

Interprovincial Program Guide

Steamfitter/Pipefitter

2010

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

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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.

User Guide (*continued*)

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.

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.

IPG Glossary of Terms *(continued)*

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	<p>v. To subject to a procedure that ascertains effectiveness, value, proper function, or other quality.</p> <p>n. A way of examining something to determine its characteristics or properties, or to determine whether or not it is working correctly.</p>
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/essential_skills/general/home.shtml

Profile Chart

OCCUPATIONAL SKILLS			
PIP-005 Safety	PIP-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		
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		
RIGGING AND HOISTING			
PIP-020 Hoisting, Lifting and Rigging	STM-220 Advanced Hoisting, Lifting and Rigging		
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
TESTING AND COMMISSIONING			
STM-410 System Testing and Commissioning			

Recommended Level Structure

PIP = Common Units to Steamfitter/Pipefitter and Plumber IPGs.

STM = Specific Units to Steamfitter/Pipefitter IPG.

Level 1			Level 2		
Unit Code	Title	Page	Unit Code	Title	Page
PIP-005	Safety	20	STM-200	Industrial Drawings and Specifications	46
PIP-010	Tools and Equipment	21	STM-205	Template Development	47
PIP-015	Access Equipment	23	STM-210	Spool Fabrication	48
PIP-050	Communication and Trade Documentation	24	STM-215	Fitting Fabrication	49
PIP-020	Hoisting, Lifting and Rigging	25	STM-220	Advanced Hoisting, Lifting and Rigging	50
PIP-025	Introduction to Electricity	27	STM-225	Stainless Steel Piping	51
PIP-040	Pipe, Tube and Tubing Fundamentals	28	STM-230	Fiberglass Piping	53
PIP-045	Piping Valves	30	STM-235	Specialty Piping	55
STM-100	Copper Tube and Tubing	32	STM-240	Hydronic Systems	57
STM-105	Plastic Piping	34	STM-245	Hydronic System Controls	61
STM-110	Black Iron Piping	36	STM-250	Cross Connection Control	63
PIP-030	Drawings	38			
STM-115	Introduction to Welding	40			
PIP-035	Fuel Brazing and Cutting	42			
Level 3			Level 4		
Unit Code	Title	Page	Unit Code	Title	Page
STM-300	Low Pressure Steam Systems	66	STM-400	Refrigeration Systems	82
STM-305	High Pressure Steam Systems	69	STM-405	Process Piping Systems	84
STM-310	Condensate Return Systems	71	PIP-070	Job Planning	86
STM-315	Hydraulic Systems	73	STM-410	System Testing and Commissioning	87
PIP-055	Compressed Air Systems	75	STM-415	Quality Control	89
PIP-065	Medical Gas Systems	77			
PIP-060	Gas Piping Systems	79			

2007 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
		STM-220	Advanced Hoisting, Lifting and Rigging
7.02	Selects rigging equipment.	PIP-020	Hoisting, Lifting and Rigging
		STM-220	Advanced Hoisting, Lifting and Rigging
7.03	Selects lifting equipment.	PIP-020	Hoisting, Lifting and Rigging
		STM-220	Advanced Hoisting, Lifting and Rigging
Task 8 - Hoists load.			
8.01	Secures lift area.	PIP-020	Hoisting, Lifting and Rigging
		STM-220	Advanced Hoisting, Lifting and Rigging
8.02	Sets up rigging equipment.	PIP-020	Hoisting, Lifting and Rigging
		STM-220	Advanced Hoisting, Lifting and Rigging
8.03	Performs lift.	PIP-020	Hoisting, Lifting and Rigging
		STM-220	Advanced Hoisting, Lifting and Rigging

NOA Sub-task		IPG Unit	
8.04	Conducts post-lift equipment inspection.	PIP-020	Hoisting, Lifting and Rigging
		STM-220	Advanced Hoisting, Lifting and Rigging
8.05	Stores equipment.	PIP-020	Hoisting, Lifting and Rigging
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
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

NOA Sub-task		IPG Unit	
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
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

NOA Sub-task		IPG Unit	
		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
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

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
 - asbestos
 - 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
 - iii) municipal

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.

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.

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.

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:

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
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

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.

Learning Outcomes:

- Demonstrate knowledge of pipe, tube and tubing and their characteristics and applications.

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

4. Explain forces that impact on pipe, tube and tubing systems and perform associated calculations.
 - i) thermal expansion
 - ii) thermal contraction
 - iii) weight
 - iv) friction loss
 - v) turbulence
 - vi) galvanic action
 - vii) environmental
5. Perform calculations to determine pipe, tube and tubing measurements.
 - i) fitting allowances
 - center to center
 - end to end
 - ii) offsets
 - travel
 - rise and run
 - rolling
 - equal spread
 - unequal spread

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
 - ii) globe
 - iii) ball
 - iv) plug
 - v) butterfly
 - vi) check
 - vii) relief
 - viii) pop safety
 - ix) pressure reducing
 - x) float operated
 - xi) diaphragm
 - xii) mixing
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
 9. Identify the methods used to join piping valves and describe their associated procedures.
 10. Describe the procedures used to install piping valves.
 11. Describe the procedures used to maintain and repair piping valves.
 12. Describe the procedures used to test and troubleshoot piping valves.

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.
 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.

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.

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.

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

PIP-030 Drawings

Learning Outcomes:

- Demonstrate knowledge of drawings and their applications.
- Demonstrate knowledge of interpreting and extracting information from drawings.
- Demonstrate knowledge of basic drawing and sketching techniques.

Objectives and Content:

1. Define terminology associated with drawings and sketches.
2. Describe metric and imperial systems of measurement and the procedures used to perform conversions.
3. 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
4. Identify types of symbols and describe their characteristics and applications.
5. Identify drawing-related documentation and describe their applications.
 - i) change orders
 - ii) addendums
 - iii) as-builts
 - iv) specifications
6. Identify drawing projections and views and describe their applications.
 - i) projections
 - orthographic
 - oblique
 - isometric
 - pictorial

- ii) views
 - plan
 - section
 - detail
 - elevation
 - cross section
- 7. Describe the use of scales.
- 8. Interpret information on drawings.
 - i) lines
 - ii) legend
 - iii) symbols and abbreviations
 - iv) notes and specifications
 - v) schedules
 - vi) scales
- 9. Describe the procedures used for the care, handling and storage of drawings.
- 10. Demonstrate basic drawing and sketching techniques.

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.

LEVEL 2

Learning Outcomes:

- Demonstrate knowledge of industrial drawings and specifications and their applications.
- Demonstrate knowledge of interpreting and extracting information from industrial drawings and specifications.

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.

STM-205 Template Development

Learning Outcomes:

- Demonstrate knowledge of the methods of template development and their associated procedures.

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. Describe the procedures used to 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.

Learning Outcomes:

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

Objectives and Content:

1. Identify hazards and describe safe work practices pertaining to advanced 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

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.

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.

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-240 Hydronic Systems

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.

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. Identify sources of heat used in hydronic systems.
 - i) oil
 - ii) gas
 - iii) wood
 - iv) geothermal
 - v) solar
8. Identify sources of cooling used in hydronic systems.
 - i) ground source

- ii) cooling towers
 - iii) direct expansion
9. Identify types of hydronic systems and describe their characteristics and operation.
- i) high pressure
 - high temperature
 - ii) low pressure
10. Identify alternate heating and cooling sources and describe their characteristics.
- i) solar
 - ii) geothermal
 - iii) radiant
11. 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
12. 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

13. 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
14. Identify fluids used in hydronic systems and describe their characteristics and applications.
 - i) water
 - ii) glycol
 - iii) methyl hydrate
15. Identify additives used in hydronic systems and describe their purpose and applications.
16. 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
17. 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
18. Identify piping arrangements used with hydronic cooling systems and describe their characteristics and applications.
19. Describe the procedures used to install piping for hydronic systems.

20. Describe the procedures used to install hydronic system components.
21. Describe the procedures used to protect hydronic system piping and components.
22. Describe the procedures used to maintain and repair hydronic system components.
23. Describe the procedures used to test and troubleshoot hydronic system components.
24. Describe the procedures used to install heat transfer equipment.
25. Describe the procedures used to protect heat transfer equipment.
26. Describe the procedures used to maintain and repair heat transfer equipment.
27. Describe the procedures used to test and troubleshoot heat transfer equipment.

STM-245 Hydronic System Control

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.

LEVEL 3

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.

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.

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-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.

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.

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.

LEVEL 4

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.

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.

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.

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
 - ii) pneumatic
 - iii) 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
 - vii) removal of test equipment
9. Describe the procedures used to commission systems.
 - i) flushing
 - ii) chemical treating
 - iii) start-up
 - iv) documentation

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.