



Saskatchewan  
Apprenticeship and  
Trade Certification  
Commission



# **Steamfitter-Pipefitter On-the-Job Training Guide**

**2021**



Online: [www.saskapprenticeship.ca](http://www.saskapprenticeship.ca)

*Recognition:*

*To promote transparency and consistency, this document has been adapted from the 2015 Steamfitter-Pipefitter Red Seal Occupational Standard (Employment and Social Development Canada).*

*A complete version of the Occupational Standard can be found at [www.red-seal.ca](http://www.red-seal.ca)*

# STRUCTURE OF THE ON THE JOB TRAINING GUIDE CONTENT

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

**Description of the Steamfitter-Pipefitter 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 Steamfitter-Pipefitter 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 Steamfitter-Pipefitter 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 STEAMFITTER-PIPEFITTER TRADE

*Steamfitter/Pipefitters install and repair low and high pressure piping systems and their components, including heating and processing applications. They may also be licensed as gasfitters.*

Steamfitters/Pipefitters lay out, assemble, fabricate, maintain, repair and service equipment and piping systems carrying water, steam, fluids, gases, chemicals and fuel in various systems such as heating, cooling, lubricating and process piping systems. They read and interpret drawings, specifications and codes to determine layout, type and size of pipe, and tools to use. They measure, cut, thread, groove, bend, solder, braze, assemble and install metal, plastic and fiberglass pipes, valves and fittings. As well, they must be able to join and secure pipe sections of related equipment. They check systems for leaks. Steamfitters/Pipefitters also do general maintenance work including replacement of worn components.

Steamfitters/Pipefitters must carry out quality control checks on work performed. The system must be tested and commissioned to verify the quality of work and to confirm that the system is functioning to design specifications. They use welding, cutting, shaping, soldering, threading and brazing equipment to join pipes and fabricate sections of piping systems.

Areas of specialization in this trade include maintenance, quality control, rigging, fabrication and installation of various types of systems and specialty piping.

Steamfitters/Pipefitters must have mechanical aptitude, manual dexterity, mathematical skills, an ability to read and understand complex instructions and an ability to do careful and exacting work. They sometimes work in uncomfortable or cramped positions. The work can also be physically demanding. In aspects of layout, work organization, project planning and supervisory tasks, steamfitters/pipefitters may also make use of many digital tools and applications.

With experience, steamfitters/pipefitters may advance to positions such as foreman, contractor, owner, superintendent and instructor.

**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: 7 weeks

Level Four: 7 weeks

**It is the employer's or journeyperson'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 of drainage, waste and vent systems; potable water distribution; fixtures and appliances; hydronic heating and cooling systems; specialty piping; pumps and private sewage disposal 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.

Designated Trade Name	Math Credit at the Indicated Grade Level <sup>❶</sup>	Science Credit at Grade Level
Steamfitter-Pipefitter	Grade 10	Grade 10
<p><sup>❶</sup> - (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>For information about high school curriculum, including Math and Science course names, please see:  <a href="http://www.curriculum.gov.sk.ca/#">http://www.curriculum.gov.sk.ca/#</a></p> <p><b>Individuals not meeting the entrance requirements will be subject to an assessment and any required training</b></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](http://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](http://www.red-seal.ca).

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## READING

Steamfitters/Pipefitters require strong reading skills to refer to and interpret manufacturers' manuals and instructions including diagrams, charts and graphs. They also need to consult multiple professional codes concerning industry standards and safety requirements.

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## DOCUMENT USE

Steamfitters/Pipefitters must be comfortable in document use to interpret work schedules. They consult reference manuals on measurement, materials and pipe sizing, pressures and mathematical formulas for calculations. They interpret information from mechanical drawings, schematic diagrams and architectural plans to ensure proper installation of piping. They also use quality control documentation which records information such as heat numbers, weld mapping and material identification.

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## WRITING

Writing skills are used by steamfitters/pipefitters to write lists of materials and fittings needed for a job, complete forms to request materials and keep daily logs to record measurements and reminders. When required, they must write incident or accident reports.

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## ORAL COMMUNICATION

Steamfitters/Pipefitters require good oral communication skills to interact with colleagues, supervisors and other tradespersons when co-ordinating work, resolving problems and ensuring safety. They interact with apprentices to provide mentorship and speak with vendors to order materials.

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## NUMERACY

Numeracy skills are very important in the everyday work of steamfitters/pipefitters. They frequently take or calculate measurements of temperature, pressure and volume. They verify conformity with manufacturers' recommendations and operating practices. The work requires a strong understanding of mathematical calculations and trigonometry. The ability to estimate the quantity of piping material required and to convert between imperial and metric systems of measurement is also important.

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## THINKING SKILLS

Steamfitters/Pipefitters identify the steps and develop a plan to accomplish a task and coordinate the work. They must decide how to configure and relocate pipes. The ability to problem solve during testing or when a pipe or system failure is encountered is important. Decision making is important when considering job safety and risk prevention. Steamfitters/Pipefitters must also be able to find information they need in multiple sources such as blueprints, code documents, reference manuals and product catalogues.

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## WORKING WITH OTHERS

Steamfitters/Pipefitters liaise with supervisors, colleagues and other trades to coordinate multiple tasks. They may work with trades such as welders, pipe insulators and electricians. They supervise others and mentor apprentices, offering both practical training and safety information. Additionally, the conduct, behaviour, appearance and attitude of a steamfitter/pipefitter are essential to the success of a job or project.

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## DIGITAL TECHNOLOGY

Steamfitters/Pipefitters may use communications software for e-mail or use the Internet to look up material and trade-related information, to order materials online or to access training. They may use a spreadsheet to keep track of the status of materials ordered. They may also use CAD software to input measurements taken on the job site, to generate drawings and for referencing purposes. The use of digital equipment for the trade such as smart phones, laser and digital layout equipment such as total station, building information modeling and GPS technology is increasingly important for trade activities.

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## CONTINUOUS LEARNING

Steamfitters/Pipefitters may pursue refresher courses or specialty certifications and attend supplier seminars. Continuous learning is essential as they must keep up-to-date with the regulatory requirements and the various codes that are periodically revised. Also, they must keep abreast of technological advances in their field to select the most appropriate equipment, tools and materials and be able to perform a proper installation.

# 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 Steamfitter-Pipefitter.

## **2. Number of Levels of Apprenticeship**

The number of levels of technical training recommended for the Steamfitter-Pipefitter trade is 4.

## **3. Total Training Hours during Apprenticeship Training**

The total hours of training, including both on-the-job and in-school training for the Steamfitter-Pipefitter 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 2017/2018, level two 2018/2019, level three 2019/2020, and level four in 2020/2021.



# STEAMFITTER-PIPEFITTER TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2015 Steamfitter-Pipefitter Red Seal Occupational Standard. Each sub-task details the corresponding essential skill and level of training where the content is covered.

## A - PERFORMS COMMON OCCUPATIONAL SKILLS

<b>Task A-1</b> <b>Performs safety-related functions.</b>	<b>A-1.01 Maintains safe work environment.</b>  <p style="text-align: center;">1</p>	<b>A-1.02 Selects, inspects and uses personal protective equipment (PPE) and safety equipment.</b>  <p style="text-align: center;">1</p>	<b>A-1.03 Follows lock-out procedures.</b>  <p style="text-align: center;">1</p>
<b>Task A-2</b> <b>Uses and maintains tools and equipment.</b>	<b>A-2.01 Uses common tools and equipment.</b>  <p style="text-align: center;">1</p>	<b>A-2.02 Uses access equipment.</b>  <p style="text-align: center;">1</p>	<b>A-2.03 Uses welding equipment.</b>  <p style="text-align: center;">1,2</p>
	<b>A-2.04 Uses soldering and brazing equipment.</b>  <p style="text-align: center;">1</p>	<b>A-2.05 Uses oxy-fuel equipment.</b>  <p style="text-align: center;">1,2</p>	
<b>Task A-3</b> <b>Organizes job.</b>	<b>A-3.01 Plans work.</b>  <p style="text-align: center;">1,2,3,4 In Context</p>	<b>A-3.02 Generates drawings.</b>  <p style="text-align: center;">1,2,3,4 In Context</p>	<b>A-3.03 Interprets drawings and specifications.</b>  <p style="text-align: center;">1,2,3,4 In Context</p>
	<b>A-3.04 Develops piping templates.</b>  <p style="text-align: center;">1,2,3,4 In Context</p>	<b>A-3.05 Performs preliminary quality control functions.</b>  <p style="text-align: center;">1,2,3,4 In Context</p>	

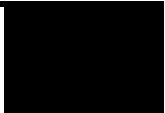
## B – PERFORMS LAYOUT, FABRICATION AND PIPING INSTALLATION

<p><b>Task B-4</b> Performs fabrication.</p>	<p><b>B-4.01 Fabricates piping system components.</b></p> <p>1,2 3 In Context</p>	<p><b>B-4.02 Fabricates brackets, supports, hangers, guides and anchors.</b></p> <p>1,2 3 In Context</p>	
<p><b>Task B-5</b> Lays out, identifies and installs piping, tubing, fittings and related components.</p>	<p><b>B-5.01 Lays out, identifies and installs copper piping, tubing, fittings and related components.</b></p> <p>1 3 In Context</p>	<p><b>B-5.02 Lays out, identifies and installs plastic piping, tubing, fittings and related components.</b></p> <p>1 3 In Context</p>	<p><b>B-5.03 Lays out, identifies and installs carbon steel piping, tubing, fittings and related components.</b></p> <p>1 3 In Context</p>
	<p><b>B-5.04 Lays out, identifies and installs stainless steel piping, tubing, fittings and related components.</b></p> <p>1 3 In Context</p>	<p><b>B-5.05 Lays out, identifies and installs fiberglass piping, fittings and related components.</b></p> <p>2 3 In Context</p>	<p><b>B-5.06 Lays out, identifies and installs specialty piping, fittings and related components.</b></p> <p>2 3 In Context</p>
<p><b>Task B-6</b> Installs, maintains, troubleshoots, repairs and tests valves.</p>	<p><b>B-6.01 Installs valves.</b></p> <p>1 2,3 In Context</p>	<p><b>B-6.02 Maintains, troubleshoots, repairs and tests valves.</b></p> <p>1 2,3 In Context</p>	
<p><b>Task B-7</b> Installs, tests, maintains, troubleshoots and repairs heat tracing systems.</p>	<p><b>B-7.01 Installs steam tracing systems.</b></p> <p>3</p>	<p><b>B-7.02 Maintains, troubleshoots, repairs and tests steam tracing systems.</b></p> <p>3</p>	<p><b>B-7.03 Installs liquid-filled tracing systems.</b></p> <p>2</p>
	<p><b>B-7.04 Maintains, troubleshoots, repairs and tests liquid-filled tracing systems.</b></p> <p>2</p>		

## C – PERFORMS RIGGING, HOISTING, LIFTING AND POSITIONING

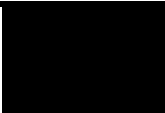
<b>Task C-8</b> Performs common rigging, hoisting, lifting and positioning.	<b>C-8.01 Determines load.</b>  1 2,3 In Context	<b>C-8.02. Prepares lift plan(s).</b>  1 2,3 In Context	<b>C-8.03 Selects rigging, hoisting, lifting and positioning equipment.</b>  1 2,3 In Context
	<b>C-8.04 Inspects rigging, hoisting, lifting and positioning equipment.</b>  1 2,3 In Context	<b>C-8.05 Secures lift area.</b>  1 2,3 In Context	<b>C-8.06 Sets up rigging, hoisting, lifting and positioning equipment.</b>  1 2,3 In Context
	<b>C-8.07 Performs lift and positioning.</b>  1 2,3 In Context	<b>C-8.08 Maintains and stores rigging, hoisting, lifting and positioning equipment.</b>  1 2,3 In Context	
<b>Task C-9</b> Performs complex and critical rigging, hoisting, lifting and positioning.	<b>C-9.01 Prepares lift plan for complex and critical rigging, hoisting, lifting and positioning.</b>  4	<b>C-9.02 Performs calculations for complex and critical rigging, hoisting, lifting and positioning.</b>  4	<b>C-9.03 Selects rigging, hoisting, lifting and positioning equipment for complex and critical lifts.</b>  4
	<b>C-9.04 Sets up rigging, hoisting, lifting and positioning equipment for complex and critical lifts.</b>  4	<b>C-9.05 Performs complex and critical lifts and positioning.</b>  4	

# D – INSTALLS, TESTS, MAINTAINS, TROUBLESHOOTS AND REPAIRS LOW AND HIGH PRESSURE STEAM AND CONDENSATE SYSTEMS



<p><b>Task D-10</b> Installs, tests, maintains, troubleshoots and repairs low pressure steam and condensate systems.</p>	<p><b>D-10.01</b> Installs equipment for low pressure steam and condensate systems.</p> <p style="text-align: center;"><b>3</b> 2 In Context</p>	<p><b>D-10.02</b> Installs piping for low pressure steam and condensate systems.</p> <p style="text-align: center;"><b>3</b> 2 In Context</p>	<p><b>D-10.03</b> Tests low pressure steam and condensate systems.</p> <p style="text-align: center;"><b>3</b> 2 In Context</p>
	<p><b>D-10.04</b> Maintains, troubleshoots and repairs low pressure steam and condensate systems.</p> <p style="text-align: center;"><b>3</b> 2 In Context</p>		
<p><b>Task D-11</b> Installs, tests, maintains, troubleshoots and repairs high pressure steam and condensate systems.</p>	<p><b>D-11.01</b> Installs equipment for high pressure steam and condensate systems.</p> <p style="text-align: center;"><b>4</b></p>	<p><b>D-11.02</b> Installs piping for high pressure steam and condensate systems.</p> <p style="text-align: center;"><b>4</b></p>	<p><b>D-11.03</b> Tests high pressure steam and condensate systems.</p> <p style="text-align: center;"><b>4</b></p>
	<p><b>D-11.04</b> Maintains, troubleshoots and repairs high pressure steam and condensate systems.</p> <p style="text-align: center;"><b>4</b></p>		

# E – INSTALLS, TESTS, MAINTAINS, TROUBLESHOOTS AND REPAIRS HEATING, COOLING AND PROCESS PIPING SYSTEMS

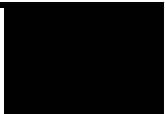


<b>Task E-12</b> Installs, tests, maintains, troubleshoots and repairs hydronic systems.	<b>E-12.01</b> Installs equipment for hydronic systems.  2,3	<b>E-12.02</b> Installs piping for hydronic systems.  2,3	<b>E-12.03</b> Tests hydronic systems.  2,3
	<b>E-12.04</b> Maintains, troubleshoots and repairs hydronic systems.  2,3		
<b>Task E-13</b> Installs, tests, maintains, troubleshoots and repairs process piping systems.	<b>E-13.01</b> Installs equipment for process piping systems.  4	<b>E-13.02</b> Installs piping for process piping systems.  4	<b>E-13.03</b> Tests process piping systems.  4
	<b>E-13.04</b> Maintains, troubleshoots and repairs process piping systems.  4		
<b>Task E-14</b> Installs, tests, maintains, troubleshoots and repairs industrial water and waste treatment systems.	<b>E-14.01</b> Installs equipment for industrial water and waste treatment systems.  3	<b>E-14.02</b> Installs piping for industrial water and waste treatment systems.  3	<b>E-14.03</b> Tests industrial water and waste treatment systems.  3
	<b>E-14.04</b> Maintains, troubleshoots and repairs industrial water and waste treatment systems.  3		
<b>Task E-15</b> Installs, tests, maintains, troubleshoots and repairs hydraulic systems.	<b>E-15.01</b> Installs equipment for hydraulic systems.  4	<b>E-15.02</b> Installs piping, tubing and hoses for hydraulic systems.  4	<b>E-15.03</b> Tests hydraulic systems.  4
	<b>E-15.04</b> Maintains, troubleshoots and repairs hydraulic systems.  4		
<b>Task E-16</b> Installs, tests, maintains, troubleshoots and repairs heating, ventilation, air conditioning and refrigeration (HVACR) systems.	<b>E-16.01</b> Installs equipment for HVACR systems.  4	<b>E-16.02</b> Installs hydronic piping and refrigeration tubing for HVACR systems.  4	<b>E-16.03</b> Tests associated components of HVACR systems.  4

	E-16.04 Maintains, troubleshoots and repairs associated components of HVACR systems.  4		
Task E-17 Installs, tests, maintains, troubleshoots and repairs fuel systems.	E-17.01 Installs equipment for fuel systems.  3	E-17.02 Installs piping and tubing for fuel systems.  3	E-17.03 Tests fuel systems.  3
	E-17.04 Maintains, troubleshoots and repairs fuel systems.  3		
Task E-18 Installs, tests, maintains, troubleshoots and repairs medical gas systems.	E-18.01 Installs equipment for medical gas systems.  3	E-18.02 Installs piping and tubing for medical gas systems.  3	E-18.03 Tests medical gas systems.  3
	E-18.04 Maintains, troubleshoots and repairs medical gas systems.  3		
Task E-19 Installs, tests, maintains, troubleshoots and repairs compressed air and pneumatic systems.	E-19.01 Installs equipment for compressed air and pneumatic systems.  4	E-19.02 Installs piping and tubing for compressed air and pneumatic systems.  4	E-19.03 Tests compressed air and pneumatic systems.  4
	E-19.04 Maintains, troubleshoots and repairs compressed air and pneumatic systems.  4		
Task E-20 Installs and tests fire protection systems. <b>(NOT COMMON CORE) *</b>	E-20.01 Installs equipment for fire protection systems. <b>(NOT COMMON CORE)</b>	E-20.02 Installs piping for fire protection systems. <b>(NOT COMMON CORE)</b>	E-20.03 Tests fire protection systems. <b>(NOT COMMON CORE)</b>

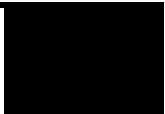
\* This Task is not consistently performed by Steamfitter-Pipefitter across Canada, therefore this content is deemed not common core and will not be assessed on the Steamfitter-Pipefitter certification examination.

# F – INSTALLS, TESTS, MAINTAINS, TROUBLESHOOTS AND REPAIRS RENEWABLE ENERGY SYSTEMS



<b>Task F-21</b> Installs, tests, maintains, troubleshoots and repairs geo-exchange and geothermal systems.	<b>F-21.01 Installs equipment for geo-exchange and geothermal systems.</b>  4	<b>F-21.02 Installs piping for geo-exchange and geothermal systems.</b>  4	<b>F-21.03 Tests geo-exchange and geothermal systems.</b>  4
	<b>F-21.04 Maintains, troubleshoots and repairs geo-exchange and geothermal systems.</b>  4		
<b>Task F-22</b> Installs, tests, maintains, troubleshoots and repairs solar heating systems.	<b>F-22.01 Installs equipment for solar heating systems.</b>  4	<b>F-22.02 Installs piping for solar heating systems.</b>  4	<b>F-22.03 Tests solar heating systems.</b>  4
	<b>F-22.04 Maintains, troubleshoots and repairs solar heating systems.</b>  4		
<b>Task F-23</b> Installs, tests, maintains, troubleshoots and repairs heat recovery systems.	<b>F-23.01 Installs equipment for heat recovery systems.</b>  4	<b>F-23.02 Installs piping for heat recovery systems.</b>  4	<b>F-23.03 Tests heat recovery systems.</b>  4
	<b>F-23.04 Maintains, troubleshoots and repairs heat recovery systems.</b>  4		

# G – PERFORMS COMMISSIONING, START-UP AND TURNOVER



<b>Task G-24</b> Prepares system for commissioning, start-up and turnover.	<b>G-24.01 Flushes system.</b>  1,2,3,4 In Context	<b>G-24.02 Chemically treats system.</b>  1,2,3,4 In Context	<b>G-24.03 Pre-checks system for commissioning.</b>  1,2,3,4 In Context
	<b>G-24.04 Selects and connects commissioning equipment.</b>  1,2,3,4 In Context		
<b>Task G-25</b> Commissions systems.	<b>G-25.01 Secures commissioning area.</b>  1,2,3,4 In Context	<b>G-25.02 Pressurizes system.</b>  1,2,3,4 In Context	<b>G-25.03 Inspects system.</b>  1,2,3,4 In Context
	<b>G-25.04 Corrects faulty conditions.</b>  1,2,3,4 In Context	<b>G-25.05 Participates in start-up and turnover procedures.</b>  1,2,3,4 In Context	



# ON-THE-JOB AND IN-SCHOOL TRAINING CONTENT FOR THE STEAMFITTER-PIPEFITTER 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.

<b>Level One</b>	<b>8 weeks</b>	<b>240 hours</b>
<b>Trade Relate Safety – Theory</b> <ul style="list-style-type: none"> <li>• discuss safe work practices</li> <li>• discuss WHMIS</li> <li>• discuss lockout and tag out procedures</li> </ul>		<b>15 hours</b>
<b>Trade Related Safety – Shop</b> <ul style="list-style-type: none"> <li>• demonstrate safe work practices</li> <li>• apply WHMIS</li> <li>• perform lockout and tag out procedures</li> </ul>		<b>15 hours</b>
<b>Mentors can assist the apprentice to prepare for this section of technical training by:</b> <ul style="list-style-type: none"> <li>• <i>attending shop safety meetings</i></li> <li>• <i>insisting on appropriate work clothes and personal protective equipment</i></li> <li>• <i>demonstrating safe work habits regarding confined spaces, ladders and scaffolds</i></li> <li>• <i>having the apprentice participate in lifting procedures, explaining how and when clevises, slings and other rigging equipment is used</i></li> <li>• <i>demonstrating, then supervising the apprentice during actual lifts of materials and equipment for crane hand signalling procedures</i></li> <li>• <i>demonstrating how knots are tied and when each should be used</i></li> <li>• <i>having the apprentice attend training for WHMIS</i></li> </ul>		
<b>Tool Basics and Equipment – Theory</b> <ul style="list-style-type: none"> <li>• discuss the use and care of hand</li> <li>• discuss the use and care of power tools</li> <li>• discuss access equipment</li> <li>• explain soldering and brazing equipment</li> </ul>		<b>15 hours</b>
<b>Tool Basics and Equipment – Shop</b> <ul style="list-style-type: none"> <li>• demonstrate the safe use and care of hand tools</li> <li>• demonstrate the safe use and care of power tools</li> <li>• demonstrate access equipment use</li> <li>• use hoisting and rigging equipment</li> <li>• perform soldering and brazing</li> </ul>		<b>15 hours</b>
<b>Mentors can assist the apprentice to prepare for this section of technical training by:</b> <ul style="list-style-type: none"> <li>• <i>spending time explaining what each tool is used for and demonstrating the proper use</i></li> <li>• <i>making the apprentice perform a shop inventory to learn the proper names of materials and tools</i></li> <li>• <i>demonstrating use of various soldering and brazing equipment</i></li> </ul>		

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**Welding****30 hours**

- describe the safe assembly, operations, shut down and equipment for oxy-fuel cutting (OFC)
- describe the safe assembly, operations, shut down and equipment for Gas Metal Arc Welding (GMAW)
- demonstrate the safe set up, operation and maintenance when performing OFC
- demonstrate the safe set up operation and maintenance when performing GMAW in multiple positions
- demonstrate the safe operation and maintenance when performing GMAW while bridge tacking pipe

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

- *discussing safe welding practices*
  - *ensuring the apprentice has appropriate PPE for welding*
  - *identifying safety hazards when using an oxy-acetylene torch and GMAW equipment*
  - *allowing the apprentice to set-up and operate an oxy-acetylene cutting torch and GMAW machine*
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**Pipe Graphics and Layout****30 hours**

- explain drafting tools
- use drafting tools
- discuss graphics language, measurements and standards
- explain graphical single line projections
- draw single line projections

**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 mean*
  - *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*
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**Pipe Fabrication – Theory****30 hours**

- discuss piping system layout
- discuss piping system measurements
- explain piping system offsets
- identify pipe support systems
- discuss common piping materials
- discuss fittings and valves
- define piping system commissioning

**Pipe Fabrication – Shop****30 hours**

- assemble copper tube and tubing
- assemble plastic tube and tubing
- assemble steel pipe project
- fabricate brackets, supports, guides and anchors
- install a hybrid piping system

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

- *assisting the apprentice to identify the various fittings found in the shop and describing their use*
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- *demonstrating the proper procedure for jointing of all piping materials and the bending and flaring of copper tube, then allowing time for the apprentice to practice these techniques on scrap materials*
- *having the apprentice repetitively perform tasks required to work with these materials*
- *describing the various types of piping supports and hangars and demonstrating their installation procedures*
- *demonstrating how piping support frequency is calculated using the code book*
- *demonstrating the proper procedure to join copper pipe using the appropriate solder and flux*

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### **Rigging, Hoisting and Lifting**

**30 hours**

- explain hoisting, lifting and rigging equipment
- explain hoisting, lifting and rigging procedures
- discuss load weight calculations
- demonstrate hoisting, lifting and rigging techniques
- perform hoisting signals and knot tying
- explain inspection and maintenance procedures

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

- *having the apprentice participate in lifting procedures, explaining how and when clevises, slings and other rigging equipment is used*
- *demonstrating, then supervising the apprentice during actual lifts of materials and equipment for crane hand signalling procedures*
- *demonstrating how knots are tied and when each should be used*

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### **Gasfitting**

**30 hours**

- explain the delivery system for natural and propane gases
- discuss the properties of natural, propane and butane gases
- explain gas codes
- install a natural gas piping system
- commission a natural gas piping system

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

- *explaining the gasfitting basics regarding safety and terminology*
- *allowing the apprentice to clock a meter to determine gas consumption*
- *allowing the apprentice to check gas pressures*
- *demonstrating how a code book is used and interpreted by having the apprentice find relevant code references as an exercise*
- *having the apprentice assist in the installation, service, testing and repair of domestic natural gas piping systems*

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## **Level Two**

**8 weeks**

**240 hours**

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### **Pipe Fabrication**

**27 hours**

- identify materials used in fabrication
- describe the fabrication process
- examine support and hanger systems
- explain pipe bending theory

- construct piping project

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

- *demonstrating the safe use of fabrication tools and equipment*
- *allowing the apprentice to develop a material take-off*
- *ensuring the apprentice can locate material identification numbers*
- *demonstrating various jointing methods, including welding for pipe and fittings*
- *allowing the apprentice to layout ordinate lines on pipe*
- *exposing the apprentice to heat tracing systems*
- *ensuring the apprentice understands heat numbers and MFD sheets*
- *introducing the apprentice to quality control definitions*
- *exposing the apprentice to piping and systems using HDP*
- *exposing the apprentice to piping and systems using FRP*

**Hydronic Systems – Theory**

**47 hours**

- explain the chemical and physical properties of water
- perform mathematical calculations
- describe boilers
- describe boiler trim
- explain circulating pump components
- describe zoning
- describe piping layouts
- discuss heat emitters

**Hydronic Systems – Shop**

**7 hours**

- identify boiler trim components
- interpret circulating pump curves
- operate hydronic systems
- hydronic system controls and transfer unit equipment and components, their applications and operation
- the procedures used to service hydronic system controls and transfer units

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

- *exposing the apprentice to various boiler types and explaining the operation of their controls*
- *supervising the apprentice when piping the make-up water for a boiler*
- *supervising the apprentice when troubleshooting a boiler system*
- *discussing the sizing of hydronic systems through heat loss calculations, and the consultation of engineered drawings, jurisdictional codes and specifications*
- *discussing pipe and fitting schedules such as Schedule 80, Schedule 120 and Schedule 160 and their application*
- *giving exposure to a variety of different system installations including series loop, one-pipe and two-pipe layouts*
- *discussing pumps and their components*

**Blueprint Reading**

**27 hours**

- draw isometric objects
- explain blueprints and specifications
- discuss spool sheets
- produce compass orientated isometric drawings
- use blueprints and specifications

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

- *ensuring the apprentice can identify blueprint lines, symbols and abbreviations*

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- *allowing the apprentice to use various types drawings*
  - *having the apprentice interpret job specifications from a blueprint*
  - *allowing the apprentice to calculate measurements and distances from a blueprint*
  - *having the apprentice determine material requirements from isometric drawings*
  - *allowing the apprentice to develop material take-off from isometric drawings*
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### **Introduction to Steam Systems**

**27 hours**

- discuss the thermodynamic properties of steam
- identify the American Society of Mechanical Engineers (ASME) code requirements for steam boilers and piping systems
- identify steam equipment
- identify steam traps

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

- *discussing the ASME code requirements for low pressure steam systems*
  - *exposing the apprentice to various low pressure steam systems*
  - *identifying low pressure boiler trim and explaining their operation*
  - *allowing the apprentice to help install a steam heating system*
  - *supervising the apprentice installing and troubleshooting steam trap*
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### **Welding**

**27 hours**

- describe the safe assembly, operations, shut down and equipment for Shield Metal Arc Welding (SMAW)
- describe the safe assembly, operations, shut down and equipment for Gas Tungsten Arc Welding (GTAW)
- demonstrate the safe set up, operation and maintenance when performing SMAW
- demonstrate the safe set up operation and maintenance when performing GTAW
- demonstrate the safe operation and maintenance when performing SMAW while beveling, preparing a land and bridge tacking pipe

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

- *identifying safety hazards when using SMAW and GTAW welding*
  - *allowing the apprentice to set up and operate a Shielded Metal Arc Welder*
  - *allowing the apprentice to select the appropriate welding rods for the application*
  - *ensuring the apprentice is transporting and storing welding equipment as per MSDS requirements*
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### **Gasfitting – Theory (Exceed)**

**42 hours**

- discuss line sizing techniques for piping systems operating at two pounds per square inch and less
- discuss the combustion process pertaining to gas appliances
- perform mathematical calculations
- apply the B149.1 and B149.2 national and provincial codes
- describe gas burners
- explain domestic controls

### **Gasfitting – Shop (Exceed)**

**12 hours**

- layout gas distribution piping system
- layout the venting system
- apply manufacturers' guidelines for furnace positioning
- perform start up procedures

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

- *having the apprentice assist in the sizing of low and high pressure gas piping systems*
- *explaining the combustion process for natural and propane gases*

- continuing to further the apprentice's ability to interpret the gas codes for both natural and propane gases
- demonstrating the operation, adjustment and servicing of atmospheric burners
- explaining series and parallel circuits
- assisting the apprentice to understand meter use while testing domestic controls and electrical systems
- exposing the apprentice to the various flame safeguard systems
- having the apprentice assist in the installation of domestic appliances
- having the apprentice assist in the start-up of domestic appliances

### **Basic Electrical (Exceed)**

**24 hours**

- describe basic electrical concepts.
- measure voltage, current, resistance, and capacitance using electrical test equipment
- interpret wiring diagrams and wiring diagrams
- test standing pilot appliance controls
- terminate wires

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

- explaining wiring diagrams and assisting the apprentice to analyze series and parallel circuits
- discussing the applications for different meters and demonstrating how they are used
- explaining how equipment controls are serviced
- supervising hands-on experience in electrical troubleshooting
- allowing the apprentice to attend manufacturer's seminars

## **Level Three**

**7 weeks**

**210 hours**

### **Pipe Fabrication**

**28 hours**

- describe quality control procedures
- discuss templates for fitting fabrication
- discuss piping offsets
- discuss serpentine piping
- discuss steam tracing
- fabricate piping spool project

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

- allowing the apprentice to develop a cut list from a spool
- giving the apprentice shop documentation for quality control
- allowing the apprentice to layout a mitred elbow
- allowing the apprentice to assemble fabricated piping and fittings
- supervising the apprentice when installing piping and systems using HDP
- supervising the apprentice when installing piping and systems using FRP

### **Low Pressure Steam Systems**

**56 hours**

- describe low pressure steam (LPS) boilers
- discuss LPS piping systems
- choose steam traps
- use the American Society of Mechanical Engineers (ASME) code
- use steam tables

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

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- *discussing the ASME code for low pressure steam systems*
  - *exposing the apprentice to various steam systems*
  - *allowing the apprentice to work on components such as heat exchangers and converters*
  - *supervising the apprentice when installing/servicing condensate returns for low pressure steam systems*
  - *discussing the application of various feed water controls*
  - *allowing the apprentice to select a steam trap for a low pressure steam system*
  - *supervising the apprentice in the installation of low pressure steam boilers and their systems*
  - *exposing the apprentice to testing and maintenance procedures in high pressure steam systems*
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### **Gasfitting**

**28 hours**

- apply line sizing techniques for piping systems operating at two pounds per square inch and less
- analyze the air supply requirements for gas appliances
- categorize domestic gas fired equipment based on flue loss and draft characteristics
- interpret combustion air code requirements for appliances with inputs of 400 MBH or less
- interpret code requirements for flue gas removal from gas appliances
- examine category one vent system requirements

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

- *allowing the apprentice to size low and high pressure gas systems*
- *having the apprentice calculate the combustion and ventilation requirements on various installations*
- *demonstrating a flue gas analysis*
- *continuing to further the apprentice's ability to interpret the gas codes for both natural and propane gases*
- *assisting the apprentice to size the ventilation and combustion air required for high input appliances*
- *allowing the apprentice to assist in the installation of category 1 appliance venting*
- *exposing the apprentice to various ignition systems*
- *demonstrating how ignition modules and ignition systems are tested*
- *ensuring the apprentice participates in the test firing of appliances to confirm the operation of all safety components*

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### **Blueprint Reading**

**28 hours**

- spool sheet drawings and specification books
- isometric spool sheet drawings
- IPT Pipe Trades Manual

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

- *demonstrating the use of labelling*
  - *allowing the apprentice to interpret job specifications from various prints*
  - *allowing the apprentice to develop drawings such as spool sheets, material take-off and isometric*
  - *allowing the apprentice to develop material take-off from isometric drawings*
  - *ensuring the apprentice can develop isometric drawings*
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**Electrical Systems****14 hours**

- testing electrical circuits
- operation of electrical switches
- electrical transformers
- relays in electrical circuits
- AC motors

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

- *continually asking the apprentice questions to ensure understanding of switches, alternating current, electromagnets, transformers, motors, relays and diagrams*
- *supervising hands-on work with meters on larger heating equipment*
- *supervising hands-on work with pump controls*
- *having the apprentice troubleshoot heating equipment and pump controls*

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**Specialty Piping****28 hours**

- specialty piping systems
- specialty piping components and equipment
- installation procedures
- specialty piping codes
- testing procedures

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

- *exposing the apprentice to fiberglass, glass and alloy systems*
- *exposing the apprentice to medical gas and compressed air systems*
- *exposing the apprentice to fuel and oil systems*
- *discussing the various code and material requirements for specialty systems*
- *exposing the apprentice to testing and maintenance of specialty systems*

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**Hydronic Heating****28 hours**

- discuss pump sciences
- calculate circulator requirements
- explain radiant heating concepts
- discuss piping strategy for multi temperature applications
- discuss design requirements for radiant panel heating systems
- recognize control systems
- discuss hydronic heating and cooling distribution piping

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

- *explaining the components of a circulator and the circulator operates*
- *explaining the components and safety devices of a hydronic boiler*
- *assisting the apprentice in the installation of a hydronic heating system*
- *discussing the operation of control systems*



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**Trade Mathematics****14 hours**

- units of measurement
- perimeter, area and volume
- trigonometry
- steamfitter-pipefitter trade calculations

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

- *ensuring the apprentice can convert metric to imperial for volume, capacity and mass as they pertain to water*
- *assisting the apprentice to calculate rolling and jumper offsets*
- *having the apprentice demonstrate the calculation of pipe sizes and flow rates*

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**Level Four****7 weeks****210 hours**

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**Process Piping****28 hours**

- process piping equipment
- industrial water and waste water systems
- installation procedures for process piping
- process control functions
- testing procedures

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

- *exposing the apprentice to various process boilers*
- *exposing the apprentice to the various process facilities such as breweries, refineries and pulp mills*
- *allowing the apprentice to install/service specialty piping systems such as hydraulic, compressed air and medical gas*
- *discussing the various heat tracing applications*
- *exposing the apprentice to water and waste water systems*

**Pipe Fabrication****28 hours**

- quality control procedures
- accurately take field measurements
- construct isometric spool drawing from field measurement
- construct a rolling off set project

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

- *allowing the apprentice to construct manufactured fittings using templates, ordinate line and jigs*
- *having the apprentice complete job planning tasks such as reading blueprints, estimate materials and knowledge of job specific permits*
- *having the apprentice complete quality control procedures*
- *allowing the apprentice to fabricate piping spool*
- *allowing the apprentice to fabricate piping with multi-piece mitered elbows, eccentric branches, and true wyes*
- *having the apprentice develop as-built drawings*
- *allowing the apprentice to install piping and systems using HDP*
- *allowing the apprentice to install piping and systems using FRP*

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**High Pressure Steam Systems****41 hours**

- Examine high pressure steam properties
- Differentiate power boilers, process boilers, and high temperature hot water boilers

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- Examine boiler trim for high pressure steam boiler
  - Relate ASME code to high pressure steam boilers and trim
  - Discuss the operation of high pressure steam systems
  - Analyze the piping procedures for high pressure steam systems
  - Discuss testing procedures for high pressure steam systems
  - Explain maintenance, troubleshooting, and repair of high pressure steam systems
  - Implement water treatment strategies

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

- *discussing the ASME code for high pressure steam systems*
- *exposing the apprentice to various steam systems*
- *allowing the apprentice to work on components such as heat exchangers and converters*
- *supervising the apprentice when installing/servicing condensate returns for low pressure steam systems*
- *discussing the application of various feed water controls*
- *allowing the apprentice to select a steam trap for a low pressure steam system*
- *supervising the apprentice in the installation of low pressure steam boilers and their systems*
- *exposing the apprentice to testing and maintenance procedures in high pressure steam systems*

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### **Blueprint Reading**

**28 hours**

- isometric and orthographic drawings
- identify industrial equipment and materials
- equipment placement with gridlines and coordinates
- industrial blueprints and specifications

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

- *ensuring the apprentice can determine locations, elevations and measurements from blueprints*
- *allowing the apprentice to interpret flow diagrams such as utilities, mechanical, process and P&ID*
- *having the apprentice determine material requirements from spool sheets*
- *ensuring the apprentice can interpret job specifications from various drawings*

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### **Critical Rigging**

**28 hours**

- Describe a complex lift plan
- Calculate load mass
- Calculate center of gravity
- Select critical lift rigging equipment

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

- *having the apprentice participate in lifting procedures, explaining how and when clevises, slings and other rigging equipment is used*
- *demonstrating, then supervising the apprentice during actual lifts of materials and equipment for crane hand signalling procedures*
- *demonstrating how knots are tied and when each should be used*

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### **Electrical Systems**

**14 hours**

- troubleshoot electrical controls for a direct spark or hot surface ignited appliance

- ladder and connection diagrams
- electrical pump controls

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

- *continuing to expose the apprentice to progressively more difficult installations*
- *insisting the apprentice read all installation manuals from start to finish*
- *assisting the apprentice to interpret detailed wiring diagrams*
- *ensuring the apprentice has an understanding of cable selection, boiler controls and components and pumps*

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## **Renewable Energy**

**15 hours**

- equipment
- piping configurations
- testing procedures

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

- *discussing geo-thermal system components such as exchangers, controls and circulating pumps*
- *allowing the apprentice to use various joining methods such as HDPE and FRP*
- *exposing the apprentice to different types of systems, such as surface, direct bore and binary*
- *allowing the apprentice to identify, test, and maintain geo- exchange, geothermal, and solar systems*

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## **HVAC and Refrigeration Systems**

**28 hours**

- system operation
- installation of HVAC equipment
- installation of refrigeration equipment
- commissioning procedures
- maintenance and repair procedures

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

- *discussing safety issues with HVAC and refrigeration systems*
  - *exposing the apprentice to HVAC and refrigeration equipment*
  - *allowing the apprentice to pipe in HVAC systems*
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**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**

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North Battleford (306) 446-7409

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