curriculum standard

apprenticeship

NOVA SCOTIA
APPRENTICESHIP
AGENCY

STEAMFITTER | PIPEFITTER 2013

Based on the Interprovincial Program Guide
(pg. 12 for Program Structure)

NOVA SCOTIA

September 2013
Version #1.0

The CCDA Executive Committee recognizes this Interprovincial Program Guide as the national curriculum for the occupation of Steamfitter/ Pipefitter.

Acknowledgements

The CCDA Executive Committee and the Interprovincial Program Guide Working Group wishes to acknowledge the contributions of the following industry and instructional representatives who participated in the development of this document.

Greg Bergman	Saskatchewan
Michael Dyment	New Brunswick
Stephen Evecsyn	Manitoba
Mike Goosney	Newfoundland and Labrador
Louis Hodder	Newfoundland and Labrador
Kenneth Hubley	Nova Scotia
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In addition to the representatives above, various federal, provincial and territorial representatives contributed to the development of this document including Gerard Ronayne representing the host province of Newfoundland and Labrador.

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PROGRAM CONTENT

Introduction

Jurisdictions have long recognized the benefit of pooling resources in the development and maintenance of apprenticeship training standards. A successful example of this is the Interprovincial Standards Red Seal Program itself. Essential to the establishment of standards is the development of suitable training systems and programs which enable tradespeople to acquire certification based on these standards. While certification is the responsibility of Apprenticeship administrators throughout Canada, the development and delivery of technical training is the responsibility of jurisdictions.

In 1999, work to develop common training for apprenticeship programs within the Atlantic Provinces began. To date, 22 Curriculum Standards have been developed through the Atlantic Standards Partnership (ASP) project to assist programming staff and instructors in the design and delivery of technical training. Similarly, the Canadian Council of Directors of Apprenticeship (CCDA) embarked on a process for the development of national Interprovincial Program Guides (IPGs) for the Boilermaker, Carpenter and Sprinkler System Installer trades. At its January 2005 strategic planning session, the CCDA identified developing common training standards as one of key activities in moving towards a more cohesive apprenticeship system.

With the support of Human Resources and Skills Development Canada (HRSDC), several provinces and territories have partnered to build on the ASP and the CCDA processes to further develop IPGs to be used across the country. This partnership will create efficiencies in time and resources and promote consistency in training and apprentice mobility.

User Guide

According to the Canadian Apprenticeship Forum, the IPG is: "a list of validated technical training outcomes, based upon those sub-tasks identified as common core in the National Occupational Analysis (NOA), and validated by industry in the provinces and territories as incorporating the essential tasks, knowledge and skills associated with a given trade."

Learning outcomes contained in the IPG represent the minimum common core content for the development of jurisdictional training standards and outlines. IPGs are developed based on the NOAs and extensive industry consultation. The IPG is intended to assist program development staff in the design of jurisdictional plans of training. Each jurisdiction has the flexibility to add additional content.

The IPG was deliberately constructed for ease of use and flexibility of structure in order to adapt to all delivery requirements. It details units of training, unit outcomes and objectives. It does not impose a delivery model or teaching format.

Jurisdictions and/or training providers will select and develop delivery materials and techniques that accommodate a variety of learning styles and delivery patterns. The IPG does not dictate study materials, textbooks or learning activities to be used in delivery.

The IPG document includes a recommended leveling structure to facilitate mobility for apprentices moving from one jurisdiction to another. Because of difference in jurisdictional regulations and program durations, levels are offered as suggestions only.

Structure

The IPG is divided into units. The unit codes are used as a means of identification and are not intended to convey the order of delivery. Prerequisites have not been detailed. Each unit consists of *Learning Outcomes* and *Objectives and Content.*

The *Learning Outcomes* are the specific performances that must be evaluated. Wording of the learning outcomes, "Demonstrate knowledge of…", acknowledges the broad spectrum of ways in which knowledge can be shown. It is at the discretion of each jurisdiction to determine the manner in which learning outcomes are evaluated; theoretically, practically or a combination of both.

The *Objectives and Content* for the unit details the information to be covered in order to achieve the performances specified in the *Learning Outcomes*. These objectives can be either theoretical or practical in nature, based on the requirements identified through the industry consultation process. The learning activities used to cover the objectives are at the discretion of the jurisdiction; however, practically worded objective statements have been used where industry indicated a need for the apprentices to receive exposure to performing the task or skill outlined while attending technical training. For example, this exposure could be done through instructor demonstration or individual or group performance of the skill or task. This practical training will help to reinforce the theoretical component of the technical training.

Detailed content for each objective has not been developed. Where detail is required for clarity, content has been provided. The content listed within the IPG document is **not** intended to represent an inclusive list; rather, it is included to illustrate the intended direction for the objective. Content may be added or extended in jurisdictional training plans as required.

Jurisdictions are free to deliver the IPG units one at a time or concurrently, provided that all *Learning Outcomes* are met. The IPG does not indicate the amount of time to be spent on a particular unit as the length of time required to deliver the *Learning Outcomes* successfully will depend upon the learning activities and teaching methods used.

Suggested Hours

Suggested Hours provide an indication of the time it should take to cover the material in the course and are provided as a guide only.

IPG Glossary of Terms

These definitions are intended as a guide to how language is used in the IPGs.

ADJUST	To put in good working order; regulate; bring to a proper state or position.
APPLICATION	The use to which something is put and/or the circumstance in which you would use it.
CHARACTERISTIC	A feature that helps to identify, tell apart, or describe recognizably; a distinguishing mark or trait.
COMPONENT	A part that can be separated from or attached to a system; a segment or unit.
DEFINE	To state the meaning of (a word, phrase, etc.).
DESCRIBE	To give a verbal account of; tell about in detail.
EXPLAIN	To make plain or clear; illustrate; rationalize.
IDENTIFY	To point out or name objectives or types.
INTERPRET	To translate information from observation, charts, tables, graphs, and written material.
MAINTAIN	To keep in a condition of good repair or efficiency.
METHOD	A means or manner of doing something that has procedures attached to it.
PROCEDURE	A prescribed series of steps taken to accomplish an end.

PURPOSE	The reason for which something exists or is done, made or used.
TECHNIQUE	Within a procedure, the manner in which technical skills are applied.
TEST	v. To subject to a procedure that ascertains effectiveness, value, proper function, or other quality. n. A way of examining something to determine its characteristics or properties, or to determine whether or not it is working correctly.
TROUBLESHOOT	To follow a systematic procedure to identify and locate a problem or malfunction and its cause.

Essential Skills Profiles

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

Over the past several years, the Government of Canada has conducted research examining the skills people use at work. From this research, Essential Skills Profiles have been developed for various occupations.

For more information regarding Essential Skills and to access Essential Skills Profiles for specific occupations, visit Human Resources and Skills Development Canada's Essential Skills website at:

http://www.hrsdc.gc.ca/eng/workplaceskills/LES/index.shtml

Profile Chart

OCCUPATIONAL SKILLS			
PIP-005 Safety	P IP-050 Communication and Trade Documentation	PIP-010 Tools and Equipment	PIP-015 Access Equipment
PIP-070 Job Planning	PIP-035 Fuel Brazing and Cutting	PIP-025 Introduction to Electricity	PIP-040 Pipe, Tube and Tubing Fundamentals
STM-415 Quality Control	STM-115 Introduction to Welding	MENT-1801 Workplace Mentoring I (NS Specific)	MENT-1802 Workplace Mentoring II (NS Specific)
DRAWINGS AND SPECIFICATIONS			
PIP-030 Drawings	STM-200 Industrial Drawings and Specifications	STM-205 Template Development	
PIPING LAYOUT AND COMMON INSTALLATION			
STM-100 Copper Tube and Tubing	STM-105 Plastic Piping	STM-110 Black Iron Piping	STM-225 Stainless Steel Piping
STM-230 Fiberglass Piping	STM-235 Specialty Piping	PIP-045 Piping Valves	STM-250 Cross Connection Control
STM-215 Fitting Fabrication	STM-210 Spool Fabrication	STMA-1002 Piping Project (NS Specific)	
RIGGING AND HOISTING			
PIP-020 Hoisting, Lifting and Rigging 1	STM-220 Hoisting, Lifting and Rigging 2		
STEAM SYSTEM INSTALLATION			
STM-300 Low Pressure Steam Systems	STM-305 High Pressure Steam Systems	STM-310 Condensate Return Systems	

Profile Chart *(continued)*

HEATING, COOLING AND PROCESS SYSTEM INSTALLATION			
STM-240 Hydronic Systems	STM-245 Hydronic System Control	PIP-060 Gas Piping Systems	PIP-065 Medical Gas Systems
STM-400 Refrigeration Systems	STM-405 Process Piping Systems	STM-315 Hydraulic Systems	PIP-055 Compressed Air Systems
STMA-1003 Introduction to Renewable Energy Systems (NS Specific)	STM-650 Specialty Steamfitting-Pipefitting Systems (Bulk Systems) (NS Specific)	STMA-1004 Pumps (NS Specific)	
TESTING AND COMMISSIONING			
STM-410 System Testing and Commissioning	STMA-1005 Controlled Bolting (NS Specific)		

Program Structure - Nova Scotia Apprenticeship Program

The courses listed below are required technical training in the Nova Scotia Steamfitter/Pipefitter Apprenticeship Program.

- PIP = Common units to Steamfitter/Pipefitter and Plumber, unless indicated otherwise (e.g. NS Specific means the unit is taught only in Nova Scotia and may be taught to Steamfitter/Pipefitter only.)
- STM = Units specific to Steamfitter/Pipefitter.

Nova Scotia Course No.	Nova Scotia Course Name	Nova Scotia Prerequisites	Interprovincial Program Guide (IPG) Content To Be Covered		Sugges-ted Hrs	Page No.
Level 1 (6 wks)						
	Integrated Milestone		MENT-1801	Workplace Mentoring I *(NS Specific)*		23
STMA-0802	Safety, Tools & Equipment	None	PIP-005	Safety	10	24
			PIP-010	Tools and Equipment	9	26
			PIP-015	Access Equipment	8	28
			PIP-020	Hoisting, Lifting and Rigging 1 (Part 1)	12	29
STMA-1863	Blueprint Reading & Interpretation 1 (Basic Commercial)	None	PIP-050	Communication and Trade Documentation	6	31
			PIP-030	Drawings (Basic Commercial)	30	32
STMA-1810	Pipe, Fittings & Piping Assembly 1A (Ferrous) **2 week course**	STMA-0802 Co-requisite: STMA-1811	PIP-040	Pipe, Tube and Tubing Fundamentals	20	35
			STM-110	Black Iron Piping	20	40
STMA-1811	Pipe, Fittings & Piping Assembly 1B (Non-Ferrous)	STMA-0802 Co-requisite: STMA-1810	PIP-040	Pipe, Tube and Tubing Fundamentals	10	35
			STM-100	Copper Tube and Tubing **PRACTICAL: TUBE BENDING**	20	42
			STM-105	Plastic Piping	5	45
STMA-1806	Pipe, Fittings & Piping Assembly 2	STMA-1811	PIP-045	Piping Valves	6	47
			STMA-1002	Piping Project (*NS Specific*) **PRACTICAL: PRACTICE JOINING METHODS**	24	50

Nova Scotia Course No.	Nova Scotia Course Name	Nova Scotia Prerequisites	Interprovincial Program Guide (IPG) Content To Be Covered		Sugges-ted Hrs	Page No.
Level 2 (6 wks)						
STMA-1864	Blueprint Reading & Interpretation 2 (Advanced Commercial)	STMA-1863	PIP-030	Drawings (Advanced Commercial)	30	32
STMA-1808	Hydronic Heating 1 (Residential)	STMA-1863, 1811	STM-240	Hydronic Systems (Residential)	19	52
			STM-245	Hydronic System Controls (Residential)	10	56
			STM-250	Cross Connection Control	1	58
STMA-1849	Introduction to Electricity	STMA-0802	PIP-025	Introduction to Electricity	30	59
STMA-1858	Blueprint Reading & Interpretation 3 (Industrial)	STMA-1864	STM-200	Industrial Drawings and Specifications	30	60
STMA-1805	Fuel / Electric Welding & Cutting	STMA-0802	STM-115	Introduction to Welding	10	61
			PIP-035	Fuel Brazing and Cutting **PRACTICAL: USE FUEL CUTTING EQUIPMENT**	20	63
STMA-1859	Hoisting, Lifting and Rigging	STMA-0802	PIP-020	Hoisting, Lifting and Rigging 1 (Part 2)	15	65
			STM-220	Hoisting, Lifting and Rigging 2	15	66
Level 3 (6 wks)						
STMA-1809	Hydronic Heating 2 (Commercial)	STMA-1808	STM-240	Hydronic Systems (Commercial)	20	52
			STM-245	Hydronic System Controls (Commercial)	10	56
STMA-1844	Low Pressure Steam	None	STM-300	Low Pressure Steam Systems	20	71
			STM-310	Condensate Return Systems	10	74
STMA-1851	Pipe Template Development	STMA-1863, 0802, 1810 Co-requisites: STMA-1851, 1852	STM-205	Template Development **PRACTICAL: TEMPLATE DEVELOPMENT**	30	76
STMA-1852	Pipe Layout & Fabrication		STM-210	Spool Fabrication	10	77
			STM-215	Fitting Fabrication **PRACTICAL: FITTING FABRICATION**	20	78

Nova Scotia Course No.	Nova Scotia Course Name	Nova Scotia Prerequisites	Interprovincial Program Guide (IPG) Content To Be Covered		Sugges-ted Hrs	Page No.
STMA-1853	Gas Piping 1	STMA-1811	PIP-060	Gas Piping Systems (Low Pressure)	30	79
STMA-1860	Specialty Piping Applications and Systems	STMA-0802, 1805, 1806, 1810	STM-235	Specialty Piping	15	81
			STM-650	Specialty Steamfitting-Pipefitting Systems (Bulk Systems) *(NS Specific)*	5	83
			PIP-065	Medical Gas Systems	10	84
			STM-225	Stainless Steel Piping	5	86
			STM-230	Fiberglass Piping	5	88
Level 4 (7 wks)						
	Integrated Milestone		MENT-1802	Workplace Mentoring II *(NS Specific)*		91
STMA-1854	Gas Piping 2	STMA-1853	PIP-060	Gas Piping Systems (High Pressure)	30	79
STMA-1855	Refrigeration / Instrumentation	STMA-0802	STM-400	Refrigeration Systems	10	92
			STM-405	Process Piping Systems	10	94
			STM-320	Instrumentation	10	96
STMA-1862	Pumps / Compressors & Hydraulic Systems **2 week course**	STMA-0802	STMA-1004	Pumps *(NS Specific)*	10	98
			STM-315	Hydraulic Systems	10	100
			PIP-055	Compressed Air Systems	10	102
			STMA 1003	Introduction to Renewable Energy Systems *(NS Specific)*	20	68
			STMA 1005	Controlled Bolting *(NS Specific)*	10	112
STMA-1856	High Pressure Steam	STMA-1844	STM-305	High Pressure Steam Systems	30	104
STMA-1861	Job Planning, Commissioning and Quality Control	Entire Program	PIP-070	Job Planning	5	106
			STM-410	System Testing and Commissioning	10	107
			STM-415	Quality Control	5	110

Nova Scotia Course No.	Nova Scotia Course Name	Nova Scotia Prerequisites	Interprovincial Program Guide (IPG) Content To Be Covered	Sugges-ted Hrs	Page No.
STMA-1857	Program Review	Entire Program	STMA-1857 Program Review (*NS Specific*)	30	113
Nova Scotia Steamfitter-Pipefitter Apprenticeship Program: All Courses are Required					

2008 NOA Sub-task to IPG Unit Comparison

NOA Sub-task		IPG Unit	
Task 1 - Uses tools and equipment.			
1.01	Uses hand tools.	PIP-010	Tools and Equipment
1.02	Uses power tools.	PIP-010	Tools and Equipment
1.03	Uses measuring tools.	PIP-010	Tools and Equipment
1.04	Uses welding equipment.	PIP-010	Tools and Equipment
		STM-115	Introduction to Welding
1.05	Uses soldering and brazing equipment.	PIP-010	Tools and Equipment
		PIP-035	Fuel Brazing and Cutting
1.06	Uses ladders and work platforms.	PIP-015	Access Equipment
1.07	Uses personal protective equipment (PPE) and safety equipment.	PIP-005	Safety
Task 2 - Organizes work.			
2.01	Plans job.	PIP-070	Job Planning
2.02	Uses documentation.	PIP-050	Communication and Trade Documentation
2.03	Communicates with others.	PIP-050	Communication and Trade Documentation
2.04	Selects piping and components.	PIP-040	Pipe, Tube and Tubing Fundamentals
		STM-100	Copper Tube and Tubing
		STM-105	Plastic Piping
		STM-110	Black Iron Piping
		STM-225	Stainless Steel Piping
		STM-230	Fiberglass Piping
		STM-235	Specialty Piping
2.05	Performs quality control functions.	PIP-030	Drawings
		STM-200	Industrial Drawings and Specifications
		STM-410	System Testing and Commissioning
		STM-415	Quality Control
2.06	Maintains safe work environment.	PIP-005	Safety
Task 3 - Interprets drawings and specifications.			
3.01	Compares specifications to drawings.	PIP-030	Drawings
		STM-200	Industrial Drawings and Specifications

NOA Sub-task		IPG Unit	
3.02	Refers to types of drawings.	PIP-030	Drawings
		STM-200	Industrial Drawings and Specifications
3.03	Determines location of piping and equipment.	PIP-030	Drawings
		STM-200	Industrial Drawings and Specifications
3.04	Generates material list.	PIP-030	Drawings
		STM-200	Industrial Drawings and Specifications
Task 4 - Performs drafting.			
4.01	Generates drawings.	PIP-030	Drawings
		STM-200	Industrial Drawings and Specifications
4.02	Develops templates.	STM-205	Template Development
Task 5 - Performs layout and fabrication.			
5.01	Uses templates.	STM-205	Template Development
		STM-215	Fitting Fabrication
5.02	Lays out pipe and fittings.	STM-100	Copper Tube and Tubing
		STM-105	Plastic Piping
		STM-110	Black Iron Piping
		STM-225	Stainless Steel Piping
		STM-230	Fiberglass Piping
		STM-235	Specialty Piping
		STM-215	Fitting Fabrication
5.03	Prepares pipe and fittings.	STM-100	Copper Tube and Tubing
		STM-105	Plastic Piping
		STM-110	Black Iron Piping
		STM-225	Stainless Steel Piping
		STM-230	Fiberglass Piping
		STM-235	Specialty Piping
		STM-215	Fitting Fabrication
5.04	Fabricates spools.	STM-210	Spool Fabrication
Task 6 - Performs common installation processes.			
6.01	Installs supports, hangers, guides and anchors.	STM-100	Copper Tube and Tubing
		STM-105	Plastic Piping
		STM-110	Black Iron Piping
		STM-225	Stainless Steel Piping
		STM-230	Fiberglass Piping
		STM-235	Specialty Piping

NOA Sub-task		IPG Unit	
6.02	Joins piping.	STM-100	Copper Tube and Tubing
		STM-105	Plastic Piping
		STM-110	Black Iron Piping
		STM-225	Stainless Steel Piping
		STM-230	Fiberglass Piping
		STM-235	Specialty Piping
6.03	Installs piping system components and equipment.	STM-240	Hydronic Systems
		STM-245	Hydronic System Control
		PIP-060	Gas Piping Systems
		PIP-065	Medical Gas Systems
		PIP-045	Piping Valves
		STM-250	Cross Connection Control
		STM-300	Low Pressure Steam Systems
		STM-305	High Pressure Steam Systems
		STM-310	Condensate Return Systems
		STM-400	Refrigeration Systems
		STM-405	Process Piping Systems
		STM-315	Hydraulic Systems
		PIP-055	Compressed Air Systems
Task 7 - Plans lift.			
7.01	Determines load.	PIP-020	Hoisting, Lifting and Rigging 1
		STM-220	Hoisting, Lifting and Rigging 2
7.02	Selects rigging equipment.	PIP-020	Hoisting, Lifting and Rigging 1
		STM-220	Hoisting, Lifting and Rigging 2
7.03	Selects lifting equipment.	PIP-020	Hoisting, Lifting and Rigging 1
		STM-220	Hoisting, Lifting and Rigging 2
Task 8 - Hoists load.			
8.01	Secures lift area.	PIP-020	Hoisting, Lifting and Rigging 1
		STM-220	Hoisting, Lifting and Rigging 2
8.02	Sets up rigging equipment.	PIP-020	Hoisting, Lifting and Rigging 1
		STM-220	Hoisting, Lifting and Rigging 2
8.03	Performs lift.	PIP-020	Hoisting, Lifting and Rigging 1
		STM-220	Hoisting, Lifting and Rigging 2
8.04	Conducts post-lift equipment inspection.	PIP-020	Hoisting, Lifting and Rigging 1
		STM-220	Hoisting, Lifting and Rigging 2
8.05	Stores equipment.	PIP-020	Hoisting, Lifting and Rigging 1
Task 9 - Installs high and low pressure process steam systems.			
9.01	Installs equipment for high and low pressure process steam.	STM-300	Low Pressure Steam Systems
		STM-305	High Pressure Steam Systems
		STM-310	Condensate Return Systems

NOA Sub-task		IPG Unit	
9.02	Installs piping for high pressure process steam.	STM-305	High Pressure Steam Systems
		STM-310	Condensate Return Systems
9.03	Installs piping for low pressure process steam.	STM-300	Low Pressure Steam Systems
		STM-310	Condensate Return Systems
Task 10 - Installs steam heating systems.			
10.01	Installs equipment for steam heating systems.	STM-300	Low Pressure Steam Systems
		STM-305	High Pressure Steam Systems
		STM-310	Condensate Return Systems
10.02	Installs piping for steam heating systems.	STM-300	Low Pressure Steam Systems
		STM-305	High Pressure Steam Systems
		STM-310	Condensate Return Systems
Task 11 - Installs hydronic systems.			
11.01	Installs equipment for hydronic systems.	STM-240	Hydronic Systems
		STM-245	Hydronic System Control
11.02	Installs piping for hydronic systems.	STM-240	Hydronic Systems
Task 12 - Installs refrigeration systems.			
12.01	Installs equipment for refrigeration systems.	STM-400	Refrigeration Systems
12.02	Installs piping and tubing for refrigeration systems.	STM-400	Refrigeration Systems
Task 13 - Installs process piping systems.			
13.01	Installs equipment for process piping systems.	STM-405	Process Piping Systems
13.02	Installs piping for process piping systems.	STM-405	Process Piping Systems
Task 14 - Installs hydraulic systems.			
14.01	Installs equipment for hydraulic systems.	STM-315	Hydraulic Systems
14.02	Installs piping and tubing for hydraulic systems.	STM-315	Hydraulic Systems
Task 15 - Installs fuel systems.			
15.01	Installs equipment for fuel systems.	PIP-060	Gas Piping Systems
15.02	Installs piping for fuel systems.	PIP-060	Gas Piping Systems
Task 16 - Installs compressed air and medical gas systems.			
16.01	Installs equipment for compressed air and medical gas systems.	PIP-065	Medical Gas Systems
		PIP-055	Compressed Air Systems
16.02	Installs piping and tubing for compressed air systems.	PIP-055	Compressed Air Systems
16.03	Installs piping and tubing for medical gas systems.	PIP-065	Medical Gas Systems

NOA Sub-task		IPG Unit	
Task 17 - Prepares system for test.			
17.01	Pre-checks system for test.	STM-410	System Testing and Commissioning
17.02	Selects test equipment.	STM-410	System Testing and Commissioning
17.03	Isolates system.	STM-410	System Testing and Commissioning
17.04	Connects test equipment.	STM-410	System Testing and Commissioning
Task 18 - Performs test.			
18.01	Secures test area.	STM-410	System Testing and Commissioning
18.02	Pressurized system.	STM-410	System Testing and Commissioning
18.03	Inspects system.	STM-410	System Testing and Commissioning
18.04	Corrects leaks.	STM-410	System Testing and Commissioning
18.05	Removes test equipment.	STM-410	System Testing and Commissioning
Task 19 - Commissions systems.			
19.01	Flushes system.	STM-410	System Testing and Commissioning
19.02	Chemically treats system.	STM-410	System Testing and Commissioning
19.03	Assists in start-up procedure.	STM-410	System Testing and Commissioning
Task 20 - Maintains system.			
20.01	Follows lock-out procedures.	PIP-005	Safety
20.02	Performs preventative maintenance and service.	STM-240	Hydronic Systems
		STM-245	Hydronic System Control
		PIP-060	Gas Piping Systems
		PIP-065	Medical Gas Systems
		PIP-045	Piping Valves
		STM-300	Low Pressure Steam Systems
		STM-305	High Pressure Steam Systems
		STM-310	Condensate Return Systems
		STM-400	Refrigeration Systems
		STM-405	Process Piping Systems
		STM-315	Hydraulic Systems
		PIP-055	Compressed Air Systems

NOA Sub-task		IPG Unit	
Task 21 - Performs repairs.			
21.01	Locates problems.	STM-240	Hydronic Systems
		STM-245	Hydronic System Control
		PIP-060	Gas Piping Systems
		PIP-065	Medical Gas Systems
		PIP-045	Piping Valves
		STM-300	Low Pressure Steam Systems
		STM-305	High Pressure Steam Systems
		STM-310	Condensate Return Systems
		STM-400	Refrigeration Systems
		STM-405	Process Piping Systems
		STM-315	Hydraulic Systems
		PIP-055	Compressed Air Systems
21.02	Repairs piping and components.	STM-240	Hydronic Systems
		STM-245	Hydronic System Control
		PIP-060	Gas Piping Systems
		PIP-065	Medical Gas Systems
		PIP-045	Piping Valves
		STM-300	Low Pressure Steam Systems
		STM-305	High Pressure Steam Systems
		STM-310	Condensate Return Systems
		STM-400	Refrigeration Systems
		STM-405	Process Piping Systems
		STM-315	Hydraulic Systems
		PIP-055	Compressed Air Systems

LEVEL 1

MENT-1801 Workplace Mentoring I

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Identify and explain strategies for learning workplace skills.
- Demonstrate strategies to assist in learning skills in the workplace.

Objectives and Content:

1. Describe the importance of your own experiences.

2. Identify the partners involved in apprenticeship.

3. Describe the shared responsibilities for workplace learning.

4. Determine your own learning preferences and explain how these relate to learning new skills.

5. Describe the importance of different types of skills in the workplace.

6. Describe the importance of essential skills in the trade.

7. Identify different ways of learning.

8. Identify your learning preferences.

9. Identify different learning needs and strategies to meet learning needs.

10. Identify techniques for effective communication.

11. Identify strategies to assist in learning a skill.

Resource:

- Recommended resource to use in the delivery of this unit: www.apprenticeship.nscc.ca/mentoring/apprentice.htm

PIP-005 Safety

Learning Outcomes:

- Demonstrate knowledge of safety equipment, its applications, maintenance and procedures for use.
- Demonstrate knowledge of safe work practices.
- Demonstrate knowledge of regulatory requirements pertaining to safety.

Objectives and Content:

1. Identify types of personal protective equipment (PPE) and clothing and describe their applications, limitations and procedures for use.

2. Describe the procedures used to care for, maintain and store PPE.

3. Identify hazards and describe safe work practices.
   - i) personal
   - ii) workplace
     - electrical
     - isolation and de-energizing procedures
     - tag out/lockout
     - confined space
     - trenches
     - fire
     - heights (ladders, scaffolds)
     - asbestos
     - welding equipment
     - pressurized systems (hydraulics, air, fluid, steam)
     - high temperature systems
   - iii) environment

4. Identify and describe workplace safety and health regulations and certification requirements.
   - i) federal
     - Material Safety Data Sheets (MSDS)
     - Workplace Hazardous Material Information System (WHMIS)
     - Transportation of Dangerous Goods (TDG)

ii) provincial/territorial
- Occupational Health and Safety Act (OHS)

iii) municipal

5. Describe good housekeeping practices.

6. Describe the correct use and applications of various types of firefighting equipment.
   i) classes of fire extinguishers
   ii) standpipe systems

PIP-010 Tools and Equipment

Learning Outcomes:

- Demonstrate knowledge of tools and equipment, their applications, maintenance and procedures for use.

Objectives and Content:

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

2. Interpret codes and regulations and describe site specific requirements pertaining to tools and equipment.
   i) training and certification requirements

3. Identify types of hand tools and describe their applications and procedures for use.

4. Describe the procedures used to inspect, maintain and store hand tools.

5. Identify types of measuring tools and equipment and describe their applications and procedures for use.

6. Describe the procedures used to inspect, maintain and store measuring tools and equipment.

7. Identify types of power tools and equipment and describe their applications and procedures for use.
   i) hydraulic
   ii) pneumatic
   iii) electric

8. Describe the procedures used to inspect, maintain and store power tools and equipment.

9. Identify types of powder actuated tools and describe their applications.

10. Describe the procedures used to inspect, maintain and store powder actuated tools.

11. Identify types of cutting and welding equipment and describe their applications.

12. Describe the procedures used to inspect, maintain and store cutting and welding equipment.

x. Identify fittings used to assemble steel, galvanized and stainless steel pipe and describe their characteristics and applications.
    i) terminology
    ii) types
    iii) parts
    iv) abbreviations

PIP-015 Access Equipment

Learning Outcomes:

- Demonstrate knowledge of ladders, scaffolding and hydraulic lifts, their applications, limitations and procedures for use.

Objectives and Content:

1. Define terminology associated with ladders, scaffolding and hydraulic lifts.

2. Identify hazards and describe safe work practices pertaining to ladders, scaffolding and hydraulic lifts.

3. Identify codes and regulations pertaining to ladders, scaffolding and hydraulic lifts.
   i) training and certification requirements

4. Identify types of ladders, scaffolding and hydraulic lifts and describe their characteristics and applications.

5. Describe the procedures used to erect and dismantle ladders and scaffolding.

6. Describe the procedures used to inspect, maintain and store ladders, scaffolding and hydraulic lifts.

PIP-020 Hoisting, Lifting and Rigging 1 (Part 1)

Learning Outcomes:

- Demonstrate knowledge of hoisting, lifting and rigging equipment, their applications, limitations and procedures for use.
- Demonstrate knowledge of the procedures used to perform hoisting and lifting operations.

Objectives and Content:

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

2. Identify hazards and describe safe work practices pertaining to hoisting, lifting and rigging.

3. Identify codes and regulations pertaining to hoisting, lifting and rigging.

4. Identify types of rigging equipment and accessories and describe their limitations, applications and procedures for use.

5. Identify types of hoisting and lifting equipment and accessories and describe their applications and procedures for use.

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

7. Identify types of knots, hitches and bends and describe their applications and the procedures used to tie them.

8. Describe the procedures used to rig material/equipment for lifting.

9. Describe the procedures used to ensure the work area is safe for lifting.
   i) supervision of lift
   ii) securing work area
   iii) communication

10. Identify and describe procedures used to communicate during hoisting, lifting and rigging operations.
    i) hand signals
    ii) electronic communications
    iii) audible/visual

PIP-050 Communication and Trade Documentation

Learning Outcomes:

- Demonstrate knowledge of effective communication practices.
- Demonstrate knowledge of trade related documentation and its use.

Objectives and Content:

1. Describe the importance of effective verbal and non-verbal communication.
   - i) other tradespersons
   - ii) colleagues
   - iii) supervisors
   - iv) suppliers/manufacturers
   - v) clients/customers
   - vi) inspectors

2. Identify types of communication equipment and describe their applications and procedures for use.

3. Identify types of trade related documentation and describe their applications and procedures for use.
   - i) manufacturers' specifications
   - ii) codes and standards
   - iii) work orders
   - iv) maintenance schedules
   - v) permits
   - vi) quality control

4. Explain the process, requirements and information sources for completing trade related documentation and reports.

PIP-030 Drawings

Notes:

- This unit is covered in two courses.
- In course STMA-1863 Blueprint Reading & Interpretation 1 (Basic Commercial), the following learning outcomes and objectives are covered in the context of basic commercial installations.
- In course STMA-1864 Blueprint Reading & Interpretation 2 (Advanced Commercial), the following learning outcomes and objectives are covered in the context of advanced commercial installations.

Learning Outcomes:

- Demonstrate knowledge of drawings and their applications.
- Demonstrate knowledge of interpreting and extracting information from drawings.
- Demonstrate knowledge of calculations to add, subtract, multiply and divide whole and rational numbers.
- Demonstrate knowledge of metric and imperial systems of measurement and the calculations used to perform conversions.
- Demonstrate knowledge of basic drawing and sketching techniques.

Objectives and Content:

1. Define terminology associated with drawings and sketches.

2. Perform calculations to add, subtract, multiply and divide numbers.
   i) whole numbers
   ii) rational numbers
      - fractions
      - decimals
      - percentages

3. Perform calculations to transpose formulas.
   i) processes

4. Describe metric and imperial systems of measurement and the procedures used to perform conversions.
   i) length

ii) volume
iii) capacity
iv) area
v) mass
vi) weight
viii) temperature
- Fahrenheit
- Centigrade
- Kelvin
- Rankin

ix) pressure
- absolute
- gauge

5. Perform calculations to determine conversions.
i) length
ii) volume
iii) capacity
iv) area
v) mass
vi) weight
viii) temperature
- Fahrenheit
- Centigrade
- Kelvin
- Rankin

ix) pressure
- absolute
- gauge

6. Identify the types of drawings and describe their applications.
i) civil/site
ii) architectural
iii) mechanical
iv) structural
v) electrical
vi) shop drawings
vii) sketches

7. Identify types of symbols and describe their characteristics and applications.

8. Identify drawing-related documentation and describe their applications.
   i) change orders
   ii) addendums
   iii) as-builts
   iv) specifications

9. Identify drawing projections and views and describe their applications.
   i) projections
      - orthographic
      - oblique
      - isometric
      - pictoral
   ii) views
      - plan
      - section
      - detail
      - elevation
      - cross section

10. Describe the use of scales.

11. Interpret information on drawings.
   i) lines
   ii) legend
   iii) symbols and abbreviations
   iv) notes and specifications
   v) schedules
   vi) scales

12. Describe the procedures used for the care, handling and storage of drawings.

13. Demonstrate basic drawing and sketching techniques.

PIP-040 Pipe, Tube and Tubing Fundamentals

Learning Outcomes:

- Demonstrate knowledge of pipe, tube and tubing and their characteristics and applications.
- Demonstrate knowledge of calculations to determine pipe, tube and tubing measurements.
- Demonstrate knowledge of the hazards, methods and calculations required to perform pipe and tube bending.

Objectives and Content:

1. Define terminology associated with pipe, tube and tubing.

2. Identify types of pipe, tube and tubing systems.
   - i) water supply
   - ii) sanitary drainage, waste and vent
   - iii) storm drainage
   - iv) heating
   - v) sprinkler
   - vi) gas
   - vii) process and power generating
   - viii) refrigeration
   - ix) compressed air

3. Identify types of pipe, tube and tubing and describe their applications.
   - i) steel
   - ii) plastic
   - iii) copper
   - iv) brass
   - v) aluminum
   - vi) cast iron
     - ductile
     - duriron
     - grey
   - vii) historic
   - viii) glass
   - ix) asbestos-cement

x) reinforced concrete
xi) stainless steel
xii) fiberglass
xiii) galvanized

4. Describe an angle and its parts.
   i) vertex
   ii) degrees
   iii) letters

5. Describe a circle and its parts.
   i) centre
   ii) circumference
   iii) diameter
   iv) radius
   v) cord
   vi) arc
   vii) concentric and eccentric circle

6. Perform calculations to determine perimeter and area.
   i) squares
   ii) rectangles
   iii) triangles
   iv) circles
      - cross-sectional area of pipe

7. Perform calculations to determine volume.
   i) cubes
   ii) rectangular prisms and cylinders
      - rectangular tanks

8. Use the Pythagorean theorem of right angles.
   i) hypotenuse
   ii) side opposite
   iii) side adjacent

9. Perform calculations to determine pipe, tube and tubing measurements.
   i) fitting allowances
      - center to center
      - end to end

- equal spread

ii) offsets
- travel
- rise and run

iii) run and branch

iv) degree fittings
- diagonal
- offset

10. Identify types of piping systems and types of pipes used in the systems and describe their applications.
    i) heating systems
    ii) cooling systems
    iii) drainage, waste and vent systems
    iv) compressed gas/air systems
    v) fuel oil/gas systems
    vi) steam, humidification systems
    vii) industrial, marine, process piping

11. Explain forces that impact on pipe, tube and tubing systems and perform associated calculations.
    i) thermal expansion
    ii) thermal contraction
    iii) weight
    - head pressure

    iv) friction loss
    v) turbulence
    vi) galvanic action
    vii) environmental

12. Identify the information required to select and order steel pipe.
    i) material (steel, galvanized, stainless)
    ii) size (diameter, length, standard lengths)
    iii) schedule (wall thickness, grade)
    iv) characteristics (welded, seamless)
    v) end finishes (plain end, thread, grooved, beveled)

13. Identify tools and methods used for cutting steel, galvanized and stainless steel pipe.
    i) pipe cutters, reamers

ii) cut-off saw
iii) oxy-acetylene pipe beveller
iv) plasma arc cutter
v) angle grinder
vi) carbon arc cutter
vii) band saw

14. Identify methods of joining steel, galvanized and stainless steel pipe and their associated procedures.
    i) threading and grooving
    ii) welding
    iii) flanging
    iv) press-fit

15. Identify tools used to prepare and assemble steel and galvanized pipe and procedures for their use.
    i) hand and power threaders
    ii) hand and power roll groovers
    iii) cut groovers
    iv) welding and cutting equipment
        - oxy/acetylene
        - electric
        - mig/tig
    v) press-fit crimper
    vi) vice, wrenches
    vii) beveller

16. Identify and describe the types of hangers and supports and procedures used to hang and support steel pipe and fittings.
    i) code
    ii) specifications
    iii) grade
    iv) components
    v) fire stopping systems

17. Describe the factors affecting the selection of materials for bending.
    i) temper
    ii) composition
    iii) purpose
    iv) applications

18. Describe methods of bending and their applications.
    i) draw
    ii) compression
    iii) roll
    iv) ram
    v) stretch
    vi) wrinkle

19. Describe the dangers and safety precautions associated with bending procedures.
    i) working with silica sand
    ii) moisture content of sand
    iii) supports and anchors
    iv) protective clothing
    v) pinch points

20. Explain bending terminology.
    i) developed length
    ii) tangent
    iii) gain
    iv) bending zone
    v) outside arc
    vi) inside arc
    vii) layout marks
    viii) minimum radii
    ix) spring back

21. Identify and perform calculations used in hot bending.
    i) minimum radius of bend
    ii) constant for developed length
    iii) tangents
    iv) layout marks on pipe

STM-110 Black Iron Piping

Learning Outcomes:

- Demonstrate knowledge of black iron piping, fittings and accessories.
- Demonstrate knowledge of the procedures used to measure black iron piping.
- Demonstrate knowledge of the procedures used to cut and join black iron piping.
- Demonstrate knowledge of the procedures used to perform hot bending.

Objectives and Content:

1. Define terminology associated with black iron piping.

2. Identify hazards and describe safe work practices pertaining to black iron piping.
   i) galvanized pipe

3. Interpret codes and regulations pertaining to black iron piping.

4. Interpret information pertaining to black iron piping found on drawings and specifications.

5. Describe the identification system and methods used for black iron piping.

6. Identify tools and equipment related to black iron piping and describe their applications and procedures for use.

7. Identify fittings used with black iron piping and describe their purpose and applications.

8. Identify black iron piping accessories and describe their purpose and applications.
   i) supports
   ii) hangers
   iii) sleeves

9. Explain the systems of measurement for black iron piping.
   i) dimension
   ii) length
   iii) wall thickness/schedule

10. Describe the procedures used to measure black iron piping.

11. Describe the procedures used to inspect black iron piping.

12. Identify the methods used to cut black iron piping and describe their associated procedures.

13. Describe procedures used to perform hot bending.
    i) marking / layout
    ii) use of fillers, plugs and mandrels
    iii) securing pipe
    iv) application of heat
    v) desired angle/ radii
    vi) cooling rate
    vii) verification of bend to establish tolerance
    viii) removal of plugs, fillers and mandrels

14. Identify the methods used to join black iron piping and describe their associated procedures.
    i) threaded
    ii) grooved
    iii) welded
    iv) flanged
    v) press-fit
    vi) compression fittings

15. Describe the procedures used to install fittings and accessories for black iron piping.

STM-100 Copper Tube and Tubing

Learning Outcomes:

- Demonstrate knowledge of copper tube and tubing, fittings and accessories.
- Demonstrate knowledge of the procedures used to measure copper tube and tubing.
- Demonstrate knowledge of the procedures used to cut, bend and join copper tube and tubing.

Objectives and Content:

1. Define terminology associated with copper tube and tubing.

2. Identify hazards and describe safe work practices pertaining to copper tube and tubing.

3. Interpret codes and regulations pertaining to copper tube and tubing.
   i) manufacturers' certification requirements

4. Interpret information pertaining to copper tube and tubing found on drawings and specifications.

5. Describe the identification systems and methods for copper tube and tubing.

6. Identify tools and equipment relating to copper tube and tubing and describe their applications and procedures for use.

7. Identify fittings used with copper tube and tubing and describe their purpose and applications.

8. Identify copper tube and tubing accessories and describe their purpose and applications.
   i) supports
   ii) hangers
   iii) sleeves

9. Explain the systems of measurement for copper tube and tubing.
   i) dimension
   ii) length
   iii) wall thickness

10. Describe the procedures used to measure copper tube and tubing.

11. Describe the procedures used to inspect copper tube and tubing.

12. Identify the methods used to cut copper tube and tubing and describe their associated procedures.

13. Describe the procedures used to bend copper tube and tubing.
   i) use of hydraulic benders
      - manufacturer's instructions
      - component parts
      - set up
      - desired angle
      - verification of bend angle
   ii) using of hand benders

14. Demonstrate bending procedures for copper tube and tubing.

15. Identify the methods used to join copper tube and tubing and describe their associated procedures.
   i) brazing
   ii) soldering
   iii) flaring
   iv) roll grooved
   v) compression fittings

16. Demonstrate joining procedures for copper tube and tubing.

17. Describe the procedures used to install fittings and accessories for copper tube and tubing.

Practical:

Practical skills enhance the apprentice's ability to meet the objectives of this course. Practical activities include:

1. Perform tube bending.

Description: Skill supports steam tracing and instrumentation. Hands-on would consist of bending small diameter copper and stainless steel tubing.

STM-105 Plastic Piping

Learning Outcomes:

- Demonstrate knowledge of plastic piping, fittings and accessories.
- Demonstrate knowledge of the procedures used to measure plastic piping.
- Demonstrate knowledge of the procedures used to cut and join plastic piping.

Objectives and Content:

1. Define terminology associated with plastic piping.

2. Identify hazards and describe safe work practices pertaining to plastic piping.

3. Interpret codes and regulations pertaining to plastic piping.
   i) manufacturers' certification requirements

4. Interpret information pertaining to plastic piping found on drawings and specifications.

5. Describe the identification systems and methods for plastic piping.

6. Identify tools and equipment relating to plastic piping and describe their applications and procedures for use.

7. Identify fittings used with plastic piping and describe their purpose and applications.

8. Identify plastic piping accessories and describe their purpose and applications.
   i) supports
   ii) hangers
   iii) sleeves

9. Explain the systems of measurement for plastic piping.
   i) dimension
   ii) length
   iii) wall thickness/schedule

10. Describe the procedures used to measure plastic piping.

11. Describe the procedures used to inspect plastic piping.

12. Identify the methods used to cut plastic piping and describe their associated procedures.

13. Identify the methods used to join plastic piping and describe their associated procedures.
    i) heat fusion welding
    ii) threading
    iii) solvent welding
    iv) compression fittings
    v) flanging
    vi) grooved

14. Describe the procedures used to install fittings and accessories for plastic piping.

PIP-045 Piping Valves

Learning Outcomes:

- Demonstrate knowledge of piping valves, their applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot piping valves.

Objectives and Content:

1. Define terminology associated with piping valves.

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

3. Interpret codes, regulations and standards pertaining to piping valves.

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

5. Identify tools and equipment relating to piping valves and describe their applications and procedures for use.

6. Identify types of piping valves and describe their characteristics, operation and applications.
   - i) gate
     - solid wedge disc
     - double disc
     - flexible wedge disc
     - split wedge disc
     - valve seat and disc design
   - ii) globe
   - iii) ball
     - swing
     - lift
   - iv) plug
   - v) butterfly
   - vi) check
   - vii) relief
   - viii) pop safety

ix) pressure reducing
x) float operated
xi) diaphragm
xii) mixing
xiii) safety and safety relief
xiv) pinch
xv) angle design
xvi) plug type disc
xvii) conventional disc
xviii) composition disc
xix) pulp stock
xx) radiator
xxi) water pressure regulating
xxii) emergency operation

7. Identify types of valve actuators and describe their purpose.
   i) electric
   ii) pneumatic
   iii) manual

8. Explain piping valve rating systems.
   i) pressure
   ii) temperature
   iii) types of fluid/gas

9. Identify the methods used to join piping valves and describe their associated procedures.

10. Describe the procedures used to select and install piping valves.
    i) considerations
       - application
       - valve materials
       - service rating marks
    ii) installation and safety
       - position and assembly
       - maintenance procedures
       - safety guidelines

11. Describe the procedures used to maintain and repair piping valves.
    i) care of valves
        - remedy for leaking valves
        - repacking the stuffing box
        - interchangeability
        - valve packings
    ii) lapping packing tools
        - types
        - uses
    iii) repacking
    iv) grinding
    v) lapping
    vi) required tools

12. Describe the procedures used to test and troubleshoot piping valves.

STMA-1002 Piping Project

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Demonstrate ability to join pipe.

Objectives and Content:

Practical:

Practical skills enhance the apprentice's ability to meet the objectives of this course. Practical activities include:

1. Prepare pipe for joining:
   - i) beveling
   - ii) grinding

2. Perform pipe joining methods:
   - i) soldering
   - ii) threading
   - iii) fusion welding
   - iv) crimping
   - v) flaring
   - vi) grooving
   - vii) brazing

Description: may involve use of Victaulic, 2 in. pipe, black iron, copper pipe, silver soldering and flared fittings.

LEVEL 2

STM-240 Hydronic Systems

Notes:

- This unit is covered in two courses.
- In course STMA-1808 Hydronic Heating 1 (Residential), the following learning outcomes and objectives are covered in the context of residential installations.
- In course STMA-1809 Hydronic Heating 2 (Commercial), the following learning outcomes and objectives are covered in the context of commercial installations.

Learning Outcomes:

- Demonstrate knowledge of hydronic systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot hydronic systems.
- Demonstrate knowledge of the procedures used to perform heat load calculations.

Objectives and Content:

1. Define terminology associated with hydronic systems.

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

3. Interpret codes and regulations pertaining to hydronic systems.

4. Interpret information pertaining to hydronic systems found on drawings and specifications.

5. Identify tools and equipment relating to hydronic systems and describe their applications and procedures for use.

6. Explain the principles of heat transfer.
   i) radiation
   ii) conduction
   iii) convection

7. Perform calculations to determine heat energy conversions.
   i) kilowatts
   ii) BTUs
   iii) gigajoules
   iv) calories

8. Perform heat load calculations.
   i) sensible
   ii) latent
   iii) specific heat as it applies to change of state
   iv) steam tables

9. Identify sources of heat used in hydronic systems.
   i) oil
   ii) gas
   iii) wood
   iv) geothermal
   v) solar

10. Identify sources of cooling used in hydronic systems.
   i) ground source
   ii) cooling towers
   iii) direct expansion

11. Identify types of hydronic systems and describe their characteristics and operation.
   i) high pressure
      - high temperature
   ii) low pressure

12. Identify alternate heating and cooling sources and describe their characteristics.
   i) solar
   ii) geothermal
   iii) radiant

13. Identify hydronic heating system components and describe their purpose and operation.
   i) piping
   ii) boilers
      - low mass

- high mass

iii) boiler trim
iv) heat pumps
v) expansion tanks
vi) heat exchangers
vii) circulating pumps
viii) mixing components
ix) valves
x) water treatment equipment

14. Explain forces that impact on pipe and tubing in hydronic systems and their associated calculations.
    i) thermal expansion
    ii) thermal contraction
    iii) weight
    iv) friction loss
    v) turbulence
    vi) galvanic action

15. Identify types of heat transfer equipment and describe their characteristics and operation.
    i) radiators
    ii) convectors
    iii) pipe coils
    iv) horizontal and vertical unit heaters
    v) radiant panels

16. Identify fluids used in hydronic systems and describe their characteristics and applications.
    i) water
    ii) glycol
    iii) methyl hydrate

17. Identify additives used in hydronic systems and describe their purpose and applications.

18. Identify piping arrangements used with hydronic heating systems and describe their characteristics and applications.
    i) reverse return
    ii) direct return

iii) monoflow
iv) series loop
v) primary/secondary
vi) gravity

19. Identify hydronic cooling system components and describe their purpose and operation.
    i) piping
    ii) cooling towers
    iii) expansion tanks
    iv) chillers
    v) circulating pumps
    vi) valves

20. Identify piping arrangements used with hydronic cooling systems and describe their characteristics and applications.

21. Describe the procedures used to install piping for hydronic systems.

22. Describe the procedures used to install hydronic system components.

23. Describe the procedures used to protect hydronic system piping and components.

24. Describe the procedures used to maintain and repair hydronic system components.

25. Describe the procedures used to test and troubleshoot hydronic system components.

26. Describe the procedures used to install heat transfer equipment.

27. Describe the procedures used to protect heat transfer equipment.

28. Describe the procedures used to maintain and repair heat transfer equipment.

29. Describe the procedures used to test and troubleshoot heat transfer equipment.

STM-245 Hydronic System Control

Notes:

- This unit is covered in two courses.
- In course STMA-1808 Hydronic Heating 1 (Residential), the following learning outcomes and objectives are covered in the context of residential installations.
- In course STMA-1809 Hydronic Heating 2 (Commercial), the following learning outcomes and objectives are covered in the context of commercial installations.

Learning Outcomes:

- Demonstrate knowledge of hydronic system control components, their applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot hydronic system control.

Objectives and Content:

1. Define terminology associated with hydronic system control.

2. Identify hazards and describe safe work practices pertaining to hydronic system control.

3. Interpret codes and regulations pertaining to hydronic system control.

4. Interpret information pertaining to hydronic system control found on drawings and specifications.

5. Identify tools and equipment relating to hydronic system controls and describe their applications and procedures for use.

6. Identify types of hydronic system controls and describe their characteristics, applications and operation.
   i) operating and temperature controls
   ii) safety controls

7. Identify hydronic system control components and describe their purpose and operation.

8. Describe the procedures used to install hydronic system control components.

9. Describe the procedures used to protect hydronic system control components.

10. Describe the procedures used to set and adjust hydronic system control components.

11. Describe the procedures used to maintain and repair hydronic system control components.

12. Describe the procedures used to test and troubleshoot hydronic system control components.

STM-250 Cross Connection Control

Learning Outcomes:

- Demonstrate knowledge of cross connection control devices, their applications and operation.

Objectives and Content:

1. Define terminology associated with cross connection control.

2. Identify hazards and describe safe work practices pertaining to cross connection control.

3. Identify certification requirements pertaining to cross connection control.

4. Interpret information pertaining to cross connection control devices found on drawings and specifications.

5. Explain backflow and its causes.

6. Identify types of cross connection control devices and describe their characteristics, operation and applications.

PIP-025 Introduction to Electricity

Learning Outcomes:

- Demonstrate knowledge of the basic concepts of electricity.

Objectives and Content:

1. Define terminology associated with electricity as related to the trade.

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

3. Interpret electrical-related information found on drawings and specifications.

4. Identify tools and equipment used to test electrical circuits and describe their applications and procedures for use.

5. Explain Ohm's law and describe its applications and associated calculations.

6. Identify types of current and describe their characteristics and applications.
   i) direct current (DC)
   ii) alternating current (AC)

7. Identify types of electrical circuits and describe their characteristics, operation and applications.
   i) series
   ii) parallel
   iii) series-parallel

8. Identify types of related electrical equipment and components and describe their characteristics, operation and applications.

STM-200 Industrial Drawings and Specifications

Learning Outcomes:

- Demonstrate knowledge of industrial drawings and specifications and their applications.
- Demonstrate knowledge of interpreting and extracting information from industrial drawings and specifications.
- Demonstrate knowledge of offset calculations to determine pipe, tube and tubing measurements.

Objectives and Content:

1. Define terminology associated with industrial drawings and specifications.

2. Identify types of industrial drawings and describe their applications.
   i) process and instrumentation drawings (P&ID)
   ii) spool sheets
   iii) isometric (ISO) drawings
   iv) revisions
   v) vendor/shop

3. Identify symbols relating to industrial drawings and describe their characteristics and applications.

4. Identify industrial drawing-related documentation and describe their applications.

5. Interpret and extract information from industrial drawings and specifications.

6. Perform calculations to determine pipe, tube and tubing offset measurements.
   i) rolling
   ii) unequal spread
   iii) jumper

STM-115 Introduction to Welding

Learning Outcomes:

- Demonstrate knowledge of welding equipment and accessories.
- Demonstrate knowledge of weld joints and their applications.
- Demonstrate knowledge of the procedures used to set up and adjust welding equipment.
- Demonstrate knowledge of tack weld procedures.

Objectives and Content:

1. Define terminology associated with welding.

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

3. Interpret codes and regulations pertaining to welding.
   i) certification requirements

4. Interpret information pertaining to welding found on drawings and specifications.
   i) symbols and abbreviations

5. Describe the properties and characteristics of metals.

6. Identify types of welding processes and describe their characteristics and applications.
   i) metal inert gas (MIG)
      - gas metal arc welding (GMAW)
      - flux core arc welding (FCAW)
   ii) tungsten inert gas (TIG)
   iii) electric welding/shielded metal arc welding (SMAW)

7. Identify types of welding equipment and describe their associated components, accessories and consumables.

8. Identify basic weld joints and describe their applications.

9. Describe the procedures used to set up and adjust welding equipment.

10. Describe the procedures used to tack weld.

11. Describe the procedures used to maintain and store welding equipment, their components, accessories and consumables.

PIP-035 Fuel Brazing and Cutting

Learning Outcomes:

- Demonstrate knowledge of fuel brazing and cutting equipment and their applications.
- Demonstrate knowledge of the procedures used to cut and braze materials using fuel brazing and cutting equipment.

Objectives and Content:

1. Define terminology associated with fuel brazing and cutting.

2. Identify hazards and describe safe work practices pertaining to fuel brazing and cutting.
   i) personal
   ii) workplace

3. Interpret codes and regulations pertaining to fuel brazing and cutting.

4. Identify types of fuel brazing and cutting equipment and describe their components and applications.
   i) air-propane
   ii) air-acetylene
   iii) oxy-propane
   iv) oxy-acetylene

5. Identify fuel brazing and cutting equipment accessories and describe their applications and procedures for use.

6. Describe the procedures used to set-up, adjust and shut-down fuel cutting and brazing equipment.

7. Describe the procedures used to cut materials using fuel cutting equipment.

8. Identify cutting faults and describe the procedures to prevent and correct them.

9. Describe the procedures used to braze materials using fuel brazing equipment.

10. Describe the procedures used to inspect and maintain fuel cutting and brazing equipment.

11. Describe the procedures used to transport and store fuel cutting and brazing equipment.

Practical:

Practical skills enhance the apprentice's ability to meet the objectives of this course. Practical activities include:

1. Prepare pipe for welding processes
   i) cutting

2. Set-up and shut down fuel cutting equipment.
   i) oxy-acetylene

3. Cut materials using fuel cutting equipment.

PIP-020 Hoisting, Lifting and Rigging 1 (Part 2)

Learning Outcomes:

- Demonstrate knowledge of hoisting, lifting and rigging equipment, their applications, limitations and procedures for use.
- Demonstrate knowledge of the procedures used to perform hoisting and lifting operations.
- Demonstrate knowledge of calculations required when performing hoisting and lifting operations.

Objectives and Content:

11. Explain sling angle when preparing for hoisting and lifting operations.

12. Identify the factors to consider when selecting rigging equipment.
    i) load characteristics
    ii) environment
    iii) safety factor

13. Describe the procedures used for attaching rigging equipment to the load.

14. Describe the procedures used to perform a lift.
    i) load determination
    ii) communication methods
    iii) pre-lift checks
    iv) placement of load
    v) post-lift inspection

STM-220 Hoisting, Lifting and Rigging 2

Learning Outcomes:

- Demonstrate knowledge of the procedures used to perform hoisting and lifting operations.
- Demonstrate knowledge of calculations required when performing hoisting and lifting operations.

Objectives and Content:

1. Identify hazards and describe safe work practices pertaining to hoisting, lifting and rigging operations.
   - i) energized power lines
   - ii) critical lifts
   - iii) weather conditions
   - iv) ground conditions
   - v) multi-tag lines

2. Identify documentation required for engineered lifts.

3. Perform calculations pertaining to hoisting, lifting and rigging.
   - i) sling angle
   - ii) load/weight
   - iii) centre of gravity
   - iv) safe working loads (SWL)

4. Demonstrate advanced lifts.
   - i) ball and hook
   - ii) multi-lift
   - iii) transferring
   - iv) unbalanced
   - v) positioning

LEVEL 3

STMA-1003 Introduction to Renewable Energy Systems

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Demonstrate knowledge of renewable energy systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot renewable energy systems.

Objectives and Content:

1. Define terminology associated with renewable energy systems.

2. Identify hazards and describe safe work practices pertaining to renewable energy systems.

3. Interpret codes and regulations pertaining to renewable energy systems.

4. Interpret information pertaining to renewable energy systems found on drawings and specifications.
   i) pumps
   ii) flow centres
   iii) outside loop

5. Identify tools and equipment relating to renewable energy systems and describe their applications and procedures for use.
   i) temperature monitors
   ii) pressure monitors
   iii) glycol and methyl hydrate testing equipment

6. Identify types of renewable energy systems and describe their characteristics and operation.
   i) geo-thermal
   ii) solar heating
   iii) heat recovery

7. Identify renewable energy system equipment components and describe their purpose and operation.
   - i) piping
   - ii) exchangers
   - iii) geo-thermal
     - controls
     - circulating pumps
   - iv) solar heating
     - panels
     - cells
   - v) heat recovery
     - pumps

8. Identify piping arrangements used with renewable energy systems and describe their characteristics and applications.
   - i) reverse return

9. Identify renewable energy system configurations and describe their characteristics and operation.

10. Describe the procedures used to install piping for renewable energy systems.
   - i) selection
     - heat loss
     - size of loop
     - medium selection
   - ii) venting
   - iii) assembly and configuration
   - iv) process medium installation

11. Describe the procedures used to install renewable energy system equipment components.
   - i) selection
     - flow centres
     - pumps
   - ii) placement
   - iii) supports and fasteners
   - iv) settings
   - v) integration with existing systems

12. Describe the procedures used to protect renewable energy system piping and components.

13. Describe the procedures used to maintain and repair renewable energy system components.
    i) pumps
    ii) piping systems
    iii) valves

14. Describe the procedures used to test and troubleshoot renewable energy system components.
    i) temperature checks
    ii) flow
    iii) refrigerant

STM-300 Low Pressure Steam Systems

Learning Outcomes:

- Demonstrate knowledge of the properties of steam.
- Demonstrate knowledge of low pressure steam systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot low pressure steam systems.

Objectives and Content:

1. Explain the properties of steam.

2. Describe the use of steam tables.
   i) pressure
   ii) temperature
   iii) latent heat
   iv) sensible heat
   v) total heat
   vi) volume

3. Define terminology associated with low pressure steam systems.

4. Identify hazards and describe safe work practices pertaining to low pressure steam systems.

5. Interpret codes and regulations pertaining to low pressure steam systems.
   i) American Society of Mechanical Engineers (ASME)

6. Interpret information pertaining to low pressure steam systems found on drawings and specifications.

7. Identify tools and equipment relating to low pressure steam systems and describe their applications and procedures for use.

8. Explain the applications of low pressure steam systems.
   i) heating
   ii) process

9. Identify types of low pressure steam heating systems and describe their characteristics.
   i) mechanical return
   ii) gravity return

10. Identify types of low pressure steam process systems and describe their characteristics.
   i) mechanical return
   ii) gravity return

11. Identify low pressure steam system components and describe their purpose and operation.
   i) boilers
      - fire tube
      - water tube
   ii) boiler trim
   iii) piping
   iv) supports
   v) connections
   vi) expansion joints
   vii) pumps
   viii) heat transfer equipment
   ix) steam traps
      - mechanical
      - thermostatic
      - thermodynamic
   x) tanks
   xi) valves
   xii) water treatment equipment

12. Identify types of low pressure steam system controls and describe their purpose and operation.
   i) low water cut-offs (LWCO)
   ii) operating pressure controls
   iii) high limit pressure controls
   iv) zone valves (motorized)

13. Describe the procedures used to install steam tracing, their controls and components.

14. Describe the procedures used to install low pressure steam systems, their controls and components.

15. Describe the procedures used to maintain and repair low pressure steam systems, their controls and components.

16. Describe the procedures used to test and troubleshoot low pressure steam systems, their controls and components.

STM-310 Condensate Return Systems

Learning Outcomes:

- Demonstrate knowledge of condensate return systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot condensate return systems.

Objectives and Content:

1. Define terminology associated with condensate return systems.

2. Identify hazards and describe safe work practices pertaining to condensate return systems.

3. Interpret codes and regulations pertaining to condensate return systems.
   i) American Society of Mechanical Engineers (ASME)

4. Interpret information pertaining to condensate return systems found on drawings and specifications.

5. Identify types of condensate return systems and describe their characteristics and applications.

6. Identify condensate return system components and describe their purpose and operation.
   i) piping
   ii) traps
   iii) tanks
   iv) expansion joints
   v) pumps
   vi) valves

7. Describe the procedures used to install condensate return systems and components.

8. Describe the procedures used to maintain and repair condensate return systems and components.

9. Describe the procedures used to test and troubleshoot condensate return systems and components.

STM-205 Template Development

Learning Outcomes:

- Demonstrate knowledge of the methods of template development and their associated procedures.
- Demonstrate knowledge of offset calculations to determine template measurements.

Objectives and Content:

1. Define terminology associated with template development.

2. Interpret information pertaining to template development found on drawings and specifications.

3. Identify tools and equipment relating to template development and describe their applications and procedures for use.

4. Identify the methods used for template development.
   i) simple
   ii) parallel line
   iii) radial line
   iv) triangulation

5. Perform offset calculations using the applicable trigonometric function.
   i) calculator methods
   ii) table-based methods

6. Describe the procedures used to develop templates.

Practical:

Practical skills enhance the apprentice's ability to meet the objectives of this course. Practical activities include:

1. Develop templates.

STM-210 Spool Fabrication

Learning Outcomes:

- Demonstrate knowledge of the procedures used to fabricate pipe spools.

Objectives and Content:

1. Define terminology associated with spool fabrication.

2. Interpret information pertaining to spool fabrication found on drawings and specifications.

3. Identify tools and equipment relating to spool fabrication and describe their applications and procedures for use.

4. Describe the procedures used to fabricate and assemble pipe spools.

STM-215 Fitting Fabrication

Learning Outcomes:

- Demonstrate knowledge of the procedures to fabricate pipe fittings.

Objectives and Content:

1. Define terminology associated with fitting fabrication.

2. Interpret codes and regulations pertaining to fitting fabrication.

3. Interpret information pertaining to fitting fabrication found on drawings and specifications.

4. Identify tools and equipment relating to fitting fabrication and describe their applications and procedures for use.

5. Identify types of fittings and describe their characteristics and applications.
   i) elbows
   ii) tees
   iii) true wyes
   iv) laterals
   v) crosses

6. Describe the procedures used to layout and fabricate fittings.

Practical:

Practical skills enhance the apprentice's ability to meet the objectives of this course. Practical activities include:

1. Lay out pipe fittings.

2. Fabricate pipe fittings.

PIP-060 Gas Piping Systems

Learning Outcomes:

- Demonstrate knowledge of gas piping systems, their components, applications and operation.
- Demonstrate knowledge of gases used in gas piping systems.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot gas piping systems.

Objectives and Content:

1. Define terminology associated with gas piping systems.

2. Identify hazards and describe safe work practices pertaining to gas piping systems.

3. Identify hazards and describe safe work practices pertaining to the handling, storage and transportation of gas cylinders.

4. Describe the properties and characteristics of gases used in gas piping systems.
   - i) physical characteristics
   - ii) composition
   - iii) toxicity
   - iv) specific gravity
   - v) heating value
   - vi) flame temperature and speed
   - vii) limits of flammability
   - viii) ignition temperature
   - ix) combustion process

5. Identify types of gas piping systems and describe their characteristics and applications.
   - i) natural gas
     - liquefied
     - compressed
   - ii) liquefied petroleum gas
   - iii) petroleum
   - iv) inert gas

6. Interpret codes and regulations pertaining to gas piping systems.
   i) jurisdictional certification requirements

7. Interpret information pertaining to gas piping systems found on drawings and specifications.

8. Identify tools and equipment relating to gas piping systems and describe their applications and procedures for use.

9. Identify gas piping system components and describe their purpose and operation.

10. Identify the factors to consider for determining pipe sizing in gas piping systems.

11. Describe the procedures used to install gas piping system components.

12. Describe the procedures used to protect gas piping system components.

13. Describe the procedures used to maintain and repair gas piping system components.

14. Describe the procedures used to test and troubleshoot gas piping system components.

STM-235 Specialty Piping

Learning Outcomes:

- Demonstrate knowledge of specialty piping, fittings and accessories.
- Demonstrate knowledge of the procedures used to measure specialty piping.
- Demonstrate knowledge of the procedures used to cut and join specialty piping.

Objectives and Content:

1. Define terminology associated with specialty piping.

2. Identify hazards and describe safe work practices pertaining to specialty piping.

3. Interpret codes and regulations pertaining to specialty piping.

4. Interpret information pertaining to specialty piping found on drawings and specifications.

5. Describe the identification systems and methods for specialty piping.

6. Identify tools and equipment relating to specialty piping and describe their applications and procedures for use.

7. Identify specialty piping systems and describe their characteristics and applications.

8. Identify types of specialty piping and describe their properties and characteristics.
   i) duplex
   ii) super duplex
   iii) copper nickel
   iv) chrome molybdenum
   v) monel
   vi) inconel
   vii) titanium
   viii) aluminum

9. Identify fittings used with specialty piping and describe their purpose and applications.

10. Identify specialty piping accessories and describe their purpose and applications.
    i) supports
    ii) hangers
    iii) sleeves

11. Explain the systems of measurement for specialty piping.
    i) dimension
    ii) length
    iii) wall thickness/schedule

12. Describe the procedures used to measure specialty piping.

13. Describe the procedures used to inspect specialty piping.

14. Identify the methods used to cut specialty piping and describe their associated procedures.

15. Identify the methods used to join specialty piping and describe their associated procedures.

16. Describe the procedures used to install fittings and accessories for specialty piping.

STM-650 Specialty Steamfitting-Pipefitting Systems (Bulk Systems)

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Demonstrate knowledge of safety requirements for installation of specialty piping systems.

Objectives and Content:

1. Identify specialty systems and their specific safety requirements
   - i) bulk loading station
   - ii) chemical unloading station piping
   - iii) marine piping
   - iv) pipeline
   - v) slurry piping
   - vi) nuclear systems

PIP-065 Medical Gas Systems

Learning Outcomes:

- Demonstrate knowledge of medical gas systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot medical gas systems.

Objectives and Content:

1. Define terminology associated with medical gas systems.

2. Identify hazards and describe safe work practices pertaining to medical gas systems.

3. Interpret codes and regulations pertaining to medical gas systems.
   i) Diameter Index Safety System (DISS)
   ii) pin indexing system

4. Interpret information pertaining to medical gas systems found on drawings and specifications.

5. Identify tools and equipment relating to medical gas systems and describe their applications and procedures for use.

6. Identify types of medical gases and describe their characteristics.
   i) oxygen
   ii) nitrogen
   iii) nitrous oxide/anesthetic
   iv) medical air
   v) vacuum

7. Identify medical gas system equipment, components and accessories and describe their applications and operation.
   i) vacuum pumps
   ii) medical air compressors
   iii) piping
   iv) valves

v) alarms
vi) sensors

8. Identify the considerations for selecting components and accessories for medical gas systems.

9. Describe the procedures used to install medical gas systems.

10. Describe the procedures used to protect medical gas systems.

11. Describe the procedures used to maintain and repair medical gas systems.

12. Describe the procedures used to test and troubleshoot medical gas systems.

STM-225 Stainless Steel Piping

Learning Outcomes:

- Demonstrate knowledge of stainless steel piping, fittings and accessories.
- Demonstrate knowledge of the procedures used to measure stainless steel piping.
- Demonstrate knowledge of the procedures used to cut and join stainless steel piping.

Objectives and Content:

1. Define terminology associated with stainless steel piping.

2. Identify hazards and describe safe work practices pertaining to stainless steel piping.

3. Interpret codes and regulations pertaining to stainless steel piping.

4. Interpret information pertaining to stainless steel piping found on drawings and specifications.

5. Describe identification systems and methods used for stainless steel piping.

6. Identify tools and equipment related to stainless steel piping and describe their applications and procedures for use.

7. Identify fittings used with stainless steel piping and describe their purpose and applications.

8. Identify stainless steel piping accessories and describe their purpose and applications.
   i) supports
   ii) hangers
   iii) sleeves

9. Explain the systems of measurement for stainless steel piping.
   i) dimension

ii) length
iii) wall thickness/schedule

10. Describe the procedures used to measure stainless steel piping.

11. Describe the procedures used to inspect stainless steel piping.

12. Identify the methods used to cut stainless steel piping and describe their associated procedures.

13. Identify the methods used to join stainless steel piping and describe their associated procedures.
    i) threaded
    ii) grooved
    iii) welded
    iv) flanged
    v) press-fit
    vi) compression fittings

14. Describe the procedures used to install fittings and accessories for stainless steel piping.

STM-230 Fiberglass Piping

Learning Outcomes:

- Demonstrate knowledge of fiberglass piping, fittings and accessories.
- Demonstrate knowledge of the procedures used to measure fiberglass piping.
- Demonstrate knowledge of the procedures used to cut and join fiberglass piping.

Objectives and Content:

1. Define terminology associated with fiberglass piping.

2. Identify hazards and describe safe work practices pertaining to fiberglass piping.

3. Interpret codes and regulations pertaining to fiberglass piping.
   i) manufacturers' certification requirements

4. Interpret information pertaining to fiberglass piping found on drawings and specifications.

5. Describe the identification systems and methods for fiberglass piping.

6. Identify tools and equipment relating to fiberglass piping and describe their applications and procedures for use.

7. Identify fittings used with fiberglass piping and describe their purpose and applications.

8. Identify fiberglass piping accessories and describe their purpose and applications.
   i) supports
   ii) hangers
   iii) sleeves

9. Explain the systems of measurement for fiberglass piping.
   i) dimension
   ii) length
   iii) wall thickness/schedule

10. Describe the procedures used to measure fiberglass piping.

11. Describe the procedures used to inspect fiberglass piping.

12. Identify the methods used to cut fiberglass piping and describe their associated procedures.

13. Identify the methods used to join fiberglass piping and describe their associated procedures.

14. Describe the procedures used to install fittings and accessories for fiberglass piping.

LEVEL 4

MENT-1802 Workplace Mentoring II

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Identify and explain strategies for teaching workplace skills.
- Demonstrate strategies to assist in teaching skills in the workplace

Objectives and Content:

1. Describe the impact of your own experiences in teaching skills.
2. Identify the different roles played by a workplace mentor.
3. Describe the six-step approach to teaching skills.
4. Explain the importance of identifying the point of the lesson.
5. Identify how to choose a good time to present a lesson.
6. Explain the importance of linking the lessons.
7. Identify the components of the skill (the context).
8. Describe considerations for demonstrating a skill.
9. Identify types of skill practice.
10. Describe considerations in setting up opportunities for skill practice.
11. Explain the importance of providing feedback.
12. Identify techniques for giving effective feedback.
13. Describe a skill assessment.
14. Identify methods of assessing progress.
15. Explain how to adjust a lesson to different situations.

Resource:

- Recommended resource to use in the delivery of this unit: www.apprenticeship.nscc.ca/mentoring/apprentice.htm

STM-400 Refrigeration Systems

Learning Outcomes:

- Demonstrate knowledge of refrigeration systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot piping and components for refrigeration systems.

Objectives and Content:

1. Define terminology associated with refrigeration systems.

2. Explain the refrigeration cycle.

3. Identify hazards and describe safe work practices pertaining to refrigeration systems.
   i) refrigerants

4. Interpret codes and regulations pertaining to refrigeration systems.
   i) certification requirements for the use of refrigerants

5. Interpret information pertaining to refrigeration systems found on drawings and specifications.

6. Identify types of refrigeration systems and describe their characteristics and applications.
   i) compressor systems
   ii) absorption systems

7. Identify refrigeration system components and describe their purpose and operation.
   i) compressors
   ii) chillers
   iii) evaporators
   iv) valves
   v) condensers/cooling towers
      - water treatment equipment

8. Describe the procedures used to install piping and components for refrigeration systems.

9. Describe the procedures used to maintain and repair piping and components for refrigeration systems.

10. Describe the procedures used to test and troubleshoot piping and components for refrigeration systems.

STM-405 Process Piping Systems

Learning Outcomes:

- Demonstrate knowledge of process piping systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot process piping systems.

Objectives and Content:

1. Define terminology associated with process piping systems.

2. Identify hazards and describe safe work practices pertaining to process piping systems.

3. Interpret codes and regulations pertaining to process piping systems.

4. Interpret information pertaining to process piping systems found on drawings and specifications.

5. Identify tools and equipment relating to process piping systems and describe their applications and procedures for use.

6. Identify types of process piping systems and describe their characteristics and applications.
   i) gas/oil refining
   ii) pulp production
   iii) mining
   iv) food processing
   v) chemical production

7. Identify process piping system components and describe their purpose and operation.

8. Describe the procedures used to install process piping systems and their components.

9. Describe the procedures used to maintain and repair process piping systems and their components.

10. Describe the procedures used to test and troubleshoot process piping systems and their components.

STM-320 Instrumentation

Learning Outcomes:

- Demonstrate knowledge of instrumentation devices, their applications and operation.
- Demonstrate knowledge of the procedures used to install instrumentation devices.
- Demonstrate knowledge of the procedures used to install tubing for instrumentation devices.

Objectives and Content:

1. Define terminology associated with instrumentation.

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

3. Interpret codes and regulations pertaining to instrumentation.

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

5. Identify tools and equipment relating to instrumentation and describe their applications and procedures for use.

6. Identify types of devices used in instrumentation and describe their characteristics, operation and applications.
   - i) pressure measuring
     - bourdon tub gauges
     - manometers
     - bellows elements
     - diaphragm elements
   - ii) flow measuring
     - venturi tubes
     - orifice plates
     - orifices
     - flow nozzles
   - iii) temperature measuring
     - thermometers

- remote bulb thermostats

iv) level measuring

7. Identify types of piping valves used in instrumentation and describe their characteristics, operation and applications.
   i) steam pressure regulating
      - piping arrangement
   ii) cylinder operated
      - special equipment
      - control systems
      - cylinder operators
      - ordering and dimensional data

8. Identify types of controllers and describe their applications and operation.
   i) valve controllers
   ii) damper controllers

9. Identify tubing materials used in instrumentation and describe their characteristics and applications.

10. Describe the procedures used to install instrumentation devices.

11. Describe the procedures used to install controllers.

12. Describe the procedures used to install and support tubing for instrumentation devices.

13. Describe the procedures used to maintain and repair instrumentation systems.

14. Describe the procedures used to test and troubleshoot instrumentation systems.

STMA-1004 Pumps

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Demonstrate knowledge of pumps, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install pumps.

Objectives and Content:

1. Identify types of pumps and describe their characteristics, operation and applications.
   - i) reciprocating pumps
   - ii) single-acting
   - iii) double-acting
   - iv) centrifugal
   - v) turbine
   - vi) rotary
     - gear
     - lobe
     - sliding vane
   - vii) injector
   - viii) vacuum

2. Describe the procedures and considerations necessary to install pumps, suction and discharge.
   - i) fluid medium
   - ii) piping and component parts
   - iii) field layout
   - iv) guidelines and design
   - v) layout of base lines
   - vi) suction and discharge piping and components
   - vii) elbows
   - viii) valves
   - ix) flexible couplings
   - x) pipe alignment
   - xi) pipe strain
   - xii) strainers

xiii) flange jointing and bolt-up
xiv) torque procedures
xv) gasket selection
xvi) packing systems
xvii) priming and start procedures

STM-315 Hydraulic Systems

Learning Outcomes:

- Demonstrate knowledge of hydraulic systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot piping and components for hydraulic systems.

Objectives and Content:

1. Define terminology associated with hydraulic systems.

2. Explain the principles and theories of fluids.
   i) Pascal's law
   ii) Bernoulli's principle

3. Describe units of measure as they relate to fluids.

4. Identify fluid-related formulae and describe their applications.

5. Identify hazards and describe safe work practices pertaining to hydraulic systems.

6. Interpret codes and regulations pertaining to hydraulic systems.
   i) manufacturers' certification requirements

7. Interpret information pertaining to hydraulic systems found on drawings and specifications.
   i) fluid-related symbols and abbreviations

8. Identify tools and equipment relating to hydraulic systems and describe their applications and procedures for use.

9. Identify hydraulic system components and describe their purpose and operation.
   i) pumps
   ii) motors
   iii) actuators
   iv) valves

v) accumulators
vi) piping
vii) strainers
viii) supports

10. Identify types of fluids used in hydraulic systems and describe their characteristics and applications.

11. Interpret schematics to determine the operation of hydraulic systems.

12. Describe the procedures used to install piping and components for hydraulic systems.

13. Describe the procedures used to maintain and repair piping and components for hydraulic systems.

14. Describe the procedures used to test and troubleshoot piping and components for hydraulic systems.

PIP-055 Compressed Air Systems

Learning Outcomes:

- Demonstrate knowledge of compressed air systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot compressed air systems.

Objectives and Content:

1. Define terminology associated with compressed air systems.

2. Identify hazards and describe safe work practices pertaining to compressed air systems.

3. Interpret codes and regulations pertaining to compressed air systems.
   i) American Society of Mechanical Engineers (ASME)
   ii) manufacturers' certification requirements

4. Interpret information found on drawings and specifications pertaining to compressed air systems.

5. Identify tools and equipment relating to compressed air systems and describe their applications and procedures for use.

6. Explain the principles of compressed air systems.

7. Identify types of compressed air systems and describe their characteristics and applications.
   i) instrument
   ii) utility
   iii) process
   iv) make up/breathable

8. Identify compressed air system components and describe their purpose and operation.
   i) compressors
   ii) piping

iii) valves
iv) controls
v) supports
vi) receivers/tanks
vii) flex connectors
viii) auto drains

9. Describe the methods of air treatment in compressed air systems.
   i) filters
   ii) dryers
   iii) after-coolers
   iv) de-icers

10. Describe the procedures used to install compressed air systems and components.

11. Describe the procedures used to protect compressed air systems.

12. Describe the procedures used to maintain and repair compressed air systems and components.

13. Describe the procedures used to test and troubleshoot compressed air systems and components.

STM-305 High Pressure Steam Systems

Learning Outcomes:

- Demonstrate knowledge of high pressure steam systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot high pressure steam systems.

Objectives and Content:

1. Define terminology associated with high pressure steam systems.

2. Identify hazards and describe safe work practices pertaining to high pressure steam systems.

3. Interpret codes and regulations pertaining to high pressure steam systems.
   i) American Society of Mechanical Engineers (ASME)

4. Interpret information pertaining to high pressure steam systems found on drawings and specifications.

5. Identify tools and equipment relating to high pressure steam systems and describe their applications and procedures for use.

6. Explain the applications of high pressure steam systems.
   i) power generation
   ii) process

7. Identify types of high pressure steam systems and describe their characteristics.
   i) condensing
   ii) non-condensing

8. Identify high pressure steam system components and describe their purpose and operation.
   i) boilers
      - fire tube
      - water tube
   ii) boiler trim

iii) piping
iv) tanks
v) supports
vi) connections
vii) expansion joints
viii) pumps
ix) heat transfer equipment
x) steam traps
- mechanical
- thermostatic
- thermodynamic

xi) valves
xii) water treatment equipment

9. Identify types of high pressure steam system controls and describe their purpose and operation.
i) low water cut-offs (LWCO)
ii) operating pressure controls
iii) high limit pressure controls
iv) pressure reducing valves

10. Describe the procedures used to install high pressure steam and super-heated systems, their controls and components.

11. Describe the procedures used to maintain and repair high pressure steam and super-heated systems, their controls and components.

12. Describe the procedures used to test and troubleshoot high pressure steam and super-heated systems, their controls and components.

PIP-070 Job Planning

Learning Outcomes:

- Demonstrate knowledge of the procedures used to plan and organize jobs.

Objectives and Content:

1. Identify sources of information relevant to job planning.
   - i) documentation
   - ii) drawings
   - iii) related professionals
   - iv) clients

2. Describe the considerations for determining job requirements.
   - i) personnel
   - ii) tools and equipment
   - iii) materials
   - iv) permits

3. Describe the procedures used to plan job tasks.
   - i) scheduling
   - ii) estimating

4. Describe the procedures used to organize and maintain inventory.

STM-410 System Testing and Commissioning

Learning Outcomes:

- Demonstrate knowledge of system testing and its associated procedures.
- Demonstrate knowledge of commissioning and its associated procedures.

Objectives and Content:

1. Define terminology associated with system testing and commissioning.

2. Identify hazards and describe safe work practices pertaining to system testing and commissioning.
   - i) system isolation
   - ii) lock out procedures
   - iii) testing medium

3. Identify sources of information pertaining to system testing and commissioning.
   - i) specifications
   - ii) drawings

4. Identify tools and equipment relating to system testing and commissioning and describe their applications and procedures for use.

5. Identify types of system testing and describe their applications.
   - i) hydrostatic
     - water
     - glycol mixture
   - ii) pneumatic
     - air
     - nitrogen
     - CO_2
     - helium
   - iii) components
     - vents
     - drains
     - blinds
     - pressure regulators
     - gauges

- hydrostatic test pumps
- compressed air
- nitrogen

iv) service test

6. Identify fluids used in hydrostatic testing and describe their characteristics and applications.
   i) water
   ii) glycol mixture

7. Identify gases used in pneumatic testing and describe their characteristics and applications.
   i) air
   ii) inert gas

8. Describe the procedures used to perform system testing.
   i) system pre-check/inspection
   ii) system isolation
   iii) selection and connection of test equipment
   iv) system pressurization
   v) system inspection and correction of leaks
   vi) documentation
      - code requirements
      - drawings
      - specifications
      - manufacturer's literature
   vii) safety considerations
   viii) removal of test equipment

9. Describe the procedures used to commission systems.
   i) flushing
      - pre-flush preparation
      - components
      - flushing medium
      - specifications
      - manufacturers' literature
   ii) chemical treating
      - safe handling considerations
      - environmental considerations
      - obtain testing sample

- equipment
- specifications

iii) start-up
- install trim
- install protective equipment
- verify system operation
- fill system
- identify components.

iv) documentation

STM-415 Quality Control

Learning Outcomes:

- Demonstrate knowledge of quality control and its applications.
- Demonstrate knowledge of the procedures used to complete quality control documentation.

Objectives and Content:

1. Define terminology associated with quality control.

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

3. Interpret codes and regulations pertaining to quality control.

4. Interpret information pertaining to quality control found on drawings and specifications.

5. Identify tools and equipment relating to quality control and describe their applications and procedures for use.

6. Identify methods of non-destructive testing (NDT) and describe their associated procedures.
   i) hydrostatic
   ii) pneumatic
   iii) visual
   iv) dye penetrate
   v) magnetic particle
   vi) x-ray
   vii) ultrasonic
   viii) Brinell hardness

7. Identify methods of heat treatment and stress relief and describe their associated procedures.

8. Identify types of quality control documentation and describe their applications and procedures for use.
   i) manuals

ii) daily reports
iii) mill test reports
iv) welders logs

9. Explain the process, requirements and information sources for completing quality control documentation.

STMA-1005 Controlled Bolting

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Demonstrate knowledge of torquing and controlled bolting.
- Demonstrate knowledge of torquing procedures for fasteners.

Objectives and Content:

1. Explain the need for controlled bolting of fasteners.
   - i) controlled bolting
   - ii) bolt stress

2. Explain the principle of hydraulic tensioning and torquing of fasteners.
   - i) torque principle
   - ii) hydraulic tensioning equipment
   - iii) hydraulic torque wrenches

3. Describe types of fasteners used for joints on piping and vessels.
   - i) grades of stud bolts and nuts
   - ii) lengths of stud bolts
   - iv) formulas for length of bolts, nuts and wrench sizes
   - v) thread lubricants

4. Describe torquing procedures for fasteners.
   - i) use of torque wrenches for fastening of flanged piping joints
   - ii) applications of torque patterns on flanges
   - iii) formulas required for use of equipment
   - iv) power supplies for different applications
   - v) safety requirements for use of power supplies in hazardous atmospheres

STMA-1857 Program Review

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Upon successful completion of this unit, the apprentice will complete a study plan based on the National Occupational Analysis.

Objectives and Content:

1. Identify areas of the program where knowledge of theory is weakest.

2. Identify areas where workplace experience is lacking or weak.

3. Identify resources necessary to address areas of shortfall.

4. Identify timelines to address areas of weakness.

Suggested Learning Activities:

1. Conduct a mock certification exam to be used for diagnostic purposes.
2. Review the National Occupational Analysis.
3. Review the Apprentice Logbook.
4. Review the Exam Preparation information found at www.nsapprenticeship.ca under Quick Links, Exam Preparation.
5. Conduct a final mock certification exam.

Resources:

These are the recommended resources to use in the delivery of this unit:

- Exam Preparation information, including videos, occupational analyses, exam counseling sheets, practice exams and sample questions, and other study materials and resources, can be found at www.nsapprenticeship.ca under Quick Links, Exam Preparation.
- Apprentice's personal logbook
- Applicable codes and regulations
- Program texts

Evaluation: pass/fail

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