



INDUSTRIAL MECHANIC (MILLWRIGHT)

2017

Based on the CCDA Harmonization Recommendations and
the Interprovincial Program Guide
(pg. 12 for Program Structure)



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The Joint Planning Committee (JPC) recognizes this Interprovincial Program Guide as the national curriculum for the occupation of Industrial Mechanic (Millwright).

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Introduction

Jurisdictions have long recognized the benefit of pooling resources in the development and maintenance of apprenticeship training standards. A successful example of this is the Interprovincial Standards (Red Seal) program itself. Essential to the establishment of standards is the development of suitable training systems and programs which enable tradespeople to acquire certification based on these standards. While certification is the responsibility of Apprenticeship administrators throughout Canada, the development and delivery of technical training is the responsibility of jurisdictions.

In 1999, work to develop common training for apprenticeship programs within the Atlantic Provinces began. To date, 22 Curriculum Standards have been developed through the Atlantic Standards Partnership (ASP) project to assist programming staff and instructors in the design and delivery of technical training. Similarly, the Canadian Council of Directors of Apprenticeship (CCDA) embarked on a process for the development of national Interprovincial Program Guides (IPGs) for the Boilermaker, Carpenter and Sprinkler System Installer trades. At its January 2005 strategic planning session, the CCDA identified developing common training standards as one of key activities in moving towards a more cohesive apprenticeship system.

With the support of Human Resources and Social Development Canada (HRSDC), several provinces and territories have partnered to build on the ASP and the CCDA processes to further develop IPGs to be used across the country. This partnership will create efficiencies in time and resources and promote consistency in training and apprentice mobility.

User Guide

According to the Canadian Apprenticeship Forum, the Interprovincial Program Guide (IPG) is: "a list of validated technical training outcomes, based upon those sub-tasks identified as common core in the National Occupational Analysis, and validated by industry in the provinces and territories as incorporating the essential tasks, knowledge and skills associated with a given trade."

Learning outcomes contained in the IPG represent the minimum common core content for the development of jurisdictional training standards and outlines. IPGs are developed based on the National Occupational Analyses and extensive industry consultation. The IPG is intended to assist program development staff in the design of jurisdictional plans of training. Each jurisdiction has the flexibility to add additional content.

The IPG was deliberately constructed for ease of use and flexibility of structure in order to adapt to all delivery requirements. It details units of training, unit outcomes and objectives. It does not impose a delivery model or teaching format.

Jurisdictions and/or training providers will select and develop delivery materials and techniques that accommodate a variety of learning styles and delivery patterns. The IPG does not dictate study materials, textbooks or learning activities to be used in delivery.

The IPG document includes a recommended leveling structure to facilitate mobility for apprentices moving from one jurisdiction to another. Because of difference in jurisdictional regulations and program durations, levels are offered as suggestions only.

Structure

The content of the IPG is divided into units. Unit codes are used as a means of identification and are not intended to convey the order of delivery. Prerequisites have not been detailed. Jurisdictions are free to deliver units one at a time or concurrently provided all outcomes are met.

User Guide *(continued)*

The IPG does not indicate the amount of time to be spent on a particular unit. The length of time required to deliver an outcome successfully will depend upon the learning activities and teaching methods used. Jurisdictions are encouraged to use practical demonstration and opportunities for hands-on learning whenever possible.

The unit outcomes are the specific performances that must be evaluated. Wording of outcomes, "Demonstrate knowledge of...", acknowledges the broad spectrum of ways in which knowledge can be shown. It is at the discretion of each jurisdiction to determine the manner in which outcomes are evaluated; theoretically, practically or a combination of both.

Detailed content for each objective has not been developed. Where detail is required for clarity, content has been provided. Content may be added or extended in jurisdictional training plans.

IPG Glossary of Terms

These definitions are intended as a guide to how language is used in the IPGs.

ADJUST	To put in good working order; regulate; bring to a proper state or position.
APPLICATION	The use to which something is put and/or the circumstance in which you would use it.
CHARACTERISTIC	A feature that helps to identify, tell apart, or describe recognizably; a distinguishing mark or trait.
COMPONENT	A part that can be separated from or attached to a system; a segment or unit.
DEFINE	To state the meaning of (a word, phrase, etc.).
DESCRIBE	To give a verbal account of; tell about in detail.
EXPLAIN	To make plain or clear; illustrate; rationalize.
IDENTIFY	To point out or name objectives or types.
INTERPRET	To translate information from observation, charts, tables, graphs, and written material.
MAINTAIN	To keep in a condition of good repair or efficiency.
METHOD	A means or manner of doing something that has procedures attached to it.
PROCEDURE	A prescribed series of steps taken to accomplish an end.
PURPOSE	The reason for which something exists or is done, made or used.

IPG Glossary of Terms *(continued)*

TECHNIQUE	Within a procedure, the manner in which technical skills are applied.
TEST	v. To subject to a procedure that ascertains effectiveness, value, proper function, or other quality. n. A way of examining something to determine its characteristics or properties, or to determine whether or not it is working correctly.
TROUBLESHOOT	To follow a systematic procedure to identify and locate a problem or malfunction and its cause.

Essential Skills Profiles

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

Over the past several years, the Government of Canada has conducted research examining the skills people use at work. From this research, Essential Skills Profiles have been developed for various occupations.

For more information regarding Essential Skills and to access Essential Skills Profiles for specific occupations, visit Human Resources and Social Development Canada's Essential Skills website at:

http://srv108.services.gc.ca/english/general/home_e.shtml

Profile Chart

OCCUPATIONAL SKILLS			
IMM-100 Trade Overview	IMM-105 Safety	IMM-110 Communications	IMM-115 Drawings and Sketching
IMM-120 Tools and Equipment	IMM-125 Measuring and Layout	IMM-145 Fastening and Retaining Devices	IMM-160 Access Equipment
IMM-150 Metallurgy	IMM-205 Equipment Assembly Drawings	IMM-440 Mechanical Installation Drawings	IMM-470 Job Planning
WELDING			
IMM-170 Oxy-fuel Cutting, Heating and Welding	IMM-250 Shielded Metal Arc Welding	IMM-255 Metal Inert Gas Welding	IMM-260 Tungsten Inert Gas Welding
IMM-265 Plasma Arc Cutting			
SHOP MACHINES			
IMM-130 Grinders	IMM-135 Power Metal Saws	IMM-140 Drilling Machines	IMM-270 Lathe Operations
IMM-275 Milling Machines			
TRADE PRACTICES			
IMM-210 Lubrication Systems	IMM-230 Shaft Alignment I	IMM-300 Shaft Alignment II	IMM-415 Electrical Principles
IMM-460 Balancing	IMM-445 Equipment Installation and Alignment		
RIGGING, HOISTING AND LIFTING			
IMM-165 Hoisting, Lifting and Rigging			

Profile Chart (continued)

MECHANICAL COMPONENTS AND SYSTEMS			
IMM-175 Bearings	IMM-180 Seals and Gaskets	IMM-215 Couplings	IMM-220 Clutches and Brakes
IMM-230 Shafts	IMM-235 Chain and Belt Drive Systems	IMM-240 Gear Drives	IMM-420 Prime Movers (Electric Motors)
IMM-425 Prime Movers (Internal Combustion Engines)	IMM-430 Prime Movers (Turbines)		
MATERIAL HANDLING/PROCESS SYSTEMS			
IMM-245 Compressors I	IMM-325 Process Tanks and Containers	IMM-330 Compressors II	IMM-335 Centrifugal Pumps
IMM-340 Positive Displacement Pumps	IMM-345 Conveying Systems	IMM-435 Fans and Blowers	
FLUID POWER			
IMM-305 Introduction to Fluid Power	IMM-310 Hydraulic Systems I	IMM-310 Pneumatic Systems I	IMM-315 Piping Systems
IMM-400 Hydraulic Systems II	IMM-405 Pneumatic Systems II	IMM-410 Vacuum Systems	
PREVENTIVE AND PREDICTIVE MAINTENANCE, TESTING AND COMMISSIONING			
IMM-155 Non-Destructive Testing	IMM-200 Introduction to Commissioning	IMM-450 Preventive and Predictive Maintenance	IMM-455 Vibration Analysis
IMM-465 Fluid Analysis			

Nova Scotia Program Structure

The courses listed below are required technical training in the Nova Scotia Industrial Mechanic (Millwright) Apprenticeship Program.

Nova Scotia Course #	Nova Scotia Course Name	Nova Scotia Prerequisites	Interprovincial Program Guide (IPG) To Be Covered		Content
			IPG Units		Pg. #
Level 1 (7 weeks)					
MENT-1801	Integrated Milestone	None	MENT-1801	Workplace Mentoring I (NS Specific)	22
IMMA-1829	Safety and Trade Practice	None	IMM-105	Safety	23
			IMM-100	Trade Overview	24
			IMM-110	Communications	25
			IMM-120	Tools and Equipment	26
			*IMM-140	*Drilling Machines (covers theory statements on drills, taps and reamers)	27
			IMM-145	Fastening and Retaining Devices	28
IMMA-1802	Power Tools	IMMA-1829	*IMM-140	*Drilling Machines (covers theory on drill presses)	27
			IMM-135	Power Metal Saws	29
			MMA-130	Grinders	30
IMMA-0803	Blueprint Reading and Sketching	None	IMM-115	Drawings and Sketching	31
IMMA-1805	Rigging	IMMA-1829	IMM-165	Hoisting, Lifting and Rigging	33
			IMM-160	Access Equipment	35
IMMA-0820	Metallurgy	None	IMM-150	Metallurgy	36
			IMM-155	Non-Destructive Testing	38
IMMA-1806	Machine Shop Fundamentals	IMMA-1829, 1802	IMM-125	Measuring and Layout	39
			IMM-270	Lathe Operations	41
			IMM-275	Milling Machines	43
IMMA-1821	Oxy-Fuel/ Electric Arc Welding	IMMA-0820	IMM-170	Oxy-fuel Cutting, Heating and Welding	44
			IMM-250	Shielded Metal Arc Welding (SMAW)	45
			IMM-255	Metal Inert Gas (MIG) Welding	46
			IMM-260	Tungsten Inert Gas (TIG) Welding	47
			IMM-265	Plasma Arc Cutting	48

Nova Scotia Course #	Nova Scotia Course Name	Nova Scotia Prerequisites	Interprovincial Program Guide (IPG) To Be Covered		Content
			IPG Units		Pg. #
Level 2 (7 weeks)					
IMMA-1807	Static and Dynamic Seals	IMMA-1829, 1806	IMM-180	Seals and Gaskets	50
IMMA-1813	Bearings and Lubrication	IMMA-1829, 1806	IMM-175	Bearings	51
			IMM-210	Lubrication Systems	52
IMMA-1809	Couplings and Clutches	IMMA-1829, 1802, 1806	IMM-215	Couplings	54
			IMM-220	Clutches and Brakes	55
IMMA-1810	Gear Drive Units	IMMA-1809	IMM-240	Gear Drives	57
IMMA-1812	Conveyors (Material Handling Systems)	IMMA-1809, 1810	IMM-345	Conveying Systems	59
			IMM-410	Vacuum Systems	61
IMMA-1819	Sheaves and Sprockets	IMMA-1829, 1809	IMM-235	Chain and Belt Drive Systems	63
IMMA-1804	Equipment and Mechanical Installation Blueprint	IMMA-0803	IMM-205	Equipment Assembly Drawings	65
			IMM-200	Introduction to Commissioning	66
			IMM-440	Mechanical Installation Drawings	67
Level 3 (7 weeks)					
IMMA-1808	Pumps (Positive and Non-positive)	IMMA-1829, 1804	IMM 340	Positive Displacement Pumps	69
			IMM-335	Centrifugal Pumps	70
IMMA-1814	Fluid Power 1 (Basic Hydraulics, Schematics and Components)	IMMA-1804, 1807, 1808, 1810, 1813	IMM 305	Introduction to Fluid Power	71
			IMM 320	Piping Systems	72
			IMM 310	Hydraulic Systems I	74
			IMM-325	Process Tanks and Containers	75
IMMA-1815	Fluid Power 2 (Controls, Circuits and Testing)	IMMA-1814	IMM-400	Hydraulic Systems II	77
			IMM-465	Fluid Analysis	78
IMMA-1817	Pneumatics	IMMA-1804, 1808, 1809, 1814	IMM-315	Pneumatic Systems I	79
			IMM-405	Pneumatic Systems II	80
IMMA-1818	Compressors	IMMA-1807, 1817	IMM-245	Compressors I	81
			IMM-330	Compressors II	83
IMMA-1831	Internal Combustion Engines	IMMA-1829	IMM-425	Prime Movers (Internal Combustion Engines)	84
			IMM-420	Prime Movers (Electric Motors)	86
IMMA-1833	Basic Electricity	None	IMM-415	Electrical Principles	87

Nova Scotia Course #	Nova Scotia Course Name	Nova Scotia Prerequisites	Interprovincial Program Guide (IPG) To Be Covered		Content
			IPG Units		Pg. #
Level 4 (7 weeks)					
MENT-1802	Integrated Milestone	MENT-1801	MENT-1802	Workplace Mentoring II <i>(NS Specific)</i>	90
IMMA-1822	Fans and Boilers	IMMA-1808	IMM-435	Fans and Blowers	91
IMMA-1824	Steam and Gas Turbines	IMMA-1822	IMM-430	Prime Movers (Turbines)	92
IMMA-1811	Alignment 1 (Basic)	IMMA-1804, 1809 Co-requisites: IMMA-1811, 1828	IMM-225	Shafts	94
			IMM-230	Shaft Alignment I	95
IMMA-1828	Alignment 2 (Reverse and Cross Dial, Laser)		IMM-300	Shaft Alignment II	96
IMMA-1825	Dynamic Balancing / Vibration Analysis / Maintenance	IMMA-1829, 1804, 1805, 1809, 1811, 1812	IMM-460	Balancing	97
			IMM-455	Vibration Analysis	98
			IMM-450	Preventative and Predictive Maintenance	99
			IMM-470	Job Planning	100
IMMA-1826	Machinery Installation and Optical Alignment	IMMA-1829, 1804, 1805, 1809	IMM-445	Equipment Installation and Alignment	101
IMMA-1830	Program Review	Entire Program	IMMA-1830	Program Review <i>(NS Specific)</i>	103
Nova Scotia Industrial Mechanic Millwright Apprenticeship Program: All Courses are Required					

NOA Comparison Table

NOA Sub-task		Curriculum Unit	
Task 1 – Maintains tools and equipment			
1.01	Maintains hand tools.	IMM-120	Tools and Equipment
1.02	Maintains portable power tools.	IMM-120	Tools and Equipment
1.03	Maintains shop machines.	IMM-120	Tools and Equipment
		IMM-270	Lathe Operations
		IMM-140	Drilling Machines
		IMM-275	Milling Machines
		IMM-135	Power Metal Saws
		IMM-130	Grinders
1.04	Maintains precision measuring tools.	IMM-120	Tools and Equipment
		IMM-125	Measuring and Layout
1.05	Maintains layout tools.	IMM-120	Tools and Equipment
1.06	Maintains access equipment.	IMM-160	Access Equipment
1.07	Maintains personal protective equipment (PPE) and safety equipment.	IMM-105	Safety
Task 2 – Organizes Work			
2.01	Uses documentation.	IMM-110	Communications
2.02	Uses drawings and schematics.	IMM-115	Drawings and Sketching
		IMM-205	Equipment Assembly Drawings
		IMM-440	Mechanical Installation Drawings
2.03	Identifies job requirements.	IMM-470	Job Planning
2.04	Communicates with others.	IMM-110	Communications
2.05	Maintains safe work environment.	IMM-105	Safety
Task 3 – Performs routine trade tasks			
3.01	Performs lockout procedures.	IMM-105	Safety
		IMM-415	Electrical Principles
		IMM-305	Introduction to Fluid Power
3.02	Fabricates work piece.	IMM-205	Equipment Installation and Alignment
		IMM-270	Lathe Operations
		IMM-140	Drilling Machines
		IMM-275	Milling Machines
		IMM-135	Power Metal Saws
		IMM-130	Grinders
3.03	Operates shop machines.	IMM-270	Lathe Operations
		IMM-140	Drilling Machines
		IMM-275	Milling Machines
		IMM-135	Power Metal Saws
		IMM-130	Grinders
3.04	Uses access equipment.	IMM-160	Access Equipment
3.05	Lubricates systems and components.	IMM-210	Lubrication Systems

NOA Comparison Table *(continued)*

NOA Sub-task		Curriculum Unit	
3.06	Aligns components and systems.	IMM-230	Shaft Alignment I
		IMM-205	Equipment Installation and Alignment
		IMM-300	Shaft Alignment II
3.07	Uses fastening and retaining devices.	IMM-145	Fastening and Retaining Devices
3.08	Tests metal and other materials using standardized procedures.	IMM-150	Metallurgy
3.09	Performs heat treatment of metal.	IMM-150	Metallurgy
Task 4 – Performs measuring and layout			
4.01	Measures material and components using precision tools.	IMM-125	Measuring and Layout
4.02	Places components using layout tools.	IMM-125	Measuring and Layout
		IMM-125	Equipment Installation and Alignment
Task 5 – Uses cutting and welding equipment			
5.01	Cuts material using gas-cutting equipment.	IMM-170	Oxy-Fuel Cutting, Heating and Welding
5.02	Cuts material using plasma arc cutting equipment.	IMM-265	Plasma Arc Cutting
5.03	Welds/brazes/solders material using gas welding equipment.	IMM-170	Oxy-Fuel Cutting, Heating and Welding
5.04	Welds material using arc welding equipment.	IMM-250	Shielded Metal Arc Welding
5.05	Welds material using metal inert gas (MIG) welding equipment.	IMM-255	Metal Inert Gas (MIG) Welding
5.06	Welds material using tungsten inert gas (TIG) welding equipment.	IMM-260	Tungsten Inert Gas (TIG) Welding
Task 6 – Prepares for installation and maintenance of components and systems			
6.01	Prepares for installation of components and systems.	IMM-445	Equipment Installation and Alignment
6.02	Prepares for maintenance of components and systems.	IMM-105	Safety
		IMM-110	Communication
		IMM-470	Job Planning
Task 7 – Plans lift			
7.01	Determines load.	IMM-165	Hoisting, Lifting and Rigging II
7.02	Selects rigging equipment.	IMM-165	Hoisting, Lifting and Rigging I
7.03	Selects lifting equipment.	IMM-165	Hoisting, Lifting and Rigging I
Task 8 – Hoists load			
8.01	Secures lift area.	IMM-165	Hoisting, Lifting and Rigging
8.02	Sets up rigging, hoisting and lifting equipment.	IMM-165	Hoisting, Lifting and Rigging

NOA Comparison Table (continued)

NOA Sub-task		Curriculum Unit	
8.03	Performs lift.	IMM-165	Hoisting, Lifting and Rigging
Task 9 – Inspects and maintains rigging, hoisting and lifting equipment			
9.01	Conducts post-lift equipment inspection.	IMM-165	Hoisting, Lifting and Rigging
9.02	Maintains rigging, hoisting and lifting equipment.	IMM-165	Hoisting, Lifting and Rigging
9.03	Stores equipment.	IMM-165	Hoisting, Lifting and Rigging
Task 10 – Services prime movers			
10.01	Installs prime movers.	IMM-420	Prime Movers (Electric Motors)
		IMM-425	Prime Movers (Internal Combustion Engines)
		IMM-430	Prime Movers (Turbines)
10.02	Diagnose prime movers.	IMM-420	Prime Movers (Electric Motors)
		IMM-425	Prime Movers (Internal Combustion Engines)
		IMM-430	Prime Movers (Turbines)
10.03	Repairs prime movers.	IMM-420	Prime Movers (Electric Motors)
		IMM-425	Prime Movers (Internal Combustion Engines)
		IMM-430	Prime Movers (Turbines)
10.04	Maintains prime movers.	IMM-420	Prime Movers (Electric Motors)
		IMM-425	Prime Movers (Internal Combustion Engines)
		IMM-430	Prime Movers (Turbines)
Task 11 – Services shafts, bearings and seals			
11.01	Installs shafts, bearings and seals.	IMM-175	Bearings
		IMM-225	Shafts
		IMM-180	Seals and Gaskets
11.02	Diagnose shafts, bearings and seals.	IMM-175	Bearings
		IMM-225	Shafts
		IMM-180	Seals and Gaskets
11.03	Repairs shafts, bearings and seals.	IMM-175	Bearings
		IMM-225	Shafts
		IMM-180	Seals and Gaskets
11.04	Maintains shafts, bearings and seals.	IMM-175	Bearings
		IMM-225	Shafts
		IMM-180	Seals and Gaskets
Task 12 – Services couplings, clutches and brakes			
12.01	Installs couplings, clutches and brakes.	IMM-215	Couplings
		IMM-220	Clutches and Brakes
		IMM-230	Shaft Alignment I
		IMM-300	Shaft Alignment II
12.02	Diagnoses couplings, clutches and brakes.	IMM-215	Couplings
		IMM-220	Clutches and Brakes
12.03	Repairs couplings, clutches and brakes.	IMM-215	Couplings
		IMM-220	Clutches and Brakes

NOA Comparison Table *(continued)*

NOA Sub-task		Curriculum Unit	
12.04	Maintains couplings, clutches and brakes.	IMM-215	Couplings
		IMM-220	Clutches and Brakes
Task 13 – Services chain and belt drive systems			
13.01	Installs chain and belt drive systems.	IMM-235	Chain and Belt Drive Systems
13.02	Diagnoses chain and belt drive systems.	IMM-235	Chain and Belt Drive Systems
13.03	Repairs chain and belt drive systems.	IMM-235	Chain and Belt Drive Systems
13.04	Maintains chain and belt drive systems.	IMM-235	Chain and Belt Drive Systems
Task 14 – Services gear systems			
14.01	Installs gear systems.	IMM-240	Gear Drives
14.02	Diagnoses gear systems.	IMM-240	Gear Drives
14.03	Repairs gear systems.	IMM-240	Gear Drives
14.04	Maintains gear systems.	IMM-240	Gear Drives
Task 15 – Services fans and blowers			
15.01	Installs fans and blowers.	IMM-435	Fans and Blowers
15.02	Diagnoses fans and blowers.	IMM-435	Fans and Blowers
15.03	Repairs fans and blowers.	IMM-435	Fans and Blowers
15.04	Maintains fans and blowers.	IMM-435	Fans and Blowers
Task 16 – Services compressors			
16.01	Installs compressors.	IMM-245	Compressors I
		IMM-330	Compressors II
16.02	Diagnoses compressors.	IMM-245	Compressors I
		IMM-330	Compressors II
16.03	Repairs compressors.	IMM-245	Compressors I
		IMM-330	Compressors II
16.04	Maintains compressors.	IMM-245	Compressors I
		IMM-330	Compressors II
Task 17 – Services pumps			
17.01	Installs pumps.	IMM-335	Centrifugal Pumps
		IMM-340	Positive Displacement Pumps
17.02	Diagnoses pumps.	IMM-335	Centrifugal Pumps
		IMM-340	Positive Displacement Pumps
17.03	Repairs pumps.	IMM-335	Centrifugal Pumps
		IMM-340	Positive Displacement Pumps
17.04	Maintains pumps.	IMM-335	Centrifugal Pumps
		IMM-340	Positive Displacement Pumps
Task 18 – Services conveying systems			
18.01	Installs conveying systems.	IMM-345	Conveying Systems

NOA Comparison Table (continued)

NOA Sub-task		Curriculum Unit	
Task 20 – Services hydraulic systems			
18.02	Diagnoses conveying systems.	IMM-345	Conveying Systems
18.03	Repairs conveying systems.	IMM-345	Conveying Systems
18.04	Maintains conveying systems.	IMM-345	Conveying Systems
Task 19 – Services process tanks and containers			
19.01	Installs process tanks and containers.	IMM-325	Process Tanks and Containers
19.02	Diagnoses process tanks and containers.	IMM-325	Process Tanks and Containers
19.03	Repairs process tanks and containers.	IMM-325	Process Tanks and Containers
19.04	Maintains process tanks and containers.	IMM-325	Process Tanks and Containers
Task 2 – Services hydraulic Systems			
20.01	Installs hydraulic systems.	IMM-305	Introduction to Fluid Power
		IMM-310	Hydraulic Systems I
		IMM-320	Piping Systems
		IMM-400	Hydraulic Systems II
20.02	Diagnoses hydraulic systems.	IMM-305	Introduction to Fluid Power
		IMM-310	Hydraulic Systems I
		IMM-400	Hydraulic Systems II
20.03	Repairs hydraulic systems.	IMM-305	Introduction to Fluid Power
		IMM-310	Hydraulic Systems I
		IMM-400	Hydraulic Systems II
20.04	Maintains hydraulic systems.	IMM-305	Introduction to Fluid Power
		IMM-310	Hydraulic Systems I
		IMM-400	Hydraulic Systems II
Task 21 – Services and vacuum systems			
21.01	Installs pneumatic and vacuum systems.	IMM-305	Introduction to Fluid Power
		IMM-315	Pneumatic Systems I
		IMM-320	Piping Systems
		IMM-405	Pneumatic Systems II
		IMM-410	Vacuum Systems
21.02	Diagnoses pneumatic and vacuum systems.	IMM-305	Introduction to Fluid Power
		IMM-315	Pneumatic Systems I
		IMM-405	Pneumatic Systems II
		IMM-410	Vacuum Systems
21.03	Repairs pneumatic and vacuum systems.	IMM-305	Introduction to Fluid Power
		IMM-310	Pneumatic Systems I
		IMM-405	Pneumatic Systems II
		IMM-410	Vacuum Systems

NOA Comparison Table (continued)

NOA Sub-task		Curriculum Unit	
21.04	Maintains pneumatic and vacuum systems.	IMM-305	Introduction to Fluid Power
		IMM-315	Pneumatic Systems I
		IMM-405	Pneumatic Systems II
		IMM-410	Vacuum Systems
Task 22 – Performs preventive and predictive maintenance			
22.01	Performs preventive maintenance activities.	IMM-450	Preventive and Predictive Maintenance
22.02	Performs predictive maintenance activities.	IMM-450	Preventive and Predictive Maintenance
22.03	Performs machinery and equipment balancing.	IMM-460	Balancing
Task 23 – Performs specialized testing and analysis			
23.01	Analyzes maintenance history of equipment.	IMM-450	Preventive and Predictive Maintenance
23.02	Tests machinery and equipment using vibration analysis procedures.	IMM-455	Vibration Analysis
23.03	Analyzes vibration test data.	IMM-455	Vibration Analysis
23.04	Tests equipment and components using non-destructive testing (NDT).	IMM-155	Non-Destructive Testing
23.05	Analyzes NDT.	IMM-155	Non-Destructive Testing
23.06	Collects fluid samples.	IMM-465	Fluid Analysis
23.07	Analyzes fluids and fluid test data.	IMM-465	Fluid Analysis
Task 24 – Commissions equipment			
24.01	Commissions mechanical systems and components, and material handling/process systems.	IMM-200	Introduction to Commissioning
		IMM-240	Gear Drives
		IMM-245	Compressors I
		IMM-330	Compressors II
		IMM-335	Centrifugal Pumps
		IMM-340	Positive Displacement Pumps
		IMM-345	Conveying Systems
		IMM-420	Prime Movers (Electric Motors)
		IMM-425	Prime Movers (Internal Combustion Engines)
		IMM-430	Prime Movers (Turbines)
24.02	Commissions fluid power systems.	IMM-200	Introduction to Commissioning
		IMM-400	Hydraulics II
		IMM-405	Pneumatics II

LEVEL 1

MENT-1801

Workplace Mentoring I

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Identify and explain strategies for learning workplace skills.
- Demonstrate strategies to assist in learning skills in the workplace.

Objectives and Content:

1. Describe the importance of your own experiences.
2. Identify the partners involved in apprenticeship.
3. Describe the shared responsibilities for workplace learning.
4. Determine your own learning preferences and explain how these relate to learning new skills.
5. Describe the importance of different types of skills in the workplace.
6. Describe the importance of essential skills in the trade.
7. Identify different ways of learning.
8. Identify your learning preferences.
9. Identify different learning needs and strategies to meet learning needs.
10. Identify techniques for effective communication.
11. Identify strategies to assist in learning a skill.

Resource:

- Recommended resource to use in the delivery of this unit:
www.apprenticeship.nsc.ca/mentoring/apprentice.htm

IMM-105 Safety

Learning Outcomes:

- Demonstrate knowledge of safety equipment, their applications, maintenance and procedures for use.
- Demonstrate knowledge of safe work practices.
- Demonstrate knowledge of regulatory requirements pertaining to safety.

Objectives and Content:

1. Identify types of personal protective equipment (PPE) and clothing and describe their applications.
2. Describe the procedures used to care and maintain PPE as per manufacturers' specifications.
3. Identify hazards, assess risks and describe safe work practices.
 - i) personal
 - ii) workplace
 - electrical
 - isolation procedures
 - tag out/lockout
 - chemical
 - potential sources of energy
 - confined space
 - fire
 - heights
 - iii) environment
4. Identify and describe workplace safety and health regulations.
 - i) federal
 - material safety data sheets (MSDS)
 - workplace hazardous material information system (WHMIS)
 - ii) provincial/territorial
 - worker's rights and responsibilities
 - iii) municipal
 - iv) company safety policies

IMM-100 Trade Overview

Learning Outcomes:

- Demonstrate knowledge of the Industrial Mechanic (Millwright) trade, its sectors and associated equipment.

Objectives and Content:

1. Identify the sectors of the Industrial Mechanic (Millwright) trade and describe their associated equipment and machinery.
 - i) mining
 - ii) forestry
 - iii) processing
 - food & beverage
 - fish
 - iv) manufacturing
 - auto
 - textile
 - fertilizer
 - v) oil and gas
 - vi) power generation
 - vii) marine
 - viii) aerospace

IMM-110 Communications

Learning Outcomes:

- Demonstrate knowledge of effective communication practices.
- Demonstrate knowledge of trade related documentation and its use.
- Demonstrate knowledge of the procedures used to prepare and complete trade documentation.

Objectives and Content:

1. Describe effective verbal and non-verbal communication.
 - i) other tradespersons
 - ii) colleagues
 - iii) supervisors
 - iv) clients

2. Identify types of trade related documentation and describe their applications and procedures for use.
 - i) work orders
 - ii) purchase orders
 - iii) parts lists
 - iv) manufacturers' specifications
 - v) codes and standards
 - vi) technical manuals

3. Describe the procedures used to prepare and complete trade related documentation.
 - i) work orders
 - ii) safety reports
 - iii) maintenance records
 - iv) accident/incident investigation reports
 - equipment
 - production loss

IMM-120 Tools and Equipment

Learning Outcomes:

- Demonstrate knowledge of tools and equipment, their applications, maintenance and procedures for use.

Objectives and Content:

1. Identify hazards and describe safe work practices pertaining to the use of tools and equipment.
2. Identify types of hand tools and describe their applications and procedures for use.
 - i) cutting
 - ii) non-cutting
3. Identify types of portable power tools and describe their applications and procedures for use.
 - i) electric/battery
 - ii) pneumatic
 - iii) hydraulic
 - iv) fuel
4. Identify types of powder actuated tools and describe their applications.
5. Identify types of shop machines and describe their applications.
6. Identify types of measuring and layout tools and equipment and describe their applications and procedures for use.
7. Identify types of welding and cutting equipment and describe their applications.
8. Describe the procedures used to clean, inspect, maintain and store tools and equipment as per manufacturers' specifications.

IMM-140 Drilling Machines

Learning Outcomes:

- Demonstrate knowledge of drilling machines and their accessories.
- Demonstrate knowledge of drilling machine maintenance and applications.
- Demonstrate knowledge of the procedures and calculations used to perform drilling operations.

Objectives and Content:

1. Define terminology associated with drilling machines.
2. Identify hazards and describe safe work practices pertaining to drilling operations.
3. Identify types of drilling machines, their components and accessories and describe their applications, maintenance and procedures for use.
4. Identify types of drill bits and describe their characteristics and applications.
5. Identify cutting fluids and coolants used during drilling operations.
6. Describe the procedures used to set up, operate and troubleshoot drilling machines.
 - i) drilling
 - ii) boring
 - iii) reaming
 - iv) counterboring
 - v) countersinking
 - vi) tapping
 - vii) spot facing
7. Describe the procedures used to sharpen drill bits.
8. Determine and calculate speeds and feeds for drilling operations.

Learning Outcomes:

- Demonstrate knowledge of fastening and retaining devices and their applications.
- Demonstrate knowledge of the procedures to install and remove fastening and retaining devices.

Objectives and Content:

1. Define terminology associated with fastening and retaining devices.
2. Identify hazards and describe safe work practices pertaining to installing and removing fastening and retaining devices.
3. Identify tools and equipment used to install, remove, and repair fastening and retaining devices and describe their applications and procedures for use.
4. Identify types of fastening devices and materials and describe their characteristics and applications.
 - i) mechanical
 - ii) adhesives
5. Describe the procedures used to install, remove, and repair fastening devices.
6. Describe the purpose and procedures associated with torquing fastening devices.
7. Identify types of retaining devices and describe their characteristics and applications.
8. Describe the procedures used to install and remove retaining devices.
9. Identify thread classifications and describe the procedures used for thread identification.

IMM-135 Power Metal Saws

Learning Outcomes:

- Demonstrate knowledge of power metal saws and their maintenance and applications.
- Demonstrate knowledge of the procedures used to perform cutting operations using power metal saws.

Objectives and Content:

1. Define terminology associated with power metal saws.
2. Identify hazards and describe safe work practices pertaining to power metal saws.
3. Identify types of power metal saws and describe their maintenance and applications.
4. Identify power metal saw components, accessories and attachments and describe their applications.
5. Identify cutting fluids and coolants used during cutting operations.
6. Describe the procedures used to perform and troubleshoot cutting operations using power metal saws.

IMM-130 Grinders

Learning Outcomes:

- Demonstrate knowledge of grinders and their applications.
- Demonstrate knowledge of the procedures used to perform grinding operations.

Objectives and Content:

1. Define terminology associated with grinders.
2. Identify hazards and describe safe work practices pertaining to grinding operations.
3. Identify types of grinders and describe their applications.
4. Identify grinder components, accessories and attachments and describe their applications and maintenance.
5. Describe the procedures used to select grinding wheels for specific operations.
6. Describe the procedures used to change, ring test, mount and dress grinding wheels.
7. Describe the procedures used to operate grinders.
8. Describe the techniques used to sharpen or dress tools using grinders.
 - i) chisels
 - ii) lathe tool bits
 - iii) twist drills
 - iv) punches

IMM-115 Drawings and Sketching

Learning Outcomes:

- Demonstrate knowledge of drawings, their use and interpretation.
- Demonstrate knowledge of basic sketching techniques.

Objectives and Content:

1. Define terminology associated with drawings and sketches.
2. Describe metric and imperial systems of measurement and the procedures used to perform conversions.
3. Identify the types of drawings and describe their applications.
 - i) civil/site
 - ii) architectural
 - iii) mechanical
 - iv) structural
 - v) electrical
 - vi) shop drawings
 - vii) sketches
4. Identify drawing projections and views and describe their applications.
 - i) orthographic
 - ii) oblique
 - iii) isometric
 - iv) section
 - v) auxiliary
5. Interpret and extract information from drawings.
 - i) lines
 - ii) legend
 - iii) symbols and abbreviations
 - welding
 - machining
 - iv) title block
 - v) notes and specifications
 - vi) tolerances/allowances

- vii) bill of materials
- 6. Describe the use of scales.
- 7. Identify the styles of dimensioning on drawings and describe their applications.
- 8. Demonstrate basic sketching techniques.
- 9. Describe the functions of a CAD system.

Learning Outcomes:

- Demonstrate knowledge of hoisting, lifting and rigging equipment, their applications, limitations and procedures for use.
- Demonstrate knowledge of the procedures used to perform hoisting and lifting operations.
- Demonstrate knowledge of calculations required when performing hoisting and lifting operations.

Objectives and Content:

1. Define terminology associated with hoisting, lifting and rigging.
2. Identify hazards and describe safe work practices pertaining to hoisting, lifting and rigging.
3. Identify hazards and describe safe work practices pertaining to mobile and overhead cranes.
4. Identify codes and regulations pertaining to hoisting, lifting and rigging.
5. Identify types of rigging equipment and accessories and describe their applications and procedures for use.
6. Identify types of hoisting and lifting equipment and accessories and describe their applications and procedures for use.
7. Describe the procedures used to inspect, maintain and store rigging, hoisting and lifting equipment.
8. Identify types of knots, hitches and bends and describe their applications and the procedures used to tie them.
9. Describe the procedures used to rig material/equipment for lifting.
10. Describe the procedures used to ensure the work area is safe for lifting.
 - i) supervision of lift

- ii) securing work area
 - iii) communication
11. Identify and describe procedures used to communicate during hoisting, lifting and rigging operations.
- i) hand signals
 - ii) electronic communications
 - iii) audible/visual
12. Explain sling angle when preparing for hoisting and lifting operations.
13. Describe the procedures used to determine the weight and weight distribution of loads.
- i) reference load charts
 - ii) determine types of loads
 - iii) engineered lifts
14. Identify the factors to consider when selecting rigging equipment.
- i) load characteristics
 - ii) environment
15. Describe the procedures used to perform a lift.
- i) load determination
 - ii) communication methods
 - iii) pre-lift checks
 - iv) placement of load
 - v) post-lift inspection

IMM-160 Access Equipment

Learning Outcomes:

- Demonstrate knowledge of ladders, scaffolding and hydraulic lifts, their applications, limitations and procedures for use.

Objectives and Content:

1. Define terminology associated with ladders, scaffolding and hydraulic lifts.
2. Identify hazards and describe safe work practices pertaining to ladders, scaffolding and hydraulic lifts.
3. Identify codes and regulations pertaining to ladders, scaffolding and hydraulic lifts.
4. Identify types of ladders, scaffolding and hydraulic lifts and describe their characteristics and applications.
5. Identify types of fall arrest equipment and describe their applications and procedures for use.
6. Describe the procedures used to erect and dismantle ladders and scaffolding.
7. Describe the procedures used to inspect and maintain ladders, scaffolding and hydraulic lifts.

IMM-150 Metallurgy

Learning Outcomes:

- Demonstrate knowledge of metals and their characteristics.
- Demonstrate knowledge of metallurgic principles.
- Demonstrate knowledge of material testing procedures.
- Demonstrate knowledge of structural shapes and their applications.

Objectives and Content:

1. Define terminology associated with metallurgy.
2. Describe the properties of metals.
3. Describe the identification systems for metals.
4. Describe the processes used in the heat treatment of metals.
 - i) stress relieving
 - ii) hardening
 - iii) annealing
 - iv) tempering
 - v) normalizing
 - vi) quenching
5. Identify the methods and processes used in the manufacture of steel and alloys.
6. Describe forging and casting processes.
7. Describe the problems that can occur when working metals.
 - i) stress
 - ii) contraction
 - iii) expansion
 - iv) distortion
 - v) work hardening
 - vi) galvanic action
8. Describe the procedures used to prevent and correct problems that occur when working with metals.

9. Identify common metal testing techniques and describe their associated procedures.
 - i) Rockwell
 - ii) Brinnell
 - iii) spark
 - iv) chisel
 - v) file

10. Identify structural shapes and describe their characteristics and applications.

IMM-155 Non-Destructive Testing

Learning Outcomes:

- Demonstrate knowledge of the procedures used to perform non-destructive testing.

Objectives and Content:

1. Define terminology associated with non-destructive testing.
2. Identify hazards and describe safe work practices pertaining to non-destructive testing.
3. Identify and interpret codes and regulations pertaining to non-destructive testing.
4. Identify tools and equipment used for non-destructive testing and describe their applications and procedures for use.
5. Identify types of non-destructive tests and describe their applications.
 - i) dye penetrant
 - ii) magnetic particle
 - iii) radiography
 - iv) ultrasonic
 - v) visual
6. Describe the procedures used to perform dye penetrant and magnetic particle testing.
7. Record and interpret data collected using non-destructive testing.

IMM-125 Measuring and Layout

Learning Outcomes:

- Demonstrate knowledge of precision measuring and layout tools, their applications and procedures for use.
- Demonstrate knowledge of the procedures used to layout equipment and components.

Objectives and Content:

1. Define terminology associated with measuring and layout.
2. Identify types of precision measuring tools and describe their applications and procedures for use.
 - i) micrometers
 - ii) calipers
 - iii) dial indicators
 - iv) protractors
 - v) height gauges
 - vi) feeler gauges
 - vii) plug, ring and snap gauges
 - viii) gauge blocks
3. Identify types of layout tools and describe their applications and procedures for use.
 - i) straightedges
 - ii) solid squares
 - iii) combination sets
 - iv) surface plates
 - v) scribes
 - vi) hermaphrodite calipers
 - vii) dividers
 - viii) trammels
 - ix) prick and centre punches
 - x) angle plates
 - xi) parallels
 - xii) V- blocks
 - xiii) surface gauges

xiv) layout dye

4. Describe the procedures used to lay out equipment and components.
5. Describe the procedures used to inspect, maintain, calibrate, and store precision measuring and layout tools.

IMM-270 Lathe Operations

Learning Outcomes:

- Demonstrate knowledge of lathes, their accessories, attachments and applications.
- Demonstrate knowledge of the procedures and calculations used to perform lathe operations.

Objectives and Content:

1. Define terminology associated with lathes.
2. Identify hazards and describe safe work practices pertaining to lathe operations.
3. Identify types of lathes and describe their applications and operation.
4. Identify lathe components, accessories and attachments and describe their applications and maintenance.
5. Identify types of tool holding and work holding devices and describe their applications.
6. Identify types of lathe tools and describe their characteristics and applications.
7. Describe the procedures used to sharpen lathe cutting tools.
8. Calculate and determine speeds, feeds and depth of cut for lathe operations.
9. Describe the procedures used to set up lathes.
10. Identify cutting fluids and coolants used during lathe operations.
11. Describe the procedures used to perform basic lathe operations.
 - i) turning
 - ii) boring
 - iii) grooving
 - iv) facing
 - v) knurling

- vi) parting off
- vii) drilling
- viii) threading

12. Describe the procedures used to prevent and correct problems that occur when performing lathe operations.

IMM-275 Milling Machines

Learning Outcomes:

- Demonstrate knowledge of milling machines and their applications.
- Demonstrate knowledge of the procedures and calculations used to perform milling operations.

Objectives and Content:

1. Define terminology associated with milling machines.
2. Identify hazards and describe safe work practices pertaining to milling operations.
3. Identify types of milling machines and describe their applications.
4. Identify milling machine components, accessories and attachments and describe their applications and maintenance.
5. Identify types of tool holding and work holding devices and describe their applications.
6. Identify types of cutting tools and describe their applications.
7. Calculate and determine speeds, feeds and depth of cut for milling operations.
8. Describe the procedures used to align workpieces.
9. Identify cutting fluids and coolants used during milling operations.
10. Describe the procedures used to perform basic milling operations.
11. Describe the procedures used to prevent and correct problems that occur when performing milling machine operations.

Learning Outcomes:

- Demonstrate knowledge of oxy-fuel equipment and accessories.
- Demonstrate knowledge of the procedures used to cut, heat, weld, solder and braze with oxy-fuel equipment.

Objectives and Content:

1. Define terminology associated with oxy-fuel cutting, heating and welding.
2. Identify hazards and describe safe work practices pertaining to oxy-fuel cutting, heating, welding, brazing and soldering.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
 - v) storage
3. Identify and interpret codes and regulations pertaining to oxy-fuel cutting, heating, welding, brazing and soldering.
4. Identify oxy-fuel cutting, heating, welding, brazing and soldering equipment and accessories and describe their applications.
5. Describe the procedures used to set-up, adjust and shut-down oxy-fuel equipment.
6. Describe the procedures used to inspect and maintain oxy-fuel equipment.
7. Describe the procedures used to cut, heat, weld, braze and solder materials using oxy-fuel equipment.

IMM-250 Shielded Metal Arc Welding (SMAW)

Learning Outcomes:

- Demonstrate knowledge of SMAW equipment and accessories.
- Demonstrate knowledge of procedures used to weld using SMAW equipment.

Objectives and Content:

1. Define terminology associated with SMAW.
2. Identify hazards and describe safe work practices pertaining to SMAW.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
3. Identify and interpret codes and regulations pertaining to SMAW.
4. Describe the SMAW welding process and its applications.
5. Identify and describe SMAW equipment, consumables and accessories and describe their application.
6. Describe the procedures used to set-up and adjust SMAW equipment.
7. Describe the procedures used to inspect and maintain SMAW equipment.
8. Identify the types of welds performed using SMAW equipment.
9. Identify welding positions and describe their applications.
10. Describe the procedures used to weld using SMAW equipment.
11. Describe weld defects, their causes and prevention.

IMM-255

Metal Inert Gas (MIG) Welding

Learning Outcomes:

- Demonstrate knowledge of MIG welding equipment and accessories.
- Demonstrate knowledge of the procedures used to weld with MIG welding equipment.

Objectives and Content:

1. Define terminology associated with MIG welding.
2. Identify hazards and describe safe work practices pertaining to MIG welding.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
3. Describe the MIG welding process and its applications.
 - i) GMAW
 - ii) FCAW
4. Identify and describe MIG welding equipment, consumables and accessories and describe their applications.
5. Describe the procedures used to set-up, adjust and shut-down MIG welding equipment.
6. Describe the procedures used to inspect and maintain MIG welding equipment.
7. Identify the types of welds performed using MIG welding equipment.
8. Describe the procedures used to weld using MIG welding equipment.
9. Describe weld defects, their causes and prevention.

Learning Outcomes:

- Demonstrate knowledge of TIG welding equipment and accessories.
- Demonstrate knowledge of procedures used to weld using TIG welding equipment.

Objectives and Content:

1. Define terminology associated with TIG welding.
2. Identify hazards and describe safe work practices pertaining to TIG welding.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
3. Describe the TIG welding process and its applications.
4. Identify and describe TIG welding equipment, consumables and accessories and describe their applications.
5. Describe the procedures used to set-up, adjust and shut-down TIG welding equipment.
6. Describe the procedures used to inspect and maintain TIG welding equipment.
7. Identify the types of welds performed using TIG welding equipment.
8. Describe the procedures used to weld using TIG welding equipment.
9. Describe weld defects, their causes and prevention.

IMM-265 Plasma Arc Cutting

Learning Outcomes:

- Demonstrate knowledge of plasma arc cutting equipment and accessories.
- Demonstrate knowledge of procedures used to cut with plasma arc cutting equipment.

Objectives and Content:

1. Define terminology associated with plasma arc cutting.
2. Identify hazards and describe safe work practices pertaining to plasma arc cutting.
 - i) personal
 - ii) shop/facility
 - iii) equipment
 - iv) ventilation
3. Describe the plasma arc cutting process and its applications.
4. Identify plasma arc cutting equipment and accessories and describe their applications.
5. Describe the procedures used to set-up, adjust and shut-down plasma arc cutting equipment.
6. Describe the procedures used to inspect and maintain plasma arc cutting equipment.
7. Describe the procedures used to cut using plasma arc cutting equipment.

Level 2

IMM-180 Seals and Gaskets

Learning Outcomes:

- Demonstrate knowledge of seals and gaskets and their applications.
- Demonstrate knowledge of the procedures used to remove and install seals and gaskets.

Objectives and Content:

1. Define terminology associated with seals and gaskets.
2. Identify hazards and describe safe work practices pertaining to seals and gaskets.
3. Identify types of seals and describe their applications.
 - i) static
 - ii) dynamic
 - iii) mechanical
 - iv) non-contacting (labyrinth/annulus)
4. Identify types of gaskets and describe their applications.
5. Identify tools and equipment used to remove and install seals and gaskets and describe their applications and procedures for use.
6. Identify the tools and equipment used to fabricate gaskets and describe their procedures for use.
7. Describe the procedures used to remove and install seals and gaskets.
8. Identify the considerations for determining if mechanical seal repair or replacement is required.
9. Describe the procedures used to repair mechanical seals.

IMM-175 Bearings

Learning Outcomes:

- Demonstrate knowledge of bearings and their applications.
- Demonstrate knowledge of the procedures used to remove, install, maintain, troubleshoot and repair bearings.

Objectives and Content:

1. Define terminology associated with bearings.
2. Identify hazards and describe safe work practices pertaining to bearings.
3. Identify types of bearings and describe their applications.
4. Identify types of bearing housings and describe their applications.
5. Identify types of bearing fits and describe their applications.
6. Identify tools and equipment used to remove, install, maintain, troubleshoot and repair bearings and describe their applications and procedures for use.
7. Describe the procedures used to remove and install bearings.
8. Describe the procedures used to inspect and maintain bearings.
9. Describe the procedures used to troubleshoot bearing problems.
10. Identify the considerations for determining if bearing repair or replacement is required.
11. Describe the procedures used to repair bearings.

IMM-210 Lubrication Systems

Learning Outcomes:

- Demonstrate knowledge of lubricants and lubrication, their applications and procedures for use.
- Demonstrate knowledge of lubrication systems, their components and their applications.

Objectives and Content:

1. Define terminology associated with lubricants and lubrication systems.
2. Identify hazards and describe safe work practices pertaining to lubricants and lubrication systems.
3. Explain the principles of friction and its affects on surfaces in contact.
4. Identify types of lubricants and describe their applications.
 - i) oil
 - ii) grease
 - iii) dry solid
5. Identify the properties and characteristics of lubricants.
 - i) adhesion/cohesion
 - ii) viscosity
 - iii) additives and inhibitors
 - iv) penetration
 - v) dropping point
 - vi) flash point
 - vii) classifications and grades
6. Identify types of lubrication systems and describe their characteristics and applications.
7. Identify sources of information relating to system lubricant and lubrication requirements.
 - i) technical manuals
 - ii) manufacturers' specifications

8. Describe the procedures and regulatory requirements to handle, store, recycle and dispose of lubricants and fluids.

IMM-215 Couplings

Learning Outcomes:

- Demonstrate knowledge of couplings and their applications.
- Demonstrate knowledge of the procedures to remove, install, maintain, troubleshoot and repair couplings.

Objectives and Content:

1. Define terminology associated with couplings.
2. Identify hazards and describe safe work practices pertaining to couplings.
3. Identify types of couplings and describe their applications.
4. Identify tools and equipment used to remove, install, maintain, troubleshoot, and repair couplings and describe their applications and procedures for use.
5. Describe the procedures used to remove and install couplings.
6. Describe the procedures used to inspect and maintain couplings.
7. Describe the procedures used to troubleshoot couplings.
8. Identify the considerations for determining if coupling repair or replacement is required.
9. Describe the procedures used to repair couplings.

Learning Outcomes:

- Demonstrate knowledge of clutches and brakes and their applications.
- Demonstrate knowledge of the procedures used to remove, install, maintain, troubleshoot and repair clutches and brakes.

Objectives and Content:

1. Define terminology associated with clutches and brakes.
2. Identify hazards and describe safe work practices pertaining to clutches and brakes.
3. Identify types of clutches and describe their applications.
 - i) overrunning
 - ii) friction
 - iii) positive contact
 - iv) fluid
4. Identify types of brakes and describe their applications.
 - i) friction
 - ii) fluid/wet disc
 - iii) electromagnetic
5. Identify tools and equipment used to remove, install, maintain, troubleshoot and repair clutches and brakes and describe their applications and procedures for use.
6. Describe the procedures used to remove and install clutches and brakes.
7. Describe the procedures used to inspect and maintain clutches and brakes.
8. Describe the procedures used to troubleshoot clutches and brakes.
9. Identify the considerations for determining if clutch and brake repair or replacement is required.

10. Describe the procedures used to repair clutches and brakes

IMM-240 Gear Drives

Learning Outcomes:

- Demonstrate knowledge of gears and gear drives, their components and operation.
- Demonstrate knowledge of the procedures used to remove, install, maintain, troubleshoot, repair and commission gears and gear drives.

Objectives and Content:

1. Define terminology associated with gears and gear drives.
2. Identify hazards and describe safe work practices pertaining to gear drives.
3. Identify types of gears and describe their applications.
 - i) spur
 - ii) bevel
 - iii) spiral
 - iv) herringbone
 - v) helical
 - vi) worm
4. Identify types of gear drives and describe their components, applications and operation.
 - i) planetary
 - ii) worm
 - iii) parallel shaft
 - iv) crown and pinion
5. Identify formulae and perform gear ratio calculations.
6. Identify tools and equipment used to remove, install, maintain, troubleshoot and repair and gear drives and describe their applications and procedures for use.
7. Describe the procedures used to remove and install gears and gear drives and their components.

8. Describe the procedures used to inspect and maintain gears and gear drives and their components.
 - i) monitor temperature
 - ii) perform vibration analysis
 - iii) check lubrication
 - iv) check contact patterns
 - v) adjust clearance and backlash
9. Describe the procedures used to troubleshoot gears and gear drives and their components.
10. Identify the considerations for determining if gear drive component repair or replacement is required.
11. Describe the procedures used to repair gears and gear drives and their components.
12. Describe the procedures used to commission gear drives.

IMM-345 Conveying Systems

Learning Outcomes:

- Demonstrate knowledge of conveying systems, their components and operation.
- Demonstrate knowledge of the procedures used to remove, install, maintain troubleshoot, repair and commission conveying systems.

Objectives and Content:

1. Define terminology associated with conveying systems.
2. Identify hazards and describe safe work practices associated with conveying systems.
3. Identify types of conveying systems and describe their applications and operation.
 - i) pneumatic
 - ii) belt
 - iii) rollers
 - iv) chain
 - v) screw
 - vi) bucket
 - vii) flume/water
4. Identify conveying system components and accessories and describe their purpose and operation.
5. Identify tools and equipment used to remove, install, maintain, troubleshoot and repair conveying systems and components and describe their applications and procedures for use.
6. Identify the factors to consider and required calculations to determine conveying system requirements.
7. Describe the procedures used to remove and install conveying systems and their components.

8. Describe the procedures used to inspect and maintain conveying systems and components.
9. Describe the procedures used to troubleshoot conveying systems and their components.
10. Describe the procedures used to repair conveying systems and their components.
11. Describe the procedures used to commission conveying systems.

IMM-410 Vacuum Systems

Learning Outcomes:

- Demonstrate knowledge of vacuum systems, their components and operation.
- Demonstrate knowledge of the calculations and procedures used to install, maintain, troubleshoot and repair vacuum systems and components.
- Demonstrate knowledge of the procedures used to commission vacuum systems.

Objectives and Content:

1. Identify hazards and describe safe work practices pertaining to vacuum systems.
 - i) achieve zero energy state
2. Identify types of vacuum systems and describe their applications and operation.
3. Identify vacuum system components and describe their purpose and operation.
4. Identify tools and equipment used to install, maintain, troubleshoot and repair vacuum systems and describe their applications and procedures for use.
5. Describe the calculations and procedures used to select and install vacuum systems and components.
6. Perform vacuum related calculations.
7. Describe the procedures used to inspect and maintain vacuum systems and components.
 - i) check hoses, piping and tubing
 - ii) check/change filters
 - iii) determine operating parameters
 - iv) adjust system vacuum, temperature, cycling and flow
8. Describe the procedures used to troubleshoot vacuum systems and components.
9. Identify considerations for determining if vacuum system component repair or replacement is required.
10. Describe the procedures used to repair vacuum systems and components.

11. Describe the procedures used to commission vacuum systems.

Learning Outcomes:

- Demonstrate knowledge of chain and belt drive systems, their components and operation.
- Demonstrate knowledge of the procedures used to remove, install, maintain, troubleshoot and repair chain and belt drive systems.

Objectives and Content:

1. Define terminology associated with chain and belt drive systems.
2. Identify hazards and describe safe work practices pertaining to chain and belt drive systems.
3. Identify types of chain drive systems and describe their applications.
 - i) roller
 - ii) silent
4. Identify chain drive system components and accessories and describe their applications.
5. Identify types of belt drive systems, their components and accessories and describe their applications.
 - i) v-belt drive
 - ii) cog belt (timing) drive
 - iii) flat belt drive
6. Identify formulae and perform calculations.
 - i) belt/chain lengths
 - ii) speed and torque ratios
7. Identify tools and equipment used to remove, install, maintain, troubleshoot and repair chain and belt drive systems and describe their applications and procedures for use.
8. Describe the procedures used to remove and install chain and belt drive systems and their components.

9. Describe the procedures used to inspect and maintain chain and belt drives and their components.
10. Describe the procedures used to troubleshoot chain and belt drive systems and their components.
11. Identify the considerations for determining if chain and belt drive system component repair or replacement is required.
12. Describe the procedures used to repair chain and belt drive systems and their components.

IMM-205 Equipment Assembly Drawings

Learning Outcomes:

- Demonstrate knowledge of equipment assembly drawings, their use and interpretation.

Objectives and Content:

1. Define terminology associated with equipment assembly drawings.
2. Identify the views found on equipment assembly drawings and describe their characteristics.
3. Interpret assembly instructions on equipment assembly drawings.
4. Interpret material specifications found on equipment assembly drawings.

IMM-200 Introduction to Commissioning

Learning Outcomes:

- Demonstrate knowledge of commissioning and its purpose.

Objectives and Content:

1. Define terminology associated with commissioning.
2. Identify hazards and describe safe work practices pertaining to commissioning systems or components.
 - i) verify equipment/system safety components
 - guards
 - emergency stops
 - overrun switches
3. Identify the purpose of commissioning and the types of systems and components requiring it.
4. Identify and interpret information sources and documentation pertaining to the commissioning of systems or components.
 - i) manufacturers' specifications
 - ii) operating parameters

Learning Outcomes:

- Demonstrate knowledge of mechanical installation drawings, their use and interpretation

Objectives and Content:

1. Define terminology associated with mechanical installation drawings.
2. Identify the purposes for mechanical installation drawings.
 - i) determine location of components
 - ii) determine the positioning of components
 - iii) determine elevation of components
3. Identify the views found on mechanical installation drawings and describe their characteristics.
4. Interpret mechanical installation drawings.

Level 3

IMM-340 Positive Displacement Pumps

Learning Outcomes:

- Demonstrate knowledge of positive displacement pumps, their components and operation.
- Demonstrate knowledge of the procedures used to remove, install, maintain, troubleshoot, repair and commission positive displacement pumps.

Objectives and Content:

1. Define terminology associated with positive displacement pumps.
2. Identify hazards and describe safe work practices associated with positive displacement pumps.
 - i) achieve zero energy state
3. Identify types of positive displacement pumps and their components and describe their applications and operation.
4. Identify tools and equipment used to remove, install, maintain, troubleshoot and repair positive displacement pumps and describe their applications and procedures for use.
5. Describe the procedures used to remove and install positive displacement pumps.
6. Describe the procedures used to inspect and maintain positive displacement pumps.
7. Describe the procedures used to troubleshoot positive displacement pumps.
8. Identify considerations for determining if positive displacement pump repair or replacement is required.
9. Describe the procedures used to repair positive displacement pumps.
10. Describe the procedures used to commission positive displacement pumps.

IMM-335 Centrifugal Pumps

Learning Outcomes:

- Demonstrate knowledge of centrifugal pumps their components and operation.
- Demonstrate knowledge of the procedures used to remove, install, maintain, troubleshoot, repair and commission centrifugal pumps.

Objectives and Content:

1. Define terminology associated with centrifugal pumps.
2. Identify hazards and describe safe work practices associated with centrifugal pumps.
 - i) achieve zero energy state
3. Identify types of centrifugal pumps and their components and describe their applications and operation.
4. Identify the types of seals and packing and describe their applications.
5. Identify tools and equipment used to remove, install, maintain, troubleshoot and repair centrifugal pumps and describe their applications and procedures for use.
6. Describe the procedures used to remove and install centrifugal pumps.
7. Describe the procedures used to inspect and maintain centrifugal pumps.
8. Describe the procedures used to troubleshoot centrifugal pumps.
9. Identify considerations for determining if centrifugal pump repair or replacement is required.
10. Describe the procedures used to repair centrifugal pumps.
11. Describe the procedures used to commission centrifugal pumps.

IMM-305 Introduction to Fluid Power

Learning Outcomes:

- Demonstrate knowledge of the principles and applications of fluid power.

Objectives and Content:

1. Define terminology associated with fluid power.
 - i) hydraulic
 - ii) pneumatic
 - iii) vacuum
2. Identify hazards and describe safe work practices pertaining to fluid power.
3. Explain the principles and theories of fluid power.
 - i) Pascal's law
 - ii) Boyle's law
 - iii) Charles' law
 - iv) Guy-Lusac's law
 - v) Bernoulli's principle
4. Describe units of measure as they relate to fluid power.
5. Identify fluid power related formulae and describe their applications.
6. Identify fluid power related symbols and abbreviations found on drawings and schematics.

IMM-320 Piping Systems

Learning Outcomes:

- Demonstrate knowledge of piping systems, their components and operation.
- Demonstrate knowledge of the procedures used to remove, install, maintain, troubleshoot and repair piping systems and their components.

Objectives and Content:

1. Define terminology associated with piping systems.
2. Identify hazards and describe safe work practices pertaining to piping systems.
3. Identify and interpret codes and regulations pertaining to piping systems.
4. Identify types of piping systems and describe their applications.
5. Identify types of piping, tubing, and hoses and describe their compatibility, characteristics and applications.
6. Identify types of fittings and describe their characteristics and applications.
7. Identify piping system accessories and describe their characteristics and applications.
8. Identify types of valves used in piping systems and describe their applications and operation.
9. Interpret schematics for piping systems.
10. Describe the procedures used to remove and install pipe, tubing and hoses.
11. Describe the procedures used to inspect and maintain piping systems and their components.
12. Describe the procedures used to troubleshoot piping systems and components.

13. Identify considerations for determining if piping system component repair or replacement is required.
14. Describe the procedures used to repair piping systems and components.

IMM-310 Hydraulic Systems I

Learning Outcomes:

- Demonstrate knowledge of hydraulic systems, their components and operation.
- Demonstrate knowledge of schematics, their use and interpretation.
- Demonstrate knowledge of hydraulic related calculations.

Objectives and Content:

1. Identify hazards and describe safe work practices pertaining to hydraulic systems.
 - i) achieve zero energy state
2. Identify types of hydraulic systems and describe their applications and operation.
3. Identify hydraulic system components and describe their purpose and operation.
 - i) pumps
 - ii) motors
 - iii) actuators
 - iv) valves
 - v) accumulators
4. Describe schematics and their applications.
5. Interpret schematics to determine the operation of a hydraulic system.
6. Perform hydraulic calculations.

Learning Outcomes:

- Demonstrate knowledge of process tanks and containers, their components and applications.
- Demonstrate knowledge of the procedures used to remove, install, maintain and repair process tanks and containers.

Objectives and Content:

1. Define terminology associated with process tanks and containers.
2. Identify hazards and describe safe work practices associated with process tanks and containers.
3. Identify and interpret codes and regulations pertaining to process tanks and containers.
4. Identify types of process tanks and containers and describe their applications and operation.
 - i) bins
 - ii) hoppers
 - iii) receivers
5. Identify process tank and container components and describe their applications.
6. Identify tools and equipment used to remove, install, maintain and repair process tanks and containers and describe their applications and procedures for use.
7. Describe the procedures used to remove and install process tanks and containers and their components.
8. Describe the procedures used to inspect and maintain process tanks and containers and their components.
9. Identify the considerations for determining if process tank and container repair or replacement is required.

10. Describe the procedures used to repair process tanks and containers and their components.

Learning Outcomes:

- Demonstrate knowledge of the procedures and calculations used to install, maintain, troubleshoot and repair hydraulic systems and components.
- Demonstrate knowledge of the procedures used to commission hydraulic systems.

Objectives and Content:

1. Identify tools and equipment used to install, maintain, troubleshoot and repair hydraulic systems and describe their applications and procedures for use.
2. Identify the types of fluids used in hydraulics systems and describe their characteristics and applications.
3. Describe the calculations and procedures used to select and install hydraulic systems and components.
4. Describe the procedures used to inspect and maintain hydraulic systems and components.
 - i) check hoses, piping and tubing
 - ii) check fluids (condition and level)
 - iii) check/change filters
 - iv) determine operating parameters
 - v) adjust system pressure, temperature and flow
5. Describe the procedures used to troubleshoot hydraulic systems and components.
6. Identify considerations for determining if hydraulic system component repair or replacement is required.
7. Describe the procedures used to repair hydraulic systems and components.
8. Describe the procedures used to commission hydraulic systems.

IMM-465 Fluid Analysis

Learning Outcomes:

- Demonstrate knowledge of the procedures used to collect and test fluid samples.

Objectives and Content:

1. Define terminology associated with fluid analysis.
2. Identify hazards and describe safe work practices pertaining to fluid sampling.
3. Identify and interpret codes and regulations pertaining to fluid sampling.
4. Identify tools and equipment used for fluid sampling and describe their applications and procedures for use.
5. Identify fluid contaminants and describe their causes and remedies.
6. Describe the procedures used to collect and test fluid samples from systems.
7. Record and interpret data from fluid analysis.

IMM-315 Pneumatic Systems I

Learning Outcomes:

- Demonstrate knowledge of pneumatic systems, their components and operation.
- Demonstrate knowledge of schematics, their use and interpretation.
- Demonstrate knowledge of pneumatic related calculations.

Objectives and Content:

1. Identify hazards and describe safe work practices pertaining to pneumatic systems.
 - i) achieve zero energy state
2. Identify types of pneumatic systems and describe their applications and operation.
3. Identify pneumatic system components and describe their purpose and operation.
4. Describe the methods of air treatment in pneumatic systems.
 - i) filters
 - ii) dryers
 - iii) after-coolers
 - iv) de-icers
 - v) receivers
5. Interpret schematics to determine the operation of a pneumatic system.
6. Perform pneumatic related calculations.

Learning Outcomes:

- Demonstrate knowledge of the calculations and procedures used to install, maintain, troubleshoot and repair pneumatic systems and components.
- Demonstrate knowledge of the procedures used to commission pneumatic systems.

Objectives and Content:

1. Identify tools and equipment used to install, maintain, troubleshoot and repair pneumatic systems and describe their applications and procedures for use.
2. Describe the calculations and procedures used to select and install pneumatic systems and components.
3. Describe the procedures used to inspect and maintain pneumatic systems and components.
 - i) check hoses, piping and tubing
 - ii) check lubricating fluids (condition and level)
 - iii) check/change filters
 - iv) determine operating parameters
 - v) adjust system pressure, temperature and flow
4. Describe the procedures used to troubleshoot pneumatic systems and components.
5. Identify considerations for determining if pneumatic system component repair or replacement is required.
6. Describe the procedures used to repair pneumatic systems and components.
7. Describe the procedures used to commission pneumatic systems.

IMM-245 Compressors I

Learning Outcomes:

- Demonstrate knowledge of compressors, their components and operation.
- Demonstrate knowledge of the procedures used to remove, install, maintain, troubleshoot, repair and commission reciprocating compressors.

Objectives and Content:

1. Define terminology associated with compressors.
2. Identify hazards and describe safe work practices associated with compressors.
3. Identify classifications and types of compressors, their specifications and applications.
 - i) dynamic/centrifugal
 - ii) positive displacement
 - reciprocating
 - radial
 - screw
 - vane
4. Identify reciprocating compressor components and accessories and describe their purpose and operation.
5. Identify tools and equipment used to remove, install, maintain, troubleshoot and repair reciprocating compressors and describe their applications and procedures for use.
6. Describe the procedures used to remove and install reciprocating compressors and their components.
7. Describe the procedures used to inspect and maintain reciprocating compressors and their components.
8. Describe the procedures used to troubleshoot reciprocating compressors and their components.

9. Identify the considerations for determining if reciprocating compressor component repair or replacement is required.
10. Describe the procedures used to repair reciprocating compressors and their components.
11. Describe the procedures used to commission reciprocating compressors.

IMM-330 Compressors II

Learning Outcomes:

- Demonstrate knowledge of vane, screw, radial and centrifugal compressors, their components and operation.
- Demonstrate knowledge of the procedures used to remove, install, maintain, troubleshoot, repair and commission vane, screw, radial and centrifugal compressors.

Objectives and Content:

1. Identify compressor components and accessories and describe their purpose and operation.
2. Identify tools and equipment used to remove, install, maintain, troubleshoot and repair compressors and describe their applications and procedures for use.
3. Describe the procedures used to remove and install compressors and their components.
4. Describe the procedures used to inspect and maintain compressors and their components.
5. Describe the procedures used to troubleshoot compressors and their components.
6. Identify considerations for determining if compressor repair or replacement is required.
7. Describe the procedures used to repair compressors and their components.
8. Describe the procedures used to commission compressors.

Learning Outcomes:

- Demonstrate knowledge of internal combustion engines, their components and operation.
- Demonstrate knowledge of the procedures to install, maintain, troubleshoot, repair and commission internal combustion engines.

Objectives and Content:

1. Define terminology associated with internal combustion engines.
2. Identify hazards and describe safe work practices pertaining to internal combustion engines.
3. Identify the types of internal combustion engines and describe their operation.
4. Identify internal combustion engines components and describe their purpose and operation.
5. Identify tools and equipment used to install, maintain, troubleshoot and repair internal combustion engines and describe their applications and procedures for use.
6. Describe the factors to consider when installing internal combustion engines.
 - i) manufacturers' specifications
 - ii) job site specifications
 - iii) location drawings
 - iv) auxiliary systems
 - v) sequence of installation
7. Describe the procedures used to remove and install internal combustion engines and their components.
8. Describe the procedures used to inspect and maintain internal combustion engines and their components.

9. Describe the procedures used to troubleshoot internal combustion engines and their components.
10. Identify the considerations for determining if internal combustion engine component repair or replacement is required.
11. Describe the procedures used to repair internal combustion engines and their components.
12. Describe the procedures used to commission internal combustion engines.

Learning Outcomes:

- Demonstrate knowledge of electric motors, their components and operation.
- Demonstrate knowledge of the procedures used to install and maintain electric motors.

Objectives and Content:

1. Define terminology associated with electric motors.
2. Identify hazards and describe safe work practices pertaining to electric motors.
3. Identify the types of electric motors and describe their applications.
4. Describe the procedures used to remove and install electric motors.
5. Describe the procedures used to inspect and maintain bearings in electric motors.

IMM-415 Electrical Principles

Learning Outcomes:

- Demonstrate knowledge of the basic concepts of electricity.
- Demonstrate knowledge of electrical components and equipment.

*** The content of the electrical section in this course outline is not to suggest a Journey person Industrial Mechanic (Millwright) should complete tasks normally performed by Journey person Electricians. The intent is to provide the Industrial Mechanic (Millwright) with enough electrical knowledge so that safe decisions may be made when working on or around electrical equipment.*

Objectives and Content:

1. Define terminology associated with electricity.
2. Explain the basic principles of electricity.
3. Explain the principles of magnetism and electromagnetism.
4. Describe the types of electric current, phases and cycles.
5. Explain the mathematical relationship between amps, volts, ohms and watts.
6. Identify hazards and describe safe work practices pertaining to working on or around electrical equipment and sources.
7. Identify electrical devices and describe their purpose.
 - i) circuit breakers
 - ii) disconnects
 - iii) overload heaters
 - iv) ground fault interrupters
 - v) fuses
 - vi) contactors
 - vii) transformers
 - viii) interlocks
 - ix) programmable logic controllers (PLC's)
 - x) motors

8. Describe series and parallel circuits.
9. Identify the types of electrical test meters and describe their applications and procedures for use.
10. Explain the purpose of the electrical code.

Level 4

MENT-1802

Workplace Mentoring II

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Identify and explain strategies for teaching workplace skills.
- Demonstrate strategies to assist in teaching skills in the workplace

Objectives and Content:

1. Describe the impact of your own experiences in teaching skills.
2. Identify the different roles played by a workplace mentor.
3. Describe the six-step approach to teaching skills.
4. Explain the importance of identifying the point of the lesson.
5. Identify how to choose a good time to present a lesson.
6. Explain the importance of linking the lessons.
7. Identify the components of the skill (the context).
8. Describe considerations for demonstrating a skill.
9. Identify types of skill practice.
10. Describe considerations in setting up opportunities for skill practice.
11. Explain the importance of providing feedback.
12. Identify techniques for giving effective feedback.
13. Describe a skill assessment.
14. Identify methods of assessing progress.
15. Explain how to adjust a lesson to different situations.

Resource:

- Recommended resource to use in the delivery of this unit:
www.apprenticeship.nsc.ca/mentoring/apprentice.htm

IMM-435 Fans and Blowers

Learning Outcomes:

- Demonstrate knowledge of fans and blowers, their components and operation.
- Demonstrate knowledge of the procedures used to remove install, maintain, troubleshoot, repair and commission fans and blowers.

Objectives and Content:

1. Define terminology associated with fans and blowers.
2. Identify hazards and describe safe work practices pertaining to fans and blowers.
3. Identify types of fans and blower systems and describe their components and operation.
4. Identify types of fan blades and describe their applications.
5. Identify tools and equipment used to remove, install, maintain, troubleshoot and repair fans and blowers and describe their applications and procedures for use.
6. Describe the procedures used to remove and install fans and blowers.
7. Describe the procedures used to inspect and maintain fans and blowers.
8. Describe the procedures used to troubleshoot fans and blowers.
9. Identify considerations for determining if fan and blower repair or replacement is required.
10. Describe the procedures used to repair fans and blowers.
11. Describe the procedures used to regulate output for fans and blowers.
12. Describe the procedures used to commission fans and blowers.

IMM-430 Prime Movers (Turbines)

Learning Outcomes:

- Demonstrate knowledge of turbines, their components and operation.
- Demonstrate knowledge of the procedures used to install, maintain, troubleshoot, repair and commission turbines.

Objectives and Content:

1. Define terminology associated with turbines.
2. Identify hazards and describe safe work practices pertaining to turbines.
3. Identify the types of turbines and describe their operation.
 - i) steam
 - ii) gas
 - iii) hydro
 - iv) wind
4. Explain the principles and operation of boilers.
5. Identify turbine components and describe their purpose and operation.
6. Identify tools and equipment used to install, maintain, troubleshoot and repair turbines and describe their applications and procedures for use.
7. Describe the factors to consider when installing turbines.
 - i) manufacturers' specifications
 - ii) job site specifications
 - iii) location drawings
 - iv) auxiliary systems
 - v) sequence of installation
8. Describe the procedures used to install turbines and their components.
9. Describe the procedures used to inspect and maintain turbines and their components.
 - i) manufacturers' specifications

- manufacturers' representative
 - technical manuals
10. Describe the procedures used to troubleshoot turbines and their components.
 11. Identify considerations for determining if turbine component repair or replacement is required.
 12. Describe the procedures used to repair turbines and their components.
 - i) manufacturers' specifications
 - manufacturers' representative
 - technical manuals
 13. Describe the procedures used to commission turbines.

IMM-225 Shafts

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.

Objectives and Content:

1. Define terminology associated with shafts and accessories.
2. Identify hazards and describe safe work practices pertaining to shafts.
3. Identify types of shafts and describe their applications.
 - i) drive
 - ii) counter
 - iii) jack
 - iv) hollow
4. Identify shaft accessories.
 - i) keys
 - ii) pins
 - iii) taper lock bushings
 - iv) retaining rings
 - v) sleeves
5. Identify tools and equipment used to remove, install, maintain, and repair shafts and describe their applications and procedures for use.
6. Describe the procedures used to remove and install shafts.
7. Describe the procedures used to inspect and maintain shafts.
8. Identify the considerations for determining if shaft repair or replacement is required.
9. Describe the procedures used to repair shafts.

Learning Outcomes:

- Demonstrate knowledge of the procedures for shaft alignment using the straight edge and feeler gauge method.
- Demonstrate knowledge of the procedures for shaft alignment using the rim and face dial method.

Objectives and Content:

1. Define terminology associated with shaft alignment.
2. Identify hazards and describe safe work practices pertaining to shaft alignment.
3. Identify tools and equipment used for shaft alignment and describe their applications and procedures for use.
4. Describe the procedures used to determine shaft misalignment.
5. Identify the types of alignment methods and describe their applications.
 - i) straight edge and feeler gauge
 - ii) rim and face dial
 - iii) reverse dial
 - iv) cross dial
 - v) laser
6. Describe the procedures used to align shafts using the straight edge and feeler gauge method.
 - i) pre-alignment checks
 - ii) select tools and equipment
 - iii) perform calculations
 - iv) make adjustments
7. Describe the procedures used to align shafts using the rim and face dial method.
 - i) pre-alignment checks
 - ii) select tools and equipment
 - iii) perform calculations
 - iv) make adjustments

Learning Outcomes:

- Demonstrate knowledge of the procedures for shaft alignment using the reverse dial method.
- Demonstrate knowledge of the procedures for shaft alignment using the cross dial method.
- Demonstrate knowledge of the procedures for shaft alignment using the laser method.

Objectives and Content:

1. Identify tools and equipment used for shaft alignment and describe their applications and procedures for use.
2. Describe the procedures used to align shafts using the reverse dial method.
 - i) pre-alignment checks
 - ii) select tools and equipment
 - iii) perform calculations
 - iv) make adjustments
3. Describe the procedures used to align shafts using the cross dial method.
 - i) pre-alignment checks
 - ii) select tools and equipment
 - iii) perform calculations
 - iv) make adjustments
4. Describe the procedures used to align shafts using the laser method.
 - i) pre-alignment checks
 - ii) select tools and equipment
 - iii) perform calculations
 - iv) make adjustments

IMM-460 Balancing

Learning Outcomes:

- Demonstrate knowledge of balancing procedures.

Objectives and Content:

1. Define terminology associated with balancing.
2. Identify hazards and describe safe work practices pertaining to balancing.
3. Identify tools and equipment required for balancing and describe their applications and procedures for use.
4. Identify and interpret sources of information pertaining to balancing.
 - i) manufacturers' specifications
 - ii) vibration standards and charts
 - iii) Canadian Machinery Vibration Association (CMVA) interpretations and guidelines
5. Identify the conditions of unbalance and describe their characteristics.
 - i) static
 - ii) couple
 - iii) quasi-static
 - iv) dynamic
6. Identify the types of balancing methods and describe their applications.
 - i) single-plane
 - ii) multi-plane
7. Perform calculations required for balancing.
8. Describe balancing procedures.
 - i) static
 - ii) dynamic

IMM-455 Vibration Analysis

Learning Outcomes:

- Demonstrate knowledge of the procedures used to perform vibration analysis.

Objectives and Content:

1. Define terminology associated with vibration analysis.
2. Identify hazards and describe safe work practices pertaining to vibration analysis.
3. Identify tools and equipment used for vibration analysis and describe their applications and procedures for use.
4. Identify and interpret sources of information pertaining to vibration analysis.
 - i) manufacturers' specifications
 - ii) vibration standards and charts
 - iii) Canadian Machinery Vibration Association (CMVA) interpretations and guidelines
5. Identify causes of vibration.
6. Identify vibration analysis methods and describe their applications.
7. Describe the procedures used to perform vibration analysis.
8. Record and interpret data collected using vibration analysis.

Learning Outcomes:

- Demonstrate knowledge of preventive and predictive maintenance practices.

Objectives and Content:

1. Define terminology associated with preventive and predictive maintenance.
2. Identify tools and equipment used for preventive and predictive maintenance and describe their applications and procedures for use.
3. Identify types of maintenance and describe their purpose and applications.
 - i) breakdown
 - ii) preventive
 - iii) predictive
 - iv) proactive
 - v) corrective
4. Identify sources of information used to develop maintenance history.
 - i) reports and checklists
 - ii) manufacturers' specifications
 - iii) root cause analysis
5. Identify preventive and predictive maintenance practices and describe their applications.
 - i) vibration analysis
 - ii) non-destructive testing
 - iii) fluid analysis
 - iv) balancing
 - v) thermography
6. Describe the procedures used to record preventive and predictive maintenance data.

IMM-470 Job Planning

Learning Outcomes:

- Demonstrate knowledge of the procedures used to plan and organize jobs.

Objectives and Content:

1. Identify sources of information relevant to job planning.
 - i) documentation
 - ii) drawings
 - iii) related professionals
 - iv) clients

2. Describe the considerations for determining job requirements.
 - i) personnel
 - ii) tools and equipment
 - iii) materials
 - iv) permits
 - v) environmental

3. Describe the procedures used to plan job tasks.
 - i) scheduling
 - ii) estimating

4. Describe the procedures used to organize and store tools, equipment and materials on-site.

Learning Outcomes:

- Demonstrate knowledge of the procedures used to install equipment.
- Demonstrate knowledge of the procedures used to level and align equipment.

Objectives and Content:

1. Define terminology associated with equipment installation, leveling and alignment.
2. Identify hazards and describe safe work practices pertaining to equipment installation, leveling and alignment.
3. Identify tools and equipment used for equipment installation, leveling and alignment and describe their application and procedures for use.
 - i) theodolites
 - ii) optical levels
 - iii) piano wire
 - iv) water level
 - v) laser
4. Identify types of bases and describe their applications.
 - i) base plate
 - ii) sole plate
 - iii) fabricated
 - iv) skid mounted
5. Describe the procedures used to install, level and align equipment.
 - i) planning
 - ii) interpret drawings
 - iii) fabricate component supports
 - iv) install base
 - v) position equipment
 - vi) relieve stresses/strains
 - vii) anchor and grout
 - viii) complete documentation

6. Describe the procedures used to commission equipment.

IMMA-1830

Program Review

(Nova Scotia Unit of Instruction)

Learning Outcomes:

- Upon successful completion of this unit, the apprentice will complete a study plan based on the National Occupational Analysis.

Objectives and Content:

1. Identify areas of the program where knowledge of theory is weakest.
2. Identify areas where workplace experience is lacking or weak.
3. Identify resources necessary to address areas of shortfall.
4. Identify timelines to address areas of weakness.

Suggested Learning Activities:

1. Conduct a mock certification exam to be used for diagnostic purposes.
2. Review the National Occupational Analysis.
3. Review the Apprentice Logbook.
4. Review the Exam Preparation information found at www.nsapprenticeship.ca under Quick Links, Exam Preparation.
5. Conduct a final mock certification exam.

Resources:

These are the recommended resources to use in the delivery of this unit:

- Exam Preparation information, including videos, occupational analyses, exam counseling sheets, practice exams and sample questions, and other study materials and resources, can be found at www.nsapprenticeship.ca under Quick Links, Exam Preparation.
- Apprentice's personal logbook
- Applicable codes and regulations
- Program texts

Evaluation: pass/fail

Nova Scotia Document Evaluation Form

Thank you for your interest in the development and revision of this document. Upon review of the document, please record your feedback in relation to the following items:

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