Pre-Employment Plan of Training

Refrigeration and Air Conditioning Mechanic

March 2019

Newfoundland & Labrador

PLAN OF TRAINING

Refrigeration and Air Conditioning Mechanic

March, 2019

Government of Newfoundland and Labrador
Department of Advanced Education, Skills and Labour
Apprenticeship and Trades Certification Division

Approved by:

Chairperson, Provincial Apprenticeship and Certification Board

Date: March 20, 2019

Preface

This curriculum standard is aligned with the 2019 Level 1 Newfoundland & Labrador Curriculum Standard (NLCS) and the 2018 Red Seal Occupational Standard (RSOS) for the Refrigeration and Air Conditioning Mechanic trade. It describes the curriculum content for the Refrigeration and Air Conditioning Mechanic Pre-Employment training program.

Acknowledgements

The Provincial Trade Advisory Committee (PTAC), industry representatives, instructors and apprenticeship staff provided valuable input to the development of this provincial plan of training. Without their dedication to quality apprenticeship training, this document could not have been produced.

We offer a sincere thank you.

Contact Information

Department of Education and Early Childhood Development
Apprenticeship and Trades Certification Division
Tel: 709-729-2729
Toll Free: 1-877-771-3737
Email: app@gov.nl.ca
Web: www.gov.nl.ca/atcd

Document Status	Date Distributed	Mandatory Implementation Dates	Comments
New	March 2019	Pre-Employment September 2019	
Approved	June 2020		Updated Essential Skills courses to 2019 versions. Applied accessibility formatting.

Table of Contents

A. RSOS Comparison Chart

An RSOS comparison chart is located in the NLCS.

B. Program Structure

For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.

The order of course delivery within each level can be determined by the training institution, as long as pre-requisite conditions are satisfied.

Upon completion of an entry level program, individuals may be required to complete other certifications (employer or job site specific) in order to gain employment.

Courses with an identified AACS number are equivalent to Level 1 units (courses) in the AACS.

A Pre-Employment student who becomes an apprentice will also be required to complete Levels 2, 3 & 4 in the NLCS.

Pre-Employment				
Course No.	**AACS No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
TS1510		Occupational Health & Safety	6	None
TS1520		WHMIS	6	None
TS1530		Standard First Aid	14	None
RF1290		Ozone-Depletion Substances	6	None
RF1161		Safety	12	None
RF1341		Hoisting, Lifting, Rigging and Access/Egress Equipment	18	RF1161
RF1171		Tools and Equipment	36	RF1161
RF1221		Refrigeration Fundamentals	90	RF1171
RF1241		Refrigerants, Gases and Oils	42	RF1290 RF1221
RF1361		Compressor Fundamentals	30	RF1221
RF1251		Valves and Accessory Devices	30	RF1361
RF1211		Piping, Tubing, Soldering and Brazing	42	RF1221

Pre-Employment				
Course No.	**AACS No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
RF1262		Leak Testing, Evacuation and Charging	36	RF1241
RF1271		Electrical Fundamentals	60	RF1161
RF1281		Motor Fundamentals	42	RF1271
RF1181		Trade-Related Documentation and Work Organization	12	None
RF1451		Refrigeration and Air Conditioning Installation	112	RF1221 RF1262 RF1271
RF1351		Pressure Enthalpy Diagrams and System Analysis	24	RF1221
RF1381		Evaporators	24	RF1221
RF1190		Residential and Commercial Compressors	48	RF1271 RF1361
RF1371		Condensers	24	RF1221
RF1390		Metering Devices	30	RF1381
RF1401		Refrigerant Flow Controls and Accessory Devices	30	RF1361
RF1331		Air Conditioning Fundamentals	18	RF1221
RF1611		Air Movement and Indoor Air Quality	30	RF1331
RF1321		Control Fundamentals	24	RF1281
RF1481		Control Circuits and Wiring Diagrams	54	RF1321
RF1810		Blueprints, Drawings and Specifications	30	None
AM1101		Math Essentials	42	None
AM1000		Introduction to Essential Skills	9	None
AM1291		Refrigeration Math Fundamentals	42	AM1101
CM2161		Communication Essentials	36	None
SD1761		Workplace Essentials	24	None
MC1062		Computer Essentials	15	None

Pre-Employment				
Course No.	**AACS No.**	**Course Name**	**Hours**	**Pre-Requisite(s)**
AP1102		Introduction to Apprenticeship	12	None
		Total Pre-Employment Hours	1110	

*A student who can meet the mathematics requirement through an ACUPLACER® test may be exempted from AM1101 - Math Essentials. Please check with your training institution.

Required Work Experience

Pre-Employment

TS1510 Occupational Health and Safety

Learning Outcomes:

- Demonstrate knowledge of interpreting the Occupational Health and Safety Act, laws and regulations.
- Demonstrate knowledge of understanding the designated responsibilities within the laws and regulations such as the right to refuse dangerous work; and the importance of reporting accidents.
- Demonstrate knowledge of how to prevent accidents and illnesses.
- Demonstrate knowledge of how to improve health and safety conditions in the workplace.

Duration: 6 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Interpret the Occupational Health and Safety Act laws and regulations.
   i. explain the scope of the act
      - application of the act
      - Federal/Provincial jurisdictions
      - Canada Labour Code
      - rules and regulations
      - private home application
      - conformity of the Crown by the Act

2. Explain responsibilities under the Act and Regulations.
   i. duties of employer, owner, contractors, sub-contractors, employees, and suppliers

3. Explain the purpose of joint health and safety committees.
   i. formation of committee
   ii. functions of committee
   iii. legislated rights
   iv. health and safety representation
   v. reporting endangerment to health
   vi. appropriate remedial action
   vii. investigation of endangerment
   viii. committee recommendation
   ix. employer’s responsibility in taking remedial action

4. Examine right to refuse dangerous work.
   i. reasonable grounds for refusal
   ii. reporting endangerment to health
   iii. appropriate remedial action
   iv. investigation of endangerment
   v. committee recommendation
   vi. employer's responsibility to take appropriate remedial action
   vii. action taken when employee does not have reasonable grounds for refusing dangerous work
   viii. employee's rights
   ix. assigning another employee to perform duties
   x. temporary reassignment of employee to perform other duties
   xi. collective agreement influences
   xii. wages and benefits

5. State examples of work situations where one might refuse work.

6. Describe discriminatory action.
   i. definition
   ii. filing a complaint procedure
   iii. allocated period of time a complaint can be filed with the Commission
   iv. duties of an arbitrator under the Labour Relations Act
   v. order in writing inclusion
   vi. report to commission Allocated period of time to request Arbitrator to deal with the matter of the request
   vii. notice of application
   viii. failure to comply with the terms of an order
   ix. order filed in the court

7. Explain duties of commission officers.
   i. powers and duties of officers
   ii. procedure for examinations and inspections
   iii. orders given by officers orally or in writing
   iv. specifications of an order given by an officer to owner of the place of employment, employer, contractor, sub-contractor, employee, or supplier
   v. service of an order
   vi. prohibition of persons towards an officer in the exercise of his/her power or duties
   vii. rescinding of an order
   viii. posting a copy of the order
   ix. illegal removal of an order

8. Interpret appeals of others.
   i. allocated period of time for appeal of an order
   ii. person who may appeal order
   iii. action taken by Commission when person involved does not comply with the order
   iv. enforcement of the order
   v. notice of application
   vi. rules of court

9. Explain the process for reporting of accidents.
   i. application of act
   ii. report procedure
   iii. reporting notification of injury
   iv. reporting accidental explosion or exposure
   v. posting of act and regulations

Practical Requirements:

1. Conduct an interview with someone in your occupation on two or more aspects of the act and report results.

2. Conduct a safety inspection of shop area.

TS1520 Workplace Hazardous Materials Information System (WHMIS)

Learning Outcomes:

- Demonstrate knowledge of interpreting and applying the Workplace Hazardous Materials Information System (WHMIS) Regulation under the Occupational Health and Safety Act.

Duration: 6 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define WHMIS safety.
   - i. rational and key elements
   - ii. history and development of WHMIS
   - iii. WHMIS legislation
   - iv. WHMIS implementation program
   - v. definitions of legal and technical terms

2. Examine hazard identification and ingredient disclosure.
   - i. prohibited, restricted and controlled products
   - ii. classification and the application of WHMIS information requirements
   - iii. responsibilities for classification
     - the supplier
     - the employer
     - the worker - Classification: rules and criteria
     - information on classification
     - classes, divisions and subdivision in WHMIS
     - general rules for classification
     - class A - compressed gases
     - class B - flammable and combustible materials
     - class C - oxidizing material
     - class D - poisonous and infectious material
     - class E - corrosive material
     - class F - dangerously reactive material
   - iv. products excluded from the application of WHMIS legislation
     - consumer products
     - explosives
     - cosmetics, drugs, foods and devices
     - pest control products
     - radioactive prescribed substances
     - wood or products made of wood
     - manufactured articles

- tobacco or products of tobacco
- hazardous wastes
- products handled or transported pursuant to the Transportation of Dangerous Goods (TDG) Act

v. comparison of classification systems - WHMIS and TDG
vi. general comparison of classification categories
vii. detailed comparison of classified criteria

3. Explain labeling and other forms of warning.
   i. definition of a WHMIS label
   ii. supplier label
   iii. workplace label
   iv. other means of identification
   v. responsibility for labels
      - supplier responsibility
      - employer responsibility
      - worker responsibility
   vi. introduce label content, design and location
      - supplier labels
      - workplace labels
      - other means of identification

4. Introduce material safety data sheets (MSDS).
   i. definition of a material safety data sheet
   ii. purpose of the data sheet
   iii. responsibility for the production and availability of data sheets
   iv. supplier responsibility
   v. employer responsibility
   vi. workers responsibility

Practical Requirements:

1. Locate WHMIS label and interpret the information displayed.

2. Locate a MSDS sheet for a product used in the workplace and determine what personal protective equipment and other precautions are required when handling this product.

TS1530 Standard First Aid

Learning Outcomes:

- Demonstrate knowledge of recognizing situations requiring emergency action.
- Demonstrate knowledge of making appropriate decisions concerning first aid.

Duration: 14 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Complete a **St. John Ambulance or Canadian Red Cross** Standard First Aid Certificate course.

RF1290 Ozone-Depletion Substances

Learning Outcomes:

- Demonstrate knowledge of regulations on ozone-depleting substances.

Duration: 6 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Describe procedures for handling ozone-depletion substances (refrigerants) used in the Refrigeration and Air Conditioning Mechanic Occupation.

2. Identify the federal and provincial halocarbon regulations relating to ozone-depletion substances regulations.

NOTE: **Curriculum and certification supplied by HRAI are to be delivered by instructors who are certified to teach ODS courses.**

Practical Requirements:

1. Complete ODS course with a certified instructor.

RF1161 Safety

Learning Outcomes:

- Demonstrate knowledge of maintaining a safe work environment
- Demonstrate knowledge of codes and regulations pertaining to a safe work environment and work site safety.
- Demonstrate knowledge of procedures used to lock-out, tag-out and isolate equipment.
- Demonstrate knowledge of PPE and safety equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of standards and regulations pertaining to PPE and safety equipment.
- Demonstrate knowledge of safe work practices.

Duration: 12 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define terminology associated with PPE and safety equipment.

2. Identify workplace hazards and describe safe work practices.
   i. high voltage
   ii. corrosive chemicals
   iii. toxicity
   iv. combustive reactions
   v. fire
   vi. rotating equipment
   vii. working at heights
   viii. confined spaces
   ix. noisy locations
   x. pressure hazards
   xi. refrigerants
   xii. weather
   xiii. overhead obstacles

3. Describe procedures used to maintain a safe work environment and to remedy the potential dangers related to workplace hazards.

4. Describe procedures used to handle, store, transport and dispose of hazardous materials.

5. Interpret codes and regulations pertaining to workplace hazards and safe work practices.

6. Describe procedures used to lock-out, tag-out and isolate equipment and confirm zero energy.

7. Determine when a lock-out procedure is required.

8. Identify energy sources to be locked out.

9. Identify the potential of stored energy.

10. Identify types of PPE and safety equipment, their applications and procedures for use.
    i. PPE
        - hard hats
        - safety glasses
        - respirators
        - boots
        - gloves
        - safety vests
        - harnesses
        - lanyards
    ii. safety equipment
        - fire extinguishers
        - eye wash stations
        - first aid kits
        - spill kits

11. Describe the procedures used to maintain and store PPE and safety equipment.

12. Identify standards and regulations pertaining to PPE and safety equipment.

13. Describe the procedures used to conduct a job hazard assessment.

Practical Requirements:

1. Perform a lock-out/tag-out procedure on an operating refrigeration system.

RF1341 Hoisting, Lifting, Rigging, Access/Egress Equipment

Learning Outcomes:

- Demonstrate knowledge of hoisting, lifting, rigging and access/egress equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of regulations pertaining to access equipment.
- Demonstrate knowledge of regulations pertaining to rigging, hoisting and lifting equipment.
- Demonstrate knowledge of communication methods.
- Demonstrate knowledge of basic hand signals.

Duration: 18 Hours

Pre-Requisite(s): RF1161

Objectives and Content:

1. Define terminology associated with rigging, hoisting and lifting equipment.

2. Identify hazards and describe safe work practices pertaining to the use of rigging, hoisting and lifting equipment.

3. Interpret codes and regulations pertaining to using rigging, hoisting and lifting, equipment.

4. Interpret information pertaining to using rigging, hoisting and lifting equipment found on drawings and specifications.

5. Identify types of rigging, hoisting and lifting equipment and accessories, and describe their applications, limitations and procedures for use.
   i. belts
   ii. ropes
   iii. cables
   iv. slings
   v. shackles
   vi. spreader bars
   vii. come-alongs/chain falls
   viii. jacks
   ix. hoists
   x. pry bars

6. Identify types of knots, hitches and bends, and describe their applications and associated procedures.
   i. reef knot
   ii. bowline
   iii. timber hitch

7. Identify the factors to consider when selecting hoisting, lifting, rigging and access/egress equipment.
   i. safety factor
   ii. load characteristics
   iii. environment
   iv. application

8. Identify the factors to consider when rigging a load (material and/or equipment) for hoisting and lifting.
   i. load characteristics
   ii. equipment and accessories
   iii. environmental factors
   iv. anchor points/attachment locations
   v. sling angles
   vi. machine capacity/load chart

9. Identify and interpret communication methods used during hoisting, lifting, rigging, and using access/egress equipment and describe their associated procedures.
   i. visual
      - standard crane and hoist hand signals
      - video
   ii. audible
      - radio
      - two-way radios
      - mobile phones

10. Describe the procedures used to inspect, store and maintain rigging, hoisting and lifting equipment.

11. Describe the procedures used to rig and secure a load (material and/or equipment) for lifting and hoisting.

12. Describe the procedures used to perform a lift.

13. Identify types of access/egress equipment, and describe their applications, limitations and procedures for use.
    i. ladders
    ii. staging
    iii. scaffolding
    iv. lifts

14. Identify hazards and describe safe work practices pertaining to the use of egress/ access equipment.

15. Interpret information pertaining to the using egress/access equipment found on drawings and specification.

16. Describe the procedures used to inspect, store and maintain egress/ access equipment.

17. Interpret codes and regulations pertaining to using egress/ access equipment.

18. Describe the procedures used to inspect, store and maintain egress/access equipment.

Practical Requirements:

1. Tie various knots for lifting and securing loads.

2. Perform crane hand signals.

3. Perform setup and use of ladders.

RF1171 Tools and Equipment

Learning Outcomes:

- Demonstrate knowledge of hand tools, and portable and stationary power tools, their applications, maintenance and procedures for use.
- Demonstrate knowledge of recovery and recycling tools and equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of evacuation and charging tools and equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of diagnostic and measuring tools and equipment, their applications, maintenance and procedures for use.

Duration: 36 Hours

Pre-Requisite(s): RF1161

Objectives and Content:

1. Define terminology associated with hand tools and equipment.
   i. flaring tools
   ii. pipe cutters
   iii. benders
   iv. wrenches
   v. screwdrivers

2. Identify hazards and describe safe work practices pertaining to the use of hand tools and equipment.

3. Identify types of hand tools and describe their applications and procedures for use.
   i. screwdrivers
   ii. hammers
   iii. pliers
   iv. wrenches
   v. measuring and layout tools

4. Describe the procedures used to care for, store and maintain hand tools.
   i. lubricate
   ii. sharpen
   iii. tighten

5. Define terminology associated with portable and stationary power tools.

6. Identify types of portable and stationary power tools, and describe their applications and procedures for use.
   i. pneumatic
   ii. electric
   iii. hydraulic
   iv. gas
   v. generators

7. Identify hazards and describe safe work practices pertaining to the use of portable and stationary power tools.

8. Describe the procedures used to care for, store and maintain portable and stationary power tools.
   i. lubricate
   ii. sharpen
   iii. tighten

9. Identify types of anchors and supports used to place HVAC/R equipment.
   i. hangers
   ii. hurricane straps
   iii. seismic restraints

10. Define terminology associated with recovery and recycling tools and equipment.
    i. recovery units
    ii. hoses
    iii. cylinders
    iv. gauges
    v. scales
    vi. filter driers

11. Identify hazards and describe safe work practices pertaining to the use of recovery and recycling tools and equipment.

12. Identify types of recovery and recycling equipment, and describe their applications and procedures for use.

13. Identify the method of recovery.

14. Identify the capacity of recovery systems.

15. Describe the procedures used to care for, store and maintain recovery and recycling tools equipment.

16. Define terminology associated with evacuation tools and equipment and charging tools and equipment.

17. Identify hazards and describe safe work practices pertaining to the use of evacuations tools and equipment and charging tools and equipment.

18. Identify types of evacuation and charging tools and equipment and describe their applications and procedures for use.
    i. gauge manifold
    ii. charging hoses
    iii. vacuum pumps
    iv. electronic thermistor
    v. electronic weight scales

19. Describe the procedures used to care for, store and maintain evacuation and charging tools and equipment.

20. Define terminology associated with diagnostic and measuring tools and equipment.
    i. thermometers
    ii. scales
    iii. leak detectors
    iv. meters
    v. calipers
    vi. micrometers
    vii. gauge manifolds
    viii. manometers
    ix. hygrometers
    x. refractometer
    xi. decibel meters

21. Identify hazards and describe safe work practices pertaining to the use of diagnostic and measuring tools and equipment.

22. Identify types of diagnostic and measuring tools and equipment, and describe their applications and procedures for use.

23. Describe the procedures used to care for, store and maintain diagnostic and measuring tools and equipment.

24. Identify the types of fasteners and fastening devices and describe their sizes, classifications, use and application.

25. Identify tools and equipment used to install control systems, and describe their applications and procedures for use.

26. Identify tools and materials used to connect and secure wiring and control tubing, and describe their applications and procedures for use.

27. Identify types of tools and test equipment and their procedures for use and inspection.
    i. thermometers
    ii. gauges
    iii. hand tools
    iv. electrical meters
    v. psychrometers
    vi. instruments
    vii. electronic devices
    viii. analysing devices

Practical Requirements:

1. Install various types of fasteners and torque to specifications.

2. Assemble and dis-assemble equipment using various tools.

3. Test systems with various test instruments, tools and accessories.

RF1221 Refrigeration Fundamentals

Learning Outcomes:

- Demonstrate knowledge of refrigeration fundamentals.
- Demonstrate knowledge of the refrigeration cycle.

Duration: 90 Hours

Pre-Requisite(s): RF1171

Objectives and Content:

1. Define terminology associated with refrigeration.

2. Explain concepts associated with refrigeration.

3. Identify pressure and temperature scales, and describe the procedures used to perform conversion calculations.

4. Explain heat flow and identify methods of heat transfer.

5. Identify states of matter and describe their characteristics.

6. Explain basic gas laws associated with refrigeration, and describe the associated calculations to demonstrate relationships.

7. Explain the effect of pressure on evaporation, condensing, freezing and melting temperatures.

8. Explain the operation of the vapour compression cycle.

9. Identify components of a vapour compression cycle, and describe their purpose and operation.
   i. compressor
   ii. discharge line
   iii. condenser
   iv. liquid line
   v. metering device
   vi. evaporator
   vii. suction line
   viii. system accessories
   ix. condensate line

10. Describe the physical changes of the refrigerant as it circulates through the system.

11. Describe the pressure/temperature chart and its use in determining refrigerant conditions.
    i. dew point
    ii. bubble point

12. Explain superheat and sub-cooling, and their significance in the refrigeration cycle.

13. Identify factors that affect system capacity.
    i. condensing pressure/temperature
    ii. evaporating pressure/temperature
    iii. heat of compression
    iv. sub-cooling
    v. superheat

Practical Requirements:

1. Operate and monitor a refrigeration system.
    i. measure operating temperatures
    ii. obtain operating pressures
    iii. determine the amount of superheat
    iv. determine the amount of subcooling
    v. determine net refrigerating effect

2. Perform calculations.
    i. convert temperatures from one scale to another
    ii. convert pressures from absolute to gauge pressure
    iii. use various gas laws
    iv. heat calculations

RF1241 Refrigerants, Gases and Oils

Learning Outcomes:

- Demonstrate knowledge of refrigerants, gases and refrigerant oils, their applications and procedures for use.
- Demonstrate knowledge of codes and regulations pertaining to refrigerants, gases and refrigerant oils.
- Demonstrate knowledge of the procedures used to recover and recycle refrigerants and oils.

Duration: 42 Hours

Pre-Requisite(s): RF1290, RF1221

Objectives and Content:

1. Define terminology associated with refrigerants, gases and refrigerant oils.

2. Identify hazards and safe work practices pertaining to refrigerants, gases and oils.

3. Identify types of refrigerants and describe their characteristics and applications.
   i. primary
   ii. secondary

4. Identify the safety classifications of refrigerants.
   i. toxicity
   ii. flammability

5. Identify types of refrigerant containers and colour coding classifications.

6. Identify types of refrigerant oils and describe their characteristics and applications.

7. Identify types of gases and describe their characteristics and applications.
   i. nitrogen
   ii. acetylene
   iii. oxygen
   iv. carbon dioxide
   v. argon
   vi. helium

8. Describe the procedures used to perform refrigerant and oil conversions.

9. Describe the procedures used to recover and recycle refrigerants and oils.

10. Describe the procedures used to store and transport refrigerants, gases and oils.

Practical Requirements:

1. Remove, add and transfer refrigerant in an operating system.

2. Test refrigerant in an operating system to determine type.

3. Perform refrigerant and oil conversion.

4. Perform a compressor oil change.

5. Recover refrigerant from a refrigeration system.

6. Perform an acid test.

7. Perform an oil conversion test.

8. Use a refractometer.

RF1361 Compressor Fundamentals

Learning Outcomes:

- Demonstrate knowledge of the fundamental principles of compressors.
- Demonstrate knowledge of compressors, their applications, components, accessories and operation.
- Demonstrate knowledge of codes and regulations pertaining to HVAC/R equipment, components and accessories.

Duration: 30 Hours

Pre-Requisite(s): RF1221

Objectives and Content:

1. Define terminology associated with compressors.

2. Identify hazards and describe safe work practices pertaining to compressors.

3. Interpret codes and regulations pertaining to compressors and the placement of compressors, components and accessories.

4. Interpret information pertaining to compressors found on drawings and specifications.

5. Explain compressor efficiency.

6. Explain the purpose and operation of compressors and their components.

7. Identify types of compressors, and describe their characteristics and applications.
   i. reciprocating
   ii. scroll
   iii. rotary
   iv. screw
   v. centrifugal
   vi. swing
   vii. linear

8. Describe belt drive and direct drive compressors.

9. Identify compressor components, and describe their characteristics and applications.

10. Identify methods used to lubricate compressors.

11. Identify methods used to cool compressors.

12. Identify common compressor failures and describe their causes and remedies.
    i. mechanical
    ii. electrical

Practical Requirements:

1. Disassemble, inspect, and reassemble open type and semi-hermetic compressors.

RF1251 Valves and Accessory Devices

Learning Outcomes:

- Demonstrate knowledge of refrigeration valves, their characteristics, applications and operation.
- Demonstrate knowledge of refrigeration accessory devices, their characteristics, applications and operation.
- Demonstrate knowledge of codes and regulations pertaining to HVAC/R equipment, components and accessories.

Duration: 30 Hours

Pre-Requisite(s): RF1361

Objectives and Content:

1. Define terminology associated with valves and accessory devices.

2. Identify hazards and describe safe work practices pertaining to valves and accessory devices.

3. Interpret codes and regulations pertaining to valves and accessory devices.

4. Interpret information pertaining to valves and accessory devices found on drawings and specifications.

5. Explain the purpose and operation of valves and accessory devices.

6. Identity types of valves and describe their characteristics and applications.
   i. safety
   ii. metering
   iii. service/access
   iv. flow controls
   v. water regulating valves

7. Identify types of accessory devices and describe their characteristics and applications.
   i. pressure regulators
   ii. filters and driers
   iii. liquid/moisture indicators
   iv. suction accumulators
   v. oil separators
   vi. liquid receivers
   vii. pressure relief devices
   viii. heat exchangers

8. Identify common valves and accessory device failures and describe their causes and remedies.

Practical Requirements:

1. Sketch then explain the purpose of various system valves and accessories on operating refrigeration and air conditioning systems.

RF1211 Piping, Tubing, Soldering and Brazing

Learning Outcomes:

- Demonstrate knowledge of refrigeration piping, tubing and fittings, and their applications.
- Demonstrate knowledge of the procedures used to install piping, tubing and their associated components.
- Demonstrate knowledge of codes and regulations pertaining to the installation of piping and tubing.
- Demonstrate knowledge of the procedures used to solder and braze piping and fittings.
- Demonstrate knowledge of sealants and adhesives, their applications and procedures for use.
- Demonstrate knowledge of codes and regulations pertaining to sealants and adhesives.
- Demonstrate knowledge of the procedures used to install fasteners, brackets and hangers, and their applications.
- Demonstrate knowledge of codes and regulations pertaining to the installation of fasteners, brackets and hangers.

Duration: 42 Hours

Pre-Requisite(s): RF1221

Objectives and Content:

1. Define trade terminology.
   i. piping and tubing
   ii. soldering and brazing
   iii. fasteners, brackets and hangers

2. Identify hazards and describe safe work practices.
   i. piping and tubing
   ii. soldering and brazing

3. Identify and interpret codes and regulations.
   i. piping and tubing
   ii. soldering and brazing
   iii. installation of piping and tubing
   iv. securing fasteners, brackets and hangers
   v. sealants and adhesives

4. Interpret information found on drawings and specifications.
   i. piping and tubing
   ii. soldering and brazing
   iii. fasteners, brackets and hangers

5. Identify specialized tools and equipment used in piping practices, and describe their applications and procedures for use.
   i. cutting
   ii. bending
   iii. joining
      - flaring
      - swaging
      - brazing
      - soldering
      - threading

6. Identify types of refrigeration piping, tubing and fittings, and describe their characteristics and applications.

7. Identify types of pipe materials, fittings and accessories.
   i. copper
   ii. stainless steel
   iii. steel
   iv. copper-iron alloy
   v. brass
   vi. aluminum

8. Identify brazing, soldering and welding materials and fillers, and describe their characteristics and applications.
   i. silver brazing alloys
   ii. flux
   iii. BCuP
   iv. solder

9. Describe the use, care and application of nitrogen when brazing copper tubing.

10. Identify types of pipe hangers, brackets and fasteners, and describe their characteristics and applications.

11. Identify tools and equipment used in installation, and describe their applications and procedures for use.
   i. hand tools
   ii. power tools
   iii. measuring tapes
   iv. levelling devices

12. Identify when the scope of work requires certified welding.

13. Identify the requirements for selecting hardware and fasteners for specific base materials.

14. Identify types of pipe and tubing insulation, and describe their characteristics and applications.

15. Identify types of sealants and adhesives, and describe their characteristics and applications.
    i. sealants
        - silicone
        - spray foam
        - thread seal
        - fire stop
        - duct seal
        - mastic
    ii. adhesives
        - insulation glues
        - primers
        - pipe adhesives

16. Identify tools and equipment used to apply sealants and adhesives, and describe their applications and procedures for use.
    i. brushes
    ii. caulking guns

17. Identify the factors to consider when selecting piping system components for installation.

18. Describe the procedures used to install piping systems.
    i. cutting
    ii. bending
    iii. joining
        - flaring
        - swaging
        - brazing
        - soldering
        - threading
    iv. supporting
        - hangers
        - brackets/fasteners
    v. insulating
    vi. applying sealants and adhesives

19. Identify types of isolation components used to eliminate vibration transmission and noise.

Practical Requirements:

1. Assemble air-acetylene and oxy-acetylene equipment.

2. Install soft and hard drawn copper tubing.
   i. different methods of cutting copper tubing
   ii. ream copper tubing
   iii. bend copper tubing
   iv. prepare tubing for soldering/brazing
   v. solder and braze copper tubing
   vi. select copper/brass mechanical and sweat fittings

3. Fabricate flares and swages in various sized copper tubes.

4. Fabricate various pipe hangers and supports.

5. Assemble, ignite and adjust air-acetylene and oxy-acetylene equipment and demonstrate safe use.

RF1262 Leak Testing, Evacuation and Charging

Learning Outcomes:

- Demonstrate knowledge of the procedures used to leak test refrigeration systems.
- Demonstrate knowledge of the procedures used to evacuate refrigeration systems.
- Demonstrate knowledge of the procedures used to charge refrigeration systems.
- Demonstrate knowledge of codes and regulations pertaining to leak and pressure testing.
- Demonstrate knowledge of applying holding charge.
- Demonstrate knowledge of refrigerants, their applications and procedures for use.
- Demonstrate knowledge of codes and regulations pertaining to evacuation and holding charge.

Duration: 36 Hours

Pre-Requisite(s): RF1241

Objectives and Content:

1. Define terminology associated with leak and pressure testing, evacuation and charging of refrigeration systems.

2. Identify hazards and describe safe work practices pertaining to leak and pressure testing, evacuation and charging of refrigeration systems.

3. Identify hazards and safe work practices pertaining to refrigerants and applying a holding charge.

4. Interpret codes and regulations pertaining to leak and pressure testing, evacuation and charging of refrigeration systems.

5. Identify specialized tools and equipment used to leak test, evacuate and charge a refrigeration system, and describe their applications and procedures for use.

6. Describe the procedures used to leak test a refrigeration system.

7. Identify tools and equipment used to evacuate systems, and describe their applications and procedures for use.

8. Describe the procedures used to evacuate and dehydrate a refrigeration system.
   i. single evacuation
   ii. multiple evacuation (sweeping)

9. Determine approved and compatible liquids or gases required for system pressure test.

10. Calculate volumes of liquids in glycol loops and gases required to pressure test a system.

11. Describe the methods used to verify the charge of a refrigeration system.
   i. superheat
   ii. sub-cooling
   iii. critical charge
   iv. charge charts
   v. sight glass

12. Identify tools and equipment used to apply a holding charge and describe their applications and procedures for use.
   i. service valve wrenches
   ii. charging scales
   iii. transfer pumps (recovery unit)
   iv. gauge manifold

13. Describe the procedures used to pressurize a system with refrigerant to achieve a positive pressure.
   i. primary (CFC, HFC, HFO, HCFC, HC)
   ii. natural (R744, R717)
   iii. secondary (water, glycol solutions, brine solutions)

14. Identify types of refrigerants and describe their characteristics and applications.

Practical Requirements:

1. Install and remove gauge manifold on refrigeration and air conditioning systems.

2. Evacuate a refrigeration system using a vacuum pump and vacuum gauge.

3. Charge a refrigeration system.
   i. using a refrigerant weighing device
   ii. with no refrigerant weighing device

4. Pressurize a refrigeration/air conditioning system with nitrogen then check for leaks.

RF1271 Electrical Fundamentals

Learning Outcomes:

- Demonstrate knowledge of the fundamental concepts of electricity.
- Demonstrate knowledge of the procedures used to measure voltage, resistance, current and power, and to calculate their interrelationships.
- Demonstrate knowledge of electrical circuits and loads.
- Demonstrate knowledge of conductors, relays, switches, contactors, overloads and transformers, and their operation.
- Demonstrate knowledge of electronic controls and their operation.
- Demonstrate knowledge of electrical wiring diagrams.
- Demonstrate knowledge of testing systems and components.

Duration: 60 Hours

Pre-Requisite(s): RF1161

Objectives and Content:

1. Define terminology associated with electrical fundamentals.

2. Identify hazards and describe safe work practices pertaining to electricity.

3. Explain current and electron flow in both alternating current (AC) and direct current (DC) circuits.

4. Explain the relationship between voltage, current, resistance and power.

5. Identify units of electrical measurement and symbols.

6. Identify types of conductors and describe their characteristics and applications.

7. Identify the factors used to determine conductor ampacity rating.

8. Identify types of wire insulating materials and describe their characteristics and applications.
9. Identify the factors to consider when selecting resistors using rating and coding information.

10. Identify types of electrical circuits and describe their characteristics and applications.
    i. series
    ii. parallel
    iii. series-parallel

11. Describe an overloaded, grounded, open and short circuit.

12. Identify types of distribution panels and wiring configurations used in single phase and three-phase systems, and describe their characteristics and applications.

13. Identify types of over-current and overload protection devices, and describe their characteristics, applications and operation.

14. Identify types of relays, starters, switches and contactors, and describe their characteristics, applications and operation.

15. Identify types of transformers and describe their characteristics, applications and operation.

16. Identify types of electronic controls, and explain their purpose and operation.

17. Identify types of electrical wiring diagrams and explain their purpose.

18. Describe the procedures used to troubleshoot basic electrical control circuit systems and components using schematic wiring diagrams.

19. Identify types of wiring termination.

20. Identify types of gauges of wire.

21. Identify types of components.
    i. strain relief connectors
    ii. junction boxes
    iii. terminal strips

22. Interpret codes and regulations pertaining to wiring of systems.
    i. Canadian Electrical Code
    ii. jurisdictional regulations

23. Describe the procedure to calculate voltage, current and resistance in series, parallel and combination circuits.

24. Describe the use, application and procedures of electrical test instruments.

25. Describe the procedures used to test electrical components.
    i. relays
    ii. motors
    iii. coils
    iv. controls
    v. defrost timers
    vi. defrost heaters
    vii. drain pan heaters

Practical Requirements:

1. Measure the voltage, component resistance and current of a refrigeration system using a digital meter.

2. Perform labs to demonstrate the characteristics of series, parallel, and combination electrical circuits using Ohm's law and Kirchhoff voltage and current laws.

3. Troubleshoot overload circuits and components for proper operation.

4. Troubleshoot and wire switching relays.

5. Troubleshoot transformers.

RF1281 Motor Fundamentals

Learning Outcomes:

- Demonstrate knowledge of basic motors, their components, accessories and operation.
- Demonstrate knowledge of basic motor controls and their operation.

Duration: 42 Hours

Pre-Requisite(s): RF1271

Objectives and Content:

1. Define terminology associated with basic motors and motor controls.

2. Identify hazards and describe safe work practices pertaining to basic motors and motor controls.

3. Interpret codes and regulations pertaining to basic motors and motor controls.

4. Interpret information pertaining to basic motors and motor controls found on drawings and specifications.

5. Explain the purpose and operation of motors and their components.

6. Identify types of motors and their components, and describe their characteristics and applications.
   i. single-phase
   ii. three-phase
   iii. electrically commutated motors (ECM)
   iv. multi-lead
   v. dual-voltage
   vi. multi-speed

7. Interpret information found on motor nameplates.

8. Identify types of starting devices for single-phase motors, and describe their characteristics, applications, operation and wiring configurations.

9. Identify types of capacitors and describe their characteristics and applications.

10. Explain the effects of load and voltage changes on motor operation.

11. Describe the procedures used to test capacitors.

12. Describe the procedures used to change rotation of motors.

13. Describe the procedures used to measure voltage, resistance and current in motor circuits.

14. Identify common motor failures and describe their causes and remedies.
    i. mechanical
    ii. electrical

15. Describe the effects of motor pulley selection, adjustment and alignment.

16. Identify the types of motor overload protection devices and describe their use and applications.

Practical Requirements:

1. Test single and three phase motors for normal operation.

2. Install electrical starting components on single phase motors.

3. Connect, run and reverse three phase motors.

4. Check motor insulation resistance with a megohmmeter.

RF1181 Trade-Related Documentation and Work Organization

Learning Outcomes:

- Demonstrate knowledge of documentation and reference material, its purpose and application for use.
- Demonstrate knowledge of the procedures used to complete and interpret trade related documentation.
- Demonstrate knowledge of digital technology, their applications, maintenance and procedures for use.
- Demonstrate knowledge of planning job tasks and procedures.
- Demonstrate knowledge of the procedures used to prepare a work site.
- Demonstrate knowledge of the procedures used to handle materials and supplies.
- Demonstrate knowledge of regulations pertaining to the handling of materials and supplies.

Duration: 12 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define terminology associated with job planning.
   - i. trade-related documentation
   - ii. job tasks and procedures
   - iii. job coordination

2. Identify types and sources of trade-related documentation and reference materials, and describe their applications.
   - i. manufacturers' specifications
   - ii. manufacturers' and wholesaler catalogues
   - iii. codes and standards
   - iv. energy efficiency guides
   - v. manuals
     - safety
     - service
     - operating
   - vi. permits
   - vii. drawings and specifications
   - viii. employer-specific forms and reports
   - ix. preventative/predictive maintenance sheets
   - x. technical bulletins
   - xi. service records
   - xii. warranties

xiii. refrigerant management records

3. Explain the importance of appropriate and effective use of electronic devices and sources of information.

4. Describe the procedures used to complete trade-related documentation.

5. Describe the procedures used to access, interpret and apply information found on trade-related documentation and reference material.

6. Identify types of digital technology used to set up operation of systems.
   i. direct digital control
   ii. programmable logic controller (PLC)
   iii. micro processor
   iv. communication protocols
   v. software

7. Describe procedures used to set up operation of systems.

8. Describe procedures used to diagnose problems.

9. Identify sources of information relevant to job planning and execution.
   i. on-site log books
   ii. permits (hot/enclosed vessel)
   iii. reports
   iv. drawings
   v. specifications
   vi. manufacturers literature
   vii. code books
   viii. company policy manual for job requirements
   ix. Safety Data Sheets (SDS)
   x. asbestos/lead/workplace hazards assessment report
   xi. handling materials and supplies

10. Identify information gathering and communication techniques, and describe their associated procedures.

11. Describe the procedures used to coordinate work requirements, job tasks and procedures.

12. Describe the procedures used to estimate work requirements.

13. Identify and interpret the sources of information and regulatory requirements and responsibilities for handling materials and supplies and disposing of waste materials.

Practical Requirements:

None.

RF1451 Refrigeration and Air Conditioning Installation

Learning Outcomes:

- Demonstrate knowledge of the procedures used to prepare for the installation of refrigeration and air conditioning systems and their components.
- Demonstrate knowledge of determining placement of refrigeration and air conditioning equipment, components and accessories.
- Demonstrate knowledge of the procedures used to install refrigeration and air conditioning systems and their components.
- Demonstrate knowledge of the procedures used to start up and commission refrigeration and air conditioning systems and their components.
- Demonstrate knowledge of types of controls and devices, their applications and operations.
- Demonstrate knowledge of connecting system wiring and control tubing.
- Demonstrate knowledge of systems, their applications and components.

Duration: 112 Hours

Pre-Requisite(s): RF1221, RF1262, RF1271

Objectives and Content:

1. Define terminology associated with refrigeration and air conditioning installations.

2. Identify hazards and describe safe work practices pertaining to refrigeration and air conditioning installations.

3. Interpret codes and regulations pertaining to refrigeration and air conditioning installations and the placement of equipment, components and accessories.

4. Interpret information pertaining to refrigeration and air conditioning installations found in drawings, specifications and diagrams.
   i. electrical diagrams
   ii. piping schematic diagrams

5. Identify tools and equipment used for refrigeration and air conditioning system installations, and describe their applications and procedures for use.

6. Identify the factors to consider when selecting refrigeration and air conditioning system components for installation.

7. Identify components used in the installation of refrigeration and air conditioning systems, and describe their characteristics and applications.

8. Identify the factors to consider when installing refrigeration and air conditioning systems.
   i. component placement
   ii. tool requirements
   iii. material list
   iv. scheduling

9. Describe the procedures used to prepare for the placement of refrigeration and air conditioning system installations.

10. Describe the procedures used to install refrigeration and air conditioning systems.

11. Identify sequence of operation required for correct operation and proper function of HVAC/R systems.

12. Identify the factors to consider when performing a system start-up.
   i. phasing, voltage imbalance and amperage
   ii. refrigerant charge adjustments
   iii. oil levels
   iv. operating pressures and temperatures
   v. system control adjustments
   vi. manufacturers' recommendations
   vii. air movement requirements

13. Identify documentation requirements for system installation, start up and commissioning.

14. Identify system problems at start-up and describe their causes and remedies.

15. Describe the procedures used to start up and commission refrigeration and air conditioning systems.

16. Describe the procedures used to verify system requirements.
   i. voltages
   ii. amperages
   iii. temperatures
   iv. pressures

17. Interpret information pertaining to controls and devices found on drawings and specifications.

18. Interpret codes and regulations pertaining to controls and devices.

19. Describe the sequence of operation of a control circuit and explain its relationship to its physical wiring configuration.

20. Describe the procedures used to test mechanical components and accessories.
    i. compressors
    ii. condensers
    iii. metering devices
    iv. evaporators
    v. fans and fan motors
    vi. actuators
    vii. dampers
    viii. crankcase heaters
    ix. solenoid valves
    x. limit switches

Practical Requirements:

1. Install refrigeration and air conditioning systems and components.

2. Commission an operating refrigeration/AC system.
    i. create a complete bill of material.

3. Complete a startup report.

RF1351 Pressure Enthalpy Diagrams and System Analysis

Learning Outcomes:

- Demonstrate knowledge of pressure enthalpy diagrams and their use in troubleshooting refrigeration systems.

Duration: 24 Hours

Pre-Requisite(s): RF1221

Objectives and Content:

1. Define terminology associated with pressure enthalpy diagrams and system analysis.

2. Locate and interpret information found on pressure enthalpy diagrams.

3. Identify the factors affecting system capacity and explain their effect.
   i. saturated discharge temperature
   ii. saturated suction temperature
   iii. liquid sub-cooling
   iv. suction superheat
   v. suction to liquid heat exchange
   vi. high and low side pressure drops

4. Explain theoretical horsepower and brake horsepower.

5. Explain the effects of pressure drop in refrigeration piping.

6. Explain the concept of system equilibrium and the factors that determine system balance.

7. Explain the effects of an unbalanced system on system performance.

8. Plot a refrigeration cycle using a pressure enthalpy diagram and perform associated calculations.

9. Apply cycle diagrams to assist with system troubleshooting.

Practical Requirements:

1. Plot a refrigeration cycle on a pressure enthalpy diagram.

2. Calculate the following from plotted data:
   i. actual displacement
   ii. brake horsepower
   iii. coefficient of performance
   iv. compression ratio
   v. condenser heat of rejection
   vi. desuperheating
   vii. heat of compression
   viii. mass flow rate
   ix. net refrigeration effect
   x. subcooling
   xi. system capacity
   xii. theoretical displacement
   xiii. theoretical horsepower
   xiv. total heat rejected from the condenser
   xv. total heat rejected from the system

RF1381 Evaporators

Learning Outcomes:

- Demonstrate knowledge of evaporators, their components, accessories and their operation.
- Demonstrate knowledge of the procedures used to place and install evaporators and their components and accessories.
- Demonstrate knowledge of the procedures used to maintain and troubleshoot evaporators and their components.
- Demonstrate knowledge of codes and regulations pertaining to equipment, components and accessories.

Duration: 24 Hours

Pre-Requisite(s): RF1221

Objectives and Content:

1. Define terminology associated with evaporators and their components.

2. Identify hazards and describe safe work practices pertaining to evaporators and their components.

3. Interpret codes and regulations pertaining to evaporators and components and their placement of evaporators and their components.

4. Interpret information pertaining to evaporators and their components found on drawings and specifications.

5. Identify specialized tools and equipment used with evaporators and their components, and describe their applications and procedures for use.

6. Explain the purpose and operation of evaporators and their components.

7. Identify types of evaporators and describe their characteristics and applications.
   i. counter, cross and parallel flow
   ii. direct expansion, flooded and liquid overfeed
   iii. forced and induced
   iv. plate or eutectic
   v. brazed plate/plate and frame
   vi. primary and secondary surface
   vii. chiller barrel (fluid cooler)

8. Identify evaporator components, and describe their characteristics and applications.
   i. drain pan heaters
   ii. evaporator fans and controls
   iii. drain lines
   iv. flow switches
   v. defrost heaters

9. Describe defrost methods and identify their associated electrical and piping considerations.

10. Describe defrost cycle and operation.

11. Identify the factors and conditions that determine evaporator capacity and efficiency.

12. Describe the procedures used to size evaporators.

13. Identify the factors and environmental issues to consider when placing and selecting evaporators and their components for installation.

14. Describe the procedures used to place and install evaporators, their components and accessories.

15. Describe the procedures used to maintain and troubleshoot evaporators and their components.

16. Identify evaporator and component failures, and describe their causes and repair procedures.

17. Identify alternative heat transfer devices and describe their characteristics and applications.

Practical Requirements:

1. Select evaporators based on given design criteria.

2. Perform cleaning procedures on evaporator coils**.**

RF1190 Residential and Commercial Compressors

Learning Outcomes:

- Demonstrate knowledge of the procedures used to install residential and commercial compressors and their components.
- Demonstrate knowledge of the procedures used to maintain and troubleshoot residential and commercial compressors and their components.

Duration: 48 Hours

Pre-Requisite(s): RF1271, RF1361

Objectives and Content:

1. Define terminology associated with residential and commercial compressors.

2. Identify hazards and describe safe work practices pertaining to residential and commercial compressors.

3. Interpret codes and regulations pertaining to residential and commercial compressors.

4. Interpret information pertaining to residential and commercial compressors found on drawings and specifications.

5. Identify specialized tools and equipment used with residential and commercial compressors, and describe their applications and procedures for use.

6. Explain the purpose and operation of residential and commercial compressors and their components.

7. Identify types of residential and commercial compressors, and describe their characteristics and applications.
   i. hermetic
      - reciprocating
      - scroll
      - swing (rotary)
   ii. semi-hermetic
      - reciprocating

8. Identify residential and commercial compressor components, and describe their characteristics and applications.

9. Describe compressor classifications according to temperature ranges and capacities.

10. Identify the factors that affect compressor efficiency.
    i. compression ratio
    ii. clearance volume
    iii. wear
    iv. types of valves

11. Identify the factors to consider when selecting residential and commercial compressors and their components for installation.

12. Describe the procedures used to install residential and commercial compressors and their components.

13. Describe the procedures used to maintain and troubleshoot residential and commercial compressors and their components.

14. Describe control strategies for compressor protection.
    i. pump down cycle
    ii. pressure controls

15. Describe the procedures used to start up, commission and shut down residential and commercial compressors.

16. Describe the difference between oil pump pressure and net oil pressure.

17. Describe the procedures to determine net oil pressure.

18. Identify residential and commercial compressor failures, and describe their causes and procedures for repair.
    i. mechanical
        - mechanical component failure
        - improper lubrication/oil return
        - high discharge temperatures
        - slugging
        - improper refrigerant control
    ii. electrical
        - defective motor or motor protector
        - improper clean up after a previous compressor failure
        - low, high, or unbalanced voltage/amperage
        - loose wiring or faulty controls
        - mechanical failure
        - misapplication of compressor
    iii. lubrication
        - improper liquid refrigerant control
        - refrigerant migration
        - flooded starts
        - compressor overheating

Practical Requirements:

1. Test and replace current and potential relays.
2. Test and replace start and run capacitors.
3. Sketch and explain overload operation.
4. Test and check compressor motor windings.
5. Measure net oil pressure.
6. Disassemble compressors to identify failure.
7. Test compressor for pumping efficiency.

RF1371 Condensers

Learning Outcomes:

- Demonstrate knowledge of condensers, their components, accessories and operation.
- Demonstrate knowledge of the procedures used to install condensers and their components.
- Demonstrate knowledge of the procedures used to maintain and troubleshoot condensers and their components.

Duration: 24 Hours

Pre-Requisite(s): RF1221

Objectives and Content:

1. Define terminology associated with condensers.

2. Identify hazards and describe safe work practices pertaining to condensers.

3. Interpret codes and regulations pertaining to condensers.

4. Interpret information pertaining to condensers found on drawings and specifications.

5. Identify specialized tools and equipment used with condensers, and describe their applications and procedures for use.

6. Explain the purpose and operation of condensers and their components.

7. Identify types of condensers and describe their characteristics and applications.
   i. air-cooled
   ii. water-cooled
   iii. evaporative

8. Identify condenser components and describe their characteristics and applications.

9. Describe heat reclaim strategies.

10. Describe head pressure control strategies.

11. Identify the factors and conditions that determine condenser capacity and efficiency.

12. Identify the factors to consider when selecting condensers and their components for installation.

13. Describe the procedures used to size condensers.

14. Describe the procedures used to install condensers and their components.

15. Describe the procedures used to maintain and troubleshoot condensers and their components.

16. Identify condenser failures and describe their causes and procedures for repair.

Practical Requirements:

1. Select condensers based on given design criteria.

2. Perform cleaning procedures on condensers.

3. Adjust water regulating valve on water cooled condenser.

RF1390 Metering Devices

Learning Outcomes:

- Demonstrate knowledge of metering devices, their components, accessories and operation.
- Demonstrate knowledge of the procedures used to install metering devices and their components.
- Demonstrate knowledge of the procedures used to maintain and troubleshoot metering devices and their components.

Duration: 30 Hours

Pre-Requisite(s): RF1381

Objectives and Content:

1. Define terminology associated with metering devices.

2. Identify hazards and describe safe work practices pertaining to metering devices.

3. Interpret codes and regulations pertaining to metering devices.

4. Interpret information pertaining to metering devices found on drawings and specifications.

5. Identify specialized tools and equipment used with metering devices, and describe their applications and procedures for use.

6. Explain the purpose and operation of metering devices and their components.

7. Identify types of metering devices and describe their characteristics and applications.

8. Identify metering device components and describe their characteristics and applications.

9. Identify the factors to consider when selecting and installing metering devices and their components.

10. Describe the procedures used to install metering devices and their components.

11. Describe the procedures used to maintain and troubleshoot metering devices and their components.

12. Identify metering device and component failures and describe their causes and procedures for repair.

13. Describe the charging methods for various metering devices.

Practical Requirements:

1. Select expansion valves based on various applications.

2. Install, adjust and repair expansion valves on operating systems.

3. Troubleshoot system operations.
   i. high load conditions
   ii. low load conditions
   iii. refrigerant overcharge
   iv. refrigerant undercharge
   v. restricted expansion valve

RF1401 Refrigerant Flow Controls and Accessory Devices

Learning Outcomes:

- Demonstrate knowledge of refrigerant flow controls and accessory devices, and their operation.
- Demonstrate knowledge of the procedures used to install refrigerant flow controls and accessory devices.
- Demonstrate knowledge of the procedures used to maintain and troubleshoot refrigerant flow controls and accessory devices.
- Demonstrate knowledge of HVAC/R systems, their applications and components.

Duration: 30 Hours

Pre-Requisite(s): RF1361

Objectives and Content:

1. Define terminology associated with refrigerant flow controls and accessory devices.

2. Identify hazards and describe safe work practices pertaining to refrigerant flow controls and accessory devices.

3. Interpret codes and regulations pertaining to refrigerant flow controls and accessory devices.

4. Interpret information pertaining to refrigerant flow controls and accessory devices found on drawings and specifications.

5. Identify specialized tools and equipment used with refrigerant flow controls and accessory devices, and describe their applications and procedures for use.

6. Explain the purpose and operation of refrigerant flow controls and accessory devices.

7. Identify types of refrigerant flow controls and accessory devices, and describe their characteristics and applications.
   i. direct-acting
   ii. pilot-operated
   iii. reverse-acting
   iv. pressure regulators
   v. reversing valves

8. Identify the factors to consider when selecting and installing refrigerant flow controls and accessory devices.

9. Describe the procedures used to install refrigerant flow controls and accessory devices.

10. Describe the procedures used to maintain and troubleshoot refrigerant flow controls and accessory devices.

11. Identify refrigerant flow controls and accessory device failures and describe their causes and procedures for repair.

Practical Requirements:

1. Disassemble, inspect, service, repair and adjust various refrigeration flow control valves.

RF1331 Air Conditioning Fundamentals

Learning Outcomes:

- Demonstrate knowledge of air conditioning fundamentals.
- Demonstrate knowledge of air conditioning systems, their components and operation.
- Demonstrate knowledge of psychrometrics.

Duration: 18 Hours

Pre-Requisite(s): RF1221

Objectives and Content:

1. Define terminology associated with air conditioning and psychrometrics.

2. Explain air quality, air circulation and ventilation.

3. Identify the factors that affect human comfort with respect to air quality.

4. Identify specialized tools and instruments used to determine air quality, air circulation and ventilation.

5. Identify types of air conditioning systems and their components, and describe their characteristics, applications and operation.

6. Explain the fundamentals of psychrometrics.

7. Describe psychrometric processes.
   i. cooling
   ii. evaporative cooling
   iii. humidification
   iv. heating and humidification
   v. heating
   vi. heating and dehumidification
   vii. dehumidification
   viii. cooling and dehumidification

8. Describe indoor and outdoor design conditions.

Practical Requirements:

1. Plot air properties on a psychrometric chart.

RF1611 Air Movement and Indoor Air Quality

Learning Outcomes:

- Demonstrate knowledge of air movement and indoor air quality components and their operation.
- Demonstrate knowledge of the procedures used to install air movement and indoor air quality components.
- Demonstrate knowledge of the procedures used to maintain and troubleshoot air movement and indoor air quality components.

Duration: 30 Hours

Pre-Requisite(s): RF1331

Objectives and Content:

1. Define terminology associated with air movement and indoor air quality.

2. Identify hazards and describe safe work practices pertaining to air movement and indoor air quality components.

3. Interpret codes and regulations pertaining to air movement and indoor air quality components.

4. Interpret information pertaining to air movement and indoor air quality components found on drawings, specifications and curve charts.

5. Identify specialized tools and equipment used with air movement and indoor air quality components, and describe their applications and procedures for use.

6. Explain the purpose and operation of air movement and indoor air quality components.

7. Identify types of air movement components, and describe their characteristics and applications.
   i. fans
      - axial
      - radial
   ii. mechanical drives
      - belt
      - direct

8. Identify factors that affect fan performance.

9. Identify types of indoor air quality components, and describe their characteristics and applications.
   i. filter
   ii. cleaner
   iii. purifier
   iv. humidifier
   v. exhaust/fresh air
   vi. dehumidifier

10. Identify the factors to consider when selecting and installing air movement and indoor air quality components.

11. Describe the procedures used to install air movement and indoor air quality components.

12. Describe the procedures used to maintain and troubleshoot air movement and indoor air quality components.

13. Identify air movement and indoor air quality component failures and describe their causes and procedures for repair.

14. Describe the procedures used to start up, commission and shut down air movement and indoor air quality components.

Practical Requirements:

1. Replace blower belt, adjust and align.

2. Remove pulley/sheave, replace, align and adjust.

3. Adjust blower fan speed.

RF1321 Control Fundamentals

Learning Outcomes:

- Demonstrate knowledge of control fundamentals.
- Demonstrate knowledge of controls, their components, applications and operation.
- Demonstrate knowledge of performing predictive and scheduled maintenance on HVAC/R systems.

Duration: 24 Hours

Pre-Requisite(s): RF1281

Objectives and Content:

1. Define terminology associated with controls.

2. Explain closed and open loop control.

3. Explain the purpose and operation of control systems, devices and components.

4. Identify types of control systems and their components, and describe their characteristics and applications.
   i. electromechanical
   ii. electronic
   iii. pneumatic
   iv. direct digital control (DDC)

5. Identify types of control devices, and describe their characteristics and applications.
   i. relays
   ii. switches
   iii. actuators

6. Identify types of sensing controls, and describe their characteristics and applications.
   i. flow
   ii. humidity
   iii. liquid level
   iv. pressure
   v. temperature

7. Describe control and control actions.

8. Describe the procedures used to perform a basis diagnosis of electronic controls.

Practical Requirements:

1. Draw and describe an open and closed loop control circuit.

2. Draw and describe various control circuits.

3. Draw and describe a typical residential heat/cool system control circuit.

RF1481 Control Circuits and Wiring Diagrams

Learning Outcomes:

- Demonstrate knowledge of the procedures used to install control circuit components.
- Demonstrate knowledge of the procedures used to troubleshoot control circuits.
- Demonstrate knowledge of wiring diagrams and their use.
- Demonstrate knowledge of connecting system wiring and control tubing.
- Demonstrate knowledge of codes and regulations pertaining to HVAC/R control system wiring and tubing.

Duration: 54 Hours

Pre-Requisite(s): RF1321

Objectives and Content:

1. Define terminology associated with control circuits and wiring diagrams their components and accessories.

2. Identify hazards and describe safe work practices pertaining to control circuits systems.

3. Interpret codes and regulations pertaining to control circuits.

4. Interpret information pertaining to control circuits found in on drawings, wiring diagrams, and schematic diagrams.

5. Interpret information pertaining to control systems found in drawings, wiring diagrams, and schematic diagrams.
   i. pictorial
   ii. schematic
   iii. ladder
   iv. component location
   v. installation

6. Identify specialized tools and equipment used with control circuits, and describe their applications and procedures for use.

7. Identify types of control circuits and their components, and describe their characteristics and applications.
   i. operating
   ii. safety

8. Identify types of wiring diagrams and describe their characteristics and applications.
   i. pictorial
   ii. schematic
   iii. ladder
   iv. component location
   v. installation

9. Describe the sequence of operation of a control circuit and explain its relationship to its physical wiring configuration.

10. Identify the factors to consider when selecting and installing control circuit components.

11. Describe the procedures used to install control circuits and their components.

12. Describe the procedures used to troubleshoot control circuits using wiring diagrams.

13. Describe the procedure to sketch a schematic wiring diagram based on a written sequence of control events.

14. Describe the procedure to sketch a schematic wiring diagram from a pictorial diagram.

15. Describe the procedure to sketch a pictorial diagram from a schematic wiring diagram.

16. Interpret codes and regulations pertaining to HVAC/R control system wiring and tubing.

Practical Requirements:

1. Draw schematic diagrams based on a written sequence of control events complete with a legend.

2. Draw a schematic wiring diagram from a pictorial diagram.

3. Wire control circuits.

RF1810 Blueprints, Drawings and Specifications

Learning Outcomes:

- Demonstrate knowledge of blueprints/drawings and specifications and their applications.

Duration: 30 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define terminology associated with blueprints/drawings and specifications.

2. Identify types of specification documents and describe their applications.
   i. manufacturers'
   ii. engineers'
   iii. contractors'
   iv. clients'

3. Identify types of blueprints/drawings and describe their applications.
   i. civil/site
   ii. architectural
   iii. mechanical
   iv. structural
   v. electrical
   vi. plan views
   vii. shop drawings
   viii. sketches
   ix. as-built

4. Identify views used on blueprints/drawings.
   i. plan
   ii. section
   iii. detail

5. Identify information found on blueprints/drawings.
   i. lines
   ii. legend
   iii. symbols and abbreviations
   iv. title block
   v. notes and specifications
   vi. schedules
   vii. units of measurement (metric/imperial)

6. Explain the use of blueprints/drawings measurement scales.

7. Describe the procedures used to convert between metric and imperial units of measurement.

8. Describe the procedures used to interpret and extract information from blueprints/drawings and specifications.

9. Describe the procedure to perform conversions between the metric and imperial systems of measurement.

10. Describe the procedure to perform a basic take-off from a blueprint/drawing.

Practical Requirements:

1. Sketch and interpret basic drawings and diagrams.

2. Perform conversions between the metric and imperial systems of measurement.

3. Perform a basic take-off from a blueprint/drawing.

AM1000 Introduction to Essential Skills

Learning Outcomes:

- Demonstrate knowledge of the nine nationally recognized essential skills.
- Demonstrate knowledge of the essential skills levels of complexity.
- Demonstrate knowledge of the essential skills required for the learners chosen trade.
- Demonstrate an awareness of essential skills assessments.

Duration: 9 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Identify and describe the essential skills recognized by the Government of Canada through the Office of Literacy and Essential Skills (OLES).
   i. reading
   ii. document use
   iii. numeracy
   iv. writing
   v. oral communication
   vi. working with others
   vii. thinking
   viii. computer use
   ix. continuous learning

2. Describe the Levels of Complexity measurement assigned to essential skills.

3. Identify the essential skills, along with their complexity level, identified as necessary for the learner's trade.
   i. RSOS / NOA content[1]
   ii. OLES Essential Skills Profiles[2]
   iii. OLES tools and support for apprentices and tradespersons[3]

4. Describe the nature and purpose of essential skills assessment.
   i. self-assessment & formal assessment tools
   ii. indicators of deficiencies
   iii. suggestions for improvement

5. Describe the benefits of essential skills improvement.
   i. confidence at work
   ii. employability
   iii. success in apprenticeship
   iv. wage & job advancement

Practical Requirements:

1. Complete an essential skills self-assessment addressing numeracy, document use and reading. The online **Government of Canada Essential Skills Indicator**[4] and **Essential Skills self-assessment for the trades**[5] are to be used unless the instructor provides a similar assessment tool or tools.

2. Participate in a group discussion about the impact of gaps in essential skills that may be revealed by the self-assessments completed, and the value of improving essential skills.

Students are graded complete or incomplete on this practical work, no grade is permitted for self-assessment performance. However, completion of the practical requirements is mandatory for completion of this unit.

Resources:

All footnotes are in the companion document “Resources for Introduction to Essential Skills” which is available online from Apprenticeship and Trade Certification.

AM1101 Math Essentials

Note: It is recommended that AM1101 be delivered in the first semester of the Pre-Employment program.

Learning Outcomes:

- Demonstrate knowledge of essential numeracy skills.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Demonstrate knowledge of mathematical principles in trade problem solving situations.
- Demonstrate the ability to solve simple mathematical word problems.

Duration: 42 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Describe whole number operations.
   i. read, write, count, round off, add, subtract, multiply and divide whole numbers.

2. Describe the application of the order of operations in math problems.

3. Describe fraction and mixed number operations.
   i. read, write, add, subtract, multiply and divide fractions.

4. Describe decimal operations.
   i. read, write, round off, add, subtract, multiply and divide decimals.

5. Describe percent/decimal/fraction conversion and comparison.
   i. convert between fractions, decimals and percents.

6. Identify percentage operations.
   i. read and write percentages
   ii. calculate base, rates and percentages

7. Identify ratio and proportion operations.
   i. use a ratio comparing two quantities with the same units
   ii. use a proportion comparing two ratios

8. Describe the use of the imperial measurement system in math problems.
   i. identify units of measurement
      - length
      - mass
      - area
      - volume
      - capacity

9. Describe the use of the metric measurement system in math problems.
   i. identify units of measurement
      - length
      - mass
      - area
      - volume
      - capacity

10. Identify angles, lines and geometric shapes.
   i. use a protractor to measure angles
   ii. determine whether an angle is right, acute or obtuse
   iii. identify parallel, perpendicular, horizontal and vertical lines
   iv. identify types of triangles, quadrilaterals, and 3-dimensional shapes

11. Describe estimation strategies.
   i. estimate a linear measure using a referent
   ii. estimate length, area and volume of objects in metric and imperial systems

12. Describe problem solving that involves linear measurement using instruments such as rulers or tape measures, in the metric and imperial systems.

Practical Requirements:

To emphasize or further develop specific knowledge objectives, students will be required to complete practical demonstrations which confirm proper application of mathematical theory to job skills.

AM1291 Refrigeration Math Fundamentals

Learning Outcomes:

- Demonstrate knowledge of mathematical concepts in the performance of trade practices.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Solve mathematical word problems.
- Demonstration knowledge of mathematical principles for the purposes of problem solving, job and materials estimation, measurement, calculation, system conversion, diagram interpretation and scale conversions, formulae calculations, and geometric applications.

Duration: 42 Hours

Pre-Requisite(s): AM1101

Objectives and Content:

The instructor is required to use trade specific examples to reinforce the course objectives.

1. Describe percent/decimal/fraction conversions and comparisons in trade specific situations.

2. Describe ratios and proportions as they relate to trade specific problems.

3. Describe the use of the Imperial and Metric measurement systems in trade specific applications.

4. Describe Imperial and Metric conversions in trade specific situations.
   i. convert between imperial and metric measurements
   ii. convert to another unit within the same measurement system

5. Describe how to manipulate formulas using cross multiplication, dividing throughout, elimination, and substitution to solve trade specific problems.
   i. right angle triangles
   ii. area
   iii. volume
   iv. perimeter
   v. density

6. Identify calculations involving geometry that are relevant to the trade.
   i. angle calculations
   ii. circle calculations

7. Identify math processes used to complete administrative trade tasks.
   i. material estimation
   ii. material costing
   iii. time & labour estimates
   iv. taxes & surcharges
   v. markup & projecting revenue

Practical Requirements:

1. To emphasize or further develop specific knowledge objectives, students will be asked to complete practical demonstrations which confirm proper application of mathematical theory to job skills.

Note: This course is **non - transferable** to other trades programs, and **not eligible for prior learning assessment**. Students completing training in this trade program are required to complete this math course. Apprentice transfers under Provincial / Territorial Mobility agreements may be exempt from this requirement.

CM2161 Communication Essentials

Learning Outcomes:

- Demonstrate knowledge of the importance of well-developed writing and oral communication skills in the workplace.
- Demonstrate knowledge of the principles of effective workplace writing.
- Demonstrate knowledge of the purpose of various types of workplace documentation and workplace meetings.
- Demonstrate knowledge of the importance of effective interpersonal skills in the workplace.
- Demonstrate knowledge of effective job search techniques.

Duration: 36 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Define communications terminology used in the trade.

2. Identify the principles of effective workplace writing.
   i. grammar, punctuation, mechanics
   ii. sentence and paragraph construction
   iii. tone, language, and word choice
   iv. the writing process
      - planning
      - writing
      - editing/revising

3. Identify sources of information used to communicate in the workplace.
   i. regulations
   ii. codes
   iii. OH&S requirements
   iv. prints, drawings and specifications
   v. company and client documentation

4. Identify types and purposes of informal workplace documents.
   i. reports
      - incident
      - process
      - progress
   ii. common trade specific forms
   iii. primary and secondary methods of information gathering
   iv. accuracy and completeness in reports and forms

5. Demonstrate an understanding of interpersonal communications in the workplace.
   i. recognize group dynamics
   ii. contribute information and expertise
   iii. individual learning styles
      - audible
      - visual
      - experiential
      - theoretical
   iv. recognize respectful and open communication
   v. accept and provide feedback
   vi. interpret non-verbal communication cues
      - body language
      - signals

6. Demonstrate an understanding of effective oral communication skills.
   i. listening
      - receiving, understanding, remembering, reflecting, evaluating, paraphrasing, and responding
   ii. speaking
      - using clear and proper words
      - tone, style, and vocabulary
      - brevity
   iii. common workplace oral communication situations
      - introducing self and others
      - telephone conversations
      - tool box/safety talks
      - face-to-face conversations
      - communicating with co-workers, supervisors, clients, and other trades people

7. Identify common practices related to workplace meetings.
   i. meeting formats
   ii. meeting preparation
   iii. agendas and minutes
   iv. roles, responsibilities, and etiquette of meeting participants

8. Identify acceptable workplace use of communication technologies
   i. cell / smart phone etiquette
   ii. voice mail
   iii. e-mail
   iv. texting / messaging through social media
   v. teleconferencing / videoconferencing for meetings and interviews
   vi. social networking
   vii. other emerging technologies

9. Demonstrate an understanding of effective job search techniques
   i. employment trends, opportunities, and sources of employment
   ii. job ads and the importance of fitting qualifications to job requirements
   iii. resumes
      - characteristics of effective resumes
      - types of resumes
      - principles of resume formatting
   iv. effective cover letters
   v. job interview process
      - pre-interview preparation
      - interview conduct
      - post-interview follow up

Practical Requirements:

1. Write a well-developed, coherent, unified paragraph.

2. Complete a trade-related form.

3. Prepare an agenda for a toolbox safety talk.

4. Participate in a simulated oral workplace communication situation.

5. Prepare a resume.

SD1761 Workplace Essentials

Note: It is recommended that SD1761 be delivered in the second half of pre-Employment training.

Learning Outcomes:

- Demonstrate a knowledge of workplace requirements in the areas of personal responsibility, unions, workers compensation, workers' rights, and human rights.
- Demonstrate a knowledge of quality customer service.

Duration: 24 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Identify personal responsibilities and attitudes that contribute to on-the-job success.
   i. asking questions
   ii. working safely
   iii. accepting constructive feedback
   iv. time management & punctuality
   v. respect for authority
   vi. stewardship of materials, tools and properties

2. Define unions and identify their role in the workplace.
   i. purpose of unions
   ii. common union structure
   iii. unions in this trade

3. Demonstrate an understanding of the Worker's Compensation process.
   i. aims, objectives, and benefits of the Workplace Health, Safety and Compensation Commission
   ii. role of the workers advisor
   iii. internal review process

4. Demonstrate an understanding of worker's rights.
   i. labour standards
   ii. regulations, including:
      - hours of work & overtime
      - termination of employment
      - minimum wages & allowable deductions
      - statutory holidays, vacation time, and vacation pay

5. Demonstrate an understanding of human rights issues.
   i. awareness of the Human Rights Code and the role of the Human Rights Commission
   ii. categories of discrimination and strategies for prevention
      - direct
      - systemic
      - adverse effect
   iii. types of discrimination
      - race
      - ethnic origin
      - colour
      - religion
      - age
      - gender identify
      - sexual orientation
      - marital status
      - family status
      - disability
      - criminal conviction that has been pardoned
   iv. conduct that constitutes harassment and discrimination
      - objectionable conduct
      - comments or displays made either on a one-time or continuous basis that demeans, belittles, or causes personal humiliation or embarrassment to the recipient
   v. the value of diversity in the workplace
      - culture
      - gender identify
      - sexual orientation

6. Demonstrate an understanding of quality customer service.
   i. importance of quality service
   ii. barriers to quality service
      - physical and physiological
      - cultural
      - technological
   iii. customer needs & common methods for meeting them
   iv. characteristics & importance of a positive attitude
   v. interactions with challenging customers
   vi. addressing complaints and resolve conflict

Practical Requirements:

None.

MC1062 Computer Essentials

Learning Outcomes:

- Demonstrate knowledge of desktop/laptop and mobile computers and their operation.
- Demonstrate knowledge of word processing and spreadsheet software, internet browsers and their applications.
- Demonstrate knowledge of e-mail applications and procedures.
- Demonstrate an awareness of security issues related to computers.
- Demonstrate an awareness of online learning using computers.

Duration: 15 Hours

Pre-Requisite(s): None

Objectives and Content:

When possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Identify computer types used in the workplace, and the characteristics of each.
   i. desktop/laptop computers
   ii. tablets
   iii. smartphones

2. Identify common desktop and mobile operating systems.
   i. Windows
   ii. Mac OS
   iii. iOS
   iv. Android

3. Describe the use of Windows operating system software.
   i. start and end a program
   ii. use the help function
   iii. use the find function
   iv. maximize and minimize a window
   v. open and scroll through multiple windows
   vi. use the task bar
   vii. adjust desktop settings such as screen savers, screen resolution, and backgrounds
   viii. shut down a computer

4. Identify the skills necessary to perform file management commands.
   i. create folders
   ii. copy files and folders
   iii. move files and folders
   iv. rename files and folders
   v. delete files and folders

5. Describe the use of word processing software to create documents.
   i. enter & edit text
   ii. indent and tab text
   iii. change text attributes
      - bold
      - underline
      - font
   iv. change layout format
      - margins
      - alignment
      - line spacing
   v. spell check and proofread
   vi. save, close & reopen a document
   vii. print document

6. Describe the use of spreadsheet software to create documents.
   i. enter data in cells
   ii. format data in cells
   iii. create formulas to add, subtract, multiply and divide
   iv. save, close & reopen a spreadsheet
   v. print spreadsheet

7. Describe the use of the internet in the workplace.
   i. web browsers
   ii. search engines
   iii. security issues
   iv. personal responsibility for internet use at work

8. Describe the role of e-mail.
   i. e-mail etiquette
      - grammar and punctuation
      - privacy issues when sharing and forwarding e-mail
      - work appropriate content
      - awareness of employer policies
   ii. managing e-mail
      - using folders
      - deleting, forwarding, replying
   iii. adding attachments to e-mail
   iv. view e-mail attachments

v. printing e-mail

9. Describe computer use for online learning.
   i. online training
   ii. level exams
   iii. study guides
   iv. practice exams

Practical Requirements:

1. Create, save and print a document using word processing software.

2. Create, save and print a document using spreadsheet software.

3. Send and receive an e-mail with an attachment.

AP1102 Introduction to Apprenticeship

Learning Outcomes:

- Demonstrate knowledge of how to become a registered apprentice.
- Demonstrate knowledge of the steps to complete an apprenticeship program.
- Demonstrate knowledge of various stakeholders in the apprenticeship process.
- Demonstrate knowledge of the Red Seal Program.

Duration: 12 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define terminology associated with apprenticeship.
   - i. apprentice
   - ii. registered apprentice
   - iii. trade qualifier
   - iv. journeyperson
   - v. certified journeyperson
   - vi. Certificate of Apprenticeship
   - vii. Certificate of Qualification
   - viii. dual certification
   - ix. compulsory trades

2. Explain the roles and responsibilities of those involved in the apprenticeship system in Newfoundland and Labrador.
   - i. registered apprentice
   - ii. training institution
   - iii. employer
   - iv. journeyperson
   - v. mentor
   - vi. Department of Jobs, Immigration and Growth
     - Industrial Training section
     - Standards and Curriculum section
   - vii. Provincial Trade Advisory Committees (PTAC)
   - viii. Provincial Apprenticeship and Certification Board (PACB)

3. Describe the training components of an apprenticeship.
   - i. in-school
     - Pre-Employment / Level 1
     - advanced levels
   - ii. workplace experience

4. Explain the steps in the registered apprenticeship process.
   - i. meet entrance requirements
     - education
     - employment
     - Recognition of Prior Learning (RPL) - if applicable
   - ii. complete the registration process
     - application
     - required documents
   - iii. complete the Memorandum of Understanding (MOU)
     - contract responsibilities
     - probation period
     - cancellation
   - iv. maintain Record of Occupational Progress (Logbook)
     - sign off skills
     - record hours
     - update Apprenticeship Program Officer (APO) on progress
   - v. class calls
     - hour requirements
     - EI eligibility
     - training schedule
   - vi. level examinations - if applicable
   - vii. progression schedule
     - apprenticeship level
     - wage rates
   - viii. certification examinations
     - Provincial
     - Red Seal
       - written
       - practical - if applicable
   - ix. certification
     - Certificate of Apprenticeship
     - Certificate of Qualification
     - Provincial journeyperson - Blue Seal
     - Interprovincial journeyperson - Red Seal endorsement (RSE)

5. Identify the Conditions Governing Apprenticeship.

6. Discuss cancellation of apprenticeship.
   - i. failure to notify of address change
   - ii. extended periods of unemployment
   - iii. lack of contact with an APO for an extended period
   - iv. failure to respond to class calls
   - v. declining of multiple class calls

7. Explain the Red Seal program.
   i. designated Red Seal trades
   ii. the Red Seal Occupational Standard (RSOS)
   iii. relationship of RSOS to Red Seal examination
   iv. national qualification recognition and mobility

8. Identify the current financial incentives available to apprentices.
   i. Federal
   ii. Provincial

9. Explain the Provincial / Territorial Apprentice Mobility Guidelines.
   i. temporary mobility
   ii. permanent mobility

10. Describe Atlantic and National Harmonization initiatives.

Practical Requirements:

1. Use the Provincial Apprenticeship and Trades Certification website at www.gov.nl.ca/atcd
   i. locate, download, and complete the Application for Apprenticeship and Memorandum of Understanding (MOU)
   ii. locate the address of the Industrial Training office closest to this campus
   iii. locate the training schedule and identify the start date of the next class call for this trade
   iv. locate and review the learning resources applicable to this trade
      - Study Guide
      - Exam Preparation Guide
      - Plan of Training

2. Use the Plan of Training applicable to this trade.
   i. locate the hours for the trade
      - total in-school
      - total required for certification
   ii. locate the number of levels
   iii. locate the courses in each level
   iv. locate the hours required for progression to a Level 2 apprentice and the wage percentage of that level

C. Conditions Governing Apprenticeship Training

1.0 General

The following general conditions apply to all apprenticeship training programs approved by the Provincial Apprenticeship and Certification Board (PACB) in accordance with the **Apprenticeship and Certification Act (1999)**. If an occupation requires additional conditions, these will be noted in the specific Plan of Training for the occupation. In no case should there be a conflict between these conditions and the additional requirements specified in a certain Plan of Training. All references to Memorandum of Understanding will also apply to Letter of Understanding (LOU) agreements.

2.0 Entrance Requirements

2.1 Entry into the occupation as an apprentice requires:

Indenturing into the occupation by an employer who agrees to provide the appropriate training and work experiences as outlined in the Plan of Training.

2.2 Notwithstanding the above, each candidate must have successfully completed a high school program or equivalent, and in addition may be required to have completed certain academic subjects as specified in a particular Plan of Training. Mature students, at the discretion of the Director of Apprenticeship and Trades Certification, may be registered. A mature student is defined as one who has reached the age of 19 and who can demonstrate the ability and the interest to complete the requirements for certification.

2.3 At the discretion of the Director of Apprenticeship and Trades Certification, credit toward the apprenticeship program may be awarded to an apprentice for previous work experience and/or training as validated through prior learning assessment.

2.4 An Application for Apprenticeship form must be duly completed along with a Memorandum of Understanding as applicable to be indentured into an Apprenticeship. The Memorandum of Understanding must contain signatures of an authorized employer representative, the apprentice and an official representing the Provincial Apprenticeship and Certification Board to be valid.

2.5 A new Memorandum of Understanding must be completed for each change in an employer during the apprenticeship term.

3.0 Probationary Period

The probationary period for each Memorandum of Understanding will be six months or 900 employment credit hours. Within that period the memorandum may be terminated by either party upon giving the other party and the PACB one week notice in writing.

4.0 Termination of a Memorandum of Understanding

After the probationary period referred to in Section 3.0, the Memorandum of Understanding may be terminated by the PACB by mutual consent of the parties involved, or cancelled by the PACB for proper and sufficient cause in the opinion of the PACB, such as that stated in Section 14.

5.0 Apprenticeship Progression Schedule, Wage Rates and Advanced Training Criteria

Progression Schedule

Refrigeration and Air Conditioning Mechanic - 7200 Hours			
Apprenticeship Level and Wages			
Level	Wage Rate	Requirements for Progression to Next Level	Next Level
1st	60%	▪ Completion of Pre-Employment training ▪ Registration as an apprentice ▪ Minimum 1800 hours of combined relevant work experience and training	2nd Year
2nd	70%	▪ Completion of Level 2 training ▪ Pass Level 2 exam* ▪ Minimum 3600 hours of combined relevant work experience and training	3rd Year
3rd	80%	▪ Completion of Level 3 training ▪ Pass Level 3 exam* ▪ Minimum 5400 hours of combined relevant work experience and training	4th Year
4th	90%	▪ Completion of Level 4 training ▪ Pass Level 4 exam* ▪ Minimum 7200 hours of combined relevant work experience and training ▪ Sign-off of all workplace skills in apprentice logbook ▪ Pass certification exam	Journeyperson Certification

Wage Rates

- Rates are percentages of the prevailing journeyperson's wage rate in the place of employment of the apprentice.
- Rates must not be less than the wage rate established by the Labour Standards Act (1990), as now in force or as hereafter amended, or by other order, as amended from time to time replacing the first mentioned order.
- Rates must not be less than the wage rate established by any collective agreement which may be in force at the apprentice's workplace.
- Employers are free to pay wage rates above the minimums specified.

Level Exams*

- This program may not currently contain Level Exams, in which case this requirement will be waived until such time as Level Exams are available.

Refrigeration and Air Conditioning Mechanic - 7200 Hours		
Class Calls (After Apprenticeship Registration)		
Call Level	Requirements for Class Call	Hours Awarded for In-School Training
Level 2	▪ Minimum of 3000 hours of relevant work experience and training	240
Level 3	▪ Minimum of 5000 hours of relevant work experience and training	240
Level 4	▪ Minimum of 7000 hours of relevant work experience and training	240

Class Calls at Minimum Hours

- Class calls may not always occur at the minimum hours indicated. Some variation is permitted to allow for the availability of training resources and apprentices.

6.0 Tools

Apprentices shall be required to obtain their own hand tools applicable for the designated occupation of registration or tools as specified by the PACB.

7.0 Periodic Examinations and Evaluation

7.1 Every apprentice shall submit to such occupational tests and examinations as the PACB shall direct. If after such occupational tests and examinations the apprentice is found to be making unsatisfactory progress, his/her apprenticeship level and rate of wage shall not be advanced as provided in Section 5 until his/her progress is satisfactory to the Director of Apprenticeship and Trades Certification and his/her date of completion shall be deferred accordingly. Persistent failure to pass required tests shall be a cause for revocation of his/her Memorandum of Understanding.

7.2 Upon receipt of reports of accelerated progress of the apprentice, the PACB may shorten the term of apprenticeship and advance the date of completion accordingly.

7.3 For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.

7.4 Course credits may be granted through the use of a PACB approved matrix which identifies course equivalencies between designated trades and between current and historical Plans of Training for the same trade.

8.0 Granting of Certificates of Apprenticeship

Upon the successful completion of apprenticeship, the PACB shall issue a Certificate of Apprenticeship.

9.0 Hours of Work

Any hours employed in the performance of duties related to the designated occupation will be credited towards the completion of the term of apprenticeship. Appropriate documentation of these hours must be provided.

10.0 Copies of the Registration for Apprenticeship

The Director of Apprenticeship and Trades Certification shall provide copies of the Registration for Apprenticeship form to all signatories to the document.

11.0 Ratio of Apprentices to Journeypersons

Under normal practice, the ratio of apprentices to journeypersons shall not exceed two apprentices to every one journeyperson employed. Other ratio arrangements would be determined and approved by the PACB.

12.0 Relationship to a Collective Bargaining Agreement

Where applicable in Section 5 of these conditions, Collective Agreements take precedence.

13.0 Amendments to a Plan of Apprenticeship Training

A Plan of Training may be amended at any time by the PACB.

14.0 Employment, Re-Employment and Training Requirements

14.1 The Plan of Training requires apprentices to regularly attend their place of employment.

14.2 The Plan of Training requires apprentices to attend training for that occupation as prescribed by the PACB.

14.3 Failure to comply with Sections 14.1 and/or 14.2 will result in cancellation of the Memorandum of Understanding. Apprentices may have their MOUs reinstated by the PACB but would be subject to a commitment to complete the entire program as outlined in the General Conditions of Apprenticeship. Permanent cancellation in the said occupation is the result of non-compliance.

14.4 Cancellation of the Memorandum of Understanding to challenge journeyperson examinations, if unsuccessful, would require an apprentice to serve a time penalty of two (2) years before reinstatement as an apprentice or qualifying to receive a class call to training as a registered Trade Qualifier. Cancellation must be mutually agreed upon by the employer and the apprentice.

14.5 An employer shall ensure that each apprentice is under the direct supervision of an approved journeyperson supervisor who is located at the same worksite as the apprentice, and that the apprentice is able to communicate with the journeyperson with respect to the task, activity or function that is being supervised.

14.6 Under the Plan of Training the employer is required to keep each apprentice employed as long as work is available, and if the apprentice is laid off due to lack of work, to give first opportunity to be hired before another is hired.

14.7 The employer will permit each apprentice to attend training programs as prescribed by the PACB.

14.8 Apprentices who cannot acquire all the workplace skills at their place of employment will have to be evaluated in a simulated work environment at a PACB authorized training institution and have sign-off done by instructors to meet the requirements for certification.

15.0 Appeals to Decisions Based on Conditions Governing Apprenticeship Training

Persons wishing to appeal any decisions based on the above conditions must do so in writing to the Minister of Education and Early Childhood Development within 30 days of the decision.

D. Requirements for Red Seal Endorsement

1. Evidence the required work experiences outlined in this Plan of Training have been obtained. This evidence must be in a format clearly outlining the experiences and must be signed by an appropriate person or persons attesting that these experiences have been obtained to the level required.

2. Successful completion of all required courses in the program.

3. A combination of training from an approved training program and suitable work experience totaling 7200 hours.

   Or

   A total of 10,800 hours of suitable work experience.

4. Completion of a National Red Seal examination, to be set at a place and time determined by the Apprenticeship and Trades Certification Division.

E. Roles and Responsibilities of Stakeholders in the Apprenticeship Process

The apprenticeship process involves a number of stakeholders playing significant roles in the training of apprentices. This section outlines these roles and the responsibilities resulting from them.

The Apprentice:

- completes all required technical training courses as approved by the PACB.
- finds appropriate employment.
- completes all required work experiences in combination with the required hours.
- ensures work experiences are well documented.
- approaches apprenticeship training with an attitude and commitment that fosters the qualities necessary for a successful career as a qualified journeyperson.
- obtains the required hand tools as specified by the PACB for each period of training of the apprenticeship program.

The Employer:

- provides high quality work experiences in an environment conducive to learning.
- remunerates apprentices as set out in the Plan of Training or Collective Agreements.
- provides feedback to training institutions, Apprenticeship and Trades Certification Division and apprentices in an effort to establish a process of continuous quality improvement.
- where appropriate, releases apprentices for the purpose of returning to a training institution to complete the necessary technical courses.
- ensures work experiences of the apprentice are documented.
- ensures a certified journeyperson is currently on staff in the same trade area as the apprentice and whose certification is recognized by the NL Department of Education and Early Childhood Development.

The Training Institution:

- provides a high quality learning environment.
- provides the necessary student support services that will enhance an apprentice's ability to be successful.
- participates with other stakeholders in the continual updating of programs.

The Apprenticeship and Trades Certification Division:

- establishes and maintains program advisory committees under the direction of the PACB.
- promotes apprenticeship training as a viable career option to prospective apprentices and other appropriate persons involved, such as career guidance counsellors, teachers, parents, etc.
- establishes and maintains a protocol with training institutions, employers and other appropriate stakeholders to ensure the quality of apprenticeship training programs.
- ensures all apprentices are appropriately registered and records are maintained as required.
- schedules all necessary technical training periods for apprentices to complete requirements for certification.
- administers Level, provincial and Red Seal examinations.

The Provincial Apprenticeship and Certification Board:

- sets policies to ensure the provisions of the **Apprenticeship and Certification Act (1999)** are implemented.
- ensures advisory and examination committees are established and maintained.
- accredits institutions to deliver apprenticeship training programs.
- designates occupations for apprenticeship training and/or certification.

Department of Education and Early Childhood Development
Apprenticeship and Trades Certification Division

Newfoundland & Labrador