

---

# Plan of Training

## INDUSTRIAL MECHANIC (MILLWRIGHT)



Government of Newfoundland and Labrador  
Department of Advanced Education and Skills  
Apprenticeship and Trades Certification Division

March 2010

# PLAN OF TRAINING

## Industrial Mechanic (Millwright)

March 2010



Government of Newfoundland and Labrador  
Department of Education  
Institutional and Industrial Education Division

Approved by:

A handwritten signature in cursive script, appearing to read "Paula Hood".

Chairperson, Provincial Apprenticeship and Certification Board

Date: March 17, 2010

## Preface

This Apprenticeship Standard is based on the 2009 edition of the National Occupational Analysis for the Industrial Mechanic (Millwright) trade.

This document describes the curriculum content for the Industrial Mechanic (Millwright) apprenticeship training program and outlines each of the technical training units necessary for the completion of apprenticeship.

## Acknowledgements

Advisory committees, industry representatives, instructors and apprenticeship staff provided valuable input to the development of this Apprenticeship Curriculum Standard. Without their dedication to quality apprenticeship training, this document could not have been produced.

We offer you a sincere thank you.

## Contact Information

Department of Advanced Education and Skills  
Apprenticeship and Trades Certification Division

Tel: 709-729-2729 / 1-877-771-3737

Email: [app@gov.nl.ca](mailto:app@gov.nl.ca)

Web: [www.gov.nl.ca/app](http://www.gov.nl.ca/app)

<b>Document Status</b>	<b>Date Distributed</b>	<b>Mandatory Implementation Date</b>	<b>Comments</b>
Approved	March 2010	September 2010	
Approved	October 2012	September 2012	Related Courses Updated

## Table of Contents

A.	Profile Chart.....	5
B.	NOA Comparison Chart.....	7
C.	Program Structure.....	13
BLOCK I	.....	19
TS1510	Occupational Health and Safety .....	19
TS1520	Workplace Hazardous Materials Information System (WHMIS).....	22
TS1530	Standard First Aid.....	25
MS1230	Hand Tools.....	26
MW1240	Portable Power Tools.....	28
MW1251	Blueprint Reading and Sketching.....	30
MW1261	Equipment Assembly Blueprints.....	32
MW1270	Mechanical Installation Blueprints.....	34
MW1281	Schematics Advanced.....	35
MW1291	Rigging .....	36
MW1450	Drills, Taps, and Reamers.....	40
MW1460	Measuring and Layout.....	44
MW1470	Piping Components.....	46
MW1511	Power Metal Saws.....	48
MW1521	Pedestal Grinders.....	50
MW1530	Bearings.....	52
MW1541	Fasteners.....	55
MW1550	Metallurgy.....	58
MW1580	Static and Dynamic Seals.....	60
MW1591	Couplings and Clutches.....	62
MW1360	Shafts and Shaft Alignment.....	64
MW1610	Belt and Chain Drive Systems.....	67
MW1640	Gear Drive Systems .....	70
MW1650	Lubrication Practices .....	72
MW1670	Non-Positive Displacement Pumps.....	74
MW1690	Positive Displacement Pumps.....	76
MW1730	Electrical Fundamentals.....	78
MW2150	Hydraulics I.....	80
WD1330	Oxy-Fuel Welding.....	82
OT1190	Workplace Exposure.....	84
AP1101	Introduction to Apprenticeship .....	85
AM1100	Math Essentials.....	89
AM1180	Industrial Math Fundamentals .....	91

CM2160	Communication Essentials .....	93
SD1760	Workplace Essentials.....	96
MC1060	Computer Essentials.....	99
BLOCK II.....		102
MW1560	Coupling Alignment.....	102
MW1660	Material Handling Systems .....	105
MW2160	Hydraulics II.....	108
MW2170	Pneumatics.....	110
WD1380	Electric Arc Welding.....	113
BLOCK III.....		115
MW1620	Metal Lathe .....	115
MW1630	Milling Machines .....	118
MW2180	Compressors .....	120
MW2190	Machinery Installation and Alignment.....	122
BLOCK IV.....		124
MW1680	Dynamic Balancing.....	124
MW1740	Preventative and Predictive Maintenance.....	126
MW1480	Tanks, Fans and Blowers .....	128
MW2210	Prime Movers 1 (Internal Combustion Engines).....	130
MW2220	Prime Movers II (Turbines) .....	132
MW2230	Vibration Analysis.....	135
D.	Conditions Governing Apprenticeship Training .....	138
E.	Requirements for Red Seal Endorsement.....	145
F.	Roles and Responsibilities of Stakeholders in the Apprenticeship Process .....	146

**A. Profile Chart**

Occupational Skills			
MS1230 Hand Tools	MW1240 Portable Power Tools	MW1251 Blueprint Reading and Sketching	MW1261 Equipment Assembly Blueprints
MW1270 Mechanical Installation Blueprints	MW1281 Schematics Advanced	MW1291 Rigging	MW1450 Drills, Taps and Reamers
MW1460 Measuring and Layout	MW1511 Power Metal Saws	MW1521 Pedestal Grinders	MW1541 Fasteners
MW1560 Coupling Alignment	MW1360 Shafts and Shaft Alignment	MW1620 Metal Lathe	MW1630 Milling Machines
MW1650 Lubrication Practices	MW1730 Electrical Fundamentals	MW2160 Hydraulics II	MW2190 Machinery Installation and Alignment
WD1330 Oxy-Fuel Welding	WD1380 Electric Arc Welding	CM2160 Communication Essentials	SD1760 Workplace Essentials
Rigging, Hoisting and Lifting			
MW1291 Rigging			
Mechanical Components and Systems			
MW1530 Bearings	MW1560 Couplings Alignment	MW1580 Stating and Dynamic Seals	MW1591 Couplings and Clutches
MW1360 Shafts and Shaft Alignment	MW1610 Belt and Chain Drive Systems	MW1640 Gear Drive Systems	MW1730 Electrical Fundamentals
MW2220 Prime Movers I	MW2220 Prime Movers II		

Material Handling / Process Systems			
MW1660 Material Handling Systems	MW1670 Non-Positive Displacement Pumps	MW1690 Positive Displacement Pumps	MW2180 Compressors
MW1480 Tanks, Fans and Blowers			
Fluid Power			
MW1470 Piping Components	MW1660 Material handling Systems	MW2150 Hydraulics I	MW2160 Hydraulics II
MW2170 Pneumatics			
Preventive and Predictive Maintenance, Testing and Commissioning			
MW1640 Gear Drive Systems	MW1660 Material Handling Systems	MW1670 Non-Positive Displacement Pumps	MW1680 Dynamic Balancing
MW1690 Positive Displacement Pumps	MW1740 Preventative and Predictive Maintenance	MW2150 Hydraulics I	MW2160 Hydraulics II
MW2180 Compressors	MW1480 Tanks, Fans and Blowers	MW2210 Prime Movers I	MW2220 Prime Movers II
MW2230 Vibration Analysis			

## B. NOA Comparison Chart

NOA 2009 Tasks		2010 POT	
<b>Task 1 – Maintains tools and equipment</b>			
1.01	Maintains hand tools	MS1230	Hand Tools
1.02	Maintains portable tools	MW1240	Portable Power Tools
1.03	Maintains shop machines	MW1240 MW1450 MW1511 MW1620 MW1630	Portable Power Tools Drills, Taps and Reamers Power Metal Saws Metal Lathe Milling Machines
1.04	Maintains precision measuring tools	MS1230 MW1460	Hand Tools Measuring and Layout
1.05	Maintains layout tools	MS1230	Hand Tools
1.06	Maintains access equipment	MW1291	Rigging
1.07	Maintains personal protective equipment and safety equipment	MS1230	Hand Tools
<b>Task 2 – Organizes Work</b>			
2.01	Uses Documentation	CM2160	Communication Essentials
2.02	Uses drawings and Schematics	MW1251 MW1261 MW1270 MW1281	Blueprint Reading and Sketching Equipment Assembly Blueprints Mechanical Installation Blueprints Schematics Advanced
2.03	Identifies job requirements	SD1760	Workplace Essentials
2.04	Communicates with others	CM2160 SD1760	Communication Essentials Workplace Essentials
2.05	Maintains safe work environment	MS1230	Hand Tools
<b>Task 3 – Performs Routine Trade Tasks</b>			
3.01	Performs Lockout procedures	MW1730 MW2160	Electrical Principles Hydraulics II
3.02	Fabricates work piece	MW1240 MW1450 MW1511 MW1620 MW1630	Portable Power Tools Drills, Taps and Reamers Power Metal Saws Metal Lathe Milling Machines
3.03	Operates shop machines	MW1450 MW1511 MW1521 MW1620 MW1630	Drills, Taps and Reamers Power Metal Saws Pedestal Grinders Metal Lathe Milling Machines
3.04	Uses access equipment	MW1291	Rigging



NOA 2009 Tasks		2010 POT	
3.05	Lubricates system and components	MW1650	Lubrication practices
3.06	Aligns components and systems	MW1560 MW1360	Coupling Alignment Shafts and Shaft Alignment
3.07	Uses fastening and retaining devices	MW1541	Fasteners
3.08	Tests metal and other materials using standardized procedures	MW1550	Metallurgy
3.09	Performs heat treatment of metal		
<b>Task 4 – Performs Measuring and Layout</b>			
4.01	Measures material and components using precision tools	MW1460	Measuring and Layout
4.02	Places components using layout tools		
<b>Task 5 – uses cutting and welding equipment</b>			
5.01	Cuts material using gas-cutting equipment.	WD1330	Oxy Fuel Welding
5.02	Cuts material using plasma arc cutting equipment.	WD1380	Electric Arc Welding
5.03	Welds/brazes/solders material using gas welding equipment.	WD1330	Oxy Fuel Welding
5.04	Welds material using arc welding equipment.	WD1380	Electric Arc Welding
5.05	Welds material using metal inert gas (MIG) welding equipment.		
5.06	Welds material using tungsten inert gas (TIG) welding equipment.		
<b>Task 6 – Prepares for installation and maintenance of components and systems</b>			
6.01	Prepares for installation of components and systems.	MW2190	Machinery Installation and Alignment
6.02	Prepares for maintenance of components and systems.		
<b>Task 7 – Plans lift</b>			
7.01	Determines Load	MW1291	Rigging
7.02	Selects rigging equipment		
7.03	Selects lifting equipment		

NOA 2009 Tasks		2010 POT	
<b>Task 8 – Hoists load</b>			
8.01	Secures lift area	MW1291	Rigging
8.02	Sets up rigging, hoisting and lifting equipment		
8.03	Performs lift		
<b>Task 9 – Inspects and maintains rigging, hoisting and lifting equipment</b>			
9.01	Conducts post lift equipment inspection	MW1291	Rigging
9.02	Maintains rigging, hoisting and lifting equipment		
9.03	Stores equipment		
<b>Task 10 – Services prime movers</b>			
10.01	Installs prime movers	MW1730	Electrical Fundamentals Prime Movers I Primer Movers II
10.02	Diagnoses prime movers	MW2210 MW2220	
10.03	Repairs prime movers		
10.04	Maintains prime movers		
<b>Task 11 – Services shafts, bearings and seals</b>			
11.01	Installs shafts, bearing and seals	MW1530 MW1580 MW1360	Bearings Static and Dynamic Seals Shafts and Shaft Alignment
11.02	Diagnoses shafts, bearing and seals		
11.03	Repairs shafts, bearing and seals		
11.04	Maintains shafts, bearing and seals		
<b>Task 12 – Services Couplings, Clutches and Brakes</b>			
12.01	Installs couplings, clutches and brakes	MW1560 MW1591 MW1360	Coupling Alignment Couplings and Clutches Shafts and Shaft Alignment
12.02	Diagnoses couplings, clutches and brakes	MW1591	Couplings and Clutches
12.03	Repairs couplings, clutches and brakes	MW1591	Couplings and Clutches
12.04	Maintains couplings, clutches and brakes		

NOA 2009 Tasks		2010 POT	
<b>Task 13 – Services chain and belt drive systems</b>			
13.01	Installs chain and belt drive systems	MW1610	Belt and Chain Drives Systems
13.02	Diagnoses chain and belt drive systems		
13.03	Repairs chain and belt drive systems		
13.04	Maintains chain and belt drive systems		
<b>Task 14 – Services gear systems</b>			
14.01	Installs gear systems	MW1640	Gear Drive Systems
14.02	Diagnoses gear systems		
14.03	Repairs gear systems		
14.04	Maintains gear systems		
<b>Task 15 – Services fans and blowers</b>			
15.01	Installs fans and blowers	MW1480	Tanks, Fans and Blowers
15.02	Diagnoses fans and blowers		
15.03	Repairs fans and blowers		
15.04	Maintains fans and blowers		
<b>Task 16 – Services compressors</b>			
16.01	Installs compressors	MW2180	Compressors
16.02	Diagnoses compressors		
16.03	Repairs compressors		
16.04	Maintains compressors		
<b>Task 17 – Services pumps</b>			
17.01	Installs pumps	MW1670	Non-Positive Displacement Pumps Positive Displacement Pumps
17.02	Diagnoses pumps	MW1690	
17.03	Repairs pumps		
17.04	Maintains pumps		
<b>Task 18 – Services conveying systems</b>			
18.01	Installs conveying systems	MW1660	Material Handling Systems
18.02	Installs conveying systems		
18.03	Installs conveying systems		
18.04	Installs conveying systems		
<b>Task 19 – Services Process Tanks and Containers</b>			
19.01	Installs process tanks and controllers	MW1480	Tanks, Fans and Blowers

NOA 2009 Tasks		2010 POT	
19.02	Diagnoses process tanks and controllers	MW1480	Tanks, Fans and Blowers
19.03	Repairs process tanks and controllers		
19.04	Maintains process tanks and controllers		
<b>Task 20 – Services Hydraulic Systems</b>			
20.01	Installs hydraulic systems	MW1470 MW2150 MW2160	Piping Components Hydraulics I Hydraulics II
20.02	Diagnoses hydraulic systems	MW2150 MW2160	Hydraulics I Hydraulics II
20.03	Repairs hydraulic systems		
20.04	Maintains hydraulic systems		
<b>Task 21 – Services pneumatic and vacuum systems</b>			
21.01	Installs pneumatic and vacuum systems	MW1470 MW2160 MW2170	Piping Components Hydraulics II Pneumatics
21.02	Diagnoses pneumatic and vacuum systems	MW1660 MW2160 MW2170	Material Handling Systems Hydraulics II Pneumatics
21.03	Repairs pneumatic and vacuum systems		
21.04	Maintains pneumatic and vacuum systems		
<b>Task 22 – Performs preventive and predictive maintenance</b>			
22.01	Performs preventive maintenance	MW1740	Preventative and Predictive Maintenance
22.02	Performs predictive maintenance		
22.03	Performs machinery and equipment balancing	MW1680	Dynamic Balancing
<b>Task 23 – Performs specialized testing and analysis</b>			
23.01	Analyzes maintenance history of equipment.	MW1740	Preventative and Predictive Maintenance
23.02	Tests machinery and equipment using vibration analysis procedures.	MW2230	Vibration Analysis
23.03	Analyzes vibration test data.		
23.04	Tests equipment and components using non-destructive testing (NDT).	MW1740	Preventative and Predictive Maintenance

NOA 2009 Tasks		2010 POT	
23.05	Analyzes NDT.	MW1740	Preventative and Predictive Maintenance
23.06	Collects fluid samples.		
23.07	Analyzes fluids and fluid test data.		
Task 24 – Commissions Equipment			
24.01	Commissions mechanical systems and components, and material handling / process systems.	MW1640	Gear Drive Systems
		MW1660	Material Handling Systems
		MW1670	Non-Positive Displacement Pumps
		MW1690	Positive Displacement Pumps
		MW2180	Compressors
		MW1480	Tanks, Fans and Blowers
		MW2210	Prime Movers I
		MW2220	Primer Movers II
24.02	Commissions fluid power systems	MW2150	Hydraulics I
		MW2160	Hydraulics II

### C. Program Structure

For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.

The order of course delivery within each block can be determined by the educational agency, as long as pre-requisite conditions are satisfied.

Upon completion of an entry level program, individuals may be required to complete other certifications (employer or job site specific) in order to gain employment.

<b>Block I</b>				
<b>Course No.</b>	<b>IPG No.</b>	<b>Course Name</b>	<b>Hours</b>	<b>Pre-Requisite(s)</b>
TS1510	-	OH&S	6	None
TS1520	-	WHMIS	6	None
TS1530	-	Standard First Aid	14	None
MS1230	-	Hand Tools	20	TS1510; TS1520; TS1530
MW1240	-	Portable Power Tools	20	MS1230
MW1251	-	Blueprint Reading and Sketching	15	-
MW1261	-	Equipment Assembly Blueprints	15	MW1251
MW1270	-	Mechanical Installation Blueprints	15	MW1261
MW1281	-	Schematics Advanced	15	MW1251
MW1291	-	Rigging	30	MW1240
MW1450	-	Drills, Taps and Reamers	30	MW1240

<b>Block I</b>				
<b>Course No.</b>	<b>IPG No.</b>	<b>Course Name</b>	<b>Hours</b>	<b>Pre-Requisite(s)</b>
MW1460	-	Measuring and Layout	60	MS1230
MW1470	-	Piping Components	30	MW1460
MW1511	-	Power Metal Saws	15	MW1460
MW1521	-	Pedestal Grinders	15	MW1511
MW1530	-	Bearings	40	MW1580
MW1541	-	Fasteners	9	MS1230
MW1550	-	Metallurgy	30	WD1330
MW1580	-	Static and Dynamic Seals	30	MW1650
MW1591	-	Coupling and Clutches	20	MW1640
MW1360	-	Shafts and Shaft Alignment	20	MW1591
MW1610	-	Belt and Chain Drive Systems	45	MW1530
MW1640	-	Gear Drive Systems	50	MW1610
MW1650	-	Lubrication Practices	20	MS1230
MW1670	-	Non-Positive Displacement Pumps	40	MW1591
MW1690	-	Positive Displacement Pumps	50	MW1670
MW1730	-	Electrical Fundamentals	30	MW2150
MW2150	-	Hydraulics I	30	MW1690
WD1330	-	Oxy-Fuel Welding	30	MS1230
OT1190	-	Workplace Exposure	90	-

<b>Block I</b>				
<b>Course No.</b>	<b>IPG No.</b>	<b>Course Name</b>	<b>Hours</b>	<b>Pre-Requisite(s)</b>
AP1101	-	Introduction to Apprenticeship	15	None
*AM1100	-	Math Essentials	30	None
AM1180	-	Industrial Math Fundamentals	30	AM1100
CM2160	-	Communication Essentials	45	None
SD1760	-	Workplace Essentials	45	None
MC1060	-	Computer Essentials	15	None
Total Hours			1020	

**\*A student who can meet the mathematics requirement through an ACUPLACER® test may be exempted from AM1100 - Math Essentials. Please check with your training institution.**

<b>Required Work Experience</b>
---------------------------------



<b>Block II</b>				
<b>Course No.</b>	<b>IPG No.</b>	<b>Course Name</b>	<b>Hours</b>	<b>Pre-Requisite(s)</b>
MW1560	-	Coupling Alignment	45	MW1591
MW1660	-	Material Handling Systems	60	MW1591
MW2160	-	Hydraulics II	35	MW2150
MW2170	-	Pneumatics	40	MW2160
WD1380	-	Electric Arc Welding	60	WD1330
Total Hours			240	

<b>Required Work Experience</b>
---------------------------------

<b>Block III</b>				
<b>Course No.</b>	<b>IPG No.</b>	<b>Course Name</b>	<b>Hours</b>	<b>Pre-Requisite(s)</b>
MW1620	-	Metal Lathe	100	MW1450
MW1630	-	Milling Machines	40	MW1620
MW2180	-	Compressors	40	MW2170
MW2190	-	Machinery Installation and Alignment	60	MW1560
Total Hours			240	

<b>Required Work Experience</b>
---------------------------------

<b>Block IV</b>				
<b>Course No.</b>	<b>IPG No.</b>	<b>Course Name</b>	<b>Hours</b>	<b>Pre-Requisite(s)</b>
MW1680	-	Dynamic Balancing	45	MW2230
MW1740	-	Preventative and Predictive Maintenance	35	MW2180
MW1480	-	Tanks, Fans and Blowers	30	MW1690
MW2210	-	Prime Movers I (Internal Combustion Engines)	45	MW1580
MW2220	-	Prime Movers II (Turbines)	45	MW2210
MW2230	-	Vibration Analysis	40	MW1740
Total Hours			240	

<b>Required Work Experience</b>
---------------------------------

<b>Total Course Credit Hours</b>	1740
----------------------------------	------

## **BLOCK I**

### **TS1510 Occupational Health and Safety**

#### **Learning Outcomes:**

- Demonstrate knowledge of interpreting the Occupational Health and Safety Act, laws and regulations.
- Demonstrate knowledge of understanding the designated responsibilities within the laws and regulations such as the right to refuse dangerous work; and the importance of reporting accidents.
- Demonstrate knowledge of how to prevent accidents and illnesses.
- Demonstrate knowledge of how to improve health and safety conditions in the workplace.

**Duration:** 6 Hours

**Pre-Requisite(s):** None

#### **Objectives and Content:**

1. Interpret the Occupational Health and Safety Act laws and regulations.
  - i. explain the scope of the act
    - application of the act
    - Federal/Provincial jurisdictions
    - Canada Labour Code
    - rules and regulations
    - private home application
    - conformity of the Crown by the Act
2. Explain responsibilities under the Act and Regulations.
  - i. duties of employer, owner, contractors, sub-contractors, employees, and suppliers

3. Explain the purpose of joint health and safety committees.
  - i. formation of committee
  - ii. functions of committee
  - iii. legislated rights
  - iv. health and safety representation
  - v. reporting endangerment to health
  - vi. appropriate remedial action
  - vii. investigation of endangerment
  - viii. committee recommendation
  - ix. employer's responsibility in taking remedial action
  
4. Examine right to refuse dangerous work.
  - i. reasonable grounds for refusal
  - ii. reporting endangerment to health
  - iii. appropriate remedial action
  - iv. investigation of endangerment
  - v. committee recommendation
  - vi. employer's responsibility to take appropriate remedial action
  - vii. action taken when employee does not have reasonable grounds for refusing dangerous work
  - viii. employee's rights
  - ix. assigning another employee to perform duties
  - x. temporary reassignment of employee to perform other duties
  - xi. collective agreement influences
  - xii. wages and benefits
  
5. State examples of work situations where one might refuse work.
  
6. Describe discriminatory action.
  - i. definition
  - ii. filing a complaint procedure
  - iii. allocated period of time a complaint can be filed with the Commission
  - iv. duties of an arbitrator under the Labour Relations Act
  - v. order in writing inclusion
  - vi. report to commission Allocated period of time to request Arbitrator to deal with the matter of the request
  - vii. notice of application
  - viii. failure to comply with the terms of an order
  - ix. order filed in the court

7. Explain duties of commission officers.
  - i. powers and duties of officers
  - ii. procedure for examinations and inspections
  - iii. orders given by officers orally or in writing
  - iv. specifications of an order given by an officer to owner of the place of employment, employer, contractor, sub-contractor, employee, or supplier
  - v. service of an order
  - vi. prohibition of persons towards an officer in the exercise of his/her power or duties
  - vii. rescinding of an order
  - viii. posting a copy of the order
  - ix. illegal removal of an order
  
8. Interpret appeals of others.
  - i. allocated period of time for appeal of an order
  - ii. person who may appeal order
  - iii. action taken by Commission when person involved does not comply with the order
  - iv. enforcement of the order
  - v. notice of application
  - vi. rules of court
  
9. Explain the process for reporting of accidents.
  - i. application of act
  - ii. report procedure
  - iii. reporting notification of injury
  - iv. reporting accidental explosion or exposure
  - v. posting of act and regulations

**Practical Requirements:**

1. Conduct an interview with someone in your occupation on two or more aspects of the act and report results.
  
2. Conduct a safety inspection of shop area.

## TS1520 Workplace Hazardous Materials Information System (WHMIS)

### Learning Outcomes:

- Demonstrate knowledge of interpreting and applying the Workplace Hazardous Materials Information System (WHMIS) Regulation under the Occupational Health and Safety Act.

**Duration:** 6 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

1. Define WHMIS safety.
  - i. rational and key elements
  - ii. history and development of WHMIS
  - iii. WHMIS legislation
  - iv. WHMIS implementation program
  - v. definitions of legal and technical terms
  
2. Examine hazard identification and ingredient disclosure.
  - i. prohibited, restricted and controlled products
  - ii. classification and the application of WHMIS information requirements
  - iii. responsibilities for classification
    - the supplier
    - the employer
    - the worker - Classification: rules and criteria
    - information on classification
    - classes, divisions and subdivision in WHMIS
    - general rules for classification
    - class A - compressed gases
    - class B - flammable and combustible materials
    - class C - oxidizing material
    - class D - poisonous and infectious material
    - class E - corrosive material
    - class F - dangerously reactive material

- iv. products excluded from the application of WHMIS legislation
    - consumer products
    - explosives
    - cosmetics, drugs, foods and devices
    - pest control products
    - radioactive prescribed substances
    - wood or products made of wood
    - manufactured articles
    - tobacco or products of tobacco
    - hazardous wastes
    - products handled or transported pursuant to the Transportation of Dangerous Goods (TDG) Act
  - v. comparison of classification systems - WHMIS and TDG
  - vi. general comparison of classification categories
  - vii. detailed comparison of classified criteria
3. Explain labeling and other forms of warning.
- i. definition of a WHMIS label
    - supplier label
    - workplace label
    - other means of identification
  - ii. responsibility for labels
    - supplier responsibility
    - employer responsibility
    - worker responsibility
  - iii. introduce label content, design and location
    - supplier labels
    - workplace labels
    - other means of identification
4. Introduce material safety data sheets (MSDS).
- i. definition of a material safety data sheet
  - ii. purpose of the data sheet
  - iii. responsibility for the production and availability of data sheets
    - supplier responsibility
    - employer responsibility
    - workers responsibility



**Practical Requirements:**

1. Locate WHMIS label and interpret the information displayed.
2. Locate a MSDS sheet for a product used in the workplace and determine what personal protective equipment and other precautions are required when handling this product.

TS1530      Standard First Aid

**Learning Outcomes:**

- Demonstrate knowledge of recognizing situations requiring emergency action.
- Demonstrate knowledge of making appropriate decisions concerning first aid.

**Duration:**              14 Hours

**Pre-Requisite(s):**    None

**Practical Requirements:**

1. Complete a **St. John Ambulance or Canadian Red Cross** Standard First Aid Certificate course.

## MS1230 Hand Tools

### Learning Outcomes:

- Demonstrate an understanding of safety practices in the use and care of hand tools.
- Demonstrate the ability to select, operate and maintain hand tools properly.

**Duration:** 20

**Pre-requisite(s):** TS1510 Occupational Health & Safety  
TS1520 WHMIS  
TS1530 Standard First Aid

### Objectives and Content:

1. Describe hazards and safe work practices pertaining to the use of tools and equipment.
2. Describe and identify cutting and non-cutting hand tools.
  - i. proper tool selection
  - ii. open end, boxed end, and combination wrenches
  - iii. pliers and their use
  - iv. snips and their use
  - v. screwdrivers and their use
  - vi. ratchets, sockets and power bars
  - vii. allen wrenches
  - viii. torque wrenches and torque multipliers: hydraulic and mechanical
  - ix. hammers
  - x. hacksaws
    - blade selection
  - xi. file types, sizes and selection
  - xii. chisels and punches
  - xiii. oil and honing stones
  - xiv. scrapers

3. Explain two uses of arbour presses.
  - i. arbour press classification
  - ii. safe use
  - iii. broach sets
  
4. Describe torque and its importance.
  - i. definition of torque
  - ii. purposes
  - iii. torque wrench types
  - iv. torque charts
  - v. torque wrench adjustment
  - vi. torque wrench accuracy

**Practical Requirements:**

1. Cut metal using a hacksaw.
2. Debur metal using proper file selection.
3. Cut metal using tin snips and chisels.
4. Torque bolts to specifications.

## MW1240 Portable Power Tools

### Learning Outcomes:

- Demonstrate an understanding of safe practices in the use and care of pneumatic and electric portable power tools.
- Demonstrate the ability to select, operate and maintain pneumatic and electric portable power tools properly.

**Duration:** 20 Hours

**Pre-requisite(s):** MS1230 Hand Tools

### Objectives and Content:

1. Describe the procedures used to select the proper power tool for a specific task.
  - i. proper tool selection based on job requirements
  - ii. drill types and classification
  - iii. portable grinders and grinding wheel types and classification
  - iv. power screwdriver classification, and clutch mechanisms
  - v. circular saw classification
  - vi. reciprocating saw classification
  - vii. pipe threading machines and their uses
2. Describe the procedures used to operate portable power tools.
  - i. safe practices for the operation of shears, nibblers, drills, circular and reciprocating saws, power screwdrivers, grinders and impact tools
  - ii. current flow through electric tools
  - iii. over current protection and double insulated tools
3. Describe the procedures used to inspect and maintain portable power tools.
  - i. operating principles of various electrical and pneumatic tools
  - ii. proper methods of lubricating pneumatic tools
  - iii. power cord inspection
  - iv. airline inspection
  - v. designed operating pressure
  - vi. pressure loss in lines
  - vii. filters, regulators and lubricators

4. Describe powder (explosive) actuated tools and their applications.
  - i. power loads
  - ii. fastener spacing
  - iii. maintenance

**Practical Requirements:**

1. Replace a power cord on an electric portable tool.
2. Replace a disc on a portable grinder.
3. Replace power saw blades.
4. Operate power tools listed in objectives and content section.
5. Cut thread pipe.

## MW1251 Blueprint Reading and Sketching

### Learning Outcomes:

- Demonstrate an understanding of blueprint reading.
- Demonstrate the ability to make freehand sketches.
- Demonstrate the ability to extract pertinent information from basic blueprints.

**Duration:** 15 Hours

**Pre-requisite(s):** None

### Objectives and Content:

1. Describe the principles of basic blueprint reading and the components involved.
  - i. visualization
  - ii. interpretation of the print
2. Describe the procedures used to develop freehand sketches.
  - i. drawing production
  - ii. accepted sketching methods
  - iii. drawing to scale
  - iv. proportion in sketching
3. Describe orthographic projection.
  - i. definition of orthographic projection
  - ii. projection and selection of views
  - iii. rules of procedure for the visualization of objects
  - iv. identification of lines and surfaces
  - v. matching views
  - vi. sketching orthographic views
4. Describe the use of different lines: visible, hidden, section, centre, dimension, extension, cutting plane, break and phantom lines.

5. Describe basic machining symbols used on blueprints.
  - i. ANSI and ASME standards
  - ii. welding/weld
  - iii. surface finishes
  
6. Describe the methods of dimensioning.
  - i. size and location dimensions
  - ii. dimension and extension lines
  - iii. placement of dimensions
  
7. Describe the procedures use to read drawings in order to extract relevant information.
  - i. basis for interpreting drawings
  - ii. sectional views
  - iii. tolerances and allowances
  - iv. removed and revolved sections
  - v. inclined surfaces
  - vi. circular features
  
8. Identify the functions of a CAD system.

**Practical Requirements:**

1. Develop freehand sketches as per instructor's directives.
2. Complete assignment drawings as per instructor's directives.
3. Operate a CAD system.



## MW1261 Equipment Assembly Blueprints

### Learning Outcomes:

- Demonstrate the ability to use blueprints to establish assembly procedures in order to install equipment and machinery.

**Duration:** 15 Hours

**Pre-requisite(s):** MW1251 Blueprint Reading and Sketching

### Objectives and Content:

1. Identify the procedures used to interpret and use equipment assembly blueprints, to determine the assembly procedures for equipment components.
  - i. purpose of detail drawings
  - ii. purpose of assembly drawings
  - iii. sub-assembly, working assembly, diagram assembly, installation assembly and exploded pictorial assembly drawings
  - iv. identify terms used in dimensioning
  - v. identifying various types of dimensions
  - vi. identifying spur, bevel and worm gears
  - vii. identifying splines and serrations
  - viii. recognizing basic weld and welding symbols
2. Identify various views and their arrangement.
  - i. auxiliary views
  - ii. sectional views
  - iii. full, half, offset, aligned, broken out, revolved, removed, partial and outlined
  - iv. sections
3. Identify steel specifications found on the blueprints.
  - i. ANSI and ASME methods of identifying steel by code

**Practical Requirements:**

1. Interpret and use equipment assembly blueprints as per instructor s directives.
2. Complete assignment drawings as per instructor’s directives.

## MW1270 Mechanical Installation Blueprints

### Learning Outcomes:

- Demonstrate the ability use mechanical drawings to determine the location, position and elevation of trade related pieces of equipment or one of its components.

**Duration:** 15 Hours

**Pre-requisite(s):** MW1261 Equipment Assembly Blueprints

### Objectives and Content:

1. Identify the procedures used to read and interpret mechanical drawings to determine the location, the position and the elevation of various pieces of equipment, electrical components, mechanical components or piping components.
  - i. purpose of blueprints
  - ii. purpose of schematics
  - iii. purpose of drawings
  - iv. partial views and their uses
  - v. piping components, valves and fittings
    - schematics and symbols

### Practical Requirements:

1. Interpret and use mechanical blueprints to confirm equipment location and installation procedures.

## MW1281 Schematics Advanced

### Learning Outcomes:

- Demonstrate the ability to recognize schematic symbols for hydraulic and pneumatic systems.
- Demonstrate the ability to develop schematic drawings.
- Demonstrate the ability to use schematics to troubleshoot hydraulic and pneumatic systems.

**Duration:** 15 Hours

**Pre-requisite(s):** MW1251 Blueprint reading and sketching

### Objectives and Content:

1. Identify schematic symbols found on drawings and describe their use in troubleshooting hydraulic and pneumatic systems.
  - i. types and uses of schematic symbols
2. Identify schematic symbols.
  - i. understand the language of schematic symbols
  - ii. sequence of operation of a system
  - iii. understand what the system is supposed to do
  - iv. follow oil/air flow through various components
  - v. understand systems using schematic symbols

### Practical Requirements:

1. Develop a hydraulic schematic by hand or by computer.

## MW1291 Rigging

### Learning Outcomes:

- Demonstrate the ability to safely use different rigging apparatus to lift and move equipment and machinery.
- Demonstrate the ability to erect ladders and scaffolding.
- Demonstrate the ability to use safety harnesses.

**Duration:** 30 Hours

**Pre-requisite(s):** MW1240 Portable Power Tools

### Objectives and Content:

1. Describe proper method of erecting and installing ladders.
  - i. 100% tie off
2. Describe proper use of safety harnesses and lanyards.
3. Describe proper method of erecting scaffolding.
  - i. limits in accordance with regulations
  - ii. 100 % tie off
4. Identify and describe the types, construction and use of fibre rope.
  - i. construction of wire rope
    - lays
    - cores
  - ii. grades of wire rope
  - iii. preformed wire rope
  - iv. classification of wire rope
  - v. wire rope size
  - vi. fleet angles
  - vii. lubrication of wire rope
  - viii. storing and handling
  - ix. determining rope anchorage on a drum
  - x. natural fibre ropes
  - xi. synthetic fibre ropes
  - xii. fibre rope size

5. Identify safety factors pertaining to rigging.
  - i. determine safe working loads of ropes and slings at various angles
  - ii. determine weight of lifted objects
  - iii. determine of gravity
  
6. Identify various types of knots used in rigging equipment for lifting or moving.
  - i. figure eight knot
  - ii. reef knot
  - iii. bowline
  - iv. bowline on the bight
  - v. clove hitch
  - vi. rolling hitch
  - vii. sheep shank
  - viii. sheet bend
  
7. Describe the procedures used to select the appropriate sling to perform a given task.
  - i. single vertical hitch
  - ii. bridle hitch
  - iii. single and double basket hitch
  - iv. single and double choker hitch
  - v. endless slings
  - vi. synthetic web slings
  - vii. metal mesh slings
  - viii. chain slings
  
8. Describe the procedure for lifting, moving and securing equipment.
  - i. safety considerations
  - ii. hand signals
  - iii. jacks

9. Describe the procedures used to select and use various chain blocks and come-alongs.
  - i. blocks and block types
  - ii. mechanical advantage
  - iii. snatch blocks
  - iv. chain hoists
  - v. inspection of chain hoists
  - vi. tirfor
  - vii. jacks
  
10. Describe the different types of lifting accessories and their uses.
  - i. poured sockets
  - ii. wedge sockets
  - iii. swaged sockets
  - iv. cable clips
  - v. thimbles
  - vi. hooks
  - vii. shackles
  - viii. eye bolts
  - ix. turnbuckles
  - x. spreader and equalizer beams
  
11. Describe forklifts, mobile and overhead cranes and their uses.

**Practical Requirements:**

1. Erect ladders.
2. Erect scaffolding as per instructor's directives.
3. Demonstrate proper use of safety harnesses and lanyards.
4. Tie various types of knots used with rigging equipment.
5. Prepare rigging attachments for moving a piece of equipment and conduct safety inspection using hand signals.
6. Lift and move a piece of equipment using rigging methods and procedures, demonstrating hand signals.
7. Choose and install cable clips required to join a section of wire cable as listed in the manufacturer specifications.



## MW1450 Drills, Taps, and Reamers

### Learning Outcomes:

- Demonstrate the ability to operate and maintain drilling machines and reamers in a safe and efficient manner.
- Demonstrate the ability to sharpen twist drills.
- Demonstrate and understanding of proper speed and feed while using drilling machines and reamers.
- Demonstrate the ability to properly use dies.
- Demonstrate the ability to drill, ream, counter bore, countersink and tap hole.

**Duration:** 30 Hours

**Pre-requisite(s):** MW1240 Portable Power Tools

### Objectives and Content:

1. Describe the different types of drilling machines and their uses.
  - i. types and application of drilling machines
2. Identify accepted safety practices when operating drilling machines.
3. Describe the procedures used to calculate speeds and feeds for efficient drilling of different metals.
  - i. definition of cutting speed
  - ii. purpose of using recommended cutting speeds
  - iii. factors governing cutting speeds
  - iv. rpm
  - v. definition of feed
  - vi. expression of feed rates
  - vii. feeds and feed charts
4. Describe the procedures used to select the proper cutting fluids used for machining various metals.
  - i. purpose of cutting fluids
  - ii. fluids for ferrous and non-ferrous metals

5. Describe the different parts of a twist drill and their purpose.
  - i. shanks (straight and tapered)
  - ii. body
    - flutes, margins, lands and cutting lips
  - iii. point
    - cutting edge, heel, body clearance and chisel edge
  
6. Describe the procedures used to calculate the tap drill size using the formula.
  - iv. purpose of the proper tap drill size
  - v. tap drill formulas for imperial and metric sizes
  - vi. tap drill charts
  
7. Describe the different taps in a set and the purpose of each.
  - i. taper, plug and bottoming taps
  - ii. tap extractors
  - iii. tap handles
  - iv. tapping procedures
  - v. special tap attachments
  
8. Describe procedures to sharpen a twist drill for various materials.
  - i. drill point characteristics
  - ii. drill point angles for various materials
  - iii. cutting lip length
  - iv. web thickness
  - v. clearance angles
  - vi. chisel point
  - vii. grinding procedures
  - viii. web thinning
  - ix. drill point angle measurement
  - x. problems caused by improperly sharpened drills
  - xi. relieving cutting for soft material
  
9. Describe the different types of threading dies.
  - i. purpose of dies
  - ii. solid die
  - iii. adjustable split die
  - iv. adjustable screw plate die
  - v. die stocks
  - vi. threading procedures

10. Describe the different types of hand and machine reamers and describe their purpose.
  - i. purpose of reaming
  - ii. solid hand reamer
  - iii. expansion hand reamer
  - iv. adjustable hand reamer
  - v. taper reamers
  - vi. straight and helical fluted reamers
  - vii. rose reamers
  - viii. shell reamers
  
11. Describe the procedures used to determine tolerances, speeds and feeds for reaming.
  - i. reaming allowances for hand and machine reamers
  - ii. cutting speeds for various metals
  - iii. recommended feed rates for hand and machine reaming
  
12. Describe different types of drill bits and their purpose.
  - i. straight and tapered shank twist drills
  - ii. high helix drills
  - iii. core drills
  - iv. oil hole drills
  - v. straight fluted drills
  - vi. deep hole drills
  - vii. spade drills
  - viii. step drills
  - ix. hole saws
  
13. Describe procedures to countersink, counterbore holes and spot face.
  - i. purpose of countersinking and counterboring holes
  - ii. counterbore styles
  - iii. speeds and feeds procedures
  - iv. countersink angles
  - v. speeds and feeds for countersinking
  - vi. spot facing
  
14. Describe pipe taps and dies and their uses.
  - i. special tap attachments

**Practical Requirements:**

1. Drill, tap, ream, counter-bore and counter-sink holes as directed by the instructor.
2. Sharpen a twist drill at various angles.
3. Mix cutting fluids.

## MW1460 Measuring and Layout

### Learning Outcomes:

- Demonstrate the ability to make accurate measurements with precision and semi-precision measuring tools.

**Duration:** 60 Hours

**Pre-requisite(s):** MS1230 Hand Tools

### Objectives and Content:

1. Identify measuring tools in the imperial and metric systems.
  - i. comparison and direct reading measuring tools
  - ii. fractional, decimal, and metric steel rules
  - iii. calipers
  - iv. micrometers
  - v. vernier calipers
  - vi. protractors
  - vii. dial indicators
  - viii. vernier height gauges
  - ix. surface plates
  - x. squares
  - xi. small hole gauges
  - xii. telescoping gauges
  - xiii. dial bore gauges
  - xiv. gage blocks
  - xv. feeler gauges
  - xvi. universal bevel protractors
  - xvii. plug, ring and snap gauges
  - xviii. thread gauge
  
2. Describe the procedures used to select the appropriate layout tools needed to perform a layout for a specific job.
  - i. layout solutions
  - ii. layout tables
  - iii. surface plates

- iv. scribes
  - v. combination sets
  - vi. hermaphrodite calipers
  - vii. dividers
  - viii. trammels
  - ix. prick and centre punches
  - x. angle plates
  - xi. parallels
  - xii. V-blocks
  - xiii. surface gauges
3. Describe the procedures used to accurately lay out straight and irregular profile lines.
    - i. layout procedures
  4. Describe the principles of operation that apply to precision measuring tools.
    - i. principle of the imperial and metric micrometer
    - ii. differences between imperial and metric micrometers
    - iii. parts of the micrometer
    - iv. inside, outside and depth micrometers
    - v. vernier micrometer
    - vi. adjusting micrometers
    - vii. specialty micrometers
    - viii. vernier calipers
    - ix. parts of the vernier caliper
  5. Describe the procedures used to properly store and maintain measuring and layout tools.
    - i. calibration of precision measuring tools
    - ii. sharpening of layout tools

**Practical Requirements:**

1. Perform several measuring tasks as directed by the instructor, using tools outlined in objectives and content section.
2. Lay out and fabricate a drill point gauge to specifications.

## MW1470 Piping Components

### Learning Outcomes:

- Demonstrate the ability to thread, install and maintain pipes, tubing, valves and fittings.

**Duration:** 30 Hours

**Pre-requisite(s):** MW1460 Measuring and Layout

### Objectives & Content:

1. Identify various types of pipe fittings that are related to the Industrial Mechanic (Millwright) occupation and their uses.
  - i. pressure ratings for valves and fittings
  - ii. pipe fittings and joints
2. Describe procedures to cut, thread and assemble pipe and tubing.
  - i. pipe sizing methods
  - ii. pipe hangers and supports
  - iii. cutting, reaming and threading pipe
  - iv. cutting fluids
  - v. pipe thread sealants
  - vi. tubing and tube fittings
3. Identify various types and uses of valves.
  - i. identification of codes on valves and fittings
  - ii. gate valves
  - iii. globe valves
  - iv. check valves
  - v. needle valves
  - vi. relief valves
  - vii. steam traps purpose
  - viii. steam separators
  - ix. low pressure steam control valve
  - x. ball valve

- xii. butterfly
  - xiii. diaphragm valves
  - xiv. wing valves
  - xv. disk valves
4. Describe procedures to maintain valves.
- i. gate valves
  - ii. globe valves
  - iii. check valves
  - iv. needle valves
  - v. relief valves
  - vi. steam traps
  - vii. steam separators
  - viii. low pressure steam control valve
  - ix. ball valves
  - x. butterfly valves
  - xi. bypass valves
5. Describe electrolysis.
6. Describe the detrimental effect of electrolysis on piping.
- i. dissimilar piping
  - ii. incompatible pipe hanger
  - iii. underground installations of liquid and gas lines

**Practical Requirements:**

- 1. Fabricate a screwed piping project as per instructor's directives.
- 2. Repack a valve.
- 3. Cut, thread by hand and by machines.
- 4. Complete a flared tubing project.
- 5. Assemble and disassemble valves.



## MW1511 Power Metal Saws

### Learning Outcomes:

- Demonstrate the ability to cut metal with band, reciprocating and abrasive wheel cut off saws.
- Demonstrate the ability to maintain power metal saws.

**Duration:** 15 Hours

**Pre-requisite(s):** MW1460 Measuring and Layout

### Objectives and Content:

1. Describe the procedures used to cut metal with a band saw.
  - i. methods of cutting off material
  - ii. saw types and operation
  - iii. speeds and feeds
  - iv. contour saw operations
  
2. Describe the procedures used to select the proper band saw blade for a specific task.
  - i. saw blade classification
  - ii. speeds and feeds
  - iii. set
  - iv. blade pattern
  - v. pitch
  - vi. tooth form
  - vii. width and gauge
  - viii. blade length calculations
  - ix. blade installation
  
3. Describe the procedures used to weld band saw blades.
  - i. blade preparation
  - ii. machine settings
  - iii. annealing

4. Describe the procedures used to cut metal with a reciprocating saw.
  - i. blade classification
  - ii. blade installation
  
5. Describe the procedures used to cut metal with an abrasive wheel cut off saw.
  - i. theory of operation
  - ii. wheel selection
  - iii. safety hazard
  
6. Describe maintenance procedures for power metal saws.
  - i. lubrication methods
  - ii. coolant systems

**Practical Requirements:**

1. Cut metal with a band saw and/or cut metal with a reciprocating saw.
2. Cut metal with an abrasive wheel cut off saw.
3. Weld band saw blade.
4. Layout and use a contour saw to complete a project as assigned by the instructor.

## MW1521 Pedestal Grinders

### Learning Outcomes:

- Demonstrate the ability to operate and maintain pedestal grinders in a safe, efficient and responsible manner.

**Duration:** 15 Hours

**Pre-requisite(s):** MW1511 Power Metal Saws

### Objectives and Content:

1. Describe the procedures used to select the proper type of wheel to grind a specific metal.
  - i. theory of operation of pedestal grinders
  - ii. abrasive types
  - iii. bonds
  - iv. coarse and fine wheels
  - v. hard and soft wheels
  - vi. mounted grinding wheels
  - vii. rotary files and burrs
2. Describe the procedures used to change, mount and dress wheels on a pedestal grinder.
  - i. safe dismantling procedures
  - ii. blotters and flanges and their purpose
  - iii. ring test
  - iv. safe operating speeds for wheels
  - v. dressing tools and their purpose
  - vi. adjustment of tool rest
3. Identify the code systems found on grinding wheels.
4. Describe the techniques used to sharpen different tools.
  - i. techniques for grinding chisels, twist drills and punches

**Practical Requirements:**

1. Inspect, dress and true a grinding wheel.
2. Sharpen a cold chisel.
3. Sharpen a twist drill.
4. Dismantle and replace a grinding wheel.

## MW1530 Bearings

### Learning Outcomes:

- Demonstrate the ability to select, install, remove and maintain bearings.
- Demonstrate an understanding of the purpose of different types of bearings and their proper uses.
- Demonstrate the ability to determine the proper clearance and fits for bearings.

**Duration:** 40 Hours

**Pre-requisite(s):** MW1580 Bearings

### Objectives and Content:

1. Identify the classification, uses, styles and purpose of friction bearings.
  - i. bearing housings
  - ii. dimensions of friction bearings
  - iii. styles of friction bearings
  - iv. joint design
  - v. liner materials
    - metallic and non-metallic liner material
    - babbitt
  - vi. keys
  - vii. mandrels
  - viii. pouring babbitt
  - ix. preformed liners
  - x. bushings
  - xi. thrust control
  - xii. Kingsbury thrust bearings
  - xiii. guide bearings
2. Describe friction bearing clearances and fits.
  - i. fitting process for contact
  - ii. chamfering, relieving and oil grooves
  - iii. clearance in a bearing
  - iv. shims

3. Describe the different types of anti-friction bearings (rolling elements) and their applications.
  - i. basic parts of a bearing
  - ii. common bearing types
  - iii. rolling elements
  - iv. shielded and sealed bearings
  - v. types of load for bearings
  - vi. service weight of a bearing
  - vii. separable and non-separable bearings
  - viii. non-aligning and self-aligning bearings
  - ix. straight and tapered bore bearings
  
4. Describe the numbering and lettering in the bearing code.
  - i. information supplied in the code
  - ii. four and five figure codes and their meanings
  - iii. code prefixes and suffixes and their meaning
  - iv. codes for tapered bore bearings
  - v. definition of bearing clearance terms
  
5. Describe the procedures to remove and install anti-friction bearings.
  - i. shaft and housing checks
  - ii. push fit
  - iii. creep
  - iv. interference fit
  - v. examples of fits and clearances
  - vi. press fits
  - vii. procedures for pressing bearings on shafts
  - viii. shrink fits
  - ix. methods of heating and chilling a bearing
  - x. installing a hot bearing
  - xi. installing bearing outer rings in split or bored housings
  - xii. axial positioning
  - xiii. positive positioning of the inner race
  - xiv. positive positioning of the outer race
  - xv. floating and fixed bearings
  - xvi. methods of thrust adjustment
  - xvii. arrangement of angular contact bearings
  - xviii. mounting spherical roller bearings
  - xix. non-destructive bearing removal methods
  - xx. withdrawal sleeves

- xxi. adapter sleeves
  - xxii. destructive bearing removal methods
  - xxiii. hydraulic removal procedures
  - xxiv. pillow block installation and removal methods
  - xxv. mounting flange, needle and thrust bearings
6. Describe maintenance procedures for anti-friction bearings.
- i. keeping bearings clean
  - ii. cleaning bearings
  - iii. storing bearings
  - iv. preventing contamination
  - v. checking for bearing wear
  - vi. checking for bearing failure
  - vii. choosing correct lubrication
  - viii. cooper split bearings

**Practical Requirements:**

- 1. Remove and install an anti-friction bearing.
- 2. Check a friction bearing for clearance.
- 3. Check a surface contact using machine blue.
- 4. Install and remove a taper bore bearing with taper lock.

## MW1541 Fasteners

### Learning Outcomes:

- Demonstrate the ability to select and install fastening devices.

**Duration:** 9 Hours

**Pre-requisite(s):** MS1230 Hand Tools

### Objectives and Content:

1. Describe the types, sizes, classification and uses of threaded and non-threaded fastening devices.
  - i. purpose of threads
  - ii. screw thread terms and systems
  - iii. thread designation
  - iv. thread series
  - v. thread size
  - vi. thread measurement
  - vii. right and left hand threads
  - viii. nuts, bolts, cap screws and machine screws
  - ix. multiple threads keys
  - x. keyways
  - xi. splines
  - xii. class of fit
  - xiii. flat washers
  - xiv. lock washer styles and application
  - xv. lock nuts
2. Describe the procedures used to select the proper fastening device for use in metal, wood and concrete.
  - i. wood screw classification
  - ii. sheet metal screws
  - iii. self-drilling screws
  - iv. rivets
  - v. taper pins
  - vi. cotter pins



- vii. dowel pins
  - viii. shear pins
  - ix. spring pins
  - x. clevis pins
  - xi. spring locking pins
  - xii. toggle bolt styles
  - xiii. expansion shields
  - xiv. concrete anchor types
  - xv. reasons for failure during installation
  - xvi. thread adhesives
3. Describe the procedures used to identify the grade of cap screws and nuts.
- i. classification methods for fasteners
  - ii. tensile strength
  - iii. grade markings
4. Describe the installation procedure for various fastening devices.
- i. threaded and non-threaded fasteners
  - ii. hammer drill use
  - iii. pop rivet installation
  - iv. thread inserts
  - v. broken stud removal methods
  - vi. preloading fasteners
  - vii. lock wires
  - viii. resins
5. Describe the procedure to torque fastening devices to specifications.
- i. definition and purpose of torque
  - ii. torque wrenches
  - iii. torque multipliers
  - iv. torque charts
  - v. wet and dry torque
  - vi. proper sequence

**Practical Requirements:**

1. Install various fastening devices
  - i. threaded and non-threaded fasteners
  - ii. hammer drill
  - iii. pop rivet tools
2. Torque fastening devices as per instructor's directives.
3. Install fasteners using a powder (explosive actuated) actuated tool.

## MW1550 Metallurgy

### Learning Outcomes:

- Demonstrate an understanding of basic metallurgy principles.

**Duration:** 30 Hours

**Pre-requisite(s):** WD1330 Oxy-fuel Welding

### Objectives and Content:

1. Identify and describe the various properties of metals.
  - i. chemical, physical and mechanical properties
  - ii. brittleness, ductility, elasticity, hardness, malleability, tensile strength and toughness
2. Identify the classification of steel and describe the numbering system for steel.
  - i. hot rolled and cold rolled steel
  - ii. alloy steels
  - iii. plain, medium and high carbon steels
  - iv. Identifying steel using the SAE and ANSI classification systems
3. Define heat treatment terms.
  - i. definition of heat treatment
  - ii. upper and lower critical temperature
  - iii. critical range
  - iv. hardening
  - v. tempering
  - vi. annealing
  - vii. normalizing
  - viii. case hardening
  - ix. induction hardening
  - x. flame hardening
4. Describe the properties and uses of various non-ferrous metals.
  - i. definition of non-ferrous metals
  - ii. aluminum

- iii. copper and copper base alloys
  - iv. lead and lead based alloys
  - v. tin and tin alloys
  - vi. zinc
  - vii. leaded bronzes
  - viii. Babbitt
  - ix. magnesium
5. Define terms and describe methods and procedures used in hardness testing.
- i. definition of hardness
  - ii. Rockwell Hardness Tester
  - iii. Brinnell Hardness Tester
  - iv. conversion charts
6. Identify structural steel shapes and how they are sized.
- i. angle iron
  - ii. flat bar
  - iii. channel
  - iv. I beam
  - v. H beam
  - vi. structural tubing
  - vii. sheet stock
  - viii. expanded metal
  - ix. perforated metal
  - x. checker plate

**Practical Requirements:**

- 1. Fabricate, heat treat and sharpen a cold chisel as per instructor s directives.
- 2. Perform a hardness test.
- 3. Perform a spark test analysis.

## MW1580 Static and Dynamic Seals

### Learning Outcomes:

- Demonstrate the ability to select, install, remove and maintain gaskets, seals and packing.
- Demonstrate an understanding of different types of gaskets, seals and packing and identify their proper use.

**Duration:** 30 Hours

**Pre-requisite(s):** MW1650 Lubrication Practices

### Objectives and Content:

8. Describe hazards and safe work practices pertaining to seals and gaskets.
9. Describe the principles of operation and classification of static and dynamic seals.
  - i. definition of static and dynamic seals
  - ii. using gaskets to seal housings
  - iii. gasket and flange arrangements
  - iv. gasket compression
  - v. O-rings used as gaskets
  - vi. dynamic seals
  - vii. contact and clearance seals
  - viii. packing
  - ix. inside and outside packed installations
  - x. compression packing removal and installation methods
  - xi. lantern rings
  - xii. V-ring packing uses, installation and adjustment procedures
  - xiii. U-ring packing uses, installation procedures
  - xiv. cup packing uses and installation procedures
  - xv. O-rings used as dynamic seals
  - xvi. anti-extrusion rings
  - xvii. piston rings
  - xviii. lip seal
    - inclusion and exclusive

- installation procedures
  - xix. inclusion and exclusion seals
  - xx. lip seal installation procedures
  - xxi. emergency shaft repairs
  - xxii. wipers, boots, bellows and diaphragm seals
  - xxiii. mechanical seal theory of operation
  - xxiv. flushing and quenching mechanical seals
  - xxv. mechanical seal maintenance
  - xxvi. bushings
  - xxvii. annulus, slinger and labyrinth seals
10. Describe the procedures used to select the proper sealant for different applications.
- ii. definition of sealants
  - iii. hardening and non-hardening sealants
  - iv. tapes
11. Describe the procedures used to select the proper gasket material for specific applications.
- ii. requirements of gasket materials
  - iii. metallic and non-metallic gaskets
  - iv. making and installing gaskets
12. Describe the procedures used to inspect, remove, and replace gaskets, seals and packing.

**Practical Requirements:**

8. Make a gasket using gasket material and hand tools.
9. Remove and install
- ii. a mechanical seal
  - iii. static seal
  - iv. dynamic seal
10. Fabricate an O-ring.

## MW1591 Couplings and Clutches

### Learning Outcomes:

- Demonstrate the ability to remove, install and maintain couplings and clutches.
- Demonstrate an understanding of the different types of couplings and clutches and their proper use.

**Duration:** 20 Hours

**Pre-requisite(s):** MW1640 Gear Drive Systems

### Objectives and Content:

1. Describe the theory of operation of various types of couplings and clutches.
  - i. purpose of couplings
  - ii. types of couplings
  - iii. purpose of clutches
  
2. Identify the various types of couplings and explain their application.
  - i. rigid couplings
  - ii. sleeve, flanged, compression and clamp couplings
  - iii. flexible coupling
  - iv. mechanically flexible couplings
  - v. jaw and slider, gear, chain, metallic grid and metallic disc couplings
  - vi. elastomeric couplings
  - vii. jaw, clamped and unclamped doughnut, rubber tire and bushed pin couplings
  - viii. failure of flexible couplings
  - ix. universal joints
  - x. centrifugal couplings
  - xi. clutch style couplings
  - xii. fluid couplings
  - xiii. dry fluid couplings
  - xiv. clutches and brakes
  - xv. mechanical clutches: positive contact, friction, and over-running
  - xvi. disc clutches and brakes
  - xvii. torque limiting clutch

- xviii. drum clutches and brakes
  - xix. cone clutches and brakes
  - xx. over-running clutches
  - xxi. sprag, wrap spring, roller ramp types
  - xxii. electromagnetic clutches and brakes
  - xxiii. actuation methods for clutches and brakes
  - xxiv. mechanical, electrical, pneumatic, hydraulic and self-activating
3. Describe the procedures used to select the proper lubrication for the various clutches and couplings.
- i. types of couplings that require lubrication
  - ii. lubricant choice criteria

**Practical Requirements:**

- 1. Broach a keyway in a hub and fit a key in the keyway.
- 2. Install a coupling or a clutch.



## MW1360 Shafts and Shaft Alignment

### Learning Outcomes:

- Demonstrate knowledge of shafts, their accessories and applications.
- Demonstrate knowledge of the procedures used to remove, install maintain and repair shafts and accessories.
- Demonstrate knowledge of the procedures for shaft alignment.

**Duration:** 20 Hours

**Pre-requisite(s):** MW1591 Couplings and Clutches

### Objectives and Content:

1. Identify the different types of keys and keyways and their purpose.
  - ii. types and purpose of keys
    - parallel keys
    - square and rectangular keys
    - stepped keys
    - saddle keys
    - boxed keys
    - gib headed keys
    - tapered keys
    - woodruff keys
  - iii. ANSI code numbering system for woodruff keys
  - iv. keyseats in shafts
    - parallel and boxed keyseats
  - v. measurement of keyseats and keys
    - woodruff keyseats
  - vi. keyways in attachments
  - vii. tapered key
  - viii. cutting keyseats
    - end mills
    - broach and arbor press
  - ix. installing and fitting keys
  - x. securing keys with adhesives and setscrews
    - types of set screws for various applications

- set screw location
  - xi. types of adhesive
  - xii. removing keys
  
- 2. Describe the specific use of various types of shafts and attachments.
  - ii. terms and definitions relating to shafts
  - iii. types of shafting
  - iv. uses of shafts
  - v. identifying shafting
  - vi. shaft stresses and their sources
  - vii. stress reduction
  - viii. bearing replacement
  - ix. shaft maintenance
    - alignment
    - shaft centres
    - critical speed
    - types of run-out
    - shaft repair methods
  - x. shaft attachment
    - bearings, hubs, couplings and gears
  - xi. installing attachments
  - xii. definition of tolerances and fits
    - types of tolerance
    - types of fit
    - methods of assembly
    - shrink, forced and expansion fitting
  - xiii. assembly and disassembly equipment
    - presses
    - pullers and bearing splitters
  
- 3. Identify the different types of misalignment.
  - i. parallel
  - ii. angular
  - iii. combination
  
- 4. Describe pre-alignment checks.
  
- 5. Describe soft foot.

6. Describe the procedure to align a coupling using a straight edge and feeler gauges.

**Practical Requirements:**

1. Perform alignment using straight edge and feeler gauges.

## MW1610 Belt and Chain Drive Systems

### Learning Outcomes:

- Demonstrate an understanding of the operation of belt and chain drive systems.
- Demonstrate the ability to install and maintain belt and chain drive systems.

**Duration:** 45 Hours

**Pre-requisite(s):** MW1530 Bearings

### Objectives and Content:

1. Describe the principles of operation of belt and chain drive systems.
  - i. belt drive principles
  - ii. area of contact
  - iii. belt and pulley materials
  - iv. definition of installed and effective tension
  - v. methods for checking tension
  - vi. slip and creep in belts
  - vii. v-belt advantages and construction
    - standard, heavy duty and double angle belts
    - straight and concave sidewalls
    - notched belt
    - endless and joined belts
  - viii. pulleys and sheaves
    - diameters and rim speed
  - ix. idler purpose and location
  - x. pulley and sheave hubs
  - xi. determining pulley width
2. Describe the various classifications of belts and chains.
  - i. v-belt types, sizes and codes
    - conventional and high capacity belts
    - light duty and double angle belts
    - wide belts
    - positive drive belts
    - linked belts

- poly belts
    - power band belts
    - matched belts
  - ii. crowned and flanged pulleys
  - iii. V-flat drives
  - iv. variable speed belt drives
    - adjustable and fixed centres
    - sheave action
  - v. chain drive components
    - types of links
    - standard roller chain
    - connecting links
    - offset links
  - vi. definition of roller chain dimensions
    - pitch, width, roller and pin diameter, and link plate thickness
  - vii. roller chain code numbers
    - ANSI code number interpretation
    - ISO code numbers
  - viii. types of roller chain and their application
    - multiple strand chain
    - double pitch chain
    - silent chain
  - ix. sprocket types and their application
    - type A, B, C, and D sprockets
    - sprocket sizing
    - sprockets for double pitch chain
    - single and double cut sprockets
  - x. advantages of roller chain drives
  - xi. drive design
    - shaft centre distances
    - drive and driven sprockets
  - xii. determining proper amounts of chain slack for horizontal and vertical drives
  - xiii. idler sprocket purpose and location
- 3. Describe the procedures used to perform calculations required for the installation and maintenance of belt and chain drive systems.
  - i. approximate and exact belt length calculations
  - ii. arc of contact calculations
  - iii. recommended speed ratios for sheaves and sprockets

- iv. rim speed calculation for belt drives
  - v. chain pitch, width, roller and pin diameter calculations
  - vi. calculating chain length in inches and pitches
  - vii. chain speed calculations
4. Describe the procedures to remove, install and align sheaves and sprockets.
- i. installation and alignment methods
  - ii. belt storage
  - iii. sheaves for V-belts
  - iv. groove angle
  - v. troubleshooting belt drives
  - vi. aligning shafts and sprockets for chain drives
  - vii. roller chain lubrication
    - oil grades
    - lubrication methods
  - viii. chain drive misalignment
  - ix. chain wear due to stretch and pin wear
  - x. sprocket wear
  - xi. causes of excessive slack
  - xii. procedures for roller chain replacement
    - sprocket condition
    - new chain length
    - breaking and joining the chain
  - xiii. troubleshooting tips for chain drives
  - xiv. chain maximum speed

**Practical Requirements:**

1. Remove, install and align v-belts, sheaves and chain, sprockets.

## MW1640 Gear Drive Systems

### Learning Outcomes:

- Demonstrate the ability to calculate correct speeds and feeds.
- Demonstrate the ability to perform repair and maintenance on gear drive units.
- Demonstrate the ability to operate gear drive units.

**Duration:** 50 Hours

**Pre-requisite(s):** MW1610 Belt and Chain Drive Systems

### Objectives and Content:

1. Describe principle of operation of gear drive units.
  - i. purpose of gears
  - ii. gear terminology
    - addendum and dedendum
    - circular pitch and diametral pitch
    - working depth and clearance
  - iii. conditions for gear meshing
  - iv. tooth profile and action
  - v. backlash
  - vi. gear material
  - vii. shaft arrangement
  - viii. gear types
    - internal and external spur gears
    - helical gears
      - single and double helical gears
      - left and right hand gears
      - thrust
    - girth gears
  - ix. bevel and angular and spiral bevel gears
    - mounting distance
  - x. mitre gears
  - xi. hypoid gears
  - xii. worm and worm gears

- non-throated, single and double throated worm and worm gear sets
  - xiii. gear types and shaft arrangements
2. Describe the procedures used to perform gear calculations.
    - i. formulas used for drive system calculations
      - speed of driver or driven
      - calculating for reducer ratio
      - single and compound gear reductions
  3. Describe speed reducers of their various designs, their uses and their operation.
    - i. overdrive and reduction units
      - PIV drives
      - worm gear reduction units
        - internal parts and their purpose
        - shimming for bearing clearance
        - fitting for proper mesh
        - single and multiple reduction and recommended speed ranges for each
      - helical and herringbone reducers
        - fitting
      - planetary gear reduction units
        - sun gears, ring gear and carrier
      - installing and maintaining drive units
      - lubrication methods used in reducers
  4. Describe the procedures used to commission gear drives.

### **Practical Requirements:**

1. Dismantle, inspect and reassemble speed reducers to specifications.



## MW1650 Lubrication Practices

### Learning Outcomes:

- Demonstrate the ability to select the proper lubricant and lubrication methods and apply proper lubricants where required.

**Duration:** 20 Hours

**Pre-requisite(s):** MS1230 Hand Tools

### Objectives and Content:

1. Identify the purpose and use of lubricants.
  - i. sliding, rolling and fluid friction
2. Define lubrication related terminology.
  - i. boundary and full film lubrication
  - ii. hydraulic lock
3. Describe various lubrication systems.
  - i. once through lubricating systems
  - ii. enclosed lubricating systems
    - ring oiler lubrication
    - splash lubrication
    - oil bath lubrication
    - recirculating lubrication
    - pressurized system
    - oil mist lubrication
  - iii. visual oil quality checks
  - iv. pour point and flash point
4. Describe different properties of lubricants.
  - i. adhesion and cohesion
  - ii. oiliness
  - iii. viscosity and its effects on lubrication
  - iv. viscosity measurement
  - v. viscosity index

- vi. oil wedge theory of lubrication
  - vii. additives and inhibitors
    - air, water and load capacity control
  - viii. properties of grease
  - ix. grease types
    - simple, mixed and complex soap greases
    - extreme pressure grease
  - x. penetration numbers for grease
  - xi. dropping point
  - xii. grease lubricating systems
    - hand packing bearings
    - greasing with a grease gun
    - greasing with a spring compression cup
    - automatic lubricators
    - lubricating open and enclosed gears
  - xiii. oil and grease comparison
  - xiv. cutting oils
  - xv. safe storage handling and disposal of lubricants
5. Identify the classifications of lubricants and their specific uses.
6. Describe the procedures used to select the proper lubricant for specific applications.
- i. technical manuals
  - ii. manufacturers specifications

**Practical Requirements:**

- 1. Apply the proper lubricant for a specific application.
- 2. Repack a bearing.
- 3. Drain and refill an oil reservoir according to manufacturer's specifications.

## MW1670 Non-Positive Displacement Pumps

### Learning Outcomes:

- Demonstrate the ability to inspect, maintain, repair and assemble non-positive displacement pumps.

**Duration:** 40 Hours

**Pre-requisite(s):** MW1591 Coupling and Clutches

### Objectives and Content:

1. Identify and describe the parts of dynamic pumps and their purpose.
  - i. casing styles
  - ii. impeller styles
  - iii. stuffing box
  - iv. packing
  - v. mechanical seals
  - vi. shaft sleeves
  - vii. packing glands
  - viii. wear rings and plates
  - ix. suction strainer
2. Describe the principles of operation of centrifugal pumps.
  - i. non-positive displacement pump theory
  - ii. pump types and their use
  - iii. centrifugal and axial flow
  - iv. terms and definitions
  - v. volute and diffuser pumps
  - vi. multi-stage pumps and their purpose
3. Identify the different terms associated with the operation of the pump.
  - i. pump head
  - ii. suction head
  - iii. suction lift
  - iv. velocity head
  - v. internal and external sealing

- vi. slip
  - vii. displacement
  - viii. pump speed (rpm)
  - ix. pump capacity
  - x. outlet pressure
  - xi. discharge head
  - xii. total static head
  - xiii. operating life
4. Describe the procedures used to troubleshoot and correct problems encountered with pumps.
- i. vapour binding
  - ii. cavitation
  - iii. failure to deliver product
  - iv. reduced capacity or pressure
  - v. pump vibration
  - vi. casing wear/damage
  - vii. excessive packing wear
  - viii. over speeding
  - ix. storage requirements
  - x. start-up and shut-down procedures
5. Describe procedures to disassemble, inspect, repair and reassemble centrifugal pumps.
- i. pump isolation and lock out
  - ii. pump casings
  - iii. impeller design and mounting
  - iv. wear rings and plates
  - v. hydraulic balancing devices
  - vi. seals and packing
  - vii. bearings

### **Practical Requirements:**

1. Disassemble, inspect, repair and reassemble centrifugal pumps.

## MW1690 Positive Displacement Pumps

### Learning Outcomes:

- Demonstrate the ability to inspect, maintain, repair, and assemble positive displacement pumps.

**Duration:** 50 Hours

**Pre-requisite(s):** MW1670 Non-Positive Displacement Pumps

### Objectives and Content:

1. Describe the principles of operation of a positive displacement pump.
  - i. theory of operation of positive displacement pumps
  - ii. classification and uses of positive displacement pumps
  - iii. volumetric efficiency
  - iv. positive displacement
  - v. variable displacement
  - vi. pressure, volume, velocity
  - vii. pressure compensation
  - viii. valve operation
  - ix. determine capacity
  
2. Describe the different types of positive displacement pumps.
  - i. plunger and piston pumps
  - ii. diaphragm pumps
  - iii. metering pumps
  - iv. rotary pumps
  - v. axial and radial piston pumps
  - vi. gear and vane pumps
  - vii. cavitation
  - viii. pump calibration
  - ix. storage requirements
  - x. gear backlash

3. Identify safety precautions when working with positive displacement pumps.
  - i. achieve zero energy state
  - ii. pressure relief valves
  - iii. accumulators
  
4. Identify parts of the pump and state their purpose.
  - i. packing and seals
  
5. Describe the procedures used to troubleshoot and repair common positive displacement pumps.
  - ii. external leakage
  - iii. pressure and flow loss
  - iv. noisy pump operation
  - v. describe start up and shut down procedures
    - checking for rotation
    - priming
    - checking for proper operating temperature
    - draining before maintenance
  
6. Describe the procedures used to maintain positive displacement pumps.
  - i. dismantling procedures
  - ii. visual inspection
  - iii. packing procedures

**Practical Requirements:**

1. Disassemble, inspect, reassemble and align positive displacement pumps.
2. Troubleshoot problems with positive displacement pumps.

## MW1730 Electrical Fundamentals

### Learning Outcomes:

- Demonstrate an understanding of basic electrical principles.
- Demonstrate an understanding of basic PLC s (Programmable Logic Controllers).
- Demonstrate an understanding of the Provincial Public Safety Act as it relates to electrical work.

**Duration:** 30 Hours

**Pre-requisite(s):** MW2150 Hydraulics I

### Objectives and Content:

1. Define electron theory, Ohms Law and associated formulae.
2. Define electrical terminology.
  - i. cycle
  - ii. hertz
  - iii. wattage
  - iv. AC voltage
  - v. AC current
  - vi. ampere
  - vii. resistance
  - viii. ohm
  - ix. DC voltage
  - x. DC current
  - xi. Circuits
    - series
    - parallel
    - series parallel
3. Describe the characteristics of conductors and insulators and their applications.
4. Describe the causes of excessive current.
5. Describe overload protection circuits.

6. Describe the procedures used for troubleshooting and repair of electric motors.
7. Describe procedures to follow when using a multi meter.
8. Describe and identify basic PLC's.
  - i. introduction to PLC's
  - ii. fundamentals

**Practical Requirements:**

1. Write a synopsis of the Public Safety Act as it relates to electrical work.



## MW2150 Hydraulics I

### Learning Outcomes:

- Demonstrate an understanding of basic hydraulic principles of operation and hydraulic formulae.
- Demonstrate the ability to identify components, parts and accessories.

**Duration:** 30 Hours

**Pre-requisite(s):** MW1690 Positive Displacement Pumps

### Objectives and Content:

1. Describe Pascal's Law as it applies to hydraulics.
  - i. pressure
  - ii. force
  - iii. area
  - iv. work and power
  - v. horsepower and torque
2. Describe Bernoulli's Principle as it applies to hydraulics.
  - i. velocity
  - ii. pressure drop and flow
3. Describe the procedures used to solve problems using hydraulic formulas.
  - i. force, pressure and area formula
  - ii. cylinder rod speed formula
  - iii. sizing hydraulic reservoirs
  - iv. mechanical advantage
4. Identify the basic components used to make up a hydraulic system.
5. Describe the operation of various components used in hydraulic systems and safety considerations that would apply to them.
  - i. reservoirs
  - ii. hydraulic fluid
  - iii. piping and sealing

- iv. pumps
- v. cylinders
- vi. filters and strainers
- vii. motors
- viii. accumulators
- ix. intensifiers
- x. pressure switches
- xi. hydraulic hose and fittings
- xii. pipe and tubing
- xiii. solenoids
- xiv. cavitation
- xv. deceleration valves
- xvi. relief valves
- xvii. schematics
- xviii. poppet valves
- xix. gauges and flow meters
- xx. counterbalance valves
- xxi. heat exchangers
- xxii. flow control valves
- xxiii. actuator rods and pistons
- xxiv. sequence valves

**Practical Requirements:**

1. Build a simple hydraulic circuit as per instructors' specifications.

## WD1330 Oxy-Fuel Welding

### Learning Outcomes:

- Demonstrate the ability to operate oxy-fuel equipment to cut metals, perform basic welding procedures, and perform basic brazing and soldering procedures.

**Duration:** 30 Hours

**Pre-requisite(s):** MS1230 Hand Tools

### Objectives and Content:

1. Describe the purpose of various safety devices and the precautions to follow when using oxy-fuel equipment.
  - i. safety
    - transportation of oxy-fuel equipment
    - handling and storage
    - operating pressure
  - ii. regulators and gauges (single stage and two stage)
  - iii. fusible plugs
  - iv. flashback arresters
  - v. properties of oxygen and fuel
2. Describe proper procedures to set up oxy-fuel equipment.
  - i. regulator installation
    - left and right hand threads
    - hazards of oil or grease in contact with oxy-fuel equipment
  - ii. different gases
  - iii. securing cylinders
  - iv. proper order of operations when opening cylinder valves
  - v. proper regulator adjustment
3. Describe the procedures used to select the proper tips for various cutting and welding jobs on different metals.
  - i. numbering system for tips
  - ii. heating tips

4. Describe the procedures used to perform basic burning operations using oxy-fuel equipment.
  - i. safety hazards present when using oxy-fuel equipment
  - ii. check torch valves and regulator pressure screws
  - iii. open cylinder valves and adjust regulator pressures
  - iv. checking for leaks
  - v. torch lighting procedures
  - vi. types of oxy-acetylene flames and their purpose
    - proper torch use
5. Describe brazing techniques.
  - i. brazing rods
  - ii. purpose of fluxes and pastes
6. Describe soldering techniques.
  - i. soft solder
  - ii. purpose of fluxes and pastes
7. Describe procedures for cutting metal with oxy-fuel equipment.
8. Describe procedures to prepare a hot work permit.

**Practical Requirements:**

1. Properly set up oxy-acetylene equipment for the purpose of cutting metal.
2. Perform cutting operations and shut down equipment.
3. Solder a cap on the end of a copper pipe.
4. Braze a lap joint.
5. Prepare a hot work permit.

## OT1190 Workplace Exposure

### **Learning Outcomes:**

- Demonstrate knowledge of theory and practical application of trade skills, safe work practices, appropriate workplace behaviour, and time management through exposure to the trade in an authentic work environment.

NOTE: The pre-apprentice must be supervised at the workplace. Supervision staff must be appropriately qualified to undertake that role – preferably a certified Journeyman for the trade.

**Duration:** 90 Hours

**Pre-requisite(s):** None

## AP1101 Introduction to Apprenticeship

### Learning Outcomes:

- Demonstrate knowledge of how to become a registered apprentice.
- Demonstrate knowledge of the steps to complete an apprenticeship program.
- Demonstrate knowledge of various stakeholders in the apprenticeship process.
- Demonstrate knowledge of the Red Seal Program.

**Duration:** 15 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

1. Define the following terms:
  - i. apprenticeship
  - ii. apprentice vs. registered apprentice
  - iii. Journeyperson vs. Certified Journeyperson
  - iv. Certificate of Apprenticeship
  - v. Certificate of Qualification
  - vi. Recognition of Prior Learning
  - vii. dual certification
  
2. Explain the apprenticeship system in Newfoundland and Labrador and the roles and responsibilities of those involved.
  - i. registered apprentice
  - ii. training institution
  - iii. employer
  - iv. Journeyperson
  - v. Department of Advanced Education and Skills
    - Industrial Training Section
    - Standards and Curriculum Section
  - vi. Provincial Trade Advisory Committees
  - vii. Provincial Apprenticeship and Certification Board

3. Identify the Conditions Governing Apprenticeship.
4. Describe the training and educational requirements.
  - i. pre-employment (entry level) training
  - ii. block release
  - iii. on-the-job
5. Explain the steps in the registered apprenticeship process.
  - i. criteria for eligibility
    - entrance requirements as per Conditions of Apprenticeship
    - employment
  - ii. registration process
    - application requirements
  - iii. Memorandum of Understanding
    - probation period
    - cancellation
  - iv. Record of Occupational Progress (Logbook)
    - signing off skills
    - recording hours
    - updating PDO on progress
  - v. class calls
    - schedule
    - EI Eligibility
    - Direct Entry
    - advanced level
  - vi. Block Exams
  - vii. progression
    - schedule
    - wage rates
  - viii. cancellation of apprenticeship
  - ix. Practical Examinations
  - x. Provincial and Interprovincial examinations
  - xi. certification
    - Certification of Apprenticeship
    - Certification of Qualification
    - Provincial certification
    - Interprovincial Red Seal endorsement

6. Explain the Interprovincial Standards Red Seal Program.
  - i. designated Red Seal trade
  - ii. the National Occupational Analysis (NOA)
  - iii. Interprovincial (IP) Red Seal Endorsement Examination
  - iv. relationship of NOA to IP Examination
  - v. qualification recognition and mobility
7. Identify the current financial incentives available to apprentices.
8. Explain the NL apprenticeship and trades certification division's out-of- province apprenticeship policy.

**Practical Requirements:**

1. Use the Provincial Apprenticeship and Trades Certification web site at [www.gov.nl.ca/app](http://www.gov.nl.ca/app) to:
  - i. locate, download, and complete the Application for Apprenticeship and Memorandum of Understanding (MOU)
  - ii. locate, download, and complete the Out of Province registration forms
    - Application for Apprenticeship (out of province)
    - Letter of Understanding (LOU)
    - Acceptance of Conditions Letter
  - iii. locate, download, and complete the Work Experience Credits form
  - iv. identify the locations of all Industrial Training offices
  - v. locate and review the following learning resources relevant to the trade:
    - Study Guide
    - Exam Preparation Guide
    - Plan of Training
2. Use a logbook for this trade to:
  - i. identify the hours for the trade (in-school and on-the-job)
  - ii. identify the number of blocks
  - iii. identify the courses in each block
  - iv. identify the workplace skills to be completed and verified



3. Use the Red Seal Web site, <http://www.red-seal.ca> to retrieve the National Occupational Analyses (NOA) for this trade.
  - i. identify the following components of the NOA:
    - Trends
    - Scope
    - Key Competencies
    - Blocks
    - Tasks
    - Subtasks
    - Pie Charts
    - Table of Specifications

## AM1100 Math Essentials

Note: It is recommended that AM1100 be delivered in the first semester of the Entry Level training program.

### Learning Outcomes:

- Demonstrate knowledge of the numeracy skills required to begin the 2<sup>nd</sup> level math course.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Demonstrate knowledge of mathematical principles in trade problem solving situations.
- Demonstrate the ability to solve simple mathematical word problems.

**Duration:** 30 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

*Wherever possible, the instructor should use trade specific examples to reinforce the course objectives*

1. Use multiplication tables from memory.
2. Perform whole number operations.
  - i. read, write, count, round off, add, subtract, multiply and divide whole numbers
3. Apply the order of operations in math problems.
4. Perform fraction and mixed number operations.
  - i. read, write, add, subtract, multiply and divide fractions

5. Perform decimal operations.
  - i. read, write, round off, add, subtract, multiply and divide decimals
6. Perform percent/decimal/fraction conversion and comparison.
  - i. convert between fractions, decimals and percentages
7. Perform percentage operations.
  - i. read and write percentages
  - ii. calculate base, rates and percentages
8. Perform ratio and proportion operations.
  - i. use a ratio comparing two quantities with the same units
  - ii. use a proportion comparing two ratios
9. Use the imperial measurement system in math problems.
  - i. identify units of measurement for:
    - length
    - mass
    - area
    - volume
    - capacity
10. Use the metric measurement system in math problems.
  - i. identify units of measurement for:
    - length
    - mass
    - area
    - volume
    - capacity

**Practical Requirements:**

1. To emphasize or further develop specific knowledge objectives, students will be asked to complete practical demonstrations which confirm proper application of mathematical theory to job skills.

## AM1180 Industrial Math Fundamentals

### Learning Outcomes:

- Demonstrate knowledge of mathematical concepts in the performance of trade practices.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Demonstrate knowledge of solving mathematical word problems.
- Demonstrate knowledge of mathematical principles for the purposes of problem solving, job and materials estimation, measurement, calculation, system conversion, diagram interpretation and scale conversions, formulae calculations, and geometric applications.

**Duration:** 30 Hours

**Pre-Requisite(s):** AM1100

### Objectives and Content:

*The instructor is required to use trade specific examples to reinforce the course objectives.*

1. Employ percent/decimal/fraction conversion and comparison in trade specific situations.
2. Apply ratios and proportions to trade specific problems.
3. Use the Imperial Measurement system in trade specific applications.
4. Use the Metric Measurement system in trade specific applications.
5. Complete Imperial/Metric conversions in trade specific situations.
  - i. convert between imperial and metric measurements
  - ii. convert to another unit within the same measurement system

6. Manipulate formulas using cross multiplication, dividing throughout, elimination, and substitution to solve trade specific problems, such as:
  - i. right angle triangles
  - ii. area
  - iii. volume
  - iv. perimeter
  
7. Perform calculations involving geometry that are relevant to the trade, such as:
  - i. angle calculations
  - ii. circle calculations
  
8. Use practical math skills to complete administrative trade tasks.
  - i. material estimation
  - ii. material costing
  - iii. time & labour estimates
  - iv. taxes & surcharges
  - v. markup & projecting revenue

**Practical Requirements:**

1. To emphasize or further develop specific knowledge objectives, students will be asked to complete practical demonstrations which confirm proper application of mathematical theory to job skills.

Note:

This course has been designated as NON-TRANSFERABLE to other trades programs, and NOT ELIGIBLE FOR PRIOR LEARNING ASSESSMENT. Students completing training in this trade program are required to complete this math course.

## CM2160 Communication Essentials

### Learning Outcomes:

- Demonstrate knowledge of the importance of well-developed writing skills in the workplace and in career development.
- Demonstrate knowledge of the purpose of various types of workplace correspondence.
- Demonstrate knowledge of the principles of effective workplace writing.
- Demonstrate knowledge of standard formats for letters and memos.
- Demonstrate knowledge of principles related to writing effective letters and memos.
- Demonstrate the ability to prepare and deliver an oral presentation.
- Demonstrate knowledge of the importance of effective interpersonal skills in the workplace.

**Duration:** 45 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

*Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.*

1. Identify the principles for writing clear, concise, complete sentences and paragraphs which adhere to the conventions of grammar, punctuation, and mechanics.
2. Identify the principles of effective workplace writing.
  - i. describe the value of well-developed writing skills to career success
  - ii. discuss the importance of tone, and language or word choice in workplace communication, regardless of the circumstances
  - iii. demonstrate an awareness of cultural differences when preparing workplace correspondence
  - iv. describe the writing process as it applies to workplace communication
    - planning
    - writing

- editing/revising
  - v. identify the parts of a business letter and memo, and when each should be used in the workplace
  - vi. identify the standard formats for business letters and memos
  - vii. identify guidelines for writing sample letters and memos which convey:
    - acknowledgment
    - routine request
    - routine response
    - complaint
    - refusal
    - persuasive request
    - letters of appeal
- 3. Identify types of informal workplace documents.
  - i. identify types & purposes of reports
    - incident
    - process
    - progress
  - ii. identify common trade specific forms
  - iii. describe primary and secondary methods used to gather information
  - iv. discuss the importance of accuracy and completeness in reports and forms
- 4. Identify the elements of presentations used in the workplace.
  - i. identify presentation types
    - impromptu
    - informative
    - demonstration
    - persuasive
  - ii. identify the components of an effective presentation
    - eye contact
    - body language
    - vocal qualities
    - audience analysis
    - multimedia tools
    - keeping on topic

5. Demonstrate an understanding of interpersonal communications in the workplace.
  - i. identify listening techniques
  - ii. demonstrate an understanding of group dynamics
  - iii. describe the importance of contributing information and expertise in the workplace
  - iv. describe the importance of respectful and open communication in the workplace
  - v. identify methods to accept and provide feedback in a constructive and considerate manner
  - vi. explain the role of conflict in a group to reach solutions
  
6. Identify acceptable workplace uses of communication technologies.
  - i. cell / Smart Phone etiquette
  - ii. voice mail
  - iii. e-mail
  - iv. teleconferencing / videoconferencing for meetings and interviews
  - v. social networking
  - vi. other emerging technologies

**Practical Requirements:**

1. Write well-developed, coherent, unified paragraphs.
2. Write sample letters and memos.
3. Write one short informal report.
4. Complete a selection of at least 3 trade-related forms.
5. Deliver an effective oral presentation.



## SD1760 Workplace Essentials

Note: It is recommended that SD1760 be delivered in the second half of the Entry Level training program.

### Learning Outcomes:

- Demonstrate knowledge of workplace essentials in the areas of meetings, unions, workers compensation, workers' rights, and human rights.
- Demonstrate knowledge of good customer service practices.
- Demonstrate knowledge of effective job search techniques.

**Duration:** 45 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

*Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.*

1. Identify common practices related to workplace meetings.
  - i. identify and discuss meeting format and preparation required for a meeting
  - ii. explain the purpose of an agenda
  - iii. explain the expected roles, responsibilities, and etiquette of meeting participants
  
2. Define unions and identify their role in the workplace.
  - i. identify the purpose of unions
  - ii. identify a common union structure
  - iii. identify the function of unions in this trade

3. Demonstrate an understanding of the Worker’s Compensation process.
  - i. describe the aims, objectives, regulations and benefits of the Workplace Health, Safety and Compensation Commission
  - ii. explain the role of the Workers Advisor
  - iii. explain the internal review process
  
4. Demonstrate an understanding of workers’ rights.
  - i. define labour standards
  - ii. identify regulations, including:
    - hours of work & overtime
    - termination of employment
    - minimum wages & allowable deductions
    - statutory holidays, vacation time, and vacation pay
  
5. Demonstrate an understanding of Human Rights issues.
  - i. examine the Human Rights Code and explain the role of the Human Rights Commission
  - ii. define harassment in various forms and identify strategies for prevention
    - direct
    - systemic
    - adverse effect
  - iii. identify gender and stereotyping issues in the workplace
  - iv. define basic concepts and terms related to workplace diversity including age, race, culture, religion, socio-economic status, and sexual orientation
  
6. Demonstrate an understanding of quality customer service.
  - i. explain why quality service is important
  - ii. identify barriers to quality customer service
  - iii. identify customer needs & common methods for meeting them
  - iv. identify and discuss the characteristics & importance of a positive attitude
  - v. identify the importance of demonstrating good communication skills including body language, listening, questioning, and when using electronic communication devices
  - vi. identify techniques for interacting with challenging customers to address complaints and resolve conflict

7. Demonstrate an understanding of effective job search techniques.
  - i. identify and explain employment trends, opportunities, and sources of employment
  - ii. identify and discuss essential skills for the trades as outlined by Human Resources and Skills Development Canada
  - iii. review job ads and identify the importance of fitting qualifications to job requirements
  - iv. identify the characteristics of effective resumes, the types of resumes, and principles of resume formatting
  - v. identify the characteristics of an effective cover letter
  - vi. identify the components of a portfolio, and discuss the value of establishing and maintaining a personal portfolio
  - vii. identify the common characteristics of the job interview process:
    - pre-interview preparation
    - interview conduct
    - post-interview follow up

**Practical Requirements:**

1. Create a resume.
2. Create a cover letter.
3. Participate in a mock job interview.

## MC1060 Computer Essentials

### Learning Outcomes:

- Demonstrate knowledge of computer systems and their operation.
- Demonstrate knowledge of popular software packages and their applications.
- Demonstrate knowledge of security issues related to computers.

**Duration:** 15 Hours

**Pre-Requisite(s):** None

### Objectives and Content:

*Wherever possible, the instructor is expected to use trade specific examples to reinforce the course objectives.*

1. Identify the major external components of a microcomputer system.
  - i. input devices
  - ii. output devices
  - iii. central control unit
  
2. Use operating system software.
  - i. start and quit a program
  - ii. use the help function
  - iii. use the find function
  - iv. maximize and minimize a window
  - v. use the task bar
  - vi. adjust desktop settings such as screen savers, screen resolution, and backgrounds
  - vii. shut down a computer

3. Perform file management commands.
  - i. create folders
  - ii. copy files and folders
  - iii. move files and folders
  - iv. rename files and folders
  - v. delete files and folders
  
4. Use word processing software to create documents.
  - i. enter text
  - ii. indent and tab text
  - iii. change text attributes (bold, underline, font, etc.)
  - iv. change layout format (margins, alignment, line spacing)
  - v. spell check and proofread
  - vi. edit text
  - vii. save document
  - viii. print document
  - ix. close document
  - x. retrieve documents
  
5. Use spreadsheet software to create spreadsheets.
  - i. enter data in cells
  - ii. create formulas to add, subtract, multiply and divide
  - iii. save spreadsheet
  - iv. print spreadsheet
  - v. close spreadsheet
  - vi. retrieve spreadsheet
  
6. Access the Internet.
  - i. access websites using the world wide web(www)
  - ii. identify examples of web browsers
  - iii. use search engines with common searching techniques
  - iv. describe security issues

7. Use electronic mail.
  - i. describe e-mail etiquette
    - grammar and punctuation
    - privacy and legal issues when sharing and forwarding e-mail
    - work appropriate content
    - awareness of employer policies
  - ii. manage e-mail using the inbox, sent, and deleted folders
  - iii. send an e-mail message with attachment(s)
  - iv. print e-mail

**Practical Requirements:**

None.

## **BLOCK II**

### **MW1560 Coupling Alignment**

#### **Learning Outcomes:**

- Demonstrate the ability to align couplings using standard alignment methods, reverse dial alignment method, and the laser alignment method.

**Duration:** 45 Hours

**Pre-requisite(s):** MW1591 Couplings and Clutches

#### **Objectives and Content:**

#### **Standard Alignment**

1. Identify the different types of misalignment.
  - i. conditions of misalignment
  - ii. planes of misalignment
  - iii. results of misalignment
2. Describe the procedures used to perform pre-alignment checks.
  - i. piping strains
  - ii. concentricity of coupling and shaft
  - iii. tools and shims
3. Describe the procedure for checking and correction for soft foot.
4. Describe the procedure to align a coupling using a straight edge and feeler gauges.
5. Describe the procedure to align a coupling utilizing dial indicators and the rim and face method.
  - i. use of dial indicators
  - ii. rim and face readings
  - iii. recording readings- soft foot
  - iv. fixtures

- v. total run out
- vi. explanation of formulas
- vii. bar sag
- viii. thermal growth
- ix. methods of moving equipment to be aligned
- x. jacking devices
- xi. corrections

### **Reverse Dial Alignment**

1. Identify the advantages of the reverse dial alignment method compared to the rim and face method.
2. Describe how to determine and compensate for bar sag.
3. Describe the procedures used to calculate shims required for alignment using the graph method.
  - i. soft foot
  - ii. bar sag
  - iii. using graph paper and graphs
  - iv. definitions of target and sight
  - v. target and sight indicator lines
  - vi. hot alignment lines
  - vii. cold alignment lines
  - viii. shaft misalignment lines
  - ix. thermal growth
  - x. plotting the different lines on graph paper
  - xi. using the calculator method
  - xii. setting up the dial indicators
  - xiii. checking and recording bar sag
  - xiv. obtaining accurate readings
4. Describe the procedures used to calculate shims required for alignment using calculator method.



## **Laser Coupling Alignment**

1. Identify the different accessories used in alignment with the optical alignment system.
  - i. safety with laser-optic equipment
  - ii. lasers and detectors
  - iii. use of beam finder
  - iv. inclinometer/level
  - v. installation of brackets
  - vi. connecting the system
  
2. Describe procedures to obtain misalignment readings.
  - i. adjusting the prism
  - ii. adjusting the reflected beam
  - iii. measurement procedure ( zero-zero alignment)
  - iv. entering measurements of the machine to be moved
  
3. Describe procedures to correct for misalignment using shims.
  - i. vertical and horizontal adjustment

## **Practical Requirements:**

1. Perform alignment per instructor's requirements.
  - i. standard
  - ii. rim and face
  - iii. reverse dial
  - iv. laser
  
2. Calculate requirements for thermal expansion.

## MW1660 Material Handling Systems

### Learning Outcomes:

- Demonstrate the ability to assemble, install, operate, repair and maintain.

**Duration:** 60 Hours

**Pre-requisite(s):** MW1591 Coupling and Clutches

### Objectives and Content:

1. Describe the operating principles of belt conveyors.
  - i. types of belts
    - construction
    - uses
  - ii. troughed conveyors
  - iii. idlers and their use
  - iv. pulley terms and types
  - v. loading chutes
2. Describe the procedures used to calculate belt length, surface speeds forces, arc of contact, and belt loading.
  - i. formulas and their specific applications
3. Describe the various types of conveyor systems and their uses.
  - i. slide conveyors
  - ii. troughed conveyors
  - iii. roller conveyors
  - iv. bucket elevators
  - v. chain conveyors
  - vi. screw conveyors
  - vii. pneumatic conveyors
  - viii. food handling conveyors
  - ix. slurry systems
  - x. apron feeders
  - xi. overhead conveyors

4. Describe the purpose for various attachments and accessories used in conveyor systems.
  - i. belt take up methods
  - ii. loading and unloading methods
  - iii. scrapers and cleaners
  - iv. magnetic pulleys and Electromagnetic belt conveyors
  - v. backstops and braking methods for inclined conveyors
  - vi. take up devices
  - vii. plow
  - viii. skirting
  
5. Describe the joining and splicing of belts.
  - i. belt installation
  - ii. methods of joining belts
    - vulcanization (hot Splice)
    - chemical
    - mechanical fasteners
    - cold splices
  
6. Describe procedures to troubleshoot belt and conveyor problems.
  - i. alignment and training a conveyor belt
  - ii. belt slip
  - iii. belt stretch
  - iv. belt breakage
  - v. belt deterioration
  - vi. excessive belt wear
  - vii. rapid drive wear
  
7. Describe the operating principles, the classification and the uses of chain, screw and pneumatic conveyors.
  - i. theory of operation of chain conveyors
  - ii. flight conveyors
  - iii. drag conveyors
  - iv. transfer tables
  - v. head and tail end details
    - roll cases
  - vi. trough conveyors
  - vii. theory of operation and classification of screw conveyors
  - viii. screw conveyor components
  - ix. theory of operation of pneumatic conveyors

- x. vacuum conveying systems
  - xi. feeders
  - xii. flow regulation
  - xiii. low, medium and high pressure systems
  - xiv. cyclones
  - xv. air slide systems
  - xvi. blowers and fans
  - xvii. bulk conveyors
  - xviii. angle of repose
  - xix. transfer cases
  - xx. S-drives
  - xxi. chain classes
  - xxii. fluid couplings
8. Describe the maintenance procedures for chain, screw, and pneumatic conveyors.
- i. dismantling
  - ii. inspection
  - iii. repair procedures
  - iv. reassembly methods for conveyors.
  - v. lockout

**Practical Requirements:**

- 1. Perform a belt splice.
  - i. cold
  - ii. mechanical
- 2. Train a belt; inspect and troubleshoot.
- 3. Calculate belt speed in surface feet per minute (SFPM).

## MW2160 Hydraulics II

### Learning Outcomes:

- Demonstrate the ability to use hydraulic controls, use schematics to identify components of hydraulic systems, test hydraulic system faults, identify hydraulic parts, components and accessories.

**Duration:** 35 Hours

**Pre-requisite(s):** MW2150 Hydraulics I

### Objectives and Content:

1. Identify the various valves used in hydraulic systems.
2. Describe the operation and purpose of various valves used in hydraulic systems.
  - i. directional control valves
  - ii. pressure control valves
  - iii. volume control valves
  - iv. needle valves
  - v. unloading valves
  - vi. exhaust valves
  - vii. deceleration valves
  - viii. pilot operated check valves
  - ix. sequence valves
  - x. brake valves
  - xi. thermal relief valves
3. Explain how to use schematics to determine the series of operation and locate problems in a system.
  - i. understanding the language of symbols
  - ii. following fluid flow in a hydraulic circuit
4. Identify various components of a system on a schematic.

5. Describe preventive maintenance procedures.
  - i. cleaning suction strainers
  - ii. changing filters
  - iii. changing hydraulic fluids
  - iv. changing tubing
  - v. leak checks
  - vi. motor rotation
  
6. Explain how to use testing equipment to determine system faults.
  - i. troubleshooting practices
  - ii. pressure gauges and flow meters

**Practical Requirements:**

1. Complete a linear motion project from a schematic on the simulator.
2. Complete a rotary motion project from a schematic on the simulator.
3. Complete a sequence project from a schematic on the simulator.
4. Use schematics & testing equipment to troubleshoot a system.
5. Set-up a filter, regulator and lubricator system.
6. Fabricate a hydraulic hose using crimped, and/or reusable fittings.

## MW2170 Pneumatics

### Learning Outcomes:

- Demonstrate the ability to install, maintain, trouble shoot and repair pneumatic systems
- Demonstrate an understanding of components, parts and accessories in pneumatic systems
- Demonstrate an understanding of components, parts and accessories in vacuum systems
- Demonstrate the ability to maintain and repair vacuum systems

**Duration:** 40 Hours

**Pre-requisite(s):** MW2160 Hydraulics II

### Objectives and Content:

1. Describe gas laws as they pertain to pneumatics.
  - i. atmospheric pressure
  - ii. gauge and absolute pressure
  - iii. force, pressure, area
  - iv. Boyle's law
  - v. Charles's law
  - vi. Guy-Lusac's law
  - vii. Bernoulli's principle
  - viii. relative humidity
  - ix. dew point
  
2. Classify the various components of a system by the functions they perform.
  - i. compressors
  - ii. pressure control valves
  - iii. directional control valves
  - iv. packed bore
  - v. packed spool
  - vi. volume control valves
  - vii. quick exhaust and shuttle valves
  - viii. filters

- ix. lubricators
  - x. regulators
  - xi. coolers and heat exchanger
  - xii. receivers
  - xiii. dryers
  - xiv. pressure relief valves
  - xv. muffler
  - xvi. actuators
  - xvii. cylinder cushions
  - xviii. blowers
  - xix. air contaminants
  - xx. steel tubing (sizing)
  - xxi. pneumatic motors
  - xxii. output horsepower
  - xxiii. time delay switches
- 
- 1. Explain the differences in operating principles in vacuum systems compared to pneumatics.
    - i. pressure
    - ii. plumbing
    - iii. valves
    - iv. cylinders
    - v. pumps/blowers
    - vi. manifolds
  
  - 2. Describe the procedures used to determine the series of operation of a system from a schematic.
    - i. schematics
    - ii. symbols
    - iii. schematic development
  
  - 3. Describe procedures to troubleshoot and repair various components of a pneumatic system using testing equipment and schematics.
    - i. using schematics to troubleshoot systems
    - ii. pressure gauges
    - iii. flow metres



**Practical Requirements:**

1. Use schematics to troubleshoot and repair pneumatic systems.
2. Complete a sequence project from a schematic on a simulator.
3. Set up a filter, regulator, lubricator system.

## WD1380 Electric Arc Welding

### Learning Outcomes:

- Demonstrate the ability to set up arc welding equipment.
- Demonstrate an understanding of the different types of electrodes and their purpose.
- Demonstrate an understanding of the different types of joints.
- Demonstrate the ability to perform basic arc welding procedures.

**Duration:** 60 Hours

**Pre-requisite(s):** WD1330 Oxy-Fuel Welding

### Objectives and Content:

1. Describe how to set up and operate arc welding equipment.
  - i. AC and DC machines
  - ii. straight and reverse polarity
  - iii. proper grounding methods
  - iv. electrode holders
  - v. amperage settings for various electrodes
2. Describe the numbering system for electrodes.
  - i. electrode numbering system
    - tensile strength
    - welding position recommended for the electrode
    - penetration
3. Define terms involved in electric arc welding.
  - i. duty cycle
  - ii. arc blow
  - iii. polarity
  - iv. spatter
4. Demonstrate a working knowledge of the different types of joints encountered.
  - i. in welding
  - ii. butt, tee, lap, corner, edge joints

5. Describe procedures for welding in the flat, vertical and horizontal positions.
6. Describe procedures to weld with GMAW (MIG).
  - i. setting up GMAW equipment
  - ii. basic operation of GMAW equipment
7. Describe procedures to weld with GTAW (TIG).
  - i. setting up GTAW equipment
  - ii. basic operation of GTAW equipment
8. Describe procedures used in cutting with the plasma arc process.

**Practical Requirements:**

1. Perform the following types of welds: butt, tee, lap, corner & edge joints.
2. Set-up and MIG a tee joint.
3. Set- up and cut various metal using the plasma arc process.

## BLOCK III

### MW1620 Metal Lathe

#### Learning Outcomes:

- Demonstrate the ability to identify parts and accessories, calculate correct speeds and feeds, calculate thread depth, and perform turning, facing, and boring / threading operations.

**Duration:** 100 Hours

**Pre-requisite(s):** MW1450 Drills, Taps and Reamers

#### Objectives and Content:

4. Describe procedures to perform basic lathe functions such as turning, facing, boring and threading.
  - i. lathe size and capacity
  - ii. lathe parts and their function
    - bed
    - head stock
      - spindle
      - feed reverse lever
    - quick change gear box
      - top lever
      - tumbler lever
      - lead screw and feed rod
    - carriage
      - saddle
      - cross-slide and compound rest
      - apron hand wheel, automatic feed lever and
      - feed change lever
    - tailstocks
      - tailstocks clamp lever, spindle and spindle lock, offsetting screw and centre
  - iii. work holding devices
    - spindle nose types

- lathe centres
  - jaw, 4 jaw, collett, magnetic chucks, face plates and lathe dogs
  - mounting chucks
  - mounting jaws in chucks
  - mounting work in chucks
  - trueing work in a 4 jaw chuck with a dial indicator
    - steady rest and follow rest
  - iv. cutting tool holders
    - left and right hand offset tool holders
    - parting tool holders
    - boring bars
    - standard tool post
    - quick change tool holders
  - v. mounting, removing and aligning lathe centres
  - vi. facing and machining between centres and in chucks
  - vii. facing to accurate length
    - rough and finish cut
    - turning to a shoulder
    - filing and polishing in a lathe
    - knurling and form turning
    - cutting off work in a chuck
    - drilling, boring, reaming and tapping on the lathe
6. Describe the procedures used to calculate correct speeds and feeds.
- i. definition of speeds and feeds for lathes
  - ii. formulas for speeds and feeds and depth of cut
  - iii. sheer pins and slip clutches
  - iv. graduated micrometer collars
3. Describe the procedures used to calculate thread depths and perform thread cutting operations.
- i. thread cutting on the lathe
  - ii. terminology
  - iii. thread forms
  - iv. fits and classifications
  - v. thread pitch and depth of cut calculations
  - vi. thread chasing dial
  - vii. set up procedures for thread cutting
  - viii. thread cutting operations
  - ix. resetting a threading tool

- x. thread measurement
  - xi. multiple threads
4. Describe procedures to turn a taper.
- i. tapers and taper turning
  - ii. types of tapers
  - iii. taper calculations
  - iv. taper turning methods
  - v. tailstock offset, taper attachments and compound rest method
5. Describe a mandrel.

**Practical Requirements:**

1. Sharpen a tool bit.
2. Perform the following operations using a lathe:
- i. straight turning
  - ii. facing
  - iii. boring
  - iv. threading
  - v. taper

## MW1630 Milling Machines

### Learning Outcomes:

- Demonstrate the ability to calculate correct speeds and feeds, perform set up and safely, and execute basic milling operations.

**Duration:** 40 Hours

**Pre-requisite(s):** MW1620 Metal Lathe

### Objectives and Content:

Identify safety hazards involved in operating a milling machine.

1. Describe the principles of operation of milling machines.
  - i. horizontal and vertical milling machines
  - ii. knee and column mills
  - iii. parts of the milling machine
  - iv. milling machine attachments
    - vertical milling attachment
    - slotting attachment
    - arbors, collets and adapters
    - vises
2. Describe the procedures used to perform calculations involved in using a milling machine.
  - i. definition of speed and feeds
  - ii. calculations for feed, speed and depth of cut
  - iii. keyseat depth calculations
3. Describe set-up procedures.
  - i. direction of feed
  - ii. climb and conventional milling

4. Describe the procedures used to select cutters in order to perform specific tasks.
  - i. plain mill cutters
  - ii. face mill cutters
  - iii. end mills
  - iv. woodruff keyseat cutter
  - v. fly cutters
  
5. Describe the procedures for centering cutters on shafts.

**Practical Requirements:**

1. Complete a project using a milling machine, as assigned by instructor.



## MW2180 Compressors

### Learning Outcomes:

- Demonstrate an understanding of the operating principles of compressors.
- Demonstrate the ability to maintain compressors and their assembly.

**Duration:** 40 Hours

**Pre-requisite(s):** MW2170 Pneumatics

### Objectives and Content:

1. Describe the principles of operation of reciprocating and rotary compressors.
  - i. reciprocating and access compressor
  - ii. rotary compressor
  - iii. screw compressor
  - iv. vane compressor
  - v. diaphragm compressor
  - vi. wet screw compressor
  - vii. dry screw compressor
  - viii. positive displacement
  - ix. pre-start and inspection
2. Identify gas laws and apply them to compressors.
  - i. Boyle's Law
  - ii. Charles's Law
  - iii. Lusac's Law
3. Identify and describe the parts and accessories for compressors.
  - i. regulators
  - ii. lubricators
  - iii. filters
  - iv. receivers
  - v. valves
  - vi. pistons
  - vii. connecting rods
  - viii. crankshafts

- ix. rotors
  - x. vanes
  - xi. crossheads
  - xii. cylinders
  - xiii. maximum pressure control devices
  - xiv. pressure relief valve on receiver
  - xv. discharge lines
  - xvi. clearance pockets
  - xvii. mufflers
  - xviii. timing gears
  - xix. non-ferrous metals and heat conductivity
4. Describe methods of maximum pressure control on a compressor.
- i. unloading devices
  - ii. stop start method
  - iii. throttling intake
  - iv. variable speed drives
  - v. centrifugal pressure relief valves
  - vi. atmospheric pressure
5. Describe maintenance procedures for compressors.
- i. air treatment
  - ii. separators
  - iii. lubrication methods
  - iv. intercoolers
  - v. aftercoolers
  - vi. receivers
  - vii. air dryers
  - viii. regulators
  - ix. lubricators
  - x. start-up procedure

**Practical Requirements:**

- 1. Perform a preventative check on compressors.
- 2. Disassemble, inspect and assemble a reciprocating compressor.

## MW2190 Machinery Installation and Alignment

### Learning Outcomes:

- Demonstrate the ability to perform machinery set-up procedures.
- Demonstrate the ability to locate and lay out machinery.

**Duration:** 60 Hours

**Pre-requisite(s):** MW1560 Coupling Alignment

### Objectives and Content:

1. Describe set-up procedures for using transits and levels.
  - i. precision levels
  - ii. builders level
  - iii. water level
  - iv. transits and theodolites
  - v. lasers
  - vi. effects of temperature on optical alignment (reflection/refraction)
  - vii. optical tooling and accessories
2. Describe procedures to construct foundations for equipment.
  - i. concrete terms
  - ii. controlling vibration
  - iii. anchor bolt types and applications
  - iv. mechanical expansion anchors
  - v. chemical adhesive anchors
  - vi. positioning and setting anchors bolts
  - vii. tools required to build a form
3. Describe procedures to properly place and level a piece of equipment on its base or foundation.
  - i. base plate and sole plate purpose and installation procedure
  - ii. leveling and jacking screws
  - iii. shims
  - iv. wedges
  - v. precision leveling the base plate
  - vi. dementitious and polymeric grout and their purpose

- vii. placing grout
  - viii. preventing and filling voids
  - ix. dowelling
4. Describe procedures to locate and lay out a form from a blueprint.
- i. building tie-in
  - ii. reference lines
  - iii. center lines
  - iv. benchmarks and datums
  - v. brass plugs
  - vi. establishing references lines
  - vii. mechanical methods
  - viii. optical methods

**Practical Requirements:**

- 1. Locate and lay out a form from a blueprint.
- 2. Transfer elevations using levels and lasers.
- 3. Level soleplates using optical tooling.
- 4. Perform bucking in.
- 5. Using the optical level, perform leveling and alignment projects as per instructor's directives.

## BLOCK IV

### MW1680 Dynamic Balancing

#### Learning Outcomes:

- Demonstrate the ability to collect data, use a computer to execute balancing calculations, and use balancing techniques to correct vibration problems.

**Duration:** 45 Hours

**Pre-requisite(s):** MW2230 Vibration Analysis

#### Objectives and Content:

1. Define unbalance.
  - i. types of unbalance: static, couple, quasi-static, dynamic
  - ii. list the most common causes of unbalance
    - causes of vibration
    - causes of unbalance
    - shaft axis and central principle axis
2. Identify and define terms associated with vibration.
3. Describe the procedures used to perform the necessary operations, calculations and weight corrections to balance in one plane.
  - i. transducer mounting and reading locations
  - ii. data collection, amplitude and phase
  - iii. selecting safe trial weights
  - iv. vector techniques and calculations
  - v. single and two plane balancing techniques
  - vi. static couple derivation
  - vii. balancing standards
    - use weight removal charts

4. Describe the use of personal computers and system software for balancing calculations and record keeping.
  - i. software and a personal computer to perform the following:
    - one plane balance
    - no phase balance
    - safe trial weights
    - combine weights
    - split weight
    - utilities

**Practical Requirements:**

1. Perform single plane balancing operations as per instructor's direction.

## MW1740 Preventative and Predictive Maintenance

### Learning Outcomes:

- Demonstrate the ability to perform preventative maintenance and maintain proper records.
- Demonstrate an understanding of the procedures used to plan and organize jobs.

**Duration:** 35 Hours

**Pre-requisite(s):** MW2180 Compressors

### Objectives and Content:

1. Describe various maintenance styles.
  - i. breakdown maintenance
  - ii. preventive maintenance
  - iii. predictive maintenance
  - iv. proactive maintenance
  - v. total productive maintenance
  - vi. preventive engineering
  - vii. reliability engineering
  - viii. productive maintenance
  - ix. corrective maintenance
  
2. Describe the basic components of a preventive maintenance program.
  - i. equipment record files
  - ii. equipment repair history
  - iii. inspection reports
  - iv. priority system
  - v. work order
  - vi. equipment manuals
  - vii. specification
  - viii. troubleshooting charts
  - ix. blueprints
  - x. personal operator input

3. Describe basic procedures followed under preventative maintenance programs.
  - i. vibration analysis
  - ii. key frequency and rpm
  - iii. dynamic balancing
  - iv. non-destructive testing
    - types
    - visual inspection
    - dye penetrate inspection
    - magnetic particle inspection
    - eddy current inspection
    - ultrasonic inspection
    - radiographic inspection
  
4. Describe the purpose of lube oil analysis.
  - i. particle analysis
  - ii. gravimetric level analysis
  - iii. spectrographic oil analysis
  - iv. ferromagnetic analysis
  - v. total base number tests
  - vi. total acid number tests
  - vii. infrared tests
  - viii. water content tests
  - ix. computerized lubrication management system
  - x. capable employees
  - xi. component wear rate
  - xii. operating conditions when taking samples
  - xiii. oil system types
  
5. Describe the procedures used to plan job tasks.
  - i. scheduling
  - ii. estimating

**Practical Requirements:**

1. Design a preventative maintenance sheet on a piece of equipment.
  
2. Perform a dye penetrants inspection.
  
3. Collect and interpret data on equipment.



## MW1480 Tanks, Fans and Blowers

### Learning Outcomes:

- Demonstrate an understanding of process tanks and containers, their components and applications.
- Demonstrate an understanding of fans and blowers, their components and operation.
- Demonstrate the ability to remove install, maintain, troubleshoot, repair and commission fans and blowers.

**Duration :** 30 Hours

**Pre-requisite(s):** MW1690 Positive Displacement Pumps

### Objectives and Content:

1. Identify the classification of fans and blowers, blade designs, and describe their specific uses.
  - i. axial and radial flow fans
  - ii. forward and backward curved, and straight fans and their application
  - iii. single and double width fans
  - iv. single and double inlet fans
2. Define terminology associated with fans and blowers.
3. Identify hazards and describe safe work practices pertaining to fans and blowers.
4. Identify types of fans and blower systems and describe their components and operation.
5. Identify the procedures used to inspect and maintain fans and blowers.
6. Identify the procedures used to troubleshoot fans and blowers.
7. Identify the procedures used to repair fans and blowers.
8. Identify the procedures used to regulate output for fans and blowers

9. Identify the procedures used to commission fans and blowers.
10. Define terminology associated with process tanks and containers.
11. Identify hazards and describe safe work practices associated with process tanks and containers.
12. Identify and interpret codes and regulations pertaining to process tanks and containers.
13. Identify types of process tanks and containers and describe their applications and operation.
  - i. bins
  - ii. hoppers
  - iii. receivers
14. Identify process tank and container components and describe their applications.
  - i. agitators
  - ii. mixers

**Practical Requirements:**

1. Identify various types of fans.

## MW2210 Prime Movers 1 (Internal Combustion Engines)

### Learning Outcomes:

- Demonstrate the ability to install and maintain internal combustion engines.

**Duration:** 45 Hours

**Pre-requisite(s):** MW1580 Static and Dynamic Seals

### Objectives and Content:

1. Describe the principles of operation of an internal combustion engine.
  - i. stroke cycle engines principles for gas and diesel engines
  - ii. stroke cycle engines principles for gas and diesel engines
  - iii. differences between 2 stroke and 4 stroke engines
  - iv. differences between gas and diesel engines
  - v. fuel injection
  - vi. lubrication methods
  
2. Describe the internal parts and list their functions.
  - i. crankshaft
  - ii. main bearings
  - iii. flywheels
  - iv. cylinder head
  - v. camshafts, lifters and pushrods
  - vi. engine block
  - vii. pistons, rings and connecting rods
  - viii. valve trains
  - ix. aspiration
  - x. turbo-chargers
  - xi. superchargers
  - xii. glow plug
  - xiii. injectors
    - safety
  - xiv. governors

3. Describe the procedures used to troubleshoot internal combustion engine performance problems.
  - i. routine maintenance practices
  - ii. shut down
  
4. Describe the principles of operation for diesel engines.
  - i. compression ignition
  - ii. fuel injection
    - safety
  - iii. turbochargers and superchargers

**Practical Requirements:**

1. Participate in the disassembling, inspecting and reassembling of an internal combustion engine. (Subject to availability of equipment)
  
2. Perform a compression test on an engine and analyze the results

## MW2220 Prime Movers II (Turbines)

### Learning Outcomes:

- Demonstrate an awareness of turbine types.
- Demonstrate the ability to maintain steam and gas turbines.

**Duration:** 45 Hours

**Prerequisites:** MW2210 Prime Movers I (Internal Combustion Engines)

### Objectives and Content:

1. Identify the types of turbines
  - i. steam
  - ii. gas
  - iii. hydro
  - iv. wind
  
2. Describe the principles of operation of steam turbine drives.
  - i. uses for steam turbines
  - ii. definitions and construction
  - iii. steam flow through a turbine
  - iv. axial and radial flow turbines
  - v. back pressure turbines
  - vi. back pressure / extraction turbines
  - vii. condensing turbines
  - viii. extracting / condensing turbines
  
3. Describe the components and accessories used on steam turbines.
  - i. impulse and reaction blades
  - ii. shaft attachments
  - iii. shrouds
  - iv. journal bearings
  - v. thrust bearings
  - vi. steam chests and nozzle blocks
  - vii. diaphragms and steam nozzles
  - viii. disc and drum rotor diaphragms

- ix. shaft seal purpose
  - x. carbon seals
  - xi. labyrinth seals
  - xii. shaft steam - seal system
  - xiii. turbine condenser and hot well
  - xiv. main stop valves
  - xv. exhaust valves
  - xvi. throttle valves
  - xvii. overspeed trips
  - xviii. governors valves
  - xix. extraction valves
  - xx. governor types and operation
  - xxi. lubricating systems
  - xxii. turning gears
  - xxiii. jacking pumps
4. Describe the principles of operation for gas turbines.
- i. differences between gas and steam turbines
  - ii. types of gas turbines
  - iii. classifying gas turbines by cycle
    - simple open cycle
    - complex cycle
  - iv. classifying gas turbines by shaft arrangement
    - single shaft turbines
    - two shaft turbines
5. Describe gas turbine components and their purpose.
- i. compressor types
  - ii. combustion
    - igniter
    - fuel atomizer
    - flame tube
  - iii. turbines
    - blade cooling
    - blade shapes and roots
    - bearings and shaft seals
  - iv. governors
  - v. lubrication systems

**Practical Requirements:**

1. Participate in the disassembling, inspecting and reassembling of a steam and/or gas turbine.

## MW2230 Vibration Analysis

### Learning Outcomes:

- Demonstrate the ability to collect data used in vibration analysis, analyze causes of unbalances, and detect and diagnose vibration levels.

**Duration:** 40 Hours

**Pre-requisite(s):** MW1740 Preventative and Predictive Maintenance

### Objectives and Content:

1. Identify benefits of vibration analysis.
2. Describe safety precautions regarding rotating equipment.
3. Describe differences between the corrective, preventive and predictive maintenance methods.
  - i. corrective, preventive and predictive maintenance methods
    - organizing a predictive maintenance program
  - ii. design an equipment route
4. Describe the causes of vibration.
  - i. terminology
  - ii. characteristics of vibration
5. Describe vibration data collection procedures.
  - i. information provided by vibration frequency, amplitude and phase measurements
  - ii. when to use velocity, displacement or acceleration methods
  - iii. phase information
  - iv. common types of measurements
  - v. using a strobe light for diagnosis
  - vi. common pitfalls in vibration measurements
  - vii. using data collectors for collecting predictive maintenance data
  - viii. how to build load and unload route



6. Describe procedures to detect and diagnose vibration data to determine causes of vibration.
  - i. assessing vibration severity
  - ii. harmonic identification methods
  - iii. waveform measurement and analysis
  - iv. data interpretation and general analysis procedures
  - v. detecting and diagnosing vibration due to unbalance, misalignment eccentricity, rolling element bearings, sleeve bearings, mechanical looseness, drive belts, gear problems, electrical faults, resonance, harmonics, aerodynamic and hydraulic forces, reciprocating action and rubbing
  
7. Describe procedures when using hand held data collectors.
  - i. data acquisition - routine checks, baseline measurements, pre and post overhaul checks, machine troubleshooting
  
8. Describe procedures when using personal computers and system software to generate reports and analyze data.
  - i. downloading from data collectors to personal computers with system software
  - ii. using system software to generate schedule reports, data collection routes, PUMP reports, analysis reports, file modifications and alarm and inspection reports.
  
9. Describe fundamental procedures for determining:
  - i. unbalance
  - ii. misalignment
  - iii. ball pass frequency
  - iv. gear mesh
  - v. line frequency
  - vi. mechanical looseness
  - vii. harmonics
  - viii. ball pass inner race (BPIR)
  - ix. ball pass outer race (BPOR)
  - x. ball spin frequency (BSF)
  - xi. fundamental train frequency (FTF)

**Practical Requirements:**

1. Build an equipment route.
2. Load and unload route data.
3. Use data collectors.
4. Use personal computers and system software to generate reports and analyse data.

## **D. Conditions Governing Apprenticeship Training**

### **1.0 General**

The following general conditions apply to all apprenticeship training programs approved by the Provincial Apprenticeship and Certification Board (PACB) in accordance with the *Apprenticeship Training and Certification Act (1999)*. If an occupation requires additional conditions, these will be noted in the specific Plan of Training for the occupation. In no case should there be a conflict between these conditions and the additional requirements specified in a certain Plan of Training. All references to Memorandum of Understanding will also apply to Letter of Understanding (LOU) agreements.

### **2.0 Entrance Requirements**

#### **2.1 Entry into the occupation as an apprentice requires:**

Indenturing into the occupation by an employer who agrees to provide the appropriate training and work experiences as outlined in the Plan of Training.

#### **2.2 Notwithstanding the above, each candidate must have successfully completed a high school program or equivalent, and in addition may be required to have completed certain academic subjects as specified in a particular Plan of Training. Mature students, at the discretion of the Director of Apprenticeship and Trades Certification, may be registered. A mature student is defined as one who has reached the age of 19 and who can demonstrate the ability and the interest to complete the requirements for certification.**

#### **2.3 At the discretion of the Director of Apprenticeship and Trades Certification, credit toward the apprenticeship program may be awarded to an apprentice for previous work experience and/or training as validated through prior learning assessment.**

#### **2.4 An Application for Apprenticeship form must be duly completed along with a Memorandum of Understanding as applicable to be indentured into an Apprenticeship. The Memorandum of Understanding must contain signatures of**

an authorized employer representative, the apprentice and an official representing the Provincial Apprenticeship and Certification Board to be valid.

- 2.5 A new Memorandum of Understanding must be completed for each change in an employer during the apprenticeship term.

### **3.0 Probationary Period**

The probationary period for each Memorandum of Understanding will be six months or 900 employment credit hours. Within that period the memorandum may be terminated by either party upon giving the other party and the PACB one week notice in writing.

### **4.0 Termination of a Memorandum of Understanding**

After the probationary period referred to in Section 3.0, the Memorandum of Understanding may be terminated by the PACB by mutual consent of the parties involved, or cancelled by the PACB for proper and sufficient cause in the opinion of the PACB, such as that stated in Section 14.

### **5.0 Apprenticeship Progression Schedule and Wage Rates**

## Progression Schedule

Industrial Mechanic 7200 Hours			
APPRENTICESHIP LEVEL AND WAGES			
Year	Wage Rate At This Level	Requirements for progression to next level of apprenticeship	When requirements are met, the apprentice will progress to...
1 <sup>st</sup>	60 %	<ul style="list-style-type: none"> <li>▪ Completion of Block 1 (pre-employment) training</li> <li>▪ Pass block 1 exam</li> <li>▪ Relevant work experience totaling 1800 hours or more</li> </ul>	2 <sup>nd</sup> Year
2 <sup>nd</sup>	70%	<ul style="list-style-type: none"> <li>▪ Completion of Block 2 training</li> <li>▪ Pass block 2 exam</li> <li>▪ Relevant work experience totaling 3600 hours or more</li> </ul>	3 <sup>rd</sup> Year
3 <sup>rd</sup>	80%	<ul style="list-style-type: none"> <li>▪ Completion of Block 3 training</li> <li>▪ Pass block 3 exam</li> <li>▪ Relevant work experience totaling 5400 hours or more</li> </ul>	4 <sup>th</sup> Year
4 <sup>th</sup>	90%	<ul style="list-style-type: none"> <li>▪ Completion of Block 4 training</li> <li>▪ Relevant work experience totaling 7200 hours or more</li> <li>▪ Sign-off of all workplace skills in apprentice logbook</li> <li>▪ Pass certification exam</li> </ul>	Journeyman Certification
<p>Wage Rates</p> <ul style="list-style-type: none"> <li>▪ Rates are percentages of the prevailing journeyman's wage rate in the place of employment of the apprentice.</li> <li>▪ Rates must not be less than the wage rate established by the Labour standards Act (1990), as now in force or as hereafter amended, or by other order, as amended from time to time replacing the first mentioned order.</li> <li>▪ Rates must not be less than the wage rate established by any collective agreement which may be in force at the apprentice's workplace.</li> <li>▪ Employers are free to pay wage rates above the minimums specified.</li> </ul> <p>Block Exams</p> <ul style="list-style-type: none"> <li>▪ This program may not currently contain block exams, in which case this requirement will be waived until such time as block exams are available.</li> </ul> <p>Programs with five or more blocks</p> <ul style="list-style-type: none"> <li>▪ Apprentices in these programs are considered fourth year apprentices until they have satisfied all their program requirements and have become journeymen.</li> </ul>			

Industrial Mechanic 7200 Hours		
CLASS CALLS		
Call Level	Requirements for Class Call	Hours awarded for In-School Training
Direct Entry Apprentice: PLA & / or Block 1	<ul style="list-style-type: none"> <li>▪ Minimum of 1000 hours of relevant work experience</li> <li>▪ Prior Learning Assessment (PLA) at designated college (if applicable)</li> </ul>	To be determined by the number of courses completed after each class call
Block 2	<ul style="list-style-type: none"> <li>▪ Minimum of 3000 hours of relevant work experience and training</li> </ul>	240
Block 3	<ul style="list-style-type: none"> <li>▪ Minimum of 5000 hours of relevant work experience and training</li> </ul>	240
Block 4	<ul style="list-style-type: none"> <li>▪ Minimum of 7000 hours of relevant work experience and training</li> </ul>	240
<p>Direct Entry Apprentice</p> <ul style="list-style-type: none"> <li>▪ Must complete block 1 courses through PLA and / or in school training.</li> <li>▪ Block 1 training is to be completed via class calls; up to 16 weeks of training per calendar year.</li> <li>▪ Must attend in-school training until Block 1 is complete before attending Blocks 2 or 3</li> </ul> <p>Class calls at Minimum Hours</p> <ul style="list-style-type: none"> <li>▪ Class calls may not always occur at the minimum hours indicated. Some variation is permitted to allow for the availability of training resources and apprentices.</li> </ul>		

## 6.0 Tools

Apprentices shall be required to obtain their own hand tools applicable for the designated occupation of registration or tools as specified by the PACB.

## 7.0 Periodic Examinations and Evaluation

7.1 Every apprentice shall submit to such occupational tests and examinations as the PACB shall direct. If after such occupational tests and examinations the apprentice is found to be making unsatisfactory progress, his/her apprenticeship level and rate of wage shall not be advanced as provided in Section 5 until his/her progress is satisfactory to the Director of Apprenticeship and Trades Certification and his/her date of completion shall be deferred accordingly.

Persistent failure to pass required tests shall be a cause for revocation of his/her Memorandum of Understanding.

- 7.2 Upon receipt of reports of accelerated progress of the apprentice, the PACB may shorten the term of apprenticeship and advance the date of completion accordingly.
- 7.3 For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.
- 7.4 Course credits may be granted through the use of a PACB approved matrix which identifies course equivalencies between designated trades and between current and historical Plans of Training for the same trade.

## **8.0 Granting of Certificates of Apprenticeship**

Upon the successful completion of apprenticeship, the PACB shall issue a Certificate of Apprenticeship.

## **9.0 Hours of Work**

Any hours employed in the performance of duties related to the designated occupation will be credited towards the completion of the term of apprenticeship. Appropriate documentation of these hours must be provided.

## **10.0 Copies of the Registration for Apprenticeship**

The Director of Apprenticeship and Trades Certification shall provide copies of the Registration for Apprenticeship form to all signatories to the document.

## **11.0 Ratio of Apprentices to Journeypersons**

Under normal practice, the ratio of apprentices to journeypersons shall not exceed two apprentices to every one journeyperson employed. Other ratio arrangements would be determined and approved by the PACB.

## **12.0 Relationship to a Collective Bargaining Agreement**

Where applicable in Section 5 of these conditions, Collective Agreements take precedence.

## **13.0 Amendments to a Plan of Apprenticeship Training**

A Plan of Training may be amended at any time by the PACB.

## **14.0 Employment, Re-Employment and Training Requirements**

- 14.1 The Plan of Training requires apprentices to regularly attend their place of employment.
- 14.2 The Plan of Training requires apprentices to attend training for that occupation as prescribed by the PACB.
- 14.3 Failure to comply with Sections 14.1 and/or 14.2 will result in cancellation of the Memorandum of Understanding. Apprentices may have their MOUs reinstated by the PACB but would be subject to a commitment to complete the entire program as outlined in the General Conditions of Apprenticeship. Permanent cancellation in the said occupation is the result of non-compliance.
- 14.4 Cancellation of the Memorandum of Understanding to challenge journeyperson examinations, if unsuccessful, would require an apprentice to serve a time penalty of two (2) years before reinstatement as an apprentice or qualifying to receive a class call to training as a registered Trade Qualifier. Cancellation must be mutually agreed upon by the employer and the apprentice.
- 14.5 An employer shall ensure that each apprentice is under the direct supervision of an approved journeyperson supervisor who is located at the same worksite as the apprentice, and that the apprentice is able to communicate with the journeyperson with respect to the task, activity or function that is being supervised.
- 14.6 Under the Plan of Training the employer is required to keep each apprentice employed as long as work is available, and if the apprentice is laid off due to lack of work, to give first opportunity to be hired before another is hired.



- 14.7 The employer will permit each apprentice to attend training programs as prescribed by the PACB.
- 14.8 Apprentices who cannot acquire all the workplace skills at their place of employment will have to be evaluated in a simulated work environment at a PACB authorized training institution and have sign-off done by instructors to meet the requirements for certification.

### **15.0 Appeals to Decisions Based on Conditions Governing Apprenticeship Training**

Persons wishing to appeal any decisions based on the above conditions must do so in writing to the Minister of Advanced Education and Skills within 30 days of the decision.

## **E. Requirements for Red Seal Endorsement**

1. Evidence the required work experiences outlined in this Plan of Training have been obtained. This evidence must be in a format clearly outlining the experiences and must be signed by an appropriate person or persons attesting that these experiences have been obtained to the level required.
2. Successful completion of all required courses in the program.
3. A combination of training from an approved training program and suitable work experience totaling 7200 hours.

**Or**

A total of 9000 hours of suitable work experience.

4. Completion of a National Red Seal examination, to be set at a place and time determined by the Apprenticeship and Trades Certification Division.

## **F. Roles and Responsibilities of Stakeholders in the Apprenticeship Process**

The apprenticeship process involves a number of stakeholders playing significant roles in the training of apprentices. This section outlines these roles and the responsibilities resulting from them.

### **The Apprentice:**

- completes all required technical training courses as approved by the PACB.
- finds appropriate employment.
- completes all required work experiences in combination with the required hours.
- ensures work experiences are well documented.
- approaches apprenticeship training with an attitude and commitment that fosters the qualities necessary for a successful career as a qualified journeyman.
- obtains the required hand tools as specified by the PACB for each period of training of the apprenticeship program.

### **The Employer:**

- provides high quality work experiences in an environment conducive to learning.
- remunerates apprentices as set out in the Plan of Training or Collective Agreements.
- provides feedback to training institutions, Apprenticeship and Trades Certification Division and apprentices in an effort to establish a process of continuous quality improvement.
- where appropriate, releases apprentices for the purpose of returning to a training institution to complete the necessary technical courses.
- ensures work experiences of the apprentice are documented.
- ensures a certified journeyman is currently on staff in the same trade area as the apprentice and whose certification is recognized by the NL Department of Advanced Education and Skills.

### **The Training Institution:**

- provides a high quality learning environment.
- provides the necessary student support services that will enhance an apprentice's ability to be successful.
- participates with other stakeholders in the continual updating of programs.

### **The Apprenticeship and Trades Certification Division:**

- establishes and maintains program advisory committees under the direction of the PACB.
- promotes apprenticeship training as a viable career option to prospective apprentices and other appropriate persons involved, such as career guidance counsellors, teachers, parents, etc.
- establishes and maintains a protocol with training institutions, employers and other appropriate stakeholders to ensure the quality of apprenticeship training programs.
- ensures all apprentices are appropriately registered and records are maintained as required.
- schedules all necessary technical training periods for apprentices to complete requirements for certification.
- administers block, provincial and interprovincial examinations.

### **The Provincial Apprenticeship and Certification Board:**

- sets policies to ensure the provisions of the *Apprenticeship and Certification Act (1999)* are implemented.
- ensures advisory and examination committees are established and maintained.
- accredits institutions to deliver apprenticeship training programs.
- designates occupations for apprenticeship training and/or certification.