



# **Industrial Mechanic (Millwright)**

## **Guide to Course Content**

**2022**

Online: [www.saskapprenticeship.ca](http://www.saskapprenticeship.ca)

*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).*

*Industrial Mechanic (Millwright) Red Seal Occupational Standard (RSOS), describing the “full scope” of the trade, can be found at [www.red-seal.ca](http://www.red-seal.ca)*

# STRUCTURE OF THE GUIDE TO COURSE CONTENT

To facilitate understanding of the occupation, this guide to course content 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 are applied in this trade.

**Elements of harmonization of apprenticeship training:** includes adoption of Red Seal trade name, number of levels of apprenticeship, total training hours (on-the-job and in-school) and consistent sequencing of technical training content. 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.

**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.

**Training Profile Chart:** a chart which outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training.

**Technical Training Course Content for the Industrial Mechanic (Millwright) trade:** a chart which outlines the model for SATCC technical training sequencing. For the harmonized level of training, a cross reference to the Harmonized apprenticeship technical training sequencing, at the learning outcome level, is provided.

**Appendix A: Post Harmonization Training Profile Chart:** a chart which outlines the finalized model for SATCC technical training sequencing with a cross reference to the Harmonized apprenticeship technical training sequencing, at the topic level.

# 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.

Level One:	8 weeks
Level Two:	8 weeks
Level Three:	8 weeks
Level Four:	8 weeks

The information contained in this guide to course content details the technical training delivered for each level of apprenticeship. An apprentice spends approximately 15% of their apprenticeship term in a technical training institute learning the technical and theoretical aspects of the trade. The hours and percentages of technical and practical training may vary according to class needs and progress.

The content of the technical 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 journeyperson 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/#">http://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: <https://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.

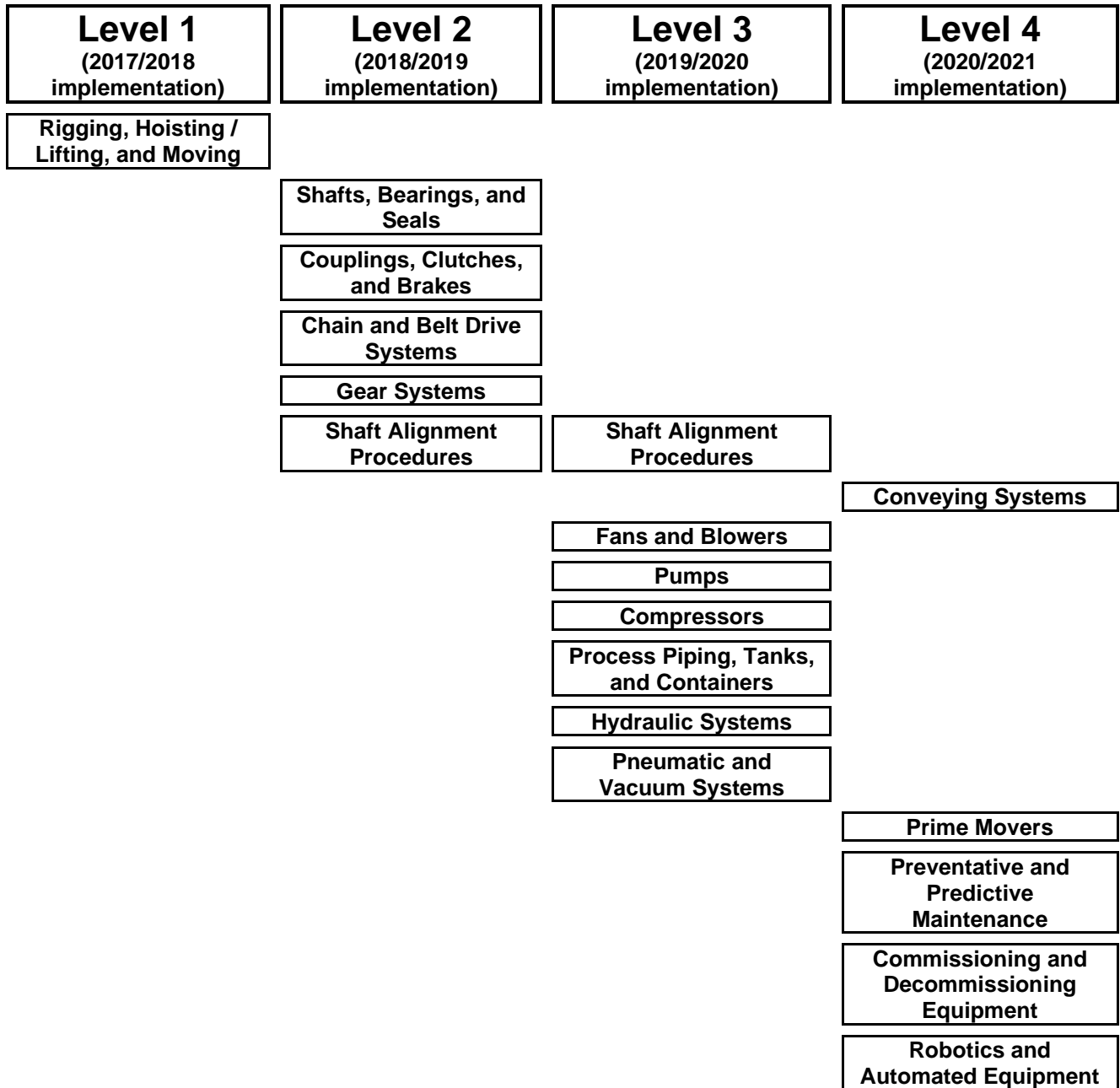
## 4. Consistent sequencing of training content (at each level) using the most recent Occupational Standard

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.

White boxes are “Topics,” grey boxes are “In Context”. In context means learning that has already taken place and is being applied to the applicable task. Learning outcomes for in context topics are accomplished in other topics in that level.

Level 1 (2017/2018 implementation)	Level 2 (2018/2019 implementation)	Level 3 (2019/2020 implementation)	Level 4 (2020/2021 implementation)
Routine Trade Tasks	Routine Trade Tasks	Routine Trade Tasks	Routine Trade Tasks
Drawings and Schematics	Drawings and Schematics	Drawings and Schematics	Drawings and Schematics
Safety Related Functions	Safety Related Functions	Safety Related Functions	Safety Related Functions
Tools and Equipment			
Communication Techniques			Mentoring Techniques
Measuring and Layout			
Cutting and Welding	Cutting and Welding		





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

<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 IMMs 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.



# TECHNICAL TRAINING COURSE CONTENT

This chart outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training sequencing. For the harmonized level of training, a cross reference to the Red Seal Occupational Standard (RSOS) apprenticeship technical training sequencing, at the learning outcome level, is provided.

The Red Seal Industrial Mechanic (Millwright) Curriculum Outline, which provides additional detail of the Harmonized technical training, can be found at [www.red-seal.ca](http://www.red-seal.ca)

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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>RSOS topics covered in this section of training:</b>		
<b>A-2 Uses tools and equipment</b>		
A-2.01 Uses hand and portable power tools		
<ul style="list-style-type: none"><li>• hand tools and portable power tools, their applications and procedures for use</li><li>• procedures used to clean, inspect, maintain and store hand tools and portable power tools</li><li>• safety practices related to hand tools and portable power tools and equipment</li></ul>		
<b>A-3 Performs routine trade tasks</b>		
A-3.01 Plans work		
<ul style="list-style-type: none"><li>• job planning</li><li>• procedures used to plan and organize jobs</li></ul>		
<hr/>		
<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>RSOS topics covered in this section of training:</b>		
<b>A-2 Uses tools and equipment</b>		
A-2.02 Uses shop machines		
<ul style="list-style-type: none"><li>• shop machines, their applications and procedures for use</li><li>• safety practices related to the use of shop machines</li><li>• ironworkers shop equipment, their applications and procedures for use</li><li>• safety practices related to the use of ironworkers shop equipment</li><li>• grinders and their applications</li><li>• procedures used to perform grinding operations</li></ul>		

- power metal saws and their applications
- procedures to perform cutting operations using power metal saws
- drilling machines, their accessories and their applications
- the procedures used to perform drilling operations, and the associated calculations
- lathes, their accessories, attachments and applications
- procedures used to perform lathe operations, and the associated calculations
- milling machines and their applications
- procedures used to perform milling operations, and the associated calculations

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## Metallurgy

**26 hours**

- Describe metallurgy of ferrous and non-ferrous metals
- Identify steel manufacturing
- Identify soldering methods
- Identify destructive and non-destructive testing methods
- Construct tools made from steel
- Identify types of ferrous and non-ferrous metals
- Perform destructive and non-destructive testing methods
- Perform soldering methods

### RSOS topics covered in this section of training:

#### A-2 Uses tools and equipment

##### A-2.01 Uses hand and portable power tools

- hand tools and portable power tools, their applications and procedures for use
- procedures used to clean, inspect, maintain and store hand tools and portable power tools
- safety practices related to hand tools and portable power tools and equipment

##### A-2.02 Uses shop machines

- shop machines, their applications and procedures for use
- safety practices related to the use of shop machines
- ironworkers shop equipment, their applications and procedures for use
- safety practices related to the use of ironworkers shop equipment
- grinders and their applications
- procedures used to perform grinding operations
- power metal saws and their applications
- procedures to perform cutting operations using power metal saws
- drilling machines, their accessories and their applications
- the procedures used to perform drilling operations, and the associated calculations
- lathes, their accessories, attachments and applications
- procedures used to perform lathe operations, and the associated calculations
- milling machines and their applications
- procedures used to perform milling operations, and the associated calculations

##### A-2.03 Uses access equipment

- access equipment and fall protection equipment, their applications, limitations and procedures for use
- safety practices related to access equipment and fall protection equipment

#### A-3 Performs routine trade tasks

##### A-3.01 Plans work

- job planning
- procedures used to plan and organize jobs

##### A-3.02 Fabricates work piece

- shop machines, their applications and procedures for use
- safety practices related to the use of shop machines

- grinders and their applications
  - procedures used to perform grinding operations
  - power metal saws and their applications
  - procedures to perform cutting operations using power metal saws
  - drilling machines, their accessories and their applications
  - procedures used to perform drilling operations, and the associated calculations
  - lathes, their accessories, attachments and applications
  - procedures used to perform lathe operations, and the associated calculations
  - milling machines and their applications
  - procedures used to perform milling operations, and the associated calculations
- A-3.03 Lubricates systems and components
- lubricants, lubrication systems and their components, applications and procedures for use
  - procedures used to handle, store, recycle and dispose of lubricants
  - demonstrate knowledge of safety practices related to lubricants and lubricant systems
- A-3.04 Performs leveling of components and systems
- procedures used to level and align equipment
  - safety practices related to equipment leveling and alignment
- A-3.05 Uses fastening and retaining devices
- fastening and retaining devices, and their applications
  - procedures used to install and remove fastening and retaining devices
  - safety practices related to fastening and retaining devices
- A-3.06 Performs material identification
- metals and their characteristics
  - non-metallic materials and their characteristics
  - metallurgic principles
  - material testing procedures
  - structural shapes and their applications
- A-3.07 Performs heat treatment of metal
- metals and their characteristics
  - metallurgic principles
  - structural shapes and their applications
  - processes used in the heat treatment of metals
  - safety practices related to heat treatment of metal
- A-3.08 Uses mechanical drawings and schematics
- drawings, their use and interpretation
  - calculations relevant to drawings
  - basic sketching techniques

### **Precision Measuring; Assembly Tools; Fasteners; Threading**

**52 Hours**

- Identify precision measuring tools
- Describe uses of precision measuring tools
- Identify hand threading tools
- Describe use of hand threading tools
- Identify types of fasteners
- Identify assembly tools
- Operate precision measuring tools
- Maintain precision measuring tools
- Operate hand threading tools

### **RSOS topics covered in this section of training:**

#### **A-5 Performs measuring and layout**

- A-5.01 Prepares work area, tools and materials
- measuring and layout

- procedures used to maintain, calibrate and store precision measuring and layout tools
  - preparing a work area
  - safe work practices related to preparing work area, tools and materials
- A-5.02 Measures material and components
- measuring and layout and their applications
  - procedures used to perform measuring operations
  - safe work practices related to measuring material and components
- A-5.03 Lays out components
- layout of components and their applications
  - procedures used to perform layout operations
  - safe work practices related to laying out components
- A-5.04 Maintains precision measuring and layout tools
- precision measuring and layout tools, their applications and procedures
  - safety practices related to the maintenance of precision measuring and layout tools

## **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

### **RSOS topics covered in this section of training:**

#### **A-6 Performs cutting and welding operations**

##### A-6.01 Cuts material with oxy-fuel and plasma arc equipment

- oxy-fuel equipment and accessories
- procedures used to cut with oxy-fuel equipment
- safety practices related to oxy-fuel cutting
- procedures used for plasma arc cutting
- plasma arc equipment and accessories
- safety practices related to plasma arc cutting

##### A-6.02 Joins material using oxy-fuel welding equipment

- oxy-fuel equipment and accessories
- procedures used to heat, weld, solder and braze with oxy-fuel equipment
- safety practices related to oxy-fuel heating, welding, brazing and soldering

##### A-6.06 Maintains welding equipment

- different types of welding equipment and accessories
- procedures used to maintain welding equipment
- safety practices related to the maintenance of welding equipment

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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

### **RSOS topics covered in this section of training:**

#### **B-7 Plans rigging, hoisting/lifting and moving**

##### **B-7.01 Determines load**

- rigging, hoisting/lifting and moving equipment, their applications, limitations and procedures for use
- calculations required when performing hoisting and lifting operations

##### **B-7.02 Selects rigging equipment**

- rigging equipment, its applications, limitations and procedures
- procedures used to rig material or equipment for lifting
- safety practices related to rigging equipment

##### **B-7.03 Selects hoisting/lifting and moving equipment**

- hoisting/lifting and moving equipment, their applications, limitations and procedures
- safety practices related to hoisting/lifting and moving equipment

##### **B-7.04 Secures area**

- rigging, hoisting/lifting and moving equipment, their applications, limitations and procedures
- safety practices related to rigging, hoisting/lifting and moving operations

#### **B-8 Rigs, hoists/lifts and moves load**

##### **B-8.01 Sets up rigging, hoisting/lifting and moving equipment**

- rigging, hoisting/lifting and moving equipment, their applications, limitations and procedures
- procedures used to perform rigging, hoisting/lifting and moving operations
- safety practices related to rigging, hoisting/lifting and moving operations

##### **B-8.02 Performs hoist/lift and move**

- hoisting/lifting and moving equipment, their applications, limitations and procedures
- procedures used to perform hoisting/lifting and moving operations
- standard hand signals
- calculations required when performing hoisting/lifting and moving operations
- demonstrate knowledge of safety practices related to hoisting/lifting and moving operations

##### **B-8.03 Maintains rigging, hoisting/lifting and moving equipment**

- rigging, hoisting/lifting and moving equipment, their applications, limitations and procedures
- procedures used to maintain rigging, hoisting/lifting and moving equipment
- safety practices related to rigging, hoisting/lifting and moving equipment

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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

**RSOS topics covered in this section of training:**

**A-1 Performs safety-related functions**

A-1.01 Uses personal protective equipment (PPE) and safety equipment

- personal protective equipment (PPE) and safety equipment, their applications, maintenance and procedures for use

A-1.02 Maintains safe worksite

- safe work practices
- regulatory requirements pertaining to safety

A-1.03 Protects the environment

- regulatory requirements pertaining to environmental safety and protection

A-1.04 Performs lock-out/tag-out and zero-energy state procedures

- procedures used to perform lock-out/tag-out and zero energy procedures
- potential hazards associated with lock-out/tag-out and zero energy procedures

**A-4 Uses communication and mentoring techniques**

A-4.01 Uses communication techniques

- trade terminology
- effective communication practices

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**Technical Drawing**

**16 hours**

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

**RSOS topics covered in this section of training:**

**A-3 Performs routine trade tasks**

A-3.08 Uses mechanical drawings and schematics

- drawings, their use and interpretation
- calculations relevant to drawings
- basic sketching techniques

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**Trade Mathematics**

**16 hours**

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

**This section of training exceeds the minimum sequencing as set out by the IMM RSOS.**

**Level One topics from the RSOS that are taught in context:**

***A-1 Safety Related Functions***

***A-3 Routine Trade Tasks***

***A-3.08 Drawings and Schematics***

***For details regarding the In Context Topic, see page 27***

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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

#### RSOS topics covered in this section of training:

#### C-10 Services shafts, bearings and seals

##### C-10.01 Installs shafts, bearings and seals

- select shafts, bearings and seals
- position and mount shafts, seals and bearings

##### C-10.02 Diagnoses shafts, bearings and seals

- inspect shafts, bearings and seals
- obtain a description of the problem and symptoms

##### C-10.03 Maintains shafts, bearings and seals

- inspect, modify and adjust shafts, bearing and seals
- align components
- check coolant and lubricant levels
- monitor temperature, vibration and pressure
- adjust flow and pressure control
- identify faulty and damaged equipment

##### C-10.04 Repairs shafts, bearings and seals

- rebuild and replace faulty shafts, bearings and seals
- access shafts, bearings and seals

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### Lubrication and Levelling

26 hours

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

#### RSOS topics covered in this section of training:

#### A-3 Performs routine trade tasks

##### A-3.03 Lubricates systems and components

- select lubricants
- determine lubricants requirements and maintain levels
- identify points requiring lubricants
- remove and replace lubricants
- treat, clean and maintain systems and components

##### A-3.04 Performs levelling of components and systems

- select and use levelling tools
- level machinery and components
- record levelling data
- demonstrate procedures used to level and align equipment

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## 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

### RSOS topics covered in this section of training:

#### A-6 Performs cutting and welding operations

##### A-6.03 Welds material using shielded metal arc welding (SMAW) equipment

- select and prepare material to be welded
- select and use electrodes
- perform welding procedures
- adjust amperage and polarity
- inspect welds

##### A-6.04 Welds material with gas metal arc welding (GMAW) equipment

- select and prepare material to be welded
- select types of gas used for welding
- select and use wire
- perform welding procedures
- adjust amperage, shielding gas flow and feed rate to achieve proper fusion and penetration
- inspect welds

##### A-6.05 Welds material with gas tungsten arc welding (GTAW) equipment

- select and prepare material to be welded
- select types of gas used for welding
- select and use filler material
- perform GTAW procedures
- adjust amperage, shielding gas flow and feed rate to achieve proper fusion and penetration
- inspect welds

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## Belts and Chains

26 hours

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

### RSOS topics covered in this section of training:

#### C-12 Services chain and belt drive systems

##### C-12.01 Installs chain and belt drive systems

- select chain and belt drive systems
- assemble, position and align chain and belt drive systems
- check and adjust slack/tension of chain and belt drive systems
- lubricate chains

##### C-12.02 Diagnoses chain and belt drive systems

- obtain a description of the problem and symptoms
- perform sensory inspection of chain and belt drive systems
- test and evaluate chain and belt drive systems and alignment
- perform condition-based monitoring methods and analysis
- verify chain lubrication level and condition
- measure slack/tension of chain and belt drive systems
- assess and detect faulty or damaged components

##### C-12.03 Maintains chain and belt drive systems

- access chain and belt drive systems



- clean, inspect, modify and adjust chain and belt drive systems
  - check lubricants
  - check lubricants systems
  - check condition of sprockets, sheaves, belts and chains
  - check alignment of sprockets and sheaves
  - adjust chain and belt drive systems
- C-12.04 Repairs chain and belt drive systems
- rebuild and replace faulty chain and belt drive systems
  - dismantle, remove and reassemble chain and belt drive systems
  - access chain and belt drive systems
  - align components
  - lubricate chain

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## **Gear Systems, Couplings, Clutches and Brakes**

**26 hours**

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

### **RSOS topics covered in this section of training:**

#### **C-11 Services couplings, clutches and brakes**

##### **C-11.01 Installs couplings, clutches and brakes**

- select couplings, clutches and brakes
- place and mount couplings, clutches and brakes
- assemble couplings, clutches and brakes with mating equipment
- check, adjust and record clearances of couplings, clutches and brakes
- align couplings, clutches and brakes
- lubricate couplings, clutches and brakes

##### **C-11.02 Diagnoses couplings, clutches and brakes**

- obtain a description of the problem and symptoms
- perform sensory inspection of couplings, clutches and brakes for defects
- use test/evaluation procedures
- perform condition-based monitoring methods
- verify lubrication levels and condition
- measure clearances of couplings, clutches and brakes

##### **C-11.03 Maintains couplings, clutches and brakes**

- access couplings, clutches and brakes and their components
- dismantle and remove couplings, clutches and brakes and their components
- document and/or replace faulty components

##### **C-11.04 Repairs couplings, clutches and brakes**

- rebuild or replace faulty couplings, clutches and brakes
- recondition couplings, clutches and brakes and their components
- replace couplings, clutch and brake components
- adjust couplings, clutches and brakes
- align couplings, clutch and brake components

#### **C-13 Services gear systems**

##### **C-13.01 Installs gear systems**

- select gear systems
- position and assemble gear systems
- align gear systems with driven and driver equipment
- check and adjust backlash and tooth contact
- lubricate gear systems

#### C-13.02 Diagnoses gear systems

- obtain a description of the problem and symptoms
- perform sensory inspection of gear systems
- test and evaluate gear systems
- perform condition-based monitoring methods and analysis
- verify lubrication level and condition
- measure clearance, backlash and tooth contact of gear systems
- assess and detect faulty or damaged components

#### C-13.03 Maintains gear systems

- assess gear systems
- clean, inspect, modify and adjust gear systems
- check vents, lubricants and seals
- check condition of gear systems
- check alignment, backlash, clearance and tooth contact of gear systems

#### C-13.04 Repairs gear systems

- rebuild and replace faulty gear systems
- access gear systems
- dismantle, remove and reassemble gear systems
- replace and align gears and gear systems
- adjust gears, backlash clearance and tooth contact
- lubricate gear

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### **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

#### **RSOS topics covered in this section of training:**

#### **C-14 Performs shaft alignment procedures**

##### C-14.01 Performs rough alignment

- inspect alignment
- select and use rough alignment tools
- identify cause of misalignment in equipment
- correct vertical, horizontal and angular misalignment
- record alignment date

##### C-14.02 Performs dial alignment

- inspect equipment
- select and use dial alignment tools
- identify cause of misalignment in equipment
- correct vertical, horizontal and angular misalignment
- record alignment data

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**Trade Math****16 hours**

- Basic algebra
- Metric units
- Trade calculations

**This section of training exceeds the minimum sequencing as set out by the IMM RSOS.**

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**Technical Drawing****16 Hours**

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

**RSOS topics covered in this section of training:**

***A-3.08 Drawings and Schematics***

A-3.08 Uses mechanical drawings and schematics

- drawings, their use and interpretation
- calculations relevant to drawings
- basic sketching techniques

**Level Two topics from the RSOS that are taught in context:**

***A-1 Safety Related Functions***

***A-3 Routine Trade Tasks***

***A-3.08 Drawings and Schematics***

***B-7 Plans Rigging, Hoisting/Lifting and Moving***

***B-8 Rigs, Hoists/Lifts and Moves Load***

***For details regarding the In Context Topic, see page 37***



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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

#### RSOS topics covered in this section of training:

#### C-14 Performs Shaft Alignment Procedures

##### C-14.02 Performs dial alignment

- select and use dial alignment tools
- identify the cause of misalignment in equipment
- correct vertical, horizontal and angular misalignment

##### C-14.03 Performs Laser alignment

- select and use laser alignment tools
  - identify the cause of misalignment in equipment
  - correct vertical, horizontal and angular misalignment
  - record alignment data
- 

### Pipe Fitting, Tanks and Containers

26 hours

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

#### RSOS topics covered in this section of training:

#### D-19 Services Process Piping, Tanks and Containers

##### D-19.01 Installs process tanks and containers

- position process tanks and containers
- level, align and secure process tanks and containers

##### D-19.02 Installs process piping

- place and secure process piping
- connect process piping and components

##### D-19.03 Diagnoses process tanks and containers

- perform inspections of process tanks, containers and components for defects
- identify conditions that lead to failures

##### D-19.04 Diagnoses process piping

- perform inspections of process piping
- identify conditions that led to failures

##### D-19.05 Maintains process tanks and containers

- check temperatures, pressures, vacuum and flow rates
- adjust process tank and container components
- clean and or replace filters, strainers, liners and ventilation systems

##### D-19.06 Maintains process piping

- verify operation of process piping
- lubricate and adjust process piping

##### D-19.07 Repairs process tanks and containers

- replace faulty components and auxiliary equipment

##### D-19.08 Repairs process piping

- repair or replace piping supports
- repair leaks
- replace faulty components and auxiliary equipment

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## **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

### **RSOS topics covered in this section of training:**

#### **D-16 Services Fans and Blowers**

##### **D-16.01 Installs fans and blowers**

- position, level and secure fans
- check rotation, static and dynamic balance and vibration

##### **D-16.02 Diagnoses fans and blowers**

- perform condition based monitoring
- measure clearances
- assess and detect faulty components
- identify conditions that led to failure

##### **D-16.03 Maintains fans and blowers**

- verify maintenance procedures lubricate bearings and couplings
- re-align, replace and adjust fan and blower components

##### **D-16.04 Repairs fans and blowers**

- correct imbalances
- recondition, rebuild or replace fans, blowers and their components
- adjust clearances

#### **D-18 Services Compressors**

##### **D-18.01 Installs compressors**

- position, align and level compressors during installation
- verify proper operation

##### **D-18.02 Diagnoses compressors**

- perform inspections of compressors and components for defects
- assess and detect faulty or damaged components

##### **D-18.03 Maintains compressors**

- check fluid levels, pressures and temperatures
- align and adjust compressor components

##### **D-18.04 Repairs Compressors**

- identify faulty components
- repair or replace faulty system components

#### **E-22 Services pneumatic and vacuum systems**

##### **E-22.01 Installs pneumatic and vacuum systems**

- select components
- positions, align and secure pneumatic and vacuum system components

##### **E-22.02 Diagnoses pneumatic and vacuum systems**

- visually inspect systems
- perform condition-based monitoring methods and analysis

##### **E-22.03 Maintains pneumatic and vacuum systems**

- check and adjust system pressure, vacuum, lubricators, regulators, temperature, cycling and flow



- check, clean and/or repair system components
- E-22.04 Repairs pneumatic and vacuum systems
- remove and replace component parts
  - modify systems
- 

## **Pumps**

**52 hours**

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

### **RSOS topics covered in this section of training:**

#### **D-17 Services Pumps**

##### **D-17.01 Installs pumps**

- determine location of pump
- position, secure, level and align pump
- install seals and gaskets
- connect suction and discharge piping

##### **D-17.02 Diagnoses pumps**

- inspect pumps and their components for defects
- determine the necessary repairs required

##### **D-17.03 Maintains pumps**

- adjust packing and monitor mechanical seals
- check temperatures, pressures and flow rates
- verify maintenance requirements

##### **D-17.04 Repairs pumps**

- repair or replace pump components
  - correct operation is verified
- 

## **Hydraulics**

**52 hours**

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

### **RSOS topics covered in this section of training:**

#### **E-21 Services Hydraulic systems**

##### **E-21.01 Installs hydraulic systems**

- position, align and secure components and reservoirs for hydraulic systems
- connect piping, hoses and tubing
- selection of system components

##### **E-21.02 Diagnoses hydraulic systems**

- visually inspect hydraulic systems
- assess and detect faulty or damaged components

##### **E-21.03 Maintains hydraulic systems**

- verify and adjust fluid levels
- check filters
- check and adjust system pressure, temperature, flow and lubrication

- E-21.04 Repairs conveying systems
- repair and replace components
  - modify systems
- 

**Technical Drawing**

**16 hours**

- Construct fabrication drawings
- Interpret fabrication drawings
- Interpret piping drawings

**RSOS topics covered in this section of training:**

**A-3 Performs routine trade tasks**

**A-3.08 Uses mechanical drawings and schematics**

- drawings, their use and interpretation
  - calculations relevant to drawings
  - basic sketching techniques
- 

**Trade Mathematics**

**16 hours**

- Basic geometry
- Trade calculations

**This section of training exceeds the minimum sequencing as set out by the IMM RSOS.**

**Level Three topics from the RSOS that are taught in context:**

***A-1 Safety Related Functions***

***A-3 Routine Trade Tasks***

***A-3.08 Drawings and Schematics***

***B-7 Plans Rigging, Hoisting/Lifting and Moving***

***B-8 Rigs, Hoists/Lifts and Moves Load***

***For details regarding the In Context Topic, see page 37***



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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

#### RSOS topics covered in this section of training:

#### A-3 Performs routine trade tasks

A-3.04 Performs leveling of components and systems

- select and use leveling tools
- level machinery and components
- record leveling data

A-3.08 Uses mechanical drawings and schematics

- determine and recognize locations of equipment, components and parts
- interpret and cross-reference specifications, technical manuals and drawings
- perform trade related calculations

#### A-5 Performs Measuring and Layout

A-5.02 Measures material and components

- read and interpret measurements
- transfer measurements to components, work area and material

A-5.02 Lays out components

- transfer measurements from benchmark and datum points to work area
- transfer measurements from drawings to work material

#### C-9 Services prime movers

C-9.01 Installs prime movers

- determine location and elevation for installation
- prepare foundation
- prepare base, base plates, sole plates and structure

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### Material Handling

26 hours

- Conveyor system identification and maintenance
- Conveyor components

#### RSOS topics covered in this section of training:

#### D-20 Services conveying systems

D-20.02 Diagnoses conveying systems

- obtain a description of the problem and symptoms
- perform sensory inspection of components
- inspect filters
- perform condition-based monitoring routine procedures
- determine type of repair required
- identify conditions that led to failure or breakdown of conveying system

D-20.03 Maintains conveying systems

- verify maintenance requirements
- check conditions
- verify power transmission alignment and correct



- check clearances
- monitor components
- monitor power transmission
- adjust tracking of mechanical conveying systems
- adjust conveying system accessories
- monitor safety device components and guards

#### D-20.04 Repairs conveying systems

- access conveying systems
- prepare conveying systems for repair
- dismantle conveying system
- size, replace and align components
- repair power transmission
- patch, shorten or replace conveying belt
- verify rotation and adjust tracking

### **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

#### **RSOS topics covered in this section of training:**

#### **D-15 Services robotics and automated equipment**

##### D-15.01 Installs robotics and automated equipment

- determine location and elevation for installation
- prepare foundation, base, base plates and structure
- prepare and inspect robotics and automated equipment
- position robotics and automated equipment
- secure, level and align robotics and automated equipment
- install auxiliary systems
- verify complete range of movement
- connect robotics and automated equipment with controller
- install safety guards and safety devices
- energize equipment
- verify functionality of safety devices

##### D-15.02 Diagnoses robotics and automated equipment

- perform sensory inspection of robotics and automated equipment defects
- perform condition-based monitoring methods and analysis
- test and evaluate robotics and automated equipment and components

##### D-15.03 Maintains robotics and automated equipment

- inspect, modify and adjust robotics and automated equipment
- align components
- check coolant and lubrication levels, packing, seals and safety devices
- monitor temperature, vibration, range of movement and pressure
- check automatic bearing and seal lubrication systems
- identify faulty or damaged equipment

D-15.04 Repairs robotics and automated equipment

- dismantle and remove robotics and automated equipment and components
- size and replace seals, bearings and power transmission devices
- inspect and repair zero backlash devices
- replace faulty components and auxiliary equipment

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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

**RSOS topics covered in this section of training:**

**A-4 Uses communication and mentoring techniques**

A-4.02 Uses mentoring techniques

- demonstrates performance of a skill to a learner
- set up conditions required for a learner to develop proficiency in a skill
- support apprentices in pursuing technical training opportunities

**F-24 Commissions and decommissions equipment**

F-24.01 Commissions systems and components

- review information sources and documentation
- review mechanical system and component checklist
- review fluid power system and component checklist
- check mechanical systems safety components
- check fluid power systems safety components
- start up systems and components
- perform monitoring activities
- confirm alignment of equipment and components
- perform and record baseline readings

F-24.02 Decommissions systems and components

- perform decontamination procedures
- sort, recycle and dispose of materials
- perform decommissioning
- record decommissioning

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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

**RSOS topics covered in this section of training:**

**C-9 Services prime movers**

C-9.03 Maintains prime movers

- inspect, modify and adjust prime movers
- align components
- check coolant and lubricant levels, packing, seals and equipment protection devices

- monitor temperature, vibration and pressure
- check automatic bearing and seal lubrication systems
- adjust flow and pressure controls
- remove and replace safety guards and safety devices
- energize equipment
- identify faulty or damaged equipment

### **F-23 Performs preventative and predictive maintenance**

#### F-23.01 Performs preventative maintenance activities

- perform sensory inspections of equipment and components
- performs hands-on inspections
- check system conditions
- record information for future equipment evaluation and repair

#### F23.02 Performs vibration analysis procedures

- select vibration analysis equipment
- set parameters to use vibration analysis equipment
- collect readings at consistent points across rotating and non-rotating equipment
- identify vibration frequencies related to type of components on which data is being collected

#### F-23.03 Performs balancing procedures

- inspect and clean equipment
- identify type of imbalance in equipment
- use balancing equipment
- add or remove specific weights at identified locations

#### F-23.05 Performs fluid analysis procedures

- perform sensory inspections of fluid condition
- determine location and frequency of sample collection
- interpret test report information

#### F-23.06 Performs predictive maintenance activities

- select NTD methods
- detect faults, frequencies or defects in machine components
- record information for future equipment evaluation and repair
- review collected data.

## **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

### **RSOS topics covered in this section of training:**

#### **A-3 Performs routine trade tasks**

##### A-3.08 Uses mechanical drawings and schematics

- drawings, their use and interpretation
- calculations relevant to drawings
- basic sketching techniques

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

- Basic geometry and trigonometry
- Trade calculations

**This section of training exceeds the minimum sequencing as set out by the IMM RSOS.**

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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

**This section of training exceeds the minimum sequencing as set out by the IMM RSOS.**

**Level Four topics from the RSOS that are taught in context:**

***A-1 Safety Related Functions***

***A-3 Routine Trade Tasks***

***A-3.08 Drawings and Schematics***

***B-7 Plans Rigging, Hoisting/Lifting and Moving***

***B-8 Rigs, Hoists/Lifts and Moves Load***

***For details regarding the In Context Topic, see page 37***



# In Context Topics

Some material may be taught 'in context.' In context means learning that has already taken place and is being applied to the applicable task. Learning outcomes for in context topics are accomplished in other topics in that level.

## A-1 Safety Related Functions

A-1.01 Uses personal protective equipment (PPE) and safety equipment

- personal protective equipment (PPE) and safety equipment, their applications, maintenance and procedures for use

A-1.02 Maintains safe worksite

- safe work practices
- regulatory requirements pertaining to safety

A-1.03 Protects the environment

- regulatory requirements pertaining to environmental safety and protection

A-1.04 Performs lock-out/tag-out and zero-energy state procedures

- procedures used to perform lock-out/tag-out and zero energy procedures
- potential hazards associated with lock-out/tag-out and zero energy procedures

## A-3 Routine Trade Tasks

A-3.01 Plans work

- job planning
- procedures used to plan and organize jobs

A-3.02 Fabricates work piece

- shop machines, their applications and procedures for use
- safety practices related to the use of shop machines
- grinders and their applications
- procedures used to perform grinding operations
- power metal saws and their applications
- procedures to perform cutting operations using power metal saws
- drilling machines, their accessories and their applications
- procedures used to perform drilling operations, and the associated calculations
- lathes, their accessories, attachments and applications
- procedures used to perform lathe operations, and the associated calculations
- milling machines and their applications
- procedures used to perform milling operations, and the associated calculations

A-3.03 Lubricates systems and components

- lubricants, lubrication systems and their components, applications and procedures for use
- procedures used to handle, store, recycle and dispose of lubricants
- demonstrate knowledge of safety practices related to lubricants and lubricant systems

A-3.04 Performs leveling of components and systems

- procedures used to level and align equipment
- safety practices related to equipment leveling and alignment

A-3.05 Uses fastening and retaining devices

- fastening and retaining devices, and their applications
- procedures used to install and remove fastening and retaining devices
- safety practices related to fastening and retaining devices

A-3.06 Performs material identification

- metals and their characteristics
- non-metallic materials and their characteristics
- metallurgic principles
- material testing procedures

A-3.07 Performs heat treatment of metal

- metals and their characteristics
- metallurgic principles
- structural shapes and their applications
- processes used in the heat treatment of metals
- safety practices related to heat treatment of metal

A-3.08 Uses mechanical drawings and schematics

- drawings, their use and interpretation
- calculations relevant to drawings
- basic sketching techniques

**B-7 Plans Rigging, Hoisting/Lifting and Moving**

B-7.01 Determines load

- scale the load using measuring devices
- calculate load
- refer to nameplates, shipping information and manufacturers' manuals

B-7.02 Selects rigging equipment

- determine rigging equipment needed
- refer to load ratings for sling arrangements
- confirm rigging capacity
- confirm certification of rigging equipment
- assess, inspect and document rigging equipment condition
- remove and tag faulty or damaged rigging equipment from service

B-7.03 Selects hoisting/lifting and moving equipment

- determine hoisting/lifting and moving equipment needed
- inspect and document condition of hoisting/lifting and moving equipment
- confirm certification of hoisting/lifting and moving equipment
- refer to load charts for boom angles and distance
- remove and tag faulty or damaged hoisting/lifting and moving equipment from service

B-7.04 Secures area

- assess site, ground, environmental conditions and plan route
- determine and secure lift radius
- confirm location of personnel

**B-8 Rigs, Hoists/Lifts and Moves Load**

B-8.01 Sets up rigging, hoisting/lifting and moving equipment

- prepare for lift
- install and set up all rigging, hoisting/lifting and moving components
- perform pre-use inspection of equipment
- read and interpret load charts
- adjust schedule of the lift to address environmental conditions

B-8.02 Performs hoist/lift and move

- ensure direct line of sight between the operator and signal person
- use hand signals and verbal communication according to jurisdictional regulations
- use alternate communication methods when there is no direct line of site
- assess and make adjustments to stabilize load as required
- adjust schedule of lift to address environmental conditions
- perform post-lift inspection of rigging, hoisting/lifting and moving equipment

B-8.03 Maintains rigging, hoisting/lifting and moving equipment

- perform scheduled maintenance on equipment
- perform visual inspection of rigging, hoisting/lifting and moving equipment
- identify rejection criteria for hardware
- identify and replace damaged hardware and remove from service

- identify non-destructive testing (NDT) techniques used on rigging, hoisting/lifting and moving equipment
- store rigging, hoisting/lifting and moving equipment



# APPENDIX A: POST HARMONIZATION TRAINING PROFILE CHART

This chart which outlines the finalized model for SATCC technical training sequencing with a cross reference to the Harmonized apprenticeship technical training sequencing, at the topic level.

Implementation for harmonization took 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.

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



Level Two	Transcript Code	Hours	Pan-Canadian Harmonized Level Two
Shafts, Keys, Seals, Bearing and Plain Bearings	TRNM 208-Theory	26	Shafts, Bearings, and Seals
	TRNM 209-Shop	26	
Lubrication & Levelling	MCHN 200-Theory	13	
	MCHN 201-Shop	13	
Arc Welding	WLDR 200-Theory	26	Cutting and Welding
	WLDR 201-Shop	26	
Belts and Chains	INDM 206-Theory	13	Chain and Belt Drive Systems
	INDM 207-Shop	13	
Gear Systems, Couplings, Clutches, & Brakes	BRAK 208-Theory	13	Couplings, Clutches, and Brakes
	BRAK 209-Shop	13	Gear Systems
Rough Alignment and Dial Alignment	ALGN 200-Theory	13	Shaft Alignment Procedures
	ALGN 201-Shop	13	
Technical Drawing	PRNT 203	16	Safety Related Functions
			Routine Trade Tasks
			Drawings and Schematics
Trade Mathematics	MATH 201	16	Exceed
		240	

Level Three	Transcript Code	Hours	Pan-Canadian Harmonized Level Three
Advanced Shaft Alignment	ALGN 300-Theory	13	Shaft Alignment Procedures
	ALGN 301-Shop	13	
Pneumatics, Compressors, Vacuum Systems, Fans, & Blowers	PNEU 300-Theory	26	Fans and Blowers
	PNEU 301-Shop	26	Compressors
			Pneumatic and Vacuum Systems
Hydraulics	HYDR 302-Theory	26	Hydraulic Systems
	HYDR 303-Shop	26	
Pumps	PUMP 300-Theory	26	Pumps
	PUMP 301-Shop	26	
Pipe Fitting, Tanks, and Containers	PIPE 300-Theory	13	Process Piping, Tanks, and Containers
	PIPE 301-Shop	13	
Technical Drawing	PRNT 302	16	Safety Related Functions
			Routine Trade Tasks
			Drawings and Schematics
Trade Mathematics	MATH 300	16	Exceed
		240	

Level Four	Transcript Code	Hours	Pan-Canadian Harmonized Level
Material Handling Theory	MATE 400 - Theory	13	Conveying Systems
	MATE 401 - Shop	13	
Machine Installation	MCHN 400 -Theory	13	Safety Related Functions
	MCHN 401 - Shop	13	Routine Trade Tasks
Robotics and Automated Equipment	ROBT 400 - Theory	13	Robotics and Automated Equipment
	ROBT 401- Shop	13	
Mentoring Techniques, Commissioning & Decommissioning Equipment	MENT 402 - Theory	13	Mentoring Techniques
	MENT 403 - Shop	13	Commissioning and Decommissioning
Steam/Prime Movers, Preventative and Predictive Maintenance	MAIN 400 - Theory	26	Prime Movers
	MAIN 401-Shop	26	Preventative and Predictive
Technical Drawing	PRNT 405	16	Drawings and Schematics
Trade Mathematics	MATH 400	16	Exceed
Machine Shop	MACH 400-Theory	26	Exceed
	MACH 401-Shop	26	
		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.