

Refrigeration and Air Conditioning Mechanic (Commercial) Level 1

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: A1 Orientation 1: Structure and Scope of Refrigeration and Air Conditioning Mechanic

Level: One

Duration: 7 hours

Theory: 7 Hours

Practical: 0 Hours

Overview:

This unit profiles the trade's historical and modern significance, core tasks and skill requirements, as well as its job-ladders and long-term career options. It includes information about learning styles/strategies, stressing their application to apprenticeship and journey-level trade education. The unit also introduces the concept of skills stewardship, stressing the obligation that apprentices incur to help convey what their own journeypersons teach them to those who in turn following them into the trade. A sound grasp of the roles, workplace relationships and possibilities introduced in this unit is part of 'learning to learn' in Manitoba's apprenticeship system. Senior apprentices are later offered information about learning to teach in this system.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe structure and scope of the modern Refrigeration and Air Conditioning Mechanic trade.	34%
a. Historical background, including apprentice experience	
b. Structure/scope of the trade	
• International and national characteristics	
• Characteristics and practice of the trade in Manitoba	
• Trade organizations	
c. Opportunities and career ladders	
• Generalists and specialists	
• Lead hands and other immediate supervisors	
• Geographic mobility	
• Job hierarchies and innovations	
2. Describe the Manitoba Refrigeration and Air Conditioning Mechanic Apprenticeship Program.	33%
a. Concept and significance of skills stewardship.	
• To the trade	
• To apprentices	
• To journeypersons	
• To employers	
• To the community	

- b. Practical Training (on-the-job)
 - Roles/responsibilities of employer and journey person(s)
 - Roles/responsibilities of Apprenticeship Training Coordinator (ATC)
 - Roles/responsibilities of apprentice(s)
 - Roles/responsibilities of instructors (including related-area instructors)
- c. Technical Training (offsite)
- d. Attendance requirements
- e. Progression requirements
- f. Reporting of grades
- g. Trade regulation and its significance
- h. Policies (e.g. re: personal conduct, missed units, fees, harassment, etc.)
 - Apprenticeship branch
 - Training provider(s)

3. Describe special challenges and opportunities re: apprenticeship training. 33%

- a. Adapting personal learning goals to program contexts
 - Characteristics and domains (types) of adult learning
 - Description/recognition of learning and teaching styles
 - Work culture (incl. work-crew hierarchy), interpersonal skills, and trade-learning
 - Integrating technical training and practical training content
 - Possibilities and perils of peer-learning
 - Budgeting and other necessary personal arrangements
 - Handling common varieties of stress at work and in school
- b. On-the-job challenges/opportunities
 - Description/recognition of jobsite teaching styles/roles
 - Communicating with journey persons and employers
 - Coverage/documentation of formally prescribed tasks and subtasks
 - Personal record of achievements/needs: the trade learning journal option
 - Getting help and fixing mistakes
- c. In-school opportunities/challenges
 - Personal arrangements that support in-school progress
 - “Baggage-handling”- self-assessing potential impacts of previous school experience on current learning (favourable/unfavourable); resources
 - Techniques for note-taking, record-keeping, and review
 - Relations with instructors (including related-area instructors)
 - College resources (library, support services, etc.)
 - Missed-units – policies re supplementals, re-tests, make-up assignments, etc.

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: A3 Trade Safety Awareness

Level: One

Duration: 7 hours

Theory: 7 Hours

Practical: 0 Hours

Overview:

Safety education is an integral part of your apprenticeship training program both in school and on-the-job. In this unit you will be made aware of general safety and health requirements. Apprentices are urged to formulate and submit a personal study plan to their instructor. Included should be a timetable for reviewing all relevant material(s) and for strengthening self-assessed areas of deficient skills/knowledge. **The final mark for this unit is a PASS when all requirements have been achieved.**

Objectives and Content:

1. Identify safety and health requirements.

- a. Overview of the Workplace Safety and Health Act
 - Rights and responsibilities of employees under the Act
 - Rights and responsibilities of employees under the Act
 - Rights and responsibilities of employees under the Act
- b. Fourteen (14) Regulations
- c. Codes of Practice
- d. Guidelines
- e. Right to refuse
 - Explanation of right to refuse process
 - Rights and responsibilities of employees
 - Rights and responsibilities of employers
 - Rights and responsibilities of supervisors under the Act

2. Identify personal protective equipment (PPE) and procedures.

- a. Employer and employee responsibilities as related to personal protective equipment
- b. Standards: CSA, ANSI and guidelines
- c. Work protective clothing and danger if it fits poorly
- d. Gloves – importance of proper glove selection (when handling chemicals, cold items, slivers etc.)
- e. Headwear – appropriate protective head wear when required and the approved type of head wear
- f. Eye protection – comparison and distinction of everyday eyeglasses, industrial safety glasses and safety goggles
- g. Foot protection – when required according to safety standards

- h. Hearing protection
 - Hazards of various noise levels (hearing protection must be worn)
 - Laws
 - Types of hearing protection
 - i. Respiratory protection – types, overview of proper selection
 - j. Fall protection – Manitoba requirements Standards Guidelines
 - ANSI (USA standards), etc.
 - k. Ladders and scaffolding
 - l. Safety principles for working with or around industrial trucks site specific (forklifts, pallet trucks, etc.)
- 3. Identify regulations pertinent to care and cleanliness in the working area.**
- 4. Identify the regulations relevant to the safe use of chemicals.**
- 5. Identify regulations governing the use of scaffolding.**
- 6. Identify regulations governing the use of ladders and related equipment.**
- 7. Identify ergonomics.**
- a. Definition ergonomics and conditions that may affect the body
 - Working postures
 - Repetition
 - Force
 - Lifting
 - Tools
 - Identify tool and safety equipment
 - Causes of hand tools accidents
 - Equipment
- 8. Hazard recognition and control.**
- a. Safe work practices
 - b. Basic risk assessment
 - c. Injury prevention and control measures
 - d. Identification of hazards involved in pneumatic tool use and explanation of how to guard against them
 - e. Refrigerants
 - f. Toxic chemical (non-refrigerant)
 - g. High pressure fluids
- 9. Hazard of confined space entry.**
- a. Identification of a confined space
 - b. Hazards of a confined space
 - Physical
 - Biological
 - c. Working in a confined space
 - d. Emergency response plan
 - e. Self contained breathing apparatus (SCBA)

10. Identify First Aid/CPR.

- a. Overview of First Aid Regulation
Obligations of employers regarding First Aid
- b.
 - Who is certified to provide First Aid?
 - What to do while waiting for help?
 - Where is first Aid kit?
- c. Describe basic First Aid requirements and techniques
 - Scope and limits of First Aid intervention
 - Specific interventions (cuts, burns, abrasions, fractures, suffocation, shock, electrical shock, etc.)
 - What is it?
 - Interface with other services and agencies (e.g. Works Compensation claims)
- d. Describe basic CPR requirements and techniques
 - How do you get certified?
 - Scope and limits of CPR intervention (include varieties of CPR certification)

11. Identify the safety requirements as they apply to WHMIS with emphasis on:

- a. WHMIS is a system
- b. Provincial Regulation under the Safety and Health Act
 - Each province has a WHMIS regulation
- c. Federal Hazardous Products Act
- d. WHMIS generic training
 - WHMIS defined and the format used to convey information about hazardous materials in the workplace
 - Information found on supplier and workplace labeling using WHMIS
 - Hazardous materials in accordance with WHMIS
 - Compliance with government safety standards and regulations
- e. Description of WHMIS (include varieties of WHMIS Certification)
 - Typology of WHMIS labels, symbols, and classifications
 - Scope and use of Materials Safety Data Sheets (MSDS)

12. Identifying and controlling hazards.

- a. Basic control measures (injury prevention)
- b. Safe work procedures
- c. Explanation on the importance of industrial housekeeping
- d. Employer responsibilities
- e. How and where to store materials
- f. Safety measures related to walkways, stairs and floor openings
- g. Explanation of how to protect the worker and others when working in traffic paths

13. Describe the safe storage of stock equipment in service vehicles.

14. Discuss transportation of dangerous goods.

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: A4 Tools and Equipment

Level: One

Duration: 20 hours

Theory: 10 hours

Practical: 10 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of hand and power tools, measuring and testing devices, and refrigeration tools and equipment, and their applications, maintenance and procedures for use.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify types of hand tools and describe their applications and procedures for use.	5%
2. Describe the procedures used to store and maintain hand tools.	2%
3. Identify types of portable and stationary power tools and describe their applications and procedures for use.	5%
a. Pneumatic	
b. Electric	
c. Hydraulic	
d. Gas	
4. Describe the procedures used to store and maintain portable and stationary power tools.	5%
5. Identify types of specialized tools and equipment and describe their applications.	5%
a. Recovery and recycle	
b. Evacuation	
c. Charging	
6. Identify types of electric and electronic diagnostic tools and describe their applications and procedures for use.	5%
7. Identify types of mechanical measuring equipment and describe their applications and procedures for use.	5%
a. Vernier/digital calipers	
b. Micrometers	
c. Dial indicators	

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| 8. Describe the procedures used to store and maintain mechanical measuring equipment. | 5% |
| 9. Identify types of monitoring and testing tools and instruments and describe their applications and procedures for use. | 5% |
| a. Acid test kit | |
| b. Oil test kit | |
| c. Electrical test meters | |
| d. Air flow meters | |
| e. Leak detectors | |
| 10. Describe the procedures used to store and maintain monitoring and testing tools and instruments. | 5% |
| 11. Describe the use of computers in their application to specialized tools and equipment. | 5% |
| a. Computer terminology | |
| b. Operating systems and requirements | |
| c. Loading software | |
| d. File management | |
| e. Internet access | |
| f. Port configuration | |
| g. Troubleshooting | |
| 12. Demonstrate the use of computers in their application to specialized tools and equipment. | 10% |
| 13. Demonstrate the use of hand, power, and specialized tools and equipment. | 40% |

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Unit: A5 Communication

Level: One

Duration: 7 hours

Theory: 7 hours

Practical: 0 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of effective communication practices and communication equipment and their applications.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify effective communication practices. a. Respectful b. Organized	25%
2. Describe the importance of effective communication practices. a. Customers b. Co-workers c. Related industry people	25%
3. Role-play how to deal with challenging situations. Practice empathetic listening and response.	25%
4. Identify the types of communication methods and equipment and describe their applications.	25%

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: A6 Hoisting, Lifting, Rigging and Access/Egress Equipment

Level: One

Duration: 7 hours

Theory: 5 hours

Practical: 2 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of hoisting, lifting, rigging and access/egress equipment and their applications and procedures for use, and basic hand signals.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with hoisting, lifting and rigging.	7%
2. Identify and interpret regulatory requirements pertaining to hoisting, lifting, rigging and access/egress equipment.	7%
3. Identify types of rigging equipment and accessories and describe their applications, limitations and procedures for use. a. Belts b. Ropes c. Cables d. Slings e. Shackles f. Spreader bars	7%
4. Identify types of knots and describe their applications.	7%
5. Describe the procedures used to store and maintain rigging equipment.	7%
6. Identify types of hoisting and lifting equipment and accessories and describe their applications, limitations and procedures for use. a. Jacks b. Hoists c. Come-a-longs/tuggers d. Chainfalls	7%
7. Describe the procedures used to store and maintain hoisting and lifting equipment.	7%

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| 8. Identify types of access/egress equipment and describe their applications, limitations and procedures for use. | 7% |
| a. Ladders | |
| b. Staging | |
| c. Scaffolding | |
| d. Lifts | |
| 9. Describe the procedures used to store and maintain access/egress equipment. | 7% |
| 10. Identify and interpret basic hand signals used for lifting and hoisting. | 7% |
| 11. Demonstrate use of hoisting, lifting, rigging and access/egress equipment. | 15% |
| 12. Demonstrate use of basic hand signals. | 15% |

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: A7 Refrigeration Fundamentals

Level: One

Duration: 69 hours

Theory: 47 hours

Practical: 22 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of refrigeration and the refrigeration cycle.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology and concepts associated with refrigeration. a. Temperature b. Heat c. Mass and weight d. Density e. Specific gravity f. Specific volume g. Pressure	6%
2. Identify temperature scales and perform conversion calculations.	6%
3. Describe heat flow and identify methods of heat transfer.	6%
4. Identify states of matter and describe their characteristics.	6%
5. Describe basic gas laws associated with refrigeration and perform calculations to demonstrate relationships.	6%
6. Describe the effect of pressure on evaporation, condensing, freezing and melting temperatures.	6%
7. Explain the operation of the vapour compression cycle.	6%
8. Identify components of a vapour compression cycle and describe their purpose and operation.	6%
9. Describe the physical changes of the refrigerant as it circulates through the system.	6%

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| 10. Describe the pressure/temperature chart and its use in determining refrigerant conditions. | 6% |
| 11. Describe superheat and sub-cooling and their significance in the refrigeration cycle. | 6% |
| 12. Describe the pressure enthalpy diagram and its applications. | 6% |
| 13. Explain how to plot the basic cycle using a pressure enthalpy diagram. | 4% |
| 14. Perform calculations to determine refrigeration values using pressure enthalpy diagrams. | 4% |
| a. Mass flow rate | |
| b. Heat of compression | |
| c. Net refrigeration effect | |
| d. System capacity | |
| e. Ton of refrigeration | |
| f. Coefficient of performance (COP) | |
| g. Horsepower per ton | |
| 15. Identify factors that affect capacity. | 20% |
| a. Condensing pressure/temperature | |
| b. Evaporating pressure/temperature | |
| c. Heat of compression | |
| d. Sub-cooling | |
| e. Superheat | |

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: A8 Refrigerants and Oils

Level: One

Duration: 10 hours

Theory: 10 hours

Practical: 0 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of refrigerants and oils, their applications and procedures for use, of regulatory requirements pertaining to them, of recovery and recycling equipment and its maintenance and procedures for use, and the procedures used to recover and recycle refrigerants and oils.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with refrigerants and oils.	9%
2. Identify hazards, health concerns and safe work practices pertaining to the handling, storing, and disposing of refrigerants and oils.	9%
3. Identify types of refrigerants and describe their characteristics and applications.	9%
a. Primary	
b. Secondary	
4. Identify refrigerant containers and colour coding classifications.	9%
5. Identify types of oils and describe their characteristics and applications.	9%
6. Identify and interpret codes and regulations pertaining to refrigerants and oils.	9%
7. Describe the environmental effects of refrigerants.	9%
a. Ozone depletion	
b. Global warming	
8. Describe the procedures used to perform refrigerant and oil conversions.	9%
9. Identify recovery and recycling equipment and describe procedures for their use and maintenance.	9%
10. Describe the procedures used to recover and recycle refrigerants and oils.	9%
11. Describe the procedures used to transport refrigerants and oils.	10%

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Unit: A9 Piping, Tubing, Soldering and Brazing I

Level: One

Duration: 20 hours

Theory: 16 hours

Practical: 4 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of refrigeration piping and tubing and their applications and installation; fittings and their applications; soldering and brazing equipment and their applications, maintenance and procedures for use; fasteners, brackets and hangers and their applications; pipe insulation, sealants and adhesives and their applications and procedures for use.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with piping, tubing, soldering and brazing.	2%
2. Identify hazards and safe work practices pertaining to piping, tubing, soldering and brazing.	2%
3. Identify types of refrigeration piping and tubing and describe their characteristics and applications.	2%
4. Identify types of fittings and describe their applications and procedures for use.	2%
5. Describe the process for cutting pipe and tubing to proper sizes.	2%
6. Identify types of flaring and swaging tools and describe their applications and procedures for use and maintenance.	2%
7. Describe the procedures used to bend tubing.	2%
a. Piping and offsets	
• Rise	
• Run	
8. Identify types of equipment and accessories used to solder and braze and describe their applications.	2%
a. Oxy-fuel	
b. Air-fuel	
9. Identify types of soldering and brazing materials and fillers and describe their characteristics and applications.	2%

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| 10. Describe the procedures used to solder and braze tubing. | 2% |
| 11. Identify types of threaded pipe and describe their characteristics and applications. | 2% |
| 12. Describe the procedures used to install piping and tubing. | 2% |
| 13. Identify types of pipe hangers, brackets and fasteners and describe their characteristics and applications. | 2% |
| 14. Describe the procedures used to install pipe hangers, brackets and fasteners. | 2% |
| 15. Identify types of pipe and tubing insulation and how it is installed. | 1% |
| 16. Identify types of sealants and adhesives and describe their applications and procedures for use. | 1% |
| 17. Demonstrate installation of refrigeration piping and tubing. | 30% |
| 18. Demonstrate soldering and brazing. | 30% |
| 19. Demonstrate insulating and sealing pipes. | 10% |

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: A11 Leak Testing, Evacuation and Charging

Level: One

Duration: 15 hours

Theory: 8 hours

Practical: 7 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of leak test, evacuation and charging tools and equipment and their maintenance and procedures for use; and the procedures used to leak test, evacuate and charge refrigeration systems.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with leak testing, evacuation and charging.	4%
2. Identify and interpret codes and regulations pertaining to leak testing, evacuation and charging.	4%
3. Identify types of leak detection tools and describe their applications and procedures for use.	4%
4. Describe the procedures used to leak test a refrigeration system.	4%
5. Identify types of evacuation tools and equipment and describe their procedures for use and maintenance.	4%
6. Describe the procedures used to evacuate and dehydrate a system.	4%
7. Identify types of charging tools and equipment and describe their procedures for use and maintenance	4%
a. Charging scales	
8. Identify methods to charge oil into a system and describe their associated procedures.	1%
9. Identify methods to charge refrigerant into a system and describe their associated procedures.	1%
a. Superheat	
b. Sub-cooling	
c. Critical charge	
d. Charge charts	

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| 10. Demonstrate leak testing of refrigeration systems. | 20% |
| 11. Demonstrate evacuating and dehydrating a system. | 25% |
| 12. Demonstrate charging refrigerant into a system. | 25% |

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: A12 Electrical Fundamentals

Level: One

Duration: 49 hours

Theory: 37 hours

Practical: 12 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of fundamental concepts of electricity; measuring of voltage, resistance, current and power and calculating their interrelationship; electrical circuits and loads; conductors, relays, switches, contactors, overloads and transformers and their operation; electronic controls and their operation; electrical wiring diagrams; and interior system electrical wiring.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with electrical fundamentals.	4%
2. Identify hazards and safe work practices pertaining to electricity.	4%
3. Identify units of electrical measurement and symbols.	4%
4. Describe current and electron flow in both direct and alternating current circuits.	4%
5. Identify types of conductors and describe their characteristics and applications.	4%
6. Identify the factors used to determine conductor ampacity rating.	4%
7. Identify types of wire insulating materials and describe their characteristics and applications.	4%
8. Describe the relationship between voltages, current, resistance and power.	4%
9. Calculate voltage, current and resistance in series, parallel, and combination circuits.	4%
10. Describe the selection of resistors using rating and coding information.	4%
11. Identify types of electrical circuits and describe their characteristics.	4%
a. Series	
b. Parallel	
c. Series-parallel	

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| 12. Describe an overloaded, grounded, open and short circuit. | 4% |
| 13. Identify types of distribution panels and wiring configurations used in single and three-phase systems. | 4% |
| 14. Identify types of over-current and overload protection devices and describe their characteristics and applications. | 4% |
| 15. Identify types of relays, switches and contactors and describe their characteristics. | 4% |
| 16. Identify types of transformers and describe their characteristics and applications. | 4% |
| 17. Describe electronic control boards, their purpose and operation. | 4% |
| 18. Describe the procedures used to diagnose electronic control boards. | 4% |
| 19. Identify types of electrical wiring diagrams and describe their purpose. | 4% |
| 20. Demonstrate measuring voltage, resistance, current and power. | 10% |
| 21. Demonstrate operation of conductors, relays, switches, contactors, overloads and transformers. | 5% |
| 22. Demonstrate operation of electronic controls. | 5% |
| 23. Demonstrate interior system electrical wiring. | 5% |

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: A13 Blueprint Reading and Drafting

Level: One

Duration: 20 hours

Theory: 10 hours

Practical: 10 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of blueprints and their applications and of basic drafting skills.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify the types of drawings and describe their applications.	10%
a. Civil-site	
b. Architectural	
c. Mechanical	
d. Structural	
e. Electrical	
f. Shop drawings	
g. Sketches	
h. As-built	
2. Identify the views used on blueprints.	10%
a. Elevation	
b. Plan	
c. Section	
d. Detail	
e. Auxiliary	
3. Identify and interpret information found on blueprints.	10%
a. Lines	
b. Legend	
c. Symbols and abbreviations	
• Mechanical	
• Electrical	
• Architectural	
d. Title block	
e. Notes and specifications	
f. Schedules	

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| 4. Describe the use of blueprint scales. | 10% |
| 5. Describe metric and imperial systems of measurement and perform conversions. | 5% |
| 6. Describe the procedures used to develop basic drawings and skills. | 5% |
| a. pictorial | |
| b. orthographic | |
| 7. Demonstrate blueprint reading and basic drafting skills. | 50% |

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Unit: A14 Trade Documents

Level: One

Duration: 6 hours

Theory: 6 hours

Practical: 0 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of preparing and interpreting trade documents and their use.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Identify and interpret trade-related documentation.	50%
a. Repair orders	
b. Purchase orders	
c. Preventative/predictive maintenance sheets	
d. Service and operating manuals	
e. Technical bulletins	
f. Inspection forms	
g. Service records	
h. Warranties	
i. Estimates	
j. Transportation of dangerous goods (TDG) forms	
k. Refrigerant management records	
l. Material safety data sheets (MSDS)	
m. Time cards/sheets	
n. Vehicle inspection reports	
o. Bill of materials	
2. Describe the procedures used to complete trade-related documentation.	50%
a. Repair orders	
b. Purchase orders	
c. Preventative/predictive maintenance sheets	
d. Inspection forms	
e. Service records	
f. Refrigerant management records	
g. Time cards/sheets	
h. Vehicle inspection reports	
i. Bill of materials	
j. Site safety survey	

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Unit: B1 Trade Mathematics

Level: One

Duration: 15 hours

Theory: 15 hours

Practical: 0 hours

Overview:

Beginning with an overview of the importance of math to the trade, upon completion of this unit of instruction the apprentice will demonstrate knowledge of general mathematical concepts including trade-related mathematics and the use of calculators.

Objectives and Content:

**Percent of
Unit Mark (%)**

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| <p>1. Describe the practical importance of math disciplines to the trade.</p> <ul style="list-style-type: none">a. Definition and scope of relevant math disciplinesb. Time-sheets, wages, and personal budgetingc. Manufacture and packaging of refrigeration and air conditioning materials and productsd. Design/technical drawinge. Work order preparationf. Machinery and equipment set-upg. Measurement and related test readings<ul style="list-style-type: none">• Temperatures• Pressures• Other measured quantitiesh. Customer relations/perceptions (e.g. schedules, timetables, etc.) | <p>34%</p> |
| <p>2. Review general math concepts.</p> <ul style="list-style-type: none">a. Basic operations<ul style="list-style-type: none">• Linear measure• Area and volume• Perimeter• Addition• Subtraction• Multiplication• Division• Order of operations• Fractions and decimals | <p>33%</p> |

- b. Units of measure
 - Imperial
 - Metric (SI)
 - Conversion factors
- c. Calculator use
 - Basic operation keys/functions
 - Percentage keys/functions
 - Trig keys/functions
 - Keys/functions re: memory and constants

3. Demonstrate trade-related calculations as specified by instructor.

33%

- a. Basic operations
 - Linear measure
 - Area and volume
 - Perimeter
 - Addition
 - Subtraction
 - Multiplication
 - Division
 - Order of operations
 - Fractions and decimals
- b. Units of measure
 - Imperial
 - Metric (SI)
 - Conversion factors
- c. Calculator use
 - Basic operation keys/functions
 - Percentage keys/functions
 - Trig keys/functions
 - Keys/functions re: memory and constants

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Unit: B2 Science I

Level: One

Duration: 15 hours

Theory: 15 hours

Practical: 0 hours

Overview:

Beginning with an overview of the importance of science to the trade, upon completion of this unit of instruction the apprentice will demonstrate knowledge of general science concepts including trade-related science topics of thermodynamics and heat.

Objectives and Content:

**Percent of
Unit Mark (%)**

1. **Review science concepts of thermodynamics and heat.**
 - a. Thermodynamics
 - b. First law of thermodynamics
 - c. Second law of thermodynamics
 - d. Temperature conversion
 - e. Heat
 - f. Heat measurement
 - g. Heat transfer
 - h. Heat production

100 %

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Unit: E1 Valves and Accessory Devices

Level: One

Duration: 8 hours

Theory: 4 hours

Practical: 4 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of refrigeration valves and refrigeration accessory devices, their installation, their applications and procedures for use, and how to maintain and troubleshoot them.

Objectives and Content:	Percent of Unit Mark (%)
1. Define terminology associated with valves and accessory devices.	7%
2. Identify types of valves and describe their applications and procedures for use.	7%
3. Identify types of accessory devices and describe their applications and operations.	7%
a. Regulators	
b. Filters and driers	
c. Liquid/moisture indicators	
d. Suction accumulators	
e. Oil separators	
f. Liquid receivers	
g. Pressure relief devices	
h. Heat exchangers	
4. Describe the procedures used to install valves.	7%
5. Describe the procedures used to maintain and troubleshoot valves.	7%
6. Describe the procedures used to install accessory devices.	7%
7. Describe the procedures used to maintain and troubleshoot accessory devices.	8%
8. Demonstrate the procedures used to install, maintain and troubleshoot valves and accessory devices.	50%

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: E2 Compressors I

Level: One

Duration: 15 hours

Theory: 10 hours

Practical: 5 hours

Overview:

Upon completion of this unit of instruction the apprentice will demonstrate knowledge of fundamental principles of compressors, their components and operation.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Define terminology associated with compressors.	8%
2. Identify hazards and describe safe work practices pertaining to compressors.	8%
3. Describe the purpose and operating principles of the compressor in the refrigeration system.	8%
4. Identify types of compressors and describe their characteristics and applications.	8%
a. Reciprocating	
b. Scroll	
c. Rotary	
d. Screw	
e. Centrifugal	
f. Swing	
5. Identify compressor components and describe their purpose and operation.	8%
6. Identify methods of compressor lubrication.	8%
7. Identify methods used to cool compressors.	8%
8. Explain compressor efficiency and how it is determined.	9%
9. Demonstrate operation of compressors.	35%

Refrigeration and Air Conditioning Mechanic (Commercial)

Unit: G1 Gas Code I (includes Propane)

Level: One

Duration: 25 hours

Theory: 20 hours

Practical: 5 hours

Overview:

RACM (Commercial) apprentices require a good, practical grasp of the Gas Code, including Propane. This unit of instruction is the program gateway to further gas and propane learning skills.

Objectives and Content:	<u>Percent of Unit Mark (%)</u>
1. Describe CAN/CSA B-149 codes, gas notices, bulletins, supplements.	35%
2. Describe Acts and Regulations (e.g., gas and oil burner Act, gas and oil burner regulation)	15%
3. Describe proper authorities regarding permit requirements such as the Dept. of Labour for gas permit requirement and proper authorities for gas turn-on.	35%
4. Demonstrate the ability to contact proper authorities regarding permit requirements such as the Dept. of Labour for gas permit requirement and proper authorities for gas turn-on.	15%