

Apprenticeship and Industry Training

Steamfitter/Pipefitter

Apprenticeship Course Outline

0075 (2018)



Apprenticeship
and Industry
Training

ALBERTA ADVANCED EDUCATION

Steamfitter-pipefitter course outline

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**Steamfitter/Pipefitter
Table of Contents**

Steamfitter/Pipefitter Table of Contents..... 1
Apprenticeship 2
Apprenticeship and Industry Training System 2
Apprenticeship Safety 4
Procedures for Recommending Revisions to the Course Outline..... 5
Apprenticeship Route toward Certification 6
Steamfitter/Pipefitter Training Profile..... 7

Course Outline

First Period Technical Training..... 11
Second Period Technical Training..... 18
Third Period Technical Training..... 25
Fourth Period Technical Training 31

Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding an employer. Employers hire apprentices, pay their wages and provide on-the-job training and work experience. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyman or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution – usually a college or technical institute.

To become certified journeymen, apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board on the recommendation of the Steamfitter/Pipefitter Provincial Apprenticeship Committee.

The graduate of the Steamfitter/Pipefitter apprenticeship program is a certified journeyman who will be able to:

- install and maintain high pressure and low pressure steam and hot liquid systems, including various process and industrial systems
- fabricate, join and install any pipe system used for various purposes in buildings, using any type of pipe including steel, alloy, cast iron, copper or plastic, etc.
- provide safe and efficient systems which function in conjunction with other systems
- comply with rules and codes governing installations
- read and interpret plans, specifications and working drawings and prepare layouts
- be proficient with the safe use of hand and power tools and equipment
- calculate material quantities and compile materials lists
- install components according to specifications and assume responsibility for the end product
- relate to job situations and other trades that precede or follow
- understand the fundamentals of operating a small business.
- Perform assigned tasks in accordance with quality and production standards required by industry.

Apprenticeship and Industry Training System

Industry-Driven

Alberta's apprenticeship and industry training system is an industry-driven system that ensures a highly skilled, internationally competitive workforce in more than 50 designated trades and occupations. This workforce supports the economic progress of Alberta and its competitive role in the global market. Industry (employers and employees) establishes training and certification standards and provides direction to the system through an industry committee network and the Alberta Apprenticeship and Industry Training Board. The Alberta government provides the legislative framework and administrative support for the apprenticeship and industry training system.

Alberta Apprenticeship and Industry Training Board

The Alberta Apprenticeship and Industry Training Board provides a leadership role in developing Alberta's highly skilled and trained workforce. The Board's primary responsibility is to establish the standards and requirements for training and certification in programs under the Apprenticeship and Industry Training Act. The Board also provides advice to the Minister of Advanced Education on the needs of Alberta's labour market for skilled and trained workers, and the designation of trades and occupations.

The thirteen-member Board consists of a chair, eight members representing trades and four members representing other industries. There are equal numbers of employer and employee representatives.

Industry Committee Network

Alberta's apprenticeship and industry training system relies on a network of industry committees, including local and provincial apprenticeship committees in the designated trades, and occupational committees in the designated occupations. The network also includes other committees such as provisional committees that are established before the designation of a new trade or occupation comes into effect. All trade committees are composed of equal numbers of employer and employee representatives. The industry committee network is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the Board can set up a local apprenticeship committee. The Board appoints equal numbers of employee and employer representatives for terms of up to three years. The committee appoints a member as presiding officer. Local apprenticeship committees:

- monitor apprenticeship programs and the progress of apprentices in their trade, at the local level
- make recommendations to their trade's provincial apprenticeship committee (PAC) about apprenticeship and certification in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- make recommendations to the Board about the appointment of members to their trade's PAC
- help settle certain kinds of disagreements between apprentices and their employers
- carry out functions assigned by their trade's PAC or the Board

Provincial Apprenticeship Committees (PAC)

The Board establishes a provincial apprenticeship committee for each trade. It appoints an equal number of employer and employee representatives, and, on the PAC's recommendation, a presiding officer - each for a maximum of two terms of up to three years. Most PACs have nine members but can have as many as twenty-one. Provincial apprenticeship committees:

- make recommendations to the Board about:
 - standards and requirements for training and certification in their trade
 - courses and examinations in their trade
 - apprenticeship and certification
 - designation of trades and occupations
 - regulations and orders under the Apprenticeship and Industry Training Act
- monitor the activities of local apprenticeship committees in their trade
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- consult with other committees under the Apprenticeship and Industry Training Act about apprenticeship programs, training and certification and facilitate cooperation between different trades and occupations
- consult with organizations, associations and people who have an interest in their trade and with employers and employees in their trade
- may participate in resolving certain disagreements between employers and employees
- carry out functions assigned by the Board

Steamfitter/Pipefitter PAC Members at the time of publication.

Mr. T. Hopman	Airdrie	Presiding Officer
Mr. B. Thompson.....	Edmonton.....	Employer
Mr. N. Wylie.....	Edmonton.....	Employer
Mr. L. Yakemchuk	Sherwood Park.....	Employer
Mr. D. Zenchuk.....	Ardrossan.....	Employer
Ms. D. Francis	Leduc	Employee
Ms. M. Pasula.....	Beaumont.....	Employee
Mr. C. Ploof	St. Albert	Employee
Mr. C. Van Petten.....	Edmonton.....	Employee

Alberta Government

Alberta Advanced Education works with industry, employer and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and employers
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, employers, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

Alberta Apprenticeship and Industry Training Board Safety Policy

The Alberta Apprenticeship and Industry Training Board (board) fully supports safe learning and working environments and emphasizes the importance of safety awareness and education throughout apprenticeship training- in both on-the- job training and technical training. The board also recognizes that safety awareness and education begins on the first day of on-the-job training and thereby is the initial and ongoing responsibility of the employer and the apprentice as required under workplace health and safety training. However the board encourages that safe workplace behaviour is modeled not only during on-the-job training but also during all aspects of technical training, in particular, shop or lab instruction. Therefore the board recognizes that safety awareness and training in apprenticeship technical training reinforces, but does not replace, employer safety training that is required under workplace health and safety legislation.

The board has established a policy with respect to safety awareness and training:

The board promotes and supports safe workplaces, which embody a culture of safety for all apprentices, employers and employees. Employer required safety training is the responsibility of the employer and the apprentice, as required under legislation other than the *Apprenticeship and Industry Training Act*.

The board's complete document on its 'Apprenticeship Safety Training Policy' is available at www.tradesecrets.alberta.ca; access the website and conduct a search for 'safety training policy'.

Implementation of the policy includes three common safety learning outcomes and objectives for all trade course outlines. These common learning outcomes ensure that each course outline utilizes common language consistent with workplace health and safety terminology. Under the title of 'Standard Workplace Safety', this first section of each trade course outline enables the delivery of generic safety training; technical training providers will provide trade specific examples related to the content delivery of course outline safety training.

Occupational Health and Safety

A tradesperson is often exposed to more hazards than any other person in the work force and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Occupational Health and Safety (A division of Alberta Human Services) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.humanservices.alberta.ca

Technical Training

Apprenticeship technical training is delivered by the technical institutes and colleges in the public post-secondary system throughout Alberta. The colleges and institutes are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All training providers place a strong emphasis on safety that complements safe workplace practices towards the development of a culture of safety for all trades.

The technical institutes and colleges work with Alberta's Apprenticeship and Industry Training Board, industry committees and Alberta Advanced Education to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs across the Province. They develop curriculum from the course outlines established by industry and provide technical training to apprentices.

The following technical training providers deliver Steamfitter/Pipefitter apprenticeship training:

Grande Prairie Regional College	Red Deer College
Medicine Hat College	Southern Alberta Institute of Technology
Northern Alberta Institute of Technology	Lakeland College
Keyano College	Portage College

Procedures for Recommending Revisions to the Course Outline

Advanced Education has prepared this course outline in partnership with the Steamfitter/Pipefitter Provincial Apprenticeship Committee.

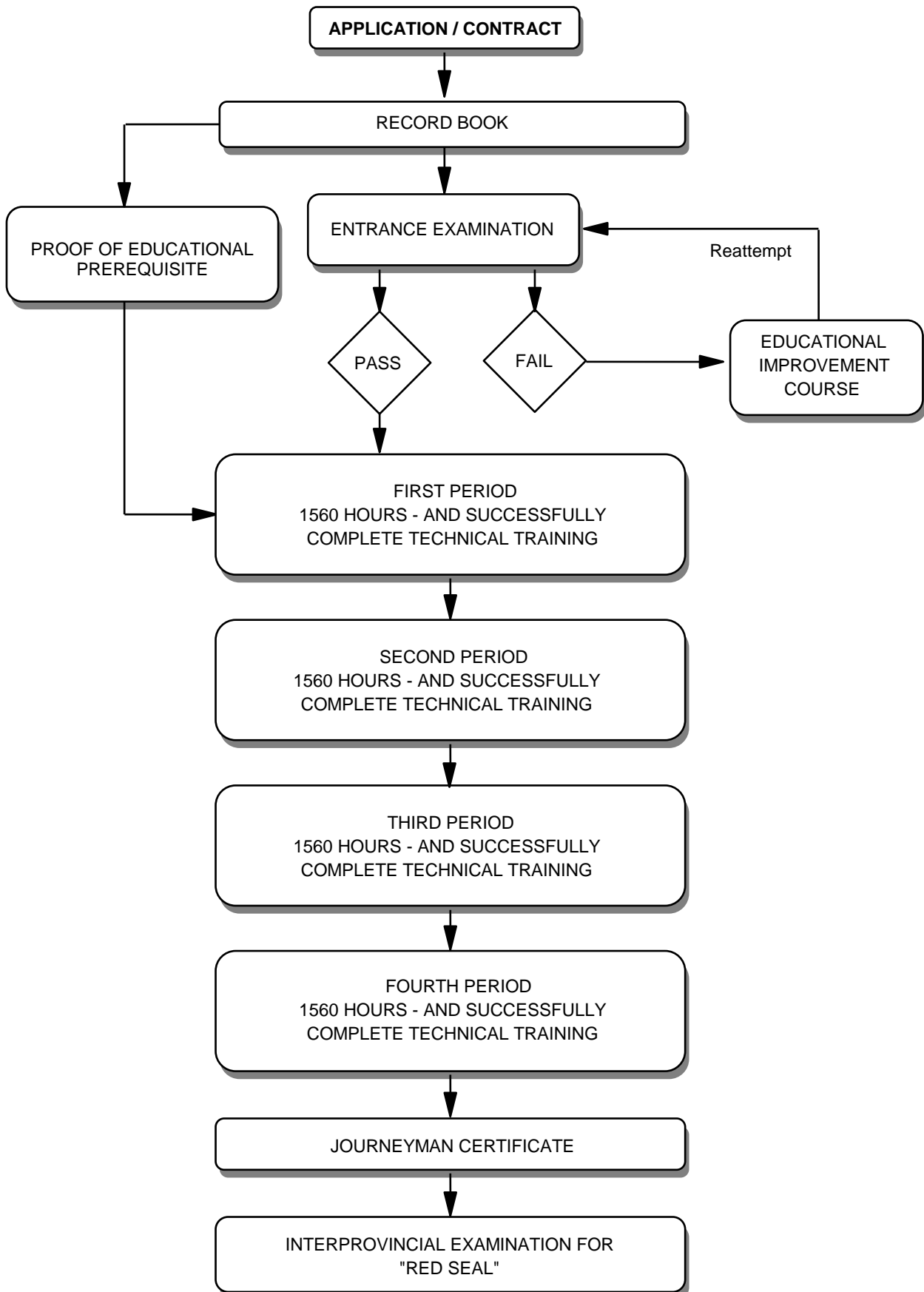
This course outline was approved on June 12, 2017 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

Steamfitter/Pipefitter Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
Advanced Education
10th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used. Recommendations for change will be placed on the agenda for regular meetings of the Steamfitter/Pipefitter Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



Steamfitter/Pipefitter Training Profile
FIRST PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

WORKPLACE SAFETY AND RIGGING
24 HOURS



A	B	C
Safety Legislation, Regulations & Industry Policy in Trades 4 Hours	Climbing, Lifting, Rigging and Hoisting 6 Hours	Hazardous Materials and Fire Protection 4 Hours
D	E	F
Apprenticeship Training Program 3 Hours	Pipe Trade Codes 3 Hours	Electrical Safety 4 Hours

SECTION TWO

TOOLS, EQUIPMENT AND MATERIALS
92 HOURS



A	B	C
Hand Tools 6 Hours	Power Tools 6 Hours	Welded Pipe and Fittings 12 Hours
D	E	F
Plastic Pipe and Tube 12 Hours	Threaded and Grooved Pipe 15 Hours	Tube and Tubing 12 Hours
G	H	I
Valves 12 Hours	Hangers, Supports and Fasteners 10 Hours	Pressure Testing 3 Hours
J		
Pumps 4 Hours		

SECTION THREE

METAL FABRICATION
46 HOURS



A	B	C
Welding Safety 4 Hours	Welding 30 Hours	Brazing and Soldering 12 Hours

SECTION FOUR

DRAWINGS AND SPECIFICATIONS
30 HOURS



A	B	C
Sketching and Drawing 6 Hours	Single Line Drawing 12 Hours	Drawing Interpretation 12 Hours

SECTION FIVE

CALCULATIONS AND SCIENCE
48 HOURS



A	B	C
Applied Calculations 8 Hours	Perimeters, Areas, Percentage and Grade 11 Hours	Volumes and Capacities 4 Hours
D	E	F
Piping Offsets 6 Hours	Matter, Density and Relative Density 6 Hours	Pressure and Atmosphere 6 Hours
G		
Principles of Electricity 7 Hours		

SECOND PERIOD
(8 Weeks 30 Hours per Week– Total of 240 Hours)

SECTION ONE

HEATING SYSTEMS
32 HOURS



A	B	C
Temperature and Heat Science 6 Hours	Expansion/Contraction Control 6 Hours	Heat Transfer Equipment 3 Hours
D	E	F
Temperature and Heat Calculations 4 Hours	Heat Loss Calculations 6 Hours	Heat Emissions Units 3 Hours
G		
Buoyancy 4 Hours		

SECTION TWO

HYDRONIC HEATING
39 HOURS



A	B	C
Hydronic Heating Systems 12 Hours	Hydronic Heating Boilers 4 Hours	Boiler Trim 6 Hours
D	E	F
Circulators and Pumps 8 Hours	Hydronic Heating/Cooling Systems 3 Hours	Liquid Heat Tracing 6 Hours

SECTION THREE

RIGGING EQUIPMENT AND HOISTING COMMUNICATION
54 HOURS



A	B	C
Lift Planning 7 Hours	Fibre and Wire Rope 18 Hours	Pulleys and Levers 6 Hours
D	E	F
Slings and Hoisting Equipment Hardware 14 Hours	Hoisting Communication 6 Hours	Scaffolds and Access Equipment 3 Hours

SECTION FOUR

SPECIALTY PIPING
24 HOURS



A	B	C
Plastic and Lined Piping 6 Hours	Fiberglass Piping 4 Hours	Iron and Glass Piping 2 Hours
D	E	F
Alloy Piping 6 Hours	Specialty Pipe Joining 3 Hours	Pipe Bending 3 Hours

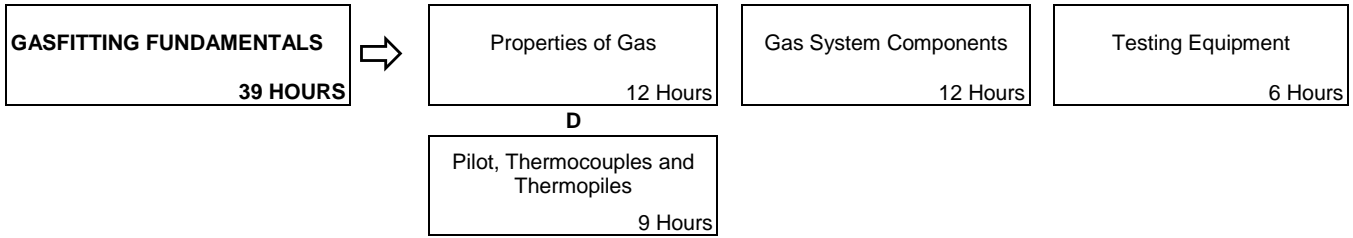
SECTION FIVE

DRAWINGS, LAYOUT AND ELEVATIONS
52 HOURS



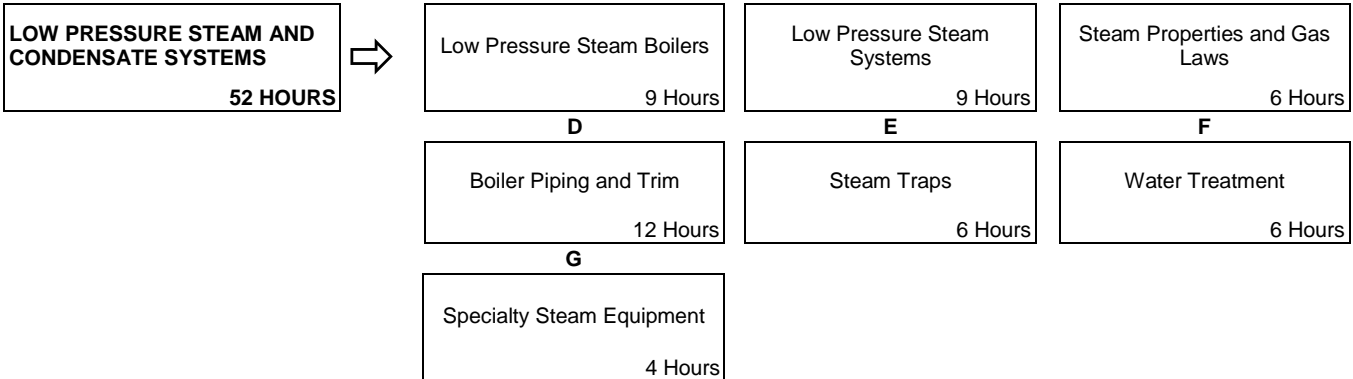
A	B	C
Trigonometry 8 Hours	Multiple Pipe Offsets 6 Hours	Gasket Joint Layout 6 Hours
D	E	F
Orthographic Projections 4 Hours	Piping Isometrics 12 Hours	Drawing Specifications 10 Hours
G		
Drawing Views 6 Hours		

SECTION SIX



THIRD PERIOD
(8 Weeks 30 Hours per Week– Total of 240 Hours)

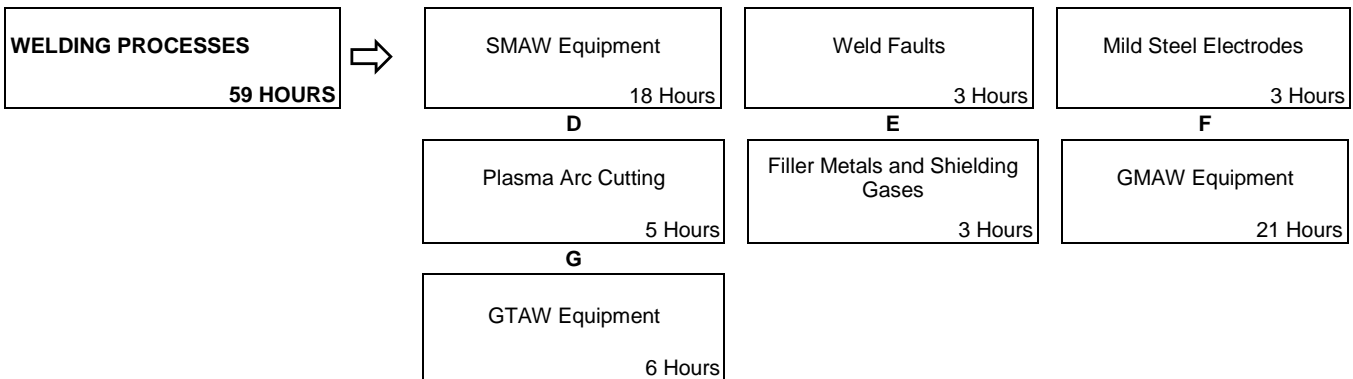
SECTION ONE



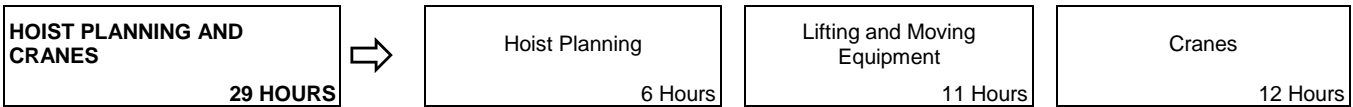
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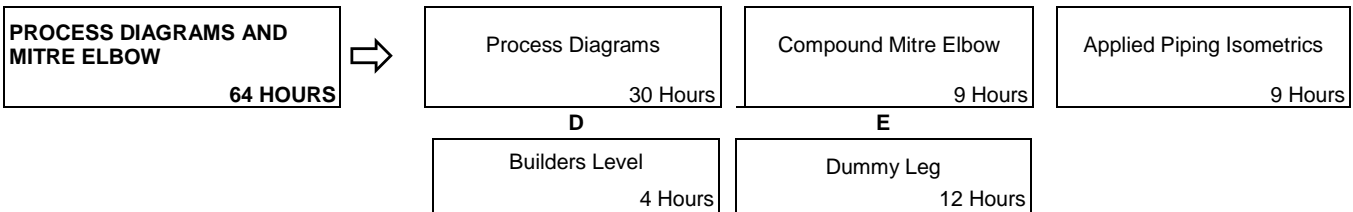
SECTION THREE



SECTION FOUR



SECTION FIVE



FOURTH PERIOD
(8 Weeks 30 Hours per Week– Total of 240 Hours)

SECTION ONE

**HIGH PRESSURE STEAM AND
CONDENSATE SYSTEMS**
45 HOURS



A	B	C
High Pressure Steam Boilers 6 Hours	High Pressure Steam Systems 6 Hours	Condensing Steam Systems 7 Hours
D	E	F
Exhaust and Cascading Steam Systems 4 Hours	High Pressure Boiler Trim 6 Hours	Auxiliary Equipment 4 Hours
G	H	I
Pressure Vessels 4 Hours	High Temperature Hot Water Systems 4 Hours	Cooling Towers and Heat Exchangers 4 Hours

SECTION TWO

PROCESS PIPING SYSTEMS
37 HOURS



A	B	C
Fire Protection Systems 4 Hours	HVACR Systems 9 Hours	Hydraulic Systems 3 Hours
D	E	F
Fuel Systems 6 Hours	Waste Water Systems 3 Hours	Medical Gas Systems 3 Hours
G	H	
Heat Recovery Systems 6 Hours	Solar and Geothermal Systems 3 Hours	

SECTION THREE

**JOB PLANNING AND CRITICAL
LIFTS**
68 HOURS



A	B	C
Alberta's Industry Network 1 Hour	Workplace Coaching Skills 1 Hour	Interprovincial Standards Red Seal Program 2 Hours
D	E	F
Critical Lifts 21 Hours	New Construction Job Planning 14 Hours	Commissioning, Turnover and Start-up 9 Hours
G	H	
Maintenance Job Planning 12 Hours	Quality Control 8 Hours	

SECTION FOUR

**REVISED DRAWINGS AND
PROJECTS**
90 HOURS



A	B	C
Rolling Offsets 24 Hours	Revised Drawing Packages 30 Hours	Reducing Tees 12 Hours
D	E	
Lateral Y Branches 12 Hours	True Wye 12 Hours	

NOTE: The hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations for the training establishment and Apprenticeship and Industry Training.

**FIRST PERIOD TECHNICAL TRAINING
STEAMFITTER/PIPEFITTER TRADE
COURSE OUTLINE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... WORKPLACE SAFETY AND RIGGING 24 HOURS

A. Safety Legislation, Regulations & Industry Policy in the Trades 4 Hours

Outcome: *Apply legislation, regulations and practices ensuring safe work in this trade.*

1. Demonstrate the application of the Occupational Health and Safety Act, Regulation and Code.
2. Describe the employer's and employee's role with Occupational Health and Safety (OH&S) regulations, Worksite Hazardous Materials Information Systems (WHMIS), fire regulations, Workers Compensation Board regulations and related advisory bodies and agencies.
3. Describe industry practices for hazard assessment and control procedures.
4. Describe the responsibilities of worker and employers to apply emergency procedures.
5. Describe tradesperson attitudes with respect to housekeeping, personal protective equipment and emergency procedures.
6. Describe the roles and responsibilities of employers and employees with the selection and use of personal protective equipment (PPE).
7. Maintain required PPE for tasks.
8. Use required PPE for tasks.

B. Climbing, Lifting, Rigging and Hoisting 6 Hours

Outcome: *Use industry standard practices for climbing, lifting, rigging and hoisting in this trade.*

1. Describe manual lifting procedures.
2. Describe rigging hardware and associated safety factors.
3. Select equipment for rigging loads.
4. Describe hoisting and load moving procedures.
5. Maintain personal protective equipment (PPE) for climbing, lifting and load moving equipment.
6. Use PPE for climbing, lifting and load moving equipment.

C. Hazardous Materials and Fire Protection..... 4 Hours

Outcome: *Apply industry standard practices for hazardous materials and fire protection in this trade.*

1. Describe roles, responsibilities, features and practices related to the Workplace Hazardous Materials Information System (WHMIS) program.
2. Describe three key elements of WHMIS.
3. Describe handling, storing and transporting procedures for hazardous material.
4. Describe venting procedures when working with hazardous materials.
5. Describe hazards, classes, procedures and equipment related to fire protection.

D. Apprenticeship Training Program 3 Hours

Outcome: *Manage an apprenticeship to earn journeyman certification.*

1. Describe the contractual responsibilities of the apprentice, employer and Alberta Apprenticeship and Industry Training.
2. Describe the purpose of the apprentice record book.
3. Describe the procedure for changing employers during an active apprenticeship.
4. Describe the purpose of the course outline.
5. Describe the procedure for progressing through an apprenticeship.
6. Describe advancement opportunities in this trade.

E. Pipe Trades Codes 3 Hours

Outcome: *Use codes and standards that are applied in the pipe trades.*

1. Identify code documents relating to pipe trades including ASME/ ABSA, CSA, NRC, NFPA, ASHRAE.
2. Explain the purpose of codes and standards.
3. Describe where codes and standards are applicable and by what authority.
4. Describe the procedures for the acceptance of the codes by the provinces and the local authorities.

F. Electrical Safety 4 Hours

Outcome: *Apply arc flash safety and lockout and tagout on a jobsite.*

1. Identify safe work practices to protect from arc flash hazards.
2. Describe lockout/ tagout procedures.
3. Identify safe work practices to prevent electrical shock.

SECTION TWO: TOOLS, EQUIPMENT AND MATERIALS 92 HOURS

A. Hand Tools 6 Hours

Outcome: *Use hand tools common to the pipe trades.*

1. Identify the types of hand tools.
2. Describe use of hand tools.
3. Describe the maintenance of hand tools.

B. Power Tools 6 Hours

Outcome: *Use power tools common to the pipe trades.*

1. Identify the types of power tools.
2. Describe use of power tools.
3. Describe the maintenance of power tools.

C. Welded Pipe and Fittings 12 Hours

Outcome: *Construct welded and flanged piping system components.*

1. Identify types, markings, designations and pressure ratings for welded pipe fittings.

2. Identify stud tensioning systems.
3. State factors, methods and torque measurements for bolt ups.
4. Identify types, markings, designations, temperature and pressure ratings of flanged fittings and gaskets.
5. Describe the fabrication process for welded pipe and fittings to the tack-up stage.
6. Describe flange preparation and joining techniques for flanged joints.

D. Plastic Pipe and Tube 12 Hours

Outcome: Construct plastic piping and tubing systems.

1. Identify types, applications and designations of plastic pipe, tubing and fittings.
2. Describe fabrication processes for solvent welding plastic pipe.
3. Describe fabrication processes for plastic pipe and tubing using alternative joining methods.
4. Describe fabrication processes for bell end joints.
5. Describe fabrication processes for plastic pipe using thermal fusion and electric resistance welding.
6. Fabricate and test a solvent weld spool to manufacturer's specifications.
7. Fabricate and test a fusion weld spool to manufacturer's specifications.

E. Threaded and Grooved Pipe 15 Hours

Outcome: Construct threaded and grooved piping system components.

1. Identify types, markings, designations, temperature and pressure ratings of ferrous pipe and fittings.
2. Identify applications of codes, regulations and manufacturer's specifications.
3. Describe the composition of ferrous, alloyed and non-ferrous pipe.
4. Describe the fabrication steps for threading and grooving pipe.
5. Calculate cut length for threaded and grooved pipe.
6. Demonstrate use of hand tools to thread and groove pipe.
7. Demonstrate use of power tools to thread and groove pipe.
8. Assemble and pressure test an assigned project.

F. Tube and Tubing..... 12 Hours

Outcome: Construct tube and tubing system components.

1. Identify types, designations and pressure ratings.
2. Identify fitting types and joining techniques.
3. Identify applications and manufacturer's specifications pertaining to joining methods.
4. Identify health and safety issues pertaining to joining methods.
5. Describe the process for bending tubing.
6. Describe the fabrication processes for joining tubing systems.
7. Assemble and pressure test an assigned project including flared, compression joints and bending components.

G. Valves 12 Hours

Outcome: Install valves in piping systems.

1. Identify types of valves.
2. Describe fundamental design variations and their applications.
3. Describe service and maintenance procedures.
4. Explain specifications and manufacturer's requirements for valves.

H. Hangers, Supports and Fasteners 10 Hours

Outcome: Install hangers, supports and fasteners for piping systems.

1. Identify types of hangers, supports and fasteners.
2. Describe applications of hangers, supports and fasteners.
3. Describe installation techniques for hangers, supports and fasteners.
4. Explain specifications and manufacturer requirements for hangers, supports and fasteners.

I. Pressure Testing..... 3 Hours

Outcome: Conduct a pressure test a system.

1. Identify equipment used for pressure testing piping installations.
2. Describe procedures and requirements for pneumatic and hydrostatic testing.
3. Describe hazards specific to pressure testing.

J. Pumps..... 4 Hours

Outcome: Describe pumps for piping systems.

1. Identify types of pumps.
2. Describe differences in pumps.
3. Describe factors affecting the operation of a pump.

SECTION THREE: METAL FABRICATION 46 HOURS

A. Welding Safety 4 Hours

Outcome: Apply safe work practices according to Occupational Health and Safety Act (OHS) legislation.

1. Identify hazards for welding and cutting operations.
2. Identify personal protective equipment for welding and cutting operations.
3. Explain hazards involved with welding fumes and gases.
4. Identify welding fume ventilation methods.
5. Explain the effects of electricity and precautions used to prevent injury.
6. Describe procedures for welding or cutting in confined spaces.
7. Interpret sections of the *Occupational Health and Safety Act*, general safety regulations.

B. Welding.....30 Hours

Outcome: Use oxy-fuel and arc welding equipment.

1. Identify five basic joint types.
2. Describe types of welds and their required dimensions.
3. Identify types of metals using practical tests.
4. Identify oxy-fuel cutting equipment.
5. Identify arc welding equipment.
6. Build a bracket project.
7. Build a spool project.

C. Brazing and Soldering12 Hours

Outcome: Braze and solder metal alloys.

1. Identify applications of brazed and solder joints.
2. Identify equipment and materials required to braze and solder.
3. Describe brazing and soldering procedures.
4. Assemble and test assigned project.

SECTION FOUR :DRAWINGS AND SPECIFCATIONS 30 HOURS

A. Sketching and Drawing.....6 Hours

Outcome: Apply sketching and drawing concepts.

1. Identify the types of drafting equipment.
2. Explain the use of drafting equipment.
3. Identify the types of drafting lines found on a drawing.
4. Identify the three views of an orthographic projection.
5. Draw and label the three views of an orthographic drawing.

B. Single Line Drawing12 Hours

Outcome: Develop single line pipe drawings.

1. Identify piping symbols.
2. Draw and label orthographic single-line drawings.
3. Draw and label isometric single-line piping drawings.

C. Drawing Interpretation12 Hours

Outcome: Interpret drawings.

1. Identify the views of a drawing.
2. Explain usage of scales.
3. Calculate dimensions using imperial and metric scales.
4. Describe symbols found on a drawing.
5. Identify the five divisions of a drawing package.

6. Describe the purpose of drawing divisions.
7. Use architectural and mechanical drawings.

SECTION FIVE: CALCULATIONS AND SCIENCE 48 HOURS

A. Applied Calculations 8 Hours

Outcome: *Apply calculations using both metric and imperial measurements.*

1. Perform calculations using whole numbers, fractions and decimals.
2. Describe the metric and imperial measurement systems.
3. Describe the operation of the AIT calculator.
4. Perform number conversions using whole numbers, fractions and decimals.
5. Perform measurement conversions using whole numbers, fractions and decimals.

B. Perimeters, Areas, Percentage and Grade..... 11 Hours

Outcome: *Perform calculations involving perimeter, areas, percentage and grade.*

1. Identify concepts when working with formulas.
2. Apply formulas for calculating perimeters of a rectangle, triangle and a circle.
3. Apply formulas for calculating the surface area of regular-shaped solids, tanks and cylinders.
4. Apply the formula for calculating percentages.
5. Calculate grades in percentage, fractions and ratio.

C. Volumes and Capacities 4 Hours

Outcome: *Calculate volumetric capacities for tanks and cylinders.*

1. Apply formulas for calculating volumes of regular shaped solids, tanks and cylinders.
2. Calculate capacities of regular shaped tanks and cylinders using both metric and imperial values.

D. Piping Offsets 6 Hours

Outcome: *Calculate 45° and 90° offsets for piping systems.*

1. Calculate offsets for right angle triangles.
2. Apply formulas for 45° and 90° offsets.
3. Calculate offset dimensions around an object.

E. Matter, Density and Relative Density 6 Hours

Outcome: *Calculate mass, densities and relative densities.*

1. Describe three common states of matter.
2. Define the terms matter, element, compound and mixture.
3. Define the terms adhesion, cohesion, surface tension and capillarity.
4. Calculate density, mass and volume of substances.
5. Calculate mass and density using relative densities.

F. Pressure and Atmosphere.....6 Hours

Outcome: *Calculate pressures in metric and imperial values.*

1. Define pressure and force.
2. State the six principles of hydrostatics.
3. Define pressure constants used for calculating pressures.
4. Describe atmospheric pressure and the effect of altitude.
5. Perform pressure and force calculations in both imperial and metric units.
6. Perform calculations to convert absolute, gauge and mercury pressures.

G. Principles of Electricity.....7 Hours

Outcome: *Perform electrical calculations.*

1. Identify principles of electricity including direct and alternating current flow, electrolysis and electromagnetism.
2. Sketch series and parallel electrical circuits.
3. Apply Ohm's Law.

**SECOND PERIOD TECHNICAL TRAINING
STEAMFITTER/PIPEFITTER TRADE
COURSE OUTLINE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... HEATING SYSTEMS 32 HOURS

A. Temperature and Heat Science 6 Hours

Outcome: *Apply scientific fundamentals relating to temperature and heat transfer processes.*

1. Identify the three methods of heat transfer.
2. Explain the principles of expansion and contraction.
3. Calculate linear expansion using coefficients of expansion tables.

B. Expansion/ Contraction Control 6 Hours

Outcome: *Apply expansion and contraction control measures on piping systems.*

1. State the principles of expansion and contraction control.
2. Describe the methods to reduce friction between shoes and supports.
3. Describe the methods of anchoring and/or guiding pipe.
4. List the expansion/ contraction equipment used for piping systems.
5. Describe installation and commissioning procedures of expansion/ contraction equipment.

C. Heat Transfer Equipment 3 Hours

Outcome: *Install heat transfer equipment and piping.*

1. Describe heat transfer equipment.
2. Describe operation of heat transfer equipment.
3. Describe heat transfer piping systems.

D. Temperature and Heat Calculations 4 Hours

Outcome: *Perform latent and sensible heat calculations.*

1. Define latent and sensible heat.
2. State the heat values of ice, water and steam.
3. Perform temperature conversion calculations.
4. Perform latent and sensible heat calculations.

E. Heat Loss Calculation 6 Hours

Outcome: *Perform heat loss calculations to determine equipment selection.*

1. Define heat loss terminology.
2. Perform heat loss calculations.
3. Describe methods used to size equipment for heating systems.

- 4. Explain installation requirements of equipment and piping referencing codes.
- 5. Develop an isometric drawing with a complete material list.

F. Heat Emission Units 3 Hours

Outcome: Install heat emission units.

- 1. Describe the types of heat emission units.
- 2. Describe trim used with heat emission units.
- 3. Explain installation procedures for heat emission units referencing codes.
- 4. Explain maintenance requirements for heat emission units.

G. Buoyancy 4 Hours

Outcome: Apply the principles of buoyancy to equipment submersed in fluids.

- 1. State the three laws of buoyancy.
- 2. Describe the effects of buoyancy on objects submersed in fluids.
- 3. Calculate buoyant force.

SECTION TWO: HYDRONIC HEATING 39 HOURS

A. Hydronic Heating Systems 12 Hours

Outcome: Install and maintain hydronic heating systems.

- 1. Describe the types of hydronic heating systems.
- 2. Describe equipment and materials used on hydronic heating systems.
- 3. Describe air elimination from hydronic heating systems.
- 4. Describe installation procedures for hydronic heating systems referencing codes.
- 5. Explain maintenance requirements for hydronic heating systems.
- 6. Calculate the layout of a serpentine system.

B. Hydronic Heating Boilers 4 Hours

Outcome: Install and maintain hydronic heating boilers.

- 1. Describe the types of hydronic heating boilers referencing codes.
- 2. Describe equipment and materials used on hydronic heating boilers.
- 3. Describe installation procedures for hydronic heating boilers.
- 4. Describe maintenance requirements for hydronic heating systems.

C. Boiler Trim 6 Hours

Outcome: Install and maintain boiler trim.

- 1. Describe the components of boiler trim.
- 2. Identify components and boiler trim on a drawing.
- 3. Describe maintenance requirements for boiler trim.

D. Circulators and Pumps 8 Hours

Outcome: Install and maintain circulators and pumps.

1. Describe the terminology pertaining to the flow of fluids in a piping system.
2. Describe the principle of a venturi.
3. Describe the cause, effects and prevention of cavitation.
4. State factors that determine pump selection.
5. Size pump according to head and flow rates.
6. Describe installation procedures for circulators and pumps.
7. Describe maintenance requirements for circulators and pumps.

E. Hydronic Heating/Cooling Systems..... 3 Hours

Outcome: Install hydronic heating/cooling systems.

1. Describe types of hydronic heating/cooling systems.
2. Describe the equipment and materials used in hydronic heating/cooling systems.
3. Describe installation procedures for hydronic heating/cooling systems referencing codes.
4. Describe maintenance requirements for hydronic heating/cooling systems.

F. Liquid Heat Tracing 6 Hours

Outcome: Install liquid heat tracing.

1. Describe types of heat tracing.
2. Describe equipment and materials used for liquid heat tracing.
3. Identify heat tracing symbols used on drawings.
4. Describe installation procedures for liquid heat tracing.
5. Fabricate a valve basket.

SECTION THREE: RIGGING EQUIPMENT AND HOISTING COMMUNICATION..... 54 HOURS

A. Lift Planning 7 Hours

Outcome: Develop a lift plan for hand rigging.

1. Describe a lift plan.
2. Calculate weights and center of gravity.

B. Fibre and Wire Rope..... 18 Hours

Outcome: Use fibre and wire rope for rigging.

1. Describe fibre rope.
2. Calculate working load limits (WLL) for fibre rope.
3. Describe the purpose of knots, hitches and bends.
4. Tie knots, hitches and bends with fibre rope.
5. Describe wire rope.

6. Calculate working load limits (WLL) for wire rope.
7. Install wire rope hardware.

C. Pulleys and Levers.....6 Hours

Outcome: Use pulleys and levers for hoisting and lifting materials and equipment.

1. Describe types of pulleys and their applications.
2. Describe types of levers and their applications.
3. Calculate mechanical advantage.
4. Use pulleys and levers.

D. Slings and Hoisting Equipment Hardware..... 14 Hours

Outcome: Use slings and hoisting equipment.

1. Describe the construction of chain and chain slings.
2. Describe the construction of steel and fibre slings.
3. Describe hoisting equipment hardware.
4. Use steel and fibre slings.

E. Hoisting Communication 6 Hours

Outcome: Use forms of communication for hoisting operations.

1. Describe hand signals used for hoisting operations.
2. Describe voice communication protocols.
3. Perform hand signals.

F. Scaffolds and Access Equipment..... 3 Hours

Outcome: Use scaffolds and aerial access equipment.

1. Describe types of scaffolds and access equipment.
2. Apply the Occupational Health and Safety Act, Regulation and Code when working from access equipment.

SECTION FOUR:SPECIALTY PIPING 24 HOURS

A. Plastic and Lined Piping 6 Hours

Outcome: Install and maintain plastic and lined piping.

1. Describe types of plastic and lined piping.
2. Describe joining methods of plastic and lined piping.
3. Explain installation procedures for plastic and lined piping.

B. Fiberglass Piping..... 4 Hours

Outcome: Install and maintain fiberglass reinforced plastic (FRP) piping.

1. Describe the materials and construction of FRP.
2. Explain piping applications and the joining methods.

- 3. Explain the installation handling procedures of FRP piping.
- 4. Observe the joining methods of FRP piping.

C. Iron and Glass Piping..... 2 Hours

Outcome: Install cast iron, ductile iron and glass piping.

- 1. Describe the properties of cast iron, ductile iron and glass piping.
- 2. Explain applications of cast iron, ductile iron and glass piping.
- 3. Explain installation procedures of cast iron, ductile and glass piping.
- 4. Observe joining methods of cast iron, ductile and glass piping.

D. Alloy Piping 6 Hours

Outcome: Install and maintain alloy piping.

- 1. Describe types of alloy piping.
- 2. Explain applications of alloy piping.
- 3. Explain fabrication procedures of alloy piping.
- 4. Explain installation procedures of alloy piping.
- 5. Observe joining methods of alloy piping.

E. Specialty Pipe Joining 3 Hours

Outcome: Install specialty pipe connectors.

- 1. Describe types of pipe connectors.
- 2. Explain the principles of pipe connectors.
- 3. Observe installation procedures for pipe connectors.

F. Pipe Bending..... 3 Hours

Outcome: Apply techniques for pipe bending.

- 1. Describe methods of pipe bending.
- 2. Explain pipe bending applications.
- 3. Calculate gain and fitting allowances on pipe bends.
- 4. Observe methods of pipe bending.

SECTION FIVE: DRAWINGS, LAYOUT AND ELEVATIONS..... 52 HOURS

A. Trigonometry..... 8 Hours

Outcome: Perform trigonometry calculations.

- 1. Describe triangle terminology and trigonometry.
- 2. Describe Pythagorean Theorem.
- 3. Use trigonometric formulas.

B. Multiple Pipe Offsets 6 Hours

Outcome: Calculate offsets for piping systems.

1. State the formulas for 22.5° and 45° offsets.
2. Describe the application of equal and unequal spread offset around corners.
3. Calculate piping offsets and fitting allowances.

C. Gasket Joint Layouts 6 Hours

Outcome: Construct flange and gasket templates.

1. Describe geometric terms of a gasket joint layout.
2. Layout a piping flange to scale.
3. Layout a gasket to scale.
4. Fabricate a gasket.

D. Orthographic Projections 4 Hours

Outcome: Draw orthographic projections of an object.

1. Describe the principles of orthographic projection.
2. Draw and label orthographic projections of objects.

E. Piping Isometrics 12 Hours

Outcome: Fabricate a piping system.

1. Define terms used in isometric drawings.
2. Draw isometric piping with horizontal and vertical offsets.

F. Drawing Specifications 10 Hours

Outcome: Interpret drawing specifications.

1. Explain the Construction Specification Institute (CSI) format.
2. Interpret architectural and mechanical specifications.
3. Interpret Line Designation Tables (LDT's).

G. Drawing Views 6 Hours

Outcome: Locate piping and equipment from a set of drawings.

1. Explain types of views from a set of drawings.
2. Explain types of elevations.
3. Define coordinate systems.
4. Locate piping and equipment using coordinates.

SECTION SIX:.....GASFITTING FUNDAMENTALS 39 HOURS

A. Properties of Gas 12 Hours

Outcome: *Apply knowledge related to the properties of gas.*

1. Describe the properties of fuel gas.
2. Identify chemical formulas.
3. Calculate problems using properties of gases.
4. Explain the principles of combustion.
5. Describe the products of complete and incomplete combustion.
6. Calculate air requirements for complete combustion.
7. Identify impurities found in fuel gas.

B. Gas System Components 12 Hours

Outcome: *Install and service gas line components.*

1. Describe types of regulators.
2. Describe types of reliefs and vent piping.
3. Calculate vent sizing of reliefs.
4. Describe the types of meters.
5. Clock a meter at low pressure.
6. Clock a meter at high pressure.
7. Troubleshoot a regulator.
8. Apply standards for CSA B149.1.

C. Test Equipment 6 Hours

Outcome: *Use test equipment to service appliances.*

1. Identify types of test equipment.
2. Describe functions of test equipment.
3. Describe settings for electrical testing equipment.
4. Use test equipment to service appliances.

D. Pilots, Thermocouples and Thermopiles 9 Hours

Outcome: *Service pilots, thermocouples and thermopiles.*

1. Identify pilot burner types and terminology.
2. Describe characteristics of pilot burners.
3. Explain operating principles of thermocouples and thermopiles.
4. Describe operational tests performed on thermopiles and thermocouples.
5. Describe causes for thermocouple and thermopile failures.
6. Troubleshoot pilots, thermocouples, and thermopiles.

**THIRD PERIOD TECHNICAL TRAINING
STEAMFITTER/PIPEFITTER TRADE
COURSE OUTLINE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... LOW PRESSURE STEAM AND CONDENSATE SYSTEMS 52 HOURS

A. Low Pressure Steam Boilers 9 Hours

Outcome: *Install and maintain low pressure steam boilers.*

1. Describe types of low pressure steam boilers.
2. Describe equipment and materials used on low pressure steam boilers.
3. Explain installation procedures for low pressure steam boilers referencing codes.
4. Explain maintenance requirements on low pressure steam boilers.
5. Troubleshoot a low pressure steam boiler.

B. Low Pressure Steam Systems 9 Hours

Outcome: *Install and maintain low pressure steam systems.*

1. Describe types of low pressure steam systems.
2. Describe materials and equipment used on low pressure steam systems referencing codes.
3. Explain installation procedures for low pressure steam systems referencing codes.
4. Explain maintenance requirements of low pressure steam systems.
5. Fabricate a low pressure steam system.
6. Troubleshoot a low pressure steam system.

C. Steam Properties and Gas Laws..... 6 Hours

Outcome: *Apply steam tables and gas laws.*

1. Explain the applications of steam tables.
2. Define terms related with steam tables.
3. State the effects of pressure, vacuum and volume of steam.
4. Describe the principles of the gas laws.
5. Perform calculations using gas laws.

D. Boiler Piping and Trim 12 Hours

Outcome: *Install and maintain boiler piping and trim.*

1. Describe piping components on a low pressure steam boiler.
2. Describe trim for a low pressure steam boiler.
3. Describe installation procedures for piping and trim referencing codes.
4. Describe cross-connection control.
5. Explain maintenance requirements for piping and trim.
6. Troubleshoot piping and trim on low pressure steam boilers.

E. Steam Traps 6 Hours

Outcome: Install and maintain steam traps.

1. Explain the purpose of a steam trap.
2. Describe types of steam traps.
3. Explain steam trap selection.
4. Explain installation procedures of steam traps.
5. Troubleshoot steam traps.

F. Water Treatment 6 Hours

Outcome: Install and maintain water treatment equipment.

1. Describe the principles of water treatment.
2. Identify types of water sources and their impurities.
3. Describe methods of testing water hardness.
4. Describe processes to neutralize or remove impurities.
5. Explain the effects of untreated water on piping and equipment.
6. Describe installation procedures for water treatment equipment.

G. Specialty Steam Equipment 4 Hours

Outcome: Install and maintain specialty steam equipment.

1. Describe steam tracing methods.
2. Describe installation procedures for steam tracing systems.
3. Describe types of specialty steam equipment.
4. Describe installation procedures of utility steam piping systems.
5. Explain maintenance requirements for specialty steam equipment.

SECTION TWO:.....INSTRUMENTATION AND TRADE TECHNOLOGIES 36 HOURS

A. Control Systems 24 Hours

Outcome: Install and maintain control systems.

1. Describe the principles of control systems.
2. Identify the symbols and acronyms found on P&ID's.
3. Describe operators and final control elements.
4. Describe the primary elements of controls and instrumentation.
5. Describe auxiliary devices found on control systems.
6. Describe types of air supply.
7. Describe pneumatic controllers.
8. List the installation procedures for control systems.
9. Fabricate a closed loop instrumentation circuit.
10. Troubleshoot a control system.

B. Trade Related Technologies..... 12 Hours

Outcome: Use emerging technologies on commercial and industrial sites.

1. Explain the purpose of a Radio Frequency Identification (RFID) Tag.
2. Explain 3-D modeling and imaging used in industry.
3. Explain CADD systems used in industry.
4. Explain the purpose of Maintenance Management Systems (MMS).
5. Identify the types of electronic pipeline inspection devices.
6. Create a CADD drawing.

SECTION THREE: WELDING PROCESSES 59 HOURS

A. SMAW Equipment..... 18 Hours

Outcome: Use SMAW equipment.

1. Describe the principles of SMAW.
2. Describe the components of a SMAW set-up.
3. Explain the effects of arc length on amperage and voltage.
4. Perform tacking and welding on plates.

B. Weld Faults..... 3 Hours

Outcome: Recognize the cause and effect of weld faults.

1. Define the classifications of weld faults.
2. Define the notching effect.
3. Identify weld faults, their causes and methods of prevention.

C. Mild Steel Electrodes 3 Hours

Outcome: Select mild steel electrodes for SMAW.

1. Define terms associated with SMAW electrodes.
2. Identify classifications and applications for SMAW electrodes.
3. Describe the types of SMAW electrode coatings.
4. Describe the function of slag.
5. Describe handling and storage procedures for electrodes.

D. Plasma Arc Cutting 5 Hours

Outcome: Cut using the plasma arc.

1. Describe the plasma arc cutting process and equipment.
2. Describe hazards associated with plasma arc cutting.
3. Observe plasma arc cutting.

E. Filler Metals and Shielding Gases 3 Hours

Outcome: *Select filler metal, and shielding gases.*

1. Describe types of filler metals.
2. Describe types of shielding gases.
3. Identify hazards associated with gas shielded welding processes.

F. GMAW Equipment 21 Hours

Outcome: *Use GMAW equipment.*

1. Describe the principles of operation of GMAW.
2. Describe the components of a GMAW set-up.
3. Describe the modes of metal transfer.
4. Describe power sources and wire feeders.
5. Describe wire drive systems, gun and cable assemblies.
6. Troubleshoot GMAW equipment.
7. Perform fillet and groove welds.

G. GTAW Equipment 6 Hours

Outcome: *Set up GTAW equipment.*

1. Describe the components of a GTAW set-up.
2. Describe the principles of operation of GTAW.
3. Prepare a pipe joint for GTAW.

SECTION FOUR: HOIST PLANNING AND CRANES..... 29 HOURS

A. Hoist Planning..... 6 Hours

Outcome: *Use load charts to determine crane selection.*

1. Describe factors that affect load chart conditions.
2. Use quadrant of operation to determine load capacity.
3. Calculate gross and net capacities.
4. Explain tipping axis and structural capacity.

B. Lifting and Moving Equipment 11 Hours

Outcome: *Use equipment for lifting and moving loads.*

1. Describe a lift plan.
2. Calculate weights and center of gravity.
3. Describe equipment for lifting and moving loads.
4. Describe procedures for moving loads vertically.
5. Describe procedures for moving loads horizontally
6. Use equipment to lift and move loads.

C. Cranes..... 12 Hours

Outcome: Hoist equipment and materials using cranes.

1. Describe types of mobile cranes.
2. List assembly, installation, removal and disassembly procedures for mobile cranes.
3. Describe types of Stationary cranes.
4. List operational procedures with stationary cranes.
5. Describe types of overhead travelling cranes.
6. Apply the Occupational Health and Safety Act, Regulation and Code pertaining to overhead travelling cranes.
7. List operational procedures with overhead travelling cranes.

SECTION FIVE: PROCESS DIAGRAMS AND MITRE ELBOW..... 64 HOURS

A. Process Diagrams 30 Hours

Outcome: Apply process diagrams from schematic to isometrics.

1. Describe the sequence of pipe drawings.
2. Describe piping and instrumentation diagrams (P&ID's) using International Society of Automation (ISA) standards.
3. Describe equipment related to P&ID's.
4. Describe the purpose of legends, notes and bill of materials (BOM).
5. Determine the relationship between drawings and P&ID's.
6. Identify piping and equipment using specifications and BOM.
7. Interpret P&ID's to verify isometric drawings.
8. Draw a P&ID.

B. Compound Mitre Elbow 9 Hours

Outcome: Fabricate a compound mitre elbow.

1. Describe procedures to fabricate a mitre elbow.
2. Calculate cut angle and cutback for mitred fittings.
3. Fabricate a compound mitre elbow.

C. Applied Piping Isometrics 9 Hours

Outcome: Fabricate a piping system.

1. Develop a materials list.
2. Calculate elevations and measurements for piping system.
3. Fabricate a piping system.

D. Builder's Level 4 Hours

Outcome: Locate elevations using a builder's level.

1. Describe the types of builder's levels.
2. Define builder's level terminology.

3. Describe the use of builder's level.
4. Use a builder's level to locate elevations.
5. Complete a survey record sheet.

E. Dummy Leg 12 Hours

Outcome: Construct a dummy leg.

1. Explain the applications of dummy legs.
2. Describe the difference between direct layout and template development.
3. Calculate the minimum length of pipe required for a dummy leg.
4. Develop a template for a dummy leg.
5. Fabricate a dummy leg.

**FOURTH PERIOD TECHNICAL TRAINING
STEAMFITTER/PIPEFITTER TRADE
COURSE OUTLINE**

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:.....HIGH PRESSURE STEAM AND CONDENSATE SYSTEMS 45 HOURS

A. High Pressure Steam Boilers 6 Hours

Outcome: *Install and maintain high pressure steam boilers.*

1. Describe types of high-pressure boilers.
2. Describe types of steam generators.
3. Describe the equipment and materials of high-pressure steam boilers.
4. Describe installation procedures on high-pressure steam boilers.
5. Explain maintenance requirements for high-pressure steam boilers.

B. High Pressure Steam Systems..... 6 Hours

Outcome: *Install and maintain high pressure steam systems.*

1. Describe the operation of a high pressure steam system.
2. Describe equipment and materials specified in high pressure steam system referencing codes.
3. Describe the piping specified in high pressure steam system referencing codes.
4. Describe code-specified installation requirements of high pressure steam systems.
5. Explain maintenance requirements with high pressure steam systems.
6. Troubleshoot a high-pressure steam system.

C. Condensing Steam Systems 7 Hours

Outcome: *Install and maintain condensing and non-condensing steam systems.*

1. Describe the operations of condensing and non-condensing steam systems.
2. Describe the equipment of condensing and non-condensing steam systems.
3. Describe code-specified installation procedures of condensing and non-condensing steam systems.
4. Explain maintenance requirements for condensing and non-condensing steam systems.

D. Exhaust and Cascading Steam Systems 4 Hours

Outcome: *Install and maintain exhaust and cascading steam systems.*

1. Describe the operation of exhaust and cascading steam systems.
2. Describe the equipment of exhaust and cascading steam systems.
3. Describe code-specified installation procedures of exhaust and cascading steam systems.
4. Explain maintenance requirements for exhaust and cascading steam systems.

E. High Pressure Boiler Trim 6 Hours

Outcome: Install and maintain high pressure boiler trim.

1. Describe the operation of trim for a high-pressure steam boiler referencing codes.
2. Describe the components of boiler trim.
3. Describe the installation of boiler trim referencing codes.
4. Explain maintenance procedures on boiler trim.
5. Re-build a sight glass.

F. Auxiliary Equipment 4 Hours

Outcome: Install and maintain auxiliary equipment on high-pressure systems.

1. Describe auxiliary equipment on high pressure systems.
2. Describe the operation of auxiliary equipment on high pressure systems.
3. Describe code-specified installation procedures of auxiliary equipment on high pressure systems.
4. Describe types of steam traps used for high pressure steam systems.
5. Explain maintenance requirements for auxiliary equipment.

G. Pressure Vessels 4 Hours

Outcome: Install and maintain pressure vessels.

1. Describe applications for pressure vessels in power, process and heating plants.
2. Describe fired and unfired pressure vessels referencing codes.
3. Describe the trim for bi-phase and liquid filled vessels.
4. Explain the maintenance requirements for pressure vessels.

H. High Temperature Hot Water (HTHW) Systems 4 Hours

Outcome: Install and maintain HTHW systems.

1. Describe equipment used in HTHW systems referencing codes.
2. Describe the operation of HTHW systems referencing codes.
3. Describe installation procedures of HTHW systems.
4. State water treatment requirements for HTHW systems.
5. Explain maintenance requirements for HTHW systems.

I. Cooling Towers and Heat Exchangers 4 Hours

Outcome: Install and maintain cooling towers and heat exchangers.

1. Describe types of heat exchangers referencing codes.
2. Describe trim for heat exchangers referencing codes.
3. Explain maintenance requirements on heat exchangers.
4. Describe types of cooling towers.
5. Describe trim for cooling towers.

- 6. List sources of water for cooling towers and heat exchangers.
- 7. Explain maintenance requirements on cooling towers.

SECTION TWO:.....PROCESS PIPING SYSTEMS..... 37 HOURS

A. Fire Protection Systems 4 Hours

Outcome: *Install and maintain fire protection systems.*

- 1. Describe types of fire protection systems.
- 2. Describe applications of fire protection systems.
- 3. Identify codes associated with fire protection requirements.

B. Heating, Ventilation, Air Conditioning and Refrigeration (HVACR) Systems 9 Hours

Outcome: *Identify the operation of HVACR systems.*

- 1. State the principles of HVACR systems.
- 2. Describe types of HVACR systems.
- 3. Describe equipment and materials used on HVACR systems.
- 4. Describe types of refrigerants.
- 5. Describe types of mechanical refrigeration systems.
- 6. Explain maintenance requirements for HVACR systems.

C. Hydraulic Systems 3 Hours

Outcome: *Install and maintain hydraulic systems.*

- 1. State the principle of a hydraulic system.
- 2. Describe equipment and materials used on hydraulic systems.
- 3. Describe installation procedures for hydraulic systems.
- 4. Explain maintenance requirements for hydraulic systems.

D. Fuel Systems..... 6 Hours

Outcome: *Install and maintain fuel systems.*

- 1. Describe types of fuel systems.
- 2. Describe equipment and materials used on fuel systems.
- 3. Describe code-required installation procedures for fuel systems.
- 4. Explain maintenance requirements for fuel systems.

E. Waste Water Systems 3 Hours

Outcome: *Install and maintain waste water systems.*

- 1. Describe types of waste water systems.
- 2. Describe equipment and materials used on waste water systems.
- 3. Describe code-required installation procedures for waste water systems.
- 4. Explain maintenance requirements for waste water systems.

F. Medical Gas Systems 3 Hours**Outcome: Install and maintain medical gas systems.**

1. Describe types of medical gas systems.
2. Describe equipment and materials used on medical gas systems.
3. Describe code-required installation procedures for medical gas systems.
4. Explain maintenance requirements for medical gas systems.

G. Heat Recovery Systems 6 Hours**Outcome: Install and maintain heat recovery systems.**

1. Describe types of heat recovery systems.
2. Describe equipment and materials used on heat recovery systems.
3. Describe code-required installation procedures for heat recovery systems.
4. Explain maintenance requirements for heat recovery systems.

H. Solar and Geothermal Exchange Systems 3 Hours**Outcome: Install and maintain solar and geothermal exchange systems.**

1. Describe types of solar and geothermal exchange systems.
2. Describe equipment and materials used on solar and geothermal exchange systems.
3. Describe code-required installation procedures for solar and geothermal exchange systems.
4. Explain maintenance requirements for solar and geothermal exchange systems.

SECTION THREE:JOB PLANNING AND CRITICAL LIFTS 68 HOURS**A. Alberta's Industry Network 1 Hour****Outcome: Describe the role of the Alberta Apprenticeship and Industry Training Board and the network of industry committees that represent the trades and occupation in Alberta.**

1. Describe Alberta's apprenticeship and industry training system.
2. Describe the roles and responsibilities of the Alberta Apprenticeship and Industry Training Board, government and post-secondary institutions.
3. Describe the roles and responsibilities of the Provincial Apprenticeship Committees (PACs), Local Apprenticeship Committees (LACs) and Occupational Committees (OCs).

B. Workplace Coaching Skills 1 Hour**Outcome: Use coaching skills when training an apprentice.**

1. Describe the process for coaching an apprentice.

C. Interprovincial Standards Red Seal Program 2 Hours**Outcome: Use Red Seal products to challenge an Interprovincial examination.**

1. Identify Red Seal products used to develop Interprovincial examinations.
2. Use Red Seal products to prepare for an Interprovincial examination.

D. Critical Lifts21 Hours

Outcome: Perform critical lifts.

1. Describe types of critical lifts.
2. List regulations required to perform a critical lift.
3. List requirements in completing a lift plan.
4. Use engineered lift drawings.
5. Perform a critical lift.

E. New Construction Job Planning 14 Hours

Outcome: Plan for a new construction project.

1. State the purpose of a new construction plan.
2. Describe the documents required for a new construction plan.
3. List the procedural sequence of a new construction plan.
4. Create a new construction plan.

F. Commissioning, Turnover and Start-up.....9 Hours

Outcome: Facilitate commissioning, turnover and start-up procedures.

1. Describe methods of flushing and treating a system.
2. Explain procedures for commissioning a system.
3. Describe the commissioning equipment.
4. List corrective actions for deficiencies.
5. Examine a start-up and turnover package.

G. Maintenance Job Planning 12 Hours

Outcome: Plan for a maintenance project.

1. State the purpose of a maintenance plan.
2. Describe the documents required in a maintenance plan.
3. List the procedural sequence of a maintenance plan.
4. Create a maintenance plan.

H. Quality Control.....8 Hours

Outcome: Apply quality control (Q.C) measures.

1. Define the terms Quality Control versus Quality Assurance.
2. Explain Q.C. roles and responsibilities.
3. Explain the methods of Q.C. used in the piping industry.
4. Define technical standards and codes.

SECTION FOUR: REVISED DRAWINGS AND PROJECTS 90 HOURS

A. Rolling Offsets 24 Hours

Outcome: Fabricate a rolling offset.

- 1. Describe types of rolling offsets.
- 2. Calculate rolling offsets.
- 3. Draw rolling offsets in isometric view.
- 4. Draw a rolling offset shop project.
- 5. Fabricate a rolling offset project.

B. Revised Drawing Packages 30 Hours

Outcome: Interpret a revised drawing package.

- 1. Describe techniques used to identify amendments on revised drawings.
- 2. Cross reference drawing revisions.
- 3. Develop as-built drawings.
- 4. Develop test packages.

C. Reducing Tees 12 Hours

Outcome: Fabricate an eccentric reducing tee.

- 1. Describe types of reducing tees.
- 2. Develop an eccentric reducing tee template.
- 3. Fabricate an eccentric reducing tee.

D. Lateral Wye Branches 12 Hours

Outcome: Fabricate a concentric lateral wye branch.

- 1. Describe types of lateral wye branches.
- 2. Develop a concentric lateral wye template.
- 3. Fabricate a concentric lateral wye.

E. True Wye..... 12 Hours

Outcome: Fabricate a true wye.

- 1. Describe types of true wyes.
- 2. Develop a true wye template.
- 3. Fabricate a true wye.



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