



Refrigeration and Air Conditioning Mechanic On-the-Job Training Guide

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1-877-363-0536
apprenticeship@gov.sk.ca
saskapprenticeship.ca



Saskatchewan
Apprenticeship and
Trade Certification
Commission

Online: www.saskapprenticeship.ca

Recognition:

To promote transparency and consistency, this document has been adapted from the 2019 Refrigeration and Air Conditioning Mechanic Red Seal Occupational Standard (Employment and Social Development Canada).

A complete version of the Occupational Standard can be found at www.red-seal.ca

STRUCTURE OF THE ON-THE-JOB TRAINING GUIDE

To facilitate understanding of the occupation, this on-the-job training guide contains the following sections:

Description of the Refrigeration and Air Conditioning Mechanic trade: an overview of the trade's duties and training requirements.

Essential Skills Summary: an overview of how each of the nine essential skills is applied in this trade.

Harmonization: a brief description on the pan-Canadian Harmonization Initiative for the Refrigeration and Air Conditioning Mechanic trade.

Task Matrix: a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard detailing the essential skills and the level of training where the content is covered.

Major Work Activity (MWA): the largest division within the standard that is comprised of a distinct set of trade activities.

Task: distinct actions that describe the activities within a major work activity.

Sub-task: distinct actions that describe the activities within a task.

On-the-Job and In-school Training Content for the Refrigeration and Air Conditioning Mechanic Trade: a chart which outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for topics of technical training.

DESCRIPTION OF THE REFRIGERATION AND AIR CONDITIONING MECHANIC TRADE

Refrigeration and Air Conditioning Mechanics install, maintain and repair primary and secondary refrigeration and cooling systems, in residential, commercial and industrial settings.

Refrigeration and air conditioning mechanics install, maintain, service, and decommission residential, commercial, industrial and institutional heating, ventilation, air conditioning and refrigeration units and systems. They also connect to and service air delivery systems, install and service hydronic and secondary refrigerant systems and associated controls. Their duties include laying out reference points for installation, assembling and installing components, installing wiring and cabling, to connect components and equipment to an electric power supply and calibrating related controls. They also measure, cut, bend, thread and connect pipe to functional components and utilities.

Refrigeration and air conditioning mechanics maintain and service systems by inspecting and testing components, brazing or soldering parts to repair defective joints, adjusting and replacing worn or defective components and reassembling repaired components and systems. As part of service and commissioning, refrigeration and air conditioning mechanics start up, test, charge, adjust, calibrate, balance, measure, verify maintain and document systems.

In addition to their regular duties, some mechanics may also prepare work estimates and design systems for clients.

Refrigeration and air conditioning mechanics work with a range of tools and equipment including hand, power, charging, diagnostic and measuring, hoisting and rigging, and recovery and recycling tools and equipment.

They may be employed by heating, ventilation, air conditioning and refrigeration contractors and manufacturers, property owners, retail establishments, and institutional and public sector employers. They also may be self-employed. Refrigeration and air conditioning mechanics may work on systems and units in office buildings, restaurants, food and beverage processing plants, ice arenas, supermarkets, hospitals, the marine and mining sectors as well as bio-medical, scientific and research and development fields. They may also work on refrigerated trucks, automotive air conditioning systems, box cars and appliances.

In some jurisdictions, refrigeration and air conditioning mechanics may be required to work on fuel-fired equipment and therefore may require additional licencing.

Refrigeration and air conditioning mechanics work in various locations such as rooftops, mechanical rooms and computer rooms. The work may be performed indoors or outdoors year round and may require extensive travelling. Much of the work is performed independently.

Inherent risks in this trade include working at heights and in confined spaces, and working with compressed gases, flammable and toxic materials, and utilities such as electrical and hazardous chemicals. Hazardous work environments and weather conditions are also factors. Refrigeration and air conditioning mechanics must be aware of the physical demands and potential for personal injury when performing tasks.

Key attributes for people entering this trade are strong client service, writing, oral communication and problem solving skills, an eye for detail, and the ability to be independent and self-directed. Coordination and manual dexterity are also important, as are mechanical and mathematical abilities. Good physical condition and the strength to lift heavy components are also valuable.

This standard recognizes similarities and overlaps with the work of steamfitters/pipefitters, plumbers, gasfitters, sheet metal workers, industrial mechanics (millwrights), electricians, instrumentation and control technicians, riggers and stationary engineers.

With experience, refrigeration and air conditioning mechanics may act as mentors and trainers of apprentices in the trade. They may also become specialized in one area of the trade, advance to supervisory positions or become instructors.

Training Requirements: To graduate from each level of the apprenticeship program, an apprentice must successfully complete the required technical training and compile enough on-the-job experience to total at least 1800 hours each year. Total trade time required is 7200 hours and at least 4 years in the trade.

There are four levels of technical training delivered by Saskatchewan Polytechnic in Saskatoon:

Level One:	8 weeks
Level Two:	8 weeks
Level Three:	8 weeks
Level Four:	8 weeks

Journeyman to apprentice ratio for this trade is 1:2

The information contained in this document serves as a guide for employers and apprentices. Apprenticeship training is mutually beneficial to both employer and apprentice. The employer's investment in training apprentices results in skilled and certified workers. The document summarizes the tasks to be covered by the apprentice during their on-the-job portion of apprenticeship training. An apprentice spends approximately 85% of their apprenticeship term training on-the-job.

It is the employer's or journeyman's responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.

EMPLOYER TRAINING RESPONSIBILITY

- promote a safety-conscious workplace
- provide mentored, hands-on practice in the use of tools and equipment
- demonstrate procedures relevant to the installation and service of HVAC/R systems
- provide the opportunity for apprentices to service the above systems and products
- further the apprentice's ability to interpret technical drawings
- ensure that the apprentice can evaluate the end product.

Employers should make every effort to expose their apprentices to work experience in as many areas of the trade as possible.

In the On-the-Job Training Guide, in-school instruction is listed first; on-the-job suggestions to help employers assist the apprentice to prepare for in-school training are listed next.

The content of the training components is subject to change without notice.

Entrance Requirements for Apprenticeship Training

Your grade twelve transcripts (with no modified classes) or GED 12 is your guarantee that you meet the educational entrance requirements for apprenticeship in Saskatchewan. In fact, employers prefer and recommend apprentices who have completed high school. This ensures the individual has all of the necessary skills required to successfully complete the apprenticeship program and receive journey person certification.

Individuals with “modified” or “general” classes in math or science do not meet our entry requirements. These individuals are required to take an entrance assessment prescribed by the SATCC.

English is the language of instruction in all apprenticeship programs and is the common language for business in Saskatchewan. Before admission, all apprentices and/or “upgraders” must be able to understand and communicate in the English language. Applicants whose first language is not English must have a minimum Canadian Language Benchmark Assessment of six (CLB6).

Note: A CLB assessment is valid for a one-year period from date of issue.

GED 12 is acceptable; “modified” or “general” classes are not.

Designated Trade Name	Math Credit at the Indicated Grade Level❶	Science Credit at Grade Level (preferred class in brackets)
Refrigeration and Air Conditioning Mechanic	WA 20 or F 20 or P 20 or Math 20	Grade 10
<p>❶ (One of the following) WA – Workplace and Apprenticeship; or F – Foundations; or P – Pre-calculus, or a Math at the indicated grade level (Modified and General Math credits are not acceptable.).</p> <p>*Applicants who have graduated in advance of 2015-2016, or who do not have access to the revised Science curricula will require a Science at the minimum grade level indicated by trade.</p> <p>Individuals not meeting the entrance requirements will be subject to an assessment and any required training</p>		

ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

The tools are available online or for order at: www.esdc.gc.ca/eng/jobs/les/profiles/index.shtml

The application of these skills may be described throughout this document within the skills and knowledge which support each sub-task of the trade. The most important essential skills for each sub-task have also been identified. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

READING

Refrigeration and air conditioning mechanics read a variety of materials including technical bulletins, manufacturers' specifications and manuals to obtain detailed information on equipment installation and troubleshooting procedures. They read work orders to ensure that the correct piece of equipment is being installed or maintained according to client requirements. They may also refer to wholesaler catalogues to assist in the selection and ordering of parts and equipment.

DOCUMENT USE

As part of document use, refrigeration and air conditioning mechanics consult company and work site procedures. They interpret information in tables, charts and graphs, and codes and regulations, and apply that knowledge when performing a task. They also use drawings to understand job requirements. Refrigeration and air conditioning mechanics adhere to hazard signs and warning labels that are part of WHMIS to prevent injury to themselves and others.

WRITING

Refrigeration and air conditioning mechanics update logbooks and complete written documents such as service reports, work orders, warranty claim forms, permits, and legislated and company documents. They may prepare sketches and update as-built drawings.

NUMERACY

Refrigeration and air conditioning mechanics use numeracy in a range of tasks. For example, they measure lengths of ducting and piping. They calculate areas and volumes of ducting and piping assemblies to meet operating specifications. They use diagnostic and measurement tools to troubleshoot and verify the proper operation of equipment. They compare equipment temperature and pressure trend graphs to equipment specifications and operating parameters to monitor systems. They also estimate time and material costs.

ORAL COMMUNICATION

Refrigeration and air conditioning mechanics communicate with other tradespeople to coordinate the installation, maintenance and service of HVAC/R systems. They interact with clients to identify system requirements and to obtain problem descriptions. They may also call suppliers to order parts, speak with manufacturers' representatives to obtain technical information and engineers to discuss design specifications.

THINKING

Refrigeration and air conditioning mechanics use problem-solving skills to troubleshoot equipment problems and resolve client issues. They determine the most efficient and economical equipment for a job and repair options available. Refrigeration and air conditioning mechanics plan their work schedule considering factors such as priority, safety, time to complete and travelling time for a job. They schedule maintenance work to minimize down time.

WORKING WITH OTHERS

Refrigeration and air conditioning mechanics providing installation, maintenance and service can work independently or as part of a team alongside co-workers, subcontractors and other trades. They interact with clients and others in a professional manner. Refrigeration and air conditioning mechanics mentor apprentices.

DIGITAL TECHNOLOGY

Refrigeration and air conditioning mechanics adjust parameters on automated control systems. They use remote access and on-board functions to monitor and diagnose problems. Refrigeration and air conditioning mechanics use electronic instruments for diagnosis. They may use software, electronic devices and the Internet during the course of their work.

CONTINUOUS LEARNING

Continuous learning is important for refrigeration and air conditioning mechanics due to ongoing changes in technology and an increased emphasis on the environment and energy efficiency. They need to keep informed about new types of equipment, energy sources, materials, computer controls and available client options. They must also keep up-to-date on code and regulation changes that govern their work. Refrigeration and air conditioning mechanics learn through reading manufacturers' literature and trade journals, and by visiting manufacturers' websites. They can also take advantage of seminars and information sessions put on by equipment manufacturers, suppliers, unions and their emplo

HARMONIZATION

At the request of industry, the Harmonization Initiative was launched in 2013 to *substantively align* apprenticeship systems across Canada by making training requirements more consistent in the Red Seal trades. Harmonization aims to improve the mobility of apprentices, support an increase in their completion rates and enable employers to access a larger pool of apprentices.

As part of this work, the Canadian Council of the Directors of Apprenticeship (CCDA) identified four main harmonization priorities in consultation with industry and training stakeholders:

1. Trade name

The official Red Seal name for this trade is Refrigeration and Air Conditioning Mechanic.

2. Number of Levels of Apprenticeship

The number of levels of technical training recommended for the Refrigeration and Air Conditioning Mechanic trade is four.

3. Total Training Hours during Apprenticeship Training

The total hours of training, including both on-the-job and in-school training for the Refrigeration and Air Conditioning trade is 7200.

4. Consistent sequencing of training content (at each level) using the most recent Occupational Standard

Implementation for harmonization will take place progressively. Level one to be implemented in 2019/2020, level two 2020/2021, level three 2021/2022, and level four in 2022/2023.

REFRIGERATION AND AIR CONDITIONING MECHANIC TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2018 Refrigeration and Air Conditioning Mechanic Red Seal Occupational Standard. Each sub-task details the corresponding essential skill and level of training where the content is covered*.

* Sub-tasks with numbers in the boxes is where the content will be delivered in training. The Task Matrix Chart will be updated every year until Harmonization implementation is complete. Implementation for harmonization will take place progressively. Level one to be implemented in 2019/2020, level two 2020/2021, level three 2021/2022, and level four in 2022/2023.

A – Performs common occupational skills

Task A-1 Performs safety-related functions	A-1.01 Maintains safe work environment 1 (2, 3, 4 in context)	A-1.02 Performs lock-out, tag-out and isolation procedures 1 (2, 3, 4 in context)	A-1.03 Uses personal protective equipment (PPE) and safety equipment 1 (2, 3, 4 in context)
Task A-2 Uses tools and equipment	A-2.01 Uses hand tools 1 (2, 3, 4 in context)	A-2.02 Uses portable and stationary power tools 1 (2, 3, 4 in context)	A-2.03 Uses brazing and soldering equipment 1 (2, 3, 4 in context)
	A-2.04 Uses recovery and recycling tools and equipment 1 (2, 3, 4 in context)	A-2.05 Uses evacuation tools and equipment 1 (2, 3, 4 in context)	A-2.06 Uses charging tools and equipment 1 (2, 3, 4 in context)
	A-2.07 Uses diagnostic and measuring tools and equipment 1 (2, 3, 4 in context)	A-2.08 Uses access equipment 1 (2, 3, 4 in context)	A-2.09 Uses rigging, hoisting and lifting equipment 1 (2, 3, 4 in context)
	A-2.10 Uses digital technology 1 (2, 3, 4 in context)		
Task A-3 Organizes work	A-3.01 Interprets drawings and specifications 2, 3, 4	A-3.02 Uses documentation and reference material 1, 2, 3, 4	A-3.03 Plans job tasks and procedures 1, 2, 3, 4
Task A-4 Uses communication and mentoring techniques	A-4.01 Uses communication techniques 1, 4	A-4.02 Uses mentoring techniques 4	

B – Performs routine trade activities

Task B-5 Performs work site preparation	B-5.01 Prepares work site 1	B-5.02 Handles materials and supplies 1	
Task B-6 Performs trade activities	B-6.01 Performs brazing and soldering 1	B-6.02 Performs leak and pressure tests on system 1	B-6.03 Evacuates systems 1
	B-6.04 Uses refrigerants, gases and oils 1, 2	B-6.05 Performs field wiring of systems 1, 2	B-6.06 Applies sealants and adhesives 1

C – Plans installation

Task C-7 Plans installation of HVAC/R systems	C-7.01 Verifies HVAC/R system parameters and requirements 2, 3, 4	C-7.02 Selects HVAC/R equipment, components and accessories 2, 3, 4	C-7.03 Determines placement of HVAC/R equipment, components and accessories 1, 2, 3, 4
	C-7.04 Performs HVAC/R material take-off 2, 3, 4		
Task C-8 Plans installation of control systems	C-8.01 Verifies control system parameters and requirements 3, 4	C-8.02 Selects control system components and accessories 2, 3, 4	C-8.03 Determines placement of control system components and accessories 1, 2, 3, 4
	C-8.04 Performs control system material take-off 2, 3, 4		

D – Performs installation

Task D-9 Installs HVAC/R systems	D-9.01 Confirms system layout 1, 3	D-9.02 Assembles HVAC/R equipment, components and accessories 2, 3	D-9.03 Places HVAC/R equipment, components and accessories 1, 2, 3
	D-9.04 Installs fasteners, brackets and hangers 1	D-9.05 Installs HVAC/R piping and tubing 1	D-9.06 Applies HVAC/R holding charge 1
Task D-10 Installs control systems	D-10.01 Places control system components 1, 2, 3	D-10.02 Connects control systems 1, 2, 3	

E – Performs commissioning

Task E-11 Commissions HVAC/R systems	E-11.01 Performs pre-start-up checks for HVAC/R systems 3, 4	E-11.02 Performs start-up of HVAC/R systems 3, 4	E-11.03 Completes HVAC/R system charge 3, 4
	E-11.04 Sets up primary and secondary HVAC/R system components 3, 4		
Task E-12 Commissions control systems	E-12.01 Performs start-up checks for control systems 3, 4	E-12.02 Verifies/sets operating parameters 3, 4	

F – Performs maintenance and service

Task F-13 Maintains HVAC/R systems	F-13.01 Inspects HVAC/R systems 1, 2 (3, 4 in context)	F-13.02 Performs predictive and scheduled maintenance on HVAC/R systems 1, 2 (3, 4 in context)	F-13.03 Tests HVAC/R system components and accessories 1, 2 (3, 4 in context)
Task F-14 Services HVAC/R systems	F-14.01 Troubleshoots HVAC/R systems 2, 3, 4	F-14.02 Repairs HVAC/R systems 2, 3, 4	
Task F-15 Maintains and services control systems	F-15.01 Performs maintenance and inspection on control systems 2, 3, 4	F-15.02 Troubleshoots control systems 2, 3, 4	F-15.03 Calibrates operating and safety controls 2, 3, 4
	F-15.04 Repairs control systems 2, 3, 4		

TRAINING PROFILE CHART

This Training Profile Chart represents Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training at the topic level.

Level One (Harmonized)	Transcript Code	Hours
Controls	CNTR 181	14
Electrical	ELEC 132	24
Graphics	GRPH 182	14
Mathematics	MATH 109	14
Components and Accessories	RFRG 102	14
Fundamentals of Refrigeration	RFRG 196	14
Basic Refrigeration Cycle	RFRG 198	14
Refrigerants	RFRG 199	14
Basic System Applications	SYST 180	24
Hand Skills and Service Techniques	TOOL 105	24
Hand Tools	TOOL 133	18
Welding	WLDR 132	18
Safety	SFTY XXX	18
HVAC Basics	RFRG 203	16
		240

Level Two (Harmonized)	Transcript Code	Hours
Electricity and Electrical Applications	ELEC 204	20
Electricity	ELEC 207	18
Trade Mathematics	MATH 286	12
Intro to Commercial Applications	RFRG 201	22
Refrigeration Flow Controls and Accessories	RFRG 202	20
Drafting	GRPH 280	12
Motors and Motor Electrics	RFRG 204	20
Comprehensive Systems Analysis	RFRG 206	20
Commercial Applications	RFRG 207	36
Medium Temp Applications	RFRG 208	34
Control Systems	RFRG 209	26

		240
Level Three (Harmonized)	Transcript Code	Hours
Electricity	ELEC 384	18
Graphics	GRPH 380	14
Mathematics	MATH 382	12
Systems and Service Management	RFRG 381	14
Piping and Line Sizing	RFRG 382	16
Capacity and Head Pressure	RFRG 383	16
Commercial Refrigeration Systems and Service	RFRG 384	18
HVAC Systems	RFRG 385	32
Practical Refrigeration Applications	RFRG 386	28
Practical HVAC Applications	RFRG 387	28
Control Systems Wiring	RFRG 388	30
Troubleshooting and Systems Analysis	RFRG 389	14
		240

Level Four (Harmonized)	Transcript Code	Hours
Electrical	ELEC 482	18
Graphics	GRPH 480	12
Mathematics	MATH 480	12
Enthalpy and Psychrometrics	RFRG 481	32
Load Calculation and Equipment Selection	RFRG 482	25
Advanced Commercial and Industrial Systems	RFRG 483	32
HVAC Systems	RFRG 484	34
Refrigeration Service Application	RFRG 485	30
HVAC Service Applications	RFRG 486	15
Control Systems Applications	RFRG 487	30
		240

ON-THE-JOB AND IN-SCHOOL TRAINING

CONTENT FOR THE REFRIGERATION AND AIR CONDITIONING MECHANIC TRADE

This chart outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for the topics of technical training. Topics of technical training are provided with the associated learning outcomes.

Level One	8 weeks	240 hours
Controls <ul style="list-style-type: none">• identify electrical controls• install basic cycling controls• set up basic circuits• adjust basic cycling controls <p>Mentors can assist the apprentice to prepare for this section of technical training by:</p> <ul style="list-style-type: none">• <i>explaining and demonstrating the installation of electrical controls</i>• <i>demonstrating the set up and adjustment of cycling controls</i>• <i>describing the function of electrical controls</i>		14 hours
Electrical <ul style="list-style-type: none">• describe an electrical circuit• explain electrical voltage• explain electrical current• explain electrical resistance• use a multimeter• perform electrical calculations using ohm's law• describe the operation of series electric circuits• describe the operation of parallel circuits <p>Mentors can assist the apprentice to prepare for this section of technical training by:</p> <ul style="list-style-type: none">• <i>demonstrating the use of a multimeter</i>• <i>explaining the operation of electrical circuits</i>• <i>explaining and demonstrate electrical calculations</i>		24 hours
Graphics <ul style="list-style-type: none">• draw a two-dimensional object• use engineering lettering• sketch orthographic views• use compass-circles, curves, arcs• prepare sectional drawings• prepare detail working assembly drawings		14 hours

- use scales to reduce and enlarge drawings
- use basic dimensioning
- sketch isometric and oblique drawings

Mentors can assist the apprentice to prepare for this section of technical training by:

- *reviewing and explaining on-site prints and shop drawings, discussing what different symbols represent*
- *explaining and demonstrating how a scale ruler is used and interpreted*
- *demonstrating how on-site blueprints and hand-drawn isometric drawings are used for material take off*

Mathematics

14 hours

- use basic mathematics
- perform trade calculations

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the importance of mathematical calculations on the job*
- *demonstrating the use of mathematical calculations*

Components and Accessories

14 hours

- explain the function of a compressor
- compare metering devices
- explain the purpose and operation of an evaporator
- explain the purpose and operation of a condenser

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the different components of a compressor*
- *explaining the function and operation of evaporators, compressors, condensers and metering devices*

Fundamentals of Refrigeration

14 hours

- discuss trade terminology
- compare temperature and temperature measurement
- compare pressure and pressure measurement
- identify types of heat and heat transfer
- explain change of state of a substance
- compare types of latent heat

Mentors can assist the apprentice to prepare for this section of technical training by:

- *using proper trade terminology*
- *explaining temperature and pressure measurements*
- *explaining the concept of heat transfer*

Basic Refrigeration Cycle

14 hours

- sketch a basic cycle diagram
- describe refrigerant condition in each component
- explain the function of each system component
- solve refrigeration system problems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrate the function of refrigeration system components*
- *explaining refrigeration cycle diagrams*

Refrigerants

14 hours

- select refrigerants
- apply refrigerant safety practices
- choose acceptable refrigerant service techniques

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the different kinds of refrigerants*
- *demonstrating refrigerant servicing*

Basic System Applications

24 hours

- assemble a refrigeration system
- perform startup procedures
- conduct system analysis
- demonstrate knowledge of effective communication practices

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating the assembly of refrigeration system equipment*
- *explaining and demonstrating start-up procedures*
- *explaining system analysis*

Hand Skills and Service Techniques

24 hours

- identify copper tubing
- demonstrate hand skills used for installation procedures
- choose service techniques and equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating and explaining service techniques to troubleshoot and repair HVAC/R equipment*
- *explaining materials used for HVAC/R repair*

Welding

18 hours

- describe the safe assembly, operation and maintenance of oxy-fuel system
- demonstrate the safe assembly, operation and maintenance when torch brazing
- demonstrate the safe assembly, operation and maintenance when oxy-fuel cutting on gauge metal and plate.
- identify safety hazards

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrate the use of welding equipment*
- *providing the opportunity for soldering and brazing*

Hand Tools**18 hours**

- select materials
- use hand tools
- use power tools
- identify safety issues
- perform measurements
- determine grinding wheel applications

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating the safe use and care of hand and power tools*
 - *demonstrating the correct tools used for a particular job task*
-

Safety**18 hours**

- discuss safe work practices
- discuss WHMIS
- demonstrate safe work practices
- demonstrate knowledge of access equipment applications, maintenance and procedures for proper use
- demonstrate knowledge of rigging, hoisting and lifting equipment applications, communication methods, maintenance and procedures for proper use.

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating safe work practices*
 - *explaining workplace hazards*
 - *demonstrating access equipment use*
 - *using hoisting and rigging equipment*
 - *using crane hand signals*
 - *demonstrating proper PPE use*
-

HVAC Basics**16 hours**

- examine air properties
- compare air conditioning systems
- select HVAC controls
- interpret air flow problems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining different air conditioning systems*
- *using HVAC controls*
- *explaining HVAC air flow problems*



Level Two

8 weeks

240 hours

Electricity and Electrical Applications

16 hours

- identify electrical components
- interpret wiring diagrams
- design electrical circuits
- apply troubleshooting techniques

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining wiring diagrams*
 - *demonstrating electrical troubleshooting techniques*
-

Electrical

18 hours

- describe the differences between dc and ac electrical circuits
- perform ac and dc circuit measurements
- describe reactance and phase shift
- describe the operation of various electrical switching circuits
- describe the operation of a transformer
- describe the operation of an electric relay
- describe the operation of various single phase electric motors and their operating characteristics

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the operation of electrical circuits*
 - *demonstrating electrical troubleshooting techniques*
-

Trade Mathematics

12 hours

- use metric and imperial units
- perform trade calculations

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the importance of mathematical calculations on the job*
 - *demonstrating the use of mathematical calculations*
-

Intro to Commercial Applications

20 hours

- compare temperature applications
- compare defrost methods
- design piping arrangements
- select refrigerant and oil conversion procedures
- identify dehydration and evacuation methods

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining temperature applications*
- *demonstrating defrost methods*
- *explaining and demonstrating piping arrangements*
- *demonstrating evacuation methods*

Refrigeration Flow Controls and Accessories**18 hours**

- select refrigerant system accessories
- select refrigerant flow controls
- calibrate refrigerant flow controls

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the selection of refrigerants*
 - *explaining the selection of refrigerant flow controls*
 - *demonstrating calibration of refrigerant flow controls*
-

Drafting**12 hours**

- orthographic views
- basic dimensioning
- views/sketch
- true lengths
- basic symbols/layout
- isometric and oblique

Mentors can assist the apprentice to prepare for this section of technical training by:

- *reviewing and explaining on-site prints and shop drawings, discussing what different symbols represent*
 - *explaining and demonstrating how a scale ruler is used and interpreted*
 - *demonstrating how on-site blueprints and hand-drawn isometric drawings are used for material take off*
-

Motors and Motors Electric**18 hours**

- identify motor types
- identify motor starting devices
- identify motor protection devices
- identify motor tests

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining different kinds of motors*
 - *explaining motor starting devices*
 - *explaining motor protection devices*
 - *demonstrating motor tests*
-

Comprehensive System Analysis**16 hours**

- manage system problems
- select system components and accessories
- select service procedure

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrate service procedures*
- *explaining possible system problems in HVAC/R systems*



Commercial Applications

36 hours

- design a two-temperature commercial system
- assemble a two-temperature system
- install the electrical system
- perform system start-up
- commission system

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the operation of two-temperature commercial systems*
 - *demonstrating the assembly of a two-temperature system*
 - *explaining and demonstrating the startup and commissioning of systems*
-

Medium Temp Applications

34 hours

- design a single temperature commercial system
- assemble system
- install electrical system
- perform system start-up
- commission system

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the operation of single temperature commercial systems*
 - *demonstrating the assembly of a single temperature system*
 - *explaining and demonstrating the startup and commissioning of systems*
-

Control Systems

26 hours

- design electrical systems
- select troubleshooting procedures
- solve electrical problems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrate troubleshooting control systems*
 - *explaining and demonstrate troubleshooting electrical systems*
 - *explaining electrical control system layout*
-

Systems and Service Analysis

14 hours

- Interpret system problems
- Solve system problems
- Choose system components, accessories and refrigerant flow controls
- Select service procedure
- Analyze basic control systems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrating troubleshooting techniques*
- *explaining service procedure*

Level Three

8 weeks

240 hours

Electricity

18 hours

- describe the theory of operation of a transformer
- explain three phase electrical power circuits
- describe the operation of three phase electric motors
- explain the operation of various motor control circuits
- describe the operation of various three phase motor starting circuits

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrate three phase circuits and motors*
 - *identifying and explaining motor control circuits*
-

Graphics

14 hours

- identify types of specification documents
- identify views used on blueprints and drawings
- sketch an exploded isometric
- interpret blueprints and manufacturer's drawings

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrate the use of blueprint documents*
 - *explaining the information found in specification documents*
 - *explaining and demonstrate the uses of isometric piping drawings*
-

Mathematics

12 hours

- use basic geometry and trigonometry
- perform trade calculations

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrating trade related mathematical calculations*
 - *explaining and demonstrating the use of charts to find numerical information*
-

Systems and Service Management

14 hours

- manage system problems
- select refrigerant components, accessories and flow controls
- select service techniques
- analyze control systems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating and explain service techniques for various system problems*
 - *explaining the selection of refrigerant components and accessories*
 - *demonstrating the proper tools used for repairs*
-

Piping and Line Sizing

16 hours

- design piping arrangements
- select pipe size
- interpret the mechanical code

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating and supervise apprentices designing piping arrangements*
- *demonstrating and explaining the selection of pipe sizes*
- *explaining the mechanical code as it refers to actual on the job circumstances*

Capacity and Head Pressure

16 hours

- identify capacity control methods
- identify head pressure control methods

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining capacity control methods*
- *explaining head pressure control methods*

Commercial Refrigeration Systems and Service

18 hours

- analyze refrigerant oil
- analyze compressor failure
- identify refrigeration flow problems
- select refrigerants and oils

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the properties of refrigerant oil*
- *explaining reasons for compressor failure*
- *demonstrating refrigerant flow problems*
- *explaining and demonstrate the selection of refrigerants and oils*

HVAC Design and Applications

32 hours

- select gas components
- compare HVAC designs
- troubleshoot HVAC control systems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the purpose of HVAC components*
- *demonstrating troubleshooting HVAC control system problems*
- *explaining how component problems can affect different parts of the HVAC system*

Practical Refrigeration Applications

28 hours

- examine refrigeration equipment
- service refrigeration equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining refrigerant equipment*
- *demonstrating the servicing of refrigerant equipment*

Control System Wiring

30 hours

- determine electrical requirements
- design the electrical system
- wire electrical system
- evaluate the electrical system

Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying electrical requirements of different control systems*
 - *explaining the design of electrical systems*
 - *explaining and demonstrating wiring of different electrical systems*
 - *explaining how to check that an electrical system is operating correctly*
-

Troubleshooting and System Analysis

14 hours

- manage system problems
- select system components and accessories
- select service procedures
- analyze control systems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying and explaining the selection of system components and accessories*
 - *demonstrating service procedures*
 - *evaluating control systems*
-

HVAC Applications

28 hours

- examine window air conditioners
- examine water cooler packages
- examine residential and commercial HVAC systems
- examine mechanical economizers
- service HVAC equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the operation of common HVAC applications*
- *demonstrating the assembly of common HVAC applications*
- *explaining and demonstrating the startup and commissioning of systems*



Level Four

8 weeks

240 hours

Electrical

18 hours

- describe the operation of a dc power supply circuit and components
- describe the basic operation of programmable logic controllers
- explain power factor and power factor correction

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrating the operation of DC power supply components*
 - *explaining and demonstrating the operation of programmable logic controllers*
 - *demonstrating power factor correction*
-

Graphics

12 hours

- interpret blueprint and manufacturer's drawings
- perform take off from the blueprint and specifications
- prepare labour and materials estimate

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrating the process of take off of material from the blueprint and specifications*
 - *explaining and demonstrating how to prepare labour and material estimates*
 - *providing the apprentice time to interpret blueprint and manufacturer's drawings*
-

Trade Mentoring

12 hours

- demonstrate knowledge of trade terminology
- demonstrate knowledge of effective communication practices
- demonstrate knowledge of strategies for learning and teaching skills in the workplace

Mentors can assist the apprentice to prepare for this section of technical training by:

- *providing the opportunity for the apprentice to mentor new apprentices*
 - *provide opportunities for an apprentice to learn new skills and provide feedback*
-

Enthalpy and Psychrometrics

32 hours

- interpret a pressure enthalpy diagram
- plot a system on a pressure enthalpy diagram
- compare system performance
- interpret a psychrometric process
- analyze system performance

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining enthalpy diagrams*
- *demonstrating how to compare system performances*
- *explaining the psychrometric process*

Load Calculation and Equipment Selection**25 hours**

- apply heat transfer calculations
- determine refrigeration heat loads
- select refrigeration equipment
- determine air conditioning heat loads
- select air conditioning equipment

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrating heat transfer calculations in a practical setting*
 - *explaining how to determine refrigeration and air conditioning heat loads*
 - *discussing the selection of air conditioning equipment*
-

Advanced Commercial and Industrial Systems**32 hours**

- arrange system components
- design piping schematics
- analyze design variations

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining commercial and industrial system components*
 - *explaining the design of commercial and industrial piping systems*
-

HVAC Variations and Refrigeration Systems**34 hours**

- examine HVAC variations
- identify air distribution systems
- describe air conditioning and refrigeration chillers
- describe cooling towers

Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining the operation of air conditioning, refrigeration chillers and cooling towers*
 - *explaining the different variations of HVAC system found in industry*
 - *identifying the differences between air distribution systems*
-

Refrigeration Service Application**30 hours**

- service two stage and extra low temperature equipment
- service ice making equipment
- calibrate refrigeration control systems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating the servicing of two stage and extra low temperature equipment*
 - *demonstrating servicing of ice making equipment*
 - *explaining how to calibrate refrigeration control systems*
-

HVAC Service Applications**15 hours**

- service rooftop heat-cool systems
- service large split systems
- service computer room systems

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating and explaining techniques uses in servicing of HVAC Systems*
- *observing the apprentice completing servicing of rooftop heat-cool systems, large split systems and computer systems.*

Control System Applications

30 hours

- design advanced control systems
- assemble control wiring
- calibrate controls
- conduct operational tests

Mentors can assist the apprentice to prepare for this section of technical training by:

- *observing and giving advice to the apprentice assembling control wiring*
- *demonstrating operational tests*
- *observing the apprentice calibrating controls*



Consider apprenticeship training as an investment in the future of your company and in the future of your workforce. Ultimately, skilled and certified workers increase your bottom line.

Get involved in the apprenticeship training system. Your commitment to training helps to maintain the integrity of the trade.

Do you have employees who have been working in the trade for a number of years but don't have trade certification? Contact your local apprenticeship office for details on how they might obtain the certification they need.

Saskatchewan Apprenticeship & Trade Certification Commission

2140 Hamilton St Regina SK S4P 2E3

Tel: (306) 787-2444

Fax: (306) 787-5105

Toll Free: 1-877-363-0536

Website: www.saskapprenticeship.ca

District Offices

Estevan (306) 637-4930

La Ronge (306) 425-4385

Moose Jaw (306) 694-3735

North Battleford (306) 446-7409

Prince Albert (306) 953-2632

Saskatoon (306) 933-8476

Swift Current (306) 778-8945

Yorkton (306) 786-1394