
<td>A0P 1E0</td>
</tr>
<tr>
<td>Telephone: (709) 896-6348</td>
</tr>
<tr>
<td>Facsimile: (709) 896-3733</td>
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Appendix B: Calculator Use

The picture below shows a calculator with the same functions as the one you will be provided with during your exam. It is advisable to borrow or purchase one with similar functions so that you can familiarize yourself with it before you write your exam.
Appendix C: Answer Sheet Example

With your exam you will be given an answer sheet like the one below. When answering multiple choice questions be sure to fill the circle completely and fill the circle that corresponds to the question on the exam.
Feedback Form
Study Guide – Refrigeration and Air Conditioning Mechanic

Please answer the following:

(1) This Study Guide is a useful tool for exam preparation.
☐ strongly agree ☐ agree ☐ disagree ☐ strongly disagree

(2) The topics contained in the guide are arranged in a logical order.
☐ strongly agree ☐ agree ☐ disagree ☐ strongly disagree

(3) The design and format of the guide caught my attention.
☐ strongly agree ☐ agree ☐ disagree ☐ strongly disagree

(4) The instructions throughout the guide are clear and to the point.
☐ strongly agree ☐ agree ☐ disagree ☐ strongly disagree

(5) The resources listed in this guide are suitable and valuable.
☐ strongly agree ☐ agree ☐ disagree ☐ strongly disagree

(6) The guide should contain more information.
☐ strongly agree ☐ agree ☐ disagree ☐ strongly disagree

Suggested information/resources to include:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Additional Comments:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Please complete this form and return via fax or mail to the following:
Department of Advanced Education and Skills
Apprenticeship and Trades Certification Division
Standards and Curriculum Unit
45 Tilley’s Road, Clarenville, NL A5A 1Z4
Fax: (709) 466-3987