

# Occupational Analyses Series

## **Boilermaker**

**2003**

Policy and Apprenticeship Division

Division des politiques et de  
l'apprentissage

Human Resources  
Partnerships Directorate

Direction des partenariats  
en ressources humaines

Disponible en français sous le titre :

Chaudronnier/chaudronnière



*The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this Occupational Analysis as the National Standard for the occupation of Boilermaker.*



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## **OTHER RELATED OCCUPATIONAL TITLE**

This analysis covers tasks performed by a Boilermaker whose occupational title has been identified by some provinces and territories of Canada by the name of:

- Construction Boilermaker

## LIST OF PUBLISHED OCCUPATIONAL ANALYSES \*

TITLE	NOC** 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 (2003)</b>	7262
<b>Bricklayer (2000)</b>	7281
<b>Cabinetmaker (2000)</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
<b>Electronics Technician (Consumer Products) (1997)</b>	2242
Electronics Technician Vol. I (1986) (Video Equipment)	2242
Electronics Technician Vol. II (1986) (Audio Equipment)	2242

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

\*\* **National Occupational Classification**

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 (2000)</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 (2000)</b>	2243
<b>Industrial Mechanic (Millwright) (1999)</b>	7311
<b>Insulator (Heat and Frost) (2000)</b>	7293
<b>Ironworker (Generalist) (1993)</b>	7264
<b>Lather (Interior Systems Mechanic) (2002)</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
New Home Builder and Residential Renovation Contractor (1992)	0712
<b>Oil Burner Mechanic (1997)</b>	7331
<b>Painter and Decorator (2000)</b>	7294
<b>Partsperson (1995)</b>	1472
<b>Plumber (1996)</b>	7251
Power Engineer (1997)	7351
<b>Powerline Technician (1996)</b>	7244
<b>Recreation Vehicle Mechanic (2000)</b>	7383
<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 (2003)</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>Truck and Transport Mechanic (2000)</b>	7321
<b>Welder (1996)</b>	7265

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

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Hull, Quebec K1A 0J9**



## 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 translation and then returned to the consultant for review to ensure conformity with the nationally approved format.

The consultant will then forward a copy of this analysis 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 elements of skill and knowledge that an individual must acquire to adequately perform the task are identified under this heading.

### **Trends**

Any shifts or changes in technology that affect the block are identified under this heading.

### **Related Components**

All components of a specified task being undertaken by the boilermaker are identified under this heading.

### **Tools and Equipment**

All tools and equipment necessary for the boilermaker to complete a task are identified under this heading.

## 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 analysis 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, that 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, that will be placed on an interprovincial examination to assess each task of the analysis.
<b>NV:</b>	<u>Not Validated</u> by a province/territory.
<b>ND:</b>	<u>Not Designated</u> in a province/territory.

### PROVINCIAL/TERRITORIAL ABBREVIATIONS

<b>NL:</b>	Newfoundland and Labrador
<b>NS:</b>	Nova Scotia
<b>PE:</b>	Prince Edward Island
<b>NB:</b>	New Brunswick
<b>QC:</b>	Quebec
<b>ON:</b>	Ontario
<b>MB:</b>	Manitoba
<b>SK:</b>	Saskatchewan
<b>AB:</b>	Alberta
<b>BC:</b>	British Columbia
<b>NT:</b>	Northwest Territories
<b>YK:</b>	Yukon
<b>NU:</b>	Nunavut

## **COMMON CORE**

The criteria for determining common core depend on the performance of sub-tasks. If 70 percent of the responding jurisdictions (excluding NVs and NDs) perform a 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 the consultant who then 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 BOILERMAKER OCCUPATION**

A journey person boilermaker is a tradesperson who must possess the full range of knowledge, abilities and skills required to fabricate, construct, install, assemble, erect, demolish, repair and maintain a wide variety of vessels, tanks, towers, boilers, hoists and other structures, ancillary equipment and fixtures made of steel, other metals, fiberglass, and other materials.

The broad scope of the boilermaker trade includes the construction and maintenance activities performed in the field and in industrial and commercial plants such as:

Cement plants, fertilizer plants, water treatment facilities, breweries, sawmills, iron and steel production facilities, steam generation plants, electric power generation (thermal, nuclear, hydro) plants, gas turbines, refineries (oil, chemical), shipbuilding and repair docks, pulp and paper mills, wind and fusion sites, and many other industrial and commercial facilities.

## OCCUPATIONAL OBSERVATIONS

The trade of the boilermaker has progressed considerably in many areas. Recent years have seen an increase in new plant construction in the offshore, aluminum, plastics, processing, and natural gas industries. The increased size and complexity of the plants being constructed in somewhat remote areas contributes to an increasingly competitive contractor environment and to a very mobile trade. For many workers the economic benefits and the availability of work outweigh other considerations and they select the working and living conditions associated with large construction projects in isolated locations. Advancing technology and new materials such as more modular construction, higher quality welds and welding material, and larger lifts and lifting capacity have contributed to many changes in the field. Current trends are resulting in the introduction of automated equipment, new techniques and processes, and a need for an increased proportion of work time spent in the welding function. Of importance, too, is the fact that more women are becoming tradespersons in this area.

A certain amount of overlap exists between trade tasks performed by boilermakers and other tradespersons such as pipefitters, steel fabricators, ironworkers, welders, etc. In addition, trade regulations and practices, which vary from province to province or from province to territory, affect the extent of work performed by various tradespersons. These “jurisdictional” matters are normally noted and defined by agreement between the union and employer associations. Insofar as this analysis is concerned, an attempt has been made to include tasks performed by boilermakers anywhere in Canada, regardless of isolated cases of overlaps, latitude and/or restrictions.

Trade training curricula are continually being updated and modified to meet the demands of the changing trends, technology and new materials. The increased complexity of the trade and the changing nature of work are increasing demand for skills upgrading, which is provided through joint union/management training trust funds.

This section would not be complete without mention of the fact that the work of the boilermaker, by its very nature, is extremely hazardous. The boilermaker is continually required to train for safety in the work place due to the possibility of exposure to hazardous materials and gases that could create health problems. Errors in judgement or in practical application of trade knowledge can be extremely costly, both in terms of injury to workers and damage to equipment or materials. Constant and vigilant attention to the application of safety and accident prevention must be maintained by workers at all times.

## **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 that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

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

It is imperative to be familiar with and follow applicable occupational health and safety laws and regulations. As well, workplace hazards must be identified and measures taken to protect oneself, co-workers, the public and the environment.

As safety education is an integral part of 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

### OCCUPATION SKILLS

*Trends:* Increased automation of tools and equipment such as laser levels, digital controls, CAD, etc.

#### **Task 1 Uses tools and equipment.**

*Related Components:* Vessels, tanks, towers, hoists, boilers, heat exchangers and other structures.

*Tools and Equipment:* Ancillary equipment and fixtures made of steel, other metals, fiberglass and other materials, equipment manuals, safety regulations.

#### **Sub-task**

##### **1.01 Uses common hand tools.**

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

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

1.01.01 knowledge of common hand tools and their applications

1.01.02 ability to use turning tools and equipment such as wrenches, screwdrivers, etc.

1.01.03 ability to use shaping tools such as files, chisels, beveling machines, etc.

1.01.04 ability to use striking tools and equipment such as hammers, sledges, etc.

1.01.05 ability to use fastening tools and equipment such as clamps and dogs

1.01.06 ability to use carrying tools and equipment such as rigging belts, etc.

1.01.07 ability to use gripping tools and equipment such as pliers, etc.

**Sub-task****1.02 Uses measuring and layout tools.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- |         |  |
|---------|--|
| 1.02.01 | knowledge of measuring and marking tools and their applications                                  |
| 1.02.02 | knowledge of layout and leveling tools and equipment such as levels and squares                  |
| 1.02.03 | ability to select and use measuring and marking tools and equipment such as measuring tapes      |
| 1.02.04 | ability to select and use leveling tools and equipment such as water levels, spirit levels, etc. |
| 1.02.05 | ability to select and use layout tools and equipment   |
| 1.02.06 | ability to maintain measuring and layout tools   |

**Sub-task****1.03 Uses cutting, grinding and shaping tools and equipment.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- |         |   |
|---------|---|
| 1.03.01 | knowledge of oxy-fuel, plasma-arc, carbon arc, air and water cutting tools and equipment                  |
| 1.03.02 | knowledge of operation and application of cutting, grinding and shaping tools and equipment               |
| 1.03.03 | knowledge of maintenance of cutting and grinding tools  |
| 1.03.04 | ability to use cutting, grinding and shaping tools such as knives, scissors, chisels, cutters, saws, etc. |

### **Supporting Knowledge & Abilities**

1.03.05	ability to use oxy-fuel cutting tools and equipment
1.03.06	ability to use plasma-arc cutting tools and equipment
1.03.07	ability to use carbon arc air cutting tools and equipment
1.03.08	ability to use grinding and shaping tools and equipment
1.03.09	ability to maintain cutting, grinding and shaping tools
1.03.10	ability to maintain and use water cutting equipment

### **Sub-task**

#### **1.04 Uses welding tools and equipment.**

### **Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	no	ND	ND	ND
					1.04.01		knowledge of welding theory and applications					
					1.04.02		knowledge of personal protective equipment for welding applications					
					1.04.03		ability to select correct process for application					
					1.04.04		ability to use welding machines, tools, accessories and related equipment					
					1.04.05		ability to use auxiliary welding supplies and personal protective equipment					
					1.04.06		ability to maintain tools, accessories and equipment related to welding machines					

**Sub-task**

**1.05 Uses lifting tools and equipment.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					1.05.01		knowledge of lifting theory					
					1.05.02		knowledge of lifting devices, components and applications					
					1.05.03		ability to use lifting equipment such as slings, shackles, tag lines, spreader bars, equalizing bars or beams, etc.					
					1.05.04		ability to work with cranes, boom trucks, forklifts, hoists, etc.					
					1.05.05		ability to use hand lifting tools and equipment such as pry bars, jacks, wire ropes, chain falls, come-alongs, etc.					

**Sub-task**

**1.06 Uses safety and environmental tools and equipment.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					1.06.01		knowledge of appropriate regulations					
					1.06.02		knowledge of workplace safety hazards					
					1.06.03		knowledge of personal protective equipment and applications					
					1.06.04		ability to select and use personal protective equipment					
					1.06.05		ability to select and use environmental equipment such as atmospheric testing equipment, explosion-proof lights, air movers, etc.					

**Supporting Knowledge & Abilities**

1.06.06 ability to select and use cleaning tools and equipment such as shovels, brooms, power brushes, cleaning agents, sandblasting equipment, buffing tools, etc.

**Task 2 Uses materials.**

*Related Components:* Vessels, tanks, towers, boilers, heat exchangers and other structures.

*Tools and Equipment:* Hoists, fastening tools and equipment, cutting tools and equipment.

**Sub-task**

**2.01 Uses metals.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

2.01.01 knowledge of ferrous and non-ferrous metals

2.01.02 knowledge of steels such as stainless steel, cast iron, nickel steel, etc.

2.01.03 knowledge of carbon steel, alloy steel, chrome and aluminum

2.01.04 knowledge of materials' purpose and applications

2.01.05 ability to fasten

2.01.06 ability to coat components using thermal spray

**Sub-task**

**2.02 Uses fiberglass and fiberglass-reinforced materials.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	no	yes	yes	yes	ND	ND	ND

2.02.01 knowledge of resins, promoters and accelerators

### Supporting Knowledge & Abilities

2.02.02	knowledge of materials' purpose and applications
2.02.03	ability to fasten
2.02.04	ability to coat components
2.02.05	ability to mix quantities
2.02.06	ability to apply lay-up applications according to specifications
2.02.07	ability to test applications

### **Task 3          Interprets construction documents.**

*Related Components:*          Prints and drawings, materials lists, procedures, handbooks, MSDS, sketches, manuals.

*Tools and Equipment:*          Layout and measuring tools.

### **Sub-task**

#### **3.01          Interprets drawings and specifications.**

### Supporting Knowledge & Abilities

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

3.01.01	knowledge of theory and layout of drawings
3.01.02	ability to interpret drawing symbols
3.01.03	ability to interpret drawing sections and views of components
3.01.04	ability to use materials lists
3.01.05	ability to interpret notes
3.01.06	ability to understand measurements
3.01.07	ability to make rough drawings or sketches

**Sub-task**

**3.02 Interprets charts and handbooks.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

3.02.01 knowledge of rigging and hoisting principles

3.02.02 ability to read rigging and hoisting charts

3.02.03 ability to read mathematical charts

3.02.04 ability to read drill and tap charts

3.02.05 ability to interpret trade reference manual

**Sub-task**

**3.03 Interprets codes, standards and regulations.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

3.03.01 knowledge of federal, provincial/territorial and municipal codes and standards

3.03.02 ability to interpret applicable codes such as ASME, ANSI, API, CSA and local jurisdiction's regulations

**Sub-task**

**3.04 Interprets general construction documents.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

3.04.01 ability to interpret scope of work documents

3.04.02 ability to read waybills

3.04.03 ability to read material mill test reports (MTRs)

**Supporting Knowledge & Abilities**

- 3.04.04 ability to read and interpret MSDS
- 3.04.05 ability to follow equipment manuals
- 3.04.06 ability to follow operation and process manuals

**Task 4 Performs welding activities.**

*Related Components:* Vessels, tanks, towers, boilers, structural elements.

*Tools and Equipment:* Welding machines, welding cables, grinders, welding wire, filler wire, rod oven, electrical intensity remote control, milling machines, welding tools, common hand tools, mirrors, damming materials such as duct tape, personal protective equipment.

**Sub-task**

**4.01 Identifies welding process.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 4.01.01 knowledge of theory and application of applicable welding processes (e.g., SMAW, GTAW)
- 4.01.02 knowledge of federal and provincial/territorial legislation and codes
- 4.01.03 ability to read and interpret weld symbols
- 4.01.04 ability to identify materials of components

**Sub-task**

**4.02 Prepares joint.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 4.02.01 knowledge of cutting, grinding and shaping tools



### **Supporting Knowledge & Abilities**

4.02.02	knowledge of cutting, grinding and shaping processes
4.02.03	knowledge of parent metals
4.02.04	ability to select appropriate cutting, grinding and shaping tools
4.02.05	ability to use appropriate cutting, grinding and shaping tools

### **Sub-task**

#### **4.03 Fits joint.**

### **Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

4.03.01	knowledge of welding processes
4.03.02	knowledge of welding preparation
4.03.03	knowledge of joint specifications
4.03.04	ability to determine alignment tolerances
4.03.05	ability to select alignment tools
4.03.06	ability to use alignment tools

### **Sub-task**

#### **4.04 Performs tack weld.**

### **Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	no	yes	yes	yes	yes	yes	yes	ND	ND	ND

4.04.01	knowledge of welding theory, processes and procedures
4.04.02	knowledge of codes and symbols
4.04.03	knowledge of material types
4.04.04	knowledge of electrode types

**Supporting Knowledge & Abilities**

- 4.04.05 ability to identify parent metals
- 4.04.06 ability to read and interpret welding symbols
- 4.04.07 ability to select filler material
- 4.04.08 ability to perform tack weld
- 4.04.09 ability to visually inspect weld

**Sub-task**

**4.05 Welds joint.**

**Supporting Knowledge & Abilities**

**(NOT COMMON CORE)**

<b><u>NL</u></b>	<b><u>NS</u></b>	<b><u>PE</u></b>	<b><u>NB</u></b>	<b><u>QC</u></b>	<b><u>ON</u></b>	<b><u>MB</u></b>	<b><u>SK</u></b>	<b><u>AB</u></b>	<b><u>BC</u></b>	<b><u>NT</u></b>	<b><u>YK</u></b>	<b><u>NU</u></b>
no	yes	yes	no	yes	yes	no	yes	yes	no	ND	ND	ND

- 4.05.01 knowledge of welding processes
- 4.05.02 ability to identify appropriate welding process
- 4.05.03 ability to select filler materials
- 4.05.04 ability to perform welding process according to specification
- 4.05.05 ability to detect welding problems (e.g., impurities)
- 4.05.06 ability to correct welding problems (e.g., impurities)

**Task 5 Tests components.**

*Related Components:*

Steel plants (blast furnaces, stoves, coke ovens, tanks, stacks, vessels, ductwork), generating plants (boilers, ductwork, stacks, precipitators, scrubbers, tanks, rectifiers, burners, water heaters), refineries (towers, exchangers, stacks, crackers), pulp mills (boilers, tanks, ductwork, bag houses).

*Tools and Equipment:*

Air pressure or vacuum equipment, soap test, linseed oil, penetrating oil, hydro testing, marking paint, etc.

**Sub-task****5.01 Inspects components.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					5.01.01		knowledge of metallurgy testing theory and applications					
					5.01.02		knowledge of component parts and their operation					
					5.01.03		ability to clean weld surface for purpose of testing					
					5.01.04		ability to identify common problems such as nicks, pick-ups, stress cracks, leaks, and improper sealing					
					5.01.05		ability to identify weld deficiencies such as undercut, pin holes, porosity and cold lap					
					5.01.06		ability to inspect components for alignment					

**Sub-task****5.02 Performs tests.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	no	yes	yes	yes	ND	ND	ND
					5.02.01		knowledge of methods for testing tank bottoms such as vacuum box testing					
					5.02.02		knowledge of hydrostatic testing processes and equipment					
					5.02.03		knowledge of air testing processes and equipment					
					5.02.04		knowledge of interpretation of radiography to be taken on vertical, horizontal and other welds					
					5.02.05		knowledge of other tests such as penetrating oil tests, nitrogen tests, dye penetration tests, magnetic particle tests and other non-destructive tests					

**Supporting Knowledge & Abilities**

- 5.02.06 ability to prepare components for testing
- 5.02.07 ability to conduct hydrostatic tests
- 5.02.08 ability to conduct air tests such as vacuum pressure tests, gauge tests, pressure gauge tests, nitrogen tests, dye penetration tests, magnetic particle tests and water/soap tests

**Sub-task**

**5.03 Interprets tests.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	no	yes	yes	no	yes	yes	yes	yes	ND	ND	ND

- 5.03.01 ability to identify customer and safety standards
- 5.03.02 ability to interpret test instruments
- 5.03.03 ability to interpret test results
- 5.03.04 ability to determine variance between test results and required standards

**Task 6 Demobilizes site.**

*Related Components:*

Steel plants (blast furnaces, stoves, coke ovens, tanks, stacks, vessels, ductwork), generating plants (boilers, ductwork, stacks, precipitators, scrubbers, tanks, rectifiers, burners, water heaters), refineries (towers, exchangers, stacks, crackers), pulp mills (boilers, tanks, ductwork, bag houses).

*Tools and Equipment:*

Common hand tools, cutting and grinding tools and equipment, common materials, rigging and hoisting equipment.

**Sub-task****6.01 Removes tools and equipment.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

6.01.01	knowledge of equipment maintenance and storage
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6.01.02	ability to dismantle equipment
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6.01.03	ability to remove rigging and hoisting equipment
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6.01.04	ability to inspect tools and equipment for damage
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6.01.05	ability to pack tools and equipment for shipping
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6.01.06	ability to transport tools from site
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6.01.07	ability to store tools
---------	------------------------

**Sub-task****6.02 Removes materials.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

6.02.01	knowledge of regulations for the removal and transportation of materials and dangerous goods (e.g., asbestos)
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6.02.02	knowledge of safe handling techniques
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6.02.03	ability to identify materials for reuse
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6.02.04	ability to identify scrap
---------	---------------------------

6.02.05	ability to arrange for proper disposal of waste materials
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6.02.06	ability to leave site clean and orderly
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## BLOCK B

### RIGGING AND HOISTING

*Trends:* Increased lifting capacities allow for larger and more complex lifts. Increased automation is increasing use of self-propelled lifts.

#### **Task 7 Uses work platforms.**

*Related Components:* Scaffolding, scissor lifts, zoom booms, thrust-out beams.

*Tools and Equipment:* Common tools, fastening tools.

#### **Sub-task**

#### **7.01 Assembles work platforms.**

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

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	no	yes	yes	yes	ND	ND	ND
					7.01.01							
					7.01.02							
					7.01.03							
					7.01.04							
					7.01.05							
					7.01.06							

**Sub-task**

**7.02 Uses self-propelled platforms.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

7.02.01 knowledge of self-propelled platform types and applications (e.g., swing stage, spider stage)

7.02.02 ability to use self-propelled platforms

**Sub-task**

**7.03 Hangs swing structures.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

7.03.01 knowledge of swing stage types, features, materials, terms and regulations

7.03.02 ability to determine swing stage requirements from structures

7.03.03 ability to attach wire ropes, lifting blocks and hoisting units

7.03.04 ability to attach lifelines to secure points

**Task 8 Rigs loads.**

*Related Components:*

Vessels, tanks, towers, boilers, heat exchangers and other structures.

*Tools and Equipment:*

Common hand tools, lifting tools and equipment, construction documents.

**Sub-task**

**8.01** Determines rigging requirements.

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

8.01.01 knowledge of load mass/weight, line pull, working load limit of wire rope, rigging formulas

8.01.02 knowledge of rigging limitations and engineering requirements

8.01.03 ability to determine number of parts of line required

**Sub-task**

**8.02** Selects slings.

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

8.02.01 knowledge of working load limits of various slings in various configurations

8.02.02 knowledge of function, purpose, advantages and disadvantages of various sling arrangements such as single vertical hitch, bridle hitch, single, double and double wrap basket hitches and single and double choker hitches

8.02.03 ability to inspect, select and assemble slings appropriate for job requirements

**Sub-task**

**8.03** Installs rigging apparatus.

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

8.03.01 knowledge of types of hardware, possible configurations and working load limits



### **Supporting Knowledge & Abilities**

8.03.02	knowledge of construction of ropes and rigging hardware
8.03.03	ability to inspect, select and install rigging hardware such as steel drop forged wire rope clips
8.03.04	ability to inspect, select and attach wire rope, lifting blocks and hoisting devices
8.03.05	ability to make splices
8.03.06	ability to tie knots and make hitches in ropes
8.03.07	ability to reeve tackle blocks

### **Task 9 Performs hoisting operations.**

*Related Components:* Vessels, tanks, towers, boilers, heat exchangers and other structures.

*Tools and Equipment:* Common hand tools, lifting tools and equipment, construction documents.

### **Sub-task**

#### **9.01 Assembles hoisting equipment.**

### **Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					9.01.01		knowledge of capacity and operation of cranes					
					9.01.02		ability to determine net capacity of crane and hoisting devices					
					9.01.03		ability to assemble and disassemble cranes such as hydraulics, lattice booms, tower cranes, etc.					
					9.01.04		ability to position and secure hoisting equipment for lifts					

### **Supporting Knowledge & Abilities**

9.01.05	ability to determine whether compressed air is adequate
9.01.06	ability to ensure structural integrity of tugger anchor points
9.01.07	ability to locate and position tuggers
9.01.08	ability to ensure proper attachment of tuggers
9.01.09	ability to determine location and safe, secure attachment of blocks

### **Sub-task**

#### **9.02 Determines load weights.**

### **Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					9.02.01							
					9.02.02							
					9.02.03							

### **Sub-task**

#### **9.03 Performs lifting operations.**

### **Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					9.03.01							
					9.03.02							
					9.03.03							
					9.03.04							
					9.03.05							

## BLOCK C

### NEW CONSTRUCTION

*Trends: Larger components and more modular construction are increasing attention on sequencing and larger lifting devices. Higher quality welding and new fueling processes are also affecting skills and abilities.*

**Task 10 Lays out job.**

*Related Components:* Steel plants (blast furnaces, stoves, coke ovens, tanks, stacks, breeching, vessels, ductwork), generating and penstock plants (boilers, ductwork, stacks, precipitators, scrubbers, tanks, rectifiers, burners, water heaters), refineries (towers, exchangers, stacks, crackers), pulp and paper mills (boilers, tanks, ductwork, bag houses).

*Tools and Equipment:* Measuring and layout tools, tool cribs, materials, MSDS.

**Sub-task**

**10.01 Ensures site preparation.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					10.01.01		knowledge of site construction facilities' purposes and operations					
					10.01.02		ability to identify site structures such as first aid and fire fighting stations					
					10.01.03		ability to obtain information regarding site safety requirements					
					10.01.04		ability to secure work site					
					10.01.05		ability to heed warning signs, tag procedures and lockout procedures					

**Sub-task**

**10.02 Inspects job.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 10.02.01 ability to interpret scope of work
- 10.02.02 ability to lay out job
- 10.02.03 ability to read drawings
- 10.02.04 ability to identify work site hazards
- 10.02.05 ability to interpret inspection criteria

**Sub-task**

**10.03 Organizes tools and equipment in new construction.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 10.03.01 knowledge of the work environment in new construction
- 10.03.02 knowledge of required tools for the job
- 10.03.03 ability to receive tools
- 10.03.04 ability to select and inspect tools and equipment
- 10.03.05 ability to establish tool crib at any given yard and work site
- 10.03.06 ability to transfer equipment
- 10.03.07 ability to obtain personal protective equipment

**Sub-task****10.04 Organizes and stores materials in new construction.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					10.04.01		knowledge of construction documents					
					10.04.02		knowledge of operations sequence or schedule					
					10.04.03		knowledge of materials (metals, welding and fiberglass)					
					10.04.04		knowledge of required materials for the job					
					10.04.05		ability to read and interpret construction documents					
					10.04.06		ability to match specifications and quality standards					
					10.04.07		ability to test and order materials					
					10.04.08		ability to transfer materials					
					10.04.09		ability to organize laydown area					
					10.04.10		ability to inspect vessels, components and equipment for defects or damage					
					10.04.11		ability to keep records of materials					

**Sub-task****10.05 Communicates with others.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					10.05.01		ability to confirm job assignments with foreman, peers, plant personnel and operator					
					10.05.02		ability to arrange schedules with other tradespeople					
					10.05.03		ability to participate in site meetings					

**Supporting Knowledge & Abilities**

- 10.05.04 ability to use hand radio and other communication
- 10.05.05 ability to provide written and oral reports
- 10.05.06 ability to produce daily reports
- 10.05.07 ability to identify appropriate skills, knowledge and qualifications required to do the job

**Sub-task**

**10.06 Maintains safe work area.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 10.06.01 ability to maintain safe work area
- 10.06.02 ability to perform housekeeping duties on site
- 10.06.03 ability to organize tools and equipment

**Task 11 Assembles and fits components.**

*Related Components:* Vessels, tanks, towers, hoists, boilers, furnaces and other structures, ancillary equipment and fixtures made of steel, other metals, fiberglass, and other materials.

*Tools and Equipment:* Lifting tools and equipment, common tools, measuring and layout tools.

**Sub-task**

**11.01 Transfers components.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 11.01.01 knowledge of assembly sequence of components

### Supporting Knowledge & Abilities

11.01.02	knowledge of required tools and equipment
11.01.03	ability to communicate with drivers and crane operators
11.01.04	ability to sequence components for pre-assembly
11.01.05	ability to read and interpret drawings
11.01.06	ability to select appropriate hoisting and rigging equipment
11.01.07	ability to lay out the job

### **Sub-task**

#### **11.02 Pre-assembles components.**

### Supporting Knowledge & Abilities

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					11.02.01		knowledge of rigging and hoisting					
					11.02.02		knowledge of component parts					
					11.02.03		knowledge of joining and fastening techniques (welding, bolting, expanding)					
					11.02.04		ability to read and interpret drawings					
					11.02.05		ability to fabricate components					
					11.02.06		ability to sequence component parts					
					11.02.07		ability to prepare plate steel for fabrication of steel vessels					
					11.02.08		ability to lay out circular shell for internals and appurtenances					
					11.02.09		ability to rig and hoist					
					11.02.10		ability to do final alignment					
					11.02.11		ability to fit and join pre-assembled components					

**Sub-task**

**11.03 Secures components.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					11.03.01		knowledge of securing techniques					
					11.03.02		knowledge of lashing components					
					11.03.03		knowledge of bolting components					
					11.03.04		ability to lift/hoist components					
					11.03.05		ability to determine structural capacity to handle component					
					11.03.06		ability to bolt components					
					11.03.07		ability to clamp components					
					11.03.08		ability to secure by welding components					

**Task 12 Connects components.**

*Related Components:* Vessels, tanks, towers, hoists, boilers, furnaces and other structure, ancillary equipment and fixtures made of steel, other metals, fiberglass, and other materials.

*Tools and Equipment:* Lifting tools and equipment, leveling and alignment tools, and common tools.

**Sub-task**

**12.01 Aligns components.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					12.01.01		knowledge of appropriate component placement and orientation					
					12.01.02		knowledge of alignment equipment					
					12.01.03		knowledge of alignment techniques					



**Supporting Knowledge & Abilities**

- 12.01.04 ability to read and interpret drawings
- 12.01.05 ability to use alignment tools
- 12.01.06 ability to perform alignment techniques
- 12.01.07 ability to level, orient, and set to elevation

**Sub-task**

**12.02 Fits components.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 12.02.01 knowledge of fitting tools
- 12.02.02 knowledge of fitting techniques
- 12.02.03 ability to select and use fitting tools
- 12.02.04 ability to carry out proper fitting techniques
- 12.02.05 ability to fit joints
- 12.02.06 ability to prepare surfaces

**Task 13 Fastens components.**

*Related Components:* Vessels, tanks, towers, hoists, boilers, furnaces and other structure, ancillary equipment and fixtures made of steel, other metals, fiberglass, and other materials.

*Tools and Equipment:* Common tools.

**Sub-task**

**13.01 Expands tubes.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 13.01.01 knowledge of expansion theory and techniques

**Supporting Knowledge & Abilities**

- 13.01.02 ability to select, use and maintain proper expansion tools
- 13.01.03 ability to use measuring devices
- 13.01.04 ability to perform tube expansion calculations
- 13.01.05 ability to use expanding equipment

**Sub-task**

**13.02 Bolts components.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 13.02.01 knowledge of bolt grade, type and size required
- 13.02.02 knowledge of bolt preparation
- 13.02.03 knowledge of bolting techniques and sequencing
- 13.02.04 knowledge of bolt-tensioning equipment
- 13.02.05 ability to select and use related tools
- 13.02.06 ability to perform bolting operations
- 13.02.07 ability to operate bolt-tensioning equipment

**Sub-task**

**13.03 Tacks components.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 13.03.01 knowledge of welding codes, symbols, machines, processes and procedures
- 13.03.02 knowledge of material types
- 13.03.03 knowledge of electrode types

**Supporting Knowledge & Abilities**

- 13.03.04 ability to ensure weld is performed by qualified boilermaker-welder
- 13.03.05 ability to identify parent metals
- 13.03.06 ability to read and interpret welding symbols
- 13.03.07 ability to select correct electrodes
- 13.03.08 ability to inspect welds

**BLOCK D**

**MAINTENANCE AND REPAIR**

*Trends:* Increased requirement for safety and quality procedures for maintenance and repair work in existing plants.

**Task 14 Mobilizes for work.**

*Related Components:* Steel plants (blast furnaces, stoves, coke ovens, tanks, stacks, vessels, ductwork), generating and penstock plants (boilers, ductwork, stacks, precipitators, scrubbers, tanks, rectifiers, burners, water heaters), refineries (towers, exchangers, stacks, crackers), pulp mills (boilers, tanks, ductwork, bag houses).

*Tools and Equipment:* Equipment manuals, safety regulations, plant policies and procedures.

**Sub-task**

**14.01 Interprets plant procedures. Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 14.01.01 knowledge of contractor/owner policy

**Supporting Knowledge & Abilities**

- 14.01.02 knowledge of maintenance within industrial and commercial plants
- 14.01.03 knowledge of safety legislation and regulations (regarding confined spaces, hazardous materials, etc.)
- 14.01.04 ability to apply contractor/owner policies and procedures
- 14.01.05 ability to complete contractor/owner safety orientation
- 14.01.06 ability to work with site personnel

**Sub-task**

**14.02 Obtains permits.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 14.02.01 knowledge of types of permits
- 14.02.02 ability to identify job hazards
- 14.02.03 ability to obtain and interpret permits

**Sub-task**

**14.03 Ensures site preparation and safety.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 14.03.01 knowledge of site facilities' purposes and operations
- 14.03.02 ability to identify site safety structures such as fire fighting and first aid locations
- 14.03.03 ability to obtain information regarding site safety requirements
- 14.03.04 ability to secure work site
- 14.03.05 ability to heed warning signs, tag procedures, and lockout procedures

**Sub-task****14.04 Inspects scope of work.****Supporting Knowledge & Abilities**

<b><u>NL</u></b>	<b><u>NS</u></b>	<b><u>PE</u></b>	<b><u>NB</u></b>	<b><u>QC</u></b>	<b><u>ON</u></b>	<b><u>MB</u></b>	<b><u>SK</u></b>	<b><u>AB</u></b>	<b><u>BC</u></b>	<b><u>NT</u></b>	<b><u>YK</u></b>	<b><u>NU</u></b>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 14.04.01 knowledge of related components
- 14.04.02 ability to lay out job
- 14.04.03 ability to read drawings
- 14.04.04 ability to interpret scope of work
- 14.04.05 ability to determine work hazards such as confined spaces
- 14.04.06 ability to follow safe work plans

**Sub-task****14.05 Organizes tools and equipment for maintenance and repair.****Supporting Knowledge & Abilities**

<b><u>NL</u></b>	<b><u>NS</u></b>	<b><u>PE</u></b>	<b><u>NB</u></b>	<b><u>QC</u></b>	<b><u>ON</u></b>	<b><u>MB</u></b>	<b><u>SK</u></b>	<b><u>AB</u></b>	<b><u>BC</u></b>	<b><u>NT</u></b>	<b><u>YK</u></b>	<b><u>NU</u></b>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 14.05.01 knowledge of maintenance and repair environment
- 14.05.02 knowledge of required tools and equipment for the job
- 14.05.03 knowledge of materials (metals, welding consumables, fiberglass)
- 14.05.04 ability to select and inspect tools and equipment
- 14.05.05 ability to obtain personal protective equipment
- 14.05.06 ability to read and interpret construction documents
- 14.05.07 ability to list and order materials
- 14.05.08 ability to transfer materials and equipment

**Supporting Knowledge & Abilities**

- 14.05.09 ability to organize laydown area
- 14.05.10 ability to keep records of materials

**Sub-task**

**14.06 Follows plant communications procedures.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 14.06.01 ability to arrange schedules with other tradespeople
- 14.06.02 ability to confirm job assignments with foreman, peers, plant personnel and operator
- 14.06.03 ability to use radio and hand communications
- 14.06.04 ability to provide written and oral reports
- 14.06.05 ability to produce daily reports
- 14.06.06 ability to follow plant communication signals

**Sub-task**

**14.07 Monitors continually work progress.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 14.07.01 ability to work in an operating plant
- 14.07.02 ability to maintain safe work area
- 14.07.03 ability to monitor work plan and adjust work procedures as required

**Task 15 Evaluates the situation.**

*Related Components:* Steel plants (blast furnaces, stoves, coke ovens, tanks, stacks, vessels, ductwork), generating and penstock plants (boilers, ductwork, stacks, precipitators, scrubbers, tanks, rectifiers, burners, water heaters), refineries (towers, exchangers, stacks, crackers), pulp mills (boilers, tanks, ductwork, bag houses).

*Tools and Equipment:* Measuring devices.

**Sub-task**

**15.01 Identifies problem.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 15.01.01 knowledge of vessels, tanks, towers, hoists and other structures, ancillary equipment and fixtures made of steel, other metals, fiberglass, and other materials
- 15.01.02 ability to recognize common problems such as water stains and leakage
- 15.01.03 ability to use common measuring devices to detect leakage
- 15.01.04 ability to evaluate and isolate problem
- 15.01.05 ability to determine problem source
- 15.01.06 ability to inspect vessels, components and equipment for defects or damage

**Sub-task**

**15.02 Identifies solutions.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 15.02.01 knowledge of vessels, tanks, towers, hoists and other structures, ancillary equipment and fixtures made of steel, other metals, fiberglass, and other materials
- 15.02.02 ability to assess possible solutions in terms of time and resources required

**Supporting Knowledge & Abilities**

- 15.02.03 ability to plan repair and maintenance of tanks, hoppers and similar vessels
- 15.02.04 ability to determine starting point and sequence of work
- 15.02.05 ability to assess safety and operating hazards
- 15.02.06 ability to communicate problem source to supervisor to determine action
- 15.02.07 ability to participate in discussions on possible solutions

**Task 16 Maintains, repairs and/or replaces components.**

*Related Components:* Steel plants (blast furnaces, stoves, coke ovens, tanks, stacks, vessels, ductwork), generating and penstock plants (boilers, ductwork, stacks, precipitators, scrubbers, tanks, rectifiers, burners, water heaters), refineries (towers, exchangers, stacks, crackers), pulp mills (boilers, tanks, ductwork, bag houses).

*Tools and Equipment:* Measuring devices, lifting tools and equipment and common hand tools.

**Sub-task**

**16.01 Obtains resources.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 16.01.01 ability to determine labour requirements
- 16.01.02 ability to determine material requirements
- 16.01.03 ability to determine tools and equipment requirements



**Sub-task****16.02 Maintains components.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					16.02.01		knowledge of vessels, tanks, towers, hoists and other structures, ancillary equipment and fixtures made of steel, other metals, fiberglass, and other materials					
					16.02.02		knowledge of hydroelectric dams and related facilities					
					16.02.03		ability to maintain boilers by doing overlay welding on tubes, putting shields on tubes, welding casings, repairing cracks, expanding tubes, and refurbishing boiler and ancillary components (precipitators, evaporators, etc.)					
					16.02.04		ability to maintain refineries by cleaning tubes, exchangers and burners, scraping down comers, etc.					
					16.02.05		ability to maintain blast furnaces by reinforcing shell patches, etc.					
					16.02.06		ability to assess, diagnose and evaluate problem					
					16.02.07		ability to maintain heat exchangers by plugging tubes, expanding tubes, overlays and shells, and cleaning digesters					
					16.02.08		ability to maintain bag houses by doing such tasks as changing filters					
					16.02.09		ability to maintain nuclear components (e.g., installing tube plugs)					
					16.02.10		ability to maintain and repair hydroelectric components and penstock sections					
					16.02.11		ability to maintain internals in processing vessels					
					16.02.12		ability to perform preheat and post-heat activities for welds					
					16.02.13		ability to perform lay-up, removal, repair and testing of fiberglass components					

**Supporting Knowledge & Abilities**

16.02.14      ability to clean digesters

**Sub-task**

**16.03 Repairs components.**

**Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND

- 16.03.01      knowledge of common problems in all industrial and commercial sites such as material fatigue, leaks, gasket failures
- 16.03.02      ability to repair components by performing such tasks as re-tubing boilers, replacing refinery tower trays, replacing expansion joints, etc.
- 16.03.03      ability to repair other areas by replacing filter bags and replacing heater gaskets
- 16.03.04      ability to fabricate and assemble components
- 16.03.05      ability to select proper material
- 16.03.06      ability to replace and re-torque
- 16.03.07      ability to change parts and/or reinforce them

**Task 17      Demolishes components.**

*Related Components:*      Steel plants (blast furnaces, stoves, coke ovens, tanks, stacks, vessels, ductwork), generating and penstock plants (boilers, ductwork, stacks, precipitators, scrubbers, tanks, rectifiers, burners, water heaters), refineries (towers, exchangers, stacks, crackers), pulp mills (boilers, tanks, ductwork, bag houses).

*Tools and Equipment:*      Rigging equipment, cutting and grinding tools.

**Sub-task****17.01 Dismantles components.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					17.01.01		knowledge of potential hazards					
					17.01.02		knowledge of erection of vessels, tanks, towers, hoists and other structures					
					17.01.03		ability to plan the dismantling of components					
					17.01.04		ability to systematically remove outer shells and basic structure					
					17.01.05		ability to use cutting equipment					
					17.01.06		ability to demolish hydroelectric components and penstock sections					
					17.01.07		ability to demolish component parts of boilers					
					17.01.08		ability to demolish precipitator components					
					17.01.09		ability to demolish stacks, tanks, towers, furnaces, etc.					

**Sub-task****17.02 Removes materials.****Supporting Knowledge & Abilities**

<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>
yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	ND	ND	ND
					17.02.01		knowledge of safe handling					
					17.02.02		knowledge of proper disposal of waste materials					
					17.02.03		ability to identify scrap					
					17.02.04		ability to identify materials for reuse					
					17.02.05		ability to plan material and scrap removal					



## **APPENDICES**



## TOOLS AND EQUIPMENT

The working environment of the boilermaker can be very hazardous. Safety is a shared responsibility with implications for management and labour as well as for government, which enforces safe working practices. Boilermakers generally need boots, coveralls, gloves, hard hats, eye, ear and respiratory protection and all other tools and equipment.

The basic hand tools and equipment, some of the power tools and equipment, and the safety equipment listed below are usually made available on the work site. Management normally supplies resource materials, drawings, manufacturers' manuals and log books.

### Welding Equipment

anti-spatter spray	power sources (welding machines)
chipping hammer	c/w ancillary equipment for welding
electrode holders (whips)	processes such as ESW, FCAW,
electrode ovens (stationary/portable)	GMAW, GTAW and SAW
electrode pouch	purge paper
fire-retardant blankets	remote amperage controls
ground clamps	stick electrodes
hand wire brush	stud welding equipment
inspection mirror	suitable respiratory protective gear
leather mitts and gloves	temperature ("temp") sticks
leather protective clothing	welding shield c/w hard hat
leather welding shield	welding cable
lenses (filtered and clear)	welding cable "y" connectors
penlight and batteries	welding distribution panel
pre-heating torch/equipment	

### Cutting Tools and Equipment

<i>Hand Type</i>	<i>Powered Type</i>
bolt cutters	abrasive cut-off saw
files	nibblers
hacksaw/replacement blades	power saw
handsaw	reciprocating saw
metal-cutting chisels	tube milling machine
metal-cutting snips	
pipe/tube cutters	<i>Alternative Open Flame Cutting</i>
rigging knife	<i>Equipment</i>
scissors	MAP gas
tap/die sets	oxygen lance
utility knife/replacement blades	propane

## **Cutting Tools and Equipment (continued)**

### *Oxy-Fuel Cutting Equipment*

burning goggles (round/rectangular)  
c/w coloured lenses  
flashback arrestors  
friction lighters (strikers)  
manifold systems  
manual cutting torches  
oxy-fuel cart c/w fire extinguishers  
oxy-fuel couplings and wrenches  
oxy-fuel cylinders  
oxy-fuel hoses and repair kits  
radiograph and related equipment  
regulators, adapters, washers tip  
cleaners and drills  
tips (cutting and heating)

### *Plasma-Arc Cutting Equipment*

power source c/w cables/torch  
replacement ceramic cups and tips

### *Air Carbon-Arc Cutting Equipment*

air-arc gouger  
carbon-cutting electrodes (round/flat)  
replacement insulators  
replacement electrode holder

## **Measuring Tools**

callipers/dividers  
combination square  
compass  
compound tube gauge  
drill point gauge  
folding rule  
framing squares  
measuring tapes

micrometers  
protractor  
scale rule  
sliding T-bevel  
steel tapes  
telescoping gauge  
vernier calliper

## **Marking Tools**

chalk  
dye  
felt pen  
lumber crayon

paint marker  
paint/brush  
soapstone/holder  
steel letter/number set

## **Layout Tools**

ball peen hammer  
chalk-line  
contour marker  
dividers  
engineer's level  
laser level  
piano wire  
plumb bob  
prick/centre punch

scribe  
spirit level  
squares  
straight edge  
theodolite (transit)  
trammel points  
water level  
wrap-around



## Hand Tools

### *Holding/Turning Tools*

adjustable (crescent) wrench  
adjustable pipe wrench  
box-end wrench  
chain wrench  
combination wrench  
hammer (slug) wrench  
hexkeys (Allen wrench)  
open-end wrench  
screwdrivers  
socket wrench sets  
strap wrench  
structural offset (SPUD wrench)  
torque wrench

### *Holding Tools*

bar clamp  
bench vice  
C-clamp  
end-cut pliers (nippers)  
locking (vise-grip) wrench pliers

### *Holding Tools (continued)*

long-nose pliers  
pipe vise  
pony clamp  
side-cutter pliers  
slip-joint pliers  
water-pump (utility) pliers/channel lock pliers

### *Struck or Hammered Tools*

ball peen hammer  
blacksmith's punch  
bull pin  
claw hammer  
drift pin  
metal-cutting chisel  
non-sparking hammer  
pin punch  
sledges  
soft-face hammer

## Pneumatic Tools and Equipment

air compressor  
air grinders  
air hammers  
air manifolds  
air scalers  
air supply hose  
air utility hoist  
drills

filters/oilers  
hydrostatic test pump  
impact wrenches/sockets  
milling machine  
regulator  
sand blasting equipment  
torque motor

## Electric-Powered Tools and Equipment

cut-off saw  
circular saw  
drills/presses  
electric supply panel  
extension cords  
floodlights  
grinders  
ground fault interrupter

hacksaw  
impact wrench  
jigsaw  
nibblers/shears  
reciprocating saw  
screwdriver  
string/trouble light

## **Rigging Equipment**

beam clamps	plate clamps
beam trolleys	rigging belt c/w tools
blocks (i.e., tackle, wire rope, snatch)	shackles
fibre rope	slings (i.e., wire rope, fibre material, chain, synthetic web, wire/chain mesh)
full body harnesses/lanyards	spreader and equalizer beams
hand chain hoists (chain falls)	swivel hoist rings, load binders
hooks/latches	terminal end connections for wire rope (i.e., clips, sockets)
jacks (i.e., hydraulic, screw, steamboat ratchet)	utility hoists (tuggers)
lever-operated hand chain pulley (come-along)	wire rope
links, swivels, rings, thimbles, eye bolts, etc.	wire rope puller
overhaul (headache ball)	

## **Tube Removal/Expansion Tools and Equipment**

air carbon arc gouging equipment	knockout tool
air motor c/w adapter sleeves	splitting chisels
beading tool	torque controlled rolling motor
blind nipples	tube cutters (i.e., revolution tube cutter)
collapsing tools	tube drift
expansion accessories (i.e., driving links, universals, gear drive)	tube end facer
expanders for boilers and heat exchangers c/w mandrels	tube plugs
flaring/belling tools	tube pulling spear
hydraulic stub puller	tube wall reducing tool
	water-soluble lubricant

## **Tube Preparation/Installation Tools**

cleaning solvent	peening tool
die grinder c/w variety of stones	serrating tool
files	tube cut-off saw
flappers wheels/emery cloth	tube guide
hand/power brushes (twist)	tube hold reamer
lead hammer	wallbanger

## **Environmental Tools and Equipment**

air movers	gloves/mitts (leather, rubber)
atmospheric testing equipment	hard hat
explosion-proof lights	hearing protection
face shield	heaters (barrel)
fans	leather apron cape, gauntlets
fire-retardant coveralls	mono goggles

### **Environmental Tools and Equipment (continued)**

personal atmospheric monitoring device	self-contained breathing apparatus (scuba)
personal protective equipment (PPE)	steel-toed boots
respiratory protection (i.e., dust mask, half-face/ full-face cartridge respirator)	supplied air respirators
safety glasses	tarpaulins
	warning tags, signs, barricades

### **Tools and Equipment for Fiberglass**

aluminum-serrated rollers	kilo scale
barrel heater	masking tape
brooms	mohair rollers
Cabosil for putty	paint brushes
carborundum grinding discs (16-36 grit)	plastic buckets (5 l. – 20 l.)
catalyst dispenser	putty knife
catalysts	resin spray gun/hoses
cleaning solvent (acetone)	resins
fiberglass material cutting tools	roll of cardboard
fiberglass materials (i.e., mat, roving, c-veil)	rubber gloves
grinder c/w flexible disc back	scale (30 kilo)
heat lamps	shovels
	styrene
	wooden mixing spatulas



**DEFINITIONS OF BOILEMAKER TERMS**

<b>ANSI</b>	American National Standards Institute
<b>API</b>	American Petroleum Institute
<b>appurtenances</b>	components or apparatus belonging to something larger or more important
<b>ASME</b>	American Society of Mechanical Engineers
<b>atmospheric testing equipment</b>	a calibrated direct-reading instrument for testing various potential hazardous atmospheric conditions in a confined work space
<b>bag house</b>	enclosure through which dust particles are collected as exhaust gases pass through a fabric filter
<b>blast furnace</b>	a smelting furnace into which compressed hot air is driven to complete the first stage in the production of all iron-based metals
<b>boiler</b>	a closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the application of heat from combustible fuels, electricity or nuclear energy
<b>bolt-tensioning equipment</b>	a power-assisted mechanical device used to tighten fasteners to a pre-determined torque value. May also be used in reverse to loosen fasteners
<b>boom</b>	the main member used to carry the hoisting tackle on a crane
<b>breeching (gas flue)</b>	a passage for gas flow
<b>carbon arc cutting</b>	an arc cutting process in which metals are severed by melting them with the heat of an arc between a carbon electrode and the base metal
<b>CAD</b>	Computer-Aided Drafting, Computer-Aided Design
<b>catalyst</b>	an additive that initiates a chemical reaction that causes resin to harden (i.e., MEKP)
<b>chain falls</b>	hand/pneumatic/electric-operated chain hoist
<b>CSA</b>	Canadian Standards Association
<b>coke oven</b>	tightly sealed unit to keep out air so coal cannot burn, rather it “bakes” with an intense heat up to 2100°F to produce coke

<b>come-along</b>	ratchet-type tool with chain and hook used for pulling
<b>confined space</b>	an area other than an underground working that a) is enclosed or partially enclosed, b) is not designed or intended for continuous human occupancy, c) has limited or restricted means for entry or exit that may complicate the provision of first aid, evacuation, rescue or other emergency response service, and d) is large enough and so configured that a worker could enter to perform assigned work
<b>digester</b>	vessel used in the pulping and recovery process
<b>digital</b>	providing a readout in numerical digits
<b>dog</b>	a tool used in fitting up plate
<b>down comer</b>	a tube or pipe in a boiler or vessel circulating system through which fluid flows downward
<b>ductwork</b>	a passage for air flow
<b>dye penetration test</b>	a process which involves the use of three non-corrosive liquids. First, the surface cleaning solution is used. Then the penetrant is applied and allowed to stand for 10 minutes. The penetrant is removed with the cleaner solution and the developer is applied. The dye penetrant, which has remained in the surface discontinuity, will be drawn to the surface by the developer, resulting in bright red indication.
<b>equalizing (bar) beam</b>	bar or beam used to equalize the loads in sling legs or to equalize loads on dual hoist lines during tandem lifts
<b>ESW</b>	electro-slag welding
<b>expansion joint</b>	a joint to permit movement due to expansion without undue stress
<b>FCAW</b>	flux-cored arc welding
<b>ferrous</b>	metals dominated by iron in their chemical composition (i.e., carbon and low alloy steels)
<b>fiberglass</b>	glass reinforcement material (i.e., chopped strand mat, woven roving)
<b>GMAW</b>	gas-metal arc welding
<b>GTAW</b>	gas tungsten arc welding
<b>heat exchanger</b>	a vessel in which heat is transferred from one medium to another

<b>hydrostatic test</b>	a strength and tightness test of a closed pressure vessel by water pressure
<b>internals</b>	components or apparatus inside vessel
<b>laser</b>	visible or infrared light used for levelling or alignment
<b>lashing</b>	a rope wrapping two pieces to fasten them together
<b>lattice boom</b>	a type of framework crane boom, usually raised or lowered by wire rope mechanisms
<b>lay-up</b>	fabrication or repair of fiberglass components
<b>low alloy steel</b>	a ferrous metal with improved mechanical and physical properties compared to plain carbon steel commonly used to fabricate pressure vessels
<b>magnetic particle test</b>	a non-destructive method of detecting cracks, porosity, seams, inclusions, lack of fusion and other discontinuities in ferromagnetic materials in surface discontinuities and shallow subsurface only
<b>mass</b>	metric equivalent of weight, usually expressed in kilograms or tonnes
<b>metallurgy</b>	involves the science of producing metals from ores, of making and compounding alloys, and the reaction of metals to many different activities and situations
<b>MSDS</b>	Material Safety Data Sheets
<b>MTR</b>	Mill Test Report
<b>nitrogen test (purge)</b>	involves using a gas heavier than air to displace oxygen in an enclosed space
<b>non-ferrous</b>	metals that do not contain iron in their chemical composition (e.g., aluminum, copper)
<b>orient</b>	to set or arrange to a determined position
<b>outriggers</b>	extendable beams attached to a crane base mounting that rest on supports at the outer ends and provide a means of balancing the load and relieving the crane weight from the tires
<b>oxy-fuel cutting</b>	a group of cutting processes used to sever metals by means of the chemical reaction of oxygen with the base metal at elevated temperatures. The necessary temperature is maintained by means of gas flames obtained from the combustion of a specified fuel gas and oxygen.

<b>parts of line</b>	the number of individual ropes supporting a travelling block in a tackle system
<b>penstock</b>	conveys water from the reservoir to the spiral case
<b>plasma-arc cutting</b>	an arc cutting process that severs metal by melting a localized area with a constricted arc and removing the molten material with a high velocity jet of hot, ionized gas issuing from the orifice
<b>PPE</b>	personal protective equipment
<b>precipitator</b>	an ash separator and collector of the electrostatic type
<b>promoter</b>	an additive used with rapid cure resins to reduce excessive exothermic heat build up
<b>reeve</b>	the act of passing a rope through a number of sheaves in a multi-part system in order to gain mechanical advantage
<b>resin</b>	a polyester (vinylester) solid usually dissolved in styrene, but when mixed with a catalyst, forms a rigid thermoset plastic
<b>rope</b>	refers to wire rope unless otherwise specified
<b>SAW</b>	submerged arc welding
<b>scrubber</b>	an apparatus used to remove solids from gases by entrainment in water
<b>self-propelled lift</b>	a power-propelled work platform with the primary controls on the platform (i.e., scissor lift)
<b>shackle</b>	a u- or anchor-shaped fitting with pin
<b>sheave</b>	a wheel or pulley with a circumferential groove designed for a particular size of wire rope; used to change direction of a running rope
<b>sling</b>	a wire rope or other material with eyes spliced on each end
<b>SMAW</b>	shielded metal-arc welding
<b>splice</b>	the joining of ends of ropes by weaving the strands of one rope over and under the strands of the other rope
<b>spreader beam/bar</b>	beam used for hoisting trusses or long loads; also used to equalize the weight and to keep the load, such as tank plate, from buckling
<b>stack</b>	a vertical conduit used to discharge combustion products to the atmosphere
<b>stove</b>	used to heat air to speed combustion



<b>stress relieving (by heat)</b>	a process of heating a fabricated piece of equipment to a high temperature to relieve any stress caused from welding the metal together
<b>swing stage</b>	a suspended scaffold
<b>tackle</b>	an assembly of ropes and sheaves arranged for lifting, lowering and pulling
<b>tag line</b>	a length of rope used to control a load during lifting or lowering
<b>thermal spray</b>	process of depositing molten metal, alloy and ceramic coatings on prepared surfaces in order to build up surfaces worn down by heat, oxidation and chemical environments
<b>thrust-out beam</b>	a manufactured beam used to support a swing stage; fitted with a number of counter-weights and secured by tiebacks to solid anchorages
<b>tower crane</b>	a power-operated fixed or slewing tower that provides elevation and support for its jib
<b>tray</b>	found internally inside crude towers
<b>tube expanding</b>	the pressure-tight joint formed by enlarging a tube end in a tube seat
<b>tugger</b>	a power source for hoisting or moving, usually consisting of a cable drum with gear-reduction unit for hand operation or with power drive
<b>vessel</b>	a cylindrical or spherical container with closed ends designed to contain liquids, gases, or solids
<b>water cutting</b>	a process of using a jet of water under high pressure to sever through a variety of construction materials
<b>water level</b>	an instrument used to determine the level of an object by means of the surface water in a tube
<b>vacuum box test</b>	a non-critical test designed to find leaks in welded lap joints of storage tank floor. Soapy water is applied to the joint, then the air is removed from the sealed see-through box creating a vacuum and exposing the leaks.



**BLOCKS AND TASKS WEIGHTING****BLOCK A OCCUPATION SKILLS**

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	National Average
%	17	25	40	40	10	36	20	40	20	25	ND	ND	ND	27%

Task 1 Uses tools and equipment.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	24	30	30	28	30	30	30	30	30	30	ND	ND	ND	29%

Task 2 Uses materials.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	19	25	10	20	10	16	30	20	10	15	ND	ND	ND	17%

Task 3 Interprets construction documents.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	15	5	10	23	20	13	15	20	25	30	ND	ND	ND	18%

Task 4 Performs welding activities.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	17	25	25	7	10	23	10	15	20	5	ND	ND	ND	16%

Task 5 Tests components.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	12	10	10	15	20	8	10	10	10	10	ND	ND	ND	11%

Task 6 Demobilizes site.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	13	5	15	7	10	10	5	5	5	10	ND	ND	ND	9%

**BLOCK B RIGGING AND HOISTING**

													National Average	
%	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	23%
	24	20	20	28	40	19	20	25	20	15	ND	ND	ND	

Task 7 Uses work platforms.

%	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	20%
	29	20	20	22	30	25	10	10	20	20	ND	ND	ND	

Task 8 Rigs loads.

%	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	43%
	37	50	40	40	40	40	50	45	40	45	ND	ND	ND	

Task 9 Performs hoisting operations.

%	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	37%
	34	30	40	38	30	35	40	45	40	35	ND	ND	ND	

**BLOCK C NEW CONSTRUCTION**

													National Average	
%	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	22%
	29	20	20	15	25	17	30	20	25	20	ND	ND	ND	

Task 10 Lays out job.

%	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	21%
	25	25	25	20	20	18	25	10	20	20	ND	ND	ND	

Task 11 Assembles and fits components.

%	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	30%
	30	25	30	30	40	26	30	30	20	35	ND	ND	ND	

Task 12 Connects components.

%	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	28%
	23	25	30	25	25	35	30	30	35	25	ND	ND	ND	

Task 13 Fastens components.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	22	25	15	25	15	21	15	30	25	20	ND	ND	ND	21%

**BLOCK D MAINTENANCE AND REPAIR**

													National Average	
%	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	28%
	30	35	20	17	25	28	30	15	35	40	ND	ND	ND	

Task 14 Mobilizes for work.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	25	20	20	20	30	16	15	15	15	18	ND	ND	ND	19%

Task 15 Evaluates the situation.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	20	10	20	22	30	13	20	15	20	9	ND	ND	ND	18%

Task 16 Maintains, repairs and/or replaces components.

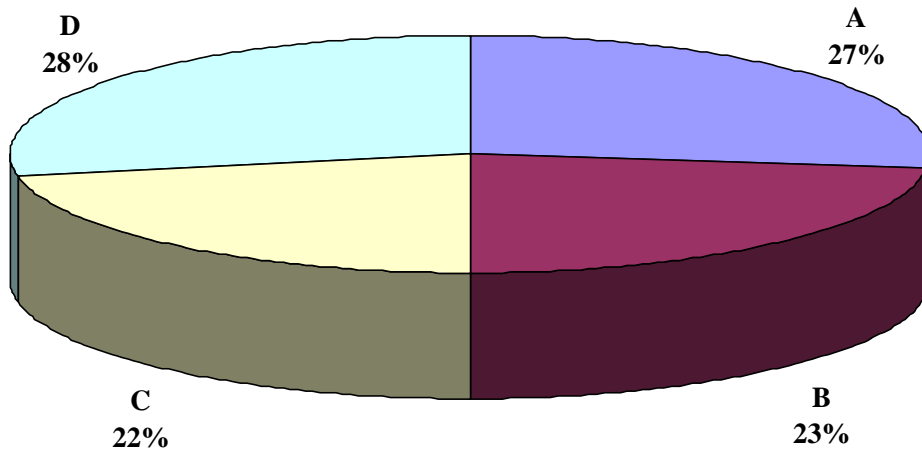
	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	39	50	40	38	25	55	40	35	50	45	ND	ND	ND	42%

Task 17 Demolishes components.

	<u>NL</u>	<u>NS</u>	<u>PE</u>	<u>NB</u>	<u>QC</u>	<u>ON</u>	<u>MB</u>	<u>SK</u>	<u>AB</u>	<u>BC</u>	<u>NT</u>	<u>YK</u>	<u>NU</u>	
%	16	20	20	20	15	16	25	35	15	28	ND	ND	ND	21%



**PIE CHART\***  
**Boilermaker**



**TITLES OF BLOCKS**

Block A	Occupation Skills	Block C	New Construction
Block B	Rigging and Hoisting	Block D	Maintenance and Repair

\* The average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from one hundred up to one hundred and fifty multiple-choice questions on each examination.





**BOILERMAKER (2003)**

BLOCKS	TASKS	SUB-TASKS					
A	<b>Occupation Skills</b>	1.01 Uses common hand tools.	1.02 Uses measuring and layout tools.	1.03 Uses cutting, grinding and shaping tools and equipment.	1.04 Uses welding tools and equipment.	1.05 Uses lifting tools and equipment.	1.06 Uses safety and environmental tools and equipment.
	2. Uses materials.	2.01 Uses metals.	2.02 Uses fiberglass and fiberglass-reinforced materials.				
	3. Interprets construction documents.	3.01 Interprets drawings and specifications.	3.02 Interprets charts and handbooks.	3.03 Interprets codes, standards and regulations.	3.04 Interprets general construction documents.		
	4. Performs welding activities.	4.01 Identifies welding process.	4.02 Prepares joint.	4.03 Fits joint.	4.04 Performs tack weld.	4.05 Welds joint.*	
	5. Tests components.	5.01 Inspects components.	5.02 Performs tests.	5.03 Interprets tests.			
	6. Demobilizes site.	6.01 Removes tools and equipment.	6.02 Removes materials.				
B	<b>Rigging and Hoisting</b>	7.01 Assembles work platforms.	7.02 Uses self-propelled platforms.	7.03 Hangs swing structures.			
	8. Rigs loads.	8.01 Determines rigging requirements.	8.02 Selects slings.	8.03 Installs rigging apparatus.			
	9. Performs hoisting operations.	9.01 Assembles hoisting equipment.	9.02 Determines load weights.	9.03 Performs lifting operations.			

**BOILERMAKER (2003)**

BLOCKS	TASKS	SUB-TASKS							
<b>C</b>	<b>New Construction</b>	<table border="1"> <tr> <td data-bbox="758 249 944 330">10.01 Ensures site preparation.</td> <td data-bbox="944 249 1131 330">10.02 Inspects job.</td> <td data-bbox="1131 249 1317 330">10.03 Organizes tools and equipment in new construction.</td> <td data-bbox="1317 249 1504 330">10.04 Organizes and stores materials in new construction.</td> <td data-bbox="1504 249 1690 330">10.05 Communicates with others.</td> <td data-bbox="1690 249 1917 330">10.06 Maintains safe work area.</td> </tr> </table>	10.01 Ensures site preparation.	10.02 Inspects job.	10.03 Organizes tools and equipment in new construction.	10.04 Organizes and stores materials in new construction.	10.05 Communicates with others.	10.06 Maintains safe work area.	
	10.01 Ensures site preparation.	10.02 Inspects job.	10.03 Organizes tools and equipment in new construction.	10.04 Organizes and stores materials in new construction.	10.05 Communicates with others.	10.06 Maintains safe work area.			
	11. Assembles and fits components.	<table border="1"> <tr> <td data-bbox="758 425 944 506">11.01 Transfers components.</td> <td data-bbox="944 425 1131 506">11.02 Pre-assembles components.</td> <td data-bbox="1131 425 1333 506">11.03 Secures components.</td> </tr> </table>	11.01 Transfers components.	11.02 Pre-assembles components.	11.03 Secures components.				
	11.01 Transfers components.	11.02 Pre-assembles components.	11.03 Secures components.						
12. Connects components.	<table border="1"> <tr> <td data-bbox="758 600 944 681">12.01 Aligns components.</td> <td data-bbox="944 600 1140 681">12.02 Fits components.</td> </tr> </table>	12.01 Aligns components.	12.02 Fits components.						
12.01 Aligns components.	12.02 Fits components.								
13. Fastens components.	<table border="1"> <tr> <td data-bbox="758 776 944 856">13.01 Expands tubes.</td> <td data-bbox="944 776 1131 856">13.02 Bolts components.</td> <td data-bbox="1131 776 1333 856">13.03 Tacks components.</td> </tr> </table>	13.01 Expands tubes.	13.02 Bolts components.	13.03 Tacks components.					
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<b>D</b>	<b>Maintenance and Repair</b>	<table border="1"> <tr> <td data-bbox="758 953 944 1034">14.01 Interprets plant procedures.</td> <td data-bbox="944 953 1131 1034">14.02 Obtains permits.</td> <td data-bbox="1131 953 1317 1034">14.03 Ensures site preparation and safety.</td> <td data-bbox="1317 953 1504 1034">14.04 Inspects scope of work.</td> <td data-bbox="1504 953 1690 1034">14.05 Organizes tools and equipment for maintenance and repair.</td> <td data-bbox="1690 953 1877 1034">14.06 Follows plant communications procedures.</td> <td data-bbox="1877 953 2110 1034">14.07 Monitors continually work progress.</td> </tr> </table>	14.01 Interprets plant procedures.	14.02 Obtains permits.	14.03 Ensures site preparation and safety.	14.04 Inspects scope of work.	14.05 Organizes tools and equipment for maintenance and repair.	14.06 Follows plant communications procedures.	14.07 Monitors continually work progress.
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	15. Evaluates the situation.	<table border="1"> <tr> <td data-bbox="758 1149 944 1229">15.01 Identifies problem.</td> <td data-bbox="944 1149 1140 1229">15.02 Identifies solutions.</td> </tr> </table>	15.01 Identifies problem.	15.02 Identifies solutions.					
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16. Maintains, repairs and/or replaces components.	<table border="1"> <tr> <td data-bbox="758 1324 944 1405">16.01 Obtains resources.</td> <td data-bbox="944 1324 1131 1405">16.02 Maintains components.</td> <td data-bbox="1131 1324 1333 1405">16.03 Repairs components.</td> </tr> </table>	16.01 Obtains resources.	16.02 Maintains components.	16.03 Repairs components.					
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17. Demolishes components.	<table border="1"> <tr> <td data-bbox="758 1499 944 1580">17.01 Dismantles components.</td> <td data-bbox="944 1499 1140 1580">17.02 Removes materials.</td> </tr> </table>	17.01 Dismantles components.	17.02 Removes materials.						
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