

Apprenticeship and Industry Training

Industrial Mechanic (Millwright) Apprenticeship Course Outline

016 (2020)



Apprenticeship
and Industry
Training

ADVANCED EDUCATION

Industrial Mechanic (Millwright) apprenticeship course outline

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Course Outline

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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 Industrial Mechanic (Millwright) Provincial Apprenticeship Committee.

The graduate of the Industrial Mechanic (Millwright) apprenticeship program is a certified journeyman who will be able to:

- Perform tasks in accordance with industry and safe work practices.
- Perform installation and maintenance of industrial equipment.
- Apply technical information to meet specified standards.
- Use hand tools, power tools and related equipment.
- Interact with other industry professionals.
- Mentor apprentices to develop trade skills.

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 provide 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 PAC's 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

Industrial Mechanic (Millwright) PAC Members at the Time of Publication

Mr. T. Tomkiewych.....	Mayerthorpe	Presiding Officer
Mr. D. Birnie	Ft. McMurray	Employer
Ms. J. Guimond	Canmore	Employer
Mr. P. Phee	Edmonton.....	Employer
Mr. D. Rock	Whitecourt.....	Employer
Mr. T. Daigle.....	Whitecourt.....	Employee
Mr. M. Lawton.....	Grande Prairie.....	Employee
Mr. C. McNeil.....	Thorhild	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 behavior 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 Industrial Mechanic (Millwright) apprenticeship technical training:

Northern Alberta Institute of Technology	Southern Alberta Institute of Technology
Keyano College	Grande Prairie Regional College
Red Deer College	

Procedures for Recommending Revisions to the Course Outline

Advanced Education has prepared this course outline in partnership with the Industrial Mechanic (Millwright) Provincial Apprenticeship Committee.

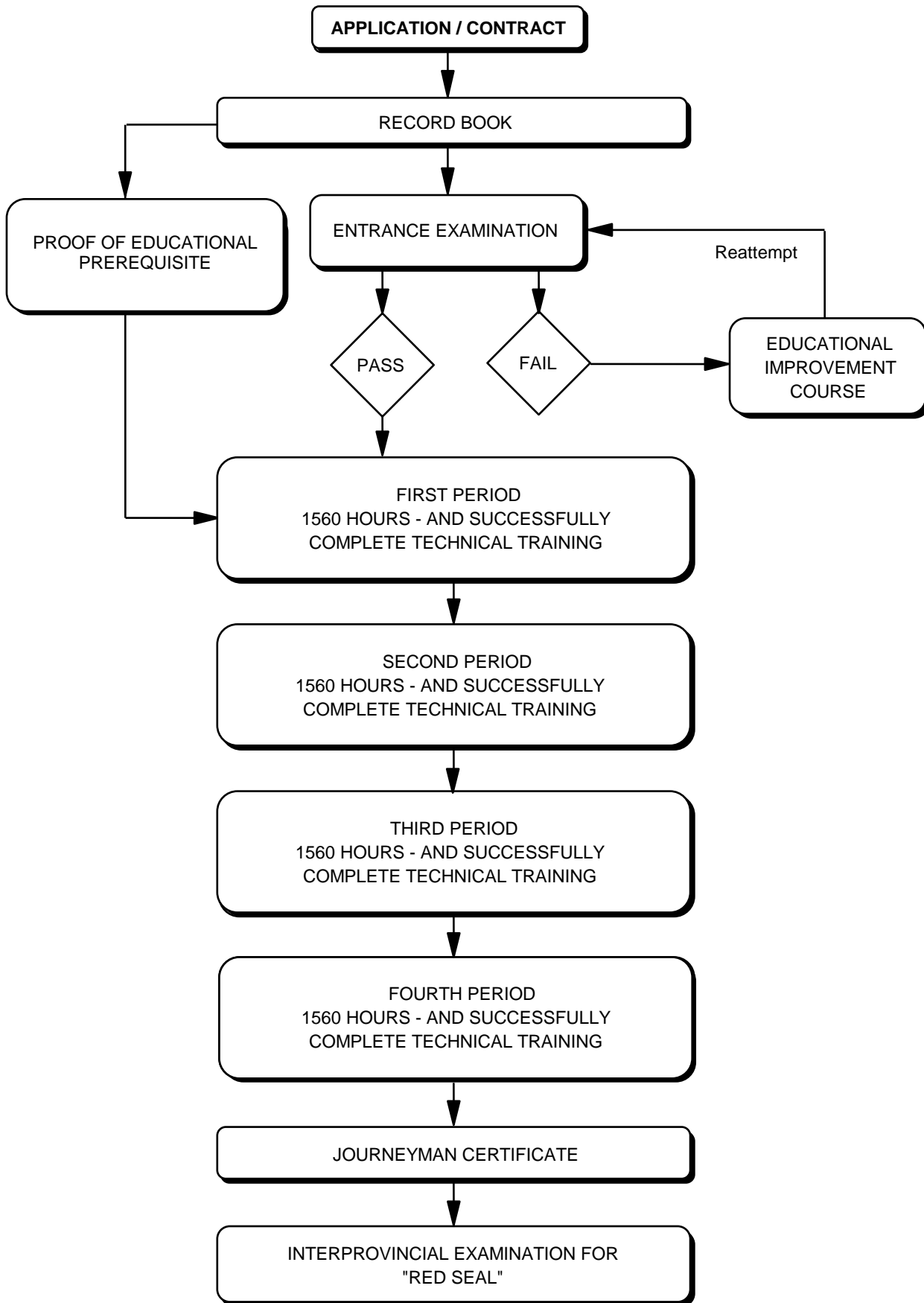
This course outline was approved on June 22, 2018 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

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

Industrial Mechanic (Millwright) 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 Industrial Mechanic (Millwright) Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



**Industrial Mechanic (Millwright) Training Profile
First Period
(8 Weeks 30 Hours per Week – Total of 240 Hours)**

SECTION ONE

**LEGISLATION,
COMMUNICATION AND
APPRENTICESHIP
DEVELOPMENT**
30 HOURS



A	B	C
Safety Legislation, Regulation & Industry Policy in the Trades 4 Hours	Climbing, Lifting, Rigging and Hoisting 20 Hours	Hazardous Materials & Fire Protection 2 Hours
D	E	
Apprenticeship Training Program 2 Hours	Communication 2 Hours	

SECTION TWO

TOOLS AND FASTENERS
42 HOURS



A	B	C
Hand Tools 10 Hours	Power Tools 10 Hours	Fasteners 22 Hours

SECTION THREE

**MEASUREMENTS, DRAWINGS
AND LAYOUTS**
52 HOURS



A	B	C
Measurement Tools 24 Hours	Technical Drawings 20 Hours	Layouts 8 Hours

SECTION FOUR

MACHINING
92 HOURS



A	B
Manual Machines, Tools and Components 28 Hours	Machining Operations 64 Hours

SECTION FIVE

**MACHINE INSTALLATION AND
ALIGNMENT**
24 HOURS



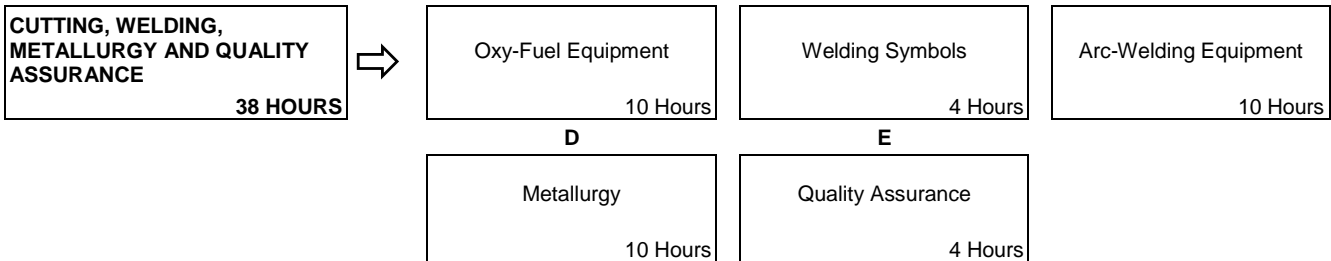
A	B
Grouting, Levelling and Anchoring 8 Hours	Shaft Alignment 16 Hours

Second Period
(8 Weeks 30 Hours per week – Total of 240 Hours)

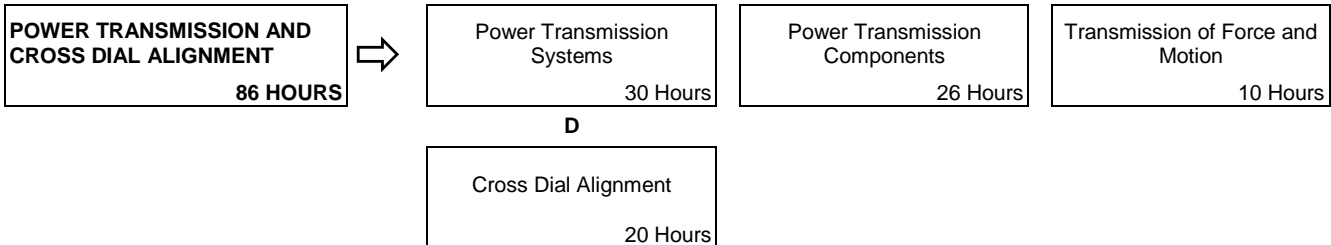
SECTION ONE



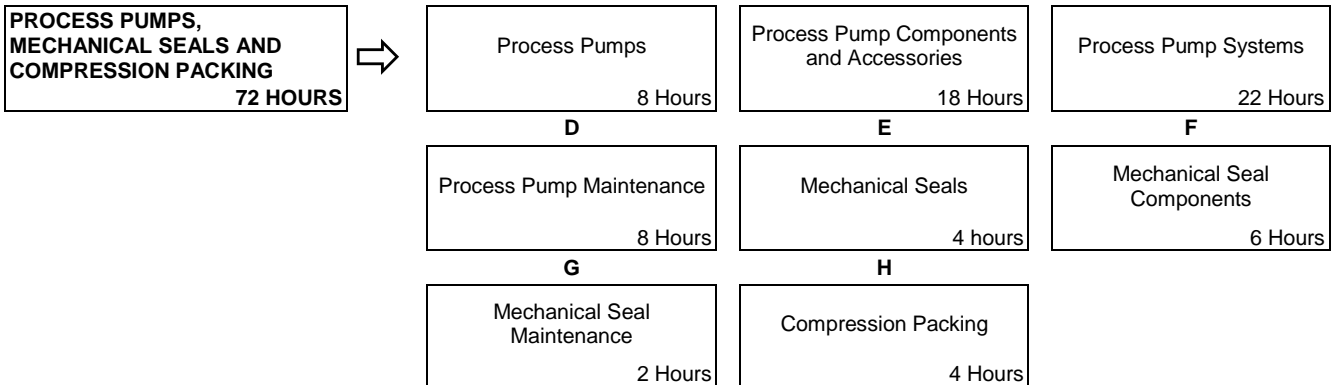
SECTION TWO



SECTION THREE



SECTION FOUR



**Third Period
(8 Weeks 30 Hours per week – Total of 240 Hours)**

SECTION ONE

COMPRESSORS
92 HOURS



A

Compressors
25 Hours

B

Compressor Components
27 Hours

C

Compressor Systems
40 Hours

SECTION TWO

FLUID POWER
88 HOURS



A

Fluid Power
22 Hours

B

Hydraulic Components
44 Hours

C

Hydraulic Systems
12 Hours

D

Pneumatic Components
5 Hours

E

Pneumatic Systems
5 Hours

SECTION THREE

**FANS, HEAT EXCHANGERS,
INDUSTRIAL REFRIGERATION
AND DRYERS**
32 HOURS



A

Fans
8 Hours

B

Heat Exchangers
8 Hours

C

Industrial Refrigeration
8 Hours

D

Gas and Air Dryers
8 Hours

SECTION FOUR

**LEVELLING, ALIGNMENT AND
PIPE STRAIN**
28 HOURS



A

Levelling
10 Hours

B

Laser Alignment
8 Hours

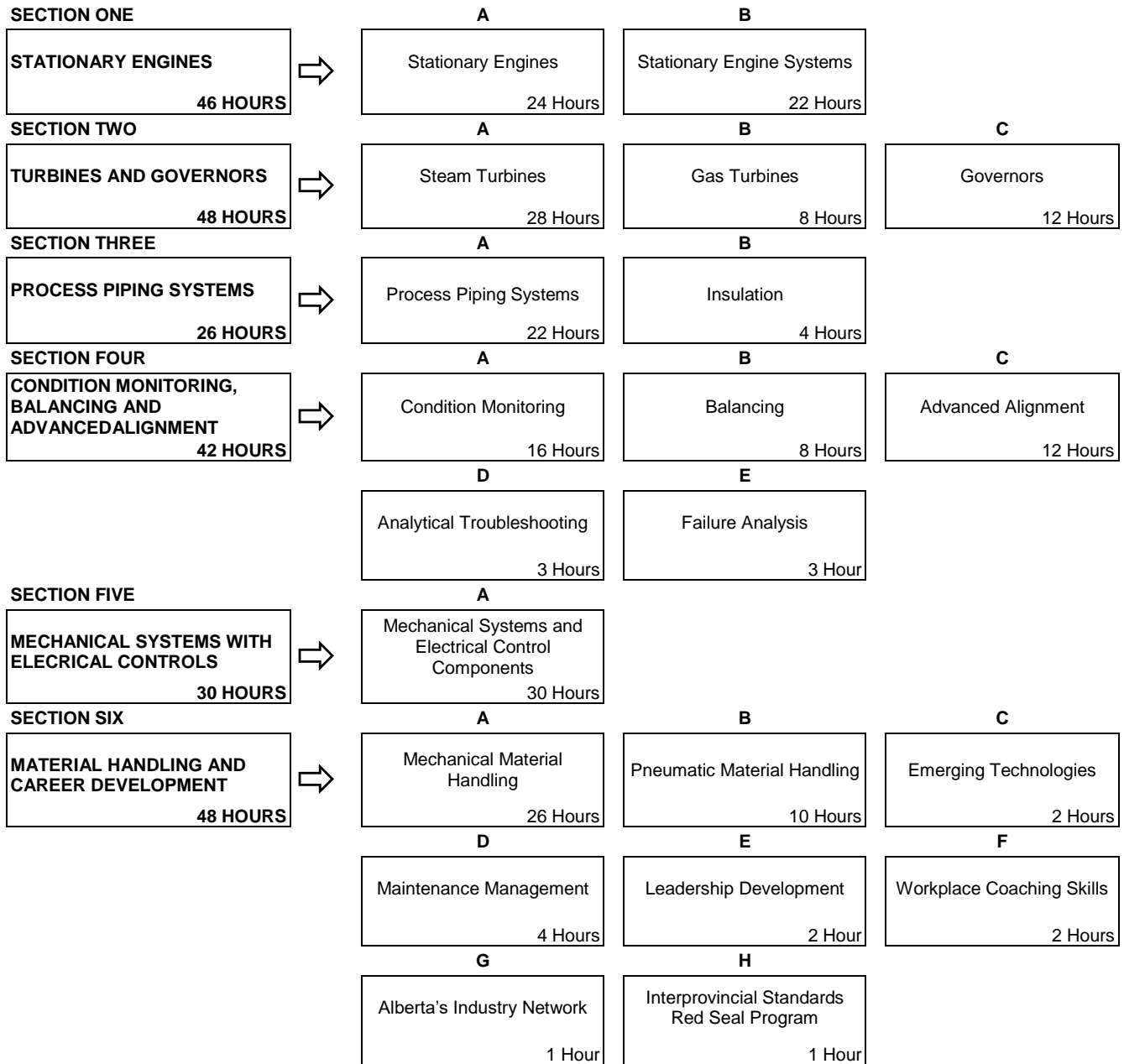
C

Bore Alignment
8 Hours

D

Pipe Strain
2 Hours

**Fourth Period
(8 Weeks 30 Hours per week – Total of 240 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
INDUSTRIAL MECHANIC (MILLWRIGHT) TRADE
COURSE OUTLINE**

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

SECTION ONE: LEGISLATION, COMMUNICATION AND APPRENTICESHIP DEVELOPMENT30 HOURS

A. Safety Legislation, Regulation & 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 (PPE) and emergency procedures.
6. Describe the roles and responsibilities of employers and employees with the selection and use of PPE.
7. Select, use and maintain appropriate PPE for worksite applications.
8. Use required PPE for tasks.

B. Climbing, Lifting, Rigging and Hoisting 20 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. Describe crane and hoisting types.
6. Describe crane and hoisting components.
7. Describe the applications of knots.
8. Describe the construction of chains.
9. Describe the application of chains.
10. Describe hoisting and moving equipment inspection procedures.
11. Describe the construction of wire rope.
12. Describe the construction of steel and fibre slings.
13. Describe the application of steel and fibre slings.
14. Describe hand-rigging equipment.
15. Perform rigging and hoisting calculations.
16. Maintain personal protective equipment (PPE) for climbing, lifting and load moving equipment.

- 17. Use PPE for climbing, lifting, and load moving equipment.
- 18. Use hoisting and moving equipment signalling.
- 19. Perform load moving procedures.

C. Hazardous Materials & Fire Protection 2 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 2 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 advancing through apprenticeship.
- 6. Describe advancement opportunities in this trade.

E. Communication..... 2 Hours

Outcome: ***Use communication strategies and techniques.***

- 1. Describe interpersonal communication skills.
- 2. Describe communication methods.

SECTION TWO: TOOLS AND FASTENERS42 HOURS

A. Hand Tools 10 Hours

Outcome: ***Use hand tools.***

- 1. Identify hand tool types.
- 2. Describe hand tools.
- 3. Describe jacks, pullers and presses.
- 4. Describe abrasive tools.
- 5. Describe cutting tools.
- 6. Describe tool functions.
- 7. Maintain hand tools.
- 8. Use hand tools.

B. Power Tools 10 Hours**Outcome: Use power tools.**

1. Identify power tool types.
2. Describe electrical tool functions.
3. Describe hydraulic tool functions.
4. Describe pneumatic tool functions.
5. Describe explosive actuated tool functions.
6. Use power tools.

C. Fasteners 22 Hours**Outcome: Use fasteners.**

1. Describe threaded fasteners.
2. Describe thread fastener functions.
3. Describe non-threaded fasteners.
4. Describe non-threaded fastener functions.
5. Describe fastener installation and removal methods.
6. Perform trade calculations related to fasteners.
7. Use fasteners.

SECTION THREE:MEASUREMENTS, DRAWINGS AND LAYOUTS52 HOURS**A. Measurement Tools 24 Hours****Outcome: Use measurement tools.**

1. Describe non-precision measurement tools.
2. Describe precision measurement tools.
3. Describe trade-specific measurement systems.
4. Describe trade-specific measurement units.
5. Describe trade-specific measurement standards.
6. Describe the effect of temperature change on trade-specific measurements.
7. Perform calculations related to trade-specific measurements.
8. Verify measurement tool accuracy.
9. Use measurement tools.

B. Technical Drawings 20 Hours**Outcome: Interpret technical drawings.**

1. Describe technical drawings.
2. Describe technical drawing layouts and conventions.
3. Describe technical drawing symbols.
4. Perform calculations using technical drawings.
5. Interpret technical drawings.

C. Layouts..... 8 Hours

Outcome: *Perform layouts.*

1. Describe layout tools and accessories.
2. Describe layout procedures.
3. Perform layouts.

SECTION FOUR:MACHINING.....92 HOURS

A. Manual Machines, Tools and Components 28 Hours

Outcome: *Use manual machines.*

1. Identify manual machine types.
2. Describe manual machine construction.
3. Describe manual machine operation.
4. Describe manual machine applications.
5. Describe machine tools.
6. Describe machine tool functions.
7. Describe machine tool applications.
8. Describe work and tool holding devices.
9. Describe work and tool holding device functions.
10. Describe work and tool holding device applications.
11. Perform manual machine maintenance.
12. Use manual machines.

B. Machining Operations..... 64 Hours

Outcome: *Perform manual machining operations.*

1. Describe cutting fluid applications.
2. Explain manual machine operations.
3. Explain speeds and feeds applications.
4. Perform calculations related to manual machine operations.
5. Perform machine tool maintenance.
6. Perform machining operations.

SECTION FIVE:..... MACHINE INSTALLATION AND ALIGNMENT24 HOURS

A. Grouting, Levelling, and Anchoring 8 Hours

Outcome: *Install machinery.*

1. Identify leveling equipment and tools.
2. Describe leveling and grouting applications.
3. Describe leveling and grouting procedures.

4. Describe anchor types.
5. Describe machinery installation methods.

B. Shaft Alignment 16 Hours

Outcome: *Perform rim and face shaft alignment.*

1. Describe the purpose of shaft alignment.
2. Describe shaft pre-alignment procedures.
3. Describe rough alignment.
4. Perform rim and face calculations.
5. Perform rim and face shaft alignment.

**SECOND PERIOD TECHNICAL TRAINING
INDUSTRIAL MECHANIC (MILLWRIGHT) TRADE
COURSE OUTLINE**

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

SECTION ONE:..... BEARINGS AND LUBRICATION..... 44 HOURS

A. Bearings 26 Hours

Outcome: *Use bearings.*

1. Identify bearing types.
2. Describe bearing functions.
3. Describe bearing applications.
4. Describe plain bearings.
5. Describe bearing lubrication principles.
6. Describe anti-friction bearings.
7. Describe bearing arrangements.
8. Describe bearing installation and removal procedures.
9. Perform calculations related to bearings.
10. Install and remove bearings.

B. Bearing Components 4 Hours

Outcome: *Use bearing components.*

1. Identify bearing components.
2. Describe bearing components.
3. Describe bearing component functions.
4. Use pillow blocks and bearing seals.

C. Bearing Maintenance 6 Hours

Outcome: *Perform bearing maintenance.*

1. Describe bearing maintenance.
2. Perform bearing maintenance.

D. Lubricants 4 Hours

Outcome: *Use lubricants.*

1. Identify lubricant types.
2. Describe lubrication theory.
3. Describe terminology associated with lubricants.
4. Describe the properties of lubrication oils.
5. Describe the applications of lubrication oil.
6. Describe the properties of lubrication greases.

7. Describe the applications of lubrication greases.
8. Describe the properties of dry solid lubricants.
9. Describe the applications of dry solid lubricants.
10. Describe testing methods of lubricants.
11. Interpret lubricant test data.

E. Lubrication Systems 4 Hours

Outcome: *Service lubrication systems.*

1. Describe lubrication system types.
2. Describe lubrication systems terminology .
3. Describe lubrication system components.
4. Describe lubricant handling and storage.
5. Describe maintenance of lubrication systems.
6. Service lubrication systems.

SECTION TWO:..... CUTTING, WELDING, METALLURGY AND QUALITY ASSURANCE..... 38 HOURS

A. Oxy-Fuel Equipment 10 Hours

Outcome: *Use oxy-fuel equipment.*

1. Describe oxy-fuel principles.
2. Describe oxy-fuel equipment.
3. Describe oxy-fuel equipment hazards.
4. Describe oxy-fuel equipment maintenance.
5. Describe oxy-fuel set up procedures.
6. Describe oxy-fuel gas properties.
7. Describe oxy-fuel gas storage.
8. Describe oxy-fuel heating procedures.
9. Describe oxy-fuel cutting procedures.
10. Use oxy-fuel equipment.

B. Welding Symbols 4 Hours

Outcome: *Interpret Welding symbols.*

1. Identify weld types.
2. Describe weld types.
3. Describe weld joints.
4. Describe weld symbols.
5. Interpret weld dimensions.

C. Arc-Welding Equipment 10 Hours

Outcome: Use arc-welding equipment.

1. Describe arc-welding principles.
2. Describe hazards associated with arc-welding.
3. Describe arc-welding equipment.
4. Describe arc-welding equipment components.
5. Describe arc-welding consumables.
6. Describe arc-welding equipment set up procedures.
7. Describe arc-welding procedures.
8. Use arc-welding equipment.

D. Metallurgy 10 Hours

Outcome: Use metallurgical data to meet specifications.

1. Describe metal properties.
2. Describe metal manufacturing.
3. Describe metal classifications.
4. Describe metal compositions.
5. Describe metal identification methods.
6. Describe the effects of heat treatment.
7. Describe destructive evaluation.
8. Describe non-destructive evaluation.

E. Quality Assurance 4 Hours

Outcome: Perform quality management.

1. Describe quality management applications.
2. Describe quality management accountability.
3. Describe quality management procedures.

SECTION THREE:POWER TRANSMISSION AND CROSS DIAL ALIGNMENT 86 HOURS

A. Power Transmission Systems 30 Hours

Outcome: Service power transmission systems.

1. Describe power transmission system types.
2. Describe power transmission system hazards.
3. Describe power transmission system functions.
4. Describe power transmission system maintenance procedures.
5. Use power transmission system technical drawings.
6. Service power transmission systems.

B. Power Transmission Components26 Hours

Outcome: Service power transmission components.

1. Describe power transmission components.
2. Describe characteristics of shafting.
3. Describe fits and applications of locking devices used with shafting.
4. Describe power transmission component functions.
5. Describe power transmission component applications.
6. Service power transmission components.

C. Transmission of Force and Motion 10 Hours

Outcome: Perform power transmission calculations.

1. Identify formulas associate with power transmission.
2. Describe power transmission calculation concepts.
3. Define terminology associated with power transmission calculations.
4. Demonstrate power transmission formula manipulation.
5. Perform power transmission calculations.

D. Cross Dial Alignment20 Hours

Outcome: Perform cross dial alignment.

1. Describe cross dial alignment methods.
2. Perform cross dial alignment using calculations.
3. Perform cross dial alignment using a graph.

SECTION FOUR:....PROCESS PUMPS, MECHANICAL SEALS AND COMPRESSION PACKING 72 HOURS

A. Process Pumps 8 Hours

Outcome: Maintain process pumps.

1. Identify positive displacement pump types.
2. Identify centrifugal pump types.
3. Describe pumping principles.
4. Define terminology associate with pump types.
5. Describe positive displacement pump functions.
6. Describe positive displacement pump applications.
7. Describe centrifugal pump functions.
8. Describe centrifugal pump applications.
9. Interpret pump data sheets.

B. Process Pump Components and Accessories 18 Hours

Outcome: Service process pump components and accessories.

1. Describe positive displacement pump components.

2. Describe positive displacement pump component functions.
3. Describe positive displacement pump accessories.
4. Describe centrifugal pump components.
5. Describe centrifugal pump component functions.
6. Describe centrifugal pump accessories.

C. Process Pump Systems22 Hours

Outcome: *Service process pump systems.*

1. Identify pump system types.
2. Describe terminology used with pump systems.
3. Describe pump system components.
4. Interpret pump system technical drawing and schematic information.
5. Diagnose process pump systems.

D. Process Pump Maintenance8 Hours

Outcome: *Service process pumps.*

1. Describe positive displacement pump maintenance procedures.
2. Describe centrifugal pump maintenance procedures.
3. Describe pump installation and removal procedures.
4. Perform pump performance calculations.
5. Analyze pump curve data.
6. Troubleshoot positive displacement pumps.
7. Troubleshoot centrifugal pumps.
8. Service positive displacement pumps.
9. Service centrifugal pumps.

E. Mechanical Seals.....4 Hours

Outcome: *Maintain mechanical seals.*

1. Identify mechanical seal types.
2. Describe mechanical seal types.
3. Describe terminology used with mechanical seals.
4. Describe mechanical seal type applications.

F. Mechanical Seal Components6 Hours

Outcome: *Service mechanical seal components.*

1. Describe mechanical seal components.
2. Describe mechanical seal component functions.
3. Describe terminology used with mechanical seal components.
4. Describe mechanical seal component materials.

5. Describe mechanical seal component configurations.
6. Describe mechanical seal component maintenance.

G. Mechanical Seal Maintenance 2 Hours

Outcome: *Service mechanical seals.*

1. Describe mechanical seal inspection methods.
2. Describe mechanical seal removal and installation procedures.
3. Describe precautions applicable to mechanical seal removal and installation.
4. Interpret mechanical seal inspection data.
5. Perform mechanical seal inspections.
6. Perform mechanical seal maintenance procedures.

H. Compression Packing 4 Hours

Outcome: *Service compression packing.*

1. Describe principles of compression packing.
2. Describe components for compression packing.
3. Describe application of compression packing.
4. Demonstrate pumps and valves compression repacking service.

**THIRD PERIOD TECHNICAL TRAINING
INDUSTRIAL MECHANIC (MILLWRIGHT) TRADE
COURSE OUTLINE**

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

SECTION ONE:..... COMPRESSORS 92 HOURS

A. Compressors25 Hours

Outcome: *Apply compressor fundamentals.*

1. Identify compressor types.
2. Describe positive displacement compressor classifications.
3. Describe dynamic compressor classifications.
4. Describe terminology used with compressors.
5. Describe compressor functions.
6. Describe compressor applications.
7. Calculate compressor ideal gas law.

B. Compressor Components27 Hours

Outcome: *Use compressor components.*

1. Identify compressor components.
2. Describe terminology used with compressor components.
3. Describe compressor component functions.
4. Describe compressor component applications.

C. Compressor Systems40 Hours

Outcome: *Service compressor systems.*

1. Describe compressor systems.
2. Describe compressor axillary systems.
3. Describe compressor system monitoring and failure analysis.
4. Describe compressor system component troubleshooting methods.
5. Describe compressor commissioning and start-up procedures.
6. Interpret compressor system monitoring and failure analysis data.
7. Perform compressor system overhaul procedures.
8. Perform compressor commissioning and start-up procedures.

SECTION TWO:..... FLUID POWER 88 HOURS

A. Fluid Power22 Hours

Outcome: *Apply fluid power fundamentals.*

1. Describe fluid power.

2. Describe fluid power systems.
3. Perform fluid power calculations.

B. Hydraulic Components 44 Hours

Outcome: *Service hydraulic components.*

1. Identify hydraulic pump types.
2. Describe hydraulic pump types and components.
3. Describe hydraulic seals.
4. Describe hydraulic seal applications.
5. Describe hydraulic actuator types and component types.
6. Describe hydraulic valves and components.
7. Interpret hydraulic component drawings.
8. Troubleshoot hydraulic components.
9. Service hydraulic components.

C. Hydraulic Systems 12 Hours

Outcome: *Service hydraulic systems.*

1. Describe hydraulic systems.
2. Describe hydraulic system troubleshooting methods.
3. Describe hydraulic system maintenance.
4. Interpret hydraulic circuit drawings.
5. Design hydraulic circuit drawings.
6. Troubleshoot hydraulic systems.
7. Service hydraulic systems.

D. Pneumatic Components 5 Hours

Outcome: *Service pneumatic components.*

1. Describe pneumatic actuator types and components.
2. Describe pneumatic valve types and components.
3. Interpret pneumatic system drawings.
4. Troubleshoot pneumatic components.

E. Pneumatic Systems 5 Hours

Outcome: *Service pneumatic systems.*

1. Describe pneumatic systems.
2. Describe pneumatic system troubleshooting methods.
3. Describe pneumatic system maintenance.
4. Interpret pneumatic circuit drawings.
5. Design pneumatic circuit drawings.

- 6. Troubleshoot pneumatic systems.
- 7. Service pneumatic systems.

**SECTION THREE: FANS, HEAT EXCHANGERS, INDUSTRIAL REFRIGERATION 32 HOURS
AND DRYERS**

A. Fans 8 Hours

Outcome: *Service fans.*

- 1. Identify fan types.
- 2. Describe fan operating principles.
- 3. Describe fan systems.
- 4. Describe fan applications.
- 5. Describe fan components and accessories.
- 6. Describe fan troubleshooting.
- 7. Describe fan service.

B. Heat Exchangers 8 Hours

Outcome: *Service heat exchangers.*

- 1. Identify heat exchanger types.
- 2. Describe heat exchanger operating principles.
- 3. Describe heat exchanger applications.
- 4. Describe heat exchanger components.
- 5. Describe heat exchanger accessories.
- 6. Describe heat exchanger troubleshooting.
- 7. Describe heat exchanger servicing.

C. Industrial Refrigeration 8 Hours

Outcome: *Service Industrial refrigeration components.*

- 1. Identify industrial refrigeration system types.
- 2. Describe industrial refrigeration system operating principles.
- 3. Describe industrial refrigeration system applications.
- 4. Describe industrial refrigeration system components.
- 5. Describe industrial refrigeration system troubleshooting.
- 6. Analyze an industrial refrigeration cycle.

D. Gas and Air Dryers 8 Hours

Outcome: *Service gas and air dryer systems.*

- 1. Describe gas and air dryer types.
- 2. Describe gas and air dryer operating principles.
- 3. Describe gas and air dryer applications.
- 4. Describe gas and air dryer components and accessories.

- 5. Describe gas and air dryer troubleshooting.
- 6. Describe gas and air dryer service.

SECTION FOUR: LEVELLING, ALIGNMENT AND PIPE STRAIN 28 HOURS

A. Levelling 10 Hours

Outcome: *Perform levelling procedures.*

- 1. Describe leveling equipment and tool types.
- 2. Describe leveling methods.
- 3. Explain leveling procedures.
- 4. Perform leveling procedures.

B. Laser Alignment 8 Hours

Outcome: *Perform laser shaft alignments.*

- 1. Describe the principles of laser shaft alignment.
- 2. Describe laser alignment equipment.
- 3. Describe laser alignment equipment procedures.
- 4. Perform laser shaft alignment.

C. Bore Alignment 8 Hours

Outcome: *Perform bore alignments.*

- 1. Describe bore alignment methods.
- 2. Describe bore alignment procedures.
- 3. Perform bore alignment.

D. Pipe Strain..... 2 Hours

Outcome: *Perform pipe strain corrections.*

- 1. Describe pipe strain.
- 2. Describe pipe strain correction methods.
- 3. Analyze pipe strain data.

**FOURTH PERIOD TECHNICAL TRAINING
INDUSTRIAL MECHANIC (MILLWRIGHT) TRADE
COURSE OUTLINE**

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

SECTION ONE:..... STATIONARY ENGINES 46 HOURS

A. Stationary Engines24 Hours

Outcome: Service stationary engines.

1. Describe stationary engine operating principles.
2. Describe stationary engine components.
3. Describe stationary engine applications.

B. Stationary Engine Systems22 Hours

Outcome: Service stationary engines.

1. Describe stationary engine lubrication systems.
2. Describe stationary engine cooling systems.
3. Describe stationary engine exhaust systems
4. Describe stationary engine fuel systems.
5. Describe stationary engine electrical systems.
6. Describe stationary engine system troubleshooting.
7. Describe stationary engine performance optimization.
8. Describe auxiliary systems service.
9. Service auxiliary systems.
10. Service stationary engines.

SECTION TWO:..... TURBINES AND GOVERNORS..... 48 HOURS

A. Steam Turbines28 Hours

Outcome: Service steam turbines.

1. Describe steam turbine fundamentals.
2. Describe steam turbine operating principles.
3. Describe steam turbine design.
4. Describe steam turbine components.
5. Describe steam turbine component servicing.
6. Describe steam turbine control systems.
7. Describe steam turbine auxiliary systems.
8. Describe steam turbine troubleshooting.
9. Describe steam turbine service procedures.
10. Describe steam turbine start up procedure.
11. Demonstrate steam turbine operation.

B. Gas Turbines 8 Hours

Outcome: Service gas turbines.

1. Describe gas turbine fundamentals.
2. Describe gas turbine operating principles.
3. Describe gas turbine design.
4. Describe gas turbine components.
5. Describe gas turbine component servicing.
6. Describe gas turbine control systems.
7. Describe gas turbine auxiliary systems.
8. Describe gas turbine troubleshooting.
9. Describe gas turbine service procedures.
10. Describe gas turbine start up procedure.

C. Governors 12 Hours

Outcome: Service governors.

1. Describe the application of governors on prime movers.
2. Describe operating principles of governors.
3. Describe maintenance procedures associated with governors.
4. Describe the setup of governor controls.
5. Describe operating principle of over-speed trip mechanisms.
6. Demonstrate over-speed trip mechanisms adjustment procedures.

SECTION THREEPROCESS PIPING SYSTEMS 26 HOURS

A. Process Piping Systems 22 Hours

Outcome: Service process piping systems.

1. Describe process-piping system components.
2. Describe process piping assembly equipment.
3. Describe mechanical joint assemblies.
4. Perform calculations related to process piping systems.
5. Perform mechanical joint assemblies.

B. Insulation 4 Hours

Outcome: Maintain insulation systems.

1. Describe insulation systems.
2. Describe insulation materials.
3. Describe insulation application procedures.
4. Describe insulation system maintenance.

**SECTION FOUR: CONDITION MONITORING, BALANCING 42 HOURS
AND ADVANCED ALIGNMENT**

A. Condition Monitoring 16 Hours

Outcome: *Use condition monitoring.*

1. Describe condition-monitoring methods.
2. Describe condition-monitoring applications.
3. Describe condition-monitoring tools and instruments.
4. Use condition monitoring tools and instruments.

B. Balancing 8 Hours

Outcome: *Perform balancing.*

1. Describe balancing theory.
2. Describe causes of imbalance.
3. Describe effects of imbalance.
4. Describe balancing methods.
5. Describe balancing procedures.
6. Solve balancing related calculation.
7. Perform balancing procedures.

C. Advanced Alignment..... 12 Hours

Outcome: *Perform advanced alignment.*

1. Describe multi-machine alignment.
2. Describe alignment procedures
3. Describe measuring techniques for growth and movement.
4. Calculate thermal expansion effect and movement.
5. Perform advanced alignment.

D. Analytical Troubleshooting 3 Hours

Outcome: *Apply analytical troubleshooting processes.*

1. Describe analytical troubleshooting processes.
2. Perform analytic troubleshooting techniques.

E. Failure Analysis 3 Hours

Outcome: *Apply failures analysis processes.*

1. Describe failure analysis.
2. Describe failure analysis procedures.
3. Describe failure analysis documentation processes.
4. Analyze failure analysis data.

SECTION FIVE: MECHANICAL SYSTEMS WITH ELECTRICAL CONTROLS..... 30 HOURS**A. Mechanical Systems and Electrical Control Components..... 30 Hours****Outcome: *Troubleshoot systems containing electrical components.***

1. Describe hazards associated with electricity.
2. Describe principles of electricity.
3. Describe principles of magnetism and electromagnetism.
4. Describe the application of a multi-meter.
5. Describe application of industrial control components.
6. Describe industrial control systems.
7. Perform calculations using Ohms law.

SECTION SIX:..... MATERIAL HANDLING AND CAREER DEVELOPMENT 48 HOURS**A. Mechanical Material Handling 26 Hours****Outcome: *Service mechanical material handling systems.***

1. Identify mechanical material handling system types.
2. Describe mechanical material handling components.
3. Describe mechanical material handling system hazards.
4. Describe mechanical material handling system functions.
5. Describe mechanical material handling system maintenance procedures.
6. Demonstrate mechanical material handling system maintenance.

B. Pneumatic Material Handling 10 Hours**Outcome: *Service pneumatic material handling systems***

1. Identify pneumatic material handling system types.
2. Describe pneumatic material handling components.
3. Describe pneumatic material handling system hazards.
4. Describe pneumatic material handling system functions.
5. Describe pneumatic material handling system maintenance procedures.
6. Demonstrate pneumatic material conveyance.

C. Emerging Technologies 2 Hours**Outcome: *Apply emerging technologies.***

1. Identify emerging technologies.
2. Describe emerging technologies.
3. Analyze emerging trends in the Industrial Mechanic (Millwright) trade.
4. Apply emerging trends to the Industrial Mechanic (Millwright) trade.

D. Maintenance Management 4 Hours**Outcome: Use maintenance management systems.**

1. Describe maintenance management systems.
2. Describe maintenance management purposes.

E. Leadership Development 2 Hours**Outcome: Apply leadership development skills.**

1. Describe the “Alberta Achievement in Business Competencies” (Blue Seal) program.
2. Describe leadership development.
3. Describe pathways to specialization in the Industrial Mechanic (Millwright) trade.

F. Workplace Coaching Skills 2 Hours**Outcome: Use coaching skills when training an apprentice.**

1. Describe the process for coaching an apprentice.

G. Alberta’s Industry Network 1 Hour**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).

H. Interprovincial Standards Red Seal Program..... 1 Hour**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.



Apprenticeship and Industry Training

Alberta Trades. World Ready.