



# **Industrial Mechanic (Millwright)**

## **On-the-Job Training Guide**

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*Recognition:*

*To promote transparency and consistency, this document has been adapted from the 2016 Industrial Mechanic (Millwright) Red Seal Occupational Standard (Employment and Social Development Canada).*

*A complete version of the Occupational Standard can be found at [www.red-seal.ca](http://www.red-seal.ca)*

# STRUCTURE OF THE ON-THE-JOB TRAINING GUIDE

To facilitate understanding of the occupation, this on-the-job training guide contains the following sections:

**Description of the Industrial Mechanic (Millwright) trade:** an overview of the trade's duties and training requirements.

**Essential Skills Summary:** an overview of how each of the nine essential skills is applied in this trade.

**Harmonization:** a brief description on the pan-Canadian Harmonization Initiative for the Industrial Mechanic (Millwright) trade.

**Task Matrix:** a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard detailing the essential skills and the level of training where the content is covered.

**Major Work Activity (MWA):** the largest division within the standard that is comprised of a distinct set of trade activities.

**Task:** distinct actions that describe the activities within a major work activity.

**Sub-task:** distinct actions that describe the activities within a task.

**On-the-Job and In-school Training Content for the Industrial Mechanic (Millwright trade):** a chart which outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for topics of technical training.

# DESCRIPTION OF THE INDUSTRIAL MECHANIC (MILLWRIGHT) TRADE

*Industrial Mechanics (Millwrights) (IMMs) work on industrial and mechanical equipment and components. This equipment may include mechanical, pneumatic, hydraulic, fuel, lubrication, cooling and exhaust systems and equipment. Some components worked on include pumps, gear boxes, fans, tanks, conveyors, presses, generators, prime movers, pneumatic and hydraulic systems, robotics and automated equipment.*

IMMs are responsible for assembling, installing, aligning, commissioning, maintaining, repairing, diagnosing, inspecting, dismantling, moving, and decommissioning equipment. Servicing may include diagnosing irregularities and malfunctions, making adjustments, and repairing or replacing parts. Cleaning and lubricating equipment are also important maintenance tasks of the trade.

Other tasks that may be performed include welding, cutting, rigging, and machining as required. IMMs may prepare bases for equipment. They may assist other trades in troubleshooting and repairing other systems.

Industrial Mechanics (Millwrights) may refer to schematics, engineered drawings and manuals, both hard copy and electronic, to determine work procedures.

IMMs work with a wide variety of hand and power tools and access equipment in installation and repair work. Larger machine tools such as lathes, milling machines, drill presses and grinders may be used in fabrication of machine parts. Rigging, hoisting/lifting, and moving equipment such as cranes, jacks and powered mobile equipment (PME) are commonly used to position large machines or machine parts.

Industrial Mechanics (Millwrights) are employed in all sectors of industry that involve mechanical moving equipment including mining, petrochemical, power generation, manufacturing, forestry, and processing facilities (food, service) among others. IMMs are involved with the installation, diagnosis, maintenance and repair of equipment and components.

The work environment for IMMs is varied and may involve working in extreme or adverse conditions. They often work shift work. They may work in confined spaces, underground (in mines), at heights, with heavy equipment and around moving equipment. The work often requires considerable standing, kneeling and lifting of materials.

Key skills for people in this trade are mechanical aptitude, problem-solving, communication, job planning, and organizing and the ability to use trade-related calculations. They have the ability to detect malfunctions through sensory tests which are often confirmed by condition-based monitoring. Other important attributes include good coordination, manual dexterity and spatial visualization.

Industrial Mechanics (Millwrights) often possess overlapping skills with other tradespeople such as steamfitter/pipefitters, industrial instrument mechanics, power engineers, welders, machinists or industrial electricians. IMMs may work in specialized areas of the trade such as vibration analysis, thermography, tribology (fluid analysis) and laser/optical alignment. With experience, they may advance to other positions such as mentor, supervisor, planner, superintendent, manager, instructor or trainer.

**Training Requirements:** To graduate from each level of the apprenticeship program, an apprentice must successfully complete the required technical training and compile enough on-the-job experience to total at least 1800 hours each year. Total trade time required is 7200 hours and at least 4 years in the trade.

There are four levels of technical training delivered by Saskatchewan Polytechnic in Saskatoon and Parkland College in Esterhazy:

Journeyman to apprentice ratio for this trade is: 1:2

The information contained in this document serves as a guide for employers and apprentices. Apprenticeship training is mutually beneficial to both employer and apprentice. The employer's investment in training apprentices results in skilled and certified workers. The document summarizes the tasks to be covered by the apprentice during their on-the-job portion of apprenticeship training. An apprentice spends approximately 85% of their apprenticeship term training on-the-job.

**It is the employer's or journeyman's responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.**

#### **EMPLOYER TRAINING RESPONSIBILITY**

- promote a safety-conscious workplace
- provide mentored, hands-on practice in the use of tools and equipment
- provide the opportunity for apprentices to service systems and products
- further the apprentice's ability to interpret technical drawings
- ensure that the apprentice can evaluate the end product.

Employers should make every effort to expose their apprentices to work experience in as many areas of the trade as possible.

In the On-the-Job Training Guide, in-school instruction is listed first; on-the-job suggestions to help employers assist the apprentice to prepare for in-school training are listed next.

The content of the training components is subject to change without notice.

## Entrance Requirements for Apprenticeship Training

Your grade twelve transcripts (with no modified classes) or GED 12 is your guarantee that you meet the educational entrance requirements for apprenticeship in Saskatchewan. In fact, employers prefer and recommend apprentices who have completed high school. This ensures the individual has all of the necessary skills required to successfully complete the apprenticeship program, and receive journey person certification.

Individuals with “modified” or “general” classes in math or science do not meet our entry requirements. These individuals are required to take an entrance assessment prescribed by the SATCC.

English is the language of instruction in all apprenticeship programs and is the common language for business in Saskatchewan. Before admission, all apprentices and/or “upgraders” must be able to understand and communicate in the English language. Applicants whose first language is not English must have a minimum Canadian Language Benchmark Assessment of six (CLB6).

Note: A CLB assessment is valid for a one-year period from date of issue.

Designated Trade Name	Math Credit at the Indicated Grade Level <sup>❶</sup>	Science Credit at Grade Level
Industrial Mechanic (Millwright)	Grade 11	Grade 10
<p><sup>❶</sup> - (One of the following) WA – Workplace and Apprenticeship; or F – Foundations; or P – Pre-calculus, or a Math at the indicated grade level (Modified and General Math credits are not acceptable.).</p> <p>*Applicants who have graduated in advance of 2015-2016, or who do not have access to the revised Science curricula will require a Science at the minimum grade level indicated by trade.</p> <p>For information about high school curriculum, including Math and Science course names, please see: <a href="http://www.curriculum.gov.sk.ca">www.curriculum.gov.sk.ca</a></p> <p><b>Individuals not meeting the entrance requirements will be subject to an assessment and any required training</b></p>		

# ESSENTIAL SKILLS SUMMARY

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

Tools are available online or for order at: [www.canada.ca/en/employment-social-development/programs/essential-skills/tools.html](http://www.canada.ca/en/employment-social-development/programs/essential-skills/tools.html)

The application of these skills may be described throughout this document within the competency statements which support each subtask of the trade. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at: [www.red-seal.ca](http://www.red-seal.ca)

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## READING

Industrial Mechanics (Millwrights) read texts such as short descriptions and directions on labels for products. They read bulletins, manuals, work orders, reports and procedures when installing, operating, diagnosing, maintaining and repairing equipment. They also read emails and memos from supervisors, co-workers and suppliers about ongoing work.

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## DOCUMENT USE

IMMs scan and locate data on labels, lists, tables and schedules. They may interpret graphs when monitoring equipment operation. They interpret or review schematics and engineered drawings of systems (pneumatic, mechanical, structural and hydraulic) to identify malfunctions. Industrial Mechanics (Millwrights) may also retrieve and study data from scale drawings to identify location of equipment to be installed and verify location. They also complete forms such as purchase orders, maintenance forms, logbooks and work orders.

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## WRITING

IMMs write brief text entries in logbooks and in forms. They may write maintenance, repair and safe work procedures. Industrial Mechanics (Millwrights) write emails to supervisors, co-workers about ongoing work, and suppliers about equipment specifications. They may also write incident reports and update drawings.

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## ORAL COMMUNICATION

IMMs talk to suppliers, engineers and contractors about equipment specifications and access, orders, delivery and service times. They discuss work orders, equipment malfunctions and job task coordination with co-workers. They inform supervisors about work progress and may seek guidance and approvals from them. Industrial Mechanics (Millwrights) may discuss work with clients, advise them about maintenance and propose equipment modifications. They also discuss safety, productivity, and procedural and policy changes at meetings with co-workers, supervisors, engineers and clients. IMMs communicate with other tradespeople and personnel from other departments.

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## NUMERACY

IMMs measure various physical properties of equipment. Calculations are required in multiple aspects of the Industrial Mechanics (Millwrights) trade, such as pneumatic, mechanical, structural and hydraulic systems. They calculate distances, totals, maximums, minimums, tolerances, fits and quantities required. They also calculate loads, capacities, speeds, feeds and dimensions for mechanical components and systems. They perform calculations in order to adjust, level and align equipment according to specifications, and for diagnosing process variables. Industrial mechanics (millwrights) estimate weights and distances appropriate for rigging, hoisting, lifting and moving equipment and procedures.

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## THINKING

Thinking skills are critical to the IMM trade. They may problem solve by fabricating or adapting parts from other machines when parts needed are not available for maintenance and repairs. They may choose among refurbish, repair and replacement options for worn and defective parts such as hoses, motors, valves and bushings. They take into consideration factors such as maintenance guidelines, performance and test results, safety, efficiency and durability of replacement parts. Industrial Mechanics (Millwrights) evaluate conditions of parts and equipment, and the safety of their work environment. They may assess feasibility of designs for small modifications to equipment, ensuring that designs meet technical specifications, performance requirements and jurisdictional regulations.

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## DIGITAL TECHNOLOGY

IMMs may use databases to perform queries on maintenance history, regulatory items and procedures. They may also enter data from completed work orders in a computerized maintenance management system (CMMS). They may use programs to aid in the adjustment of drawings with computer-assisted design (CAD) software and to control and monitor operation of manufacturing and machining equipment. Industrial Mechanics (Millwrights) use hand-held computerized alignment, leveling and vibration measurement tools. They may use word processing software to write, edit and format texts such as incident reports and maintenance procedures. They may access work orders, asset information and documents on tablets, phones and other electronic devices.

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## WORKING WITH OTHERS

IMMs are required to work independently, with other Industrial Mechanics (Millwrights), other tradespeople, and personnel from other departments and jurisdictional organisations depending on the scope of the work.

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## CONTINUOUS LEARNING

IMMs read manuals and trade related documents to stay up to date on developments in their trade. They also attend training sessions (online or classroom-based) on new technologies, equipment and safety procedures. In addition, they learn informally by exchanging information with co-workers and suppliers.



# ELEMENTS OF HARMONIZATION FOR APPRENTICESHIP TRAINING

At the request of industry, the Harmonization Initiative was launched in 2013 to *substantively align* apprenticeship systems across Canada by making training requirements more consistent in the Red Seal trades. Harmonization aims to improve the mobility of apprentices, support an increase in their completion rates and enable employers to access a larger pool of apprentices.

As part of this work, the Canadian Council of the Directors of Apprenticeship (CCDA) identified four main harmonization priorities in consultation with industry and training stakeholders:

## 1. Trade name

The official Red Seal name for this trade is Industrial Mechanic (Millwright).

## 2. Number of Levels of Apprenticeship

The number of levels of technical training recommended for the Industrial Mechanic (Millwright) trade is 4.

## 3. Total Training Hours during Apprenticeship Training

The total hours of training, including both on-the-job and in-school training for the Industrial Mechanic (Millwright) trade is 7200.

## 4. Consistent sequencing of training content (at each level) using the most recent Occupational Standard

Implementation for harmonization has taken place progressively. Level one was implemented in 2017/2018, level two in 2018/2019, level three in 2019/2020, and level four in 2020/2021.

# INDUSTRIAL MECHANIC (MILLWRIGHT) TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2016 Industrial Mechanic (Millwright) Red Seal Occupational Standard. Each sub-task details the corresponding essential skill and level of training where the content is covered. \*

\* Sub-tasks with numbers in the boxes is where the content will be delivered in training. The Task Matrix Chart will be updated every year until Harmonization implementation is complete. Implementation for harmonization has taken place progressively. Level one was implemented in 2017/2018, level two in 2018/2019, level three in 2019/2020, and level four in 2020/2021.

## A – Performs common occupational skills

<b>Task A-1</b> Performs safety-related functions	<b>A-1.01</b> Uses personal protective equipment (PPE) and safety equipment  1, 2, 3, 4	<b>A-1.02</b> Maintains safe worksite  1, 2, 3, 4	<b>A-1.03</b> Protects the environment  1, 2, 3, 4	<b>A-1.04</b> Performs lock-out/tag-out and zero-energy state procedures  1, 2, 3, 4	
<b>Task A-2</b> Uses tools and equipment	<b>A-2.01</b> Uses hand and portable power tools  1	<b>A-2.02</b> Uses shop machines  1	<b>A-2.03</b> Uses access equipment  1		
<b>Task A-3</b> Performs routine trade tasks	<b>A-3.01</b> Plans work  1, 2, 3, 4	<b>A-3.02</b> Fabricates work piece  1, 2, 3, 4	<b>A-3.03</b> Lubricates systems and components  1, 2, 3, 4	<b>A-3.04</b> Performs leveling of components and systems  1, 2, 3, 4	<b>A-3.05</b> Uses fastening and retaining devices  1, 2, 3, 4
	<b>A-3.06</b> Performs material identification  1, 2, 3, 4	<b>A-3.07</b> Performs heat treatment of metal  1, 2, 3, 4	<b>A-3.08</b> Uses mechanical drawings and schematics  1, 2, 3, 4		
<b>Task A-4</b> Uses communication and mentoring techniques	<b>A-4.01</b> Uses communication techniques  1	<b>A-4.02</b> Uses mentoring techniques  4			

<b>Task A-5</b> Performs measuring and layout	<b>A-5.01 Prepares work area, tools and materials</b>  1	<b>A-5.02 Measures material and components</b>  1	<b>A-5.03 Lays out components</b>  1 (2, 3, 4 in context)	<b>A-5.04 Maintains precision measuring and layout tools</b>  1	
<b>Task A-6</b> Performs cutting and welding operations	<b>A-6.01 Cuts material with oxy-fuel and plasma arc equipment</b>  1 (2 in context)	<b>A-6.02 Joins material using oxy-fuel welding equipment</b>  1 (2 in context)	<b>A-6.03 Welds material using shielded metal arc welding (SMAW) equipment</b>  1, 2	<b>A-6.04 Welds material with gas metal arc welding (GMAW) equipment</b>  2	<b>A-6.05* Welds material with gas tungsten arc welding (GTAW) equipment (NOT COMMON CORE)</b>  2
	<b>A-6.06 Maintains welding equipment</b>  1 (2 in context)				

Subtask 6.05 is not consistently performed by IMMIs across Canada; therefore, this content is deemed not common core and will not be assessed on the IMM certification examination.

## B – Performs rigging, hoisting/lifting and moving

<b>Task B-7</b> Plans rigging, hoisting/lifting and moving	<b>B-7.01 Determines load</b>  1, 2, 3, 4	<b>B-7.02 Selects rigging equipment</b>  1, 2, 3, 4	<b>B-7.03 Selects hoisting/lifting and moving equipment</b>  1, 2, 3, 4	<b>B-7.04 Secures area</b>  1, 2, 3, 4
<b>Task B-8</b> Rigs, hoists/lifts and moves load	<b>B-8.01 Sets up rigging, hoisting/lifting and moving equipment</b>  1, 2, 3, 4	<b>B-8.02 Performs hoist/lift and move</b>  1, 2, 3, 4	<b>B-8.03 Maintains rigging, hoisting/lifting and moving equipment</b>  1, 2, 3, 4	

## C – Services mechanical power transmission components and systems

<b>Task C-9</b> Services prime movers	<b>C-9.01 Installs prime movers</b>  4	<b>C-9.02 Diagnoses prime movers</b>  4	<b>C-9.03 Maintains prime movers</b>  4	<b>C-9.04 Repairs prime movers</b>  4
<b>Task C-10</b> Services shafts, bearings and seals	<b>C-10.01 Installs shafts, bearings and seals</b>  2	<b>C-10.02 Diagnoses shafts, bearings and seals</b>  2	<b>C-10.03 Maintains shafts, bearings and seals</b>  2	<b>C-10.04 Repairs shafts, bearings and seals</b>  2
<b>Task C-11</b> Services couplings, clutches and brakes	<b>C-11.01 Installs couplings, clutches and brakes</b>  2	<b>C-11.02 Diagnoses couplings, clutches and brakes</b>  2	<b>C-11.03 Maintains couplings, clutches and brakes</b>  2	<b>C-11.04 Repairs couplings, clutches and brakes</b>  2
<b>Task C-12</b> Services chain and belt drive systems	<b>C-12.01 Installs chain and belt drive systems</b>  2	<b>C-12.02 Diagnoses chain and belt drive systems</b>  2	<b>C-12.03 Maintains chain and belt drive systems</b>  2	<b>C-12.04 Repairs chain and belt drive systems</b>  2
<b>Task C-13</b> Services gear systems	<b>C-13.01 Installs gear systems</b>  2	<b>C-13.02 Diagnoses gear systems</b>  2	<b>C-13.03 Maintains gear systems</b>  2	<b>C-13.04 Repairs gear systems</b>  2
<b>Task C-14</b> Performs shaft alignment procedures	<b>C-14.01 Performs rough alignment</b>  2	<b>C-14.02 Performs dial alignment</b>  2, 3	<b>C-14.03 Performs laser alignment</b>  3	

## D – Services material handling/process systems

<b>Task D-15</b> Services robotics and automated equipment	<b>D-15.01 Installs robotics and automated equipment</b>  4	<b>D-15.02 Diagnoses robotics and automated equipment</b>  4	<b>D-15.03 Maintains robotics and automated equipment</b>  4	<b>D-15.04 Repairs robotics and automated equipment</b>  4
<b>Task D-16</b> Services fans and blowers	<b>D-16.01 Installs fans and blowers</b>  3	<b>D-16.02 Diagnoses fans and blowers</b>  3	<b>D-16.03 Maintains fans and blowers</b>  3	<b>D-16.04 Repairs fans and blowers</b>  3
<b>Task D-17</b> Services pumps	<b>D-17.01 Installs pumps</b>  3	<b>D-17.02 Diagnoses pumps</b>  3	<b>D-17.03 Maintains pumps</b>  3	<b>D-17.04 Repairs pumps</b>  3

<b>Task D-18</b> Services compressors	<b>D-18.01 Installs compressors</b>  3	<b>D-18.02 Diagnoses compressors</b>  3	<b>D-18.03 Maintains compressors</b>  3	<b>D-18.04 Repairs compressors</b>  3	
<b>Task D-19</b> Services process piping, tanks and containers	<b>D-19.01 Installs process tanks and containers</b>  3	<b>D-19.02 Installs process piping</b>  3	<b>D-19.03 Diagnoses process tanks and containers</b>  3	<b>D-19.04 Diagnoses process piping</b>  3	<b>D-19.05 Maintains process tanks and containers</b>  3
	<b>D-19.06 Maintains process piping</b>  3	<b>D-19.07 Repairs process tanks and containers</b>  3	<b>D-19.08 Repairs process piping</b>  3		
<b>Task D-20</b> Services conveying systems	<b>D-20.01 Installs conveying systems</b>  4	<b>D-20.02 Diagnoses conveying systems</b>  4	<b>D-20.03 Maintains conveying systems</b>  4	<b>D-20.04 Repairs conveying systems</b>  4	

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## E – Services fluid power systems

<b>Task E-21</b> Services hydraulic systems	<b>E-21.01 Installs hydraulic systems</b>  3	<b>E-21.02 Diagnoses hydraulic systems</b>  3	<b>E-21.03 Maintains hydraulic systems</b>  3	<b>E-21.04 Repairs hydraulic systems</b>  3
<b>Task E-22</b> Services pneumatic and vacuum systems	<b>E-22.01 Installs pneumatic and vacuum systems</b>  3	<b>E-22.02 Diagnoses pneumatic and vacuum systems</b>  3	<b>E-22.03 Maintains pneumatic and vacuum systems</b>  3	<b>E-22.04 Repairs pneumatic and vacuum systems</b>  3

## F – Performs preventative and predictive maintenance, commissioning and decommissioning

<b>Task F-23</b> <b>Performs preventative and predictive maintenance</b>	<b>F-23.01 Performs preventative maintenance activities</b>  <b>4</b>	<b>F-23.02 Performs vibration analysis procedures</b>  <b>4</b>	<b>F-23.03 Performs balancing procedures</b>  <b>4</b>	<b>F-23.04 Performs non-destructive testing (NDT) procedures</b>  <b>4</b>	<b>F-23.05 Performs fluid analysis procedures</b>  <b>4</b>
	<b>F-23.06 Performs predictive maintenance activities</b>  <b>4</b>				
<b>Task F-24</b> <b>Commissions and decommissions equipment</b>	<b>F-24.01 Commissions systems and components</b>  <b>4</b>	<b>F-24.02 Decommissions systems and components</b>  <b>4</b>			

# TRAINING PROFILE CHART

This Training Profile Chart represents Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training at the topic level.

Level One (Harmonized)	Transcript Code	Hours
Layout & Hand Cut Tools	TOOL 110 - Theory	11
	TOOL 111 - Shop	15
Drills & Abrasives	TOOL 152 - Theory	11
	TOOL 153 - Shop	15
Metallurgy	METL 102 - Theory	15
	METL 103 - Shop	11
Precision Measuring; Assembly Tools; Fasteners; Threading	MEAS 102 - Theory	22
	MEAS 103 - Shop	30
Thermal Cutting, Oxy-Fuel and Arc Welding	WLDR 104 - Theory	10
	WLDR 105 - Shop	16
Rigging, Hoisting, and Lifting	RIGG 101 - Theory	15
	RIGG 102 - Shop	11
Safety & Communication	SAFE 100 - Theory	11
	SAFE 101 - Shop	15
Technical Drawing	PRNT 102	16
Trade Mathematics	MATH 108	16
		240

Level Two (Harmonized)	Transcript Code	Hours
Shafts, Keys, Seals, Bearing and Plain Bearings	TRNM 208 - Theory	26
	TRNM 209 - Shop	26
Lubrication & Levelling	MCHN 200 - Theory	13
	MCHN 201 - Shop	13
Arc Welding	WLDR 200 - Theory	26
	WLDR 201 - Shop	26
Belts and Chains	INDM 206 - Theory	13
	INDM 207 - Shop	13
Gear Systems, Couplings, Clutches, & Brakes	BRAK 208 - Theory	13
	BRAK 209 - Shop	13
Rough Alignment and Dial Alignment	ALGN 200 - Theory	13
	ALGN 201 - Shop	13
Technical Drawing	PRNT 203	16
Trade Mathematics	MATH 201	16
		240

Level Three (Harmonized)	Transcript Code	Hours
Advanced Shaft Alignment	ALGN 300 - Theory	13
	ALGN 301 - Shop	13
Pipe Fitting, Tanks and Containers	PIPE 300 - Theory	13
	PIPE 301 - Shop	13
Pneumatics, Compressors, Vacuum Systems, Fans and Blowers	PNEU 300 - Theory	26
	PNEU 301 - Shop	26
Pumps	PUMP 300 - Theory	26
	PUMP 301 - Shop	26
Hydraulics	HYDR 302 - Theory	26
	HYDR 303 - Shop	26
Technical Drawing	PRNT 302	16
Trade Mathematics	MATH 300	16
		240

Level Four (Harmonized)	Transcript Code	Hours
Robotics and Automated	ROBT 400 - Theory	13
	ROBT 401 - Shop	13
Machine Installation	MCHN 400 - Theory	13
	MCHN 401 - Shop	13
Material Handling	MATE 400 - Theory	13
	MATE 401 - Shop	13
Mentoring Techniques, Commissioning & Decommissioning Equipment	MENT 402 - Theory	13
	MENT 403 - Shop	13
Machine Shop	MACH 400 - Theory	26
	MACH 401 - Shop	26
Steam/Prime/Preventative Maintenance	MAIN 400 - Theory	26
	MAIN 401 - Shop	26
Technical Drawing	PRNT 405	16
Trade Mathematics	MATH 400	16
		240

### Exceed Topics

Throughout this guide to course content there are topics, which exceed the scope of work set out by the Industrial Mechanic (Millwright) RSOS. Industry in Saskatchewan has deemed certain topics to fall within the scope of work of the Industrial Mechanic (Millwright) trade and therefore require technical training to also cover these topics.



# ON-THE-JOB AND IN-SCHOOL TRAINING CONTENT FOR THE INDUSTRIAL MECHANIC (MILLWRIGHT) TRADE

This chart outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for the topics of technical training. Topics of technical training are provided with the associated learning outcomes.

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<b>Level One</b>	<b>8 weeks</b>	<b>240 hours</b>
<b>Layout &amp; Hand Cut Tools</b>		<b>26 hours</b>
<ul style="list-style-type: none"><li>• Describe types of hand cutting tools</li><li>• Describe use of hand cutting tools</li><li>• Describe use for layout tools</li><li>• Construct projects with hand cutting tools</li><li>• Maintain hand cutting tools</li><li>• Construct projects with the use of layout tools</li></ul>		
<b>Mentors can assist the apprentice to prepare for this section of technical training by:</b>		
<ul style="list-style-type: none"><li>• <i>scheduling work in tool crib or storeroom if available</i></li><li>• <i>having apprentice work alongside journeyperson to lay out and fabricate workpiece, i.e. motor base</i></li><li>• <i>explaining use of tools, including safe use and maintenance</i></li></ul>		
<b>Drills &amp; Abrasives</b>		<b>26 hours</b>
<ul style="list-style-type: none"><li>• Identify types of power tools</li><li>• Describe use of power tools</li><li>• Construct projects with power tools</li><li>• Maintain power tools</li></ul>		
<b>Mentors can assist the apprentice to prepare for this section of technical training by:</b>		
<ul style="list-style-type: none"><li>• <i>explaining the operation of power tools, including safe operation and maintenance</i></li></ul>		
<b>Metallurgy</b>		<b>26 hours</b>
<ul style="list-style-type: none"><li>• Describe metallurgy of ferrous and non-ferrous metals</li><li>• Identify steel manufacturing</li><li>• Identify soldering methods</li><li>• Identify destructive and non-destructive testing methods</li><li>• Construct tools made from steel</li><li>• Identify types of ferrous and non-ferrous metals</li><li>• Perform destructive and non-destructive testing methods</li><li>• Perform soldering methods</li></ul>		

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**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *demonstrating recognition of ferrous and non-ferrous materials and methods of identification*
- *explaining the effects of temperature on metal*
- *discussing hardening, annealing and tempering of metals*
- *provide hands-on training in hard soldering*

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**Thermal Cutting, Oxy-Fuel and Arc Welding**

**26 hours**

- Describe the safe operation, assembly, and maintenance of OFC, OFW, PAC and TB
- Identify safe operation, assembly and maintenance of GMAW and GTAW
- Describe the safe operation of fabrication equipment
- Demonstrate the safe operation, assembly and maintenance during OFC and AC
- Demonstrate the safe operation, assembly, and maintenance while OFW
- Demonstrate the safe operation, assembly, and maintenance while TB

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *provide training in the storage and handling of compressed gases and associated equipment*
- *explaining selection of brazing and filler rods*
- *providing hands-on training in cutting and brazing*
- *providing hands-on training in GTAW and GMAW welding techniques*

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**Rigging, Hoisting, and Lifting**

**26 hours**

- Identify rigging equipment
- Describe rigging techniques
- Interpret OH&S Regulations
- Apply rigging techniques
- Maintain rigging equipment
- Calculate load estimation

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *assisting apprentice in identifying weights of a variety of materials*
- *identifying the selection and capacity of slings and other lifting hardware*
- *training in hand signals*
- *offering required crane and hoist training as per OH&S requirements*

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**Safety & Communication Techniques**

**26 hours**

- Identify Occupation Health and Safety (OH&S) Regulations
- Interpret OH&S Regulations
- Describe WHMIS 2015 (GHS) procedures
- Describe fire safety
- Describe the importance of using effective verbal and non-verbal communication with people in the workplace
- Demonstrate knowledge of trade terminology
- Demonstrate knowledge of effective communication practices

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *explaining safety hazards found in the workplace*
- *providing necessary PPE and explain how to use it properly*
- *offering training such as fall arrest and mobile equipment training as per OH&S requirements*
- *involving apprentice in hazard assessments*

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**Technical Drawing****16 hours**

- Develop working sketches
- Develop working drawings from sketches
- Construct parts and assembly from working drawings

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *training in basic on the job reading of blueprints to obtain proper information*
- 

**Trade Mathematics****16 hours**

- Use basic Mathematics
- Use basic Algebra
- Perform trade calculations

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *allowing the apprentice supervised training in on-the-job calculations*

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## Level Two

8 weeks

240 hours

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### Shafts, Keys, Seals, Bearing and Plain Bearings

52 hours

- Seal selection and maintenance
- Shafting selection and attachments
- Anti-friction bearings selection and maintenance
- Plain bearings selection and maintenance

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *training in bearing selection for the job specific applications including fixed and floating bearings*
  - *identifying causes of bearing failure including the effects of lubrication on bearing life*
  - *training in bearing adjustment including fits and tolerances*
  - *providing training in basic identification and installation of static and dynamic seal types, application and fits and tolerances*
  - *training in shaft selection for the job specific application including related attachments*
- 

### Lubrication and Levelling

26 hours

- Lubricant selection and application
- Lubrication system maintenance
- Levelling method selection
- Levelling procedures

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *explaining selection and identification of lubricants*
  - *identifying types of lubrication systems: splash, bath, mist, etc.*
  - *explaining effects of over and under lubrication, including overheating and other equipment damage*
  - *identifying level types including optical and manual*
  - *training in the use of optical and laser levels where available*
- 

### Arc Welding

52 hours

- Safe operation, setup and maintenance of GMAW and SMAW processes
- Select the appropriate voltage and shielding gas, flow rate and type of transfer while performing GMAW
- Select the appropriate amperage and electrode while performing SMAW
- Demonstrate the appropriate techniques of GMAW and SMAW

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *training in selection of rods and manipulation techniques*
- *providing hands-on training in GMAW and SMAW welding where available*

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## Belts and Chains

26 hours

- Assemble and maintain V-belt drives
- Assemble and maintain chain drives

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying types and demonstrating installation, tensioning and alignment of belts and chains*
  - *explaining proper lubrication of chains*
- 

## Gear Systems, Couplings, Clutches and Brakes

26 hours

- Describe and maintain direct drive couplings, clutches and brakes
- Describe and maintain gear drive systems

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating gear installation and fit, including clearances and backlash*
  - *explaining proper lubrication of gears*
  - *demonstrating coupling installation, fit and selection*
  - *demonstrating clutch installation, fit and selection*
  - *demonstrating brake installation, fit and selection*
  - *explaining maintenance required for gears, couplings, clutches and brake systems*
- 

## Rough Alignment and Dial Alignment

26 hours

- Identify alignment procedures, tools and current technology
- Identify rim and face method of shaft alignment
- Demonstrate feeler gauge alignment
- Perform rim and face alignment

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *training and exposure to various types of alignment*
- 

## Trade Math

16 hours

- Basic algebra
- Metric units
- Trade calculations

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *allowing the apprentice supervised training in on-the-job calculations*
- 

## Technical Drawing

16 Hours

- Construct machine drawings
- Interpret machine drawings
- Interpret assembly drawings

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *training in on the job reading of blueprints to obtain proper information*

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## Level Three

8 weeks

240 hours

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### Advanced Shaft Alignment

26 hours

- Identify and apply cross dialing method
- Identify and apply laser method

#### Mentors can assist the apprentice to prepare for this section of technical training by:

- *providing a demonstration of the sequence of steps in shaft alignment*
  - *identifying couplings types and demonstrating installation*
  - *emphasizing the importance of coupling alignment*
  - *providing a demonstration on laser alignment*
  - *training in proper techniques of dial indicator set-up and reading*
- 

### Pipe Fitting, Tanks and Containers

26 hours

- Theory and piping systems
- System components
- Piping systems construction

#### Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying components in piping systems*
  - *explaining application of valves*
  - *identifying the different kinds of tanks and containers, along with the components that are used*
- 

### Pneumatics, Compressors, Vacuum Systems, Fan and Blowers

52 hours

- Describe pneumatic theory
- Identify system components
- Identify schematics
- Identify pneumatics circuits
- Identify troubleshooting techniques
- Construct pneumatic circuits
- Test pneumatic circuits
- Demonstrate troubleshooting techniques
- Maintain pneumatic system components and actuators

#### Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating theory, safety and maintenance of pneumatic systems and components*
- *providing instruction on the operation of compressors and vacuum systems*
- *training in the repair and maintenance of compressors, vacuum systems, fans and blowers*

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## Pumps

52 hours

- Pump theory and systems
- System components
- Pump types and components
- Pump and circuit testing, pump maintenance

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *identifying a variety of pumps used on the job*
- *identifying pump components and adjustments*
- *demonstrating packing selection, installation and adjustment*

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## Hydraulics

52 hours

- Hydraulic theory
- Hydraulic system components
- Describe fluid, conductors and fittings
- Identify schematics
- Identify hydraulic circuits
- Identify troubleshooting techniques

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *explaining hydraulic theory*
- *providing instruction on the different system components and fluids found in hydraulic systems*
- *demonstrating troubleshooting techniques*

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## Technical Drawing

16 hours

- Location of surfaces, lines and points in orthographic drawings
- Identification of internal surfaces in full sectional views
- Arrow dimensioning and general tolerance data in orthographic views
- Calculation of metric tolerances, allowances and limits for fits using charts

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *assisting in the interpretation of prints and drawings*

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## Trade Mathematics

16 hours

- Basic geometry
- Trade calculations

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *allowing the apprentice supervised training in on-the-job calculations*

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## Level Four

8 weeks

240 hours

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### Machine Installation

26 hours

- Identify precision optical levels
- Identify types of foundations and bases
- Identify types of concrete forms and grouting
- Identify types of machine installation hardware
- Demonstrate field layout techniques

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *demonstrating the use of precision levels*
  - *explaining the different types of foundations and bases and where they would be used.*
  - *demonstrating field layout techniques*
  - *assisting the apprentice in completing layout of an installation*
- 

### Material Handling

26 hours

- Conveyor system identification and maintenance
- Conveyor components

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *exposure to a variety of conveying systems in the workplace if available*
  - *demonstrating the installation and repair of conveyor systems*
  - *assisting the apprentice in completing maintenance on a conveyor system*
- 

### Robotics and Automated Equipment

26 hours

- Define terminology associated with robotics and automated equipment.
- Describe safe work practices associated with robotics and automated equipment
- Identify tools and equipment associated with robotics and automated equipment
- Install robotics and automated equipment
- Diagnose robotics and automated equipment
- Maintain robotics and automated equipment
- Repair robotics and automated equipment

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *involving the apprentice in the maintenance and repair of robotic equipment*
  - *explaining the set up and ongoing maintenance required for robotic equipment*
  - *explaining the safety considerations when working with robotic equipment*
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### Steam/Prime/Preventative Maintenance

52 hours

- Prime mover identification
- Power generation system identification
- Preventative/predictive maintenance principles and methods
- Advanced torque methods

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *training and exposure to the various types of prime mover systems*
- *explaining maintenance considerations for prime movers*
- *involving the apprentice in schedule maintenance and repair of prime movers*
- *demonstrating advanced torque methods*



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## Mentoring Techniques, Commissioning & Decommissioning Equipment

26 hours

- Identify strategies for learning skills in the workplace
- Identify strategies for mentoring in the workplace
- Define terminology associated with commissioning and decommissioning
- Demonstrate knowledge of strategies for mentoring in the workplace
- Demonstrate knowledge of the procedures used to commission systems and components
- Demonstrate knowledge of procedures used to decommission systems and components
- Demonstrate knowledge of safety practices related to commissioning and decommissioning

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *explaining and demonstrating mentoring of an apprentice*
- *involving the apprentice in the commissioning of new or repair equipment*
- *involving the apprentice in the decommissioning of equipment*

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## Technical Drawing

16 hours

- Location of part features on orthographic view drawings
- Review of engineering drawings with a variety of views
- Dimension data and tolerance information from engineering drawings
- Calculating tolerances and allowances from charts
- Interpreting mechanical drawings

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *assisting in the interpretation of prints and drawings at an advanced level*
- *demonstrating calculating tolerances and allowances from charts*

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## Machine Shop

52 hours

- Describe lathe components and accessories
- Describe milling machine components and accessories
- Describe cutting tools
- Demonstrate lathe maintenance
- Perform lathe operations
- Demonstrate milling machine maintenance
- Perform milling operations

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *assisting in the use of a lathe to create or repair a machine component*
- *explaining the safety considerations when using machining equipment*
- *explaining the use of a milling machine*
- *demonstrating the use of machine shop tools*

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## Trade Mathematics

16 hours

- Basic geometry and trigonometry
- Trade calculations

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *allowing the apprentice supervised training in on-the-job calculations*

**Consider apprenticeship training as an investment in the future of your company and in the future of your workforce. Ultimately, skilled and certified workers increase your bottom line.**

**Get involved in the apprenticeship training system. Your commitment to training helps to maintain the integrity of the trade.**

**Do you have employees who have been working in the trade for a number of years but don't have trade certification? Contact your local apprenticeship office for details on how they might obtain the certification they need.**

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