



# Level D Crane Operator Operator Standards

**Copyright © 2017 BC Crane Safety**  
**[www.bccranesafety.ca](http://www.bccranesafety.ca)**

This publication may not be reproduced in any form without permission by  
BC Crane Safety

Level D Crane Operator

Operator Standards

January 2017

**Developed By  
BC Crane Safety  
Province of British Columbia**

# TABLE OF CONTENTS

|  |           |
|--|-----------|
| <b>FOREWORD</b> .....                                | <b>1</b>  |
| <b>ACKNOWLEDGEMENTS</b> .....                        | <b>2</b>  |
| <b>OCCUPATION ANALYSIS CHART</b> .....               | <b>3</b>  |
| <b>SUGGESTED INSTRUCTIONAL TIME ALLOTMENTS</b> ..... | <b>6</b>  |
| <b>A. SAFETY</b> .....                               | <b>9</b>  |
| Unit Standard D-A1u K.....                           | 9         |
| Unit Standard D-A2u K.....                           | 13        |
| Unit Standard D-A3u W.....                           | 14        |
| <b>B. COMMUNICATIONS</b> .....                       | <b>16</b> |
| Unit Standard D-B1u K.....                           | 16        |
| Unit Standard D-B2u K.....                           | 17        |
| Unit Standard D-B3u W.....                           | 18        |
| Unit Standard D-B4u W.....                           | 19        |
| <b>C. CRANES</b> .....                               | <b>21</b> |
| Unit Standard D-C1u K.....                           | 21        |
| Unit Standard D-C2u K.....                           | 23        |
| <b>D. RIGGING AND LIFTING THEORY</b> .....           | <b>25</b> |
| Unit Standard D-D1u K.....                           | 25        |
| Unit Standard D-D2u K.....                           | 26        |
| Unit Standard D-D3u K.....                           | 29        |
| Unit Standard D-D4u W.....                           | 32        |
| <b>E. HOISTING FUNDAMENTALS</b> .....                | <b>34</b> |
| Unit Standard D-E1u K.....                           | 34        |
| Unit Standard D-E2u K.....                           | 36        |
| Unit Standard D-E3u W.....                           | 37        |
| <b>H. CRANE OPERATIONS</b> .....                     | <b>39</b> |
| Unit Standard D-H1u K.....                           | 39        |
| Unit Standard D-H2u K.....                           | 42        |
| Unit Standard D-H3u W.....                           | 44        |
| <b>TRAINING PROVIDER STANDARDS</b> .....             | <b>46</b> |
| <b>RECOMMENDED REFERENCE MATERIALS</b> .....         | <b>47</b> |

## FOREWORD

The employer must be prepared to show evidence that the operator has satisfactorily completed an in-house competency certification program for the specific crane(s) operated.

This document specifies the standards that must be met by an operator to be certified for a Level D (Not Full Scope Crane Operation) Certificate.

These are competency based operator standards, separated into theoretical and practical components. Industry believes a crane operator becomes competent through building on theoretical knowledge with real world experience.

The theoretical component is made up of the Knowledge Unit Standards, which:

- can be learned in a classroom setting with a qualified instructor, or
- learned through self-study, either on-line or through printed materials, and
- are assessed by means of a formal independent third party examination.

The practical component is made up of the Workplace Unit Standards, which:

- may be first learned in a simulated setting such as a training yard, and
- are fully developed through hands-on work experience, and
- is the employer's responsibility to record that the operator has been evaluated and deemed competent for any given practical competency.

Safe working practices, though not always specified, are a part of the safe working and learning conditions underlying all these standards and will be required in the presentation of evidence to meet these standards.

This document will be useful in guiding competency-based training of crane operators to be certified for a Level D (Not Full Scope Crane Operation) Certificate. The competency standards provide a structure for on the job training and industry wishes to see trainers take full advantage of opportunities for on the job training.

This document also includes a list of recommended reference textbooks that are available to support achievement of the Knowledge Units.

## ACKNOWLEDGEMENTS

The BC Association for Crane Safety (BC Crane Safety) is a non-profit society which was formed in 2005 to lead and coordinate activities and initiatives which promote safer crane operation in BC. BC Crane Safety was started and is governed by BC's crane industry through a volunteer board of industry stakeholders. A main area of concern for the organization is the development of standards for competent crane operation in BC and the promotion of industry standards to drive excellence in crane operation and operator training.

In 2005 a representative group of crane owners from the Mobile Crane, Boom Truck and Tower Crane industries in BC began work to identify standards required for all crane operators in BC. By mid-2006 the industry had endorsed a set of competency standards across all crane types, including core competencies which are common to all crane types. These standards were approved by WorkSafeBC.

The crane operator standards have been developed through extensive consultation with a broad cross section of stakeholders from BC's crane industry – crane owners, operators and other occupations which make occasional yet regular use of cranes.

This work would not have been possible without the contribution of thousands of hours of industry stakeholder time through the BC Crane Safety task groups. BC Crane Safety wishes to thank those Subject Matter Experts (SMEs) who contributed to this development effort.

BC Crane Safety also wishes to acknowledge the funding support for this work it has received from WorkSafeBC.

### **SAFETY ADVISORY**

Be advised that references to the WorkSafeBC safety regulations contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation (the current Standards and Regulation in BC can be obtained on the following website: <http://www.worksafebc.com>. Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.

# OCCUPATION ANALYSIS CHART

## Level D Standards Profile Chart

|  |   |   |  |  |
|--|---|---|--|--|
| <b>A.<br/>Safety</b>                     | <b>D-A1u K</b><br>Demonstrate knowledge of safe working practices for crane operators                                 | <b>D-A2u K</b><br>Demonstrate knowledge of power line hazards and high voltage equipment                                  | <b>D-A3u W</b><br>Comply with WorkSafeBC Occupational Health and Safety Regulation (OHSR)                    |  |
| <b>B.<br/>Communications</b>             | <b>D-B1u K</b><br>Demonstrate knowledge of hand signals   | <b>D-B2u K</b><br>Demonstrate knowledge of radio communications   | <b>D-B3u W</b><br>Use hand signals in the workplace  | <b>D-B4u W</b><br>Use radio communications in the workplace  |
| <b>C.<br/>Cranes</b>                     | <b>D-C1u K</b><br>Demonstrate knowledge of terminology related to crane operations                                    | <b>D-C2u K</b><br>Demonstrate knowledge of regulatory requirements pertaining to cranes                                   |  |  |
| <b>D.<br/>Rigging and Lifting Theory</b> | <b>D-D1u K</b><br>Demonstrate knowledge of lifting theory and forces  | <b>D-D2u K</b><br>Demonstrate knowledge of slings (all types), rigging hardware, materials, inspection and capacity cards | <b>D-D3u K</b><br>Demonstrate knowledge of wire rope hoist line construction and inspection                  | <b>D-D4u W</b><br>Use slings (all types) rigging hardware, materials and capacity cards in the workplace |
| <b>E.<br/>Hoisting Fundamentals</b>      | <b>D-E1u K</b><br>Demonstrate knowledge of determining load weights using fundamental math functions and calculations | <b>D-E2u K</b><br>Demonstrate knowledge of load charts and load calculations  | <b>D-E3u W</b><br>Interpret load charts and load study drawings to configure a crane for workplace operation |  |
| <b>H.<br/>Crane Operations</b>           | <b>D-H1u K</b><br>Demonstrate knowledge of pre-operational requirements in crane operations                           | <b>D-H2u K</b><br>Demonstrate knowledge of safely locating and positioning a crane  | <b>D-H3u W</b><br>Conduct an accurate site assessment and safely position a crane in the workplace           |  |



# **LEVEL D CRANE OPERATOR OPERATOR STANDARDS**

## SUGGESTED INSTRUCTIONAL TIME ALLOTMENTS

---

| <b>Unit</b> | <b>Section A – Safety – Knowledge</b> | <b>15% of Time</b> |
|-------------|---------------------------------------|--------------------|
|-------------|---------------------------------------|--------------------|

|         |   |  |
|---------|---|--|
| D-A1u K | Demonstrate knowledge of safe working practices for crane operators |  |
|---------|---|--|

|         |  |  |
|---------|--|--|
| D-A2u K | Demonstrate knowledge of power line hazards and high voltage equipment |  |
|---------|--|--|

| <b>Unit</b> | <b>Section A – Safety – Practical</b> |  |
|-------------|---------------------------------------|--|
|-------------|---------------------------------------|--|

|          |   |  |
|----------|---|--|
| D-A 3u W | Comply with WorkSafeBC Occupational Health and Safety Regulation (OHSR) |  |
|----------|---|--|

---

| <b>Unit</b> | <b>Section B - Communications – Knowledge</b> | <b>10% of Time</b> |
|-------------|---|--------------------|
|-------------|---|--------------------|

|          |                                       |  |
|----------|---------------------------------------|--|
| D-B 1u K | Demonstrate knowledge of hand signals |  |
|----------|---------------------------------------|--|

|         |   |  |
|---------|---|--|
| D-B2u K | Demonstrate knowledge of radio communications |  |
|---------|---|--|

| <b>Unit</b> | <b>Section B - Communications – Practical</b> |  |
|-------------|---|--|
|-------------|---|--|

|         |                                   |  |
|---------|-----------------------------------|--|
| D-B3u W | Use hand signals in the workplace |  |
|---------|-----------------------------------|--|

|          |   |  |
|----------|---|--|
| D-B 4u W | Use radio communications in the workplace |  |
|----------|---|--|

---

| <b>Unit</b> | <b>Section C – Cranes – Knowledge</b> | <b>20% of Time</b> |
|-------------|---------------------------------------|--------------------|
|-------------|---------------------------------------|--------------------|

|          |  |  |
|----------|--|--|
| D-C 1u K | Demonstrate knowledge of terminology related to crane operations |  |
|----------|--|--|

|          |   |  |
|----------|---|--|
| D-C 2u K | Demonstrate knowledge of regulatory requirements pertaining to cranes |  |
|----------|---|--|

---

| <b>Unit</b> | <b>Section D – Rigging and Lifting Theory – Knowledge</b> | <b>15% of Time</b> |
|-------------|---|--------------------|
|-------------|---|--------------------|

|          |  |  |
|----------|--|--|
| D-D 1u K | Demonstrate knowledge of lifting theory and forces |  |
|----------|--|--|

|         |   |  |
|---------|---|--|
| D-D2u K | Demonstrate knowledge of slings (all types), rigging hardware, materials, inspection and capacity cards |  |
|---------|---|--|

|         |   |  |
|---------|---|--|
| D-D3u K | Demonstrate knowledge of wire rope hoist line construction and inspection |  |
|---------|---|--|

| <b>Unit</b> | <b>Section D - Rigging and Lifting Theory – Practical</b> |  |
|-------------|---|--|
|-------------|---|--|

|          |  |  |
|----------|--|--|
| D-D 4u W | Use slings (all types) rigging hardware, materials and capacity cards in the workplace |  |
|----------|--|--|

---

**Unit                      Section E – Hoisting Fundamentals – Knowledge                      20% of Time**

D-E 1u K                      Demonstrate knowledge of determining load weights using fundamental math functions and calculations

D-E2u K                      Demonstrate knowledge of load charts and load calculations

**Unit                      Section E – Hoisting Fundamentals – Practical**

D-E3u W                      Interpret load charts and load study drawings to configure a crane for workplace operation

**Unit                      Section H – Crane Operations – Knowledge                      8% of Time**

D-H1u K                      Demonstrate knowledge of pre-operational requirements in crane operations

D-H2u K                      Demonstrate knowledge of safely locating and positioning a crane

**Unit                      Section H – Crane Operations – Practical**

D-H3u W                      Conduct an accurate site assessment and safely position a crane in the workplace

**TOTAL ALL UNITS    100%**

# **OPERATOR STANDARDS**

## **SECTION A**

### **SAFETY**

## **A. Safety**

### **Unit Standard D-A1u K**

#### **Demonstrate knowledge of safe working practices for crane operators**

##### **Purpose**

This unit of competency covers knowledge of potential hazards in the workplace.

##### **Task 1**

Describe workplace hazards in terms of the WorkSafeBC Occupational Health and Safety Regulation (OHSR) and how to eliminate, isolate, or minimize hazards.

##### **Performance standards**

1.1 Identify and describe energy source hazards.

Must include

- hydraulic
- electrical
- pneumatic
- potential energy

1.2 Identify and describe overhead hazards.

Must include

- power lines
- cranes/other equipment
- obstructions

1.3 Identify and describe mobile machinery hazards.

Must include

- trucks
- cranes
- forklift trucks
- mobile equipment

1.4 Identify and describe rotating equipment hazards.

Must include

- belts
- pulleys
- sheaves
- sprockets
- chains
- couplings
- pinch points
- barriers

## **Task 2**

Demonstrate knowledge of worksite hazard risk assessment and risk management procedures.

### **Performance standards**

2.1 Describe risk assessment procedures and risk management procedures.

Must include

- responsibility to maintain a safe work environment
- changing weather
- frozen surfaces
- traffic
- location
- operating blind
- slips
- trips and falls
- injury to others
- injury from moving machinery

2.2 Explain methods of communicating risks and risk situations to others.

Must include

- signage
- tagging
- verbal communications
- written communications
- safe work cards
- risk hazard assessment procedures

2.3 Explain how to notify local utilities when operating near utility lines or potential hazards.

Must include

- assurance in writing
- safety watcher

## **Task 3**

Demonstrate knowledge of accident and incident reporting procedures.

## **Performance standard**

3.1 Identify and explain requirements for recording an accident and/or incident.

Must include

- report form completion
- report form processing

## **Task 4**

Describe personal protection equipment.

## **Performance standards**

4.1 Identify and describe breathing protection equipment.

Must include

- respirators and filters

4.2 Identify and describe personal protective equipment (PPE) and clothing.

Must include

- hard hat
- safety boots
- protective eyewear
- hearing protection
- high visibility apparel
- hand protection

## **Task 5**

Demonstrate knowledge of response to fire emergencies.

## **Performance standards**

5.1 Identify fire extinguisher types and describe their servicing and use.

Must include

- extinguisher types and capacities
- use of extinguishers

5.2 Explain procedures for fighting electrical fires.

Must include

- isolate power
- appropriate firefighting equipment

5.3 Explain fire emergency response and evacuation procedures in accordance with industry practice.

**Task 6**

Describe procedure for emergency rescue from a crane.

**Performance standard**

6.1 Describe emergency rescue procedures.

Must include

- crane fire
- crane tip-over (access to cab is blocked)
- submerged crane

**Task 7**

Describe the 3 point contact method when mounting and dismounting equipment.

**Performance standard**

7.1 Describe the 3 point contact method when mounting and dismounting equipment.

Must include

- cranes
- other heavy equipment
- manufacturer specific access systems
- handholds and step ladders

**Task 8**

Describe the requirements for leaving a crane unattended.

**Performance standard**

8.1 Describe requirements for leaving a crane unattended.

Must include

- knowledge of applicable WorkSafeBC regulations



## **A. Safety**

### **Unit Standard D-A2u K**

#### **Demonstrate knowledge of power line hazards and high voltage equipment**

##### **Purpose**

This unit standard covers knowledge about crane operation around high voltage equipment.

##### **Task 1**

Describe procedures for operating in proximity of overhead conductors.

##### **Performance standards**

1.1 Explain operating procedures in the vicinity of overhead conductors.

Must include

- interpret signage related to high voltage
- state safe limits of approach to overhead conductors
- assurance in writing from the local power authority
- how to determine voltage
- risk factors when working near powerlines (wind, load size/profile)
- use of tag lines

1.2 Explain protocol if contact is made with high voltage equipment.

## **A. Safety**

### **Unit Standard D-A3u W**

#### **Comply with WorkSafeBC Occupational Health and Safety Regulation (OHSR)**

##### **Purpose**

Interpret and comply with WorkSafeBC Occupational Health and Safety Regulation (OHSR), standards and guidelines.

##### **Task 1**

Comply with WorkSafeBC Occupational Health and Safety Regulation (OHSR) and procedures applicable to workers in the workplace by demonstrating knowledge gained in training.

##### **Performance standards**

- 1.1 Complete reporting procedures accurately.
- 1.2 Perform thorough workplace inspections.
- 1.3 Comply with and adhere to WorkSafeBC Occupational Health and Safety Regulation (OHSR), standards and guidelines in the workplace.

For example

- safe operating practices
- load safely landed and supported
- remain at controls with suspended load

**OPERATOR STANDARDS**

**SECTION B**

**COMMUNICATIONS**

## **B. Communications**

### **Unit Standard D-B1u K**

#### **Demonstrate knowledge of hand signals**

##### **Purpose**

Demonstrate knowledge of hand signals used in crane operations.

##### **Task 1**

Describe the hand signals used during crane operations.

##### **Performance standards**

- 1.1 Describe hand signals accurately.
- 1.2 Identify and interpret hand signals accurately.
- 1.3 Explain requirements of the signal person.
- 1.4 Describe relaying signals for a blind lift

## **B. Communications**

### **Unit Standard D-B2u K**

#### **Demonstrate knowledge of radio communications**

##### **Purpose**

Demonstrate knowledge of the use of radio communications in the workplace.

##### **Task 1**

Describe the use of two-way electronic voice communication devices.

##### **Performance standards**

1.1 Describe the basic functions of the radio communication devices.

1.2 Explain language and terminology used during radio communication.

Must include

- short form words and phrases
- use of 12 o'clock (clock face positioning reference) to aid in direction giving and interpreting

1.3 Demonstrate and test two-way communication devices in a classroom environment.

Must include

- requirement to stop operation due to lost contact or interference

## **B. Communications**

### **Unit Standard D-B3u W**

#### **Use hand signals in the workplace**

##### **Purpose**

Demonstrate ability to use hand signals correctly in crane operations.

##### **Task 1**

Use hand signals and respond to hand signals during crane operations.

##### **Performance standards**

- 1.1 Use hand signals accurately.
- 1.2 Identify and interpret hand signals of others accurately.
- 1.3 Use hand signals to aid in the safe and correct completion of a crane operation.

## **B. Communications**

### **Unit Standard D-B4u W**

#### **Use radio communications in the workplace**

##### **Purpose**

Demonstrate ability to use radio communications in the workplace.

##### **Task 1**

Use a two-way electronic voice communication device in the workplace.

##### **Performance standards**

- 1.1 Use basic functions of the radio communication devices according to equipment instructions.
- 1.2 Use appropriate language and terminology during radio communication.
- 1.3 Use two-way communication devices to relay clear, concise, relevant information.

**OPERATOR STANDARDS**

**SECTION C**

**CRANES**



## **C. Cranes**

### **Unit Standard D-C1u K**

#### **Demonstrate knowledge of terminology related to crane operations**

##### **Purpose**

Demonstrate knowledge of terminology, functions and systems related to crane operations.

##### **Task 1**

Describe terms related to cranes commonly used in the work environment.

##### **Performance standards**

1.1 Explain terms related to crane operations:

Must include

- wire rope
- fittings
- drums
- hooks
- sheaves
- winch
- slew / swing
- hoist
- boom
- swing brake
- swing dog
- overload protection systems
- load monitoring and indicating systems
- anti-two block system
- outriggers/stabilizers
- counterweight
- jib
- load block
- parts of line
- wedge socket assemblies
- crawler tracks (mini crawler cranes)
- boom hoist cylinders

##### **Task 2**

Demonstrate knowledge of travel braking systems in crane operations.

##### **Performance standards**

2.1 Identify components of the braking systems and describe their functions.

Must include

- air compressor
- brake chambers
- drums
- brake shoes and pads
- slack adjusters

2.2 Describe defects or malfunctions of braking systems.

Must include

- air compressors
- brake chambers
- drums
- brake shoes and pads
- slack adjusters

### **Task 3**

Demonstrate knowledge of hoisting functions and systems for crane operation.

#### **Performance standards**

3.1 Identify components of hoisting systems and describe their functions.

Must include

- hydraulic boom (extension/retraction, boom hoist cylinders)
- drums
- hooks
- sheaves
- winch
- brakes
- load line

3.2 Describe defects or malfunctions of hoisting systems.

Must include

- hydraulic boom (wear pads, cylinders, chain extended booms)
- drums
- hooks
- sheaves
- winch
- brakes
- load line

## **C. Cranes**

### **Unit Standard D-C2u K**

#### **Demonstrate knowledge of regulatory requirements pertaining to cranes**

##### **Purpose**

Demonstrate knowledge of the regulations to legally and safely operate cranes.

##### **Task 1**

Demonstrate knowledge of how the regulations apply to the operation of cranes in a workplace.

##### **Performance standard**

1.1 Explain the impact of current regulations on workplace practices and crane operations.

Must include

- WorkSafeBC Occupational Health and Safety Regulation (OHSR)
- CAN/CSA-Z150-98 (R2004) Safety Code for Mobile Cranes
- ANSI Standard ANSI/ASME B30.5-2004, Mobile and Locomotive Crane or ANSI/ASME B30.22-2005, Articulating Boom Crane

**OPERATOR STANDARDS**

**SECTION D**

**RIGGING AND LIFTING THEORY**

## **D. Rigging and Lifting Theory**

### **Unit Standard D-D1u K**

#### **Demonstrate knowledge of lifting theory and forces**

##### **Purpose**

Demonstrate knowledge of the fundamentals of leverage.

##### **Task 1**

Demonstrate knowledge of the principles of leverage.

##### **Performance standard**

1.1 Explain the principles of leverage.

Must include

- class 1 lever
- class 2 lever
- class 3 lever
- centre of gravity

## **D. Rigging and Lifting Theory**

### **Unit Standard D-D2u K**

#### **Demonstrate knowledge of slings (all types), rigging hardware, materials, inspection and capacity cards**

##### **Purpose**

Demonstrate knowledge of slings, rigging hardware, materials and manuals to safely lift a load.

##### **Task 1**

Demonstrate knowledge of slings and rigging hardware used in crane operations.

##### **Performance standards**

1.1 Identify slings and rigging hardware and describe their uses.

Must include types of slings

- wire rope (construction used in manufacturing)
- chain (grade of steel)
- synthetic web slings (types and material used in manufacturing)
- synthetic round slings (types and material used in manufacturing)

Must include types of hardware

- hooks
- shackles
- eyebolts
- wedge sockets

Must include types of hitch configurations

- vertical
- choker
- basket
- bridles

Must include below the hook lifting devices

- spreader bars
- equalizer beams
- pallet forks
- drywall lifters

1.2 Describe and accurately interpret specific information on slings and rigging hardware from manufacturer's and rigging manuals according to industry standards.

##### **Task 2**

Demonstrate knowledge to assemble appropriate rigging for a given load according to manufacturer's ratings and to ensure the load can be lifted safely.

## **Performance standards**

2.1 Select appropriate slings and rigging hardware for a given lift.

Must include

- determining load weight
- calculating Working Load Limit (WLL) of slings and rigging hardware required
- sling and rigging hardware angle loading is calculated

2.2 Select the correct hitch and sling arrangement.

Must include

- use of correct hitch configuration
- reduction of sling WLL when used at an angle

## **Task 3**

Demonstrate knowledge to inspect slings and rigging hardware.

## **Performance standards**

3.1 Explain the procedure for inspecting slings and rigging hardware as per manufacturer's manuals and WorkSafeBC regulations.

3.2 Describe requirements for examining slings and rigging hardware.

Must include

- excessive wear
- damage
- cracks
- missing safety clips
- broken wires
- labelling

## **Task 4**

Demonstrate knowledge to remove slings and rigging hardware from use.

## **Performance standards**

4.1 Explain criteria for removing slings and rigging hardware from service according to appropriate WorkSafeBC regulations and as per manufacturer's specifications.

4.2 Explain the process for removing slings and rigging hardware.

Must include

- remove from service if repair is not allowed
- destroy rejected rigging

4.3 Report defects to appropriate personnel.

**Task 5**

Demonstrate knowledge to store slings and rigging hardware after use.

**Performance standard**

5.1 Explain criteria for storing slings and rigging hardware as per good practice.



## **D. Rigging and Lifting Theory**

### **Unit Standard D-D3u K**

#### **Demonstrate knowledge of wire rope hoist line construction and inspection**

##### **Purpose**

Demonstrate knowledge of wire rope used in crane operations.

##### **Task 1**

Describe types of wire rope used in crane operation.

##### **Performance standard**

- 1.1 Identify types of wire rope used for hoisting and describe their characteristics, classifications and uses.

###### Must include

- conventional construction wire rope
- anti-rotational wire rope
- Seale construction
- filler construction
- Working Load Limit (WLL) of wire rope used in hoisting operations
- breaking strength vs. working load limit

##### **Task 2**

Demonstrate knowledge of the process for inspection and replacement of wire ropes in accordance with manufacturer's recommendations.

##### **Performance standards**

- 2.1 Explain the inspection and examination procedure for wire rope defects.

###### Must include

- lubrication
- excessive wear
- bird caging
- kinking
- flattening
- proper spooling
- broken wires
- distortion

- 2.2 Explain the rejection criteria for damaged or defective rope according to WorkSafeBC regulations and manufacturer's specifications.

- 2.3 Explain the process to examine the drum to ensure proper installation.

2.4 Explain the process to record and report the inspection defects and deficiencies.

Must include

- record inspection in logbook
- record defects in logbook
- report defects to supervisory personnel

### **Task 3**

Demonstrate knowledge of installing wire rope on a winch according to manufacturer's instructions.

#### **Performance standards**

3.1 Explain wire rope installation process according to manufacturer's requirements.

Must include

- procedure for installing new wire rope on a winch
- winding direction
- proper spooling on drum

3.2 Identify and describe wire rope system components.

Must include

- rope guides
- drums
- blocks
- hooks
- sheaves
- wedge and socket termination
- installing wedge sockets
- reeving multi-part line blocks

### **Task 4**

Demonstrate knowledge of how to store wire rope.

#### **Performance standard**

4.1 Explain the criteria for storing wire rope according to manufacturer's requirements.

### **Task 5**

Demonstrate knowledge of how to maintain wire rope.

#### **Performance standards**

5.1 Explain criteria for lubricating wire rope.

Must include

- inspection of rope
- identifying rope needing lubrication

5.2 Explain procedures to perform maintenance on wire ropes as manufacturer dictates.

Must include

- cutting and seizing wire ropes
- cleaning
- lubrication

5.3 Record wire rope maintenance in the logbook within the regulated timeframe.

## **D. Rigging and Lifting Theory**

### **Unit Standard D-D4u W**

#### **Use slings (all types), rigging hardware, materials and capacity cards in the workplace**

##### **Purpose**

This unit standard allows the trainee to demonstrate the knowledge gained by performing rigging activities in the workplace.

##### **Task 1**

Assemble appropriate rigging for a given load to comply with Occupational Health and Safety Regulation (OHSR).

##### **Performance standard**

1.1 Select and use appropriate slings and rigging hardware for various lifts.

##### **Must include**

- measure load
- calculate weight of load
- calculate sling requirements
- calculate hardware requirements
- reduction of WLL due to sling angle and type of hitch
- wear protective equipment
- attach slings to load to prevent slipping

##### **Task 2**

Inspect, maintain and store slings and rigging hardware in workplace operations.

##### **Performance standard**

2.1 Inspect, maintain and store slings and rigging hardware according to manufacturer and company specifications.

**OPERATOR STANDARDS**

**SECTION E**

**HOISTING FUNDAMENTALS**

## **E. Hoisting Fundamentals**

### **Unit Standard D-E1u K**

#### **Demonstrate knowledge of determining load weights using fundamental math functions and calculations**

##### **Purpose**

This unit provides the basis for determining load weights for given lifts by using fundamental math functions and calculations.

##### **Note**

A scientific calculator is required for this unit.

##### **Task 1**

Demonstrate the functions of a scientific calculator to perform mathematical calculations.

##### **Performance standards**

1.1 Perform fundamental mathematical functions.

Must include

- rounding off
- fractions
- metric and imperial units of measure
- circumference of a circle
- perimeter of an object
- surface area of an object
- Pythagorean theorem

##### **Task 2**

Demonstrate knowledge of accurately calculating load weights.

##### **Performance standard**

2.1 Determine accurate load weights.

Must include

- volume of an object
- weight of a cubic unit of an object
- weight of materials
- total weight of load

##### **Task 3**

Demonstrate ability to interpret engineering and worksite documentation.

##### **Performance standards**

3.1 Interpret lift plans accurately.

Must include

- capacity
- boom configuration
- load weight
- rigging weight
- calculations
- radius of crane
- positioning of crane
- positioning of the load

3.2 Compare shipping company's bill of lading to a calculated weight based on volume, load indicating and monitoring system and type of load to determine accuracy.

3.3 Interpret load capacity charts accurately.

Must include

- gross capacity
- net capacity
- structural capacities
- stability capacities
- operating notes
- capacities between listed chart values
- quadrants of operation
- outrigger position
- deductions from gross capacity
- operating radius
- boom length
- boom angle
- main boom capacities
- jib capacities
- range diagrams
- permissible line pull
- load chart symbols

## **E. Hoisting Fundamentals**

### **Unit Standard D-E2u K**

#### **Demonstrate knowledge of load charts and load calculations**

##### **Purpose**

This unit provides the knowledge required to operate a crane to lift and place loads in a safe and efficient manner.

##### **Task 1**

Demonstrate knowledge of load charts.

##### **Performance standards**

- 1.1 Interpret load charts accurately.
- 1.2 Verify load dimensions with crane supervisor (and engineer as required).
- 1.3 Identify and describe special lift instructions.

##### **Task 2**

Demonstrate knowledge of lift plans.

##### **Performance standard**

- 2.1 Interpret lift plans

##### **Must include**

- capacity
- boom configuration
- load weight
- rigging weight
- calculations
- radius of crane
- positioning of crane
- positioning of the load



## **E. Hoisting Fundamentals**

### **Unit Standard D-E3u W**

#### **Interpret load charts and load study drawings to configure a crane for workplace operation**

##### **Purpose**

This unit allows for the demonstration of correct crane configuration based on load charts and load study drawings.

##### **Task 1**

Configure crane appropriately after accurately interpreting load charts and lift plan drawings.

##### **Performance standards**

- 1.1 Interpret load charts accurately.
- 1.2 Verify load dimensions with crane supervisor (and engineer as required).
- 1.3 Determine centre of gravity of load.
- 1.4 Follow special lift instructions.

##### **Task 2**

Interpret lift plans accurately.

##### **Performance standard**

- 2.1 Interpret lift plans.

##### **Must include**

- capacity
- boom configuration
- load weight
- rigging weight
- calculations
- radius of crane
- positioning of crane
- positioning of the load

**OPERATOR STANDARDS**

**SECTION H**

**CRANE OPERATIONS**

## **H. Crane Operations**

### **Unit Standard D-H1u K**

#### **Demonstrate knowledge of pre-operational requirements in crane operations**

##### **Purpose**

This unit provides the knowledge required to do a pre-operational inspection in accordance with manufacturer's recommendations.

##### **Task 1**

Demonstrate knowledge of the pre-operational inspection procedures recommended for a crane.

##### **Performance standards**

1.1 Inspection procedures are described accurately.

Must include

- operator aids for crane in place
- inspection as per CSA Z150 for start of shift inspection
- WorkSafeBC OHSR requirements followed
- manufacturer's specifications are followed
- control and safety devices

1.2 The place, location and verification of operator aids for the crane are described.

Must include

- load monitoring and indicating system
- boom length indicator (if applicable)
- boom angle indicator (if applicable)

1.3 The completion and filing of inspection and erection reports is described.

Must include

- crane logbook

##### **Task 2**

Demonstrate knowledge of tests, repairs and maintenance required during the pre-operation inspection stage.

##### **Performance standards**

2.1 Function tests on hoist systems are described.

Must include

- boom up
- boom down (if applicable)
- hoist up
- hoist down
- swing left
- swing right
- retract boom (if applicable)
- extend boom (if applicable)
- brakes

- 2.2 Service and maintenance prior to operation are described according to manufacturer's requirements and they are entered in the crane logbook.

**Task 3**

Demonstrate knowledge of reports and records required for reporting deficiencies or defects.

**Performance standards**

- 3.1 The process of accurately reporting defects and deficiencies to the supervisor and properly documenting in the crane logbook is described.

Must include

- date
- description of issue
- signature of person identifying the issue
- legal requirements entries must meet WorkSafeBC regulations and any other applicable regulatory agencies codes, laws and guidelines

- 3.2 The process to ensure repairs and maintenance are recorded in the appropriate crane logbook is described.

Must include

- date
- description
- signature of person performing maintenance or repairs

**Task 4**

Demonstrate knowledge of the setup procedures for cranes.

**Performance standards**

- 4.1 Setup procedures are accurately explained according to manufacturer's specifications.
- 4.2 Overhead obstructions and underground hazards are described.

Must include

- electrical power lines
- trees
- underground services
- underground building structures
- soil/support bearing capacity
- site assessment

4.3 The requirements for blocking and mats to be sufficient considering the load requirements and surface conditions to level the crane is described.

4.4 Programming and adjusting safety devices to ensure accuracy and safety while lifting.

Must include

- load monitoring and indicating systems
- anti two block systems
- boom angle indicators

## **H. Crane Operations**

### **Unit Standard D-H2u K**

#### **Demonstrate knowledge of safely locating and positioning a crane**

##### **Purpose**

This unit provides the knowledge required to safely locate and position a crane.

##### **Task 1**

Demonstrate knowledge to establish the location of a crane on a work site.

##### **Performance standards**

1.1 Explain site conditions and hazard assessment.

###### Must include

- accessibility of site
- grade of site
- soil conditions and compaction
- distance to embankments or excavations
- initial location of load
- final placement of load
- proximity of other equipment or structures
- overhead obstructions
- distance to electrical power lines
- tail swing distance
- determine actual and potential underground hazards
- weather conditions
- walk travel path to evaluate hazards

1.2 Explain load placement considerations and potential hazards.

###### Must include

- initial location of load
- load path
- final placement of load
- proximity of other equipment or structures
- overhead obstructions
- distance to electrical power lines
- known underground hazards
- weather conditions

##### **Task 2**

Demonstrate knowledge of blocking to be used according to soil conditions.

## **Performance standards**

2.1 Explain blocking requirements according to soil types.

2.2 Explain criteria for proper blocking methods.

### **Task 3**

Demonstrate knowledge of communication required during crane and load positioning.

#### **Performance standard**

3.1 Describe requirements for communications during crane and load positioning.

Must include

- signal persons (line of sight)
- radio communications (blind, multi-crane or poor visibility)
- traffic control

### **Task 4**

Demonstrate knowledge of barriers and signage required in a worksite.

#### **Performance standard**

4.1 Describe requirements for barriers and signage.

Must include

- clearance between the counterweight of crane and any fixed object
- traffic control
- pedestrian
- audible warning when lifting overhead

### **Task 5**

Demonstrate knowledge of grounding and bonding of a crane at a worksite.

#### **Performance standard**

5.1 Explain procedures and requirements for grounding and bonding of a crane at a worksite according to local power authority requirements.

## **H. Crane Operations**

### **Unit Standard D-H3u W**

#### **Conduct an accurate site assessment and safely position a crane in the workplace**

##### **Purpose**

This unit provides demonstration of conducting a site assessment and locating and safely positioning a crane.

##### **Task 1**

Inspect a site and develop an accurate lift plan using site plan and an engineered drawing.

##### **Performance standards**

1.1 Develop an accurate lift plan.

###### Must include

- assessment of area and soil condition
- assessment of hazards
- assessment of obstacles
- overhead hazards
- underground utilities
- walk travel path
- traffic control established
- load weight
- rigging required, rigging weight, rigging certified
- lift supervisor or signal person competent
- determine the load is within the crane's capacity throughout the lift

1.2 Locate and position a crane safely and correctly.

###### Must include

- blocking and blocking mats
- signalling and barrier signage
- grounding



# **TRAINING PROVIDER STANDARDS**

## **TRAINING PROVIDER STANDARDS**

### **Instructor Qualification:**

For technical training, instructors must be occupationally competent to run the crane type they are training to and, as a minimum, hold a BC Certificate of Qualification for that crane type.

### **Minimum List of Shop/Laboratory Equipment Required**

Industry has not set minimum equipment requirements for providing training for this trade. Industry standards are focused on the outcomes of training rather than the inputs. It is left to the crane training community to deliver training that will meet these standards in a time efficient and cost effective manner. Training providers are permitted maximum flexibility in the options and strategies they may employ in training operators to meet these standards.

## RECOMMENDED REFERENCE MATERIALS

From the Construction Safety Association of Ontario <http://www.csao.org/>

### *Mobile Crane Manual*

by Donald E. Dickie, P. Eng., D. H. Campbell, P. Eng.

Construction Safety Association of Ontario ..... SBN 0-8273-6527-6

### *Rigging Manual*

by Donald E. Dickie, P. Eng.

Construction Safety Association of Ontario ..... SBN 0-7726-1574-8

### *Hoisting and Rigging Safety Manual*

Construction Safety Association of Ontario ..... SBN 0-919465-70-6

### *Slings*

Construction Safety Association of Ontario ..... SBN 0-919465-76-5

### **Safety in Rigging Video/DVD Series**

The complete set of 10 *Safety in Rigging* DVDs (FD001-FD010), complete with instructor's notes. Includes:

1. Cranes: Types, Components and Case Histories (FD001)
2. Hazard Awareness in Crane Operating Areas (FD002)
3. International Hand Signals (FD003)
4. Wire Rope (FD004)
5. Hardware (FD005)
6. Chain (FD006)
7. Slings (FD007)
8. Reeving (FD008)
9. Hoists, Winches and Related Devices (FD009)
10. Jacks, Rollers and Related Devices (FD010)

Cranes: Types, Components and Case Histories Video/DVD (set of 10)

From the Operating Engineers Training Institute of Ontario <http://www.oetio.com>

### *Mobile Craning Today*

Operating Engineers Training Institute of Ontario..... SBN 0-8273-5460-6

## Additional Resources

### *IPT's Crane and Rigging Handbook*

by Ronald G. Garby ..... ISBN 0-920855-14-8

### *IPT's Crane and Rigging Training Manual*

By Ronald G. Garby ..... ISBN 0-920855-16-4

## **Reference Authority**

1. WorkSafeBC Occupational Health and Safety Regulation (OHSR)
2. CAN/CSA-Z150-98 (R2004) Safety Code for Mobile Cranes
3. ANSI Standard ANSI/ASME B30.5-2004, Mobile and Locomotive Crane