
Plan of Training

STEAMFITTER/PIPEFITTER



Government of Newfoundland and Labrador
Department of Advanced Education and Skills
Apprenticeship and Trades Certification Division

MARCH 2011

PLAN OF TRAINING

Steamfitter/Pipefitter

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Government of Newfoundland and Labrador
Department of Education
Institutional and Industrial Education Division

Approved by:



Chairperson, Provincial Apprenticeship and Certification Board

Date: March 15, 2011

Preface

This Apprenticeship Standard is based on the 2010 edition of the National Occupational Analysis for the Steamfitter Pipefitter trade.

This document describes the curriculum content for the Steamfitter Pipefitter apprenticeship training program and outlines each of the technical training units necessary for the completion of apprenticeship.

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Advisory committees, industry representatives, instructors and apprenticeship staff provided valuable input to the development of this Apprenticeship Curriculum Standard. Without their dedication to quality apprenticeship training, this document could not have been produced.

We offer you a sincere thank you.

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A. Profile Chart

Occupational Skills			
PF-1340 Tools and Equipment	TS-1530 Standard First Aid	TS-1510 OHS	TS-1520 WHMIS
PF-1370 Rigging	PF-1571 Introduction to Electric Welding and Cutting	PF-1410 Copper Piping	PF-1380 Introduction to Fuel Brazing and Cutting
PF-1350 Blueprint 1 (Basic Residential)	PF-1360 Blueprint 2 (Advanced Residential/Light Commercial)	PF-2100 Blueprint 3 (Heavy Commercial/Industrial)	PF-2790 Advanced Rigging
PF-2330 Quality Assurance/Quality Control			
Drawings and Specifications			
PF-1350 Blueprint 1 (Basic Residential)	PF-1360 Blueprint 2 (Advanced Residential/Light Commercial)	PF-2100 Blueprint 3 (Heavy Commercial/Industrial)	PF-2780 Blueprint 4
PF-1550 Pipe Template Development			

Layout, Fabrication and Installation			
PF-1400 Steel Piping	PF-1410 Copper Piping	PF-1421 Plastic Piping	PF-1541 Low Pressure Steam
PF-1450 Hydronic Heating 1	PF-2121 Hydronic Heating 2	PF-2720 Specialty Steamfitting/Pipefitting Systems	PF-2770 Stainless Steel and Specialty Piping
PF-2711 Pipe and Tube Bending	PF-2701 Instrumentation		
Rigging and Hoisting			
PF-1370 Rigging	PF-2790 Advanced Rigging		
Steam System Installation			
PF-1541 Low Pressure Steam	PF-2750 High Pressure Steam		
Heating, Cooling and Process System Installation			
PF-1450 Hydronic Heating 1	PF-2121 Hydronic Heating 2	PF-2750 High Pressure Steam	PF-2720 Specialty Steamfitting/Pipefitting Systems
PF-2960 Hydraulic Systems	PF-2760 Refrigeration	PF-2150 Introduction to Gas Piping I (Low Pressure)	PF-2320 Introduction to Gas Piping 2 (High Pressure)
PF-2170 Medical Gas Systems	PF-2930 Compressed Air Systems		
Renewable Energy System Installation			
PF-2350 Renewable Energy Systems			

Testing and Commissioning			
PF-2800 Controlled Bolting, Testing and Commissioning			
Maintenance and Repair			
PF-1340 Tools and Equipment	PF-1440 Piping Valves	PF-1450 Hydronic Heating 1	PF-2121 Hydronic Heating 2
PF-2310 Cross Connection Control Devices	PF-2740 Valves		

B. NOA Comparison Chart

2010 Task and Sub-tasks		2011 POT	
Task 1 Performs Safety-Related Functions			
1.01	Maintains safe work environment	PF-1340	Tools and Equipment
		TS-1530	Standard First Aid
		TS-1510	OHS
		TS-1520	WHMIS
1.02	Uses personal protective equipment (PPE) and safety equipment.	PF-1340	Tools and Equipment
		TS-1530	Standard First Aid
		TS-1510	OHS
		TS-1520	WHMIS
Task 2 Uses and Maintains Tools and Equipment			
2.01	Uses ladders and work platforms	PF-1370	Rigging
2.02	Maintains tools and equipment	PF-1340	Tools and Equipment
2.03	Uses welding equipment	PF-1571	Introduction to Electric Welding and Cutting
2.04	Uses soldering and welding equipment	PF-1410	Copper Piping
2.05	Uses oxy-fuel equipment	PF-1380	Introduction to Fuel Brazing and Cutting
Task 3 Organizes Work			
3.01	Plans job	PF-1350	Blueprint 1 (Basic Residential)
		PF-1360	Blueprint 2 (Advanced Residential/Light Commercial)
		PF-1370	Rigging
		PF-2790	Advanced Rigging
3.02	Organizes material lists	PF-2100	Blueprint 3 (Heavy Commercial/Industrial)
3.03	Performs quality control functions	SP-2330	Quality Assurance/Quality Control

2010 Task and Sub-tasks		2011 POT	
Task 4 Interprets Drawings and Specifications			
4.01	Compares specifications to drawings	PF-1350	Blueprint 1 (Basic Residential)
		PF-1360	Blueprint 2 (Advanced Residential/Light Commercial)
		PF-2100	Blueprint 3 (Heavy Commercial/Industrial)
		PF-2780	Blueprint 4
4.02	Refers to types of drawings	PF-1350	Blueprint 1 (Basic Residential)
		PF-1360	Blueprint 2 (Advanced Residential/Light Commercial)
		PF-2100	Blueprint 3 (Heavy Commercial/Industrial)
		PF-2780	Blueprint 4
Task 5 Produces Drawings			
5.01	Generates drawings	PF-1550	Pipe Template Development
		PF-1350	Blueprint 1 (Basic Residential)
		PF-1360	Blueprint 2 (Advanced Residential/Light Commercial)
		PF-2100	Blueprint 3 (Heavy Commercial/Industrial)
		PF-2780	Blueprint 4
5.02	Develops templates	PF-1550	Pipe Template Development
Task 6 Performs Layout and Fabrication			
6.01	Lays out pipe and fittings	PF-1560	Pipe Layout & Fitting Fabrication
		PF-1400	Steel Piping
6.02	Fabricates piping spools	PF-1560	Pipe Layout & Fitting Fabrication
6.03	Fabricates brackets, supports, hangers, guides and hangers	PF-1560	Pipe Layout & Fitting Fabrication

2010 Task and Sub-tasks		2011 POT	
Task 7 Performs Common Installation Processes			
7.01	Installs piping system components and equipment	PF-1400	Steel Piping
		PF-1410	Copper Piping
		PF-1421	Plastic Piping
		PF-1541	Low Pressure Steam
		PF-1450	Hydronic Heating 1
		PF-2121	Hydronic Heating 2
		PF-2720	Specialty Steamfitting/Pipefitting Systems
		PF-2770	Stainless Steel and Specialty Piping
7.02	Installs brackets, supports, hangers, guides and hangers	PF-1400	Steel Piping
		PF-1410	Copper Piping
		PF-1421	Plastic Piping
		PF-1541	Low Pressure Steam
		PF-1450	Hydronic Heating 1
		PF-2121	Hydronic Heating 2
		PF-2720	Specialty Steamfitting/Pipefitting Systems
		PF-2770	Stainless Steel and Specialty Piping
Task 8 Installs Tracing Systems			
8.01	Installs steam tracing	PF-2711	Pipe and Tube Bending
		PF-2701	Instrumentation
8.02	Installs liquid-filled tracing systems	PF-2711	Pipe and Tube Bending
Task 9 Plans Lifts			
9.01	Determines load	PF-2790	Advanced Rigging
9.02	Selects rigging and hoisting equipment	PF-1370	Rigging
		PF-2790	Advanced Rigging
9.03	Prepares lift plan	PF-2790	Advanced Rigging

2010 Task and Sub-tasks		2011 POT	
Task 10 Hoists Load			
10.01	Conducts rigging and hoisting inspection	PF-1370	Rigging
		PF-2790	Advanced Rigging
10.02	Secures lift area	PF-1370	Rigging
		PF-2790	Advanced Rigging
10.03	Sets up rigging equipment	PF-1370	Rigging
		PF-2790	Advanced Rigging
10.04	Performs lift	PF-1370	Rigging
		PF-2790	Advanced Rigging
10.05	Stores equipment	PF-1370	Rigging
		PF-2790	Advanced Rigging
Task 11 Installs Low Pressure Process Steam Systems			
11.01	Installs equipment for low pressure steam	PF-1541	Low Pressure Steam
		PF-2750	High Pressure Steam
11.02	Installs piping for low pressure steam	PF-1541	Low Pressure Steam
		PF-2750	High Pressure Steam
Task 12 Installs High Pressure Process Steam Systems			
12.01	Installs equipment for high pressure steam	PF-2750	High Pressure Steam
12.02	Installs piping for high pressure steam	PF-2750	High Pressure Steam
Task 13 Installs Steam Heating Systems			
13.01	Installs equipment for steam heating systems	PF-1541	Low Pressure Steam
		PF-2750	High Pressure Steam
13.02	Installs piping for steam heating systems	PF-1541	Low Pressure Steam
		PF-2750	High Pressure Steam
Task 14 Installs Hydronic Systems			
14.01	Installs equipment for hydronic systems	PF-1450	Hydronic Heating 1
		PF-2121	Hydronic Heating 2
14.02	Installs piping for hydronic systems	PF-1450	Hydronic Heating 1
		PF-2121	Hydronic Heating 2

2010 Task and Sub-tasks		2011 POT	
Task 15 Installs Process Piping Systems			
15.01	Installs equipment for process piping systems	PF-2750	High Pressure Steam
		PF-2720	Specialty Steamfitting/Pipefitting Systems
15.02	Installs piping for process piping systems	PF-2750	High Pressure Steam
		PF-2720	Specialty Steamfitting/Pipefitting Systems
Task 16 Installs Hydraulic Systems			
16.01	Installs equipment for hydraulic systems	PF2960	Hydraulic Systems
16.02	Installs piping and tubing for hydraulic systems	PF2960	Hydraulic Systems
Task 17 Installs Refrigeration Systems			
17.01	Installs equipment for refrigeration systems	PF-2760	Refrigeration
17.02	Installs piping and tubing for refrigeration systems	PF-2760	Refrigeration
Task 18 Installs Fuel Systems			
18.01	Installs equipment for fuel systems	PF-2150	Introduction to Gas Piping I (Low Pressure)
		PF-2320	Introduction to Gas Piping 2 (High Pressure)
18.02	Installs piping fuel systems	PF-2150	Introduction to Gas Piping I (Low Pressure)
		PF-2320	Introduction to Gas Piping 2 (High Pressure)
Task 19 Installs Medical Gas Systems			
19.01	Installs equipment for medical gas systems	PF-2170	Medical Gas Systems
19.02	Installs piping and tubing for medical gas systems	PF-2170	Medical Gas Systems

2010 Task and Sub-tasks		2011 POT	
Task 20 Installs Compressed Air Systems			
20.01	Installs equipment for compressed air systems	PF2930	Compressed Air Systems
20.02	Installs piping and tubing for compressed air systems	PF2930	Compressed Air Systems
Task 21 Installs Geo-Thermal Systems			
21.01	Installs equipment for geo-thermal systems	PF2350	Renewable Energy Systems
21.02	Installs piping for geo-thermal systems	PF2350	Renewable Energy Systems
Task 22 Installs Solar Heating Systems			
22.01	Installs equipment for solar heating systems	PF2350	Renewable Energy Systems
22.02	Installs piping for solar heating systems	PF2350	Renewable Energy Systems
Task 23 Installs Heat Recovery Systems			
23.01	Installs equipment for heat recovery systems	PF2350	Renewable Energy Systems
23.02	Installs piping for heat recovery systems	PF2350	Renewable Energy Systems
Task 24 Prepares System For Test			
24.01	Pre-checks system for test	PF-2800	Controlled Bolting, Testing and Commissioning
24.02	Selects test equipment	PF-2800	Controlled Bolting, Testing and Commissioning
24.03	Isolates system	PF-2800	Controlled Bolting, Testing and Commissioning
24.04	Connects test equipment	PF-2800	Controlled Bolting, Testing and Commissioning
Task 25 Performs Test			
25.01	Secures test area	PF-2800	Controlled Bolting, Testing and Commissioning
25.02	Pressurizes system	PF-2800	Controlled Bolting, Testing and Commissioning
25.03	Inspects system	PF-2800	Controlled Bolting, Testing and Commissioning

2010 Task and Sub-tasks		2011 POT	
25.04	Corrects leaks	PF-2800	Controlled Bolting, Testing and Commissioning
25.05	Removes test equipment	PF-2800	Controlled Bolting, Testing and Commissioning
Task 26 Commissions System			
26.01	Flushes system	PF-2800	Controlled Bolting, Testing and Commissioning
26.02	Chemically treats system	PF-2800	Controlled Bolting, Testing and Commissioning
26.03	Participates in start-up procedure	PF-2800	Controlled Bolting, Testing and Commissioning
Task 27 Maintains Systems			
27.01	Follows lock-out procedure	PF-1440	Piping Valves
		PF-2900	Pumps
27.02	Performs preventative maintenance and service	PF-1450	Hydronic Heating 1
Task 28 Performs Repairs			
28.01	Diagnosis problems	PF-1340	Tools and Equipment
		PF-1440	Piping Valves
		PF-1450	Hydronic Heating 1
		PF-1541	Low Pressure Steam
		PF-2121	Hydronic Heating 2
		PF-2310	Cross Connection Control Devices
		PF-2740	Valves
28.02	Repairs piping and components	PF-1340	Tools and Equipment
		PF-1440	Piping Valves
		PF-1450	Hydronic Heating 1
		PF-1541	Low Pressure Steam
		PF-2121	Hydronic Heating 2
		PF-2310	Cross Connection Control Devices
		PF-2740	Valves

C. Program Structure

For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.

The order of course delivery within each block can be determined by the educational agency, as long as pre-requisite conditions are satisfied.

Upon completion of an entry level program, individuals may be required to complete other certifications (employer or job site specific) in order to gain employment.

Block I			
Course No.	Course Name	Hours	Pre-Requisite
TS1510	Occupational Health and Safety	6	None
TS1520	WHMIS	6	None
TS1530	Standard First Aid	14	None
PF1340	Tools and Equipment	75	None
PF1350	Blueprint 1(Basic Residential)	30	None
PF1360	Blueprint 2 (Advanced Residential/Light Commercial)	30	PF1350
PF1370	Rigging	39	None
PF1380	Introduction to Fuel Brazing and Cutting	45	PF1340
PF1390	Pipe and Tubing Fundamentals	15	PF1340
PF1400	Steel Piping	90	PF1340
PF1410	Copper Piping	45	PF1340
PF1421	Plastic Piping	43	PF1340
PF2110	Aluminum Piping	9	PF1340
PF1440	Piping Valves	30	None
PF1450	Hydronic Heating 1	60	PF1340

Block I			
Course No.	Course Name	Hours	Pre-Requisite
PF1541	Low Pressure Steam	96	PF1350; PF1360; PF1390; PF1400
PF1550	Pipe Template Development	75	PF1380; PF1390
PF1560	Pipe Layout & Fitting Fabrication	72	PF1380; PF1390
PF1571	Introduction to Electric Welding and Cutting	60	PF1340; PF1390
AP1101	Introduction to Apprenticeship	15	None
*AM1100	Math Essentials	30	None
AM11260	Pipe Trade Math Fundamentals	30	AM1100
CM2160	Communication Essentials	45	None
SD1760	Workplace Essentials	45	None
MC1060	Computer Essentials	15	None
Total Hours		1020	
Required Work Experience			

***A student who can meet the mathematics requirement through an ACUPLACER® test may be exempted from AM1100 - Math Essentials. Please check with your training institution.**

Block II			
Course No.	Course Name	Hours	Pre-Requisite
PF2100	Blueprint 3 (Heavy Commercial/Industrial)	30	Block I
PF2121	Hydronic Heating 2	54	Block I
PF2130	Introduction to Electricity	15	Block I
PF2150	Introduction to Gas Piping I (Low Pressure)	30	Block I
PF2161	Standpipe Systems	6	Block I
PF2170	Medical Gas Systems	21	Block I
PF2701	Instrumentation	30	Block I
PF2711	Pipe and Tube Bending	21	Block I
PF2720	Specialty Steamfitting/Pipefitting Systems	12	Block I
PF2350	Renewable Energy Systems	21	Block I
Total Hours		240	

Required Work Experience

Block III			
Course No.	Course Name	Hours	Pre-Requisite
PF2930	Compressed Air Systems	45	Block II
PF2960	Hydraulic Systems	45	Block II
PF2900	Pumps	45	Block II
PF2740	Valves	30	Block II
PF2750	High Pressure Steam	75	Block II
Total Hours		240	

Required Work Experience

Block IV			
Course No.	Course Name	Hours	Pre-Requisite
PF2310	Cross Connection Control Devices	45	Block III
PF2320	Introduction to Gas Piping 2 (High Pressure)	30	Block III
PF2760	Refrigeration	30	Block III
PF2770	Stainless Steel and Specialty Piping	27	Block III
PF2780	Blueprint 4	39	Block III
PF2790	Advanced Rigging	39	Block III
PF2800	Controlled Bolting, Testing and Commissioning	30	Block III
Total Hours		240	

Total Course Credit Hours	1740
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BLOCK I

TS1510 Occupational Health and Safety

Learning Outcomes:

- Demonstrate knowledge of interpreting the Occupational Health and Safety Act, laws and regulations.
- Demonstrate knowledge of understanding the designated responsibilities within the laws and regulations such as the right to refuse dangerous work; and the importance of reporting accidents.
- Demonstrate knowledge of how to prevent accidents and illnesses.
- Demonstrate knowledge of how to improve health and safety conditions in the workplace.

Duration: 6 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Interpret the Occupational Health and Safety Act laws and regulations.
 - i. explain the scope of the act
 - application of the act
 - Federal/Provincial jurisdictions
 - Canada Labour Code
 - rules and regulations
 - private home application
 - conformity of the Crown by the Act
2. Explain responsibilities under the Act and Regulations.
 - i. duties of employer, owner, contractors, sub-contractors, employees, and suppliers

3. Explain the purpose of joint health and safety committees.
 - i. formation of committee
 - ii. functions of committee
 - iii. legislated rights
 - iv. health and safety representation
 - v. reporting endangerment to health
 - vi. appropriate remedial action
 - vii. investigation of endangerment
 - viii. committee recommendation
 - ix. employer's responsibility in taking remedial action

4. Examine right to refuse dangerous work.
 - i. reasonable grounds for refusal
 - ii. reporting endangerment to health
 - iii. appropriate remedial action
 - iv. investigation of endangerment
 - v. committee recommendation
 - vi. employer's responsibility to take appropriate remedial action
 - vii. action taken when employee does not have reasonable grounds for refusing dangerous work
 - viii. employee's rights
 - ix. assigning another employee to perform duties
 - x. temporary reassignment of employee to perform other duties
 - xi. collective agreement influences
 - xii. wages and benefits

5. State examples of work situations where one might refuse work.

6. Describe discriminatory action.
 - i. definition
 - ii. filing a complaint procedure
 - iii. allocated period of time a complaint can be filed with the Commission
 - iv. duties of an arbitrator under the Labour Relations Act
 - v. order in writing inclusion
 - vi. report to commission Allocated period of time to request Arbitrator to deal with the matter of the request
 - vii. notice of application
 - viii. failure to comply with the terms of an order
 - ix. order filed in the court

7. Explain duties of commission officers.
 - i. powers and duties of officers
 - ii. procedure for examinations and inspections
 - iii. orders given by officers orally or in writing
 - iv. specifications of an order given by an officer to owner of the place of employment, employer, contractor, sub-contractor, employee, or supplier
 - v. service of an order
 - vi. prohibition of persons towards an officer in the exercise of his/her power or duties
 - vii. rescinding of an order
 - viii. posting a copy of the order
 - ix. illegal removal of an order

8. Interpret appeals of others.
 - i. allocated period of time for appeal of an order
 - ii. person who may appeal order
 - iii. action taken by Commission when person involved does not comply with the order
 - iv. enforcement of the order
 - v. notice of application
 - vi. rules of court

9. Explain the process for reporting of accidents.
 - i. application of act
 - ii. report procedure
 - iii. reporting notification of injury
 - iv. reporting accidental explosion or exposure
 - v. posting of act and regulations

Practical Requirements:

1. Conduct an interview with someone in your occupation on two or more aspects of the act and report results.

2. Conduct a safety inspection of shop area.

TS1520 Workplace Hazardous Materials Information System (WHMIS)

Learning Outcomes:

- Demonstrate knowledge of interpreting and applying the Workplace Hazardous Materials Information System (WHMIS) Regulation under the Occupational Health and Safety Act.

Duration: 6 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define WHMIS safety.
 - i. rational and key elements
 - ii. history and development of WHMIS
 - iii. WHMIS legislation
 - iv. WHMIS implementation program
 - v. definitions of legal and technical terms

2. Examine hazard identification and ingredient disclosure.
 - i. prohibited, restricted and controlled products
 - ii. classification and the application of WHMIS information requirements
 - iii. responsibilities for classification
 - the supplier
 - the employer
 - the worker - Classification: rules and criteria
 - information on classification
 - classes, divisions and subdivision in WHMIS
 - general rules for classification
 - class A - compressed gases
 - class B - flammable and combustible materials
 - class C - oxidizing material
 - class D - poisonous and infectious material
 - class E - corrosive material
 - class F - dangerously reactive material
 - iv. products excluded from the application of WHMIS legislation

- consumer products
 - explosives
 - cosmetics, drugs, foods and devices
 - pest control products
 - radioactive prescribed substances
 - wood or products made of wood
 - manufactured articles
 - tobacco or products of tobacco
 - hazardous wastes
 - products handled or transported pursuant to the Transportation of Dangerous Goods (TDG) Act
- v. comparison of classification systems - WHMIS and TDG
- vi. general comparison of classification categories
- vii. detailed comparison of classified criteria
3. Explain labeling and other forms of warning.
- i. definition of a WHMIS label
 - supplier label
 - workplace label
 - other means of identification
 - ii. responsibility for labels
 - supplier responsibility
 - employer responsibility
 - iii. worker responsibility
 - introduce label content, design and location
 - supplier labels
 - workplace labels
 - other means of identification
4. Introduce material safety data sheets (MSDS).
- i. definition of a material safety data sheet
 - ii. purpose of the data sheet
 - iii. responsibility for the production and availability of data sheets
 - supplier responsibility
 - employer responsibility
 - workers responsibility

Practical Requirements:

1. Locate WHMIS label and interpret the information displayed.
2. Locate a MSDS sheet for a product used in the workplace and determine what personal protective equipment and other precautions are required when handling this product.

TS1530 Standard First Aid

Learning Outcomes:

- Demonstrate knowledge of recognizing situations requiring emergency action.
- Demonstrate knowledge of making appropriate decisions concerning first aid.

Duration: 14 Hours

Pre-Requisite(s): None

Practical Requirements:

1. Complete a **St. John Ambulance or Canadian Red Cross** Standard First Aid Certificate course.

PF1340 Tools and Equipment

Learning Outcomes:

- Demonstrate knowledge of the care and safe use of tools and equipment.

Duration: 75 Hours

Pre-requisite(s): None

Objectives and Content:

1. Describe general safety requirements for using tools.
 - i. guarding, shielding when using tools
 - ii. body positioning
 - iii. pinch points
2. Describe the properties of metals used in hand and power tools.
 - i. tool steels for wrenches
 - ii. tool steels for saws and blades
3. Explain terminology associated with metals used in hand and power tools.
 - i. oxidation
 - ii. corrosion
 - iii. tensile strength
 - iv. shear strength
4. Identify types measuring tools and describe their purpose, applications, safe use and care.
 - i. tapes, rules, scale rules, straight edges
 - ii. calipers, micrometers, gauges
 - iii. plumb bobs, squares and levels
 - iv. torque wrench
 - v. scribes, markers, dividers and compasses

5. Identify types of hand tools and describe their purpose, applications, safe use and care.
 - i. punches, chisels, files and saws
 - ii. twist drills and drill bits
 - iii. hacksaws
 - iv. files
 - v. chisels
 - vi. hammers
 - vii. pliers
 - viii. pipe wrenches

6. Identify types of cutting, drilling and reaming tools and describe their applications and procedures for use.
 - i. snips and shears
 - ii. drills and reamers
 - iii. bolt cutters

7. Identify types of threading devices and describe their purpose, applications, safe use and care.
 - i. threading tools
 - ii. internal thread
 - iii. external thread
 - iv. tap and drill charts
 - v. bolt and pipe threads

8. Identify types of power tools and describe their purpose, applications, safe use and care.
 - i. portable power tools
 - ii. threading machines
 - iii. reaming tools
 - iv. core drill

9. Identify types of grinding tools and describe their purpose, applications, safe use and care.
 - i. portable and stationary grinders
 - ii. grinding and cutting wheels
 - iii. grinding discs

- iv. grinder dressers
 - v. rotary wire brushes
 - vi. specialty flapper wheels
 - vii. rotary files
10. Identify types of drills and their accessories and describe their purpose, applications, safe use and care.
- i. sizes and speed requirements
 - ii. power drilling equipment (hammer and portable drill)
 - iii. cutting fluids
 - iv. clamping devices
 - v. drill presses
 - vi. portable drills
 - vii. hot tap
11. Identify the tools used to cut metals and describe the procedures for their use.
- i. saws
 - ii. power operated saws
 - iii. friction cut-off equipment
 - iv. shears
 - v. metal cutting power tools
 - vi. abrasives and blades
12. Identify shop equipment and hydraulic tools and describe their purpose, applications, safe use and care.
- i. jacks
 - ii. shop cranes
 - iii. chain hoists
 - iv. solvent cleaning tanks
 - v. pullers, drivers and presses
 - vi. hydraulic benders
 - vii. pipe positioners
13. Identify types of power actuated tools and describe their applications.
- i. describe the procedures used to inspect, maintain and store power actuated tools

Practical Requirements:

1. Use and maintain gripping and turning tools, measuring devices and levels.
2. Use and maintain various types of hand tools.
3. Use and maintain various types of power tools.
4. Use and maintain various types of threading devices.
5. Use and maintain various types of grinding tools.
6. Use and maintain various types of power operated cutting tools.
7. Use and maintain various types of shop equipment.

PF1350 Blueprint 1 (Basic Residential)

Learning Outcomes:

- Interpret piping drawings in orthographic and isometric views for residential dwellings.
- Complete single line sketches from drawings and blueprints.
- Convert orthographic piping drawings to isometric drawings.
- Convert isometric piping drawings to orthographic drawings.
- Apply compass and elevations to pipe drawings.
- Produce simple orthographic sketches.

Duration: 30 Hours

Pre-requisite(s): None

Objectives and Content:

Fundamentals of Blueprint Reading

1. Describe types of drawings and sketches and their significance and use in the piping trades.
 - i. orthographic drawings (series of drawings make plan)
 - ii. isometric sketches
 - iii. single line sketches

2. Explain the importance of and procedures for proper care and handling of drawings.
 - i. plastic
 - ii. tape edges
 - iii. notes/changes
 - iv. filing/rolling
 - v. storage

3. Explain visualization and its' associated views.
 - i. vertical up/down
 - ii. horizontal side/side
 - iii. plan view
 - iv. elevation view
 - v. front, rear, left, right views

Architectural Drawing Symbols

4. Identify and interpret the common lines found on a residential blueprint.
 - i. center line
 - ii. hidden line
 - iii. cutting plane line
 - iv. break line
 - v. dimension line
 - vi. extension line
 - vii. object line
 - viii. leader line
5. Identify and interpret basic architectural symbols.
 - i. earth
 - ii. concrete
 - iii. block
 - iv. metal
 - v. structural steel
 - vi. wood
 - vii. gyproc over wood
 - viii. insulation
 - ix. windows, doors
6. Explain the terms “scale” and “dimension” and their use and location on drawings.
7. Identify and interpret the components of a sketch or drawing.
 - i. title block
 - ii. name
 - iii. address
 - iv. date
 - v. materials

- vi. system
- vii. view
- viii. measurements
- ix. orientation
- x. north
- xi. elevation orientation
- xii. legibility
- xiii. revisions

Sketches and Symbols

- 8. Identify basic plumbing symbols.
 - i. water closet
 - ii. lavatory
 - iii. bathtub
 - iv. shower
 - v. kitchen sink
 - vi. laundry tub
 - vii. hot water tank
 - viii. water meter

- 9. Identify basic piping system symbols.
 - i. piping
 - ii. fittings
 - iii. valves
 - iv. pumps
 - v. drains (roof and floor)

- 10. Identify single line sketch symbols.
 - i. fittings
 - ii. facing viewer
 - iii. facing away
 - iv. horizontal
 - v. changes in direction
 - vi. valves, unions, reducers

11. Identify and interpret isometric drawings.
 - i. vertical lines
 - ii. angles relating to horizontal
 - iii. 45 degree angle
 - iv. floor penetrations

12. Identify and interpret roughing-in dimensions for residential piping fixtures.
 - i. manufactures literature
 - ii. rough-in books
 - iii. building codes
 - iv. barrier free requirements

Practical Requirements:

1. Interpret and sketch basic drawings and diagrams.

PF1360 Blueprint 2 (Advanced Residential/Light Commercial)

Learning Outcomes:

- Interpret piping drawings in both orthographic and isometric views for advanced residential/commercial buildings.
- Complete single line sketches from advanced residential/commercial drawings and blueprints.
- Convert orthographic piping drawings to isometric drawings.
- Convert isometric piping drawings to orthographic drawings.
- Apply compass and elevations to advanced residential/commercial pipe drawings.
- Perform orthographic sketches for advanced residential/commercial installations.
- Interpret architectural drawings for advanced residential/commercial installations.

Duration: 30 Hours

Pre-requisite(s): PF1350

Objectives and Content:

Architectural Drawings And Symbols

1. Describe divisions, their content, relationship and numbering systems.
 - i. architectural
 - ii. mechanical
 - iii. electrical

2. Describe plans, their content and use in job planning.
 - i. plot (site)
 - ii. foundation
 - iii. floor plans
 - basement
 - first floor
 - second (subsequent) floor plans
 - iv. exterior elevations
 - v. sections, details

- vi. reflected ceiling drawings
 - vii. room finish schedules
3. Identify steps required in job planning.
- i. job requirements
 - ii. work schedule
 - iii. access to work location
 - iv. worksite inspection
 - v. equipment and piping
 - vi. materials list
4. Identify features found on architectural drawings and describe their use.
- i. grid lines
 - ii. exploded views
 - iii. sections
 - iv. details
 - v. finish schedule
 - vi. page references
 - vii. elevations
 - viii. architectural symbols
5. Explain the procedures used to determine accurate dimensions from a drawing, their purpose and importance.
- i. how measurements are indicated (engineer vs. architect)
 - ii. start and finish
 - iii. wall locations
 - iv. pipe penetrations
 - v. use of scaling
6. Describe the purpose and importance of specifications.

Sketches and Symbols

7. Identify plumbing symbols and interpret rough-in dimensions found on a set of commercial drawings.
- i. wall hung toilet
 - ii. wall hung lavatory
 - iii. wall hung urinal
 - iv. janitors sink
 - v. triple compartment sink

- vi. drinking fountain
 - vii. grease interceptor
 - viii. bidets
8. Identify commercial piping system symbols and explain their importance and use.
- i. piping
 - ii. building sewer
 - iii. building drain
 - iv. soil and waste stacks
 - v. fixture drains and branches
 - vi. venting
 - vii. domestic hot and cold
 - viii. re-circulation lines
 - ix. storm building drains and sewers
 - x. compressed air
 - xi. trap priming
 - xii. fittings
 - elbows
 - wye's
 - tees
 - cleanouts
 - reducers
 - unions
 - flanges
 - xiii. valves
 - ball
 - check
 - gate
 - globe
 - backwater
 - pressure reducing
 - trap primer
 - xiv. hangers and supports
 - xv. heating
 - piping
 - heating water supply
 - water return
 - anchors
 - guides

- xvi. heating equipment
 - boilers
 - oil tanks
 - radiation
 - exchangers
 - expansion tanks
 - thermometers
 - pressure gauges
 - auto air vents
 - flex connections/loops
 - xvii. heating valves
 - circuit setters
 - flow control
 - pressure relief
 - control
 - 3-way
9. Identify basic welding symbols and explain their use.
10. Identify and interpret interference drawings.
- i. mechanical
 - ii. electrical
 - iii. architectural
 - iv. structural
11. Identify and interpret rough-in dimensions for commercial piping fixtures.
- i. manufactures literature
 - ii. rough-in books
 - iii. building codes
 - iv. barrier free requirements
 - v. fixture carriers

Practical Requirements:

1. Read and interpret architectural, mechanical and electrical drawings.
2. Determine, sketch and apply dimensioning.
3. Read and interpret specifications.
4. Complete a material take-offs.

PF1370 Rigging

Learning Outcomes:

- Identify the limitations of equipment used for rigging.
- Demonstrate knowledge of safe operating procedures for slings, cables and cranes.
- Select rigging and lifting equipment using rigging charts and manuals as well as rule of thumb methods.

Duration: 39 Hours

Pre-requisite(s): None

Objectives and Content:

1. Identify the Occupational Health and Safety Regulations for rigging.
2. Describe responsibilities and liabilities in the use of rigging, lifting and hoisting equipment.
3. Identify types of fibre ropes and describe their care, inspection and related safety procedures.
 - i. types
 - natural fibre,
 - synthetic fibre
 - ii. considerations for selection and use
4. Describe kinds of knots, hitches and bends and their applications.
5. Explain angle considerations when using rigging.
 - i. rigging charts
 - ii. rule of thumb formulas
 - iii. compensation for angles in lifting of loads

6. Identify types of wire rope and accessories and describe their care, inspection and safety considerations for use.
 - i. construction
 - ii. clips and attachments
 - iii. slings and end rigging
 - iv. measurement
 - v. clamps and rigging
 - vi. splicing
 - vii. shackles and turnbuckles
7. Describe synthetic sling types, their characteristics, applications and limitations.
 - i. polyethylene slings
 - ii. polyester slings
 - iii. nylon slings
 - iv. mylar
 - v. kevlar
8. Describe chains and chain slings, their characteristics, applications and limitations.
9. Identify types of scaffolds and describe their characteristics and applications.
 - i. tube and clamp
 - ii. manufactured platforms and scaffolding
 - iii. suspended scaffolding
10. List safety rules for erecting and working on scaffolding.
 - i. kickplates
 - ii. braces
 - iii. ties
 - iv. planking
 - v. permits
 - vi. tagging
11. Describe special problems of rolling and suspended scaffolding and safety guidelines for their use.
12. Identify hydraulic lifts and describe their applications.
13. Identify types of ladders and describe their applications and safety factors to be considered.

14. Describe procedures prior to and during the movement of objects with rigging equipment.
15. Identify jacks and describe their applications and procedures for use.
16. Identify methods of communications.
 - i. hand signals
 - ii. two-way radios
17. Identify types of cranes used in rigging.
 - i. mobile
 - ii. boom truck
 - iii. overhead

Practical Requirements:

1. Assemble knots, bends and hitches.
2. Use various types of slings and related equipment.
3. Erect scaffolding and use as work platforms.
4. Use various types of ladders.
5. Set up rigging equipment to perform a safe lift.

PF1380 Introduction to Fuel Brazing and Cutting

Learning Outcomes:

- Use fuel cutting and brazing equipment.

Duration: 45 Hours

Pre-requisite(s): PF1340

Objectives and Content:

Safety and Equipment

1. Identify types of heating/cutting equipment and describe their applications and procedures for use.
 - i. air-propane equipment
 - ii. air-acetylene system
 - iii. oxy-acetylene system
 - iv. oxy-propane
 - v. accessories and related equipment
 - vi. lighting and adjusting operations
 - vii. shut down

2. Describe the possible hazards of using heating/cutting equipment and procedures.
 - i. burns
 - ii. fires
 - iii. explosions
 - iv. injuries
 - v. fumes

3. Describe safety practices for use in brazing and cutting operations.

clothing

 - i. location
 - ii. protective equipment
 - iii. work permits

4. Describe heating/cutting equipment and accessories, their components, purpose and characteristics.
 - i. cylinders
 - ii. gas
 - iii. regulators
 - iv. flashback arrestor
 - v. gauges
 - vi. hoses and connections
 - clamps,
 - y-connecters,
 - coupler-T
 - vii. fibre washers
 - viii. equipment wrench
 - ix. torches
 - x. mixer
 - xi. tips
 - xii. cutting attachment

5. Describe the use and care of oxygen cylinders.
 - i. characteristics of oxygen
 - ii. cylinder components and capacity
 - iii. storage and safety considerations
 - iv. individual cylinder
 - v. bulk packs

6. Describe the use and care of acetylene and propane cylinders.
 - i. characteristics of acetylene and propane
 - ii. cylinder components and capacity
 - iii. storage and safety considerations
 - iv. individual cylinder
 - v. bulk packs

7. Describe the types of cylinder trucks and lifting cages.

8. Describe the procedures for assembling, testing, lighting and shutting down heating/cutting equipment.

Brazing

9. Describe the principles of the brazing process and the differences between welding and brazing.
10. Describe fluxes, their applications and procedures for use.
 - i. soldering, brazing fluxes
 - ii. components and classifications of brazing fluxes
11. Describe the brazing process as applied to various metals.
12. Describe the flame adjustment for brazing various materials.
13. Describe the considerations, preparation, process and precautions used to produce various types of joints.
 - i. face feed brazed joints
 - ii. pre-inserted ring joints

Cutting

14. List metals that can be cut using oxy-fuel equipment.
15. Describe the various styles and designs of standard cutting torches.
16. Describe the various cutting tips, their care and maintenance.
 - i. sizes, styles and indexing
 - ii. accessories and tip cleaners
17. Describe the various types of cutting flames and procedures used for flame adjustment.
 - i. oxidizing
 - ii. carburizing
 - iii. neutral
18. Describe cutting procedures.
 - i. free hand
 - ii. straight edge
19. Describe common cutting faults, their causes and remedies.

Practical Requirements:

1. Set-up, test, use and shut down heating/cutting equipment.
2. Perform various types of cuts.
3. Perform various brazing processes.

PF1390 Pipe and Tubing Fundamentals

Learning Outcomes:

- Demonstrate knowledge of the types of piping systems and their characteristics.
- Demonstrate knowledge of the materials used in the construction and installation of pipe and piping systems.

Duration: 15 Hours

Pre-requisite(s): PF1340

Objectives and Content:

1. Identify types of pipe, tube, 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

2. Identify the types of piping and tubing systems.
 - i. potable/non-potable water supply
 - ii. sanitary drainage, waste and vent systems
 - iii. storm drainage systems
 - iv. heating systems
 - v. sprinkler systems
 - vi. gas systems (fuel, medical)
 - vi. process and power generating systems

3. Identify pipe and tubing sizes.
 - i. dimensions
 - ii. lengths
 - iii. wall thickness/schedule

4. Describe the terms ferrous and non-ferrous and their significance to the trade.

5. Describe the forces that act on piping systems.
 - i. thermal expansion and contraction
 - ii. weight
 - iii. electrolysis
 - iv. friction loss
 - v. turbulence
 - vi. galvanic action
 - vii. environmental

6. Describe the types of sealants used in the trade and their applications.
 - i. thread compounds
 - ii. gaskets
 - iii. packing
 - iv. cements/glue

Practical Requirements:

None

PF1400 Steel Piping

Learning Outcomes:

- Select materials.
- Demonstrate knowledge of steel pipe and fittings and their assembly.
- Carry out work in compliance with codes, standards and manufacturer's literature.

Duration: 90 Hours

Pre-requisite(s): PF1340

Objectives and Content:

1. List the properties and applications of steel pipe and fittings.
2. Identify ferrous piping systems.
 - i. heating systems
 - ii. cooling systems
 - iii. drainage, waste and vent systems
 - iv. compressed air systems
 - v. fuel oil/gas systems
 - vi. steam, humidification systems
 - vii. industrial, marine, food processing
3. List the types of ferrous piping, their characteristics and applications.
 - i. steel
 - ii. galvanized
 - iii. stainless
 - iv. cast iron
4. List the information required to select and order steel pipe.
 - i. material (steel, galvanized, stainless)
 - ii. size (diameter, length, standard lengths)
 - iii. schedule (wall thickness, grade)
 - iv. characteristics (welded, seamless)
 - v. end finishes (plain end, thread, grooved, beveled)

5. Identify the tools and methods used for cutting steel, galvanized and stainless steel pipe.
 - i. pipe cutters, reamers
 - ii. cut-off saw
 - iii. oxy-acetylene pipe beveller
 - iv. plasma arc cutter
 - v. angle grinder
 - vi. carbon arc cutter

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

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

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

9. Identify and describe the tools and procedures used to hang and support steel pipe and fittings.
 - i. code
 - ii. specifications
 - iii. grade
 - iv. components
 - v. fire stopping systems

10. Describe an angle and its parts.
 - i. vertex
 - ii. degrees
 - iii. letters

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

12. Describe pipe measurement terms and their use.
 - i. end to end
 - ii. end to centre
 - iii. centre to centre
 - iv. back to back
 - v. centre to back
 - vi. centre to throat
 - vii. face to face
 - viii. overall

13. Calculate the perimeter and areas of:
 - i. squares
 - ii. rectangles
 - iii. triangles
 - iv. circles

14. Calculate the volume of:
 - i. cubes
 - ii. rectangular prisms and cylinders

15. Explain the Metric and Imperial systems and its use in the building trades.
 - i. length
 - ii. area
 - iii. volume
 - iv. temperature
 - v. pressure
 - vi. mass

16. Calculate piping measurements.
 - i. run and branch
 - ii. fitting allowance
 - iii. center
 - iv. face
 - v. back
 - vi. throat

17. Calculate piping measurements with various degree fittings.
 - i. diagonal
 - ii. offset
 - iii. travel
 - iv. rise and run
 - v. factors

18. Perform piping calculations using:
 - i. grade
 - ii. drop
 - iii. rise and run

19. Identify and describe methods of pipe bending.
 - i. calculations
 - ii. bend locations
 - iii. determine gain
 - iv. determine length of bend
 - v. determine angle

Practical Requirements:

1. Measure, cut and prepare various types of ferrous pipe.
2. Assemble various types of ferrous pipe by the following methods.
 - i. thread
 - ii. groove
 - iii. bevel
 - iv. flange
 - v. tack-weld
 - vi. mechanical
3. Bend steel pipe using hydraulic benders.
4. Perform various types of pressure testing

PF1410 Copper Piping

Learning Outcomes:

- Select materials.
- Demonstrate knowledge of non-ferrous pipe/tubing and its assembly.
- Carry out work in compliance with codes, standards and manufacturer's literature.

Duration: 45 Hours

Pre-requisite(s): PF1340

Objectives and Content:

1. Describe the properties and applications of copper pipe and fittings, and describe the methods and colors used to identify the following associated systems:
 - i. underground water service
 - ii. domestic hot and cold water systems
 - iii. drainage, waste and vent systems
 - iv. hot water heating systems
 - v. medical gas systems
 - vi. refrigeration systems
 - vii. compressed air

2. Identify the systems and criteria used in referencing, selecting and ordering copper tube and tubing.
 - i. size
 - ii. I.D./O.D. dimension standards
 - iii. length
 - iv. type
 - heating (H)
 - K
 - L
 - M
 - drainage, waste and vent (DWV)
 - Medical Gas
 - air conditioning and refrigeration (ACR)

- gas (G)
 - general purpose (GP)
 - v. color coding (white, green, blue, red, yellow)
- 3. Describe the tools and procedures used to cut and prepare copper pipe.
 - i. tube cutter
 - ii. reamer
 - iii. cut off saw
 - iv. chop saw
 - v. hacksaw
- 4. Describe the tools and procedures used to join copper pipe.
 - i. solder/braze
 - ii. compression
 - iii. grooved
 - iv. swaged
 - v. flared
 - vi. press fit
 - vii. crimped
- 5. Describe the tools and procedures used for soldering, bending and annealing copper pipe and fittings.
- 6. Identify fittings used for joining copper pipe and describe their characteristics and applications.
 - i. terminology
 - ii. types
 - iii. parts
 - iv. acronyms and abbreviations
- 7. Identify and describe the tools and procedures used to hang, support and fasten copper pipe and fittings.
 - i. codes
 - ii. specifications
 - iii. grade
 - iv. components
 - v. fire stopping systems

8. Describe the procedures used to calculate fitting allowances.
 - i. tees
 - ii. elbows
 - iii. 45 degrees
9. Identify brass pipe and fittings and describe their properties and applications.
10. Describe methods used to cut and prepare brass pipe and their associated procedures.

Practical Requirements:

1. Measure, cut and prepare various types of copper pipe.
2. Assemble various types of copper pipe and tubing by the following methods.
 - i. solder
 - ii. braze
 - iii. compression
 - iv. swaged
 - v. grooved
 - vi. flaring
3. Bend copper tubing using tube benders.
4. Perform various types of pressure testing.

PF1421 Plastic Piping

Learning Outcomes:

- Select materials.
- Demonstrate knowledge of plastic pipe and fittings and their assembly.
- Carry out work in compliance with codes, standards and manufacturer's literature.

Duration: 43 Hours

Pre-requisite(s): PF1340

Objectives and Content:

1. Identify types of plastics and describe their characteristics and applications.
 - i. thermoplastics
 - ii. thermosetting plastics
2. Identify the types of plastic piping, their properties and applications.
 - i. ABS (Acrylonitrile-Butadiene-Styrene)
 - ii. CPVC (Chlorinated Polyvinyl Chloride)
 - iii. PE (Polyethylene)
 - iv. PP (Polypropylene)
 - v. PVC (Polyvinyl Chloride)
 - vi. PEX (Cross-linked Polyethylene)
 - with/without oxygen barrier
 - vii. PTFE (Teflon)
 - viii. PEX/Aluminum/PEX
3. Describe the labelling system used to identify plastic pipe and fittings.
4. Identify tools used to cut and prepare plastic pipe and describe the procedures for their use.
 - i. tube cutter
 - ii. file
 - iii. chop saw

- iv. hacksaw
 - v. handsaw
 - vi. tube coiler
 - vii. deburring tool
5. Describe methods used to join plastic pipe and describe their associated procedures.
- i. solvent weld
 - ii. fusion weld
 - iii. plastic welding
 - iv. thread
 - v. compression
 - vi. flare
 - vii. mechanical joint
 - viii. insert
 - ix. crimp
6. Identify types of fittings used for joining the various types of plastic pipe and describe their characteristics and applications.
- i. terminology
 - ii. types
 - iii. parts
 - iv. acronyms and abbreviations
7. Identify and describe the tools and procedures used to hang, support and fasten plastic pipe and fittings.
- i. codes
 - ii. specifications
 - iii. grade
 - iv. components
 - v. fire stopping systems
8. Describe the procedures used to calculate fitting allowances.
- i. tees
 - ii. elbows
 - iii. 45 degrees

Practical Requirements:

1. Measure, cut and prepare various types of plastic pipe.
2. Assemble various types of plastic pipe by the following methods.
 - i. solvent weld
 - ii. thread
 - iii. compression
 - iv. mechanical joint
 - v. insert
 - vi. crimp

PF2110 Aluminum Piping

Learning Outcomes:

- Demonstrate knowledge of aluminum pipe and tubing.

Duration: 9 Hours

Pre-requisite(s): PF1340

Objectives and Content:

1. Describe the properties and applications of aluminum pipe and tubing.

Practical Requirements:

None

PF1440 Piping Valves

Learning Outcomes:

- Demonstrate knowledge of piping valves and their installation.

Duration: 30 Hours

Pre-requisite(s): None

Objectives and Content:

1. Describe the materials and service ratings for valves.
2. Explain valve terminology.
3. Identify the principle types of valves and describe their purpose, design, components, operation and applications.
 - i. gate
 - ii. globe
 - iii. ball/plug
 - iv. butterfly (gear or lever)
 - v. check
 - vi. temperature / pressure relief
 - vii. pressure reducing
 - viii. float operated
 - ix. diaphragm
 - x. mixing
 - xi. pop safety valve
4. Describe procedures used to install valves.
 - i. position
 - ii. location
 - iii. accessibility
 - iv. joining methods

5. Describe the types, construction and operation of control valves.
 - i. two-way
 - ii. three-way
 - iii. actuated

6. Describe the care and maintenance of valves.
 - i. disassembly/reassembly
 - ii. replacement of parts
 - iii. re-packing
 - iv. tools

Practical Requirements:

1. Install various types of valves.

PF1450 Hydronic Heating 1

Learning Outcomes:

- Demonstrate knowledge of the operation of hot water boilers and heating systems, their component parts and control systems.

Duration: 60 Hours

Pre-requisite(s): PF1340

Objectives and Content:

1. Define terminology associated with hydronic heating.
2. Identify sources of heat used in hydronic systems.
 - i. oil
 - ii. gas
 - iii. geothermal
 - iv. solar
3. Identify types of heating systems, their components and operation
 - i. one pipe
 - ii. directional flow (monoflo)
 - iii. series loop
 - iv. two pipe
 - v. direct
 - vi. reverse return
 - vii. primary loop
 - viii. secondary circuit
 - ix. gravity systems

Boiler and Components

4. Describe boiler components and their purpose.
 - i. burner
 - ii. wiring
 - iii. tridicator
 - iv. aquastat
 - v. relief valve
 - vi. boiler water feed valve
 - vii. boiler fittings
 - viii. boiler drain
 - ix. tank fittings and valves
 - x. airtrol system
 - xi. air venting
 - xii. backflow prevention device

5. Describe expansion tanks and air control devices and procedures for their installation.
 - i. air control
 - automatic
 - manual
 - ii. tanks
 - diaphragm
 - compression

6. Describe the procedures used to remove air from hydronic systems.

7. Describe circulating pumps, their components and operation.
 - i. circulating pumps
 - ii. low head pumps

8. Describe equipment used for erecting boilers.
 - i. dog and clamps
 - ii. tie rods
 - iii. corrugated expansion washers
 - iv. rigging equipment

9. Describe the construction of modern package boilers.
 - i. components
 - ii. section assemblies
 - iii. top clean out openings
 - iv. integral flue gas collector and smoke collar
 - v. tank-less water heaters

10. Describe procedures used to install packaged boilers.
 - i. general erection instructions
 - ii. boiler foundations
 - iii. codes and regulations

Piping

11. Describe zone valves, their purpose and operation.
 - i. electric motor
 - ii. orifice seat sizes
 - iii. end switch
 - iv. thermostats
 - v. three-way valves

12. Describe piping arrangements used with heating systems.
 - i. piping layout and system components
 - ii. piping systems
 - iii. types and rating of heat distributing units

13. Describe the factors that affect pipe sizing and piping arrangement.
 - i. equivalent direct radiation
 - ii. piping systems
 - iii. changes in pipe size
 - iv. heat loss calculations

14. Describe zone control systems, their types, characteristics and operation.

15. Describe thermostats, their characteristics and controls.
 - i. differential
 - ii. adjustment
 - iii. sensitivity
 - iv. classification
 - v. installation procedures

16. Describe feedwater treatment systems and additives.
 - i. chemicals used in boiler feedwater
 - ii. methl hydrate
 - iii. glycol

17. Identify and interpret codes and regulations pertaining to the installation of piping systems.

Heat Transfer

18. Describe methods of heat transfer.
 - i. radiation
 - ii. conduction
 - iii. convection

19. Identify types of heat transfer equipment and describe their characteristics, piping arrangements and installation procedures.
 - i. heating units
 - ii. radiators
 - iii. baseboard heating
 - iv. wall fin
 - v. convectors
 - vi. pipe coils
 - vii. unit heaters horizontal and vertical unit heaters

Radiant Floor Heating

20. Describe the principles and operating characteristics of radiant floor heating.

21. Describe types of tubing used for radiant in-floor hydronic systems.
 - i. polymer piping materials
 - ii. PEX tubing
 - iii. rubber-based tubing
 - iv. steel
 - v. copper

22. Identify types of mixing components and describe their operation and applications.
 - i. three-port valves
 - ii. four-port valves
 - iii. thermostatic valves
 - iv. motorized-actuated valves
 - v. injection pump

23. Describe slab-on-grade in-floor heating, preparation and installation procedures.
 - i. tie spacing
 - ii. wire mesh
 - iii. plastic tracks
 - iv. spacing tubing
 - v. tubing depth
 - vi. insulation
 - vii. installation procedure
 - viii. floor preparation

24. Identify requirements for manifold stations and tubing installations.
 - i. mark out on plan
 - ii. studded wall cavities
 - iii. use of template block
 - iv. centers on block
 - v. plastic bed supports
 - vi. label circuits
 - vii. pressure test
 - viii. control joints

Practical Requirements:

1. Install hydronic heating boiler and trim.
2. Install maintain and repair various types of hydronic heating systems.
 - i. series loop
 - ii. direct return
 - iii. reverse return
 - iv. primary loop
 - v. secondary circuit
 - vi. in-floor

PF1541 Low Pressure Steam

Learning Outcomes:

- Sketch and label low pressure steam heating systems.
- Demonstrate knowledge of safety controls and equipment.
- Select steam traps for specific steam applications.
- Demonstrate knowledge of the piping system operation for steam to hot water converters.
- Interpret drawings for steam tracing lines and installation requirements.
- Demonstrate knowledge of installation procedures for oil burner piping and components.

Duration: 96 Hours

Pre-requisite(s): PF1350; PF1360; PF1390; PF1400

Objectives and Content:

1. Describe the characteristics and applications of steam heating systems.
 - i. heat energy
 - ii. sensible heat
 - iii. latent heat

2. Identify low pressure steam heating systems and describe their components and operating principles.
 - i. one-pipe gravity
 - components
 - boiler connections
 - main steam supply line
 - hartford loop
 - equalizer connection
 - convector connection
 - boiler piping
 - system piping
 - ii. vapour steam heating
 - theory of operation

- boiler connections
 - boiler return trap
 - air eliminator
 - boiler piping
 - system piping
 - thermostatic trap
 - condensate pump piping
 - iii. vacuum steam heating
 - theory of operation
 - system piping
 - lift fitting
 - vacuum pump
 - boiler piping
 - equalizer
 - hartford loop
 - thermostatic trap
 - iv. sub-atmospheric steam heating
 - theory of operation
 - system piping
 - differential pump
 - control valve
 - heat balancer
 - control panel
 - traps
 - boiler piping
- 3. Identify and explain the operating principles and applications of controls and equipment for steam boiler safety.
 - i. safety valves
 - characteristics
 - operating features
 - code regulations
 - testing procedures
 - ii. pressure reducing valves
 - applications
 - characteristics
 - operating principles
 - iii. steam pressure gauges
 - siphon operation
 - bourdon tube

- code regulations
 - gauge fittings
 - iv. glass water column
 - tubular water gauges
 - gauge cocks
 - testing and maintenance
 - v. fusible plugs
 - characteristics
 - design
 - applications
 - vi. manifold relief valves
 - characteristics
 - applications
 - installation considerations
 - vii. boiler stop valves
 - characteristics
 - applications
 - installation considerations
 - viii. blow-off valves
 - characteristics
 - applications
 - ix. low water cut-offs
 - types
 - characteristics
 - operating principles
 - applications
 - x. pressure control
 - types
 - characteristics
 - operating principles
 - applications
 - code requirements
4. Identify the types of traps used in low pressure steam heating systems, and describe their characteristics and applications.
- i. mechanical
 - ii. thermostatic
 - iii. thermodynamic

5. Identify types of steam traps and describe their characteristics, applications and maintenance.
 - i. inverted bucket
 - ii. ball float
 - iii. tilting bucket
 - iv. float and thermostatic
 - v. fixed orifice
 - vi. adjustable orifice
 - vii. thermodynamic
 - viii. thermostatic
 - ix. liquid expansion thermostatic

6. Describe the equipment and piping requirements for supplying steam to heat transfer equipment to supply hot water convectors.
 - i. shell and shell-tube heat exchanger
 - fluid flow arrangement
 - applications
 - piping installation
 - ii. indirect water heater
 - applications
 - piping installation
 - iii. heat exchanger
 - applications
 - piping installation
 - maintenance procedures

7. Troubleshoot potential problems with low pressure steam systems and identify solutions.

Practical Requirements:

1. Install trim and related equipment on a low pressure steam boiler.
2. Install a low pressure steam piping system.

PF1550 Pipe Template Development

Learning Outcomes:

- Use drawing procedures and tools to divide lines and circles.
- Demonstrate knowledge of template development.
- Demonstrate knowledge of procedures used to perform layout for the fabrication of pipe fittings to acceptable tolerances.

Duration: 75 Hours

Pre-requisite(s): PF1380; PF1390

Objectives and Content:

1. Explain the procedures for the development of pipe templates.
2. Lay out templates for 2, 3 and 4 piece mitre turns.
3. Lay out and develop a template for reducing tee-branch
4. Lay out and develop a template for full size laterals.
5. Lay out and develop a template for reducing tee.
6. Explain the procedures for parallel line development of pipe templates.
 - i. dividing a line into equal parts
 - ii. constructing angles
 - 20 degrees
 - 22.5 degrees
 - 45 degrees
 - 60 degrees
 - 90 degrees
 - iii. dividing an arc into equal parts

Practical Requirements:

1. Lay out templates for 2, 3 and 4 piece mitre turns.
2. Lay out and develop a template for full size laterals.
3. Lay out and develop a template for reducing tee.

PF1560 Pipe Layout and Fitting Fabrication

Learning Outcomes:

- Demonstrate knowledge of procedures used to layout elbows
- Demonstrate knowledge of procedures used to layout tees, laterals and mitre turns using templates.
- Demonstrate knowledge of procedures used to fabricate tees, laterals and mitre turns.
- Demonstrate knowledge of procedures used to machine pipes.
- Demonstrate knowledge of procedures used to fasten pipe.

Duration: 72 Hours

Pre-requisite(s): PF1380; PF1390

Objectives and Content:

Pipe Layout

1. Explain pipe fitting terminology as it relates to fabrication.
 - i. angle of turn
 - ii. pipe spool
 - iii. angle of cut
 - iv. factor for angle of cut
 - v. cutback
 - vi. outside diameter pipe
 - vii. length and number of cut pieces
2. Identify and explain the use of specialty tools for layout and fabrication of pipe fittings.
 - i. wrap-around and contour markers and accessories
 - ii. squares
 - iii. flange aligner base
 - iv. pipe flange aligners
 - v. circle-ellipse projector
 - vi. center finder

- vii. radius markers
 - viii. magnetic holder
 - ix. multi-trammel heads
 - x. universal level
 - xi. electronic level
 - xii. pro-mag level
 - xiii. dial-angle flange level
 - xiv. fitter protractor
 - xv. pipe beveler
 - xvi. burning square (circle cutter)
 - xvii. magnetic burning guide
3. Describe layout procedures for pipe fitting fabrication.
- i. using templates
 - ii. direct layout
4. Describe the layout procedures for elbows using contour marker.
5. Describe the layout procedure for tees, crosses, and wyes using contour marker.
6. Describe the layout procedure for a 60 degree turn using a 90 degree stock elbow.

Pipe and Fitting Fabrication

7. Describe pipe fitting fabrication procedures.
- i. cutting and preparing pipe
 - ii. alignment of joints
 - iii. tacking joints
 - iv. transition schedule 80 to sch 40
 - v. reducing lateral
8. Describe equipment required for machining of pipe ends for welding operations.
- i. outside diameter mounted machining equipment types (clamshell)
 - ii. inside diameter mounted machining equipment types
 - iii. tool bits
 - iv. cutting equipment

9. Describe different types of power supplies used and their applications.
 - i. hydraulic pumps
 - ii. air
 - iii. electrical

10. Describe setup of equipment for square cuts and proper end finishes.
 - i. standard 37 ½ degree bevel
 - ii. compound 10 degree / 37 ½ degree bevel
 - iii. “J” bevel

11. Describe proper cleaning, maintenance and storage of equipment used for machining.

Practical Requirements:

1. Layout odd angle using stock 90 degree elbow.

2. Perform pipe layout and fabrication.

3. Fabricate fittings from carbon steel pipe.

4. Transition pipe.

PF1571 Introduction to Electric Welding and Cutting

Learning Outcomes:

- Demonstrate knowledge of electrically operated welding and cutting equipment and associated safety procedures.

Duration: 60 Hours

Pre-requisite(s): PF1340; PF1390

Objectives and Content:

1. Explain the terminology associated with electric welding methods.
2. Describe types of welding and their applications.
 - i. GMAW (MIG)
 - ii. GTAW (TIG)
 - iii. SMAW
 - iv. Fluxcore
 - v. SUB ARC
 - vi. Orbital welding
3. Explain the safe handling requirements used when handling shielding gas cylinders.
 - i. transportation
 - ii. storage
 - iii. bulkpacks
4. Describe electric welding equipment, its operating principles and components.
 - i. AC transformers
 - ii. AC/DC rectifiers
 - iii. DC generators
 - iv. engine drive (gasoline, diesel) sources
5. Describe the basic classifications and applications of electrodes.

6. Describe procedures used to prepare for electric welding operations.
 - i. electrode selection
 - ii. current
 - iii. polarity settings
 - iv. special applications
7. Describe the five basic weld joint configurations.
8. Describe the safety procedures required in electric welding processes.
9. Explain stress relief of piping materials.
 - i. arc strikes and their effects
 - ii. grain structure of piping materials before and after welding
 - iii. methods used to normalize materials after welding
 - iv. preheat/postheat of materials.

Practical Requirements:

1. Set up welding equipment
2. Weld basic joint configurations using various electrodes.

AP1101 Introduction to Apprenticeship

Learning Outcomes:

- Demonstrate knowledge of how to become a registered apprentice.
- Demonstrate knowledge of the steps to complete an apprenticeship program.
- Demonstrate knowledge of various stakeholders in the apprenticeship process.
- Demonstrate knowledge of the Red Seal Program.

Duration: 15 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define the following terms:
 - i. apprenticeship
 - ii. apprentice vs. registered apprentice
 - iii. Journeyperson vs. Certified Journeyperson
 - iv. Certificate of Apprenticeship
 - v. Certificate of Qualification
 - vi. Recognition of Prior Learning
 - vii. dual certification

2. Explain the apprenticeship system in Newfoundland and Labrador and the roles and responsibilities of those involved.
 - i. registered apprentice
 - ii. training institution
 - iii. employer
 - iv. Journeyperson
 - v. Department of Advanced Education and Skills
 - Industrial Training Section
 - Standards and Curriculum Section
 - vi. Provincial Trade Advisory Committees
 - vii. Provincial Apprenticeship and Certification Board

3. Identify the Conditions Governing Apprenticeship.
4. Describe the training and educational requirements.
 - i. pre-employment (entry level) training
 - ii. block release
 - iii. on-the-job
5. Explain the steps in the registered apprenticeship process.
 - i. criteria for eligibility
 - entrance requirements as per Conditions of Apprenticeship
 - employment
 - ii. registration process
 - application requirements
 - iii. Memorandum of Understanding
 - probation period
 - cancellation
 - iv. Record of Occupational Progress (Logbook)
 - signing off skills
 - recording hours
 - updating PDO on progress
 - v. class calls
 - schedule
 - EI Eligibility
 - Direct Entry
 - advanced level
 - vi. Block Exams
 - vii. progression
 - schedule
 - wage rates
 - viii. cancellation of apprenticeship
 - ix. Practical Examinations
 - x. Provincial and Interprovincial examinations
 - xi. certification
 - Certification of Apprenticeship
 - Certification of Qualification
 - Provincial certification
 - Interprovincial Red Seal endorsement

6. Explain the Interprovincial Standards Red Seal Program.
 - i. designated Red Seal trade
 - ii. the National Occupational Analysis (NOA)
 - iii. Interprovincial (IP) Red Seal Endorsement Examination
 - iv. relationship of NOA to IP Examination
 - v. qualification recognition and mobility
7. Identify the current financial incentives available to apprentices.
8. Explain the NL apprenticeship and trades certification division's out-of- province apprenticeship policy.

Practical Requirements:

1. Use the Provincial Apprenticeship and Trades Certification web site at www.gov.nl.ca/app to:
 - i. locate, download, and complete the Application for Apprenticeship and Memorandum of Understanding (MOU)
 - ii. locate, download, and complete the Out of Province registration forms
 - Application for Apprenticeship (out of province)
 - Letter of Understanding (LOU)
 - Acceptance of Conditions Letter
 - iii. locate, download, and complete the Work Experience Credits form
 - iv. identify the locations of all Industrial Training offices
 - v. locate and review the following learning resources relevant to the trade:
 - Study Guide
 - Exam Preparation Guide
 - Plan of Training
2. Use a logbook for this trade to:
 - i. identify the hours for the trade (in-school and on-the-job)
 - ii. identify the number of blocks
 - iii. identify the courses in each block
 - iv. identify the workplace skills to be completed and verified

3. Use the Red Seal Web site, <http://www.red-seal.ca> to retrieve the National Occupational Analyses (NOA) for this trade.
 - i. identify the following components of the NOA:
 - Trends
 - Scope
 - Key Competencies
 - Blocks
 - Tasks
 - Subtasks
 - Pie Charts
 - Table of Specifications

AM1100 Math Essentials

Note: It is recommended that AM1100 be delivered in the first semester of the Entry Level training program.

Learning Outcomes:

- Demonstrate knowledge of the numeracy skills required to begin the 2nd level math course.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Demonstrate knowledge of mathematical principles in trade problem solving situations.
- Demonstrate the ability to solve simple mathematical word problems.

Duration: 30 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor should use trade specific examples to reinforce the course objectives

1. Use multiplication tables from memory.
2. Perform whole number operations.
 - i. read, write, count, round off, add, subtract, multiply and divide whole numbers
3. Apply the order of operations in math problems.
4. Perform fraction and mixed number operations.
 - i. read, write, add, subtract, multiply and divide fractions

5. Perform decimal operations.
 - i. read, write, round off, add, subtract, multiply and divide decimals
6. Perform percent/decimal/fraction conversion and comparison.
 - i. convert between fractions, decimals and percents
7. Perform percentage operations.
 - i. read and write percentages
 - ii. calculate base, rates and percentages
8. Perform ratio and proportion operations.
 - i. use a ratio comparing two quantities with the same units
 - ii. use a proportion comparing two ratios
9. Use the imperial measurement system in math problems.
 - i. identify units of measurement for:
 - length
 - mass
 - area
 - volume
 - capacity
10. Use the metric measurement system in math problems.
 - i. identify units of measurement for:
 - length
 - mass
 - area
 - volume
 - capacity

Practical Requirements:

1. To emphasize or further develop specific knowledge objectives, students will be asked to complete practical demonstrations which confirm proper application of mathematical theory to job skills.

AM1260 Pipe Trade Math Fundamentals

Learning Outcomes:

- Demonstrate knowledge of mathematical concepts in the performance of trade practices.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Demonstrate knowledge of solving mathematical word problems.
- Demonstrate knowledge of mathematical principles for the purposes of problem solving, job and materials estimation, measurement, calculation, system conversion, diagram interpretation and scale conversions, formulae calculations, and geometric applications.

Duration: 30 Hours

Pre-Requisite(s): AM1100

Objectives and Content:

The instructor is required to use trade specific examples to reinforce the course objectives.

1. Employ percent/decimal/fraction conversion and comparison in trade specific situations.
2. Apply ratios and proportions to trade specific problems.
3. Use the Imperial Measurement system in trade specific applications.
4. Use the Metric Measurement system in trade specific applications.
5. Complete Imperial/Metric conversions in trade specific situations.
 - i. convert between imperial and metric measurements
 - ii. convert to another unit within the same measurement system

6. Manipulate formulas using cross multiplication, dividing throughout, elimination, and substitution to solve trade specific problems, such as:
 - i. right angle triangles
 - ii. area
 - iii. volume
 - iv. perimeter

7. Perform calculations involving geometry that are relevant to the trade, such as:
 - i. angle calculations
 - ii. circle calculations

8. Use practical math skills to complete administrative trade tasks.
 - i. material estimation
 - ii. material costing
 - iii. time & labour estimates
 - iv. taxes & surcharges
 - v. markup & projecting revenue

Practical Requirements:

1. To emphasize or further develop specific knowledge objectives, students will be asked to complete practical demonstrations which confirm proper application of mathematical theory to job skills.

Note:

This course has been designated as NON-TRANSFERABLE to other trades programs, and NOT ELIGIBLE FOR PRIOR LEARNING ASSESSMENT. Students completing training in this trade program are required to complete this math course.

CM2160 Communication Essentials

Learning Outcomes:

- Demonstrate knowledge of the importance of well-developed writing skills in the workplace and in career development.
- Demonstrate knowledge of the purpose of various types of workplace correspondence.
- Demonstrate knowledge of the principles of effective workplace writing.
- Demonstrate knowledge of standard formats for letters and memos.
- Demonstrate knowledge of principles related to writing effective letters and memos.
- Demonstrate the ability to prepare and deliver an oral presentation.
- Demonstrate knowledge of the importance of effective interpersonal skills in the workplace.

Duration: 45 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Identify the principles for writing clear, concise, complete sentences and paragraphs which adhere to the conventions of grammar, punctuation, and mechanics.
2. Identify the principles of effective workplace writing.
 - i. describe the value of well-developed writing skills to career success
 - ii. discuss the importance of tone, and language or word choice in workplace communication, regardless of the circumstances
 - iii. demonstrate an awareness of cultural differences when preparing workplace correspondence
 - iv. describe the writing process as it applies to workplace communication
 - planning
 - writing

- editing/revising
 - v. identify the parts of a business letter and memo, and when each should be used in the workplace
 - vi. identify the standard formats for business letters and memos
 - vii. identify guidelines for writing sample letters and memos which convey:
 - acknowledgment
 - routine request
 - routine response
 - complaint
 - refusal
 - persuasive request
 - letters of appeal
- 3. Identify types of informal workplace documents.
 - i. identify types & purposes of reports
 - incident
 - process
 - progress
 - ii. identify common trade specific forms
 - iii. describe primary and secondary methods used to gather information
 - iv. discuss the importance of accuracy and completeness in reports and forms
- 4. Identify the elements of presentations used in the workplace.
 - i. identify presentation types
 - impromptu
 - informative
 - demonstration
 - persuasive
 - ii. identify the components of an effective presentation
 - eye contact
 - body language
 - vocal qualities
 - audience analysis
 - multimedia tools
 - keeping on topic

5. Demonstrate an understanding of interpersonal communications in the workplace.
 - i. identify listening techniques
 - ii. demonstrate an understanding of group dynamics
 - iii. describe the importance of contributing information and expertise in the workplace
 - iv. describe the importance of respectful and open communication in the workplace
 - v. identify methods to accept and provide feedback in a constructive and considerate manner
 - vi. explain the role of conflict in a group to reach solutions

6. Identify acceptable workplace uses of communication technologies.
 - i. cell / Smart Phone etiquette
 - ii. voice mail
 - iii. e-mail
 - iv. teleconferencing / videoconferencing for meetings and interviews
 - v. social networking
 - vi. other emerging technologies

Practical Requirements:

1. Write well-developed, coherent, unified paragraphs.
2. Write sample letters and memos.
3. Write one short informal report.
4. Complete a selection of at least 3 trade-related forms.
5. Deliver an effective oral presentation.

SD1760 Workplace Essentials

Note: It is recommended that SD1760 be delivered in the second half of the Entry Level training program.

Learning Outcomes:

- Demonstrate knowledge of workplace essentials in the areas of meetings, unions, workers compensation, workers' rights, and human rights.
- Demonstrate knowledge of good customer service practices.
- Demonstrate knowledge of effective job search techniques.

Duration: 45 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Identify common practices related to workplace meetings.
 - i. identify and discuss meeting format and preparation required for a meeting
 - ii. explain the purpose of an agenda
 - iii. explain the expected roles, responsibilities, and etiquette of meeting participants

2. Define unions and identify their role in the workplace.
 - i. identify the purpose of unions
 - ii. identify a common union structure
 - iii. identify the function of unions in this trade

3. Demonstrate an understanding of the Worker’s Compensation process.
 - i. describe the aims, objectives, regulations and benefits of the Workplace Health, Safety and Compensation Commission
 - ii. explain the role of the Workers Advisor
 - iii. explain the internal review process

4. Demonstrate an understanding of workers’ rights.
 - i. define labour standards
 - ii. identify regulations, including:
 - hours of work & overtime
 - termination of employment
 - minimum wages & allowable deductions
 - statutory holidays, vacation time, and vacation pay

5. Demonstrate an understanding of Human Rights issues.
 - i. examine the Human Rights Code and explain the role of the Human Rights Commission
 - ii. define harassment in various forms and identify strategies for prevention
 - direct
 - systemic
 - adverse effect
 - iii. identify gender and stereotyping issues in the workplace
 - iv. define basic concepts and terms related to workplace diversity including age, race, culture, religion, socio-economic status, and sexual orientation

6. Demonstrate an understanding of quality customer service.
 - i. explain why quality service is important
 - ii. identify barriers to quality customer service
 - iii. identify customer needs & common methods for meeting them
 - iv. identify and discuss the characteristics & importance of a positive attitude
 - v. identify the importance of demonstrating good communication skills including body language, listening, questioning, and when using electronic communication devices
 - vi. identify techniques for interacting with challenging customers to address complaints and resolve conflict

7. Demonstrate an understanding of effective job search techniques.
 - i. identify and explain employment trends, opportunities, and sources of employment
 - ii. identify and discuss essential skills for the trades as outlined by Human Resources and Skills Development Canada
 - iii. review job ads and identify the importance of fitting qualifications to job requirements
 - iv. identify the characteristics of effective resumes, the types of resumes, and principles of resume formatting
 - v. identify the characteristics of an effective cover letter
 - vi. identify the components of a portfolio, and discuss the value of establishing and maintaining a personal portfolio
 - vii. identify the common characteristics of the job interview process:
 - pre-interview preparation
 - interview conduct
 - post-interview follow up

Practical Requirements:

1. Create a resume.
2. Create a cover letter.
3. Participate in a mock job interview.

MC1060 Computer Essentials

Learning Outcomes:

- Demonstrate knowledge of computer systems and their operation.
- Demonstrate knowledge of popular software packages and their applications.
- Demonstrate knowledge of security issues related to computers.

Duration: 15 Hours

Pre-Requisite(s): None

Objectives and Content:

Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.

1. Identify the major external components of a microcomputer system.
 - i. input devices
 - ii. output devices
 - iii. central control unit

2. Use operating system software.
 - i. start and quit a program
 - ii. use the help function
 - iii. use the find function
 - iv. maximize and minimize a window
 - v. use the task bar
 - vi. adjust desktop settings such as screen savers, screen resolution, and backgrounds
 - vii. shut down a computer

3. Perform file management commands.
 - create folders
 - copy files and folders
 - move files and folders
 - rename files and folders
 - delete files and folders

4. Use word processing software to create documents.
 - i. enter text
 - ii. indent and tab text
 - iii. change text attributes (bold, underline, font, etc.)
 - iv. change layout format (margins, alignment, line spacing)
 - v. spell check and proofread
 - vi. edit text
 - vii. save document
 - viii. print document
 - ix. close document
 - x. retrieve documents

5. Use spreadsheet software to create spreadsheets.
 - i. enter data in cells
 - ii. create formulas to add, subtract, multiply and divide
 - iii. save spreadsheet
 - iv. print spreadsheet
 - v. close spreadsheet
 - vi. retrieve spreadsheet

6. Access the Internet.
 - i. access websites using the world wide web(www)
 - ii. identify examples of web browsers
 - iii. use search engines with common searching techniques
 - iv. describe security issues

7. Use electronic mail.
 - i. describe e-mail etiquette
 - grammar and punctuation
 - privacy and legal issues when sharing and forwarding e-mail
 - work appropriate content
 - awareness of employer policies
 - ii. manage e-mail using the inbox, sent, and deleted folders
 - iii. send an e-mail message with attachment(s)
 - iv. print e-mail

Practical Requirements:

None.

BLOCK II

PF2100 Blueprint 3 (Heavy Commercial/Industrial)

Learning Outcomes:

- Interpret industrial piping drawings in both orthographic and isometric and sketch views.
- Interpret architectural drawings and specifications for commercial/industrial installations.
- Complete single line sketches from commercial/industrial drawings and blueprints.
- Convert orthographic commercial/industrial pipe drawings to isometrics pipe drawings.
- Apply compass and elevations to commercial/industrial pipe drawings.
- compile as-built, design built and shop drawings.
- Demonstrate understanding of system identification procedures.
- Determine measurements and elevations using a builders level.
- Compile materials lists from sketches.

Duration: 30 Hours

Pre-requisite(s): Block I

Objectives and Content:

1. Identify the types of plans and describe their purpose and use for commercial/industrial projects.
 - i. plot (site)
 - ii. foundation
 - iii. floor plans
 - iv. elevations
 - v. sections
 - vi. details
 - vii. reflected ceiling drawings
 - viii. room finish schedules
 - ix. revisions

2. Describe the features contained in commercial/industrial drawings, their importance and use.
 - i. grid lines
 - ii. exploded views
 - iii. sections
 - iv. details
 - v. finish schedules
 - vi. page references
 - vii. elevations
 - viii. architectural symbols
3. Describe the sequencing and procedures used to plan materials for hangers, sleeves, and fixture carriers.
 - i. floor/slab construction
 - ii. wall construction
 - iii. structural supports
4. Identify and explain industrial mechanical, architectural and electrical symbols and abbreviations.
5. Identify and explain specifications.
 - i. breakdown of divisions
 - ii. trade responsibilities
6. Identify the use of computer aided drafting in the piping trades.
7. Identify and interpret the various piping related symbols found in a set of commercial or institutional drawings.
 - i. fixtures/piping/valve
 - ii. equipment
8. Identify and interpret the various heating related symbols found in a set of commercial or institutional drawings.
 - i. heating and cooling systems
 - ii. heating equipment
 - iii. heating valves
 - iv. fuel oil systems
 - v. fuel gas systems

9. Identify piping related systems from drawings.
 - i. kitchen equipment
 - ii. medical gas
 - iii. compressed air

10. Identify systems and their components found on institutional/commercial drawings.
 - i. mechanical
 - ii. electrical
 - iii. fire protection
 - iv. control systems

11. Describe the purpose and applications of the following information systems.
 - i. as-built/engineered drawings
 - ii. shop drawings

12. Explain the significance of providing system identification.
 - i. colour coding
 - ii. pipe identification
 - iii. valve tags, tabs, charts
 - iv. equipment identification

13. Explain the procedures used to compile material lists from drawings.

Builder's Level/Transit/Laser Level

14. Identify the parts of a builder's level/transit/laser level and describe their purpose.
 - i. telescope
 - ii. level bubbles
 - iii. leveling screws
 - iv. eye piece
 - v. focusing
 - vi. locking screws
 - vii. protective lens

15. Identify the extension rod and describe its purpose and procedures for use.
 - i. height of rod
 - ii. holding the rod
 - iii. markings on rod
 - iv. readings on rod

16. Explain leveling terms.
 - i. line of sight
 - ii. instrument location
 - iii. station
 - iv. bench mark
 - v. height of instrument
 - vi. back sight
 - vii. fore sight
 - viii. turning point

17. Describe the procedures used to determine measurements and elevations using a builder's level.

18. Describe the procedures used to lay out pipe lines and grades with a builder's level.
 - i. turn angle
 - ii. name station
 - iii. locate and number stations

Practical Requirements:

1. Read and interpret architectural, mechanical, electrical, as-built, and shop drawings.
2. Determine, sketch and apply dimensioning.
3. Read and interpret specifications.
4. Complete a material take-offs.
5. Use builders' level.

PF2121 Hydronic Heating 2

Learning Outcomes:

- Demonstrate knowledge of the operation of commercial heating systems, their associated piping and control systems.
- Demonstrate knowledge of the operation and controls of multi-zone hydronic heating systems.

Duration: 54 Hours

Pre-requisite(s): Block I

Objectives and Content:

1. Identify and interpret hydronic heating schematic symbols.
2. Define the following terms:
 - i. cross connection
 - ii. back flow prevention
3. Identify types of devices used for protection of cross connection control and describe their applications.
4. Describe the operation and applications of thermostats.
 - i. line voltage
 - ii. low voltage
 - iii. automatic set back
 - iv. multiple fuel supply applications
5. Describe the operation and specify the use of hot water control systems.
6. Describe the operation and specify the use of primary controls.
7. Explain the operation of outdoor temperature sensors.
8. Describe the operation and applications of heat exchanger vacuum valves.

9. Describe the operation and applications of flow-control-control valves.
10. Describe the operation and applications of motorized valves.
11. Identify types of safety controls and describe their operation and applications.
 - i. low water cutoff and fusible plugs
 - ii. feeder cutoff combinations
 - iii. high and low water alarms
 - iv. pressure controls
 - v. gauge glass
 - vi. boiler trim
 - vii. drain and blow-down valves, pigtails and steam gauges

Practical Requirements:

None

PF2130 Introduction to Electricity

Learning Outcomes:

- Demonstrate knowledge of the basic concepts of electricity.

Duration: 15 Hours

Pre-requisite(s): Block I

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. Identify tools and equipment used to test electrical circuits and describe their applications and procedures for use.
4. Identify types of current and describe their characteristics and applications.
 - i. direct current (DC)
 - ii. alternating current (AC)
5. Identify types of electrical circuits and describe their characteristics, operation.

Practical Requirements:

None

PF2150 Introduction to Gas Piping 1(Low Pressure)

Learning Outcomes:

- Demonstrate knowledge of the combustion process.
- Demonstrate knowledge of gas piping installation according to code.

Duration: 30 Hours

Pre-requisite(s): Block I

Objectives and Content:

1. Identify types of gas piping systems and describe their characteristics and applications.
 - i. natural gas
 - ii. liquefied
 - iii. compressed
 - iv. liquid petroleum gas
 - v. petroleum
 - vi. inert gas

2. Identify and interpret regulations governing:
 - i. natural gas and propane systems.
 - ii. transportation and storage of gas cylinders.

3. Describe the properties and characteristics of natural gas.
 - i. odor, color and taste
 - ii. state
 - iii. composition
 - iv. toxicity
 - v. specific gravity
 - vi. flame type
 - vii. excess air
 - viii. air composition
 - ix. heating value
 - x. flame temperature and speed

- xii. limits of flammability
 - xiii. ignition temperature
 - xiii. combustion process
4. Define terminology relating to gas piping.
- i. gas main
 - ii. gas service
 - iii. shut-off valves
 - iv. branch line
 - v. riser
 - vi. drop line
 - vii. dirt pocket
 - viii. piping extension
 - ix. concealed piping
 - x. flexible connector
5. Describe safe gas piping practices and procedures.
- i. gas code
 - ii. materials
 - iii. pipe coating
 - iv. reaming
 - v. threading
 - vi. bushings
 - vii. brazing
 - viii. joint compounds
 - ix. gasket material
 - x. grades
 - xi. supports
 - xii. prohibited practices
 - xiii. limitations at certain locations
 - xiv. outlets
 - xv. concealed piping
 - xvi. pipe identification
6. Describe the procedures used to test a gas line.
- i. before appliance is connected
 - ii. purging a gas line

7. Describe the factors that determine the correct pipe sizing for gas systems 2 PSI or lower installations.
 - i. length of pipe
 - ii. allowable pressure loss
 - iii. system capacity
 - iv. specific gravity of gas

Practical Requirements:

1. Install and test a low pressure gas piping system.

PF2161 Standpipe Systems

Learning Outcomes:

- Demonstrate knowledge of standpipe systems and their installation.

Duration: 6 Hours

Pre-requisite(s): Block I

Objectives and Content:

1. Identify and interpret applicable sections of the National Plumbing Code.
2. Identify and interpret sources of information pertaining to installation of standpipe systems.
 - i. drawings
 - ii. specifications
 - iii. manufacturer's literature
3. Identify and interpret applicable codes for fabrication and installation of standpipe systems.

Practical Requirements:

None

PF2170 Medical Gas Systems

Learning Outcomes:

- Demonstrate knowledge of medical gas systems.

Duration: 21 Hours

Pre-requisite(s): Block I

Objectives and Content:

1. Identify and interpret sources of information pertaining to installation of medical gas systems.
 - i. drawings
 - ii. specifications
 - iii. manufacturers literature
 - iv. codes
2. Describe medical gas systems, their components, materials and operation.
3. Describe materials and procedures required to join piping for medical gas systems.
 - i. degreasing
 - ii. purging
4. Describe oxygen supply systems, their components and installation.
 - i. piping and fittings
 - ii. jointing methods
 - iii. wall outlets
 - iv. valves
 - v. testing

5. Describe vacuum systems, their components and installation.
 - i. vacuum pumps and receivers
 - ii. piping and fittings
 - iii. wall outlets
 - iv. valves
 - v. testing

6. Describe anesthetic gas systems, their components and installation.
 - i. piping and fittings
 - ii. wall outlets
 - iii. valves
 - iv. testing

7. Describe nitrogen gas systems, their components and installation.
 - i. piping and fittings
 - ii. wall outlets
 - iii. valves
 - iv. safety devices
 - v. testing

8. Describe vacuum and medical air systems.
 - i. compressors
 - ii. piping and fittings
 - iii. reducing stations
 - iv. valves and strainers
 - v. pressure gauges and controls
 - vi. safety devices
 - vii. testing
 - viii. air dryers

9. Describe the color coding of medical gas systems.

10. Describe provincial regulations that may apply to the installation of medical gas systems.

Practical Requirements:

1. Perform procedure for brazing a purged and non-purged medical gas joint.

PF2701 Instrumentation

Learning Outcomes:

- Demonstrate knowledge of instrument controls and indicating devices, their operation and installation procedures.
- Interpret instrumentation requirements from drawings.

Duration: 30 Hours

Pre-requisite(s): Block I

Objectives and Content:

1. Describe pressure measuring instruments and installation considerations.
 - i. pressure measurement devices
 - ii. bourdon tube gauges
 - iii. manometers
 - iv. bellows elements
 - v. diaphragm elements
 - vi. gauge connections and accessories
 - vii. snubbers
 - viii. movement and case type
 - ix. throttling devices
 - x. installation considerations
 - xi. steam system
 - xii. gas system

2. Describe flow measuring instruments and installation considerations.
 - i. flow measurement devices
 - ii. venturi tubes
 - iii. orifice plates
 - iv. orifices
 - v. flow nozzle
 - vi. pressure taps and flange connections
 - vii. types
 - viii. location
 - ix. liquid flow pattern

- x. straightening vanes
 - xi. installation procedures
 - xii. magnetic flow meter
 - xiii. principles of operation
 - xiv. typical installation
 - xv. installation procedures
3. Describe temperature measuring devices and installation considerations.
- i. thermometers
 - ii. glass stem
 - iii. bi-metal
 - iv. filled thermal
 - v. thermocouples
 - vi. bulbs
 - vii. wells
 - viii. remote bulb thermostat
 - ix. liquid filled
 - x. operation
 - xi. mounting
 - xii. application
4. Describe liquid level instrument devices and installation considerations.
- i. types of devices
 - ii. differential pressure
 - iii. characteristics
 - iv. applications
 - v. accessories
 - vi. principles of operation
 - vii. typical installations
5. Describe the installation and operation of controllers in the operation of valves and dampers.
- i. controllers
 - ii. measuring and controlling elements
 - iii. classification
 - iv. controlled devices
 - v. automatic valves
 - components
 - characteristics
 - vi. automatic dampers

- components
 - characteristics
6. Describe the procedures for installing tubing to instrumentation devices.
- i. tubing materials
 - types
 - characteristics
 - applications
 - ii. tubing installations
 - flow and velocity
 - working pressure
 - service conditions
 - operating temperatures
 - iii. supporting instruments and tubing
 - tubing runs
 - tray installation
 - typical installations

Practical Requirements:

1. Layout tray and install stainless steel tubing.

PF2711 Pipe and Tube Bending

Learning Outcomes:

- Demonstrate knowledge of procedures used to lay out and mark pipe and tube for bending.
- Demonstrate knowledge of procedures used to bend pipe and tubing.

Duration: 21 Hours

Pre-requisite(s): Block I

Objectives and Content:

1. Describe the factors affecting the selection of materials for bending.
 - i. temper
 - ii. composition
 - iii. purpose
 - iv. applications
2. Describe methods of bending and their applications.
 - i. draw
 - ii. compression
 - iii. roll
 - iv. ram
 - v. stretch
 - vi. wrinkle
3. Describe the dangers and safety precautions associated with bending procedures.
 - i. working with silica sand
 - ii. moisture content of sand
 - iii. supports and anchors
 - iv. protective clothing
 - v. pinch points

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

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

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

7. Describe the procedures for use of benders.
 - i. manufacturer's instructions
 - ii. hydraulic bender and component parts
 - iii. set up
 - forming head
 - shoes
 - guides
 - pump
 - iv. desired angle
 - v. verification of bend angle
 - measurements
 - orientation

8. Describe procedures used for bending copper and stainless steel using hand benders.

Practical Requirements:

1. Bend steel pipe using hydraulic benders.
2. Bend copper tubing using tubing benders.

PF2720 Specialty Steamfitting/Pipefitting Systems

Learning Outcomes:

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

Duration: 12 Hours

Pre-requisite(s): Block I

Objectives and Content:

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

Practical Requirements:

None

PF2350 Renewable Energy Systems

Learning Outcomes:

- Demonstrate knowledge of geothermal systems and related components
- Demonstrate knowledge of solar heating systems and related components
- Demonstrate knowledge of heat recovery systems and related components
- Demonstrate knowledge of emerging technologies in renewable energy

Duration: 21 Hours

Pre-requisite(s): Block I

Objectives and Content:

Geothermal Systems

1. Describe geothermal systems, components and piping.
2. Describe joining methods for geothermal piping.
3. Describe the purpose, parts and operating principles of heat pumps.
4. Describe the procedures used to install heat pumps.
5. Identify tools and equipment associated with geothermal piping.

Solar Heating Systems

6. Describe solar heating systems, components and piping.
7. Describe the operation of the various types of solar heating systems.
8. Describe the applications of solar heating systems.

Heat Recovery Systems

9. Describe heat recovery systems, components and piping.
10. Describe the operation of the various types of heat recovering systems.
11. Describe the purpose, parts and operating principles of heat recovery systems.
12. Identify tools and equipment associated with heat recovery piping.

Practical Requirements:

None

BLOCK III

PF2930 Compressed Air Systems

Learning Outcomes:

- Demonstrate knowledge of safety procedures for working with and around air compressor systems.
- Demonstrate knowledge of disassembly/reassembly of compressors and components.
- Demonstrate knowledge of procedures used to maintain compressors.
- Demonstrate knowledge of procedures used to inspect, adjust and replace component parts.

Duration: 45 Hours

Pre-requisite(s): Block II

Objectives and Content:

1. Describe the operating principles of compressed air systems
 - i. composition of air
 - ii. compression process
 - isothermal
 - adiabatic
 - effects of water within a system
 - humidity
 - iii. air treatment and storage
 - air supply
 - air filters
 - dehydrating devices
 - iv. compressed air safety precautions
 - use of air hoses
 - safety valve location
 - belt and pulley guards
 - compressed air bleeding procedures

2. Describe the types, design and operation of compressors and compressed air systems.
 - i. compressed air drawing symbols
 - ii. principles of compressor operations
 - iii. types of compressors
 - positive reciprocating and rotary
 - continuous flow, centrifugal and axial
 - reciprocating
 - rotary
 - natural gas compressors
 - iv. compressor control
 - sensors
 - monitors
 - protective devices
 - v. compressor cooling
 - water cool
 - air cool
 - vi. air intake
 - filters
 - vii. cooling compressed air
 - viii. after cooler
 - trap
 - air receiver
 - filter
 - air dryer
 - ix. distribution air piping system
 - x. moisture control
 - air intake location
 - dirt pockets
 - xi. piping material
 - layout
 - hose and fitting
 - safety valves
 - air filters
 - pressure regulators
 - lubricators

3. Identify types of compressed air systems.
 - i. instrument
 - ii. utility
 - iii. process
 - iv. breathable air

Practical Requirements:

1. Layout and install a basic air system.

PF2960 Hydraulic Systems

Learning Outcomes:

- Demonstrate knowledge of safety procedures for working with and around hydraulic systems.
- Demonstrate knowledge of disassembly/reassembly of hydraulic systems and components.
- Demonstrate knowledge of procedures used to maintain, hydraulic equipment.
- Demonstrate knowledge of procedures used to inspect, adjust and replace component parts.

Duration: 45 Hours

Pre-requisite(s): Block II

Objectives and Content:

1. Describe procedures and considerations necessary to install and service hydraulic piping and equipment.
 - i. science principles
 - Pascal's principle
 - small piston/ large piston to increase forces
 - flow and velocity
 - friction
 - pressure
 - ii. hydraulic system piping and components
 - materials
 - classification of pipe and fittings
 - flexible hose and fittings
 - layout of hydraulic circuits
 - iii. accumulators
 - principles of operation
 - applications
 - iv. start-up procedures
 - filling
 - bleeding

2. Identify fluid related symbols and abbreviations pertaining to hydraulic systems.

Practical Requirements:

1. Layout and install a basic hydraulic system.

PF2900 Pumps

Learning Outcomes:

- Demonstrate knowledge of safety procedures for working with and around pumps.
- Demonstrate knowledge of procedures used to inspect, adjust and replace component parts of pumps.
- Demonstrate knowledge of disassembly/reassembly of pumps and components.
- Demonstrate knowledge of procedures used to maintain pumps.

Duration: 45 Hours

Pre-requisite(s): Block II

Objectives and Content:

1. Identify types of pumps and describe their characteristics, operation and applications.
 - i. reciprocating pumps
 - ii. single-acting
 - iii. double-acting
 - iv. centrifugal
 - v. turbine
 - vi. rotary
 - gear
 - lobe
 - sliding vane
 - vii. injector
 - viii. vacuum
2. Describe the procedures and considerations necessary to install pumps, suction and discharge.
 - i. fluid medium
 - ii. piping and component parts
 - iii. field layout
 - iv. guidelines and design
 - v. layout of base lines

- vi. suction and discharge piping and components
- vii. elbows
- viii. valves
- ix. flexible couplings
- x. pipe alignment
- xi. pipe strain
- xii. strainers
- xiii. flange jointing and bolt-up
- xiv. torque procedures
- xv. gasket selection
- xvi. packing systems
- xvii. priming and start procedures

Practical Requirements:

1. Disassemble, inspect and re-assemble various types of pumps.

PF2740 Valves

Learning Outcomes:

- Demonstrate knowledge of procedures used to select and install valves.
- Demonstrate knowledge of procedures used to maintain and service valves.

Duration: 30 Hours

Pre-requisite(s): Block II

Objectives and Content:

1. Explain the purpose of valves in a piping system.
 - i. starting and stopping flow
 - ii. regulating or throttling flow
 - iii. preventing backflow
 - iv. regulating pressure
 - v. relieving pressure

2. Identify the different types of valves, purpose, characteristics and ratings, and component parts.
 - i. gate
 - solid wedge disc
 - double disc
 - flexible wedge disc
 - split wedge disc
 - valve seat and disc design
 - ii. globe
 - iii. safety and safety relief
 - iv. pinch
 - v. angle design
 - vi. plug type disc
 - vii. conventional disc
 - viii. composition disc
 - ix. check
 - swing
 - lift

- x. ball
 - xi. butterfly
 - xii. plug cock and plug vane
 - xiii. pulp stock
 - xiv. radiator
 - xv. water pressure regulating
 - xvi. steam pressure regulating
 - piping arrangement
 - xvii. cylinder operated
 - special equipment
 - control systems
 - cylinder operators
 - ordering and dimensional data
 - xviii. actuated
 - motor operated
 - gear operated
 - electronic
 - pneumatic
 - fibre optic
 - xix. emergency operation
3. Identify and explain the features of valve stem operations and stuffing box design.
- i. stem operation
 - types
 - characteristics
 - purpose
 - ii. bonnet joints
 - types
 - characteristics
 - purpose
4. Explain the procedures for selecting and installing valves.
- i. considerations
 - application
 - valve materials
 - service rating marks
 - ii. installation and safety
 - position and assembly
 - maintenance procedures

- safety guidelines
5. Explain the procedure for servicing and repairing valves.
 - i. care of valves
 - remedy for leaking valves
 - repacking the stuffing box
 - interchangeability
 - valve packings
 - ii. lapping packing tools
 - types
 - uses
 6. Describe techniques and procedures used to service, repair and test valves.
 - i. repacking
 - ii. grinding
 - iii. lapping
 - iv. required tools

Practical Requirements:

1. Service, repair and test various types of valves.

PF2750 High Pressure Steam

Learning Outcomes:

- Sketch and label a high pressure steam system.
- Identify and explain operation and components of steam boilers
- Select high pressure gaskets, bolts, and flanges for specific steam applications.
- Interpret drawings for high pressure steam system requirements.
- Identify and interpret applicable codes.

Duration: 75 Hours

Pre-requisite(s): Block II

Objectives and Content:

1. Define terminology related to high pressure steam systems.
2. Identify the American Society of Mechanical Engineers (ASME) requirements.
 - i. 500 square feet and under
 - ii. 500 square feet and over
3. Explain the applications of high pressure steam systems.
 - i. heating
 - ii. power generation
4. Identify and describe the components of a high pressure steam system and explain their operation.
 - i. packaged fire tube boilers
 - condensing
 - non condensing
 - water tube boilers
 - fire tube boilers-horizontal return tubular boilers-internal furnace boilers
 - ii. water tube boilers
 - types
 - characteristics

- iii. superheaters and economizer
 - types
 - characteristics
 - operating features
 - components
 - applications
- iv. water feeders and cut-offs
 - types
 - characteristics
 - components
 - applications
 - safety and maintenance features
- v. water level controllers
 - types
 - characteristics
 - operating features
 - components
 - applications
- vi. high pressure boiler accessories
 - types
 - operating principles
 - characteristics
 - applications
- vii. boiler water treatment
 - equipment
 - treatment process
- viii. flash tank and surge tanks
 - characteristics
 - operating principles
- ix. steam traps
 - types
 - characteristics
- x. high pressure piping
 - layout
 - equipment
 - components
- xi. steam lines
 - components
 - characteristics
 - expansion loops

- expansion joints design
 - supports
 - hangers
 - xii. gaskets
 - design characteristics
 - materials
 - characteristics
 - types
5. Identify the location and operation of high pressure steam system components.
- i. safety valves
 - relief
 - pop
 - safety relief
 - ii. stop valves
 - non return
 - blowdown valve
 - iii. blowdown tanks
 - code regulations
 - piping requirements
 - iv. condensate pumps
 - components
 - piping
 - purpose
 - v. flashtanks
 - vents
 - high pressure steam connection
 - low pressure steam connection
 - low pressure steam return
 - vi. boiler water feeders
 - vii. industrial applications
 - viii. pumps
 - ix. piping
 - x. dual systems
 - xi. de-aerator
 - types
 - purpose
 - characteristics
 - piping components
 - installation

- xii. condensors
 - types
 - purpose
 - characteristics
 - installation
 - xiii. boiler tubes
 - materials
 - characteristics
 - tube fabrication
 - tube bending
 - water tubes
 - fire tubes
 - xiv. steam turbines
 - high pressure steam piping
 - super heated steam
6. Identify and explain installation guidelines and procedures for high pressure steam system components.
- i. water feeders and cut-offs
 - ii. high pressure piping

Practical Requirements:

None

BLOCK IV

PF2310 Cross Connection Control Devices

Learning Outcomes:

- Identify cross connections and determine how to correct them.

Duration: 45 Hours

Pre-requisite(s): Block III

Objectives and Content:

1. Identify and interpret applicable sections of the National Plumbing Code.
2. Identify and interpret sources of information pertaining to installation.
 - i. the National Plumbing Code
 - ii. manufacturers' literature
3. Describe the division of responsibilities for cross connection control.
 - i. installation
 - ii. troubleshooting
 - iii. repair
4. Describe the cross connection control program.
 - i. administration
 - ii. legal aspects
 - iii. health aspects
 - iv. minimum standards
 - v. inspection of devices
 - vi. licensing of testers
 - vii. testing of devices
5. Identify methods and devices used for cross connection control and describe their location and operation in various systems.

6. Describe the procedures used for maintenance and repair of devices.
 - i. troubleshooting
 - ii. repair procedures
7. Describe the causes of backflow and their role in cross connection.
8. Explain backflow control.
 - i. causes
 - ii. classification of hazards
 - iii. assessment of hazards
 - iv. types of devices
 - v. selection of proper devices
 - vi. methods of backflow control
 - vii. typical occurrences and recommended protection
9. Describe the purpose and operation of:
 - i. back siphonage devices
 - ii. back pressure devices
10. Identify testable devices.
 - i. non-testable devices
 - ii. testable devices
 - iii. testing procedures
11. Describe the procedures used to install devices.
 - i. location of devices
 - ii. National Plumbing Code applications
 - iii. manufacturer's recommendations
 - iv. warranty of devices

Practical Requirements:

1. Select, install, test and repair various cross connection control devices
 - i. atmospheric vacuum breaker
 - ii. pressure vacuum breaker
 - iii. double check valve assembly
 - iv. reduced pressure zone assembly

PF2320 Introduction to Gas Piping 2 (High Pressure)

Learning Outcomes:

- Demonstrate knowledge of the combustion process.
- Demonstrate knowledge of gas piping installation according to code.

Duration: 30 Hours

Pre-requisite(s): Block III

Objectives and Content:

1. Describe the purpose, parts and operation of a gas distribution system from the well head to the service regulator.
 - i. gas well
 - ii. compressor station
 - iii. city gate station
 - iv. district regulating station
 - v. regulators
 - vi. high pressure distribution service
 - vii. high pressure distribution lines
 - viii. line pressures
 - ix. meters

2. Identify types of gas pressure regulators and describe their purpose.
 - i. low capacity
 - ii. high capacity
 - iii. combination
 - iv. loading element
 - v. measuring element
 - vi. restricting element
 - vii. 1st stage
 - viii. 2nd stage
 - ix. service
 - x. system
 - xi. appliance
 - xii. code

3. Describe the factors that determine the correct pipe sizing for gas systems over 2 PSI.
 - i. installations.
 - ii. length of pipe
 - iii. allowable pressure loss
 - iv. system capacity
 - v. specific gravity of gas
 - vi. number and type of fittings

4. Describe the purpose and operation of gas venting.
 - i. gravity or natural venting
 - ii. spillage
 - iii. combustion process
 - iv. carbon monoxide
 - v. power venting
 - vi. fan assisted

Practical Requirements:

None

PF2760 Refrigeration

Learning Outcomes:

- Demonstrate knowledge of the components and operation of refrigeration piping systems.

Duration: 30 Hours

Pre-requisite(s): Block III

Objectives and Content:

1. Describe the operation and components of a refrigeration piping system.
 - i. basic compression refrigeration systems
 - refrigeration compressors
 - automatic expansion valve
 - ii. halo carbon and ammonia refrigerants
 - types
 - thermodynamic properties
 - physical properties
 - enthalpy diagrams
 - codes and safety requirements
 - iii. absorption systems
 - operation
 - components
 - iv. psychometric chart
2. Describe cooling tower systems, materials and piping requirements and installation procedures.
3. Identify hydronic cooling system components and describe their purpose and operation.
 - i. piping
 - ii. expansion tanks
 - iii. chillers
 - iv. circulating pumps
 - v. valves

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

Practical Requirements:

None

PF2770 Stainless Steel and Specialty Piping

Learning Outcomes:

- Demonstrate knowledge of methods of cutting stainless steel pipe.
- Demonstrate knowledge of the procedures for preparing chromoloy pipe and fittings for joining and welding.
- Demonstrate knowledge of the procedures for joining stainless steel and chromoloy pipe.
- Demonstrate knowledge of methods of tapping, threading and drilling of stainless steel.

Duration: 27 Hours

Pre-requisite(s): Block III

Objectives and Content:

1. Describe the types, characteristics and applications of stainless steel piping.
 - i. 200 series
 - ii. 300 series
 - iii. 400 series

2. Identify and explain the methods of cutting stainless steel.
 - i. plasma arc torch
 - ii. carbon arc gouging
 - iii. abrasive cut-off tools
 - iv. power vise
 - v. laser
 - vi. high pressure water

3. Describe the procedures specific to welding stainless steel pipe and fittings.
 - i. weld criteria
 - contamination prevention
 - purging and damming
 - rice paper and tape
 - cleaning
 - ii. welding processes

4. Describe the procedures for tapping, threading, soldering and drilling stainless steel.
 - i. tapping
 - ii. threading
 - iii. soft soldering
 - iv. silver soldering (brazing)
 - vi. drilling and reaming

5. Describe the procedures for pickling/degreasing and scale removal of stainless steel piping.
 - i. coatings
 - ii. contaminants

6. Describe chrome and nickel alloys and chrome percentage used.

7. Describe the equipment and procedures for preparing chromoly pipe and fittings for joining and welding.
 - i. heat treatment
 - purpose
 - preheat and post-heat methods
 - ii. porosity in welds
 - iii. welding equipment and supplies
 - iv. joint preparation
 - standard vee joint
 - sharp vee joint
 - u groove joint
 - consumable insert joint
 - compound bevel
 - J-bevel

8. Identify specialty piping materials but not inclusive to the listed.
 - i. inconel
 - ii. monel
 - iii. cupronickel (copper nickel)
 - iv. duplex
 - v. super duplex
 - vi. titanium
 - vii. 6% Molybdenum (6MO)

9. Identify types of fibreglass pipe and describe joining procedures.
 - i. safety requirements
 - ii. specialty tools and equipment
 - iii. pipe preparation
 - iv. resin types and mixtures
 - v. cutting procedures
 - vi. joining procedures
 - vii. support requirements
 - viii. lifting requirements

10. Identify types of lined piping and describe joining procedures.
 - i. safety requirements
 - ii. specialty tools and equipment
 - iii. pipe preparation
 - iv. resin types and mixtures
 - v. cutting procedures
 - vi. joining procedures
 - vii. support requirements
 - viii. lifting requirements

Practical Requirements:

1. Fabricate a stainless steel joint.

PF2780 Blueprint 4

Learning Outcomes:

- Identify location of piping components, controls and equipment.

Duration: 39 Hours

Pre-requisite(s): Block III

Objectives and Content:

1. Identify and describe industrial acronyms and abbreviations used in the trade.
2. Identify and explain information contained on industrial drawings.
 - i. schematic and assembly drawings
 - ii. fabrication sequence
 - iii. list cut lengths of materials
 - iv. line numbers
 - v. dimension holes, cylinders, circles and angles
3. Explain the purpose and applications of:
 - i. process and instrument drawings (P&ID)
 - ii. spool sheets
 - iii. flow diagrams
4. Identify and interpret industrial piping drawings.
 - i. plot plans
 - pipe drawing index
 - exploded view
 - ii. schematic drawings
 - flow diagrams
 - isometric drawings
 - spool sheets

Practical Requirements:

1. Interpret and extract information from industrial drawings.

PF2790 Advanced Rigging

Learning Outcomes:

- Determine the weights of loads.
- Select appropriate rigging equipment.
- Select appropriate lifting equipment.
- Ensure a safe work area for lifting.
- Set up rigging equipment to perform a lift.

Duration: 39 Hours

Pre-requisite(s): Block III

Objectives and Content:

1. Describe the considerations used to determine the weight of loads.
 - i. weight of various materials from reference chart
 - ii. types of loads
 - iii. engineered lifts

2. Describe the considerations when selecting rigging equipment.
 - i. types of rigging equipment
 - ii. sling configurations
 - iii. sling angles
 - iv. rigging equipment accessories
 - v. rigging tables and charts for equipment and accessories
 - vi. mechanical advantage for various types of rigging equipment

3. Explain the procedure for ensuring the work area is safe for lifting (notification procedures).
 - i. supervision of lift
 - ii. identification of work area
 - iii. communication

4. Describe the procedures used for attaching rigging equipment to loads.
 - i. shop drawings
 - ii. attachment points
 - iii. jacking points

5. Describe the procedures for setting up rigging equipment.
 - i. lifting points
 - ii. placement of rigging components

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

Practical Requirements:

None

PF2800 Controlled Bolting, Testing and Commissioning

Learning Outcomes:

- Explain the principles of torquing and controlled bolting.
- Demonstrate knowledge of torquing procedures for fasteners.
- Demonstrate knowledge of hydrostatic and pneumatic tests on piping systems.
- Demonstrate knowledge of procedures used when commissioning piping systems.

Duration: 30 Hours

Pre-requisite(s): Block III

Objectives and Content:

1. Explain the need for controlled bolting of fasteners.
 - i. controlled bolting
 - ii. bolt stress
2. Explain the principle of hydraulic tensioning and torquing of fasteners.
 - i. torque principle
 - ii. hydraulic tensioning equipment
 - iii. hydraulic torque wrenches
3. Describe types of fasteners used for joints on piping and vessels.
 - i. grades of stud bolts and nuts
 - ii. proper lengths of stud bolts
 - iii. formulas for length of bolts, nuts and wrench sizes
 - iv. thread lubricants
4. Describe proper torquing procedures for fasteners.
 - i. proper use of torque wrenches for fastening of flanged piping joints
 - ii. applications of torque patterns on flanges
 - iii. formulas required for use of equipment
 - iv. power supplies for different applications
 - v. safety requirements for use of power supplies in hazardous atmospheres

5. Describe pressure testing methods, their operation and applications.

i. hydrostatic

- water
- glycol mixture

ii. pneumatic

- air
- nitrogen
- CO₂
- helium

iii. components

- vents
- drains
- blinds
- pressure regulators
- gauges
- hydrostatic test pumps
- compressed air
- nitrogen

6. Describe the procedures to perform testing of piping systems.

i. pre-test preparation

ii. isolate system

iii. connect test system

iv. code requirements

v. drawings

vi. specifications

vii. manufacturer's literature

viii. safety considerations

7. Describe the procedures to commission piping systems.

i. flushing

- pre-flush preparation
- components
 - filter media
 - circulating pumps
 - blinds
- flushing medium
- specifications
- manufacturers' literature

ii. chemical treating

- safe handling considerations
 - environmental considerations
 - obtain testing sample
 - equipment
 - specifications
- iii. start-up
- install trim
 - install protective equipment
 - verify system operation
 - fill system
 - identify components

Practical Requirements:

1. Perform hydraulic torquing.
2. Perform hydraulic tensioning.

D. Conditions Governing Apprenticeship Training

1.0 General

The following general conditions apply to all apprenticeship training programs approved by the Provincial Apprenticeship and Certification Board (PACB) in accordance with the *Apprenticeship Training and Certification Act (1999)*. If an occupation requires additional conditions, these will be noted in the specific Plan of Training for the occupation. In no case should there be a conflict between these conditions and the additional requirements specified in a certain Plan of Training. All references to Memorandum of Understanding will also apply to Letter of Understanding (LOU) agreements.

2.0 Entrance Requirements

2.1 Entry into the occupation as an apprentice requires:

Indenturing into the occupation by an employer who agrees to provide the appropriate training and work experiences as outlined in the Plan of Training.

2.2 Notwithstanding the above, each candidate must have successfully completed a high school program or equivalent, and in addition may be required to have completed certain academic subjects as specified in a particular Plan of Training. Mature students, at the discretion of the Director of Apprenticeship and Trades Certification, may be registered. A mature student is defined as one who has reached the age of 19 and who can demonstrate the ability and the interest to complete the requirements for certification.

2.3 At the discretion of the Director of Apprenticeship and Trades Certification, credit toward the apprenticeship program may be awarded to an apprentice for previous work experience and/or training as validated through prior learning assessment.

- 2.4 An Application for Apprenticeship form must be duly completed along with a Memorandum of Understanding as applicable to be indentured into an Apprenticeship. The Memorandum of Understanding must contain signatures of an authorized employer representative, the apprentice and an official representing the Provincial Apprenticeship and Certification Board to be valid.
- 2.5 A new Memorandum of Understanding must be completed for each change in an employer during the apprenticeship term.

3.0 Probationary Period

The probationary period for each Memorandum of Understanding will be six months or 900 employment credit hours. Within that period the memorandum may be terminated by either party upon giving the other party and the PACB one week notice in writing.

4.0 Termination of a Memorandum of Understanding

After the probationary period referred to in Section 3.0, the Memorandum of Understanding may be terminated by the PACB by mutual consent of the parties involved, or cancelled by the PACB for proper and sufficient cause in the opinion of the PACB, such as that stated in Section 14.

5.0 Apprenticeship Progression Schedule, Wage Rates and Advanced Training Criteria

Progression Schedule, Wage Rate and Advanced Training Criteria are stated in the specific occupational Plan of Training for each designated apprenticeship occupation.

Progression Schedule

Steamfitter Pipefitter - 7200 Hours			
APPRENTICESHIP LEVEL AND WAGES			
Year	Wage Rate At This Level	Requirements for progression to next level of apprenticeship	When requirements are met, the apprentice will progress to...
1 st	60 %	<ul style="list-style-type: none"> ▪ Completion of Block 1 training ▪ Pass Block 1 exam ▪ Minimum 1800 hours of combined relevant work experience and training 	2 nd Year
2 nd	70%	<ul style="list-style-type: none"> ▪ Completion of Block 2 training ▪ Pass Block 2 exam ▪ Minimum 3600 hours of combined relevant work experience and training 	3 rd Year
3 rd	80%	<ul style="list-style-type: none"> ▪ Completion of Block 3 training ▪ Pass Block 3 exam ▪ Minimum 5400 hours of combined relevant work experience and training 	4 th Year
4 th	90%	<ul style="list-style-type: none"> ▪ Completion of Block 4 training ▪ Minimum 7200 hours of combined relevant work experience and training ▪ Sign-off of all workplace skills in apprentice logbook ▪ Pass certification exam 	Journeyman Certification
<p>Wage Rates</p> <ul style="list-style-type: none"> ▪ Rates are percentages of the prevailing journeyman's wage rate in the place of employment of the apprentice. ▪ Rates must not be less than the wage rate established by the Labour Standards Act (1990), as now in force or as hereafter amended, or by other order, as amended from time to time replacing the first mentioned order. ▪ Rates must not be less than the wage rate established by any collective agreement which may be in force at the apprentice's workplace. ▪ Employers are free to pay wage rates above the minimums specified. <p>Block Exams</p> <ul style="list-style-type: none"> ▪ This program may not currently contain Block Exams, in which case this requirement will be waived until such time as Block Exams are available. 			

Steamfitter Pipefitter - 7200 Hours		
CLASS CALLS		
Call Level	Requirements for Class Call	Hours awarded for In-School Training
Direct Entry Apprentice: PLA & / or Block 1	<ul style="list-style-type: none"> ▪ Minimum of 1000 hours of relevant work experience ▪ Prior Learning Assessment (PLA) at designated college (if applicable) 	To be determined by the number of courses completed after each class call
Block 2	<ul style="list-style-type: none"> ▪ Minimum of 3000 hours of relevant work experience and training 	240
Block 3	<ul style="list-style-type: none"> ▪ Minimum of 5000 hours of relevant work experience and training 	240
Block 4	<ul style="list-style-type: none"> ▪ Minimum of 7000 hours of relevant work experience and training 	240
<p>Direct Entry Apprentice</p> <ul style="list-style-type: none"> ▪ Must complete Block 1 courses through PLA and / or in-school training. ▪ Block 1 training is to be completed via class calls; up to 16 weeks of training per calendar year. ▪ Must attend in-school training until Block 1 is complete before attending Blocks 2 or higher <p>Class Calls at Minimum Hours</p> <ul style="list-style-type: none"> ▪ Class calls may not always occur at the minimum hours indicated. Some variation is permitted to allow for the availability of training resources and apprentices. 		

6.0 Tools

Apprentices shall be required to obtain their own hand tools applicable for the designated occupation of registration or tools as specified by the PACB.

7.0 Periodic Examinations and Evaluation

7.1 Every apprentice shall submit to such occupational tests and examinations as the PACB shall direct. If after such occupational tests and examinations the apprentice is found to be making unsatisfactory progress, his/her apprenticeship level and rate of wage shall not be advanced as provided in Section 5 until his/her progress is satisfactory to the Director of Apprenticeship and Trades Certification and his/her date of completion shall be deferred accordingly. Persistent failure to pass required tests shall be a cause for revocation of his/her Memorandum of Understanding.

7.2 Upon receipt of reports of accelerated progress of the apprentice, the PACB may shorten the term of apprenticeship and advance the date of completion accordingly.

7.3 For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.

7.4 Course credits may be granted through the use of a PACB approved matrix which identifies course equivalencies between designated trades and between current and historical Plans of Training for the same trade.

8.0 Granting of Certificates of Apprenticeship

Upon the successful completion of apprenticeship, the PACB shall issue a Certificate of Apprenticeship.

9.0 Hours of Work

Any hours employed in the performance of duties related to the designated occupation will be credited towards the completion of the term of apprenticeship. Appropriate documentation of these hours must be provided.

10.0 Copies of the Registration for Apprenticeship

The Director of Apprenticeship and Trades Certification shall provide copies of the Registration for Apprenticeship form to all signatories to the document.

11.0 Ratio of Apprentices to Journeypersons

Under normal practice, the ratio of apprentices to journeypersons shall not exceed two apprentices to every one journeyperson employed. Other ratio arrangements would be determined and approved by the PACB.

12.0 Relationship to a Collective Bargaining Agreement

Where applicable in Section 5 of these conditions, Collective Agreements take precedence.

13.0 Amendments to a Plan of Apprenticeship Training

A Plan of Training may be amended at any time by the PACB.

14.0 Employment, Re-Employment and Training Requirements

- 14.1 The Plan of Training requires apprentices to regularly attend their place of employment.
- 14.2 The Plan of Training requires apprentices to attend training for that occupation as prescribed by the PACB.
- 14.3 Failure to comply with Sections 14.1 and/or 14.2 will result in cancellation of the Memorandum of Understanding. Apprentices may have their MOUs reinstated by the PACB but would be subject to a commitment to complete the entire program as outlined in the General Conditions of Apprenticeship. Permanent cancellation in the said occupation is the result of non-compliance.
- 14.4 Cancellation of the Memorandum of Understanding to challenge journeyperson examinations, if unsuccessful, would require an apprentice to serve a time penalty of two (2) years before reinstatement as an apprentice or qualifying to receive a class call to training as a registered Trade Qualifier. Cancellation must be mutually agreed upon by the employer and the apprentice.

- 14.5 An employer shall ensure that each apprentice is under the direct supervision of an approved journeyperson supervisor who is located at the same worksite as the apprentice, and that the apprentice is able to communicate with the journeyperson with respect to the task, activity or function that is being supervised.
- 14.6 Under the Plan of Training the employer is required to keep each apprentice employed as long as work is available, and if the apprentice is laid off due to lack of work, to give first opportunity to be hired before another is hired.
- 14.7 The employer will permit each apprentice to attend training programs as prescribed by the PACB.
- 14.8 Apprentices who cannot acquire all the workplace skills at their place of employment will have to be evaluated in a simulated work environment at a PACB authorized training institution and have sign-off done by instructors to meet the requirements for certification.

15.0 Appeals to Decisions Based on Conditions Governing Apprenticeship Training

Persons wishing to appeal any decisions based on the above conditions must do so in writing to the Minister of Advanced Education and Skills within 30 days of the decision.

E. Requirements for Red Seal Endorsement

1. Evidence the required work experiences outlined in this Plan of Training have been obtained. This evidence must be in a format clearly outlining the experiences and must be signed by an appropriate person or persons attesting that these experiences have been obtained to the level required.
2. Successful completion of all required courses in the program.
3. A combination of training from an approved training program and suitable work experience totaling 7200 hours.

Or

A total of 9000 hours of suitable work experience.

4. Completion of a National Red Seal examination, to be set at a place and time determined by the Apprenticeship and Trades Certification Division.

F. Roles and Responsibilities of Stakeholders in the Apprenticeship Process

The apprenticeship process involves a number of stakeholders playing significant roles in the training of apprentices. This section outlines these roles and the responsibilities resulting from them.

The Apprentice:

- completes all required technical training courses as approved by the PACB.
- finds appropriate employment.
- completes all required work experiences in combination with the required hours.
- ensures work experiences are well documented.
- approaches apprenticeship training with an attitude and commitment that fosters the qualities necessary for a successful career as a qualified journeyman.
- obtains the required hand tools as specified by the PACB for each period of training of the apprenticeship program.

The Employer:

- provides high quality work experiences in an environment conducive to learning.
- remunerates apprentices as set out in the Plan of Training or Collective Agreements.
- provides feedback to training institutions, Apprenticeship and Trades Certification Division and apprentices in an effort to establish a process of continuous quality improvement.
- where appropriate, releases apprentices for the purpose of returning to a training institution to complete the necessary technical courses.
- ensures work experiences of the apprentice are documented.
- ensures a certified journeyman is currently on staff in the same trade area as the apprentice and whose certification is recognized by the NL Department of Advanced Education and Skills.

The Training Institution:

- provides a high quality learning environment.
- provides the necessary student support services that will enhance an apprentice's ability to be successful.
- participates with other stakeholders in the continual updating of programs.

The Apprenticeship and Trades Certification Division:

- establishes and maintains program advisory committees under the direction of the PACB.
- promotes apprenticeship training as a viable career option to prospective apprentices and other appropriate persons involved, such as career guidance counsellors, teachers, parents, etc.
- establishes and maintains a protocol with training institutions, employers and other appropriate stakeholders to ensure the quality of apprenticeship training programs.
- ensures all apprentices are appropriately registered and records are maintained as required.
- schedules all necessary technical training periods for apprentices to complete requirements for certification.
- administers block, provincial and interprovincial examinations.

The Provincial Apprenticeship and Certification Board:

- sets policies to ensure the provisions of the *Apprenticeship and Certification Act (1999)* are implemented.
- ensures advisory and examination committees are established and maintained.
- accredits institutions to deliver apprenticeship training programs.
- designates occupations for apprenticeship training and/or certification.