

RED SEAL

THE INTERPROVINCIAL STANDARDS RED SEAL PROGRAM



Interprovincial Program Guide

2010 | Plumber



Human Resources and
Skills Development Canada

Ressources humaines et
Développement des compétences Canada

Canada

Interprovincial Program Guide

Plumber

2010

You can order this publication by contacting:

Trades and Apprenticeship Division
Workplace Partnership Directorate
Human Resources and Skills Development Canada
140 Promenade du Portage, Phase IV, 5th Floor
Gatineau, Quebec K1A 0J9

Online: www.red-seal.ca

This document is available on demand in alternative formats (Large Print, Braille, Audio Cassette, Audio CD, e-Text Diskette, e-Text CD, or DAISY), by contacting 1 800 O-Canada (1 800 622-6232). If you have a hearing or speech impairment and use a teletypewriter (TTY), call 1 800 926-9105.

© Her Majesty the Queen in Right of Canada, 2010

Paper

Cat. No.: HS42-2/13-2010E

ISBN 978-1-100-14531-0

PDF

Cat. No.: HS42-2/13-2010E-PDF

ISBN 978-1-100-14532-7

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

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.

Bart Bradbury	British Columbia
Richard Briffett	Newfoundland and Labrador
Scott Carter	Prince Edward Island
Ken Crocker	Nova Scotia
Chris Gushue	Newfoundland and Labrador
Gunther Hille	Manitoba
Richard Pickering	Saskatchewan
Frederick Sawyer	New Brunswick
Michael Smith	New Brunswick
Kris Wright	Manitoba

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.

Table of Contents

Acknowledgements	2
Introduction	4
User Guide	5
IPG Glossary of Terms	7
Essential Skills Profiles	9
Profile Chart.....	10
Recommended Level Structure.....	12
2008 NOA Sub-Task to IPG Unit Comparison	14

PROGRAM CONTENT

Level 1.....	25
Level 2.....	57
Level 3.....	77
Level 4.....	97

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.
PURPOSE	The reason for which something exists or is done, made or used.

IPG Glossary of Terms *(continued)*

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-030 Drawings	PIP-035 Fuel Brazing and Cutting	PIP-025 Introduction to Electricity
PIP-020 Hoisting, Lifting and Rigging	PLB-420 Commissioning		
PIPING COMPONENTS			
PIP-040 Pipe, Tube and Tubing Fundamentals	PLB-105 Copper Tube and Tubing	PLB-100 Plastic Piping	PLB-110 Steel Piping
PLB-115 Cast Iron Piping	PLB-120 Glass Piping	PLB-125 Asbestos-Cement Piping	PIP-045 Piping Valves
PLB-325 Cross Connection Control			
DRAINAGE, WASTE AND VENT SYSTEMS			
PLB-130 Residential Sanitary Drainage Systems	PLB-135 Residential Venting Systems	PLB-305 Storm and Combination Drainage Systems	PLB-300 Commercial Sanitary Drainage Systems
PLB-310 Commercial Venting Systems	PLB-315 Commercial Waste Systems	PLB-220 Private Sewage Disposal Systems	
WATER SERVICE AND DISTRIBUTION			
PLB-200 Water Service	PLB-215 Rural Water Supply	PLB-205 Potable Water Distribution	PLB-230 Hot Water Storage Tanks and Heaters

Profile Chart *(continued)*

FIXTURES, APPLIANCES AND WATER TREATMENT SYSTEMS			
PLB-225 Water Treatment Systems	PLB-210 Residential Plumbing Fixtures and Accessories	PLB-320 Commercial/Institutional Plumbing Fixtures and Accessories	PLB-235 Appliances
HYDRONIC HEATING AND COOLING SYSTEMS			
PLB-330 Hydronic Systems (Cooling and Low Pressure Heating)	PLB-335 Hydronic System Control	PLB-400 Low Pressure Steam Systems	
SPECIALIZED SYSTEMS			
PIP-060 Gas Piping Systems	PIP-065 Medical Gas Systems	PLB-410 Irrigation Systems	PIP-055 Compressed Air Systems
PLB-415 Single Family Dwelling Fire Protection Systems	PLB-405 Process Piping Systems		

Recommended Level Structure

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

PLB = Specific Units to Plumber IPG.

Level 1			Level 2		
Unit Code	Title	Page	Unit Code	Title	Page
PIP-005	Safety	26	PIP-045	Piping Valves	58
PIP-010	Tools and Equipment	27	PLB-200	Water Service	60
PIP-015	Access Equipment	29	PLB-205	Potable Water Distribution	63
PIP-020	Hoisting, Lifting and Rigging	30	PLB-210	Residential Plumbing Fixtures and Accessories	65
PIP-025	Introduction to Electricity	32	PLB-215	Rural Water Supply	67
PIP-030	Drawings	33	PLB-220	Private Sewage Disposal Systems	70
PIP-035	Fuel Brazing and Cutting	35	PLB-225	Water Treatment Systems	72
PIP-040	Pipe, Tube and Tubing and Fundamentals	37	PLB-230	Hot Water Storage Tanks and Heaters	74
PLB-100	Plastic Piping	39	PLB-235	Appliances	76
PLB-105	Copper Tube and Tubing	41			
PLB-110	Steel Piping	43			
PLB-115	Cast Iron Piping	45			
PLB-120	Glass Piping	47			
PLB-125	Asbestos-Cement Piping	49			
PLB-130	Residential Sanitary Drainage Systems	51			
PLB-135	Residential Venting Systems	54			

Recommended Level Structure *(continued)*

Level 3			Level 4		
Unit Code	Title	Page	Unit Code	Title	Page
PLB-300	Commercial Sanitary Drainage Systems	78	PLB-400	Low Pressure Steam Systems	98
PLB-305	Storm and Combination Drainage Systems	80	PLB-405	Process Piping Systems	100
PLB-310	Commercial Venting Systems	82	PLB-410	Irrigation Systems	102
PLB-315	Commercial Waste Systems	84	PIP-055	Compressed Air Systems	104
PLB-320	Commercial/Institutional Plumbing Fixtures and Accessories	86	PLB-415	Single Family Dwelling Fire Protection Systems	106
PLB-325	Cross Connection Control	88	PIP-060	Gas Piping Systems	108
PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)	89	PIP-065	Medical Gas Systems	110
PLB-335	Hydronic System Control	93	PIP-070	Job Planning	112
PIP-050	Communication and Trade Documentation	95	PLB-420	Commissioning	113

2008 NOA Sub-task to IPG Unit Comparison

NOA Sub-task		IPG Unit	
Task 1 - Uses and maintains tools and equipment.			
1.01	Maintains hand tools.	PIP-010	Tools and Equipment
1.02	Maintains power tools.	PIP-010	Tools and Equipment
1.03	Maintains powder-actuated tools.	PIP-010	Tools and Equipment
1.04	Maintains cutting and welding equipment.	PIP-010	Tools and Equipment
		PIP-035	Fuel Brazing and Cutting
1.05	Uses ladders and work platforms.	PIP-015	Access Equipment
1.06	Uses rigging, hoisting and lifting equipment.	PIP-020	Hoisting, Lifting and Rigging
1.07	Uses personal protective equipment (PPE) and safety equipment.	PIP-005	Safety
Task 2 - Organizes work.			
2.01	Uses documentation and reference material.	PIP-050	Communication and Trade Documentation
		PIP-030	Drawings
2.02	Communicates with others.	PIP-050	Communication and Trade Documentation
2.03	Organizes materials and supplies.	PIP-070	Job Planning
2.04	Organizes project tasks and procedures.	PIP-070	Job Planning
2.05	Maintains safe work environment.	PIP-005	Safety
Task 3 - Performs routine trade activities.			
3.01	Installs piping support and hanger systems.	PLB-110	Steel Piping
		PLB-105	Copper Tube and Tubing
		PLB-100	Plastic Piping
		PLB-115	Cast Iron Piping
		PLB-120	Glass Piping
		PLB-125	Asbestos-Cement Piping
3.02	Installs sleeves.	PLB-110	Steel Piping
		PLB-105	Copper Tube and Tubing
		PLB-100	Plastic Piping
		PLB-115	Cast Iron Piping
		PLB-120	Glass Piping
3.03	Tests piping and plumbing systems.	PLB-125	Asbestos-Cement Piping
		PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
		PLB-335	Hydronic System Control
		PIP-060	Gas Piping Systems

NOA Sub-task		IPG Unit	
		PIP-065	Medical Gas Systems
		PLB-400	Low Pressure Steam Systems
		PLB-130	Residential Sanitary Drainage Systems
		PLB-135	Residential Venting Systems
		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
		PLB-310	Commercial Venting Systems
		PLB-315	Commercial Waste Systems
		PLB-220	Private Sewage Disposal Systems
		PLB-200	Water Service
		PLB-215	Rural Water Supply
		PLB-205	Potable Water Distribution
		PLB-230	Hot Water Storage Tanks and Heaters
		PLB-225	Water Treatment Systems
		PLB-410	Irrigation Systems
		PIP-055	Compressed Air Systems
		PLB-415	Single Family Dwelling Fire Protection Systems
		PLB-405	Process Piping Systems
		PLB-210	Residential Plumbing Fixtures and Accessories
		PLB-320	Commercial/Institutional Plumbing Fixtures and Accessories
		PLB-235	Appliances
3.04	Commissions systems.	PLB-420	Commissioning
3.05	Performs lock-out and tag-out procedures.	PIP-005	Safety
3.06	Protects piping systems and equipment from damage.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
		PLB-335	Hydronic System Control
		PIP-060	Gas Piping Systems
		PIP-065	Medical Gas Systems
		PLB-400	Low Pressure Steam Systems
		PLB-130	Residential Sanitary Drainage Systems
		PLB-135	Residential Venting Systems

		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
		PLB-310	Commercial Venting Systems
		PLB-315	Commercial Waste Systems
		PLB-220	Private Sewage Disposal Systems
		PLB-200	Water Service
		PLB-215	Rural Water Supply
		PLB-205	Potable Water Distribution
		PLB-230	Hot Water Storage Tanks and Heaters
		PLB-225	Water Treatment Systems
		PLB-410	Irrigation Systems
		PIP-055	Compressed Air Systems
		PLB-415	Single Family Dwelling Fire Protection Systems
		PLB-405	Process Piping Systems
		PLB-235	Appliances
3.07	Coordinates excavation and backfilling of trenches.	PLB-130	Residential Sanitary Drainage Systems
		PLB-200	Water Service
		PLB-215	Rural Water Supply
3.08	Installs fire stopping systems.	PLB-130	Residential Sanitary Drainage Systems
		PLB-135	Residential Venting Systems
		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
		PLB-310	Commercial Venting Systems
		PLB-205	Potable Water Distribution
3.09	Inspects pipe, tube and fittings before installation.	PLB-105	Copper Tube and Tubing
		PLB-100	Plastic Piping
		PLB-110	Steel Piping
		PLB-115	Cast Iron Piping
		PLB-120	Glass Piping
		PLB-125	Asbestos-Cement Piping

Task 4 - Prepares and joins copper tube, tubing and fittings.			
4.01	Cuts copper tube and tubing.	PLB-105	Copper Tube and Tubing
4.02	Bends copper tube and tubing.	PLB-105	Copper Tube and Tubing
4.03	Joins copper tube and tubing.	PLB-105	Copper Tube and Tubing
Task 5 - Prepares and joins plastic pipe.			
5.01	Cuts plastic pipe.	PLB-100	Plastic Piping
5.02	Joins plastic pipe.	PLB-100	Plastic Piping
Task 6 - Prepares and joins steel pipe.			
6.01	Cuts steel pipe.	PLB-110	Steel Piping
6.02	Joins steel pipe.	PLB-110	Steel Piping
Task 7 - Prepares and joins cast iron pipe.			
7.01	Cuts cast iron pipe.	PLB-115	Cast Iron Piping
7.02	Joins cast iron pipe.	PLB-115	Cast Iron Piping
Task 8 - Prepares and joins glass pipe.			
8.01	Cuts glass pipe.	PLB-120	Glass Piping
8.02	Joins glass pipe.	PLB-120	Glass Piping
Task 9 - Prepares asbestos-cement pipe.			
9.01	Cuts asbestos-cement pipe.	PLB-125	Asbestos-Cement Piping
9.02	Joins asbestos-cement pipe.	PLB-125	Asbestos-Cement Piping
Task 10 - Installs sewers.			
10.01	Sizes pipe for sewers.	PLB-130	Residential Sanitary Drainage Systems
		PLB-305	Storm and Combination Drainage Systems
10.02	Installs manholes and catch basins.	PLB-130	Residential Sanitary Drainage Systems
		PLB-305	Storm and Combination Drainage Systems
10.03	Installs piping for sewers.	PLB-130	Residential Sanitary Drainage Systems
		PLB-305	Storm and Combination Drainage Systems
Task 11 - Installs private sewage disposal systems.			
11.01	Plans installation of private sewage disposal systems.	PLB-220	Private Sewage Disposal Systems
11.02	Installs private sewage disposal system components.	PLB-220	Private Sewage Disposal Systems
Task 12 - Installs rough-in for interior drainage, waste and vent systems.			
12.01	Sizes pipe for interior drainage, waste and vent systems.	PLB-130	Residential Sanitary Drainage Systems
		PLB-135	Residential Venting Systems

		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
		PLB-310	Commercial Venting Systems
		PLB-315	Commercial Waste Systems
12.02	Installs underground piping and components for interior drainage, waste and vent systems.	PLB-130	Residential Sanitary Drainage Systems
		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
12.03	Installs embedded components.	PLB-130	Residential Sanitary Drainage Systems
		PLB-135	Residential Venting Systems
		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
		PLB-310	Commercial Venting Systems
		PLB-315	Commercial Waste Systems
12.04	Installs piping and components for interior drainage, waste and vent systems above-ground.	PLB-130	Residential Sanitary Drainage Systems
		PLB-135	Residential Venting Systems
		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
		PLB-310	Commercial Venting Systems
		PLB-315	Commercial Waste Systems
Task 13 - Installs water services.			
13.01	Sizes pipe for water services.	PLB-200	Water Service
13.02	Installs piping for water services.	PLB-200	Water Service
13.03	Installs water service equipment.	PLB-200	Water Service
Task 14 - Installs potable water distribution systems.			
14.01	Sizes piping and equipment for potable water distribution systems.	PLB-205	Potable Water Distribution
14.02	Installs piping for potable water distribution systems.	PLB-205	Potable Water Distribution

14.03	Installs potable water distribution equipment.	PLB-205	Potable Water Distribution
		PLB-230	Hot Water Storage Tanks and Heaters
14.04	Installs cross connection control devices.	PLB-325	Cross Connection Control
		PLB-205	Potable Water Distribution
Task 15 - Installs pressure systems.			
15.01	Sizes pressure systems.	PLB-215	Rural Water Supply
15.02	Installs piping for pumps.	PLB-215	Rural Water Supply
15.03	Installs pumps and accessories.	PIP-025	Introduction to Electricity
		PLB-215	Rural Water Supply
Task 16 - Installs plumbing fixtures and appliances.			
16.01	Installs fixture supports.	PLB-210	Residential Plumbing Fixtures and Accessories
		PLB-320	Commercial/Institutional Plumbing Fixtures and Accessories
16.02	Installs plumbing fixtures.	PLB-210	Residential Plumbing Fixtures and Accessories
		PLB-320	Commercial/Institutional Plumbing Fixtures and Accessories
16.03	Installs plumbing appliances.	PLB-235	Appliances
Task 17 - Installs water treatment systems.			
17.01	Sizes water treatment equipment.	PLB-225	Water Treatment Systems
17.02	Installs water treatment equipment.	PLB-225	Water Treatment Systems
Task 18 - Installs hydronic heating and cooling piping systems.			
18.01	Installs piping for hydronic systems.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
18.02	Installs circulating pumps.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
18.03	Installs hydronic system components.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
18.04	Installs piping and components for low pressure steam systems.	PLB-400	Low Pressure Steam Systems
Task 19 - Installs hydronic heating and cooling generating systems.			
19.01	Installs hydronic heating generating systems.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
19.02	Installs hydronic cooling generating systems.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)

Task 20 - Installs hydronic system controls and transfer units.			
20.01	Installs hydronic system controls.	PLB-335	Hydronic System Control
20.02	Installs hydronic transfer units.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
Task 21 - Installs piping and equipment for fuel systems.			
21.01	Installs piping for natural gas systems.	PIP-060	Gas Piping Systems
21.02	Installs piping for liquefied petroleum gas (LPG) systems.	PIP-060	Gas Piping Systems
21.03	Installs piping for petroleum systems.	PIP-060	Gas Piping Systems
21.04	Installs equipment for fuel systems.	PIP-060	Gas Piping Systems
Task 22 - Installs medical gas systems.			
22.01	Installs piping for medical gas systems.	PIP-065	Medical Gas Systems
22.02	Installs equipment for medical gas systems.	PIP-065	Medical Gas Systems
Task 23 - Installs irrigation systems.			
23.01	Installs piping for irrigation systems.	PLB-410	Irrigation Systems
23.02	Installs equipment for irrigation systems.	PLB-410	Irrigation Systems
Task 24 - Installs compressed air systems.			
24.01	Installs piping for compressed air systems.	PIP-055	Compressed Air Systems
24.02	Installs equipment for compressed air systems.	PIP-055	Compressed Air Systems
Task 25 - Installs fire protection systems.			
25.01	Installs piping for standpipe systems. (NOT COMMON CORE)		
25.02	Installs equipment for standpipe systems. (NOT COMMON CORE)		
25.03	Installs fire protection systems for single family dwellings.	PLB-415	Single Family Dwelling Fire Protection Systems
Task 26 - Installs process piping systems.			
26.01	Installs piping for process piping systems.	PLB-405	Process Piping Systems
26.02	Installs process piping system equipment.	PLB-405	Process Piping Systems
Task 27 - Maintains systems and components.			
27.01	Performs scheduled maintenance.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
		PLB-335	Hydronic System Control

		PIP-060	Gas Piping Systems
		PIP-065	Medical Gas Systems
		PLB-400	Low Pressure Steam Systems
		PLB-130	Residential Sanitary Drainage Systems
		PLB-135	Residential Venting Systems
		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
		PLB-310	Commercial Venting Systems
		PLB-315	Commercial Waste Systems
		PLB-220	Private Sewage Disposal Systems
		PLB-200	Water Service
		PLB-215	Rural Water Supply
		PLB-205	Potable Water Distribution
		PLB-230	Hot Water Storage Tanks and Heaters
		PLB-225	Water Treatment Systems
		PLB-410	Irrigation Systems
		PIP-055	Compressed Air Systems
		PLB-415	Single Family Dwelling Fire Protection Systems
		PLB-405	Process Piping Systems
		PLB-210	Residential Plumbing Fixtures and Accessories
		PLB-320	Commercial/Institutional Plumbing Fixtures and Accessories
		PLB-235	Appliances
27.02	Monitors system performance.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
		PLB-335	Hydronic System Control
		PIP-060	Gas Piping Systems
		PIP-065	Medical Gas Systems
		PLB-400	Low Pressure Steam Systems
		PLB-130	Residential Sanitary Drainage Systems
		PLB-135	Residential Venting Systems

		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
		PLB-310	Commercial Venting Systems
		PLB-315	Commercial Waste Systems
		PLB-220	Private Sewage Disposal Systems
		PLB-200	Water Service
		PLB-215	Rural Water Supply
		PLB-205	Potable Water Distribution
		PLB-230	Hot Water Storage Tanks and Heaters
		PLB-225	Water Treatment Systems
		PLB-410	Irrigation Systems
		PIP-055	Compressed Air Systems
		PLB-415	Single Family Dwelling Fire Protection Systems
		PLB-405	Process Piping Systems
		PLB-210	Residential Plumbing Fixtures and Accessories
		PLB-320	Commercial/Institutional Plumbing Fixtures and Accessories
		PLB-235	Appliances
Task 28 - Troubleshoots systems and components.			
28.01	Diagnoses plumbing-related systems and components.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
		PLB-335	Hydronic System Control
		PIP-060	Gas Piping Systems
		PIP-065	Medical Gas Systems
		PLB-400	Low Pressure Steam Systems
		PLB-130	Residential Sanitary Drainage Systems
		PLB-135	Residential Venting Systems
		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
		PLB-310	Commercial Venting Systems
		PLB-315	Commercial Waste Systems
		PLB-220	Private Sewage Disposal Systems
		PLB-200	Water Service
		PLB-215	Rural Water Supply

		PLB-205	Potable Water Distribution
		PLB-230	Hot Water Storage Tanks and Heaters
		PLB-225	Water Treatment Systems
		PLB-410	Irrigation Systems
		PIP-055	Compressed Air Systems
		PLB-415	Single Family Dwelling Fire Protection Systems
		PLB-405	Process Piping Systems
		PLB-210	Residential Plumbing Fixtures and Accessories
		PLB-320	Commercial/Institutional Plumbing Fixtures and Accessories
		PLB-235	Appliances
28.02	Repairs plumbing-related systems and components.	PLB-330	Hydronic Systems (Cooling and Low Pressure Heating)
		PLB-335	Hydronic System Control
		PIP-060	Gas Piping Systems
		PIP-065	Medical Gas Systems
		PLB-400	Low Pressure Steam Systems
		PLB-130	Residential Sanitary Drainage Systems
		PLB-135	Residential Venting Systems
		PLB-305	Storm and Combination Drainage Systems
		PLB-300	Commercial Sanitary Drainage Systems
		PLB-310	Commercial Venting Systems
		PLB-315	Commercial Waste Systems
		PLB-220	Private Sewage Disposal Systems
		PLB-200	Water Service
		PLB-215	Rural Water Supply
		PLB-205	Potable Water Distribution
		PLB-230	Hot Water Storage Tanks and Heaters
		PLB-225	Water Treatment Systems
		PLB-410	Irrigation Systems
		PIP-055	Compressed Air Systems
		PLB-415	Single Family Dwelling Fire Protection Systems

		PLB-405	Process Piping Systems
		PLB-210	Residential Plumbing Fixtures and Accessories
		PLB-320	Commercial/Institutional Plumbing Fixtures and Accessories
		PLB-235	Appliances

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 regulation 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 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.

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) addenda
 - 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.

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

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

PLB-100 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.
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 plastic piping systems and describe their characteristics and applications.
8. Identify types of plastic piping and describe their properties and characteristics.
 - i) thermoset
 - ii) thermoplastic
9. Identify fittings used with plastic piping and describe their purpose and applications.
10. Identify plastic piping accessories and describe their purpose and applications.
 - i) supports
 - ii) hangers
 - iii) sleeves

11. Explain the systems of measurement for plastic piping.
 - i) dimension
 - ii) length
 - iii) wall thickness/schedule
12. Describe the procedures used to measure plastic piping.
13. Perform calculations to determine plastic piping measurements.
 - i) fitting allowances
 - center to center
 - end to end
 - ii) offsets
14. Describe the procedures used to inspect plastic piping.
15. Identify the methods used to cut plastic piping and describe their associated procedures.
16. 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) mechanical joints
17. Describe the procedures used to install fittings and accessories for plastic piping.

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.
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 copper tube and tubing systems and describe their characteristics and applications.
8. Identify types of copper tube and tubing and describe their properties and characteristics.
9. Identify fittings used with copper tube and tubing and describe their purpose and applications.
10. Identify copper tube and tubing accessories and describe their purpose and applications.
 - i) supports

- ii) hangers
 - iii) sleeves
11. Explain the systems of measurement for copper tube and tubing.
- i) dimension
 - ii) length
 - iii) wall thickness
12. Describe the procedures used to measure copper tube and tubing.
13. Perform calculations to determine copper tube and tubing measurements.
- i) fitting allowances
 - center to center
 - end to end
 - ii) offsets
14. Describe the procedures used to inspect copper tube and tubing.
15. Identify the methods used to cut copper tube and tubing and describe their associated procedures.
16. Describe the procedures used to bend copper tube and tubing.
17. Identify the methods used to join copper tube and tubing and describe their associated procedures.
- i) brazing
 - ii) soldering
 - iii) flaring
 - iv) roll groove
 - v) compression fittings
 - vi) mechanical joints
18. Describe the procedures used to install fittings and accessories for copper tube and tubing.

PLB-110 Steel Piping

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with steel piping.
2. Identify hazards and describe safe work practices pertaining to steel piping.
3. Interpret codes and regulations pertaining to steel piping.
4. Interpret information pertaining to steel piping found on drawings and specifications.
5. Describe the identification system and methods used for steel piping.
6. Identify tools and equipment related to steel piping and describe their applications and procedures for use.
7. Identify steel piping systems and describe their characteristics and applications.
8. Identify types of steel piping and describe their properties and characteristics.
 - i) carbon steel
 - ii) galvanized
 - iii) stainless steel
9. Identify fittings used with steel piping and describe their purpose and applications.
10. Identify steel piping accessories and describe their purpose and applications.
 - i) supports
 - ii) hangers
 - iii) sleeves

11. Explain the systems of measurement for steel piping.
 - i) dimension
 - ii) length
 - iii) wall thickness/schedule
 - iv) grades
12. Describe the procedures used to measure steel piping.
13. Perform calculations to determine steel piping measurements.
 - i) fitting allowances
 - center to center
 - end to end
 - ii) offsets
14. Describe the procedures used to inspect steel piping.
 - i) quality control requirements
15. Identify the methods used to cut steel piping and describe their associated procedures.
16. Identify the methods used to join steel piping and describe their associated procedures.
 - i) threading and grooving
 - ii) welding
 - iii) flanging
 - iv) mechanical joints
17. Describe the procedures used to install fittings and accessories for steel piping.

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with cast iron piping.
2. Identify hazards and describe safe work practices pertaining to cast iron piping.
3. Interpret codes and regulations pertaining to cast iron piping.
4. Interpret information pertaining to cast iron piping found on drawings and specifications.
5. Describe the identification systems and methods for cast iron piping.
6. Identify tools and equipment relating to cast iron piping and describe their applications and procedures for use.
7. Identify cast iron piping systems and describe their characteristics and applications.
8. Identify types of cast iron piping and describe their properties and characteristics.
 - i) soil
 - ii) ductile
 - iii) duriron
9. Identify fittings used with cast iron piping and describe their purpose and applications.
10. Identify cast iron piping accessories and describe their purpose and applications.
 - i) supports

- ii) hangers
 - iii) sleeves
11. Explain the systems of measurement for cast iron piping.
- i) dimension
 - ii) length
 - iii) wall thickness/schedule
12. Describe the procedures used to measure cast iron piping.
13. Perform calculations to determine cast iron piping measurements.
- i) fitting allowances
 - center to center
 - end to end
 - ii) offsets
14. Describe the procedures used to inspect cast iron piping.
15. Identify the methods used to cut cast iron piping and describe their associated procedures.
16. Identify the methods used to join cast iron piping and describe their associated procedures.
- i) mechanical joints
 - ii) hub and spigot
17. Describe the procedures used to install fittings and accessories for cast iron piping.

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with glass piping.
2. Identify hazards and describe safe work practices pertaining to glass piping.
3. Interpret codes and regulations pertaining to glass piping.
4. Interpret information pertaining to glass piping found on drawings and specifications.
5. Describe the identification systems and methods for glass piping.
6. Identify tools and equipment relating to glass piping and describe their applications and procedures for use.
7. Identify glass piping systems and describe their characteristics and applications.
8. Identify types of glass piping and describe their properties and characteristics.
9. Identify fittings used with glass piping and describe their purpose and applications.
10. Identify glass piping accessories and describe their purpose and applications.
 - i) supports
 - ii) hangers
 - iii) sleeves

11. Explain the systems of measurement for glass piping.
 - i) dimension
 - ii) length
 - iii) wall thickness
12. Describe the procedures used to measure glass piping.
13. Perform calculations to determine glass piping measurements.
 - i) fitting allowances
 - center to center
 - end to end
 - ii) offsets
14. Describe the procedures used to inspect glass piping.
15. Identify the methods used to cut glass piping and describe their associated procedures.
16. Identify the methods used to join glass piping and describe their associated procedures.
 - i) bead end to bead end
 - ii) bead end to plain end
 - iii) plain end to plain end
17. Describe the procedures used to install fittings and accessories for glass piping.

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with asbestos-cement piping.
2. Identify hazards and describe safe work practices pertaining to asbestos-cement piping.
3. Interpret codes and regulations pertaining to asbestos-cement piping.
4. Interpret information pertaining to asbestos-cement piping found on drawings and specifications.
5. Describe the identification systems and methods for asbestos-cement piping.
6. Identify tools and equipment relating to asbestos-cement piping and describe their applications and procedures for use.
7. Identify asbestos-cement piping systems and describe their characteristics and applications.
8. Identify types of asbestos-cement piping and describe their properties and characteristics.
9. Identify fittings used with asbestos-cement piping and describe their purpose and applications.
10. Identify asbestos-cement piping accessories and describe their purpose and applications.
 - i) supports

- ii) hangers
 - iii) sleeves
11. Explain the systems of measurement for asbestos-cement piping.
 - i) dimension
 - ii) length
 - iii) wall thickness
 12. Describe the procedures used to measure asbestos-cement piping.
 13. Perform calculations to determine asbestos-cement piping measurements.
 - i) fitting allowances
 - center to center
 - end to end
 - ii) offsets
 14. Describe the procedures used to inspect asbestos-cement piping.
 15. Identify the methods used to cut asbestos-cement piping and describe their associated procedures.
 16. Identify the methods used to join asbestos-cement piping and describe their associated procedures.
 - i) mechanical joints
 - ii) hub and spigot
 17. Describe the procedures used to install fittings and accessories for asbestos-cement piping.

Learning Outcomes:

- Demonstrate knowledge of residential sanitary drainage systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to determine and transfer grade and elevation measurements for residential sanitary drainage systems.
- Demonstrate knowledge of the procedures used to layout, install, maintain, repair, test and troubleshoot residential sanitary drainage systems.

Objectives and Content:

1. Define terminology associated with residential sanitary drainage.
2. Identify hazards and describe safe work practices pertaining to residential sanitary drainage systems.
3. Interpret codes and regulations pertaining to residential sanitary drainage systems.
 - i) fixed homes
 - ii) mobile homes
4. Interpret information pertaining to residential sanitary drainage systems found on drawings and specifications.
5. Identify tools and equipment relating to residential sanitary drainage systems and describe their applications and procedures for use.
6. Explain the purpose of residential sanitary drainage systems.
7. Identify the methods of back flow protection used in residential sanitary drainage systems.
 - i) backwater valves
 - ii) gate valves
8. Identify the types of residential sanitary drainage systems and describe their characteristics and applications.

9. Identify residential sanitary drainage system components and describe their purpose and applications.
 - i) piping
 - ii) fixtures
 - iii) drains
 - iv) traps
 - v) cleanouts
 - vi) joints and connections
 - vii) backwater valves
 - viii) fire stopping
 - ix) sewage sumps
 - x) macerating toilet system
 - xi) expansion joints
10. Identify the factors to consider when sizing residential sanitary drainage system components.
 - i) hydraulic load
 - ii) code requirements
11. Describe the procedures used to determine hydraulic load on a residential sanitary drainage system.
12. Describe the procedures used to install residential sanitary drainage system components in trenches.
 - i) safety considerations
 - ii) support
 - iii) protection
13. Determine and transfer grade, percent of grade and elevation for piping in residential sanitary drainage systems.
14. Describe the procedures used to grade piping for residential sanitary drainage systems.
15. Describe the procedures used to rough-in/install residential sanitary drainage systems.
16. Describe the procedures used to protect residential sanitary drainage systems.

17. Describe the procedures used to maintain and repair residential sanitary drainage systems.
18. Describe the procedures used to test and troubleshoot residential sanitary drainage systems.

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with residential venting systems.
2. Identify hazards and describe safe work practices pertaining to residential venting systems.
3. Interpret codes and regulations pertaining to residential venting systems.
4. Interpret information pertaining to residential venting systems found on drawings and specifications.
5. Identify tools and equipment relating to residential venting systems and describe their applications and procedures for use.
6. Identify types of residential venting systems and describe their characteristics and applications.
 - i) stack vent
 - ii) individual vent
 - iii) branch vent
 - iv) dual vent
 - v) vent header
 - vi) continuous vent
 - vii) wet vent
 - viii) relief vent
 - ix) circuit vent
 - x) air admittance valve

7. Identify residential venting system components and describe their purpose and applications.
 - i) piping
 - ii) fixtures
 - iii) traps
 - iv) cleanouts
 - v) joints and connections
 - vi) fire stopping
8. Identify the factors to consider when sizing residential venting systems.
9. Describe the procedures used to determine hydraulic load on a residential venting system.
10. Describe the procedures used to rough-in/install residential venting systems.
11. Describe the procedures used to protect residential venting systems.
12. Describe the procedures used to maintain and repair residential venting systems.
13. Describe the procedures used to test and troubleshoot residential venting systems.

LEVEL 2

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 water service equipment and components, their applications and operation.
- Demonstrate knowledge of the procedures used to determine and transfer grade and elevation measurements for water service equipment and components.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot water service.

Objectives and Content:

1. Define terminology associated with water service.
2. Identify hazards and describe safe work practices pertaining to water service.
3. Interpret codes and regulations pertaining to water service.
 - i) residential
 - single family dwelling homes
 - mobile homes
 - ii) commercial/institutional
4. Interpret information pertaining to water service found on drawings and specifications.
5. Identify tools and equipment relating to water service systems and describe their applications and procedures for use.
6. Identify types of water service and describe their characteristics and applications.
7. Identify water service equipment and components and describe their purpose, operation and applications.
 - i) corporation main stop
 - ii) expansion loop
 - iii) curb stop
 - iv) meters
 - v) bypass
 - vi) strainers

- vii) check valves
 - viii) backflow preventers
 - ix) piping and fittings
 - x) main shut-off
 - xi) pressure reducing valve
8. Identify water service supply piping supports and restraints and describe their purpose and applications.
- i) anchors
 - ii) rods
 - iii) tie rods
 - iv) thrust blocks
 - v) mega lugs
9. Identify the factors to consider in determining elevations and grades for water service supply piping.
10. Determine and transfer grade, percent of grade and elevation for piping in water service systems.
11. Identify the factors to consider in sizing piping for water service.
- i) number of fixture units
 - ii) developed length of pipe
 - iii) elevation
 - iv) available pressure
12. Calculate piping size requirements for water service.
13. Describe the procedures used to layout and install water service supply piping in trenches.
- i) safety consideration
 - ii) support
 - iii) protection
14. Describe the procedures used to rough-in and install water service supply piping and their associated supports and restraints.
15. Describe the procedures used to protect water service supply piping.
- i) recirculation pump
 - ii) frost box

- iii) heat tracing
 - iv) insulation
16. Describe the procedures used to install water service components.
 17. Describe the procedures used to maintain and repair water service components.
 18. Describe the procedures used to test and troubleshoot water service components.

Learning Outcomes:

- Demonstrate knowledge of potable water distribution equipment and components, their applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot potable water distribution systems.

Objectives and Content:

1. Define terminology associated with potable water distribution.
2. Identify hazards and describe safe work practices pertaining to potable water distribution.
3. Interpret codes and regulations pertaining to potable water distribution.
4. Interpret information pertaining to potable water distribution found on drawings and specifications.
5. Identify tools and equipment relating to potable water distribution and describe their applications and procedures for use.
6. Explain water hammer, its causes and methods of prevention or control.
7. Identify potable water distribution components and describe their characteristics and applications.
 - i) piping
 - ii) fittings
 - iii) valves
 - iv) shock arrestors
 - v) recirculating lines and pumps
 - vi) hose bibs
 - vii) fire stopping
 - viii) cross-connection control
 - ix) expansion tanks
 - x) pressure reducing valves

8. Identify the factors to consider for sizing potable water distribution system components and equipment.
9. Describe the procedures used to size potable water distribution system components and equipment.
10. Describe the procedures used to rough-in and layout potable water distribution.
11. Describe the procedures used to install potable water distribution components.
12. Describe the procedures used to protect potable water distribution components.
13. Describe the procedures used to maintain and repair potable water distribution components.
14. Describe the procedures used to test and troubleshoot potable water distribution systems.

Learning Outcomes:

- Demonstrate knowledge of residential plumbing fixtures and accessories, their applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot residential plumbing fixtures and accessories.

Objectives and Content:

1. Define terminology associated with residential plumbing fixtures and accessories.
2. Identify hazards and describe safe work practices pertaining to residential plumbing fixtures and accessories.
3. Interpret codes and regulations pertaining to residential plumbing fixtures and accessories.
4. Interpret information pertaining to residential plumbing fixtures and accessories found on drawings and specifications.
5. Identify tools and equipment relating to residential plumbing fixtures and accessories and describe their applications and procedures for use.
6. Identify types of residential plumbing fixtures and describe their characteristics and applications.
7. Identify types of residential plumbing fixture supports and describe their characteristics and applications.
8. Identify residential plumbing accessories and describe their characteristics and applications.
9. Describe the procedures used to install residential plumbing fixtures, supports and accessories.

10. Describe the procedures used to maintain and repair residential plumbing fixtures and accessories.
11. Describe the procedures used to test and troubleshoot residential plumbing fixtures and accessories.

Learning Outcomes:

- Demonstrate knowledge of rural water supply equipment and components, their applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot rural water supply.

Objectives and Content:

1. Define terminology associated with rural water supply.
2. Identify hazards and describe safe work practices pertaining to rural water supply.
3. Interpret codes and regulations pertaining to rural water supply.
4. Interpret information pertaining to rural water supply found on drawings and specifications.
5. Interpret well driller's information reports.
6. Interpret information found on pump charts.
7. Identify tools and equipment relating to rural water supply systems and describe their applications and procedures for use.
8. Identify surface sources of water supply and describe their characteristics.
 - i) rivers
 - ii) lakes
 - iii) ponds
 - iv) streams
 - v) cisterns
 - vi) springs
9. Identify common contamination sources of rural water supplies.

10. Identify types of wells and describe their characteristics and applications.
 - i) shallow
 - ii) deep
 - iii) dug
 - iv) bored
 - v) driven
 - vi) drilled
11. Identify considerations for determining location of wells.
12. Explain forces that impact on pipe and tubing in rural water supply systems.
 - i) weight
 - ii) friction loss
 - iii) turbulence
 - iv) galvanic action
13. Identify rural water supply system components and describe their characteristics and applications.
 - i) foot valves
 - ii) piping
 - iii) clamps
 - iv) pumps
 - v) pressure tanks
 - vi) controls
 - vii) shut-off valves
 - viii) relief valves
 - ix) air volume controls
 - x) drain valves
 - xi) pitless adapter
 - xii) torque arrestors
 - xiii) cable guards
14. Identify types of pumps and describe their components, applications and operation.
 - i) positive displacement pumps
 - ii) variable displacement pumps
15. Identify types of pressure tanks and describe their components, applications and operation.
 - i) galvanized

- ii) diaphragm
 - iii) bladder
 - iv) floated
 - v) in-line
16. Identify types of pressure tank controls and describe their components, applications and operation.
 17. Identify the factors to consider for sizing rural water supply system components and equipment.
 18. Describe the procedures used to size rural water supply system components and equipment.
 19. Describe the procedures used to layout and install rural water supply system piping in trenches.
 - i) safety considerations
 - ii) supporting
 - iii) protection
 20. Describe the procedures used to install rural water supply system components and equipment.
 21. Describe the procedures used to protect rural water supply system components and equipment.
 22. Describe the procedures used to maintain and repair rural water supply system components and equipment.
 23. Describe the procedures used to test and troubleshoot rural water supply system components and equipment.

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with private sewage disposal systems.
2. Identify hazards and describe safe work practices pertaining to private sewage disposal systems.
 - i) health hazards
 - ii) environmental hazards
3. Interpret codes and regulations pertaining to private sewage disposal systems.
4. Interpret information pertaining to private sewage disposal systems found on drawings and specifications.
5. Identify tools and equipment relating to private sewage disposal systems and describe their applications and procedures for use.
6. Identify types of private sewage disposal systems and describe their characteristics and applications.
7. Identify private sewage disposal system components and describe their purpose and applications.
 - i) septic tank
 - ii) disposal field
 - iii) lift pumps
 - iv) holding tanks
 - v) biofilter

8. Identify the factors to consider when planning and installing private sewage disposal systems.
 - i) location
 - system position
 - clearances
 - relation to water table
 - ii) soil conditions/properties
 - percolation test
 - soil test
9. Identify the factors to consider when sizing private sewage disposal system components.
10. Describe the procedures used to size private sewage disposal system components.
11. Describe the procedures used to install private sewage disposal systems.
12. Describe the procedures used to protect private sewage disposal systems.
13. Describe the procedures used to maintain and repair private sewage disposal systems.
14. Describe the procedures used to test and troubleshoot private sewage disposal systems.

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with water treatment systems.
2. Identify hazards and describe safe work practices pertaining to water treatment systems.
3. Interpret codes and regulations pertaining to water treatment systems.
4. Interpret information pertaining to water treatment systems found on drawings and specifications.
5. Identify tools and equipment relating to water treatment systems and describe their applications and procedures for use.
6. Identify types of water problems and describe their characteristics and causes.
 - i) hardness
 - ii) minerals
 - iii) contamination/pollution
 - iv) pH
 - v) taste/odor
 - vi) turbidity
7. Identify types of water tests and describe their associated procedures.
8. Interpret results of water tests to determine water treatment requirements.
9. Identify methods of water treatment and describe their characteristics and applications.
 - i) filters

- ii) softeners
 - iii) purifiers
 - iv) chemical feeders
 - v) sterilizers
 - vi) reverse osmosis
 - vii) de-ionizers
 - viii) neutralizers
 - ix) distillers
10. Identify water treatment components and describe their applications and operation.
 11. Describe the procedures used to install water treatment systems and components.
 12. Describe the procedures used to protect water treatment systems and components.
 13. Describe the procedures used to maintain and repair water treatment systems and components.
 14. Describe the procedures used to test and troubleshoot water treatment systems and components.

Learning Outcomes:

- Demonstrate knowledge of hot water storage tanks and heaters, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot hot water storage tanks and heaters.

Objectives and Content:

1. Define terminology associated with hot water storage tanks and heaters.
2. Identify hazards and describe safe work practices pertaining to hot water storage tanks and heaters.
3. Interpret codes and regulations pertaining to hot water storage tanks and heaters.
4. Interpret information pertaining to hot water storage tanks and heaters found on drawings and specifications.
5. Identify tools and equipment relating to hot water storage tanks and heaters and describe their applications and procedures for use.
6. Identify types of hot water storage tanks and describe their characteristics and applications.
7. Identify hot water storage tank components and describe their purpose and operation.
 - i) vacuum relief
 - ii) temperature/pressure relief valve
 - iii) expansion tanks
 - iv) drain pans
8. Identify types of hot water heaters and describe their characteristics and applications.
 - i) direct
 - ii) indirect

9. Identify heat sources for hot water heaters and describe their characteristics and applications.
 - i) oil
 - ii) gas
 - iii) electric
 - iv) solar
 - v) solid fuel
10. Identify hot water heater components and describe their purpose and operation.
11. Identify the factors to consider for sizing hot water storage tanks and heaters, their components and equipment.
12. Describe the procedures used to size hot water storage tanks and heaters, their components and equipment.
13. Describe the procedures used to install hot water tanks and their components.
14. Describe the procedures used to protect hot water tanks and their components.
15. Describe the procedures used to maintain and repair hot water tanks and their components.
16. Describe the procedures used to test and troubleshoot hot water tanks and their components.
17. Describe the procedures used to install hot water heaters and their components.
18. Describe the procedures used to protect hot water heaters and their components.
19. Describe the procedures used to maintain and repair hot water heaters and their components.
20. Describe the procedures used to test and troubleshoot hot water heaters and their components.

PLB-235 Appliances

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with appliances.
2. Identify hazards and describe safe work practices pertaining to appliances.
3. Interpret codes and regulations pertaining to appliances.
4. Interpret information pertaining to appliances found on drawings and specifications.
5. Identify tools and equipment relating to appliances and describe their applications and procedures for use.
6. Identify types of appliances and describe their characteristics and applications.
 - i) residential
 - ii) commercial
 - iii) institutional
7. Describe the procedures used to rough-in and install appliances.
8. Describe the procedures used to protect appliances.
9. Describe the procedures used to maintain appliances.
10. Describe the procedures used to repair plumbing related appliance problems.
11. Describe the procedures used to coordinate non-plumbing related repair of appliances.
12. Describe the procedures used to test and troubleshoot appliances.

LEVEL 3

Learning Outcomes:

- Demonstrate knowledge of commercial sanitary drainage systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to determine and transfer grade and elevation measurements in commercial sanitary drainage systems.
- Demonstrate knowledge of the procedures used to layout, install, maintain, test and troubleshoot commercial sanitary drainage systems.

Objectives and Content:

1. Define terminology associated with commercial sanitary drainage systems.
2. Identify hazards and describe safe work practices pertaining to commercial sanitary drainage systems.
3. Interpret codes and regulations pertaining to commercial sanitary drainage systems.
4. Interpret information pertaining to commercial sanitary drainage systems found on drawings and specifications.
5. Identify tools and equipment relating to commercial sanitary drainage systems and describe their applications and procedures for use.
6. Identify types of commercial sanitary drainage systems and describe their characteristics and applications.
7. Identify commercial sanitary drainage system components and describe their purpose and applications.
 - i) interceptors
 - ii) traps
 - iii) drains
 - iv) cleanouts/manholes
 - v) primers
 - vi) fire stopping

8. Identify the factors to consider when sizing commercial sanitary drainage system components.
9. Describe the procedures used to size commercial sanitary drainage system components.
10. Determine and transfer grade, percent of grade and elevation for piping in commercial sanitary drainage systems.
11. Describe the procedures used to grade piping in commercial sanitary drainage systems.
12. Describe the procedures used to layout and rough-in/install commercial sanitary drainage systems.
13. Describe the procedures used to protect commercial sanitary drainage systems.
14. Describe the procedures used to maintain and repair commercial sanitary drainage systems.
15. Describe the procedures used to test and troubleshoot commercial sanitary drainage systems.

Learning Outcomes:

- Demonstrate knowledge of storm and combination drainage systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to determine and transfer grade and elevation measurements in storm and combination drainage systems.
- Demonstrate knowledge of the procedures used to layout, install, maintain, repair, test and troubleshoot storm and combination drainage systems.

Objectives and Content:

1. Define terminology associated with storm and combination drainage systems.
2. Identify hazards and describe safe work practices pertaining to storm and combination drainage systems.
3. Interpret codes and regulations pertaining to storm and combination drainage systems.
4. Interpret information pertaining to storm and combination drainage systems found on drawings and specifications.
5. Identify tools and equipment relating to storm and combination drainage systems and describe their applications and procedures for use.
6. Identify types of storm and combination drainage systems and describe their characteristics and applications.
7. Identify storm and combination drainage system components and describe their purpose and applications.
 - i) piping
 - ii) roof drains
 - iii) area drains
 - iv) fire stopping
 - v) expansion joints

8. Identify the factors to consider when sizing storm and combination drainage system components.
9. Describe the procedures used to determine hydraulic load on storm and combination drainage systems.
 - i) conversion factors
 - ii) code requirements
10. Determine and transfer grade, percent of grade and elevation for piping in storm and combination drainage systems.
11. Describe the procedures used to grade piping for storm and combination drainage systems.
12. Describe the procedures used to install storm and combination drainage systems.
13. Describe the procedures used to protect storm and combination drainage systems.
 - i) insulating
 - ii) supporting
 - iii) identification
 - iv) per mechanical specifications
14. Describe the procedures used to maintain and repair storm and combination drainage systems.
15. Describe the procedures used to test and troubleshoot storm and combination drainage systems.

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with commercial venting systems.
2. Identify hazards and describe safe work practices pertaining to commercial venting systems.
3. Interpret codes and regulations pertaining to commercial venting systems.
4. Interpret information pertaining to commercial venting systems found on drawings and specifications.
5. Identify tools and equipment relating to commercial venting systems and describe their applications and procedures for use.
6. Identify types of commercial venting systems and describe their characteristics and applications.
 - i) stack vent
 - ii) vent stack
 - iii) individual vent
 - iv) branch vent
 - v) dual vent
 - vi) vent header
 - vii) continuous vent
 - viii) wet vent
 - ix) relief vent
 - x) circuit vent
 - xi) yoke vent
 - xii) offset relief vent
 - xiii) additional circuit vent
 - xiv) miscellaneous vents

7. Identify commercial venting system components and describe their purpose and applications.
 - i) piping
 - ii) fixtures
 - iii) traps
 - iv) cleanouts
 - v) joints and connections
 - vi) fire stopping
 - vii) air admittance valve
8. Identify the factors to consider when sizing commercial venting system components.
9. Describe the procedures used to size commercial venting system components.
10. Describe the procedures used to layout and install commercial venting systems.
11. Describe the procedures used to protect commercial venting systems.
12. Describe the procedures used to maintain and repair commercial venting systems.
13. Describe the procedures used to test and troubleshoot commercial venting systems.

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with commercial waste systems.
2. Identify hazards and describe safe work practices pertaining to commercial waste systems.
3. Interpret codes and regulations pertaining to commercial waste systems.
4. Interpret information pertaining to commercial waste systems found on drawings and specifications.
5. Identify tools and equipment relating to commercial waste systems and describe their applications and procedures for use.
6. Identify types of commercial waste systems and describe their characteristics and applications.
 - i) municipal sewage systems
 - ii) waste water treatment plants
 - iii) corrosive waste systems
 - iv) indirect waste systems
7. Identify commercial waste system components and describe their purpose and applications.
 - i) sewage pumps
 - ii) receiving tanks
 - iii) interceptors
 - iv) sewage sump
 - v) piping connections
 - vi) drains

- vii) vents
 - viii) piping
8. Identify factors to consider when selecting and sizing commercial waste system components.
 9. Describe the procedures used to size commercial waste system components.
 10. Describe the procedures used to layout and install commercial waste systems.
 11. Describe the procedures used to maintain and repair commercial waste systems.
 12. Describe the procedures used to test and troubleshoot commercial waste systems.
 13. Describe the procedures used to protect commercial waste systems from extreme conditions.
 - i) high temperature
 - ii) corrosive waste
 - iii) bio-waste

Learning Outcomes:

- Demonstrate knowledge of commercial/institutional plumbing fixtures and accessories, their applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot commercial/institutional plumbing fixtures and accessories.

Objectives and Content:

1. Define terminology associated with commercial/institutional plumbing fixtures and accessories.
2. Identify hazards and describe safe work practices pertaining to commercial/institutional plumbing fixtures and accessories.
3. Interpret codes and regulations pertaining to commercial/institutional plumbing fixtures and accessories.
 - i) barrier-free design
4. Interpret information pertaining to commercial/institutional plumbing fixtures and accessories found on drawings and specifications.
5. Identify tools and equipment relating to commercial/institutional plumbing fixtures and accessories and describe their applications and procedures for use.
6. Identify types of commercial/institutional plumbing fixtures and describe their characteristics and applications.
7. Identify types of commercial/institutional plumbing fixture supports and describe their characteristics and applications.
8. Identify commercial/institutional plumbing accessories and describe their characteristics and applications.
9. Describe the procedures used to install commercial/institutional plumbing fixtures, supports and accessories.

10. Describe the procedures used to maintain and repair commercial/institutional plumbing fixtures and accessories.
11. Describe the procedures used to test and troubleshoot commercial/institutional plumbing fixtures and accessories.

Learning Outcomes:

- Demonstrate knowledge of cross connection control devices, their applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot cross connection control devices.

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. Interpret codes and regulations pertaining to cross connection control.
 - i) training and certification requirements
4. Interpret information pertaining to cross connection control found on drawings and specifications.
5. Identify tools and equipment relating to cross connection control and describe their applications and procedures for use.
6. Explain backflow and its causes.
7. Identify types of cross connection control devices and describe their characteristics, operation and applications.
8. Describe the procedures used to install cross connection control devices.
9. Describe the procedures used to maintain and repair cross connection control devices.
10. Describe the procedures used to test and troubleshoot cross connection control devices.

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) solid fuel
 - 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 (awareness of)
 - ii) low pressure
10. 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
11. 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
12. 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

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

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

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.

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.

LEVEL 4

Learning Outcomes:

- 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. Define terminology associated with low pressure steam systems.
2. Identify hazards and describe safe work practices pertaining to low pressure steam systems.
3. Interpret codes and regulations pertaining to low pressure steam systems.
4. Interpret information pertaining to low pressure steam systems found on drawings and specifications.
5. Identify tools and equipment relating to low pressure steam systems and describe their applications and procedures for use.
6. Identify types of low pressure steam systems and describe their characteristics and applications.
 - i) heating
 - ii) process
7. Identify low pressure steam system components and describe their purpose and operation.
 - i) boilers
 - ii) piping
 - iii) connections
 - iv) traps
 - mechanical
 - thermostatic
 - thermodynamic

- v) pumps
 - vi) heat transfer equipment
8. Identify types of low pressure steam system controls and describe their purpose and operation.
- i) valves
 - pressure relief/safety
 - pressure reducing
 - boiler stop
 - blow off
 - ii) steam pressure gauges
 - iii) glass water column
 - iv) fusible plugs
 - v) feedwater
 - vi) low water cut-off
9. Describe the procedures used to install low pressure steam systems and controls.
10. Describe the procedures used to protect low pressure steam systems and controls.
11. Describe the procedures used to maintain and repair low pressure steam systems and controls.
12. Describe the procedures used to test and troubleshoot low pressure steam systems and controls.

PLB-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) food processing
 - food grade
 - non-food grade
 - ii) reverse-osmosis
 - iii) high purity water
 - iv) water treatment plant
 - v) waste water treatment plant
 - vi) non-potable water
 - reclaim
7. Identify process piping system components and describe their purpose and operation.

8. Describe the procedures used to install process piping systems.
9. Describe the procedures used to protect process piping systems.
10. Describe the procedures used to maintain and repair process piping systems.
11. Describe the procedures used to test and troubleshoot process piping systems.

PLB-410 Irrigation Systems

Learning Outcomes:

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

Objectives and Content:

1. Define terminology associated with irrigation systems.
2. Identify hazards and describe safe work practices pertaining to irrigation systems.
3. Interpret codes and regulations pertaining to irrigation systems.
4. Interpret information pertaining to irrigation systems found on drawings and specifications.
5. Identify tools and equipment relating to irrigation systems and describe their applications and procedures for use.
6. Identify types of irrigation systems and describe their characteristics and applications.
 - i) residential
 - ii) commercial
7. Identify irrigation system components and describe their applications and operation.
 - i) piping
 - ii) valves
 - iii) sprinkler heads
 - iv) timers
 - v) pumps
 - vi) cross connection control devices
8. Describe the procedures used to install and adjust irrigation systems.

9. Describe the procedures used to protect irrigation systems.
10. Describe the procedures used to maintain and repair irrigation systems.
11. Describe the procedures used to test and troubleshoot irrigation 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) driers
 - 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.

Learning Outcomes:

- Demonstrate knowledge of single family dwelling fire protection systems, their components, applications and operation.
- Demonstrate knowledge of the procedures used to install, maintain, repair, test and troubleshoot single family dwelling fire protection systems.

Objectives and Content:

1. Define terminology associated with single family dwelling fire protection systems.
2. Identify hazards and describe safe work practices pertaining to single family dwelling fire protection systems.
3. Interpret codes and regulations pertaining to single family dwelling fire protection systems.
4. Interpret information pertaining to single family dwelling fire protection systems found on drawings and specifications.
5. Identify tools and equipment relating to single family dwelling fire protection systems and describe their applications and procedures for use.
6. Identify types of single family dwelling fire protection systems and describe their characteristics and applications.
 - i) flow through
 - ii) partial flow through
7. Identify single family dwelling fire protection system components and describe their purpose and operation.
 - i) sprinkler heads
 - concealed
 - sidewall
 - pendant
 - upright

- ii) cross connection control
 - iii) piping
8. Describe the procedures used to install single family dwelling fire protection systems.
 9. Describe the procedures used to protect single family dwelling fire protection systems.
 10. Describe the procedures used to maintain and repair single family dwelling fire protection systems.
 11. Describe the procedures used to test and troubleshoot single family dwelling fire protection 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.

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-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.

PLB-420 Commissioning

Learning Outcomes:

- Demonstrate knowledge of commissioning and its associated procedures.

Objectives and Content:

1. Define terminology associated with commissioning.
2. Identify hazards and describe safe work practices pertaining to commissioning.
3. Identify sources of information pertaining to commissioning.
 - i) specifications
 - ii) codes and regulations
 - iii) operation and maintenance manuals
 - iv) quality assurance/quality control documentation
 - v) as-built drawings
4. Identify tools and equipment relating to commissioning and describe their applications and procedures for use.
5. Identify systems and equipment that require commissioning.
6. Describe the procedures used to commission systems.
 - i) mark and label system
 - valve tags
 - equipment labeling
 - pipe identification
 - ii) operator training
 - iii) coordinate system start-up