

# Occupational Analyses Series

## **Industrial Mechanic (Millwright)**

**1999**

Interprovincial Partnerships and  
Occupational Information Division

Human Resources  
Partnerships Directorate

Disponible en français sous le titre :

Division des Partenariats  
interprovinciaux et Information sur les  
carrières

Direction des partenariats  
en ressources humaines

Mécanicien industriel/mécanicienne  
industrielle (de chantier)



*The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this occupational analysis as the national standard for the occupation of Industrial Mechanic (Millwright).*



## ACKNOWLEDGEMENTS

Human Resources Development Canada wishes to express sincere appreciation for the contribution of the many industrial establishments, professional associations, labour organizations, tradespersons, provincial and territorial government departments and agencies, and all others who contributed, directly or indirectly, to this publication.

Special acknowledgement is extended to Dave Meredith, of Manitoba, who revised the previous analysis with the following representatives from the industrial mechanic (millwright) industry:

Floyd Agerbak	HBMS
Ron Tate	INCO
Bob Spence	TOLKO
Paul Smith	ANCAST
Roland Misling	Keewatin Community College
Gene Germain	Apprenticeship Branch

This analysis was prepared by the Human Resources Partnerships Directorate. The planning, coordination and processing of the analysis were undertaken by staff members of the Interprovincial Partnerships and Occupational Information Division.

## **OTHER RELATED OCCUPATIONAL TITLES**

This analysis covers tasks performed by an industrial mechanic (millwright) whose occupational title has been identified by some provinces and territories of Canada under:

Industrial Mechanic  
Millwright

## LIST OF PUBLISHED OCCUPATIONAL ANALYSES \*

TITLE	NOC <sup>**</sup> Code
<b>Appliance Service Technician (1997)</b>	7332
Aquaculture Technician (1977)	2221
Arts Administrator (1989)	0114
<b>Automotive Painter (1995)</b>	7322
<b>Automotive Service Technician (1998)</b>	7321
Automotive Technician - Automatic Transmission (1990)	7321
Automotive Technician - Electrical/Electronics (1992)	7321
Automotive Technician - Engine Repair and Fuel Systems (1989)	7321
Automotive Technician - Front-End (1989)	7321
Automotive Technician - Manual Transmission, Driveline and Brakes (1990)	7321
Aviation Machinist (1994)	7231
<b>Baker (1997)</b>	6252
Blaster (Surface) (1987)	7372
<b>Boilermaker (1994)</b>	7262
<b>Bricklayer (1993)</b>	7281
<b>Cabinetmaker (1992)</b>	7272
<b>Carpenter (1998)</b>	7271
<b>Cement Finisher (1995)</b>	7282
<b>Construction Electrician (1994)</b>	7241
<b>Cook (1997)</b>	6242
<b>Electrical Rewind Mechanic (1999)</b>	7333

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\* **Red Seal analyses are indicated in bold**

\*\* **National Occupational Classification**

<b>Electronics Technician - Consumer Products (1997)</b>	2242
Electronics Technician Vol. I (1986) (Video Equipment)	2242
Electronics Technician Vol. II (1986) (Audio Equipment)	2242
Electronics Technician Vol. III (1986) (Computer Equipment)	2242
Electronics Technician Vol. IV (1986) (Office Equipment)	2242
Electronics Technician Vol. VI (1986) (Communication Equipment)	2242
Electronics Technician Vol. VII (1986) (Signaling Equipment)	2242
Electronics Technician Vol. VIII (1986) (Navigation Equipment)	2242
Electronics Technician Vol. IX (1986) (Video Game Equipment)	2242
Electronics Technician Vol. X (1987) (CADD Equipment)	2242
Electronics Technician Vol. XI (1987) (CAM Equipment)	2242
Electronics Technician Vol. XII (1987) (Robotics Equipment)	2242
Electronics Technician Vol. XIII (1987) (Biomedical and Laboratory Equipment)	2242
Electronics Technician Vol. XIV (1987) (Industrial Process-Control Equipment)	2243
<b>Farm Equipment Mechanic (1994)</b>	7312
<b>Floorcovering Installer (1997)</b>	7295
<b>Glazier (1994)</b>	7292
<b>Hairstylist (1997)</b>	6271
Heating (Gas and Oil) Servicer - Commercial and Industrial (1978)	7331
<b>Heavy Duty Equipment Mechanic (1998)</b>	7312
Heavy Equipment Operator (1983)	7421
<b>Industrial Electrician (1997)</b>	7242
<b>Industrial Instrument Mechanic (1988)</b>	2243
<b>Industrial Mechanic (Millwright) (1999)</b>	7311
<b>Insulator (Heat and Frost) (1993)</b>	7293



<b>Ironworker (Generalist) (1993)</b>	7264
<b>Lather (Interior Systems Mechanic) (1994)</b>	7284
Logistics (1992)	0713
<b>Machinist (1998)</b>	7231
Major Electrical Appliance Repairer (1984)	7332
<b>Mobile Crane Operator (1997)</b>	7371
<b>Motorcycle Mechanic (1995)</b>	7334
<b>Motor Vehicle Body Repairer (Metal and Paint) (1997)</b>	7322
<b>Motor Vehicle Repairer (Truck and Transport) (1983)</b>	7321
New Home Builder and Residential Renovation Contractor (1992)	0712
<b>Oil Burner Mechanic (1997)</b>	7331
<b>Painter and Decorator (1993)</b>	7294
<b>Partsperson (1995)</b>	1472
<b>Plumber (1996)</b>	7251
Power Engineer (1997)	7351
<b>Powerline Technician (1996)</b>	7244
<b>Refrigeration and Air Conditioning Mechanic (1997)</b>	7313
<b>Roofer (1997)</b>	7291
<b>Sheet Metal Worker (1997)</b>	7261
<b>Sprinkler System Installer (1995)</b>	7252
<b>Steamfitter-Pipefitter (1996)</b>	7252
<b>Steel Fabricator (Fitter) (1994)</b>	7263
<b>Tool and Die Maker (1997)</b>	7232
<b>Truck-Trailer Repairer (1994)</b>	7321
<b>Welder (1996)</b>	7265

**REQUESTS FOR THESE PUBLICATIONS SHOULD BE FORWARDED TO:**

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Human Resources Development Canada  
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## FOREWORD

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to co-operate with provincial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources Development Canada sponsors a program, under the guidance of the Canadian Council of Directors of Apprenticeship (CCDA), to develop a series of occupational analyses.

The Occupational Analysis Program has the following objectives:

- to identify and group the tasks performed by skilled workers in particular occupations;
- to identify those tasks that are performed by skilled workers in every province and territory;
- to develop instruments for use in the preparation of interprovincial standards "Red Seal" examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility, in Canada, of trainees and skilled workers;
- to supply employers and employees, and their associations, industries, training institutions and governments with analyses of the tasks performed in particular occupations.



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### **Analysis**

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## **GUIDE TO ANALYSIS**



## DEVELOPMENT OF ANALYSIS

A draft analysis is developed by a knowledgeable consultant who, with the assistance of a committee of industry experts in the field, identifies all the tasks performed in the occupation.

The draft is then assigned to occupational analysts at Human Resources Development Canada for review, edit and translation to ensure conformity with the nationally approved format.

The analysis is forwarded to provincial/territorial authorities for validation by specialists in the field. Their recommendations are assessed and incorporated into the final draft which also includes the identification of the common core tasks performed in the occupation.

The occupational analysis is published in both official languages.

## STRUCTURE OF ANALYSIS

To facilitate the understanding of the nature of the occupation, the work performed is divided into the following divisions:

- A. **BLOCK** - is the largest division within the analysis and reflects a distinct operation relevant to the occupation.
- B. **TASK** - is the distinct activity that, combined with others, makes up the logical and necessary steps the worker is required to perform to complete a specific assignment within a "BLOCK".
- C. **SUB-TASK** - is the smallest division into which it is practical to subdivide any work activity and, combined with others, fully describes all duties constituting a "TASK".

### **Supporting Knowledge & Abilities**

The element of skill and knowledge that an individual must acquire to adequately perform the task.

### **Trends**

Any shifts or changes in technology which completion of the sub-tasks are identified under this heading.

### **Related Components**

All components of a specified project being undertaken by the industrial mechanic (millright).

### **Tools and Equipment**

All tools and equipment necessary for the industrial mechanic (millright) to complete a task.

## VALIDATION METHOD

At the request of the Canadian Council of Directors of Apprenticeship (CCDA), the Standardization Sub-committee developed a method for the validation of the national Red Seal occupational analyses.

A draft of the analysis is sent to all provinces/territories for validation. Each jurisdiction rates the sub-tasks and applies percentage ratings to blocks and tasks. This method for the validation of the national occupational analyses identifies common core tasks across Canada for a specific occupation. This feature facilitates the weighting of the Interprovincial Red Seal examinations.

### DEFINITIONS

<b>YES:</b>	the sub-task is performed by workers in the occupation in a specific jurisdiction.
<b>NO:</b>	the sub-task is not performed by workers in the occupation in a specific jurisdiction.
<b>BLOCK %:</b>	the average number of questions (items), derived from the collective decision made by workers within the occupation from all areas of Canada, which will be placed on an interprovincial examination to assess each block of the analysis.
<b>TASK %:</b>	the average number of questions (items), derived from the collective decision made by workers within the occupation from all areas of Canada, which will be placed on an interprovincial examination to assess each task of the analysis.
<b>NV:</b>	<u>N</u> ot <u>V</u> alidated by a province/territory.
<b>ND:</b>	<u>N</u> ot <u>D</u> esignated in that province/territory.

### COMMON CORE

The criteria for determining common core are dependant on the performance of sub-tasks. If 70 percent of the responding jurisdictions (excluding NVs and NDs) perform the sub-task, it shall be considered common core.

Interprovincial Red Seal examinations are based on the common core identified through this validation process. This process identifies what will be assessed through the interprovincial examination.

## **BLOCKS AND TASKS WEIGHTING (APPENDIX "C")**

This appendix represents the block and task percentages as submitted by each jurisdiction.

Each jurisdiction, with the use of a provincial/territorial occupational advisory committee, validates the content, places percentages on blocks and tasks, and indicates whether or not the sub-tasks are performed by the skilled workers within the occupation. The results of this exercise are submitted to Human Resources Development Canada (HRDC). In turn, HRDC analyzes the data and develops this appendix which provides the individual jurisdictional validation results as well as the national averages of all responses.

## **PIE CHART (APPENDIX "D")**

The graph depicts the national percentages assigned to blocks in the analysis.

## **SCOPE OF THE INDUSTRIAL MECHANIC (MILLWRIGHT) OCCUPATION**

This occupational analysis is directed at the industrial mechanic (millwright) occupation. The construction millwrights are generally employed by millwrighting contractors. These workers are mostly engaged in the initial installation of industrial plant machinery and equipment. The industrial mechanics (millwrights) are employed in manufacturing plants, utilities or other industrial establishments. They tend to specialize in the post-installation, maintenance and repair of machinery and equipment. In the accomplishment of their job responsibilities, the industrial mechanics (millwrights) must possess and apply a wide range of knowledge, abilities and skills to perform some or all of the following duties:

- participating in the enhancement of workplace health and safety;
- assisting in the planification of work activities;
- selecting, testing and processing metals;
- tooling parts and components;
- machining parts and components using stationary equipment;
- cutting and assembling metal components using welding equipment;
- assembling components using various types of fasteners;
- installing and removing equipment and systems;
- maintaining, repairing and replacing machinery and associated equipment;
- fabricating, modifying and overhauling equipment.

## OCCUPATIONAL OBSERVATIONS

Some important observations and significant trends emerged from this national analysis of the industrial mechanic (millwright) occupation. These observations and trends are briefly outlined in this section.

Many organizations are in the process of reconceptualizing the workplace in an effort to become lean, competitive and world class organizations. These initiatives often call for greater task flexibility across occupations. Consequently, an increased number of employers are providing cross-training opportunities to their industrial mechanics (millwrights) in related areas, such as pipefitting, welding, machining and electrical maintenance. In some organizations, industrial mechanics (millwrights) are required to have a second trade ticket in a related area. These emerging trends for double ticketing and cross-training have important implications for future occupational analysis activities and for apprenticeship training in general.

The sociotechnical changes at the workplace have profound implications for the skill requirements of industrial mechanics (millwrights) across as well as within industrial settings and organizations. There is a different set of expectations from industrial mechanics (millwrights) working in organizations that have implemented new management concepts requiring high degree of workers' involvement and participation in the planning and decision-making processes. Additionally, many installation and maintenance tasks are plant-specific and require unique sets of skills. However, members of this occupational analysis committee believe that the basic skill, knowledge and attitude requirements for industrial mechanics (millwrights) are generic across industrial settings and organizations.

Industrial mechanics (millwrights) spend a considerable amount of time reading manufacturers' service manuals, technical manuals, log books, memos, forms, preventive maintenance documents, safety-related documents and trade literature. Furthermore, as the computer is becoming a common tool at the workplace, industrial mechanics (millwrights) need to be computer literate. Likewise, the availability of modern computer-based instrumentations calls for more sophisticated troubleshooting skills. Consequently, employers are increasingly looking for employees with a solid foundation in basic skills. Additionally, the need for industrial mechanics to participate in periodic updating also calls for individuals with stronger academic background.



## **SAFETY**

Safe working procedures and conditions, accident prevention and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties become aware of circumstances which may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to cause an accident or injury.

It is generally recognized that a safety-conscious attitude and work practices contribute to a healthy, safe and accident-free working environment.

It is imperative to apply and be familiar with the Occupational Health and Safety Act and Regulations. As well, it's essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

As safety education is an integral part of a training in all jurisdictions, personal safety practices are not recorded in this document. However, the technical safety aspect relating to each task and sub-task are included throughout this analysis.

## **ANALYSIS**



## BLOCK A

### PLANNING AND WORKPLACE SAFETY

*Trends: Some industrial mechanics (millwrights) are required to perform labour and material planning tasks, others may only assist supervisory personnel. There is an increasing demand for industrial mechanics to draft basic mechanical drawings. The CAD (computer assisted design) system is being more frequently used. There is increased employee/employer awareness on safety issues. More stringent safety legislation is being implemented in the workplace.*

#### **Task 1 Identifies task requirements.**

*Related Components:* Engineering drawings, schematics, sketches, specifications, technical manuals, contracts, warranty documents and workplace safety and health documents, manuals, and data.

*Tools and Equipment:* Calculator, computer.

#### **Sub-task**

**1.01 Reads and understands engineering drawings, schematics, sketches, specifications and technical manuals.**

#### **Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

1.01.01 knowledge of symbols and conventions used in engineering drawings

1.01.02 knowledge of standard codes such as: American Society for Testing and Materials (ASTM) and The American National Standards Institute (ANSI)

1.01.03 ability to read, understand, and cross-reference engineering drawings, schematics, and sketches, specifications and technical manuals

1.01.04 ability to produce a basic sketch or drawing

**Sub-task****1.02 Verifies dimensions.****Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

1.02.01 knowledge of metric and imperial systems

1.02.02 ability to determine size of parts from engineering drawings

1.02.03 ability to perform trade-related calculations

**Sub-task****1.03 Identifies fabrication requirements.****Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

1.03.01 ability to identify fabrication, construction and welding requirements

**Sub-task****1.04 Identifies fits, finishes and assembly requirements.****Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

1.04.01 ability to identify fit, tolerance, surface finish and sequencing requirements for component assembly from engineering drawings and specifications

1.04.02 ability to identify classification of fits, tolerances

and surface finishes produced by different machining processes

**Sub-task**

**1.05 Identifies installation requirements.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

1.05.01 ability to identify the type and size of foundation required from specifications

1.05.02 ability to identify the type of anchorage and grouting requirements, from specifications

**Sub-task**

**1.06 Identifies maintenance requirements.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

1.06.01 knowledge of maintenance schedules

1.06.02 knowledge of technical manuals

1.06.03 ability to identify the maintenance requirements for different types of machines and equipment from technical manuals

**Task 2 Identifies labour requirements.**

*Related Components:* Contract documents and blueprints.

*Tools and Equipment:* Calculator, computer.

**Sub-task**

**2.01 Estimates labour requirements.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV

2.01.01 ability to analyse a task and define the amount of work involved and time required to complete

**Sub-task**

**2.02 Schedules work.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

2.02.01 ability to plan own work activities

**Sub-task**

**2.03 Consults with other trades persons.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

2.03.01 ability to coordinate tasks involving other trades persons

2.03.02 ability to communicate effectively and demonstrate good interpersonal skills

**Task 3 Identifies parts and material requirements for equipment installation.**

*Related Components:*

Contract documents and blueprints.

*Tools and Equipment:*

Calculator, computer.

**Sub-task**

**3.01 Estimates material requirements.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

3.01.01 knowledge of the basic principles of estimating materials

3.01.02 ability to take off material quantities from engineering drawings and specifications

**Sub-task**

**3.02 Identifies materials, tools and equipment requirements.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

3.02.01 ability to analyse and identify tools and equipment necessary to complete a task

3.02.02 ability to perform basic arithmetic calculations

3.02.03 ability to complete material requisition forms

**Sub-task**

**3.03 Delivers tools, materials and equipment to meet job requirements.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	NV



**Supporting Knowledge & Abilities**

- 3.03.01 knowledge of Adjust-in-time delivery@
- 3.03.02 ability to plan work activities
- 3.03.03 ability to requisition materials, tools and equipment to meet requirements

**Task 4 Determines safety, lock-out procedures and personal protection.**

*Related Components:* Blueprints, Industry or Contractor=s Safety Manual (handbook), Material Safety Data Sheets (MSDS) and Workplace Hazardous Materials Information System (WHMIS) labels.

*Tools and Equipment:* Refer to Appendix A, Personal Protective Equipment, plus, calculator, computer.

**Sub-task**

**4.01 Isolates equipment.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 4.01.01 knowledge of safe practices for isolating equipment including PLC=s, electrical and mechanical

**Sub-task**

**4.02 Performs locking and tagging procedures.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.02.01 knowledge of safe practices and policies for locking and tagging equipment

**Sub-task**

**4.03 Energizes equipment.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
no	yes	yes	yes	no	yes	yes	yes	yes	yes	yes	NV

4.03.01 knowledge of safe work practices for energizing equipment

**Sub-task**

**4.04 Identifies and handles hazardous materials.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.04.01 knowledge of WHMIS and hazards related to the storage and handling of chemical products

4.04.02 ability to identify and assess all hazards before performing tasks

4.04.03 ability to read labels and Material Safety Data Sheet (MSDS)

**Sub-task**

**4.05 Maintains a safe workplace environment.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.05.01 knowledge of workplace health and safety

4.05.02 knowledge of various types of guards and protective devices

4.05.03 knowledge of regulations governing work

performed in confined spaces

4.05.04 ability to select appropriate guards and protective devices for safe operation

**Sub-task**

**4.06 Selects personal protective devices.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

4.06.01 knowledge of health and safety hazards associated with the use of equipment

4.06.02 knowledge of applicable occupational health and safety regulations

4.06.03 knowledge of Canadian Standards Association (CSA) for eye, hand, foot/body protection equipment

4.06.04 knowledge of permissible noise exposure time to various noise levels in decibels

4.06.05 knowledge of occupational hazards and the effects of chemical vapours, fumes, and dust on employees= health

4.06.06 ability to analyse specific tasks to determine the need for appropriate protective clothing and equipment

4.06.07 ability to select, adjust, inspect, wear, maintain, and sanitize personal protective clothing and equipment

4.06.08 ability to recognize the importance of protective clothing and equipment, including, but not inclusive to: hard hats, gloves, safety boots, aprons, goggles, safety glasses, face shields, respirators, etc.

## BLOCK B

### TOOLS - FASTENERS

*Trends: As technology changes, the use of electronic, digital, and lazer measuring devices are becoming more precise, user friendly and common in the workplace.*

#### Task 5 Uses precision measuring tools.

*Tools and Equipment:* Refer to Appendix A under Measuring & Layout Tools.

#### Sub-task

##### 5.01 Calibrates basic measuring tools. Supporting Knowledge & Abilities

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

5.01.01 ability to verify tool calibration

5.01.02 ability to calibrate basic measuring devices

#### Sub-task

##### 5.02 Maintains precision measuring tools. Supporting Knowledge & Abilities

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

5.02.01 knowledge of care and maintenance procedures for all common precision measuring devices

**Sub-task**

**5.03 Measures material and components using precision tools.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 5.03.01 knowledge of types, purposes, and applications of all common precision measuring tools
- 5.03.02 ability to identify and use proper measuring devices for specific tasks
- 5.03.03 ability to take measurements using all common precision measuring tools

**Sub-task**

**5.04 Stores precision tools.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 5.04.01 ability to correctly clean and store precision measuring devices

**Task 6 Uses layout tools.**

*Tools and Equipment:*

Refer to Appendix A under Measuring and Layout Tools.

**Sub-task**

**6.01 Sets out components using layout tools.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

**Supporting Knowledge & Abilities**

- 6.01.01 knowledge of the types, purposes and applications of all common layout tools
- 6.01.02 ability to identify and use all common layout tools
- 6.01.03 ability to layout parts according to specifications

**Sub-task**

**6.02 Maintains layout tools.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 6.02.01 knowledge of proper care and upkeep of layout tools
- 6.02.02 ability to inspect tools for defects
- 6.02.03 ability to store layout tools in proper and safe working conditions

**Task 7 Uses hand tools.**

*Tools and Equipment:*

Refer to Appendix A under Tools and Equipment.

**Sub-task**

**7.01 Uses hand tools.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

7.01.01 knowledge of safe practices for using common hand tools

**Supporting Knowledge & Abilities**

7.01.02 knowledge of types, purposes, and applications of all common hand tools

7.01.03 ability to identify and use all common hand tools to meet given tasks

**Sub-task**

**7.02 Maintains hand tools.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

7.02.01 knowledge of proper care and upkeep of hand tools

7.02.02 ability to inspect tools for defects

7.02.03 ability to store hand tools in proper and safe working conditions

**Task 8 Uses portable power tools.**

*Tools and Equipment:*

Refer to Appendix A under Portable Power Tools.

**Sub-task**

**8.01 Uses portable power tools.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

8.01.01 knowledge of safe practices for using all portable power tools including: electrical, pneumatic and powder actuated tools

**Supporting Knowledge & Abilities**

8.01.02 knowledge of types, purposes and application of all portable power tools

8.01.03 ability to identify and use all common portable power tools to meet given tasks

**Sub-task**

**8.02 Maintains portable power tools. Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

8.02.01 knowledge of proper care and upkeep of portable power tools

8.02.02 ability to inspect portable power tools for defects

8.02.03 ability to store portable power tools in proper and safe working conditions

**Task 9 Uses shop machines.**

*Tools and Equipment:* Refer to Appendix A under Machines.

**Sub-task**

**9.01 Operates shop machines. Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV



9.01.01 knowledge of safe practices for using all common shop machines, such as lathe, milling machines, drill press, stationary grinders, etc.

**Supporting Knowledge & Abilities**

9.01.02 knowledge of types, purposes and application of all common shop machines

9.01.03 ability to set up and operate shop machines

9.01.04 ability to apply appropriate coolants

9.01.05 ability to determine correct cutting feed and speed for various types of materials

9.01.06 ability to machine parts according to engineering drawings and specifications

**Sub-task**

**9.02 Maintains machines.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

9.02.01 knowledge of proper care and upkeep of machines

9.02.02 ability to inspect machines for defects

9.02.03 ability to maintain machines in proper and safe working conditions

**Task 10 Uses fastening devices.**

*Related Components:* All common retaining devices including: keys, retaining rings, clips, screws, dowels, springs, nuts, bolts, rivets and resins.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, some emphasis placed on torque wrenches, multipliers and bolt tensioners.

**Sub-task**

**10.01 Uses retaining devices.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

10.01.01 knowledge of various types, uses and functions of retaining devices in common use within the trade, such as retaining rings, cotter pins, clips, keys (keyways)

10.01.02 knowledge of the characteristics, uses and holding power of different types of holding devices

10.01.03 ability to identify retaining devices

10.01.04 ability to identify tools for installing and removing retaining devices

10.01.05 ability to secure components using retaining devices according to specifications

**Sub-task**

**10.02 Uses threaded fasteners.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

10.02.01 knowledge of various types, uses and functions of threaded fasteners

10.02.02 knowledge of all commonly used thread systems

10.02.03 knowledge of torque values, tensile strength, metal compatibility

10.02.04 ability to identify common threaded fasteners

10.02.05 ability to identify and use tools to install or remove threaded fasteners

**Supporting Knowledge & Abilities**

10.02.06 ability to secure components using threaded fasteners according to specifications

10.02.07 ability to identify and apply penetrating oil

10.02.08 ability to identify fasteners on the basis of environmental conditions and to meet task requirements

10.02.09 ability to follow torquing procedures

10.02.10 ability to use correct locking procedures on threaded fasteners

10.02.11 ability to clean, die down, plug, drill and tap threads

10.02.12 ability to recover threads using the helicoils

10.02.13 ability to recover internal and external threads

**Sub-task**

**10.03 Uses rivets.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV

10.03.01 knowledge of various types, uses and functions of rivets

10.03.02 knowledge of tensile strength and metal compatibility

10.03.03 ability to identify rivets

10.03.04 ability to identify and use tools to install and remove rivets

10.03.05 ability to secure components using rivets

according to specifications

10.03.06 ability to remove rivets

**Supporting Knowledge & Abilities**

10.03.07 ability to handle hot rivets safely

10.03.08 ability to select rivets on the basis of environmental conditions and to meet task requirements

**Sub-task**

**10.04 Uses resins.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV

10.04.01 knowledge of various types, uses and functions of resins

10.04.02 knowledge of drying time

10.04.03 knowledge of material compatibility

10.04.04 knowledge of resistance to water, oil and other substances

10.04.05 knowledge of bonding strength and resistance to impact and tension

10.04.06 ability to select appropriate resins on the basis of environmental conditions and to meet task requirements

10.04.07 ability to secure components according to specifications

10.04.08 ability to select appropriate solvent for cleaning excess adhesive

## BLOCK C

### RIGGING AND CRANES

*Trends:*            *Workers are displaying more awareness and placing more emphasis on safe rigging and hoisting practices.*

**Task 11            Determines rigging, hoisting and load requirements.**

*Tools and Equipment:*            Refer to Appendix A under Lifting Equipment.

**Sub-task**

**11.01   Plans rigging operations.            Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 11.01.01            knowledge of applicable safety regulations
- 11.01.02            knowledge of safe practices for rigging and hoisting
- 11.01.03            knowledge of centre of gravity principles
- 11.01.04            knowledge of techniques in common use for rigging and hoisting
- 11.01.05            ability to assess site and environmental conditions
- 11.01.06            ability to identify obstacle or other hazards
- 11.01.07            ability to determine load weight

**Sub-task**

**11.02   Selects rigging and hoisting equipment.            Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------

yes    yes    yes    yes    yes    yes    yes    yes    yes    yes    yes    NV

**Supporting Knowledge & Abilities**

11.02.01    knowledge of different types of rigging equipment, such as: chain, wire rope, fibre rope, nylon slings, shackles, eyebolts and hooks

11.02.02    knowledge of different types of hoisting equipment, such as: overhead crane, mobile crane, forklift truck, hydraulic hoist, jacks, chain-falls, rope-falls and come-a-long

**Task 12        Installs, troubleshoots and maintains lifting, rigging and hoisting equipment.**

*Tools and Equipment:*                      Refer to Appendix A under Lifting Equipment.

**Sub-task**

**12.01    Transports machinery/equipment.**

**Supporting Knowledge & Abilities**

NF    NS    PE    NB    PQ    ON    MA    SK    AB    BC    NT    YK  
 yes    yes    yes    yes    yes    yes    yes    yes    yes    yes    no    NV

12.01.01    knowledge of planning the safe lifting, loading, securing, transporting and unloading of machinery and equipment

12.01.02    ability to safely lift load, secure, transport and unload machinery and equipment

**Sub-task**

**12.02    Installs hoisting and rigging equipment.**

**Supporting Knowledge & Abilities**

NF    NS    PE    NB    PQ    ON    MA    SK    AB    BC    NT    YK  
 yes    yes    yes    yes    yes    yes    yes    yes    yes    yes    yes    NV

**Supporting Knowledge & Abilities**

- 12.02.01 knowledge of safe and functional installation of all hoisting and rigging equipment
- 12.02.02 ability to safely install all hoisting and rigging components in preparation for use

**Sub-task**

**12.03 Rigs loads using slings and attachments.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 12.03.01 knowledge of correct rigging procedures
- 12.03.02 ability to safely use all slings and attachments

**Sub-task**

**12.04 Installs and uses access structures.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 12.04.01 knowledge of various types of scaffolds, lifts and ladders
- 12.04.02 knowledge of WCB and Occupational Health and Safety (OHS) codes for ladders, platforms and scaffolds
- 12.04.03 knowledge of requirements for the thickness and spacing of rails, base, anchor and bracing
- 12.04.04 knowledge of personal safety devices required for the use with floating scaffolds, such as life jackets and harnesses

**Supporting Knowledge & Abilities**

- 12.04.05 ability to assemble and use scaffolds, lifts and ladders
- 2.04.06 ability to install and use floating scaffolds

**1Sub-task**

**12.05 Inspects and maintains lifting, rigging and hoisting equipment.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 12.05.01 knowledge of regulations, maintenance and storage procedures governing the use of rigging and hoisting equipment
- 12.05.02 ability to perform a safety audit of all lifting, rigging and hoisting equipment in common use within the trade
- 12.05.03 ability to perform maintenance checks and prepare equipment for use or storage

**Task 13 Safety and operation of rigging and hoisting equipment.**

*Tools and Equipment:*

Refer to Appendix A under Lifting Equipment and Personal Protective Equipment.

**Sub-task**

**13.01 Uses lifting, rigging and hoisting equipment.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV



**Supporting Knowledge & Abilities**

- 13.01.01 knowledge of safe practices and hazards related to falls
- 13.01.02 knowledge of limit fall requiring the use of life lines and harnesses
- 13.01.03 knowledge of recommended environmental conditions for storing life lines and harnesses
- 13.01.04 ability to inspect life line
- 13.01.05 ability to select, adjust and wear harnesses
- 13.01.06 ability to inspect harnesses before, during and after use for safety
- 13.01.07 ability to safely operate and use all lifting, rigging and hoisting equipment

**Sub-task**

**13.02 Directs crane operator.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV

- 13.02.01 knowledge of safe communication practices
- 13.02.02 ability to communicate to crane operator using hand signals and radio transmitter
- 13.02.03 ability to advise personnel and equipment operators of potential hazards
- 13.02.04 ability to read and interpret load charts

## BLOCK D

### CUTTING, WELDING AND METALLURGY

*Trends: In some jurisdictions industrial mechanics (millwrights) are being cross-trained as welders in order for them to perform non-structural welds, in others, provisions restrict welding tasks to certified welders.*

*Due to technological improvements in welding and cutting processes, industrial mechanics (millwrights) are being introduced to new techniques such as metal inert gas (MIG), tungsten inert gas (TIG) and plasma arc.*

#### **Task 14 Inspects work area for safety.**

*Tools and Equipment:* Refer to Appendix A under Personal Protective Equipment.

#### **Sub-task**

#### **14.01 Inspects work area for welding operation.**

#### **Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- |          |   |
|----------|---|
| 14.01.01 | knowledge of the correct procedures for conducting safety inspections                                       |
| 14.01.02 | knowledge of standards and regulations concerning occupational health and safety                            |
| 14.01.03 | knowledge of regulations governing work performed in confined space   |
| 14.01.04 | knowledge of fire extinguisher types  |
| 14.01.05 | ability to identify and record hazardous conditions accurately  |
| 14.01.06 | ability to apply information generated by the safety inspection process for addressing hazardous conditions |

**Task 15 Selects, tests and processes metals.**

*Tools and Equipment:* Refer to Appendix A under Testing Equipment.

**Sub-task**

**15.01 Tests metal using standardized procedures.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 15.01.01 knowledge of metal compatibility
- 15.01.02 knowledge of properties and characteristics of common types of metals used in the trade
- 15.01.03 knowledge of common methods of hardness testing and ultrasonic thickness testing processes
- 15.01.04 knowledge of scales, test results and data sheets
- 15.01.05 ability to select ferrous and non-ferrous metals
- 15.01.06 ability to identify type of metal required from specifications
- 15.01.07 ability to identify common types of metals by filing; by chiselling and examining the chips (chisel test); by grinding and examining the colour, shape, and length of the sparks (spark test); and by examining their reaction to an acid (acid test)

**Sub-task**

**15.02 Performs heat treatment of metal.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	no	yes	no	yes	yes	yes	yes	yes	yes	NV

### Supporting Knowledge & Abilities

15.02.01	knowledge of heat treatment technology and terminology
15.02.02	knowledge of safe practices for handling hot metals
15.02.03	knowledge of annealing, hardening, tempering and normalizing metals
15.02.04	knowledge of heat-treatment colour charts
15.02.05	ability to prepare component for heat treatment
15.02.06	ability to heat and cool workpiece for specified duration according to specifications
15.02.07	ability to clean workpiece
15.02.08	ability to read and interpret the heat-treatment colour chart

### **Task 16 Welds, brazes and cuts metal using gas welding equipment.**

*Related Components:* Reference to Canadian Standards as applied to CWB; especially standards W47 and W48. Also recognizing local licencing requirements.

*Tools and Equipment:* Refer to Appendix A under Machines.

### **Sub-task**

#### **16.01 Prepares workpiece.**

### Supporting Knowledge & Abilities

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

16.01.01 knowledge of workpiece preparation

16.01.02 ability to clean, grind and position metal to be welded, brazed or cut

**Sub-task****16.02 Sets up gas welding equipment.****Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- |          |   |
|----------|---|
| 16.02.01 | knowledge of safe practices for lighting torch                                  |
| 16.02.02 | knowledge of gas types, pressures and associated hazards                        |
| 16.02.03 | knowledge of proper care and handling of gas cylinders and regulators           |
| 16.02.04 | knowledge of different types of regulators                                      |
| 16.02.05 | knowledge of correct procedure for opening or closing cylinder and torch valves |
| 16.02.06 | ability to select gas cylinders   |
| 16.02.07 | ability to move and secure gas cylinders according to safe practices            |
| 16.02.08 | ability to inspect regulators for damages                                       |
| 16.02.09 | ability to install regulators according to standard practices                   |
| 16.02.10 | ability to select and install safety devices                                    |
| 16.02.11 | ability to test for leaks   |
| 16.02.12 | ability to select and install proper type of hose                               |
| 16.02.13 | ability to inspect hose for defects   |
| 16.02.14 | ability to select proper type of torch and tip                                  |
| 16.02.15 | ability to connect torch to hose  |
| 16.02.16 | ability to select and install torch tip   |
| 16.02.17 | ability to light and adjust torch   |
| 16.02.18 | ability to clean torch tip  |

**Sub-task**

**16.03 Welds, brazes or cuts metal to blueprints or specifications.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	NV

- 16.03.01 knowledge of safe practices when handling hot metals
- 16.03.02 knowledge of fusion welds
- 16.03.03 knowledge of basic and plane geometry
- 16.03.04 ability to select flux, welding and brazing rods
- 16.03.05 ability to determine welding, brazing and cutting speeds
- 16.03.06 ability to heat metal and apply flux and brazing rod to joint
- 16.03.07 ability to maintain tip at correct distance and angle from the surface of the workpiece
- 16.03.08 ability to weld or braze metal, achieve proper fusion and penetration to meet drawing specifications
- 16.03.09 ability to cut metal to drawing specifications

**Sub-task**

**16.04 Inspects workpiece.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 16.04.01 knowledge of safe work practices for cooling hot metal parts

**Supporting Knowledge & Abilities**

16.04.02 ability to clean and inspect joint for surface defects including undercuts, cracks and porosity

**Sub-task**

**16.05 Stores equipment.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

16.05.01 knowledge of safe storage practices for all gas welding and cutting equipment

16.05.02 ability to close tank valves and bleed lines

**Task 17 Welds metal using arc welding equipment.**

*Related Components:* Reference to Canadian Standards as applied to CWB (Canadian Welding Bureau); especially standards W47 and W48. Also recognizing local licencing requirements.

*Tools and Equipment:* Refer to Appendix A under Machines.

**Sub-task**

**17.01 Sets up arc welding equipment.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

17.01.01 knowledge of safe practices, i.e. electrical safety

17.01.02 knowledge of common types of arc welding equipment

17.01.03 knowledge of proper care and handling of arc welding equipment and electrodes

**Supporting Knowledge & Abilities**

17.01.04	knowledge of operating principles of arc welding equipment
17.01.05	knowledge of grounding requirements
17.01.06	ability to select correct electrodes
17.01.07	ability to adjust amperage and voltage correctly

**Sub-task**

**17.02 Performs basic arc welding procedures.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	NV

17.02.01	knowledge of SMAW (shielded metal arc welding) welding procedures and techniques
17.02.02	knowledge of AC (alternating current) and DC (direct current) welding
17.02.03	ability to weld all types of common ferrous metals using various welding techniques in different positions to meet drawing requirements
17.02.04	ability to achieve proper fusion and penetration in all positions

**Task 18 Welds metal using metal inert gas (MIG) equipment.**

*Related Components:* Reference to Canadian Standards as applied to CWB; especially standards W47 and W48. Also recognising local licencing requirements.

*Tools and Equipment:* Refer to Appendix A under Machines.

**Sub-task**



**18.01 Sets up MIG welding equipment.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	NV

- 18.01.01 knowledge of safety requirements
- 18.01.02 knowledge of common types of MIG welding equipment, wire and gases
- 18.01.03 knowledge of operating principle of the MIG welding equipment
- 18.01.04 ability to adjust MIG welding equipment to meet task requirements
- 18.01.05 ability to adjust water flow, shielding gas, wire feed and speed, voltage, amperage, current and frequency

**Sub-task**

**18.02 Performs basic MIG welding procedures.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	NV

- 18.02.01 knowledge of safe practices for the MIG welding process
- 18.02.02 knowledge of welding techniques
- 18.02.03 ability to weld metals in all positions to meet drawing specifications
- 18.02.04 ability to maintain proper gun angle
- 18.02.05 ability to maintain proper travel speed

**Supporting Knowledge & Abilities**

- 18.02.06 ability to achieve proper fusion and penetration

**Task 19 Welds metal using tungsten inert gas (TIG) equipment. (NOT COMMON CORE)**

*Related Components:* Reference to Canadian Standards as applied to CWB; especially standards W47 and W48. Also recognising local licencing requirements.

*Tools and Equipment:* Refer to Appendix A under Machines.

**Sub-task**

**19.01 Sets up TIG welding equipment.**

**Supporting Knowledge & Abilities**

**(NOT COMMON CORE)**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
no	yes	yes	yes	yes	yes	no	yes	yes	no	no	NV

- 19.01.01 knowledge of safety requirements
- 19.01.02 knowledge of common types of TIG welding equipment, tungsten tips, filler rods and gases
- 19.01.03 knowledge of operating principle of the TIG welding equipment
- 19.01.04 ability to adjust TIG welding equipment to meet task requirements
- 19.01.05 ability to adjust shielding gas, tip, voltage, amperage, current and frequency

**Sub-task**

**19.02 Performs basic TIG welding procedures.**

**Supporting Knowledge & Abilities**

**(NOT COMMON CORE)**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
no	yes	yes	yes	yes	yes	no	yes	no	no	no	NV

- 19.02.01 knowledge of safe practices for the TIG welding process
- 19.02.02 knowledge of welding techniques
- 19.02.03 ability to weld metals to meet drawing specifications
- 19.02.04 ability to maintain proper gun angle
- 19.02.05 ability to maintain proper travel speed
- 19.02.06 ability to achieve proper fusion and penetration

**Task 20 Cuts metal using plasma arc equipment. (NOT COMMON CORE)**

*Tools and Equipment:* Refer to Appendix A under Machines.

**Sub-task**

**20.01 Sets up plasma arc cutting equipment. Supporting Knowledge & Abilities**

**(NOT COMMON CORE)**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
no	yes	yes	yes	yes	yes	yes	yes	no	no	no	NV

- 20.01.01 knowledge of safety requirements

**Supporting Knowledge & Abilities**

- 20.01.02 knowledge of common types of plasma arc equipment and accessories

- 20.01.03 knowledge of operating principle of plasma arc equipment
- 20.01.04 ability to adjust plasma arc machines
- 20.01.05 ability to adjust gas, voltage, amperage, current and frequency

**Sub-task**

**20.02 Performs basic plasma arc cutting procedures.**

**Supporting Knowledge & Abilities**

**(NOT COMMON CORE)**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
no	yes	yes	yes	yes	yes	yes	yes	no	no	no	NV

- 20.02.01 ability to cut different types of metals to specifications

**BLOCK E**

**INSTALLATION AND MAINTENANCE OF COMPONENTS AND SYSTEMS**

*Trends: More frequent updating necessary due to the increased use of electronic controls. The ability to perform visual inspection and assessment is being increasingly enhanced by complex instrumentation and automatic monitoring systems.*

**Task 21 Installs safety guards and rails.**

*Related Components:* Guards and rails. National Building Code (NBC).

*Tools and Equipment:*

Refer to Appendix A under Tools and Equipment, and Portable Power Tools.

**Sub-task**

**21.01 Installs safety devices.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

21.01.01 knowledge of regulations and specifications governing guards and rails requirements

21.01.02 ability to determine guards and rails requirements from specifications

21.01.03 ability to install guards and railings from sheet metal, expanded metal and steel pipe

21.01.04 ability to select and install appropriate warning signs

21.01.05 ability to inspect guards, rails and warning signs

**Task 22 Performs lubrication practices.**

*Related Components:*

Oils, lubricants and coolants.

*Tools and Equipment:*

Refer to Appendix A under Tools and Equipment.

**Sub-task**

**22.01 Lubricates systems and components.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

**Supporting Knowledge & Abilities**

22.01.01 knowledge of lubricating systems and components

22.01.02	knowledge of basic oil/lubricant qualities such as viscosity, etc.
22.01.03	ability to determine lubricants/fluid requirements from specifications and technical manuals
22.01.04	ability to identify points requiring lubricants
22.01.05	ability to select proper lubricants and fluids
22.01.06	ability to clean systems and components

**Sub-task**

**22.02 Examines oils and lubricants.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

22.02.01	knowledge of health and environmental liabilities
22.02.02	knowledge of oil/lubricant analysis process
22.02.03	ability to collect oil/lubricant sample for analysis
22.02.04	ability to examine oil/lubricants by visual inspection and by smelling

**Task 23 Performs alignment practices.**

*Tools and Equipment:*

Dial indicators, transit/optical levels, computer and laser equipment, and shims. Also refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

**Sub-task**

**23.01 Aligns components and**

**Supporting Knowledge & Abilities**

**systems.**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

23.01.01	knowledge of optical/mechanical alignment practices
23.01.02	ability to adjust machinery/equipment using common types of levelling tools and devices, such as transit and laser
23.01.03	ability to adjust level from left to right, front to back and in diagonal plane
23.01.04	ability to align machinery/equipment according to manufacturer=s instructions
23.01.05	ability to shim machinery/equipment

**Task 24 Installs, troubleshoots and maintains power transmission systems.**

*Related Components:* Belt, chain, gear, couplings, clutches and brakes.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

**Sub-task**

**24.01 Installs drives.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

**Supporting Knowledge & Abilities**

24.01.01	knowledge of installation procedures and practices for all common types of drives and drive components found in industry
24.01.02	knowledge of common types of belts, belt drives and pulleys
24.01.03	knowledge of gears and gear drive arrangements
24.01.04	knowledge of common types of chains, chain drives, sprocket and hubs
24.01.05	knowledge of couplings
24.01.06	knowledge of brakes and clutches
24.01.07	ability to install all common types of drive and drive components found in industry, according to requirements and specifications, following correct installation techniques

**Sub-task**

**24.02 Troubleshoots drives.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

24.02.01	knowledge of different types of belts and belt drives
24.02.02	knowledge of different types of chains and chain drives, such as: roller, silent, extended pitch, duplex and triplex chains
24.02.03	knowledge of chain sprockets and hubs
24.02.04	knowledge of different types of gears and gear drives
24.02.05	knowledge of different types of couplings and coupling drives

**Supporting Knowledge & Abilities**

24.02.06	knowledge of different types of clutch and brake
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design and construction, such as: friction, mechanical, fluid, dry shot, magnetic, spring and over-running

- 24.02.07 knowledge of electrical and air operated brakes
- 24.02.08 knowledge of the operating principles of different types of drives
- 24.02.09 ability to inspect, test and examine all drive systems and drive system components to determine repair/maintenance requirements
- 24.02.10 ability to troubleshoot and identify faults and problems found in drive systems and drive system components

**Sub-task**

**24.03 Maintains drives.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 24.03.01 knowledge of safe working practices when performing drive maintenance tasks
- 24.03.02 ability to maintain/inspect, repair, modify and replace all common types of drives, drive components and associated equipment

**Task 25 Installs, troubleshoots and maintains material moving systems.**

*Related Components:* Belt, bucket, chain, screw, roller, pneumatic and specialized conveyors.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

**Sub-task**

**25.01 Installs material moving systems.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 25.01.01 knowledge of safe installation procedures and practices for all common types of material moving systems found in industry
- 25.01.02 knowledge of various types of material moving systems such as belt conveyors system ie, flat, storage and inclined
- 25.01.03 knowledge of various types of screw conveyors
- 25.01.04 knowledge of pneumatic conveying systems, i.e. low pressure, high pressure and air slide
- 25.01.05 knowledge of different types of bucket conveyors, i.e. vertical, inclined and positive discharge
- 25.01.06 knowledge of different types of filters, i.e. cyclones, scrubbers, bagged shakers, precipitators and liquid treatment systems
- 25.01.07 knowledge of specialized material handling equipment, i.e. monorail conveyors, vibrating conveyors, transfer tables, automatic guided equipment and drag chains
- 25.01.08 ability to install all types of material moving systems, components, assemblies and sub-assemblies, according to requirements and specifications, following correct installation techniques

**Sub-task**

**25.02 Troubleshoots material moving systems.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

**Supporting Knowledge & Abilities**

- 25.02.01 knowledge of various types and operating principles of material moving systems in common use
- 25.02.02 knowledge of belt conveyors system, i.e. flat, storage or inclined
- 25.02.03 knowledge of trippers, ploughs, chutes, skirt board, clutches and anti-reversing devices
- 25.02.04 knowledge of roller construction, drive systems, control systems, bearing and lubrication systems
- 25.02.05 knowledge of various types of screw conveyors
- 25.02.06 knowledge of pneumatic conveying systems, i.e. low pressure, high pressure and air slide
- 25.02.07 knowledge of various types of hydraulic operated systems
- 25.02.08 knowledge of different types of bucket elevators, i.e. vertical, inclined and positive discharge
- 25.02.09 knowledge of specialized material handling equipment, i.e. monorail conveyors, vibrating conveyors, transfer tables, automatic guided vehicles and drag chains
- 25.02.10 knowledge of safe practices when performing maintenance tasks
- 25.02.11 ability to inspect, test and examine material moving systems to determine repairs/maintenance requirements
- 25.02.12 ability to troubleshoot and identify faults and problems found in material moving systems

**Sub-task**

**25.03 Maintains material moving systems.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

**Supporting Knowledge & Abilities**

- 25.03.01 knowledge of safe work practice when performing repair/maintenance tasks on material moving systems
- 25.03.02 ability to maintain/inspect, repair, modify and replace all common types of material moving systems and component parts

**Task 26 Installs, troubleshoots and maintains shafts, bearings and seals.**

*Related Components:* Shafts, sleeve-type and rolling element bearings, static and dynamic seals.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

**Sub-task**

**26.01 Installs shafts, bearings and seals. Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 26.01.01 knowledge of installation procedures and practices for all common types of shafts, bearings and seals found in industry
- 26.01.02 knowledge of various types of shafts
- 26.01.03 knowledge of various types of bearings including sleeve-type and rolling element bearings
- 26.01.04 knowledge of various types of static and dynamic seals
- 26.01.05 ability to install all types of shafts, bearings and seals, according to requirements and specifications, following correct installation techniques

**Sub-task****26.02 Troubleshoots shafts, bearings and seals.****Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV
					26.02.01		knowledge of different types of shafts in common use				
					26.02.02		knowledge of different types of bearings in common use, such as ball, roller, needle/pin and taper bearings				
					26.02.03		knowledge of different types of seals in common use, such as friction-type and mechanical seals				
					26.02.04		knowledge of various types of packing and their applications				
					26.02.05		knowledge of break-in procedures				
					26.02.06		ability to inspect, test and examine bearings, shafts and seals for wear and damage to determine repair/maintenance requirements				
					26.02.07		ability to troubleshoot and identify faults and problems in shafts, bearings and seals				
					26.02.08		ability to determine step-by-step problems, failures or trouble with shafts, bearings and seals, using recognized test/evaluation procedures and/or the use of specialized equipment				
					26.02.09		ability to recognize conditions that lead to failure/breakdown of components/machinery				
					26.02.10		ability to recognise common failures in components/ machinery/systems				
					26.02.11		ability to evaluate corrective procedures related to the specific equipment/machinery				
					26.02.12		ability to determine tolerances from manufacturer=s service manuals				

**Sub-task**

**26.03 Maintains shafts, bearings and seals.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 26.03.01 knowledge of safe working practices when performing repair/replacement/maintenance work on shafts, bearings and seals
- 26.03.02 ability to maintain/inspect, repair, modify and replace all common shafts, bearings, seals and associated components
- 26.03.03 ability to repair keyways
- 26.03.04 ability to lubricate bearing and seals
- 26.03.05 ability to remove all burrs and nicks
- 26.03.06 ability to remove/repair/replace worn or damaged shafts, bearings, bushings and seals
- 26.03.07 ability to replace Ao@ rings
- 26.03.08 ability to set pre-load to manufacturers= specifications

**Task 27 Installs, troubleshoots and maintains pumps.**

*Related Components:* Positive displacement and non-positive displacement (dynamic) pumps.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

**Sub-task**

**27.01 Installs pumps.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

**Supporting Knowledge & Abilities**

- 27.01.01 knowledge of installation procedures and practices for all common types of industrial pumps
- 27.01.02 knowledge of piping/tubing sizing and schematics
- 27.01.03 ability to install all types of pumps, pump components, tubing and piping, according to requirements and specifications, following correct installation techniques

**Sub-task**

**27.02 Troubleshoots pumps.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 27.02.01 knowledge of various types and operating principles of common industrial pumps - fixed and non-fixed displacement
- 27.02.02 knowledge of characteristics related to pressures, flow and fluids being pumped
- 27.02.03 knowledge of operating principles and trade calculation related to pumps
- 27.02.04 knowledge of electrical safety
- 27.02.05 knowledge of the head limits of different types of pumps
- 27.02.06 ability to determine step-by-step problems, failures or trouble with pumps, using recognized test/evaluation procedures and/or the use of specialized equipment
- 27.02.07 ability to troubleshoot and identify faults and

problems with pump components

27.02.08 ability to recognize conditions that lead to failure/breakdown of pumps

**Supporting Knowledge & Abilities**

27.02.09 ability to recognize common failures in pumps

27.02.10 ability to evaluate corrective procedures related to the specific pumps

**Sub-task**

**27.03 Maintains pumps.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

27.03.01 knowledge of safe work practice when performing repair/maintenance on pumps

27.03.02 ability to maintain/inspect, repair, modify and replace pumps to ensure they operate effectively and efficiently

**Task 28 Installs, troubleshoots and maintains prime movers.**

*Related Components:* Internal combustion engines, gas, steam and water turbines, compressed air, hydraulic and electric motors.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

**Sub-task**

**28.01 Installs prime movers.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV



28.01.01 knowledge of installation procedures and practices for all common types of prime movers used in industry

**Supporting Knowledge & Abilities**

28.01.02 knowledge of installation procedures of all associated equipment and support systems

28.01.03 knowledge of characteristics related to various types of prime movers

28.01.04 ability to install all types of prime movers, associated equipment and support systems according to requirements and specifications; following correct installation procedures

**Sub-task**

**28.02 Troubleshoots prime movers.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

28.02.01 knowledge of various types and operating principles of prime moving systems and system components in common use

28.02.02 knowledge of internal combustion engines

28.02.03 knowledge of gas, steam and water turbines

28.02.04 knowledge of electric motors

28.02.05 ability to determine step-by-step problems, failures or trouble with any prime mover, using recognized test/evaluation procedures and/or the use of specialized equipment

28.02.06 ability to troubleshoot and identify faults and problems with prime movers

28.02.07 ability to identify common faults in prime moving systems

28.02.08 ability to recognize conditions that lead to

failure/breakdown of prime movers

**Supporting Knowledge & Abilities**

- 28.02.09 ability to recognize common failures in prime movers
- 28.02.10 ability to evaluate corrective procedures related to the specific prime movers

**Sub-task**

**28.03 Maintains prime movers.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 28.03.01 knowledge of safe work practice when performing repair/maintenance tasks on prime movers systems
- 28.03.02 ability to maintain/inspect, repair, modify and replace all common types of prime movers systems and component parts to ensure prime movers operate effectively and efficiently

**Task 29 Installs, troubleshoots and maintains fans and blowers.**

*Related Components:* Radial and axial blowers, centrifugal and axial flow fans.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

**Sub-task**

**29.01 Installs fans and blowers.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 29.01.01 knowledge of installation procedures and practices for all common types of fans and

blowers used in industry

**Supporting Knowledge & Abilities**

- 29.01.02 knowledge of installation procedures of all associated equipment and support systems
- 29.01.03 ability to install fans and blowers, associated equipment and support systems according to requirements and specifications, following correct procedures

**Sub-task**

**29.02 Troubleshoots fans and blowers.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 29.02.01 knowledge of various types of fans and blowers used in industry, i.e. radial and axial blowers, centrifugal and axial flow fans
- 29.02.02 knowledge of characteristics and principles of fans and blowers
- 29.02.03 ability to determine step-by-step problems, failures or trouble with industry fans and blowers, using recognized test/evaluation procedures and/or the use of specialized equipment
- 29.02.04 ability to troubleshoot and identify faults and problems with fans and blowers
- 29.02.05 ability to inspect and examine fans and blowers to determine repair/maintenance requirements
- 29.02.06 ability to identify common faults in fans and blowers
- 29.02.07 ability to recognize conditions that lead to failure/breakdown of fans and blowers

29.02.08 ability to recognize common failures in fans and blowers

**Supporting Knowledge & Abilities**

29.02.09 ability to evaluate corrective procedures related to the specific fans and blower operation

**Sub-task**

**29.03 Maintains fans and blowers.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

29.03.01 knowledge of safe work practice when performing maintenance tasks on fans and blowers

29.03.02 ability to maintain/inspect, repair, modify and replace all common types of fans and blowers, associated equipment and support systems to ensure they operate effectively and efficiently

**Task 30 Installs, troubleshoots and maintains tanks and containers.**

*Related Components:* Reservoirs, thickeners, sumps and enclosed vessels.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, Portable Power Tools, Machines, Testing Equipment, and Lifting Equipment.

**Sub-task**

**30.01 Installs tanks and containers.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

30.01.01 knowledge of installation procedures and

practices for all common types of tanks and containers

30.01.02 knowledge of installation procedures of all associated equipment and components

**Supporting Knowledge & Abilities**

30.01.03 ability to install all common types of tanks, containers and related components according to requirements and specifications, following correct procedures

**Sub-task**

**30.02 Troubleshoots tanks and containers.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

30.02.01 knowledge of all common types of tanks and containers

30.02.02 knowledge of all related equipment and components

30.02.03 knowledge of characteristics and uses of tanks and containers

30.02.04 knowledge of safe practices regarding air quality and confined entry

30.02.05 ability to identify faults and problems with tanks and containers such as periodic autogauging

30.02.06 ability to identify faults with related equipment and components

**Sub-task**

**30.03 Maintains tanks and containers.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV

**Supporting Knowledge & Abilities**

30.03.01	knowledge of safe practices when performing repair/maintenance tasks on tanks and containers
30.03.02	ability to maintain/inspect, repair, modify and replace all common types of tanks, containers and related components to requirements and specifications
30.03.03	ability to change liners
30.03.04	ability to maintain ventilation system

**Task 31 Starts up and runs in commissioning.**

*Tools and Equipment:*

Refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

**Sub-task**

**31.01 Pre-starts inspection.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

31.01.01	knowledge of system used for coding machinery and equipment
31.01.02	knowledge of safe operating procedures
31.01.03	ability to perform pre-run checks according to manufacturers= specifications
31.01.04	ability to recognize conditions that may cause equipment problems and failures

**Sub-task**

**31.02 Performs start-up procedures.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

**Supporting Knowledge & Abilities**

- 31.02.01 knowledge of the principles of equipment at hand
- 31.02.02 knowledge of the design capabilities of the machinery/equipment
- 31.02.03 ability to start and run equipment following manufacturers= specifications
- 31.02.04 ability to perform on-going checks according to manufacturers= specifications
- 31.02.05 ability to assess and monitor (temperature, pressure, etc.) equipment performance against manufacturers= specifications
- 31.02.06 ability to identify any problems, leaks or unusual conditions on equipment
- 31.02.07 ability to follow and monitor the sequence of start-up procedures

**Sub-task**

**31.03 Adjusts and tests equipment.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 31.03.01 knowledge of tests and analysis procedures in common use for assessing equipment
- 31.03.02 ability to monitor initial start-up and fine tune adjustments

31.03.03 ability to read, record and test vibration analysis data

31.03.04 ability to assess equipment performance

## BLOCK F

### FLUID POWER

*Trends: While the electrical and mechanical components are getting better, they are also becoming more sophisticated and more complex to maintain.*

#### **Task 32 Installs, troubleshoots and maintains hydraulic systems.**

*Related Components:* Pumping units, valves and actuators.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

#### **Sub-task**

##### **32.01 Installs hydraulic components and systems.**

##### **Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

32.01.01 knowledge of hydraulic principles

32.01.02 knowledge of installation procedures and practices for all common types of hydraulic systems and components

32.01.03 ability to install all common types of hydraulic systems and components found in industry

32.01.04 ability to select hydraulic/fluid types to meet requirements

32.01.05 ability to select piping requirements from



schematics and specifications to meet requirements

32.01.06 ability to install and align hydraulic pump and motor

32.01.07 ability to install the correct size and type of reservoir

**Supporting Knowledge & Abilities**

32.01.08 ability to measure, cut, bend and install piping

32.01.09 ability to install correct filters, strainers, hydraulic valves and associated equipment

**Sub-task**

**32.02 Troubleshoots hydraulic components and systems.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

32.02.01 knowledge of safe practices pertaining to hydraulic systems

32.02.02 knowledge of hydraulic principles and trade calculations

32.02.03 knowledge of various types of hydraulic systems in common use

32.02.04 knowledge of piping requirements for hydraulic systems

32.02.05 knowledge of various types of hydraulic pumps, motors and drives

32.02.06 knowledge of directional control, flow control, pressure regulation, counterbalance, pressure reduction, servo and proportional valves

32.02.07 ability to record hydraulic data, read specifications from technical manuals and make

necessary adjustments

32.02.08 ability to troubleshoot/test and identify faults and problems with hydraulic components systems

32.02.09 ability to read and understand hydraulic symbols and schematics of the International Standards Organization (ISO) and of the American National Standards Institute (ANSI)

**Supporting Knowledge & Abilities**

32.02.10 ability to inspect and examine hydraulic systems to determine repair/maintenance requirements

32.02.11 ability to read and understand manufacturers= service manuals to repair/rebuild/replace components found in common hydraulic systems

**Sub-task**

**32.03 Maintains hydraulic components and systems.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

32.03.01 knowledge of safe working practices when performing maintenance tasks on hydraulic components and systems

32.03.02 ability to maintain/inspect, repair, modify and replace hydraulic components and systems

32.03.03 ability to fine tune the operation of the hydraulic systems

**Task 33 Installs, troubleshoots and maintains pneumatic systems.**

*Related Components:* Compressors, valves, actuators and dryers.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

**Sub-task**

**33.01 Installs pneumatic components and systems.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

**Supporting Knowledge & Abilities**

- 33.01.01 knowledge of pneumatic principles
- 33.01.02 knowledge of installation procedures and practices for all common types of pneumatic systems and components
- 33.01.03 ability to install all common types of pneumatic systems and components found in industry
- 33.01.04 ability to install and align air compressors and related equipment/accessories
- 33.01.05 ability to select tubing requirements from schematics and specifications
- 33.01.06 ability to install pneumatic motor and compressor and to select and install filters according to manufacturers= specifications
- 33.01.07 ability to select and install pneumatic valves
- 33.01.08 ability to select and install the correct size and type of receiver
- 33.01.09 ability to select, measure, cut, bend and install tubing
- 33.01.10 ability to solder copper tubing and flare copper and steel tubing

**Sub-task**

**33.02 Troubleshoots pneumatic components and systems.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 33.02.01 knowledge of safe practices pertaining to pneumatic components and systems
- 33.02.02 knowledge of pneumatic principles and trade calculations
- 33.02.03 knowledge of various types of pneumatic systems in common use

**Supporting Knowledge & Abilities**

- 33.02.04 knowledge of gas laws pertaining to pneumatic systems
- 33.02.05 ability to read and understand pneumatic ISO/ANSI symbols/schematics
- 33.02.06 ability to inspect and examine pneumatic systems to determine maintenance requirements
- 33.02.07 ability to troubleshoot and identify faults and problems with pneumatic components and systems
- 33.02.08 ability to read and understand manufacturers= service manuals to repair/rebuild/replace components found in common pneumatic systems

**Sub-task**

**33.03 Maintains pneumatic components and systems.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 33.03.01 knowledge of safe working practices when performing maintenance tasks
- 33.03.02 knowledge of basic electrical principles
- 33.03.03 ability to maintain/inspect, repair, modify and replace pneumatic systems and components
- 33.03.04 ability to read and record pneumatic pressure;

determine correct pneumatic pressure from specifications and technical manuals; and adjust pressure control valve

33.03.05 ability to adjust control to maintain correct pressure, speed, temperature and cycling

33.03.06 ability to lubricate and fine tune pneumatic systems

**Task 34 Installs, troubleshoots and maintains vacuum systems.**

*Related Components:* Pumping units, valves and actuators.

*Tools and Equipment:* Refer to Appendix A under Tools and Equipment, Portable Power Tools, Testing Equipment and Lifting Equipment.

**Sub-task**

**34.01 Installs vacuum components and systems. Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

34.01.01 knowledge of installation procedures and practices for all common types of vacuum systems and components

34.01.02 knowledge of the procedures for correct installation and testing of vacuum systems

34.01.03 ability to install all common types of vacuum systems and components found in industry

34.01.04 ability to select piping/tubing requirements from schematics and specifications

**Sub-task**

**34.02 Troubleshoots vacuum components and systems. Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 34.02.01 knowledge of safe practices pertaining to vacuum components and systems
- 34.02.02 knowledge of vacuum principles and trade calculations
- 34.02.03 knowledge of various types of vacuum systems in common use
- Supporting Knowledge & Abilities**
- 34.02.04 ability to troubleshoot and identify faults and problems with vacuum components and systems
- 34.02.05 ability to read and understand vacuum ISO/ANSI symbols/schematics
- 34.02.06 ability to inspect and examine vacuum systems to determine maintenance requirements
- 34.02.07 ability to read and understand manufacturers= service manuals

**Sub-task**

**34.03 Maintains vacuum components and systems.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 34.03.01 knowledge of safe work practices
- 34.03.02 knowledge of basic electrical principles
- 34.03.03 ability to maintain/inspect, repair, modify and replace, fine tune and lubricate vacuum systems and components

## BLOCK G

### PREVENTIVE AND PREDICTIVE MAINTENANCE

*Trends:* Partly due to the use of more sophisticated electronic equipment and the need for better maintenance history records, the use of computers and the need for computer literacy is essential. The Industrial Mechanic may be required to provide services such as work order issue, time recording, maintenance history, parts inventory, planning and scheduling.

#### **Task 35**      **Determines and performs preventive and predictive maintenance.**

*Related Components:* Engineering drawings, system related schematics, sketches, specifications, technical manuals, contracts, warranty documents, workplace safety and health documents, manuals and computer data systems, stationary and rotating equipment.

*Tools and Equipment:* Refer to Appendix A under Testing Equipment.

#### **Sub-task**

##### **35.01**      **Analyses maintenance history of equipment.**

##### **Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes	NV

35.01.01      knowledge of computerized maintenance record keeping systems

35.01.02      knowledge of preventive and predictive maintenance programs

35.01.03      knowledge of system and rotating equipment problems

35.01.04      ability to understand existing data to determine

appropriate preventive maintenance requirements

35.01.05 ability to comprehend maintenance planning programs, i.e. CPM (critical path method) and PERT (program evaluation review technique)

35.01.06 ability to review and analyse collected data to determine suitable maintenance schedules

**Sub-task**

**35.02 Schedules preventive maintenance activities.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

35.02.01 knowledge of preventive maintenance programs

35.02.02 ability to perform a safety audit on equipment

35.02.03 ability to assess production and operational policies for suitable scheduled maintenance shutdowns

35.02.04 ability to access spare parts inventory efficiently

35.02.05 ability to monitor for wear, adjust and calibrate equipment

35.02.06 ability to check all fluid levels

35.02.07 ability to clean and lubricate equipment as determined by manufacturers= specifications

35.02.08 ability to record information for later equipment evaluation

**Sub-task**

**35.03 Schedules predictive maintenance activities.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV



- 35.03.01 knowledge of predictive maintenance requirements
- 35.03.02 ability to utilize information from past and current data to predict mechanical problems
- 35.03.03 ability to identify outstanding problems resulting from unusual sounds, vibrations, fluid quality or level variations or temperature changes

**Supporting Knowledge & Abilities**

- 35.03.04 ability to monitor equipment condition using manufacturers= recommendations

**Task 36 Performs vibration analysis and rotating equipment balancing.**

*Related components:* Stationary and rotating machinery/equipment.

*Tools and Equipment:* See Appendix A under Testing Equipment.

**Sub-task**

**36.01 Tests machinery and equipment using vibration analysis procedures.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	NV

- 36.01.01 knowledge of safe work practices
- 36.01.02 knowledge of vibration theory and characteristics
- 36.01.03 knowledge of types of analysers and applications
- 36.01.04 ability to follow manufacturer=s specifications
- 36.01.05 ability to determine vibration noise measurement
- 36.01.06 ability to identify vibration frequencies related to different machinery components, i.e. journal and rolling element bearings, mechanical looseness, rubbing, excessive lubrication, gears, belts,

cavitation and hydraulic systems

36.01.07 ability to select proper analysing equipment

36.01.08 ability to install transducers and related equipment

36.01.09 ability to recognize vibration causes, i.e. corrosion and wear, eccentricity, shaft problems, types of misalignment and distortion

**Sub-task**

**36.02 Analyses vibration test data.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

36.02.01 knowledge of vibration analysis test equipment and data recording systems

36.02.02 knowledge of scheduling procedures

36.02.03 ability to determine vibration limits and tolerances from manufacturers= service manuals

36.02.04 ability to input computer data from vibration analysis test equipment

36.02.05 ability to direct information for corrective action as required

**Sub-task**

**36.03 Performs machinery and equipment balancing.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	NV

36.03.01 knowledge of safe working

36.03.02 knowledge of pre-balance procedures and requirements

- 36.03.03 knowledge of types of unbalance
- 36.03.04 knowledge of balancing machines and analysing equipment
- 36.03.05 knowledge of balancing methods
- 36.03.06 ability to prepare machinery/equipment for balancing operation

**Supporting Knowledge & Abilities**

- 36.03.07 ability to calculate formula related to balancing
- 36.03.08 ability to identify unbalance in equipment and machinery
- 36.03.09 ability to use static and dynamic balancing procedures
- 36.03.10 ability to use single and multi-plane balancing methods
- 36.03.11 ability to balance equipment to ISO standards

**Task 37 Performs non-destructive testing (NDT). (NOT COMMON CORE)**

*Related Components:* Stationary and rotating machinery and equipment.

*Tools and Equipment:* Refer to Appendix A under Testing Equipment.

**Sub-task**

**37.01 Tests equipment and components using non-destructive testing.**

**Supporting Knowledge & Abilities**

**(NOT COMMON CORE)**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
no	yes	no	yes	yes	yes	yes	yes	yes	no	no	NV

- 37.01.01 knowledge of preparation techniques required

for NDT

- 37.01.02 knowledge of NDT methods and equipment
- 37.01.03 knowledge of follow-up procedures
- 37.01.04 ability to prepare machinery and components for NDT

**Supporting Knowledge & Abilities**

- 37.01.05 ability to perform NDT (in collaboration with appropriate personnel), e.i. visual inspection, liquid penetrant, magnetic particle, ultrasonic, eddy current and radiography testing
- 37.01.06 ability to input data into computerized maintenance programs

**Sub-task**

**37.02 Analyses equipment/ components using non-destructive test data.**

**Supporting Knowledge & Abilities**

**(NOT COMMON CORE)**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
no	yes	no	yes	yes	yes	yes	yes	yes	no	no	NV

- 37.02.01 knowledge of computerized maintenance programs
- 37.02.02 ability to interpret NDT data
- 37.02.03 ability to check components for concentricity and trueness
- 37.02.04 ability to perform speed, pressure and temperature tests
- 37.02.05 ability to collaborate with engineering personnel to perform ultrasonic and x-ray tests, non-destructive tests such as thermographic tests, dye penetration tests and hydrostatic tests to interpret test data

**Task 38 Documents maintenance performed using manual and computer entry.**

*Tools and Equipment:* Refer to Appendix A under Testing Equipment.

**Sub-task**

**38.01 Documents and produces machinery and equipment maintenance records.**

**Supporting Knowledge & Abilities**

<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	yes	NV

- 38.01.01 knowledge of report and incident writing related to the equipment maintenance data
- 38.01.02 knowledge of basic data entry and key manipulation using common computer software, based on planned maintenance programs
- 38.01.03 knowledge of computerized planned and predictive maintenance program spreadsheets and basic word processing procedures
- 38.01.04 ability to enter both manual and computerized equipment maintenance records
- 38.01.05 ability to write up and/or enter technical reports
- 38.01.06 ability to use basic computer programs effectively, including word processing and spreadsheets
- 38.01.07 ability to manipulate edit, spellcheck, and print reports and records

## **APPENDICES**



## TOOLS AND EQUIPMENT

### Tools and Equipment

adjustable wrenches	parallel bars
allen keys	piano wire
brushes	pipe cutter
calculators	pipe wrenches
clamps	plastic gauge
cold chisels	pliers
drill bits	plumb bob
grease gun	pop riveter
hacksaw	pry bars
hammer ball	pullers
hammer claw	punches
hammer plastic	scraper
hammer rubber	scribers
hammer slag	socket wrenches
heat gun	tap and dies
honing stone	tap extractors
jack hammer	taper reamers
lapping plates	tension meter
level	thread chasers
lifting bar	threading accessories
line up bars	tin snip
locking pliers	trammel heads
locks	trowels
lubricating gun	tube benders
mallet	vice
nibblers	wheel dresser
oil can	wrenches

### Measuring and Layout Tools

bore gauge	measuring tapes
building lines	micrometers
calipers	outside calipers
chalk lines	protractor
deflection gauge	radius gauge
depth gauge	rulers
dial indicator	sine bar
digital vernier calipers	small hole gauge
dividers	straightedge
engineer square	surface gauge



feeler gauge  
gauge block  
height gauge  
indicator gauge  
inside calipers

taper gauges  
telescopic gauges  
thread gauge  
vee block  
vernier calipers

### **Portable Power Tools**

angle drill  
chainsaw  
chop saw  
circular saw  
grinders  
hot wrench  
hydraulic gun  
impact drill  
impact gun (rivet)  
impact wrench  
jig saw

portable bender  
portable drill  
powder actuated tool  
power hack saw  
power hone  
power threader  
routers  
sabre saw  
tool grinder  
tube rollers

## Testing Equipment

balancing equipment	radio transmitter
computer alignment equipment	rockwell test equipment
computers	scales
dye penetration test equipment	speed tester
fire extinguisher	tachometer
hydraulic gauge	theodolight
lazer alignment equipment	thermographic test equipment
multitester	transit level
pressure/vacuum gauge	ultrasonic test equipment
printers	vibration analysis equipment

## Lifting Equipment

air jack	mobile crane
air tuggers	overhead crane
block and tackle	pinch bar
cable hoists	power chain blocks
carry deck crane	scissor lift
chains	screw jack
come-along	shackles
dolly	sheaves block
fork lift	slings
gantry crane	small hydraulic blocks
hand wrench	snatch block
hydraulic jack	tractor
ladders	trolleys
man lift	

## Personal Protective Equipment

apron	goggles
breathing protection (paper filter masks to self-contained breathing apparatus)	harnesses
coverall - all types (acid/chemical/fire resistant, etc)	hearing protection
face shields	helmet
facial mask	life jackets
gloves	safety boots/footware
	safety harness & fall arresting gear
	safety vests

## Information Materials

blueprints  
Canadian Standards  
Canadian Welding Bureau  
contract documents  
engineering drawings  
industry/contrators safety manual  
Local licencing data  
Material Safety Data Sheets

National Building Code  
rigging and hoisting manuals  
schematics  
sketches  
specifications  
technical manuals  
warrenty documents  
WHMIS labels

## GLOSSARY

<b>adjust</b>	this normally involves adjustment of components without dismantling the equipment. This procedure requires an in-depth knowledge of the operating principles of the equipment involved and the use of special tools and calibrating equipment.
<b>align</b>	this normally involves the alignment of drive units, couplings, gear reducers, clutches, belt and chain drives and other equipment to ensure perfect fit in the same plane and satisfactory operation. It does not necessarily involve taking the equipment apart although it may sometimes be necessary. It does involve the use of specialized alignment equipment and the use of hand and power equipment.
<b>consult</b>	often the industrial mechanics (millwrights) must seek information outside of his/her own knowledge. This is done by Aconsulting@ drawings, plans, specification sheets, service manuals or other data. This may also involve consulting with other plant personnel, such as engineers or designers.
<b>cross-training</b>	training provided to employees to enable them to perform various job functions.
<b>examine</b>	this is a detail inspection usually carried out after the equipment has been dismantled. It involves checking for excessive wear and damage, and may require the use of measuring equipment.
<b>inspect</b>	this is normally a visual inspection carried out to identify obvious problems. Dismantling of equipment is not normally involved.
<b>install</b>	an operation involving the installation of new mechanical equipment or parts of equipment. It usually incorporates more specialized procedures, such as: alignment, lubrication, and final set-up.
<b>maintain</b>	refers to keeping a machine or system running efficiently with a minimum amount of down-time. It involves regular preventive maintenance checks which may include checking worn parts, lubricating, adjusting, etc. The intent is to prevent breakdowns. <i>For use in this analysis the term maintain can encompass: adjustment, examination, inspection, modification, overhaul, reassembly, repair, replacement and set-up.</i>
<b>manufacturers specifications</b>	this term refers to the performance and engineering standards for a particular machine as detailed by the manufacturer. This information is usually available from drawings, manuals and bulletins.

<b>operate</b>	the industrial mechanic (millwright) is often required to operate a variety of mechanical equipment during the course of maintenance of operations. This requires a specialized knowledge of the operation of the equipment involved.
<b>overhaul</b>	this refers to the reassembly of mechanical equipment to manufacturers= specifications. It is a more specialized function than reassembly as it involves testing and the replacing of worn parts.
<b>reassemble</b>	this involves putting a machine or a piece of equipment back together, generally in the reverse order it was taken apart. The initial disassembly may have been performed by other personnel.
<b>remove</b>	this involves the mechanical actions necessary to remove a piece of mechanical equipment and/or associated ancillary equipment. This implies that the worker is familiar with all the hand tools, power tools, and rigging equipment to perform the operation.
<b>repair</b>	this involves the fixing, mending, or restoring of the worn or damaged parts of a machine. Repair can involve the reproduction of machine parts using power equipment, a variety of hand tools, portable power tools and different types of welding equipment.
<b>replace</b>	the replacement of damaged or broken units and components. It can be carried out on location or in the workshop and requires basically the same tools and equipment as a repair job.
<b>secure</b>	to ascertain that equipment and components are safe, firmly anchored and not subject to movement from vibration or other causes.
<b>select</b>	the industrial mechanic (millwright) will often have to decide what type of equipment or part of equipment, or other items are best suited for a particular application. The selection will be the result of that decision.
<b>set up</b>	this usually follows a rebuild operation and involves the making of any adjustment required so that the equipment performs to manufacturers= specifications.
<b>test</b>	this embraces a number of diagnostic and testing procedures ranging from simply running tests to complicated and lengthy tests involving highly specialized and sophisticated test equipment.
<b>troubleshoot</b>	a step-by-step method of determining faults or trouble with a piece of equipment. This may involve the use of specialized test equipment. A thorough knowledge on how systems and component parts are designed to operate is required.

**BLOCKS AND TASKS WEIGHTING****BLOCK A PLANNING AND WORKPLACE SAFETY**

													National Average	
%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	11%
	20	10	10	6	16	15	5	10	5	13	5			

Task 1 Identifies task requirements.

%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	28%
	23	55	30	24	20	20	40	25	20	20	30			

Task 2 Identifies labour requirements.

%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	16%
	22	5	10	12	20	10	10	25	20	20	20			

Task 3 Identifies parts and material requirements for equipment installation.

%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	24%
	28	25	10	26	28	40	10	25	20	25	30			

Task 4 Determines safety, lock-out procedures and personal protection.

%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	32%
	27	15	50	38	32	30	40	25	40	35	20			

**BLOCK B TOOLS - FASTENERS**

													National Average	
%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	11%
	14	5	10	12	14	10	10	10	10	13	10			

Task 5 Uses precision measuring tools.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	22	40	20	20	21	20	20	20	25	15	20	NV	22%

Task 6 Uses layout tools.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	14	15	15	16	14	15	25	15	25	20	10	NV	17%

Task 7 Uses hand tools.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	17	15	10	10	14	15	5	20	5	15	20	NV	14%

Task 8 Uses portable power tools.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	13	15	10	15	14	15	5	17	5	18	10	NV	12%

Task 9 Uses shop machines.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	17	10	40	20	15	15	25	13	20	20	30	NV	20%

Task 10 Uses fastening devices.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	17	5	5	19	22	20	20	15	20	12	10	NV	15%

**BLOCK C RIGGING AND CRANES**

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>		National Average
%	12	15	8	12	10	15	15	15	5	12	10	NV		12%

Task 11 Determines rigging, hoisting and load requirements.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	33	40	33	35	38	40	35	27	30	37	30	NV	34%

Task 12 Installs, troubleshoots and maintains lifting, rigging and hoisting equipment.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	31	40	34	27	33	30	50	45	30	30	30	NV	35%

Task 13 Safety and operation of rigging and hoisting equipment.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	36	20	33	38	29	30	15	28	40	33	40	NV	31%

**BLOCK D CUTTING, WELDING AND METALLURGY**

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	National Average
%	8	10	6	11	12	10	5	10	5	5	10	NV	8%

Task 14 Inspects work area for safety.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	26	15	20	16	11	15	10	13	20	13	20	NV	16%

Task 15 Selects, tests, and processes metals.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	16	15	5	11	13	20	20	10	10	12	20	NV	14%

Task 16 Welds, brazes and cuts metal using gas welding equipment.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	21	25	20	21	18	30	20	23	20	15	30	NV	22%

Task 17 Welds metal using arc welding equipment.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	24	15	20	28	16	30	20	18	30	15	30	NV	10%

Task 18 Welds metal using metal inert gas (MIG) equipment.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	13	10	15	8	14	0	5	15	10	15	0	NV	22%



Task 19 Welds metal using tungsten inert gas (TIG) equipment.  
**(NOT COMMON CORE)**

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	0	10	15	8	14	0	5	13	10	15	0	NV	8%

Task 20 Cuts metal using plasma arc equipment.  
**(NOT COMMON CORE)**

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	0	10	5	8	14	5	20	8	0	15	0	NV	8%

**BLOCK E                    INSTALLATION AND MAINTENANCE OF COMPONENTS AND SYSTEMS**

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>		National Average
%	24	30	50	27	24	25	40	25	50	30	50	NV		34%

Task 21 Installs safety guards and rails.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	9	5	5	6	1	5	3	5	5	7	5	NV	5%

Task 22 Performs lubrication practices.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	7	10	10	7	5	10	10	7	5	8	5	NV	8%

Task 23 Performs alignment practices.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	12	15	5	12	8	10	10	10	15	13	5	NV	10%

Task 24 Installs, troubleshoots and maintains power transmission systems.

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	
%	12	10	13	12	13	10	10	10	10	10	15	NV	11%

Task 25	Installs, troubleshoots and maintains material moving systems.													
%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	10%
	10	10	13	11	8	10	10	10	5	10	10			
Task 26	Installs, troubleshoots and maintains shafts, bearings and seals.													
%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	14%
	11	10	13	15	17	10	15	15	20	10	20			
Task 27	Installs, troubleshoots and maintains pumps.													
%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	12%
	11	10	13	15	13	10	10	13	10	10	15			
Task 28	Installs, troubleshoots and maintains prime movers.													
%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	10%
	8	10	9	6	13	10	10	10	10	10	10			
Task 29	Installs, troubleshoots and maintains fans and blowers.													
%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	9%
	8	10	9	8	11	10	10	10	10	10	5			
Task 30	Installs, troubleshoots and maintains tanks and containers.													
%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	4%
	6	1	5	3	2	5	2	5	5	7	5			
Task 31	Starts up and runs in commissioning.													
%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	7%
	6	9	5	5	9	10	10	5	5	5	5			

**BLOCK F FLUID POWER**

													National Average	
%	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	NV	15%
	12	20	10	18	9	20	20	10	20	20	10			

Task 32 Installs, troubleshoots and maintains hydraulic systems.

%     NF   NS   PE   NB   PQ   ON   MA   SK   AB   BC   NT   YK     44%  
          40   45   40   51   35   40   50   40   55   50   40   NV

Task 33     Installs, troubleshoots and maintains pneumatic systems.

%     NF   NS   PE   NB   PQ   ON   MA   SK   AB   BC   NT   YK     35%  
          35   40   40   34   35   40   35   40   35   25   30   NV

Task 34     Installs, troubleshoots and maintains vacuum systems.

%     NF   NS   PE   NB   PQ   ON   MA   SK   AB   BC   NT   YK     21%  
          25   15   20   15   30   20   15   20   10   25   30   NV

**BLOCK G                    PREVENTIVE AND PREDICTIVE MAINTENANCE**

	<u>NF</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>PQ</u>	<u>ON</u>	<u>MA</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	National Average
%	10	10	6	14	15	5	5	20	5	7	5	NV	9%

Task 35     Determines and performs preventive and predictive maintenance.

%     NF   NS   PE   NB   PQ   ON   MA   SK   AB   BC   NT   YK     35%  
          35   20   30   28   22   80   20   28   40   40   40   NV

Task 36     Performs vibration analysis and rotating equipment balancing.

%     NF   NS   PE   NB   PQ   ON   MA   SK   AB   BC   NT   YK     33%  
          38   35   50   37   28   20   40   33   20   35   30   NV

Task 37     Performs non-destructive testing (NDT). **(NOT COMMON CORE)**

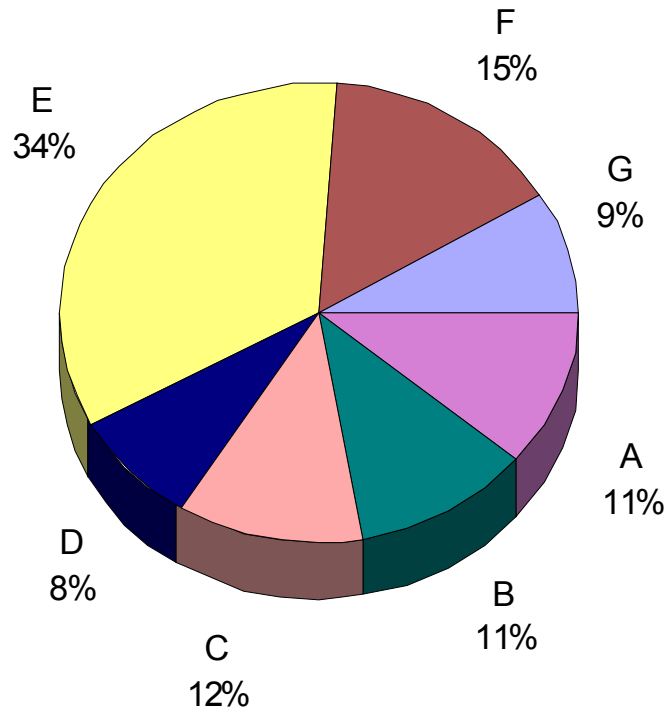
%     NF   NS   PE   NB   PQ   ON   MA   SK   AB   BC   NT   YK     13%  
          0   35   0   9   28   0   20   17   20   12   0   NV

Task 38     Documents maintenance performed using manual and computer entry.

%     NF   NS   PE   NB   PQ   ON   MA   SK   AB   BC   NT   YK     19%  
          27   10   20   26   22   0   20   22   20   13   30   NV

APPENDIX "D"

**PIE CHART\***  
**Industrial Mechanic (Millwright)**



**TITLES OF BLOCKS**

Block A	Planning and Workplace Safety	Block E	Installation and Maintenance of Components and Systems
Block B	Tools - Fasteners	Block F	Fluid Power
Block C	Rigging and Cranes	Block G	Preventive and Predictive Maintenance
Block D	Cutting, Welding and Metallurgy		

\* The average number of questions, derived from the collective decision made by workers within the occupation from all areas of Canada, which will be placed on a one-hundred question interprovincial examination to assess each block of the analysis.

INDUSTRIAL MECHANIC (MILLWRIGHT) (1999)

BLOCKS	TASKS	SUB-TASKS					
A <b>Planning and Workplace Safety</b>	1. Identifies task requirements.	1.01 Reads and understands engineering drawings, schematics, sketches, specifications and technical manuals.	1.02 Verifies dimensions.	1.03 Identifies fabrication requirements.	1.04 Identifies fits, finishes and assembly requirements.	1.05 Identifies installation requirements.	1.06 Identifies maintenance requirements.
	2. Identifies labour requirements.	2.01 Estimates labour requirements.	2.02 Schedules work.	2.03 Consults with other trades persons.			
	3. Identifies parts and material requirements for equipment installation.	3.01 Estimates material requirements.	3.02 Identifies materials, tools and equipment requirements.	3.03 Delivers tools, materials and equipment to meet job requirements.			
	4. Determines safety, lock-out procedures and personal protection.	4.01 Isolates equipment.	4.02 Performs locking and tagging procedures.	4.03 Energizes equipment.	4.04 Identifies and handles hazardous materials.	4.05 Maintains a safe workplace environment.	4.06 Selects personal protective devices.
B <b>Tools - Fasteners</b>	5. Uses precision measuring tools.	5.01 Calibrates basic measuring tools.	5.02 Maintains precision measuring tools.	5.03 Measures material and components using precision tools.	5.04 Stores precision tools.		
	6. Uses Layout tools.	6.01 Sets out components using layout tools.	6.02 Maintains layout tools.				
	7. Uses hand tools.	7.01 Uses hand tools.	7.02 Maintains hand tools.				
	8. Uses portable power tools.	8.01 Uses portable power tools.	8.02 Maintains portable power tools.				
	9. Uses shop machines.	9.01 Operates shop machines.	9.02 Maintains machines.				

**INDUSTRIAL MECHANIC (MILLWRIGHT) (1999)**

BLOCKS	TASKS	SUB-TASKS				
C <b>Rigging and Cranes</b>	10. Uses fastening devices.	10.01 Uses retaining devices.	10.02 Uses threaded fasteners.	10.03 Uses rivets.	10.04 Uses resins.	
	11. Determines rigging, hoisting and load requirements.	11.01 Plans rigging operations.	11.02 Selects rigging and hoisting equipment.			
	12. Installs, troubleshoots and maintains lifting, rigging and hoisting equipment.	12.01 Transports machinery/ equipment.	12.02 Installs hoisting and rigging equipment.	12.03 Rigs loads using slings and attachments.	12.04 Installs and uses access structures.	12.05 Inspects and maintains lifting, rigging and hoisting equipment.
D <b>Cutting, Welding and Metallurgy</b>	13. Safety and operation of rigging and hoisting equipment.	13.01 Uses lifting, rigging and hoisting equipment.	13.02 Directs crane operator.			
	14. Inspects work area for safety.	14.01 Inspects work area for welding operation.				
	15. Selects, tests and processes metals.	15.01 Tests metal using standardized procedures.	15.02 Performs heat treatment of metal.			
	16. Welds, brazes and cuts metal using gas welding equipment.	16.01 Prepares workpiece.	16.02 Sets up gas welding equipment.	16.03 Welds, brazes or cuts metal to blueprints or specifications.	16.04 Inspects workpiece.	16.05 Stores equipment.
	17. Welds metal using arc welding equipment.	17.01 Sets up arc welding equipment.	17.02 Performs basic arc welding procedures.			
18. Welds metal using metal inert gas (MIG) equipment.	18.01 Sets up MIG welding equipment.	18.02 Performs basic MIG welding procedures.				

INDUSTRIAL MECHANIC (MILLWRIGHT) (1999)

BLOCKS	TASKS	SUB-TASKS		
	19. Welds metal using tungsten inert gas (TIG) equipment.	19.01 Sets up TIG welding equipment.	19.02 Performs basic TIG welding procedures.	
	20. Cuts metal using plasma arc equipment.	20.01 Sets up plasma arc cutting equipment.	20.02 Performs basic plasma arc cutting procedures.	
E Installation and Maintenance of Components and Systems	21. Installs safety guards and rails.	21.01 Installs safety devices.		
	22. Performs lubrication practices.	22.01 Lubricates systems and components.	22.02 Examines oils and lubricants.	
	23. Performs alignment practices.	23.01 Aligns components and systems.		
	24. Installs, troubleshoots and maintains power transmission systems.	24.01 Installs drives.	24.02 Troubleshoots drives.	24.03 Maintains drives.
	25. Installs, troubleshoots and maintains material moving systems.	25.01 Installs material moving systems.	25.02 Troubleshoots material moving systems.	25.03 Maintains material moving systems.
	26. Installs, troubleshoots and maintains shafts, bearings and seals.	26.01 Installs shafts, bearings and seals.	26.02 Troubleshoots shafts, bearings and seals.	26.03 Maintains shafts, bearings and seals.
	27. Installs, troubleshoots and maintains pumps.	27.01 Installs pumps.	27.02 Troubleshoots pumps.	27.03 Maintains pumps.
	28. Installs, troubleshoots and maintains prime movers.	28.01 Installs prime movers.	28.02 Troubleshoots prime movers.	28.03 Maintains prime movers.

**INDUSTRIAL MECHANIC (MILLWRIGHT) (1999)**

BLOCKS	TASKS	SUB-TASKS			
F	<b>Fluid Power</b>	29. Installs, troubleshoots and maintains fans and blowers.	29.01 Installs fans and blowers.	29.02 Troubleshoots fans and blowers.	29.03 Maintains fans and blowers.
		30. Installs, troubleshoots and maintains tanks and containers.	30.01 Installs tanks and containers.	30.02 Troubleshoots tanks and containers.	30.03 Maintains tanks and containers.
		31. Starts up and runs in commissioning.	31.01 Pre-starts inspection.	31.02 Performs start-up procedures.	31.03 Adjusts equipment and tests.
		32. Installs, troubleshoots and maintains hydraulic systems.	32.01 Installs hydraulic components and systems.	32.02 Troubleshoots hydraulic components and systems.	32.03 Maintains hydraulic components and systems.
		33. Installs, troubleshoots and maintains pneumatic systems.	33.01 Installs pneumatic components and systems.	33.02 Troubleshoots pneumatic components and systems.	33.03 Maintains pneumatic components and systems.
G	<b>Preventive and Predictive Maintenance</b>	34. Installs, troubleshoots and maintains vacuum systems.	34.01 Installs vacuum components and systems.	34.02 Troubleshoots vacuum components and systems.	34.03 Maintains vacuum components and systems.
		35. Determines and performs preventive and predictive maintenance.	35.01 Analyses maintenance history of equipment.	35.02 Schedules preventive maintenance activities.	35.03 Schedules predictive maintenance activities.
		36. Perform vibration analysis and rotating equipment balancing.	36.01 Tests machinery and equipment using vibration analysis procedures.	36.02 Analyses vibration test data.	36.03 Performs machinery and equipment balancing.
		37. Performs non-destructive testing (NDT).	37.01 Tests equipment and components using non-destructive testing.	37.02 Analyses equipment/components using non-destructive test data.	
	38. Documents maintenance performed using manual and computer entry.	38.01 Documents and produces machinery and equipment maintenance records.			