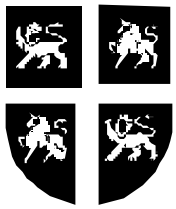

PROVINCIAL PLAN OF TRAINING

FOR THE

STEAMFITTER/PIPEFITTER

OCCUPATION

Document Status	Date Distributed	Mandatory Implementation Date	Comments
Original Version	May, 2006	September, 2006	

May, 2006

Preface

This Apprenticeship Training Standard is based on the 2005 edition of the National Occupational Analysis for the Steamfitter/Pipefitter trade. It was developed through the cooperative efforts of the Atlantic Apprenticeship Council, which consists of both the Atlantic Directors of Apprenticeship and Apprenticeship Board Chairs. This document describes the curriculum content for the Steamfitter/Pipefitter apprenticeship training program and outlines each of the technical training courses necessary for completion of apprenticeship.

Acknowledgment

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

Apprenticeship Curriculum Standard Evaluation Form

Thank you for your interest in the development and revision of this document. Upon review of this document, please record your feedback in relation to the following items:

- unit division and organization
- relevancy of the content
- errors or omissions
- other suggestions for improvement and consideration

Overall comments are to be entered on this evaluation form and specific changes are to be entered directly on the document in the relevant area(s). When making proposed corrections(s) in the curriculum standard, please use red ink. When all feedback has been recorded, return this evaluation form along with the curriculum standard to the Apprenticeship Office noted at the bottom of the page.

(PLEASE PRINT)

Trade: Steamfitter/Pipefitter

Full Name: _____

Type of Position: (Trade Practitioner, Instructor, etc.)_____

Company: _____

Address: _____

Telephone: _____

Comments: (Use a separate sheet of paper if necessary)

_____

_____

_____

_____

_____

_____

Return Evaluation Form and Curriculum Standard to:

Manager, Industrial Training
Division of Institutional and Industrial Education
Department of Education
P.O. Box 8700
St. John's, NL
A1B 4J6

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CONDITIONS GOVERNING APPRENTICESHIP TRAINING

1.0 GENERAL

The following general conditions will apply to all apprenticeship training programs approved by the Provincial Apprenticeship and Certification Board in accordance with the Apprenticeship Training and Certification Act. Where an occupation requires additional conditions, these will be noted in the specific plan of training for that occupation. In no case should there be a conflict between these conditions and the additional requirements specified in certain plans of training.

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 this 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 particular plans of training. Mature students, at the discretion of the Director of Institutional and Industrial Education, 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 Institutional and Industrial Education, credit towards the apprenticeship program may be awarded to an apprentice for previous work experience and/or training as validated through prior learning assessment.

2.4 A Registration for Apprenticeship form must be duly completed.

3.0 PROBATIONARY PERIOD

The probationary period for each memorandum of understanding will be six months. Within that period the memorandum may be terminated by either party upon giving the other party and the Provincial Apprenticeship and Certification Board one week notice in writing.

4.0 TERMINATION OF A MEMORANDUM OF UNDERSTANDING

After the probationary period referred to in Section 3.0 herein, the memorandum of understanding may be terminated by the Board by mutual consent of the parties thereto or cancelled by the Board for proper and sufficient cause in the opinion of the Board.

5.0 APPRENTICESHIP PROGRESSION SCHEDULE AND WAGE RATES

5.1 Progression Schedule

7200 Hour Programs	**Requirements for Progression**	**Progress To**
First Year Apprentice	Completion of entry level (Block 1) courses, plus relevant work experience totaling a minimum of 1800 hours *	Second Year
Second Year Apprentice	Completion of advanced level (Block 2) courses, plus relevant work experience totaling a minimum of 3600 hours	Third Year
Third Year Apprentice	Completion of advanced level (Block 3) courses, plus relevant work experience totaling a minimum of 5400 hours	Fourth Year
Fourth Year Apprentice	Completion of advanced level (Block 4) courses and (Block 5) *if applicable,* plus sign-off of workplace skills required for certification totaling a minimum of 7200 hours**	Write Certification Examination
5400 Hour Programs	**Requirements for Progression**	**Progress To**
First Year Apprentice	Completion of entry level (Block 1) courses, plus relevant work experience totaling a minimum of 1800 hours *	Second Year
Second Year Apprentice	Completion of advanced level (Block 2) courses, plus relevant work experience totaling a minimum of 3600 hours	Third Year
Third Year Apprentice	Completion of advanced level (Block 3) courses, plus sign-off of workplace skills required for certification totaling a minimum of 5400 hours	Write Certification Examination

4800 Hour Programs	Requirements for Progression	Progress To
First Year Apprentice	Completion of entry level courses (Block 1) courses, plus relevant work experience totaling a minimum of 1600 hours *	Second Year
Second Year Apprentice	Completion of advanced level (Block 2) courses, plus relevant work experience totaling a minimum of 3200 hours	Third Year
Third Year Apprentice	Completion of advanced level (Block 3) courses, plus sign-off of workplace skills required for certification totaling a minimum of 4800 hours	Write Certification Examination

* All direct entry apprentices must meet the **Requirements for Progression** either through Prior Learning Assessment and Recognition or course completion before advancing to the next year.

** Apprentices in a 7200 hour program which incorporates more than four blocks of training are considered fourth year apprentices pending completion of 100% course credits and workplace skills requirements.

5.2 For the duration of each Apprenticeship Training Period, the apprentice, who is not covered by a collective agreement, shall be paid a progressively increased schedule of wages which shall not be less than:

Program Duration	Wage Rates		Comments
7200 Hours	1st Year	55%	These wage rates are percentages of the prevailing journeyperson's wage rate in the place of employment of the apprentice. No apprentice shall be paid less than the wage rate established by the Labour Standards Act (1988), as now in force or as hereafter amended, or by other Order, as amended from time to time replacing the first mentioned Order.
	2nd Year	65%	
	3rd Year	75%	
	4th Year	90%	
5400 Hours and 4800 Hours	1st Year	55%	
	2nd Year	70%	
	3rd Year	85%	
4000 Hours			(Hairstylist Program) - The apprentice shall be paid no less than the minimum wage for hours worked and a commission agreed upon between the apprentice and the employer.

6.0 TOOLS

Apprentices shall be required to obtain hand tools as and when specified by the Board.

7.0 PERIODIC EXAMINATIONS AND EVALUATION

7.1 Every apprentice shall submit to such occupational tests and examinations as the Board shall direct. If after such occupational tests and examinations the apprentice is found to be making unsatisfactory progress, his/her rate of wage shall not be advanced as provided in Section 5 until his/her progress is satisfactory to the Director of Institutional and Industrial Education 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 Board 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. At the discretion of the instructor, the summative mark may be for completion of a theory examination or a combination of the theory examination and an assigned practical project.

8.0 GRANTING OF CERTIFICATES OF APPRENTICESHIP

Upon the successful completion of apprenticeship, the Board 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 Institutional and Industrial Education shall provide copies of the Registration for Apprenticeship form to all signatories to the document.

11.0 RATIO OF APPRENTICES TO JOURNEYPERSONS

The ratio of Apprentices to Journeypersons normally shall not exceed one apprentice to every one journeyperson employed. Exceptions for specific occupations may occur with the approval of the Provincial Apprenticeship and Certification Board.

12.0 RELATIONSHIP OF THE PLAN OF TRAINING TO A COLLECTIVE BARGAINING AGREEMENT

Collective agreements take precedence over the conditions outlined in the plan of training.

13.0 AMENDMENTS TO A PLAN OF APPRENTICESHIP TRAINING

A plan of training may be amended at any time by the Provincial Apprenticeship and Certification Board.

14.0 EMPLOYMENT, RE-EMPLOYMENT AND TRAINING REQUIREMENTS

14.1 The plan of training requires Apprentices to attend regularly their place of employment.

14.2 The plan of training requires Apprentices to regularly attend training programs for that occupation as prescribed by The Provincial Apprenticeship and Certification Board.

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 M.O.U.'s reinstated by the Provincial Apprenticeship and Certification Board 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 registering as a Trade Qualifier.

14.5 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 opportunity to be re-employed before another is hired.

14.6 The employer will permit each apprentice to attend regularly training programs as prescribed by the Provincial Apprenticeship and Certification Board.

14.7 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 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 Education within 30 days of the decision.

REQUIREMENTS FOR RED SEAL CERTIFICATION FOR APPRENTICES

1. Evidence that the required work experiences outlined in this plan of training have been obtained. This evidence must be in a format that clearly outlines 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 program.

3. A combination of training from an approved training program and suitable work experience totalling 7200 hours

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

5. Payment of the appropriate examination fee.

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 captures, in a broad sense, these roles and the responsibilities that result from them.

The Apprentice

- to complete all required technical training courses as approved by the Provincial Apprenticeship and Certification Board.
- to find appropriate employment.
- to complete all required work experiences in combination with the required hours.
- to ensure that the work experiences are well documented.
- to approach apprenticeship training with an attitude and commitment that fosters the qualities necessary for a successful career as a qualified journeyperson.
- to obtain the required hand tools as specified by the Board for each period of training of the apprenticeship program.

The Employer

- to provide high quality work experiences in an environment that is conducive to learning.
- to remunerate apprentices as set out in this Plan of Training or Collective Agreements.
- to provide feedback to Training Institutions, Industrial Training Division and Apprentices in an effort to establish a process of continuous quality improvement.
- where appropriate, to release apprentices for the purpose of returning to a training institution to complete the necessary technical courses.
- to ensure that work experiences of the apprentices are documented.

The Training Institution

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

The Industrial Training Division

- to establish and maintain program advisory committees under the direction of the Provincial Apprenticeship and Certification Board.
- to promote apprenticeship training as a viable career option to prospective apprentices and other appropriate persons involved, such as career guidance counsellors, teachers, parents, etc.
- to establish and maintain a protocol with training institutions, employers and other appropriate stakeholders to ensure the quality of apprenticeship training programs.
- to ensure that all apprentices are appropriately registered and records are maintained as required.
- to schedule all necessary technical training periods for apprentices to complete requirements for certification.
- to administer provincial/interprovincial examinations.

The Provincial Apprenticeship and Certification Board

- to set policies to ensure that the provisions of the Apprenticeship Training and Certification Act are implemented.
- to ensure that advisory and examination committees are established and maintained.
- to accredit institutions to deliver apprenticeship training programs.
- to designate occupations for apprenticeship training and/or certification.

Program Outcomes

Upon completion of the Steamfitter/Pipefitter program, students will have demonstrated the knowledge and skills required to perform the following tasks:

Task 1	Uses tools and equipment.
Task 2	Organizes work.
Task 3	Interprets drawings and specifications.
Task 4	Performs drafting.
Task 5	Performs layout and fabrication.
Task 6	Performs common installation processes.
Task 7	Plans lift.
Task 8	Hoists load.
Task 9	Installs high and low pressure process steam systems.
Task 10	Installs steam heating systems.
Task 11	Installs hydronic systems.
Task 12	Installs refrigeration systems.
Task 13	Installs process piping systems.
Task 14	Installs hydraulic systems.
Task 15	Installs fuel systems.
Task 16	Installs compressed air and medical gas systems.
Task 17	Prepares system for test.
Task 18	Performs test.
Task 19	Commissions systems.
Task 20	Maintains system.
Task 21	Performs repairs.

Program Structure

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

Entry Level Courses					
NL Course No.	**Atlantic Course No.**	**Course Name**	**Hours**	**Pre-Requisites**	**Page No.**
TS-1510		Occupational Health and Safety	6	None	14
TS-1520		WHMIS	6	None	17
TS-1530		First Aid	14	None	20
PF-1340	PIP-200	Tools and Equipment	75	None	21
PF-1350	PIP-205	Blueprint 1 (Basic Residential)	30	None	24
PF-1360	PIP-210	Blueprint 2 (Advanced Residential/Light Commercial)	30	PF-1340	27
PF-1370	PIP-220	Rigging	39	None	31
PF-1380	PIP-225	Introduction to Fuel Brazing and Cutting	45	PF-1340	34
PF-1390	PIP-230	Pipe and Tubing Fundamentals	15	PF-1340	37
PF-1400	PIP-235	Steel Piping	90	PF-1340	39
PF-1410	PIP-240	Copper Piping	45	PF-1340	43
PF-1420	PIP-245	Plastic Piping	45	PF-1340	46
PF-1430	PIP-250	Brass Piping	15	PF-1340	48
PF-1440	PIP-260	Piping Valves	30	None	50
PF-1450	PIP-265	Hydronic Heating 1	60	PF-1340	52
PF-1540	STM-630	Low Pressure Steam	90	PF-1350; PF-1360; PF-1390; PF-1400	56
PF-1550	STM-640	Pipe Template Development	75	PF-1380; PF-1390	60
PF-1560	STM-645	Pipe Layout & Fitting Fabrication	72	PF-1380; PF-1390	61
PF-1570	STM-660	Introduction to Electric Welding and Cutting	72	PF-1340; PF-1390	64
*MA-1060		Basic Math	60	None	110
CM-2150		Workplace Communications	45	None	113
MR-1220		Customer Service	30	None	115

Entry Level Courses					
NL Course No.	**Atlantic Course No.**	**Course Name**	**Hours**	**Pre-Requisites**	**Page No.**
SP-2330		Quality Assurance/Quality Control	30	None	117
MC-1050		Introduction to Computers	30	None	119
SD-1700		Workplace Skills	30	None	123
SD-1710		Job Search Techniques	15	None	125
SD-1720		Entrepreneurial Awareness	15	None	127
Total Hours			**1109**		

REQUIRED WORK EXPERIENCE

Block 2					
NL Course No.	**Atlantic Course No.**	**Course Name**	**Hours**	**Pre-Requisites**	**Page No.**
PF-2100	PIP-215	Blueprint 3 (Heavy Commercial/Industrial)	30	PF-1350; PF-1360	66
PF-2110	PIP-255	Aluminum Piping	9	PF-1340	70
PF-2120	PIP-270	Hydronic Heating 2	60	PF-1340; PF-1450	71
PF-2130	PIP-280	Introduction to Electricity	15	None	73
PF-2150	PIP-285	Introduction to Gas Piping I (Low Pressure)	30	None	75
PF-2160	PIP-295	Standpipe Systems	12	PF-1340	77
PF-2170	PIP-300	Medical Gas Systems	21	None	78
PF-2700	STM-615	Instrumentation	21	None	84
PF-2710	STM-620	Pipe and Tube Bending	30	PF-1340; PF-1380; PF-1390; PF-1570	87
PF-2720	STM-650	Specialty Steamfitting/Pipefitting Systems	12	PF-1340; PF-1390	89
Total Hours			**240**		

REQUIRED WORK EXPERIENCE

Block 3					
NL Course No.	**Atlantic Course No.**	**Course Name**	**Hours**	**Pre-Requisites**	**Page No.**
PF-2730	STM-600	Pumps/Compressors & Hydraulic Systems	135	PF-1340; PF-1350; PF-1360; PF-1380; PF-1390; PF-1570; PF-2100	90
PF-2740	STM-605	Valves	30	PF-1340; PF-1390	94
PF-2750	STM-635	High Pressure Steam	75	PF-1350; PF-1360; PF-1390; PF-1400; PF-1540	97
Total Hours			**240**		

REQUIRED WORK EXPERIENCE

Block 4					
NL Course No.	**Atlantic Course No.**	**Course Name**	**Hours**	**Pre-Requisites**	**Page No.**
PF-2310	PIP-275	Cross Connection Control Devices	45	PF-1340; PF-1390; PF-1400; PF-1410; PF-1420; PF-1430; PF-2110	80
PF-2320	PIP-290	Introduction to Gas Piping 2 (High Pressure)	30	PF-2150	82
PF-2760	STM-610	Refrigeration	30	None	100
PF-2770	STM-625	Stainless Steel and Specialty Piping	27	PF-1340; PF-1370; PF-1380; PF-1390; PF-1400; PF-1410; PF-1420; PF-1430; PF-1550; PF-1560; PF-2110	101
PF-2780	STM-655	Blueprint 4	39	PF-1350; PF-1360; PF-2100	104
PF-2790	STM-665	Advanced Rigging	39	PF-1370	105
PF-2800	STM-670	Controlled Bolting, Testing and Commissioning	30	None	107
Total Hours			**240**		

*** A student who can meet the Mathematics requirement through an ACUPLACER online test may be exempted from Mathematics 1060.**

TS-1510 OCCUPATIONAL HEALTH AND SAFETY

Description:

This course is designed to give participants the knowledge and skills necessary to interpret the Occupational Health and Safety Act, laws and regulations; understand the designated responsibilities within the laws and regulations; the right to refuse dangerous work; and the importance of reporting accidents.

Course Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
– prevent accidents and illnesses
– improve health and safety conditions in the workplace

Theory:

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 & 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 Industrial 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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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.

TS-1520 WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)

Description:

This course is designed to give participants the knowledge and skills necessary to define WHMIS, examine hazard identification and ingredient disclosure, explain labeling and other forms of warning, and introduce material safety data sheets (MSDS).

Course Outcomes:

Upon successful completion of this course, the apprentice will be able to:

– interpret and apply the Workplace Hazardous Materials Information System (WHMIS) Regulation under the Occupational Health & Safety Act.

Required Knowledge and Skills:

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 form 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
      - worker responsibility
   iii) 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

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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.

SUGGESTED RESOURCES:

1. WHMIS Regulation

2. Sample MSDS sheets

TS-1530 FIRST AID

Description:

This course is designed to give the apprentice the ability to recognize situations requiring emergency action and to make appropriate decisions concerning first aid.

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

PF-1340 TOOLS AND EQUIPMENT

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of the care and safe use of tools and equipment.

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) scribers, 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
      - – power operated saws
      - – friction cut-off equipment
      - – shears

ii) metal cutting power tools
iii) 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

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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.

PF-1350 BLUEPRINT 1 (BASIC RESIDENTIAL)

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– 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.

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Interpret and sketch basic drawings and diagrams.

PF-1360 BLUEPRINT 2 (ADVANCED RESIDENTIAL/LIGHT COMMERCIAL)

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
- 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.

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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.

PF-1370 RIGGING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– 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.

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 types of ladders and describe their applications and safety factors to be considered.

13. Describe procedures prior to and during the movement of objects with rigging equipment.

14. Identify jacks and describe their applications and procedures for use.

15. Identify methods of communications.
   i) hand signals
   ii) two-way radios

16. Identify types of cranes used in rigging.
   i) mobile
   ii) boom truck
   iii) overhead

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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.

PF-1380 INTRODUCTION TO FUEL BRAZING AND CUTTING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– use fuel cutting and brazing equipment.

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.
   i) clothing
   ii) location
   iii) protective equipment
   iv) 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
      – individual cylinder
      – 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
      – individual cylinder
      – 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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Set-up, test, use and shut down heating/cutting equipment.

2. Perform various types of cuts.

3. Perform various brazing processes.

PF-1390 PIPE AND TUBING FUNDAMENTALS

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– 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.

Objectives and Content:

1. 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)
   - vii) process and power generating systems

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

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

4. 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

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

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. No Practical.

PF-1400 STEEL PIPING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– select materials.
– demonstrate knowledge of steel pipe and fittings and their assembly.
– carry out work in compliance with codes, standards and manufacturer's literature.

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
     - – oxy/acetylene
     - – electric
     - – mig/tig
   - v) press-fit crimper
   - vi) vice, wrenches
   - vii) 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
        – center
        – face
        – back
        – 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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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) press-fit
    vi) tack-weld
    vii) mechanical

3. Bend steel pipe using hydraulic benders.

PF-1410 COPPER PIPING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– select materials.
– demonstrate knowledge of non-ferrous pipe/tubing and its assembly.
– carry out work in compliance with codes, standards and manufacturer's literature.

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) T-drill
   vii) press fit
   viii) 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

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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) T-drill
vi) press-fit
vii) grooved
viii) flaring

3. Bend copper tubing using tube benders.

PF-1420 PLASTIC PIPING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– select materials.
– demonstrate knowledge of plastic pipe and fittings and their assembly.
– carry out work in compliance with codes, standards and manufacturer's literature.

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. Identify 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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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) fusion weld
   iii) thread
   iv) compression
   v) mechanical joint
   vi) insert
   vii) crimp

PF-1430 BRASS PIPING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– select materials.
– demonstrate knowledge of brass pipe and fittings and its assembly.
– carry out work in compliance with codes, standards and manufacturer's literature.

Objectives and Content:

1. Identify brass pipe and fittings and describe their properties and applications.

2. Identify types and sizes of brass pipe and describe its characteristics and applications.

3. Describe methods used to cut and prepare brass pipe and their associated procedures.
   i) pipe cutters
   ii) reamers
   iii) cut-off saw
   iv) hacksaw

4. Describe the methods used to thread brass pipe and describe their associated procedures.

5. Identify the types of fittings used for joining brass pipe and describe their characteristics and applications.
   i) terminology
   ii) types
   iii) parts
   iv) acronyms and abbreviations

6. Identify and describe the tools and procedures used to hang, support and fasten brass pipe and fittings.
   i) codes
   ii) specifications
   iii) grade
   iv) components
   v) fire stopping systems

7. Describe the procedures used to calculate fitting allowances.
   i) tees
   ii) elbows
   iii) 45 degrees

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Measure, cut and prepare various types of brass pipe.

2. Assemble various types of brass pipe by the following methods.
   i) threading
   ii) brazing

PF-1440 PIPING VALVES

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of piping valves and their installation.

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

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Install, maintain and repair various types of valves.

PF-1450 HYDRONIC HEATING 1

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of the operation of hot water boilers and heating systems, their component parts and control systems.

Objectives and Content:

1. Define terminology associated with hydronic heating.

2. 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

3. 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

4. Describe expansion tanks and air control devices and procedures for their installation.
   i) air control
      – automatic
      – manual
   ii) tanks
      – diaphragm

– compression

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

6. Describe circulating pumps, their components and operation.
   i) circulating pumps
   ii) low head pumps

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

8. 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

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

PIPING

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

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

12. 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

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

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

15. Describe feedwater treatment systems.
    i) chemicals used in boiler feedwater

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

HEAT TRANSFER

17. Describe methods of heat transfer.
    i) radiation
    ii) conduction
    iii) convection

18. 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

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

20. 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

21. 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

22. 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

23. 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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Install hydronic heating boiler and trim.

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

PF-1540 LOW PRESSURE STEAM

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
- 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.

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

iv) de-aerator
- types
- purpose
- characteristics
- piping components
- installation

v) condensers
- types
- purpose
- characteristics
- installation

vi) boiler tubes
- materials
- characteristics
- tube fabrication
- tube bending
- water tubes
- fire tubes

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

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Install low pressure steam boiler, trim and related equipment.

2. Install a low pressure steam piping system.

3. Install water treatment device for a low pressure steam boiler.

PF-1550 PIPE TEMPLATE DEVELOPMENT

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– 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.

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. No Practical.

PF-1560 PIPE LAYOUT AND FITTING FABRICATION

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
– 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.

Objectives and Content:

PIPE LAYOUT

1. Explain pipe fitting terminology as it relates to fabrication.
   i) angle of turn
   ii) angle of cut
   iii) factor for angle of cut
   iv) cutback
   v) outside diameter pipe
   vi) 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. Explain 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. Explain different types of power supplies used and their applications.
   i) hydraulic pumps
   ii) air
   iii) electrical

10. Explain 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. Explain proper cleaning, maintenance and storage of equipment used for machining.

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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.

PF-1570 INTRODUCTION TO ELECTRIC WELDING AND CUTTING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of electrically operated welding and cutting equipment and associated safety procedures.

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Set up welding equipment

2. Weld basic joint configurations using various electrodes.

PF-2100 BLUEPRINT 3 (HEAVY COMMERCIAL/INDUSTRIAL)

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
- 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.

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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.

PF-2110 ALUMINUM PIPING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of aluminum pipe and tubing.

Objectives and Content:

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

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. No Practical.

PF-2120 HYDRONIC HEATING 2

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
– 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.

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

HEAT TRANSFER SYSTEMS

12. Describe the purpose, parts and operating principles of heat pumps.

13. Describe the procedures used to install heat pumps.

14. Describe the components and operation of the various types of solar heating systems.

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Install and test hydronic heating boiler and trim.

2. Install, test, maintain and repair various types of hydronic heating systems.
   i) mono flow
   ii) series loop
   iii) direct return
   iv) reverse return
   v) primary loop
   vi) secondary circuit
   vii) in-floor

PF-2130 INTRODUCTION TO ELECTRICITY

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of electrical principles.

Objectives and Content:

1. Explain Ohm's Law and associated formulae.

2. Explain electrical terminology.
   i) voltage
   ii) current
   iii) ampere
   iv) resistance
   v) ohm

3. Describe what is meant by resistance and the factors affecting it.

4. Describe the characteristics of conductors and insulators and their applications.

5. Describe direct current.

6. Describe the trade related applications of direct current.

7. Describe alternating current.

8. Define terms related to alternating current.
   i) cycle
   ii) hertz
   iii) electrical characteristics

9. Describe electrical circuits, their components and operation.

10. Describe the characteristics of electric circuits.
    i) series
    ii) parallel
    iii) series-parallel

11. Describe the causes of excessive current.

12. Describe overload protection circuits.

13. Interpret abbreviations, formula symbols and circuit symbols found in circuit diagrams.

14. Identify and interpret nameplate date from electric circuits.

15. Describe the procedures used to troubleshoot electric motors.

16. Explain electrolysis.

17. Describe the detrimental effect of electrolysis on piping.
    i) dissimilar piping
    ii) incompatible pipe hanger
    iii) underground installations of liquid and gas lines

18. Read and interpret basic electrical schematics.

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. No Practical.

PF-2150 INTRODUCTION TO GAS PIPING 1 (LOW PRESSURE)

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of the combustion process.
– demonstrate knowledge of gas piping installation according to code.

Objectives and Content:

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

2. 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
   xi) limits of flammability
   xii) ignition temperature
   xiii) combustion process

3. 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

4. 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

5. Describe the procedures used to test a gas line.
   i) before appliance is connected
   ii) purging a gas line

6. 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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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

PF-2160 STANDPIPE SYSTEMS

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of standpipe systems and their installation.

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. No Practical.

PF-2170 MEDICAL GAS SYSTEMS

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of medical gas systems.

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 tube 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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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

PF-2310 CROSS CONNECTION CONTROL DEVICES

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– identify cross connections and determine how to correct them.

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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

PF-2320 INTRODUCTION TO GAS PIPING 2 (HIGH PRESSURE)

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of the combustion process.
– demonstrate knowledge of gas piping installation according to code.

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. No Practical.

PF-2700 INSTRUMENTATION

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
- demonstrate knowledge of instrument controls and indicating devices, their operation and installation procedures.
- Interpret instrumentation requirements from drawings.

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
     - snubbers
     - movement and case type
     - throttling devices
   - vii) installation considerations
     - steam system
     - gas system

2. Describe flow measuring instruments and installation considerations.
   - i) flow measurement devices
     - venturi tubes
     - orifice plates
     - orifices
     - flow nozzle
   - ii) pressure taps and flange connections
     - types
     - location
     - liquid flow pattern
     - straightening vanes
     - installation procedures
   - iii) magnetic flow meter
     - principles of operation
     - typical installation
     - installation procedures

3. Describe temperature measuring devices and installation considerations.
   - i) thermometers
     - glass stem
     - bi-metal
     - filled thermal
     - thermocouples
     - bulbs
     - wells
   - ii) remote bulb thermostat
     - liquid filled
     - operation
     - mounting
     - 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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Layout tray and install stainless steel tubing.

PF-2710 PIPE AND TUBE BENDING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
- 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.

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

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Bend steel pipe using hydraulic benders.

2. Bend copper tubing using tubing benders.

3. Perform annealing process.

PF-2720 SPECIALTY STEAMFITTING/PIPEFITTING SYSTEMS

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– demonstrate knowledge of safety requirements for installation of specialty piping systems.

Objectives and Content:

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

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. No Practical.

PF-2730 PUMPS/COMPRESSORS AND HYDRAULIC SYSTEMS

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
- demonstrate knowledge of safety procedures for working with and around air compressors and hydraulic systems.
- demonstrate knowledge of disassembly/reassembly of hydraulic systems and components.
- demonstrate knowledge of procedures used to maintain, hydraulic equipment and compressors.
- demonstrate knowledge of procedures used to inspect, adjust and replace component parts.
- identify and interpret applicable codes.

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

3. 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

4. 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

5. 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

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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

2. Layout and install a basic hydraulic system.

3. Layout and install a basic air system.

PF-2740 VALVES

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
– demonstrate knowledge of procedures used to select and install valves.
– demonstrate knowledge of procedures used to maintain and service valves.

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
- electric
- 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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

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

PF-2750 HIGH PRESSURE STEAM

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
– 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.

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) steam turbines
- high pressure steam piping
- super heated steam

xii) lubrication system to turbines
- piping
- connections
- pump
- tank
- filters

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. No Practical.

PF-2760 REFRIGERATION

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
– demonstrate knowledge of the components and operation of refrigeration piping systems.

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.

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. No Practical

PF-2770 STAINLESS STEEL AND SPECIALTY PIPING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
- 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.

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)
   - v) 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.
   - i) inconel
   - ii) monel
   - iii) cupronickel (copper nickel)
   - iv) duplex
   - v) super duplex
   - vi) titanium
   - vii) 6% Molybdenum (6MO)
   - viii) alloy 20

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Fabricate joints in various types of specialty piping systems.

PF-2780 BLUEPRINT 4

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– identify location of piping components, controls and equipment.

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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Interpret and extract information from industrial drawings.

PF-2790 ADVANCED RIGGING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to:
– 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.

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
   iii) communication methods
   iv) pre-lift checks
   v) placement of load

vi) post-lift inspection

Practical:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Set up rigging equipment to perform a safe lift .

PF-2800 CONTROLLED BOLTING, TESTING AND COMMISSIONING

Outcomes:

Upon successful completion of this unit, the apprentice will be able to
– 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.

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
   iv) formulas for length of bolts, nuts and wrench sizes
   v) 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
      – CO_2
      – 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:

Practical skills enhance the apprentices' ability to meet the objectives of this course. The learning objectives outlined below are **mandatory** in Newfoundland and Labrador, but are provided as suggestions for Nova Scotia, Prince Edward Island and New Brunswick.

1. Perform hydraulic torquing.

2. Perform hydraulic tensioning.

3. Perform pressure testing.

4. Perform various types of pressure testing.

MA-1060 BASIC MATH

Description:

This course in Basic Math requires knowledge of general mathematical concepts and processes to enable trades persons to function in the institutional setting by developing numeracy skills required for technical courses. This math course should also provide a foundation for experiential learning through a knowledge of math relating to on-the-job skills and practices. A detailed course outline is available from the Department of Education, Industrial Training Section to training institutions upon request.

Course Outcomes:

1. To develop numeracy skills and knowledge required for institutional and on-the-job learning.

2. To develop the capability to apply mathematical concepts in the performance of trade practices.

3. To develop an appreciation for mathematics as a critical element of the learning environment

4. To use mathematical principles accurately for the purposes of problem solving, job and materials estimation, measurement, calculation, system conversion, diagram interpretation and scale conversions, formulae calculations, and geometric applications.

Prerequisites:

Course Duration: 60 hrs.

Course Objectives (Knowledge):

1. Define and calculate using whole number operations

2. Define and demonstrate use of correct orders of operations

3. Demonstrate examples of operations with fractions and mixed numbers

4. Demonstrate examples of operations with decimals

5. Demonstrate examples of operations with percentages

6. Employ percent/decimal/fraction conversion and comparison

7. Define and calculate with ratios and proportions

8. Use the Imperial Measurement system in relevant trade applications

9. Use the Metric Measurement system in relevant trade applications

10. Perform Imperial/Metric conversions

11. Define and demonstrate the formulation of variables

12. Demonstrate and define the various properties of angles and make relevant calculations

Major Tasks/Sub-tasks (Skills):

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

REQUIRED RELATED COURSES

CM-2150 WORKPLACE COMMUNICATIONS

Description:

This course is designed to introduce students to the principles of effective communication including letters, memos, short report writing, oral presentations and interpersonal communications.

Course Outcomes:

Upon completion of the course, students will be able to:

– understand and apply communication skills as outlined in the Employability Skills 2000, Conference Board of Canada
– understand the importance of well-developed writing skills in business and in career development.
– understand the purpose of the various types of business correspondence.
– examine the principles of effective business writing.
– examine the standard formats for letters and memos.
– write effective letters and memos.
– examine the fundamentals of informal reports and the report writing procedure.
– produce and orally present an informal report
– examine effective listening skills and body language in communication

Objectives and Content:

1. Apply rules and principles for writing clear, concise, complete sentences which adhere to the conventions of grammar, punctuation, and mechanics.

2. Explain the rules of subject-verb agreement.

3. Define and describe the major characteristics of an effective paragraph

4. Examine the Value of Business Writing Skills
   i) Describe the importance of effective writing skills in business
   ii) Describe the value of well-developed writing skills to career success as referenced in the Employability Skills

5. Examine Principles of Effective Business Writing
   i) Discuss the rationale and techniques for fostering goodwill in business communication, regardless of the circumstances
   ii) Review the importance of revising and proofreading
   iii) Differentiate between letter and memo applications in the workplace & review samples
   iv) Identify the parts of a business letter and memo
   v) Review the standard formats for business letters and memos
   vi) Examine samples of well-written and poorly written letters and memos

vii) Examine guidelines for writing sample letters and memos which convey: acknowledgment, routine request, routine response, complaint, refusal, persuasive request and letters of appeal.

6. Examine the Fundamentals of Informal Business Reports
   i) Identify the purpose of the informal report
   ii) Identify the parts and formats of an informal report
   iii) Identify methods of information gathering
   iv) Describe the methods of referencing documents
   v) Review the importance of proof reading and editing

7. Examine types of presentations
   i) Review & discuss components of an effective presentation
   ii) Review & discuss delivery techniques
   iii) Review & discuss preparation & use of audio/visual aids
   iv) Discuss & participate in confidence building exercises used to prepare for giving presentations

8. Interpersonal Communications
   i)Examine and apply listening techniques
   ii) Discuss the importance of body language

Practical:

1. Write well-developed, coherent, unified paragraphs which illustrate the following: A variety of sentence arrangements; conciseness and clarity; and adherence to correct and appropriate sentence structure, grammar, punctuation, and mechanics.

2. Write sample letters and memos which convey: acknowledgment, routine request, routine response, complaint, refusal, persuasive request and letters of appeal.

3. Gather pertinent information, organize information into an appropriate outline & write an informal report with documented resources.
   i) Edit, proofread, and revise the draft to create an effective informal report and present orally using visual aids
   ii) Participate in confidence building exercises
   iii) Present an effective presentation.

5. Evaluate presentations.

MR-1220 CUSTOMER SERVICE

Description:

This course focuses on the role of providing quality customer service. It is important to have a positive attitude and the necessary skills to effectively listen and interpret customer concerns about a product, resolve customer problems, and determine customer wants and needs. Students will be able to use the skills and knowledge gained in this course to effectively provide a consistently high level of service to the customer.

Course Outcomes:

Upon successful completion of this course, students will be able to:
- define customer service
- explain why service is important
- describe the relationship between “service” and “sales”
- demonstrate an understanding of the importance of a positive attitude
- demonstrate methods of resolving customer complaints

Objectives and Content:

1. Define quality service
   - i) Identify and discuss elements of customer service
   - ii) Explain the difference between Service vs. Sales or Selling
   - iii) Explain why quality service is important
   - iv) Identify the various types of customers & challenges they may present
   - v) Describe customer loyalty
   - vi) Examine barriers to quality Customer Service

2. Explain how to determine customers wants and needs
   - i) Identify customer needs
   - ii) Explain the difference between customer wants and needs
   - iii) Identify ways to ensure repeat business

3. Demonstrate an understanding of the importance of having a positive attitude
   - i) Identify & discuss the characteristics of a positive attitude
   - ii) Explain why it is important to have a positive attitude
   - iii) Explain how a positive attitude can improve a customer’s satisfaction
   - iv) Define perception and explain how perception can alter us and customers
   - v) Describe methods of dealing with perception

4. Communicating effectively with customers
   - i) Describe the main elements in the communication process
   - ii) Identify some barriers to effective communication
   - iii) Explain why body language is important

iv) Define active listening and state why it is important
v) Identify and discuss the steps of the listening process
vi) Identify and discuss questioning techniques

5. Demonstrate using the telephone effectively
   i) Explain why telephone skills are important
   ii) Describe the qualities of a professional telephone interaction

6. Demonstrate an understanding of the importance of asserting oneself
   i) Define assertiveness
   ii) Discuss assertive techniques
   iii) Explain the use of assertiveness when dealing with multiple customers

7. Demonstrate techniques for interacting with challenging customers in addressing complaints & resolving conflict
   i) Examine & discuss ways to control feelings
   ii) Examine & discuss ways to interact with an upset customer
   iii) Examine & discuss ways to resolve conflict/customer criticism
   iv) Examine & discuss ways to prevent unnecessary conflict with customers

Practical:

1. Participate in activities to demonstrate knowledge of the course objectives.

SP-2330 QUALITY ASSURANCE/QUALITY CONTROL

Description:

This course is designed to give students an understanding of the concepts and requirements of QA/QC such as, interpreting standards, controlling the acceptance of raw materials, controlling quality variables and documenting the process. It includes information on quality concepts, codes and standards, documentation, communications, human resources, company structure and policy, teamwork and responsibilities.

Course Outcomes:

Upon completion of this course, students will be able to:
- develop the skills and knowledge required to apply quality assurance/quality control procedures as related to the trade
- develop an awareness of quality principles and processes
- apply quality assurance/quality control procedures in a shop project

Objectives & Content:

1. Describe the reasons for quality assurance and quality plans.

2. Explain the relationship between quality assurance and quality control.

3. Describe quality control procedures as applied to the production and checking of specifications and processes in applicable occupations.

4. Describe quality control procedures as applied to the acceptance and checking of raw materials.

5. Explain the role of communications in a quality environment.

6. Explain why it is important for all employees to understand the structure of the company and its production processes.

7. Explain how human resource effectiveness is maximized in a quality managed organization.

8. Explain the role of company policy in quality management.

9. Explain the purpose of codes and standards in various occupations.

10. Explain the concepts of quality
    i) cost of quality
    ii) measurement of quality
    iii) elements of quality

iv) elements of the quality audit
v) quality standards
vi) role expectations and responsibilities

11. Explain the structure of quality assurance and quality control
    i) Describe organizational charts
    ii) Identify the elements of a quality assurance system such as ISO, CSA, WHMIS, Sanitation Safety Code (SSC)
    iii) Explain the purpose of the quality assurance manual
    iv) Describe quality assurance procedures

12. Examine quality assurance/quality control documentation
    i) Describe methods of recording reports in industry
    ii) Describe procedures of traceability (manual and computer-based recording)
    iii) Identify needs for quality control procedures

Practical:

1. Apply quality control to a project
    i) Follow QA/QC procedures for drawings, plans and specifications in applicable occupations.
    ii) Calibrate measuring instruments and devices in applicable occupations.
    iii) Interpret required standards
    iv) Follow QA/QC procedures for accepting raw materials
    v) Carry out the project
    vi) Control the quality elements (variables)
    vii) Complete QA/QC reports

MC-1050 INTRODUCTION TO COMPUTERS

Description:

This course is designed to give the student an introduction to computer systems. Particular emphasis is given to word processing, spreadsheet, e-mail and the Internet and security issues.

Course Outcomes:

Upon completion of this course, students will have a basic understanding of:
– computer systems and their operation.
– popular software packages, their applications
– security issues of Computers

Objectives & Content:

1. Identify the major components of microcomputer system hardware and software system.

2. Describe the functions of the microprocessor.
   i) Describe and give examples of I/O DEVICES.
   ii) Describe primary storage (RAM, ROM, Cache).
   iii) Define bit, byte, code and the prefixes k.m. and g.
   iv) Describe secondary storage (diskettes and hard disks, CD ROMS, Zip Drives etc).
   v) Describe how to care for a computer and its accessories.

3. Describe microcomputer software
   i) Define software.
   ii) Describe types of operational and application software
   iii) Define file and give the rules for filenames and file extensions.

4. Describe windows software
   i) Start and quit a Program
   ii) Demonstrate how to use the help function
   iii) Locate a specific file using the **find** function
   iv) Identify system settings:wall paper, screen saver, screen resolution, background
   v) Start a program by using the Run Command
   vi) Shutting down your computer

5. Identify File Management commands
   i) Demonstrate how to view directory structure and folder content
   ii) Organize files and folders
   iii) Copy, delete, and move files and folders

iv) Create folders
v) Maximize and minimize a window
vi) Describe windows task bar

6. Describe Keyboards
   i) Identify and locate alphabetic and numeric keys
   ii) Identify and locate function key & special keys

7. Describe Word Processing
   i) Describe Windows components
   ii) Menu bar
   iii) Menu indicators
   iv) Document window
   v) The Status bar
   vi) The Help feature
   vii) Insertion point movements

8. Describe the procedure used to development of a document
   i) Enter text
   ii) Change the display

9. Describe the procedure for opening, saving and exiting documents
   i) Saving a document
   ii) Closing a document.
   iii) Starting a new document Window
   iv) Opening a document
   v) Exiting word processor

10. Describe the procedure for editing a Document
    i) Adding new text
    ii) Deleting text
    iii) Using basic format enhancement (split and join paragraphs, insert text)

11. Describe the main Select Features
    i) Identify a selection
    ii) Moving a selection
    iii) Copying a selection
    iv) Deleting a selection
    v) Saving a selection

12. Explain how to change Layout Format
    i) Changing layout format: (margins, spacing, alignment, paragraph indent, tabs, line spacing, page numbering)

13. Explain how to change Text Attributes
    i) Changing text attributes: (bold, underline, font, etc.)

14. Describe the Auxiliary Tools
    i) Using Spell Check & Thesaurus

15. Describe Print features
    i) Selecting the Print Feature: (i.e; number of copies and current document)
    ii) Identifying various options in print screen dialogue box

16. Examine & Discuss Electronic Spreadsheet
    i) Spreadsheet Basics
    ii) The Worksheet Window

17. Describe Menus
    i) Menu Bar
    ii) Control menu
    iii) Shortcut menu
    iv) Save, Retrieve form menus

18. Describe the components of a worksheet
    i) Entering constant values and formulas
    ii) Using the Recalculation feature

19. Describe Use ranges
    i) Typing a range for a function
    ii) Pointing to a range for a function
    iii) Selecting a range for toolbar and menu commands

20. Describe how to print a worksheet
    i) Printing to the Screen
    ii) Printing to the Printer
    iii) Printing a selected Range

21. Describe how to edit a worksheet
    i) Replacing cell contents
    ii) Inserting & deleting rows and columns
    iii) Changing cell formats
    iv) Changing cell alignments
    v) Changing column width
    vi) Copying and moving cells

22. State major security issues in using computers
    i) Pass words
    ii) Accessing accounts
    iii) Viruses and how they can be avoided
    iv) Identity theft and ways to protect personal information

23. Describe how to use Electronic Mail
    - i) E-mail etiquette
    - ii) E-mail accounts
    - iii) E-mail messages
    - iv) E-mail message with attachments
    - v) E-mail attachments
    - vi) Print e-mail messages
    - vii) Deleting e-mail messages

24. Explain the Internet and its uses
    - i) The World Wide Web(www)
    - ii) Accessing Web sites
    - iii) Internet Web Browsers
    - iv) Internet Search Engines
    - v) Searching Techniques
    - vi) Posting documents on-line

Practical:

1. Create a document using Word Processing.

2. Complete word processing exercises to demonstrate proficiency in word processing

3. Prepare and send e-mails with attachments

4. Retrieve documents and e-mail attachments and print copies

5. Develop & print a spread sheet.

6. Post a document on-line

SD-1700 WORKPLACE SKILLS

Description:

This course involves participating in meetings, information on formal meetings, unions, workers' compensation, employment insurance regulations, workers' rights and human rights.

Course Outcomes:

Upon completion of this course, students will be able to:
- Participate in meetings
- Define and discuss basic concepts of:
  - unions
  - workers' compensation
  - employment insurance
  - workers' rights
  - human rights
  - workplace diversity
  - gender sensitivity

Objectives & Content:

1. Meetings
   - i) Identify & discuss meeting format and preparation required for a meeting.
   - ii) Explain the purpose of an agenda.
   - iii) Explain the roles and responsibilities of meeting participants.
   - iv) Explain the purpose of motions and amendments and withdrawals.
   - v) Explain the procedure to delay discussion of motions.
   - vi) Explain the voting process.

2. Unions
   - i) State why unions exist.
   - ii) Give a concise description of the history of Canadian labour.
   - iii) Explain how unions function.
   - iv) Explain labour's structure.
   - v) Describe labour's social objectives.
   - vi) Describe the relationship between Canadian labour and the workers.
   - vii) Describe the involvement of women in unions.

3. Worker's Compensation
   - i) Describe the aims, objectives, benefits and regulations of the Workplace Health, safety and Compensation Commission.
   - ii) Explain the internal review process.

4. Employment Insurance
   i) Explain employment insurance regulations
   ii) Describe how to apply for employment insurance.
   iii) Explain the appeal process.
   iv) Identify the components of a letter of appeal.

5. Worker's Rights
   i) Define labour standards.
   ii) Explain the purpose of the Labour Standards Act.
   iii) Identify regulations pertaining to:
      – Hours of work
      – Minimum wages
      – Employment of children
      – Vacation pay
   iv) Explain the purpose of the Occupational Health & Safety Act as it refers to workers' rights

6. Human Rights
   i) Describe what information cannot be included on an employment application.
   ii) Describe what information cannot be included in an interview.
   iii) Examine the Human Rights Code and explain the role of the Human Rights Commission.
   iv) Define harassment in various forms and identify strategies for prevention.

7. Workplace Diversity
   i) Define and explore basic concepts and terms related to workplace inclusively including age, race, culture, religion, socio-economic, sexual orientation with an emphasis on gender issues and gender stereotyping.

8. Gender Sensitivity
   i) Explore gender and stereotyping issues in the workplace by identifying strategies for eliminating gender bias.

Practical:

1. Prepare an agenda.

2. Participate in a meeting.

3. Analyze a documented case of a human rights complaint with special emphasis on the application, time frame, documentation needed, and legal advice available.

SD-1710 JOB SEARCH TECHNIQUES

Description:

This course is designed to give students an introduction to the critical elements of effective job search techniques.

Course Outcomes:

Upon completion of this course, students will be able to:
– Demonstrate effective use of Job Search Techniques

Objectives & Content:

1. Identify and examine employment trends and opportunities

2. Identify sources that can lead to employment

3. Access and review information on the Newfoundland and Labrador Apprenticeship and Certification Web site and the Apprenticeship Employment Gateway

4. Analyze job ads and discuss the importance of fitting qualifications to job requirements

5. Identify and discuss employability skills as outlined by the Conference Board of Canada.

6. Discuss the necessity of fully completing application forms**.**

7. Establish the aim/purpose of a resume

8. Explore characteristics of effective resumes, types of resumes, and principles of resume format .

9. Explore characteristics of an effective cover letter.

10. Identify commonly asked questions in an interview.

11. Explore other employment related correspondence.

12. Explore the job market to identify employability skills expected by an employer.

13. Conduct a self-analysis and compare with general employer expectations.

14. Discuss the value of establishing and maintaining a portfolio.

Practical:

1. Complete sample application forms.

2. Write a resume.

3. Write an effective cover letter.

4. Establish a portfolio.

5. Write out answers to commonly asked questions asked during interviews.

6. Identify three potential employers from the Apprenticeship Employment gateway, Apprenticeship & Certification web site.

SD-1720 ENTREPRENEURIAL AWARENESS

Description:

This course is designed to introduce the student to the field of entrepreneurship, including the characteristics of the entrepreneur, the pros and cons of self-employment, and some of the steps involved in starting your own business.

Course Outcomes:

Upon completion of this course, the student will be able to:

– Identify the various types of business ownership, the advantages and disadvantages of self-employment and identify the characteristics of an entrepreneur.
– State the purpose and identify the main elements of a business plan.

Objectives & Content:

1. Explore Self-Employment: An Alternative to Employment
   i) Identify the advantages and disadvantages of self-employment vs. regular employment
   ii) Differentiate between an entrepreneur and a small business owner
   iii) Evaluate present ideas about being in business

2. Identify and discuss various types of business ownership
   i) Explore the Characteristic of Entrepreneurs
   ii) Identify characteristics common to entrepreneurs
   iii) Compare one's own personal characteristics with those of entrepreneurs.
   iv) Examine one's present ideas about business people

3. Identify Business Opportunities
   i) Distinguish between an opportunity and an idea.
   ii) Examine existing traditional and innovative business ventures
   iii) Identify and summarize the role of various agencies that support business development.
   iv) Identify potential business opportunities.

4. Review the Entrepreneurial Process.
   i) Explain the entrepreneurial process
   ii) Describe the purpose of a business plan
   iii) Identify & discuss the main elements of a business plan

Practical:

1. From a list potential business opportunities prepare a list of elements that would have to be included in a business plan.

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Change Number: 114
Last Saved On: 5/25/2006 11:08 AM
Last Saved By: staff
Total Editing Time: 2,116 Minutes
Last Printed On: 5/25/2006 11:13 AM
As of Last Complete Printing
Number of Pages: 133
Number of Words: 19,544 (approx.)
Number of Characters: 111,404 (approx.)