

# Apprenticeship and Industry Training

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## Industrial Mechanic (Millwright) Curriculum Guide

016 (2022)



Apprenticeship  
and Industry  
Training

**ALBERTA ADVANCED EDUCATION**

Industrial Mechanic (Millwright): apprenticeship education program curriculum guide

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## Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding a sponsor. Sponsors guide apprentices, and support on-the-job learning through provision of mentorship. 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 (PSI) – usually a college or technical institute.

To receive their postsecondary credential, apprentices must learn theory and skills, and they must pass examinations. Criteria for the program—including the content and delivery of technical training—are developed and updated by the Registrar.

The graduate of the Industrial Mechanic (Millwright) apprenticeship education program is an individual 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

Alberta's apprenticeship education programs are supported by industry stakeholders that ensures a highly skilled, internationally competitive workforce in the province. The Registrar establishes the educational standards and provides direction to the system supported by industry and the PSI's. The Ministry of Advanced Education provides the legislative framework and administrative support for the apprenticeship and industry training system.

**Special thanks are offered to the following industry members who contributed to the development of the standard:**

Mr. T. Tomkiewych .....Mayerthorpe  
Mr. D. Birnie ..... Ft. McMurray  
Ms. J. Guimond ..... Canmore  
Mr. P. Phee ..... Edmonton  
Mr. D. Rock ..... Whitecourt  
Mr. T. Daigle ..... Whitecourt  
Mr. M. Lawton ..... Grande Prairie  
Mr. C. McNeil ..... Thorhild

## Alberta Government

Alberta Advanced Education works with industry, sponsor 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 sponsors
- 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 education programs in Alberta. These responsibilities are shared and require the joint efforts of government, sponsors, 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.

### **Occupational Health and Safety**

Persons engaged in, or supporting an individual in an experiential learning environment are often exposed to more worksite hazards than in other forms of traditional postsecondary education 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-OHS (a division of Alberta Labour and Immigration) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at [www.alberta.ca/occupational-health-safety.aspx](http://www.alberta.ca/occupational-health-safety.aspx)

### **Technical Training**

Apprenticeship technical training is delivered by the PSI's throughout Alberta. The PSI's are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All PSI's place a strong emphasis on safety that complements safe workplace practices towards the development of a culture of safety for all professions.

The PSI's work with industry 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 curriculum guides established by the Registrar in consultation with the PSI's and industry and provide the technical training to apprentices.

The following PSI's 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	

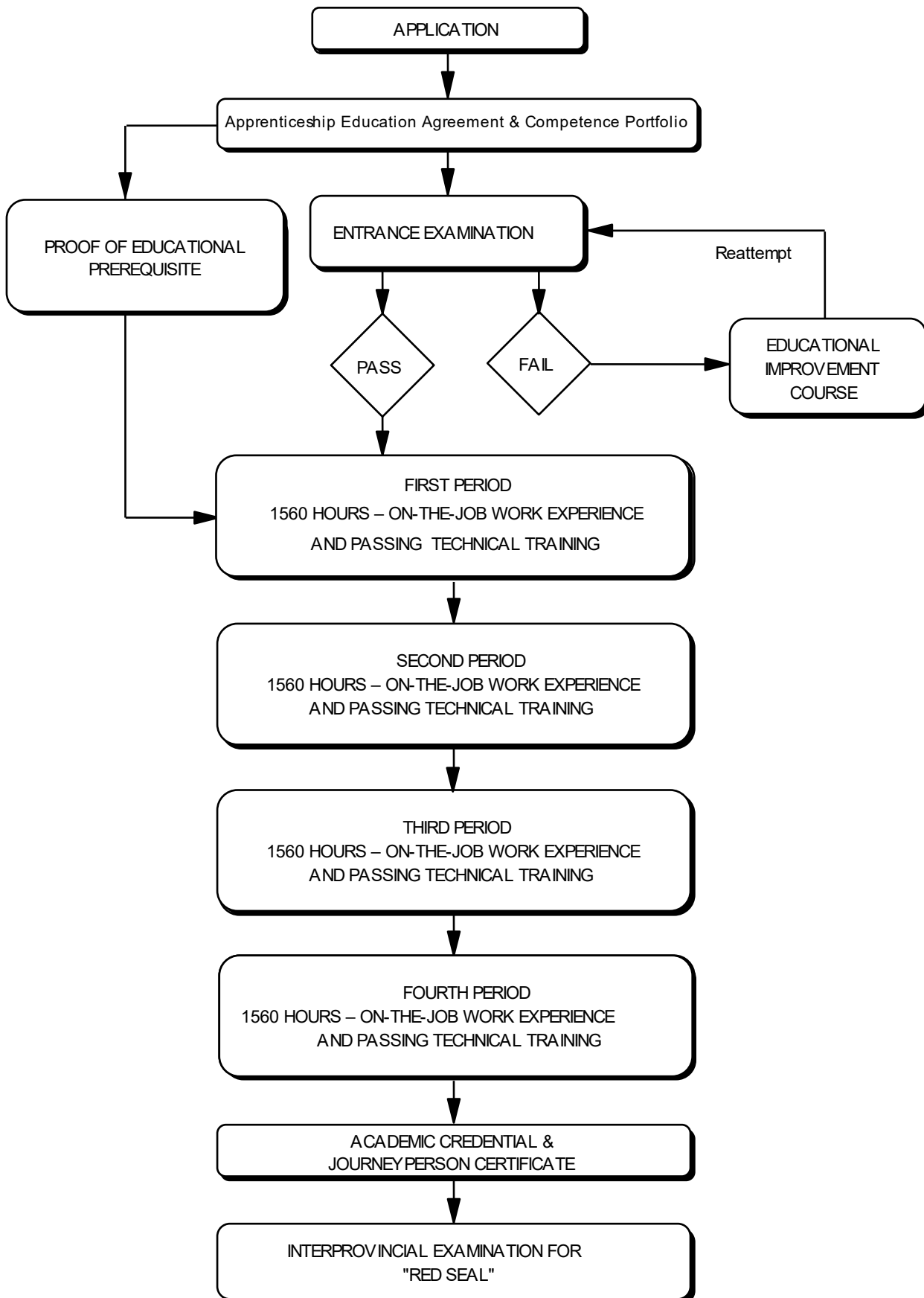
### **Procedures for Recommending Revisions to the Curriculum Guide**

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

Registrar of Apprenticeship Programs  
c/o Apprenticeship Delivery and Industry Support Services  
Apprenticeship Delivery and Industry Support  
Advanced Education  
19th 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.

### Apprenticeship Route toward Academic Credential



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

**SECTION ONE**

**LEGISLATION,  
COMMUNICATION AND  
APPRENTICESHIP  
DEVELOPMENT**  
  
13%



**A**

Safety Legislation,  
Regulation & Industry Policy  
in the Trades  
  
13%

**B**

Climbing, Lifting, Rigging and  
Hoisting  
  
67%

**C**

Hazardous Materials & Fire  
Protection  
  
7%

**D**

Apprenticeship Training  
Program  
  
7%

**E**

Communication  
  
6%

**SECTION TWO**

**TOOLS AND FASTENERS**  
  
18%



**A**

Hand Tools  
  
24%

**B**

Power Tools  
  
24%

**C**

Fasteners  
  
52%

**SECTION THREE**

**MEASUREMENTS, DRAWINGS  
AND LAYOUTS**  
  
21%



**A**

Measurement Tools  
  
46%

**B**

Technical Drawings  
  
39%

**C**

Layouts  
  
15%

**SECTION FOUR**

**MACHINING**  
  
38%



**A**

Manual Machines, Tools and  
Components  
  
30%

**B**

Machining Operations  
  
70%

**SECTION FIVE**

**MACHINE INSTALLATION AND  
ALIGNMENT**  
  
10%



**A**

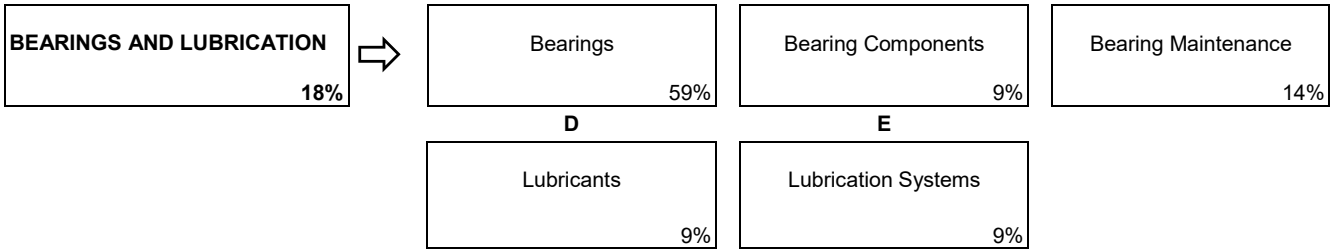
Grouting, Levelling and  
Anchoring  
  
33%

**B**

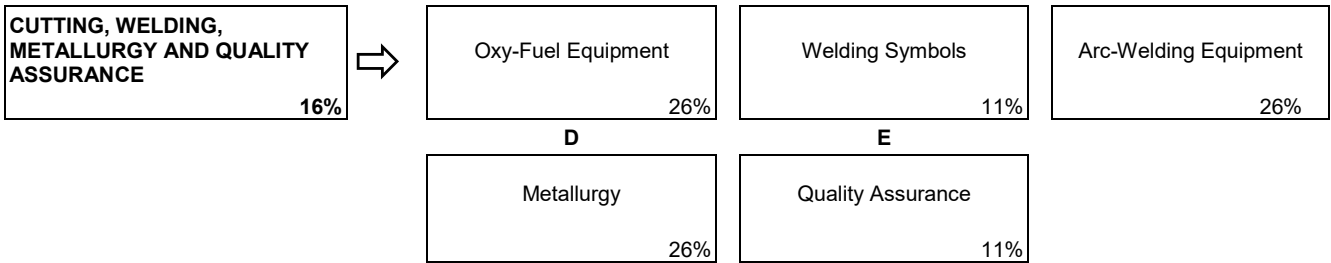
Shaft Alignment  
  
67%

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

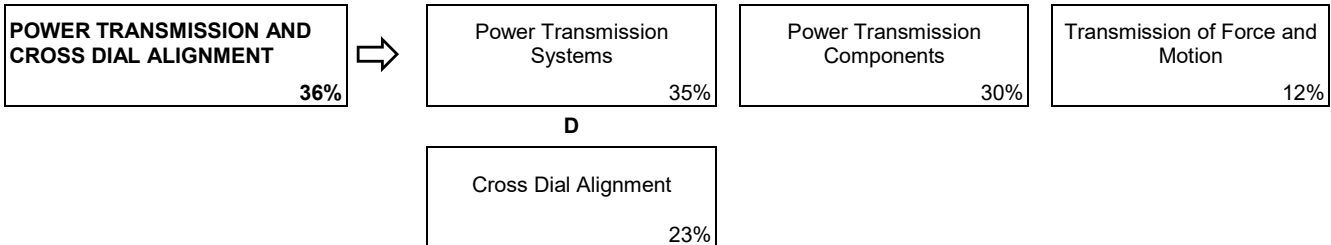
**SECTION ONE**



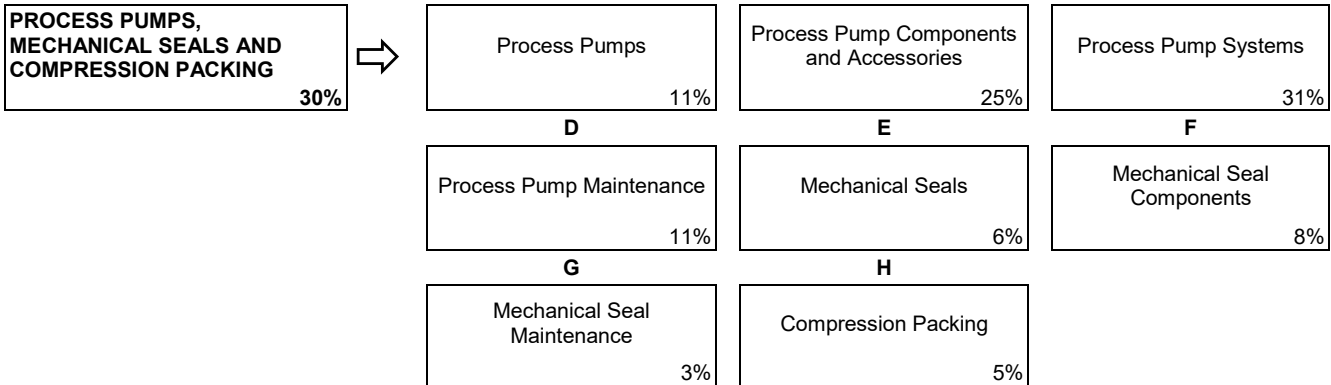
**SECTION TWO**



**SECTION THREE**



**SECTION FOUR**





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

**SECTION ONE**

**COMPRESSORS**  
38%



**A**

Compressors  
27%

**B**

Compressor Components  
29%

**C**

Compressor Systems  
44%

**SECTION TWO**

**FLUID POWER**  
37%



**A**

Fluid Power  
25%

**B**

Hydraulic Components  
50%

**C**

Hydraulic Systems  
14%

**D**

Pneumatic Components  
6%

**E**

Pneumatic Systems  
5%

**SECTION THREE**

**FANS, HEAT EXCHANGERS,  
INDUSTRIAL REFRIGERATION  
AND DRYERS**  
13%



**A**

Fans  
25%

**B**

Heat Exchangers  
25%

**C**

Industrial Refrigeration  
25%

**D**

Gas and Air Dryers  
25%

12%

**SECTION FOUR**

**LEVELLING, ALIGNMENT AND  
PIPE STRAIN**  
12%



**A**

Levelling  
36%

**B**

Laser Alignment  
28%

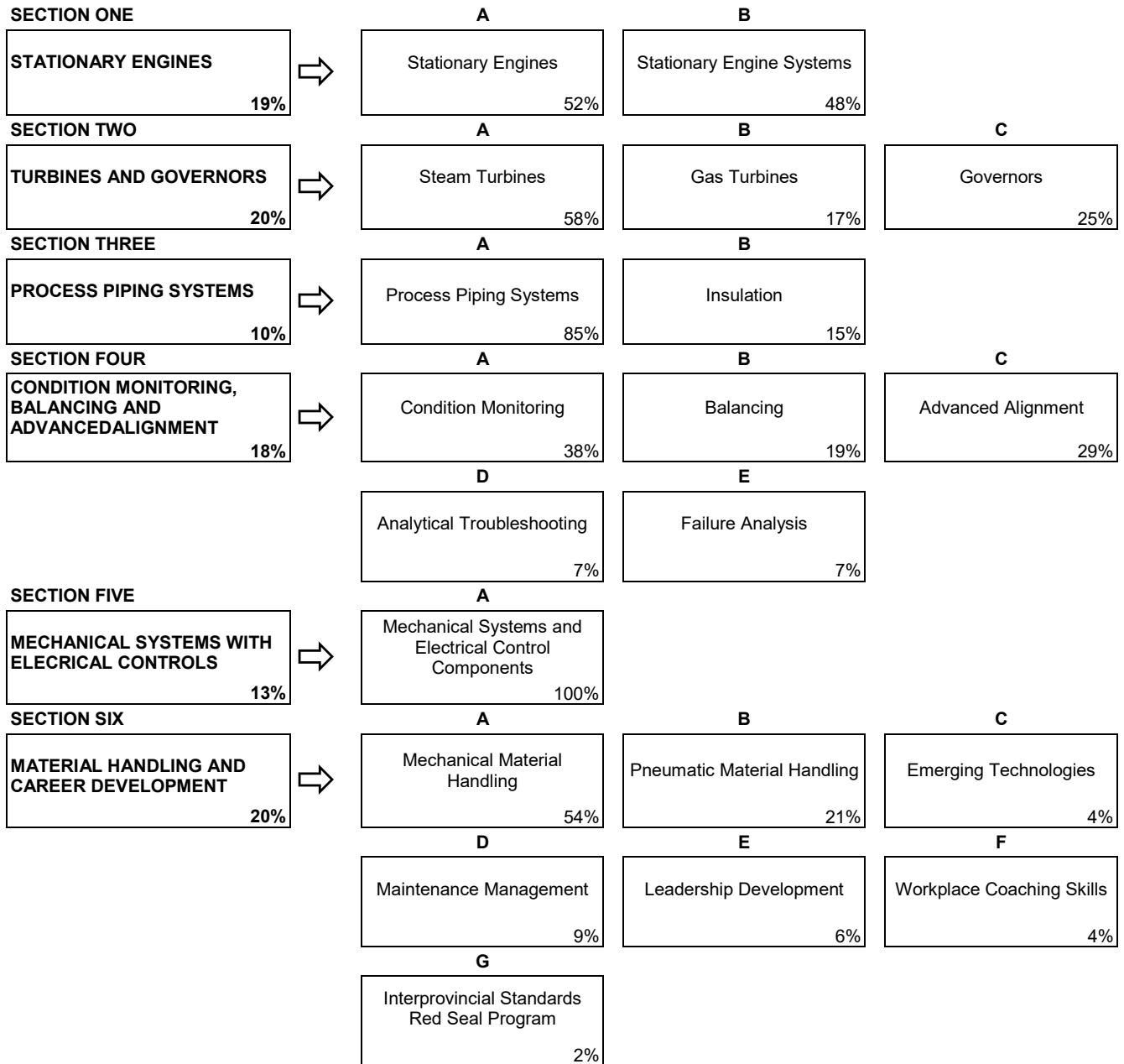
**C**

Bore Alignment  
29%

**D**

Pipe Strain  
7%

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



**FIRST PERIOD TECHNICAL TRAINING  
INDUSTRIAL MECHANIC (MILLWRIGHT) TRADE  
CURRICULUM GUIDE**

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

**SECTION ONE: LEGISLATION, COMMUNICATION AND APPRENTICESHIP DEVELOPMENT ..... 13%**

**A. Safety Legislation, Regulation & Industry Policy in the Trades ..... 13%**

**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 sponsor'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 workers and sponsors 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 sponsors 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 ..... 67%**

**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 .....7%**

**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 .....7%**

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

- 1. Describe the contractual responsibilities of the apprentice, sponsor and Alberta Apprenticeship and Industry Training.
- 2. Describe the purpose of the competency portfolio.
- 3. Describe the procedure for changing employers during an active apprenticeship.
- 4. Describe the purpose of the curriculum guide.
- 5. Describe the procedure for advancing through apprenticeship.
- 6. Describe advancement opportunities in this trade.

**E. Communication.....6%**

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

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

**SECTION TWO: ..... TOOLS AND FASTENERS..... 18%**

**A. Hand Tools ..... 24%**

**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 ..... 24%****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 ..... 52%****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 LAYOUTS ..... 21%****A. Measurement Tools ..... 46%****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 ..... 39%****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 ..... 15%**

**Outcome:      *Perform layouts.***

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

**SECTION FOUR: .....MACHINING..... 38%**

**A. Manual Machines, Tools and Components ..... 30%**

**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 ..... 70%**

**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 ALIGNMENT ..... 10%**

**A. Grouting, Levelling, and Anchoring ..... 33%**

**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 ..... 67%**

**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  
CURRICULUM GUIDE**

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

**SECTION ONE:..... BEARINGS AND LUBRICATION..... 18%**

**A. Bearings ..... 59%**

**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 ..... 9%**

**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 ..... 14%**

**Outcome:     *Perform bearing maintenance.***

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

**D. Lubricants ..... 9%**

**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 ..... 9%**

**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..... 16%**

**A. Oxy-Fuel Equipment ..... 26%**

**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 ..... 11%**

**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 ..... 26%**

**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 ..... 26%**

**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 ..... 11%**

**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 ..... 36%**

**A. Power Transmission Systems ..... 35%**

**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 Components ..... 30%**

**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 ..... 12%**

**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 Alignment ..... 23%**

**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 ..... 30%**

**A. Process Pumps ..... 11%**

**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 ..... 25%**

**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 Systems ..... 31%**

**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 Maintenance ..... 11%**

**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..... 6%**

**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 Components ..... 8%**

**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 ..... 3%**

**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 ..... 5%**

**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  
CURRICULUM GUIDE**

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

**SECTION ONE:..... COMPRESSORS ..... 38%**

**A. Compressors ..... 27%**

**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 Components ..... 29%**

**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 Systems ..... 44%**

**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..... 37%**

**A. Fluid Power ..... 25%**

**Outcome:     *Apply fluid power fundamentals.***

1. Describe fluid power.

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

**B. Hydraulic Components ..... 50%**

**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 ..... 14%**

**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 ..... 6%**

**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%**

**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 ..... 13%**  
**AND DRYERS**

**A. Fans ..... 25%**

**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 ..... 25%**

**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 ..... 25%**

**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 ..... 25%**

**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 ..... 12%**

**A. Levelling ..... 36%**

**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 ..... 28%**

**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 ..... 29%**

**Outcome:     *Perform bore alignments.***

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

**D. Pipe Strain..... 7%**

**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 ..... 19%**

**A. Stationary Engines ..... 52%**

**Outcome: Service stationary engines.**

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

**B. Stationary Engine Systems ..... 48%**

**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..... 20%**

**A. Steam Turbines ..... 58%**

**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 ..... 17%**

**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 ..... 25%**

**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 THREE .....PROCESS PIPING SYSTEMS ..... 10%**

**A. Process Piping Systems ..... 85%**

**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 ..... 15%**

**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 ..... 18%**  
**AND ADVANCED ALIGNMENT**

**A. Condition Monitoring ..... 38%**

**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 ..... 19%**

**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..... 29%**

**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 ..... 7%**

**Outcome:     *Apply analytical troubleshooting processes.***

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

**E. Failure Analysis ..... 7%**

**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..... 13%****A. Mechanical Systems and Electrical Control Components..... 100%****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 ..... 20%****A. Mechanical Material Handling ..... 54%****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 ..... 21%****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 ..... 4%****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 ..... 9%****Outcome: Use maintenance management systems.**

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

**E. Leadership Development ..... 6%****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 ..... 4%****Outcome: Use coaching skills when training an apprentice.**

1. Describe the process for coaching an apprentice.

**G. Interprovincial Standards Red Seal Program..... 2%****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

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