Apprenticeship and Industry Training

Gasfitter

Apprenticeship Course Outline

008 (2017)

Alberta

Apprenticeship and Industry Training

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Apprenticeship and Industry Training: Gasfitter Apprenticeship Course Outline 2017

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Gasfitter
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Course Outline

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 journeyperson 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 journeypersons, 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 Gasfitter Provincial Apprenticeship Committee.

The graduate of the Gasfitter apprenticeship program is a certified journeyperson who will be able to:

- apply the standards and regulations of propane and natural gas in order to provide the maximum of safety
- know the characteristics and proper use of each product
- be able to install and maintain pipe systems, appliances and equipment using propane and natural gas
- be proficient in the safe use and maintenance of hand and power tools
- read and carry out directions as given on blueprints, sketches and plans
- be familiar with the work of other tradespeople in the construction industry
- 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

Gasfitter PAC Members at the Time of Publication

Mr. K. Harris	Rocky View	Presiding Officer
Mr. N. Woynarski	Calgary	Employer
Mr. D. Pastor	Calgary	Employer
Mr. R. Van Keulen	Calgary	Employer
Mr. D. Repka	Edmonton	Employer
Mr. K. Pearson	Onoway	Employee
Mr. C. Smith	Barrhead	Employee
Mr. B. Kaiser	Calgary	Employee
Mr. K. Macfarlane	Spirit River	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 institutions deliver Gasfitter apprenticeship technical training:

Northern Alberta Institute of Technology
(Patricia Campus)
Southern Alberta Institute of Technology
(Main Campus)
Lakeland College

Procedures for Recommending Revisions to the Course Outline

Advanced Education has prepared this course outline in partnership with the Gasfitter Provincial Apprenticeship Committee.

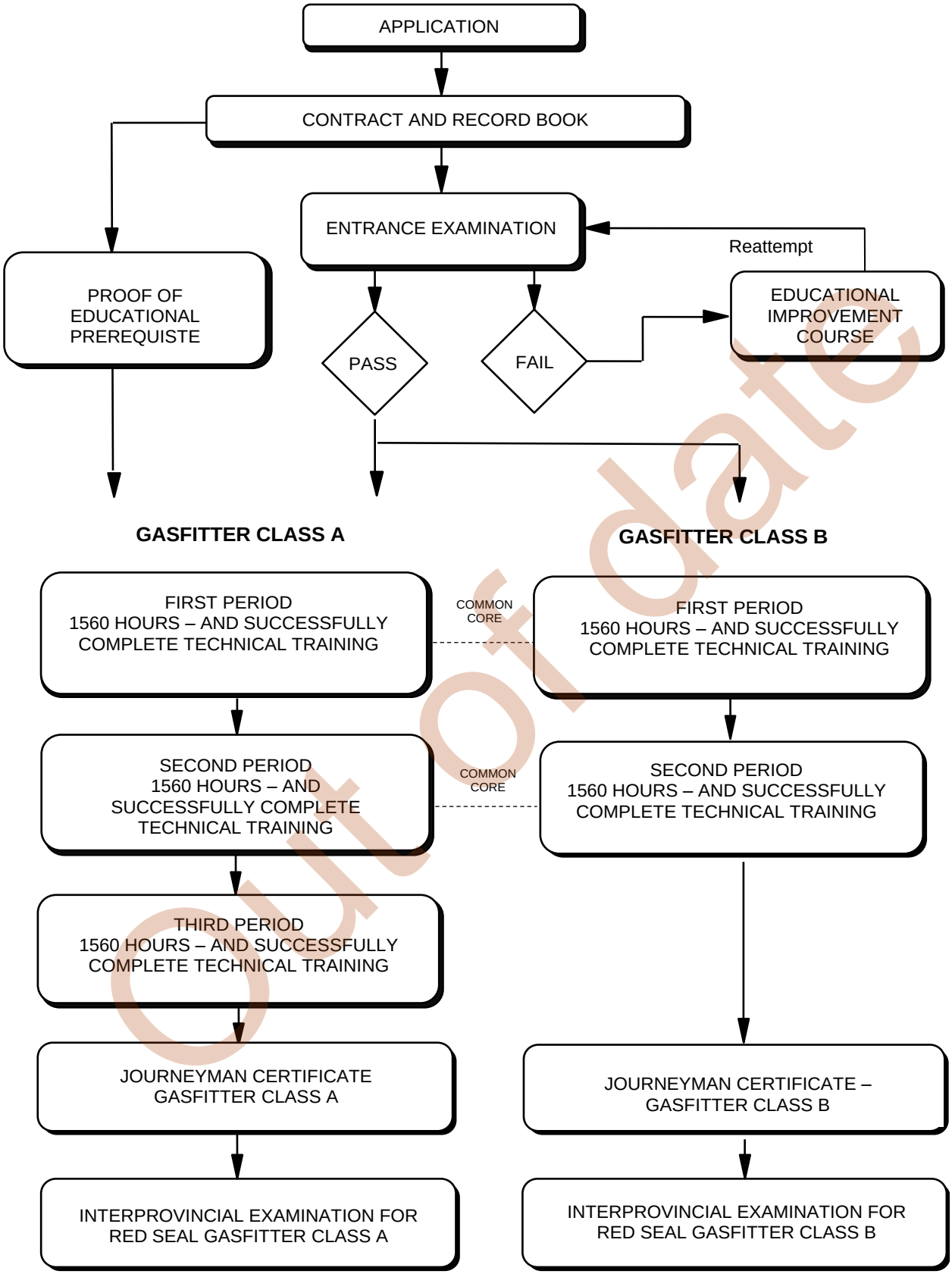
This course outline was approved on November 4, 2016 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

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

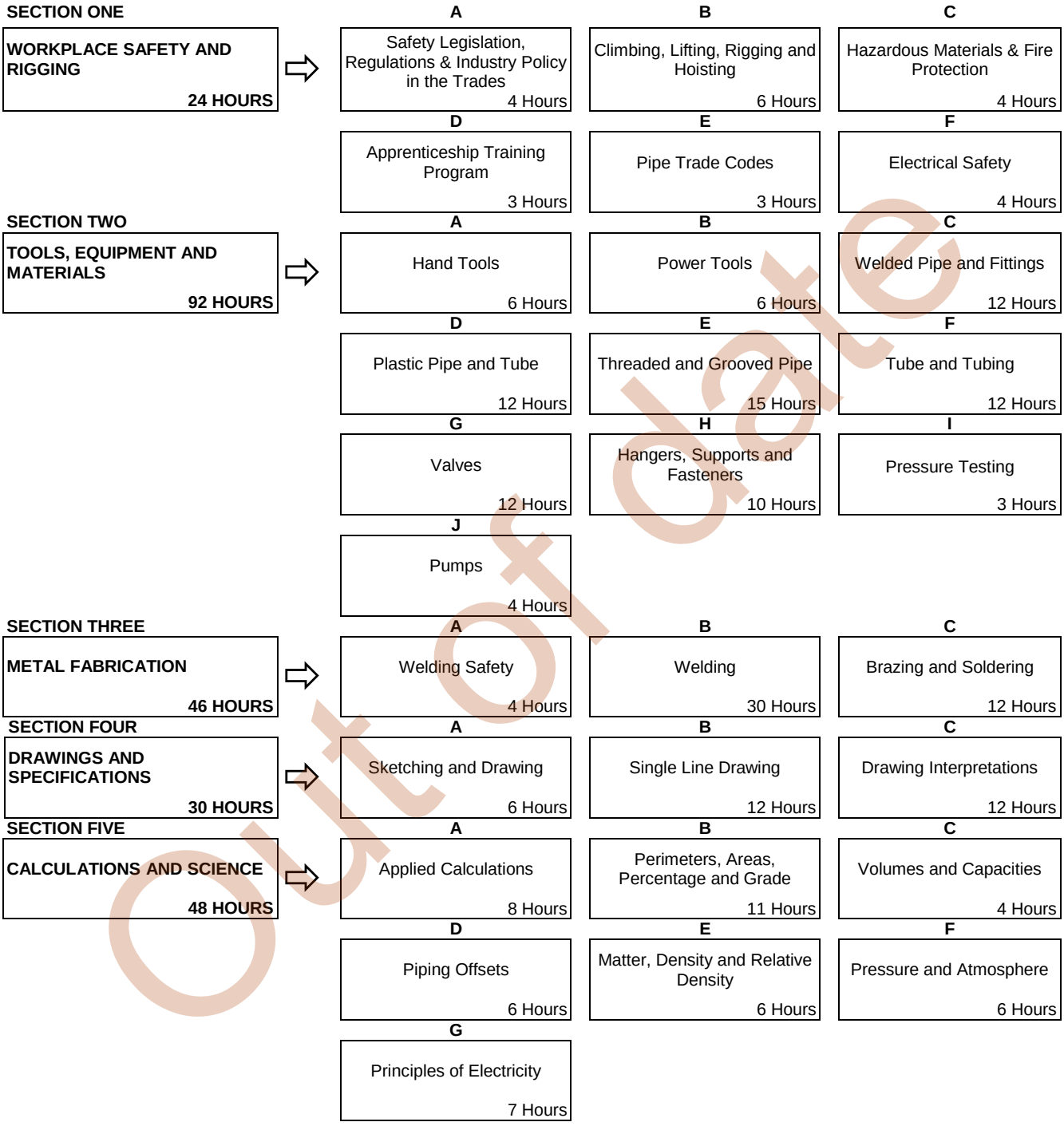
Gasfitter Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
Advanced Education
10th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

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 Gasfitter Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



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



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

	A	B	C
SECTION ONE **ELECTRICAL APPLICATIONS FOR APPLIANCES UP TO 400 MBH** **78 HOURS**	Testing Equipment 6 Hours	Pilot, Thermocouples and Thermopiles 9 Hours	Wiring Diagrams up to 400 MBH 30 Hours
	D	**E**	**F**
	Electrical Components up to 400 MBH 18 Hours	Non-Programmable Safeguards 9 Hours	Single Phase Motors 6 Hours
SECTION TWO **GAS SYSTEMS** **60 HOURS**	**A** Properties of Gas 12 Hours	**B** Temperature and Heat 3 Hours	**C** Gas System Components 12 Hours
	D	**E**	**F**
	Pipe Sizing 9 Hours	Pipe Installation 12 Hours	Propane Storage and Handling Systems 12 Hours
SECTION THREE **APPLIANCES UP TO 400 MBH** **30 HOURS**	**A** Appliance Installation 12 Hours	**B** Boiler Controls 12 Hours	**C** Refrigeration and Air Conditioning 6 Hours
SECTION FOUR **VENTING AND AIR SUPPLY** **27 HOURS**	**A** Venting 14 Hours	**B** Air Supply 6 Hours	**C** Interprovincial Standards Red Seal Program 3 Hours
	D	**E**	
	Alberta's Industry Network 2 Hours	Workplace Coaching Skills 2 Hours	
SECTION FIVE **COMMISSIONING AND SERVICING** **45 HOURS**	**A** Burners up to 400 MBH 9 Hours	**B** Combustion Analysis 6 Hours	**C** Commissioning Appliances up to 400 MBH 12 Hours
	D		
	Servicing Appliances up to 400 MBH 18 Hours		

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

SECTION ONE

ELECTRICAL APPLICATIONS FOR APPLIANCES OVER 400 MBH

138 HOURS

A	B	C
Electrical Code and Rules 3 Hours	Conductors and Bonding 3 Hours	Electrical Components/ Controls over 400 MBH 30 Hours
D	**E**	**F**
Wiring Diagrams over 400 MBH 36 Hours	Programmable Safeguards 30 Hours	Automation 18 Hours
G		
Three Phase Motors 18 Hours		

SECTION TWO

APPLIANCES OVER 400 MBH

102 HOURS

A	B	C
Regulators 18 Hours	Valve Trains 18 Hours	Burners over 400 MBH 18 Hours
D	**E**	**F**
Dual Fuel Systems 6 Hours	Commissioning/ Decommissioning Appliances over 400 MBH 12 Hours	Servicing Appliances over 400 MBH 6 Hours
G	**H**	**I**
Stationary Fuel Engines 3 Hours	Interprovincial Standards Red Seal Program 3 Hours	Make-up Air Units 6 Hours
J	**K**	
Line Heaters 6 Hours	Tank Heaters 6 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
GASFITTER 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 moving equipment.

C. Hazardous Materials & 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 the 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 fire hazards, classes, procedures and equipment related to fire protection.

D. Apprenticeship Training Program ..... 3 Hours

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

1. Describe the contractual responsibilities of the apprentice, employer and Alberta Apprenticeship and Industry Training.
2. Describe the purpose of the 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 code 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 rating 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 on 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 applications for 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 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 Soldering .....12 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 Drawing .....12 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 Interpretation .....12 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
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UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... ELECTRICAL APPLICATIONS ON APPLIANCES UP TO 400 MBH..... 78 HOURS

A. 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.

B. 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.

C. Wiring Diagrams up to 400 MBH..... 30 Hours

Outcome: ***Apply wiring diagrams for appliances up to 400 MBH.***

1. Identify types of transformers.
2. Describe the operating principles of transformers.
3. Calculate transformer load capacity.
4. Describe types of wiring diagrams.
5. Identify symbols found on wiring diagrams.
6. Describe the sequence of operation.
7. Sketch a sequence of operations flow chart.
8. Sketch wiring diagrams.
9. Wire circuits from wiring diagrams.
10. Troubleshoot circuits from a wiring diagram.

D. Electrical Components up to 400 MBH ..... 18 Hours

Outcome: ***Service electrical components up to 400 MBH.***

1. Identify types of electrical and mechanical components.
2. Describe operating principles of controls.

3. Describe the function of a resistor in a circuit.
4. Apply standards from CSA B149.1.
5. Troubleshoot electrical and mechanical components.

E. Non-Programmable Safeguards ..... 9 Hours

Outcome: ***Service non-programmable safeguards.***

1. Identify ignition systems.
2. Describe flame rectification.
3. Describe the operating principles.
4. Describe the sequence of operations
5. Sketch the sequence of operations.
6. Sketch wiring diagrams.
7. Wire circuits from wiring diagrams.
8. Troubleshoot circuits from wiring diagrams.

F. Single Phase Motors ..... 6 Hours

Outcome: ***Service single phase motors.***

1. Describe types of single phase motors.
2. Describe applications for single phase motors.
3. Describe the maintenance on a single phase motor.
4. Interpret the data on a motor nameplate.
5. Calculate the current draw on single phase motors.
6. Troubleshoot single phase motors.

SECTION TWO: ..... GAS SYSTEMS..... 57 HOURS

A. Properties of Gas ..... 12 Hours

Outcome: ***Apply knowledge of 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. Temperature and Heat ..... 3 Hours

Outcome: ***Apply knowledge of the heat transfer process relative to gasfitter trade.***

1. Explain the three methods of heat transfer.
2. Describe the principles of Charles and Boyles Law.
3. Define the terms latent and specific heat.

C. 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.

D. Pipe Sizing ..... 9 Hours

Outcome: ***Size a gas line system.***

1. Identify the type of gas and pressure.
2. Identify the type of gas line material.
3. Calculate the volume of gas consumed by appliance(s).
4. Sketch a gas line system.
5. Calculate the length of the gas piping system using different piping materials.
6. Apply standards for CSA B149.1.

E. Pipe Installation ..... 12 Hours

Outcome: ***Install a gas line system.***

1. Compile a materials list for a gas line.
2. Apply minimum standards for CSA B149.1.
3. Install a gas line.
4. Test a gas line.

F. Propane Storage and Handling Systems ..... 12 Hours

Outcome: ***Install and service propane storage and handling systems.***

1. Describe types of propane handling vessels.
2. Describe components used on propane systems.
3. Describe types of vapourizers.
4. Explain maintenance procedures for vessels and components.
5. Apply standards from CSA B149.1 & B149.2.
6. Calculate size and placement of components.

SECTION THREE: .....APPLIANCES UP TO 400 MBH..... 30 HOURS

A. Appliance Installation .....12 Hours

Outcome: ***Install a gas appliance.***

1. Describe the categories of appliances.
2. Identify rating plate requirements for specific appliances.
3. Identify gas appliance approval agencies.
4. Describe installation requirements for finish piping.
5. Explain the altitude rating requirements for appliances.
6. Calculate altitude ratings.
7. Apply standards from CSA B149.1.
8. Apply manufacturer specifications with appliance installation.

B. Boiler Controls .....12 Hours

Outcome: ***Install and service gas fired boilers.***

1. Describe the operation of boilers.
2. Apply standards from CSA B149.1, ASME and CSA B51.
3. Describe the operation of boiler controls.
4. List the sequencing process of the boiler controls.
5. Sketch wiring diagrams for a gas fired boiler.
6. Troubleshoot a gas fired boiler.

C. Refrigeration and Air Conditioning .....6 Hours

Outcome: ***Service heat/cool units.***

1. Identify the hazards with combined heating/cooling gas fired appliances.
2. Describe the components and symbols of a combined heating/cooling gas fired unit.
3. Describe the operation of a combined heating/cooling gas fired unit.
4. Explain handling requirements for refrigerants in heat/cool units.
5. Describe a compression refrigeration cycle.
6. Use wiring diagrams.
7. Troubleshoot heating/cooling gas fired units.

SECTION FOUR: .....VENTING AND AIR SUPPLY..... 27 HOURS

A. Venting .....14 Hours

Outcome: ***Install and service venting systems.***

1. Describe venting principles.
2. Describe the types of flues and draft control devices.
3. List the installation procedures for types of venting materials.
4. Size vents according to appliance category.

5. Size chimneys and liners.
6. Describe installation procedures for single and double acting barometric dampers.
7. Apply standards from CSA B149.1.
8. Describe vent and chimney applications for gas and alternate fuel appliances.

B. Air Supply ..... 6 Hours

Outcome: ***Install and service air supply systems.***

1. Describe air supply principles.
2. Apply standards from CSA B149.1.
3. Calculate the free area of grills and louvers.
4. Calculate the size of air supply ducts.
5. Calculate the air required for combustion, ventilation and flue gas dilution.

C. Interprovincial Standards Red Seal Program ..... 3 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. Alberta's Industry Network ..... 2 Hours

Outcome: ***Describe the role of the network of industry committees that represent trades and occupations in Alberta.***

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

E. Workplace Coaching Skills ..... 2 Hours

Outcome: ***Use coaching skills when training an apprentice.***

1. Describe the process for coaching an apprentice.

SECTION FIVE: ..... COMMISSIONING AND SERVICING ..... 45 HOURS

A. Burners up to 400 MBH ..... 9 Hours

Outcome: ***Install and service burners up to 400 MBH.***

1. Describe types of burners.
2. Describe components of burners.
3. Explain the ignition process for burners.
4. Adjust burners as per manufacturer's specifications.

B. Combustion Analysis.....6 Hours

Outcome: ***Perform a combustion analysis.***

1. Explain combustion analysis principles.
2. Describe factors relating to combustion analysis.
3. Describe methods for testing and adjusting combustion.
4. Calculate excess air volumes.
5. Calculate CO_2, O_2 and excess air.
6. Describe the effects of flame temperature on nitrogen oxide.
7. Perform a combustion analysis.

C. Commissioning Appliances up to 400 MBH.....12 Hours

Outcome: ***Commission appliances up to 400 MBH.***

1. Describe appliance testing, start-up and setup procedures as per manufacture specifications.
2. Explain the requirements when conducting a pre-heat chimney procedure.
3. Apply standards from CSA B149.1
4. Verify gas pressures for the installation.
5. Verify electrical requirements.
6. Commission an appliance.

D. Servicing Appliances up to 400 MBH.....18 Hours

Outcome: ***Service appliances up to 400 MBH.***

1. Use orifice sizing charts to determine orifice sizes.
2. Calculate orifice sizing using interpolation of the sizing charts.
3. Convert orifice sizes to drill sizes for hand drilling.
4. Explain methods used to check the condition of heat exchangers.
5. Perform a fuel gas conversion.
6. Apply standards from CSA B149.1.

THIRD PERIOD TECHNICAL TRAINING
GASFITTER TRADE
COURSE OUTLINE

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

SECTION ONE:.....ELECTRICAL APPLICATIONS FOR APPLIANCES OVER 400 MBH..... 138 HOURS

A. Electrical Code and Rules .....3 Hours

Outcome: Apply the Canadian Electrical Code Part I as it relates to the gasfitter trade.

1. Explain the purpose of the Canadian Electrical Code Part 1.
2. Identify the administrative rules in Section 2.

B. Conductors and Bonding .....3 Hours

Outcome: Determine conductor requirements for appliance installations.

1. State types of conductor materials.
2. List the physical characteristics of conductors.
3. Describe four classes of conductor terminations.
4. Describe the techniques for terminations.

C. Electrical Components/Controls over 400 MBH .....30 Hours

Outcome: Install and service electrical components and controls over 400 MBH.

1. Identify types of electrical components.
2. Describe operating principles of electrical components.
3. Identify types of electrical controls.
4. Describe operating principles of electrical controls.
5. Apply standards from CSA B149.1 and B149.3
6. Troubleshoot electrical components.
7. Troubleshoot electrical controls.

D. Wiring Diagrams over 400 MBH.....36 Hours

Outcome: Use wiring diagrams for appliances over 400 MBH.

1. Identify the symbols found on wiring diagrams.
2. Describe the sequence of operation.
3. Sketch a sequence of operation.
4. Sketch wiring diagrams.
5. Wire circuits from wiring diagrams.
6. Sketch a troubleshooting guide.
7. Troubleshoot circuits from a wiring diagram using a troubleshooting guide.
8. Use timing/sequencing diagrams.

E. Programmable Safeguards.....30 Hours

Outcome: ***Service programmable safeguards.***

1. Describe the types of programmable safeguards.
2. Explain the principles of programmable safeguards.
3. Describe the types of flame detection devices.
4. Apply standards from CSA B149.1 and B149.3
5. Wire a programmable safeguard.
6. Troubleshoot flame detection devices.

F. Automation .....18 Hours

Outcome: ***Configure an automation system.***

1. Describe a burner management system.
2. Describe a building management system.
3. Describe Proportional Integral Derivative (PID).
4. Explain the applications of a PID control.
5. Identify programmable logic controllers (PLC).
6. Identify pneumatic building management systems.
7. Identify network protocols.
8. Set parameters on a building management system.

G. Three Phase Motors.....18 Hours

Outcome: ***Service three phase motors.***

1. Describe types of three phase motors.
2. Describe motor starters and variable frequency drives (VFD's).
3. Describe maintenance procedures on three phase motors.
4. Interpret the data on a motor nameplate.
5. Calculate the current draw on three phase motors.
6. Troubleshoot three phase motors.

SECTION TWO:.....APPLIANCES OVER 400 MBH ..... 102 HOURS

A. Regulators.....18 Hours

Outcome: ***Service regulators.***

1. Describe pilot-operated regulators.
2. Describe zero governor regulators.
3. Describe a servo valve.
4. Describe the operation of regulators.
5. Test regulators.
6. Diagnose regulator malfunctions.

B. Valve Trains ..... 18 Hours

Outcome: ***Service valve trains.***

1. Describes types of valve trains.
2. Describe components of a valve train.
3. Describe functions of a valve train.
4. Apply standards from CSA B149.3.
5. Perform a let-by test on a valve train.

C. Burners over 400 MBH ..... 18 Hours

Outcome: ***Install and service burners over 400 MBH.***

1. Describe the types of burners.
2. Describe the components of burners.
3. Explain the ignition for burners.
4. Calculate air supply requirements.
5. Apply standards from CSA B149.1 and B149.3.
6. Describe gas-fired process equipment.
7. Explains the applications of gas-fired process equipment.
8. Adjust burners according to manufacturer's specifications.

D. Dual Fuel Systems ..... 6 Hours

Outcome: ***Install and service dual fuel systems.***

1. Describe the components of dual fuel systems.
2. Identify the fuels used for dual fuel systems.
3. Describe the operation of dual fuel systems.
4. Describe the installation of dual fuel systems.
5. Describe the sequence of operation.
6. Describe procedures for commissioning.
7. Apply standards from CSA B149.1 and B149.3.

E. Commissioning and Decommissioning Appliances over 400 MBH ..... 12 Hours

Outcome: ***Commission and decommission appliances over 400 MBH.***

1. Describe appliance testing, start-up and setup procedures as per manufacturer's specifications.
2. Apply standards from CSA B149.1 and B149.3.
3. Verify gas pressures for the installation.
4. Verify electrical requirements.
5. Describe the commissioning process.
6. Describe the decommissioning process.
7. Commission/decommission an appliance.

F. Servicing Appliances over 400 MBH ..... 6 Hours

Outcome: ***Maintain and service appliances over 400 MBH.***

1. Describe maintenance requirements.
2. Verify appliance operation according to specifications.
3. Apply standards from CSA B149.1 and B149.3
4. Diagnose problems with malfunctioning appliances.

G. Stationary Fuel Engines ..... 3 Hours

Outcome: ***Install stationary fuel engines.***

1. Identify stationary fuel engines.
2. Identify a co-generation system.
3. Describe the components of stationary fuel engines.
4. Apply standards from CSA B149.1 and B149.3.

H. Interprovincial Standards Red Seal Program ..... 3 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.

I. Make-up Air Units ..... 6 Hours

Outcome: ***Install and service make up air handling units (MAH's).***

1. Describe types of MAH systems.
2. Explain the principles of a MAH.
3. Describe the components on a MAH system.
4. List maintenance procedures on a MAH.
5. Apply standards from CSA B149.1.
6. Test a MAH.

J. Line Heaters ..... 6 Hours

Outcome: ***Install and service line heaters.***

1. Describe types of line heaters.
2. Explain the operating procedures of a line heater.
3. Describe the components on a line heater.
4. List maintenance procedures on a line heater.
5. Apply standard from CSA B149.3.

K. Tank Heaters ..... 6 Hours

Outcome: ***Install and service tank heaters.***

1. Describe types of tank heaters.
2. Explain the operating procedures of a tank heater.

3. Describe the components on a tank heater.
4. List maintenance procedures on a tank heater.
5. Apply standards from CSA B149.3.

Apprenticeship and Industry Training

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