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industry training authority

BC Crane Operator Qualification

Tower Crane Operator

WORKPLACE LEARNING GUIDE

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TOWER CRANE OPERATOR

WORKPLACE LEARNING GUIDE

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Tower Crane Operator
WORKPLACE LEARNING GUIDE

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PART 1

Introduction

INTRODUCTION

This Tower Crane Workplace Learning Guide is issued by the Industry Training Authority in partnership with the BC Crane Association for use in industry training sponsored by the ITA.

It is intended as a learning guide for participants preparing for the Workplace Assessment. Practical instruction by demonstration and trainee participation will be integrated with classroom sessions. Safe working practices, even though not always specified in each operation or topic, are an implied part of the program and will be stressed throughout the program. It is the responsibility of employers to ensure safety training for trainees working on their worksites after successful completion of the program.

SAFETY ADVISORY

Be advised that references to the Workers' Compensation Board of British Columbia 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.

TOWER CRANE OPERATOR ASSESSMENT PROCESS

This guide was developed to help trainee operators understand how they will be evaluated on their achievement throughout their apprenticeship.

It is also a useful guide for incumbent operators in understanding what they will be assessed against to achieve the standard required for BC CraneSafe Certification.

REFERENCE MATERIALS

Required Reference

WorkSafeBC Occupational Health and Safety (OHS) regulations
http://www2.worksafebc.com/publications/OHSRegulation/Home.asp

WorkSafe BC Occupational First Aid Requirements

WorkSafeBC – Tower Cranes Manual of Standard Practices

CSA Standard Z248-2004 - Code for Tower Crane

ANSI Standard ASME B30.4-1990 – Portal, Tower, and Pillar Cranes

Additional Resources

Rigging Manual – by Donald E. Dickie, P. Eng.
Construction Safety Association of Ontario, 1997 ..... ISBN 0-7726-1574-8

Hoisting and Rigging Safety Manual
Construction Safety Association of Ontario ..... ISBN 0-919465-70-6

Slings – Construction Safety Association of Ontario ..... ISBN 0-919465-76-5

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

ASSESSMENTS AND QUALITY ASSURANCE

Assessment

For assessment purposes, all explanations, descriptions, and activities must comply with current legislation, including WorkSafeBC regulations, and industry practice. CSA Standard Z248-2004 Code for Tower Cranes, ANSI Standard ASME B30.4-1990, Portal, Tower, and Pillar Cranes, Workplace Hazardous Material Information System (WHMIS) and delivery agency policy.

Quality Assurance

Any assessor assessing against this unit standard must be an occupationally competent crane operator with industrial experience, and must have completed the assessor registration competency.

References

WorkSafeBC Occupational Health and Safety (OHS) regulations
CSA Standard Z248-2004 Code for Tower Cranes,
The Hoisting and Rigging Safety Manual, Construction Safety Association of Ontario, 1997
ANSI Standard ASME B30.4-1990, Portal, Tower, and Pillar Cranes,
Workplace Hazardous Material Information System (WHMIS), and delivery agency policy

PART 2

Program Structure

Competency Profile Chart (page 1 of 2)

Tower Crane Operator Competency Profile Chart

(Note: These are considered Advanced Units and build on the corresponding Core Units)

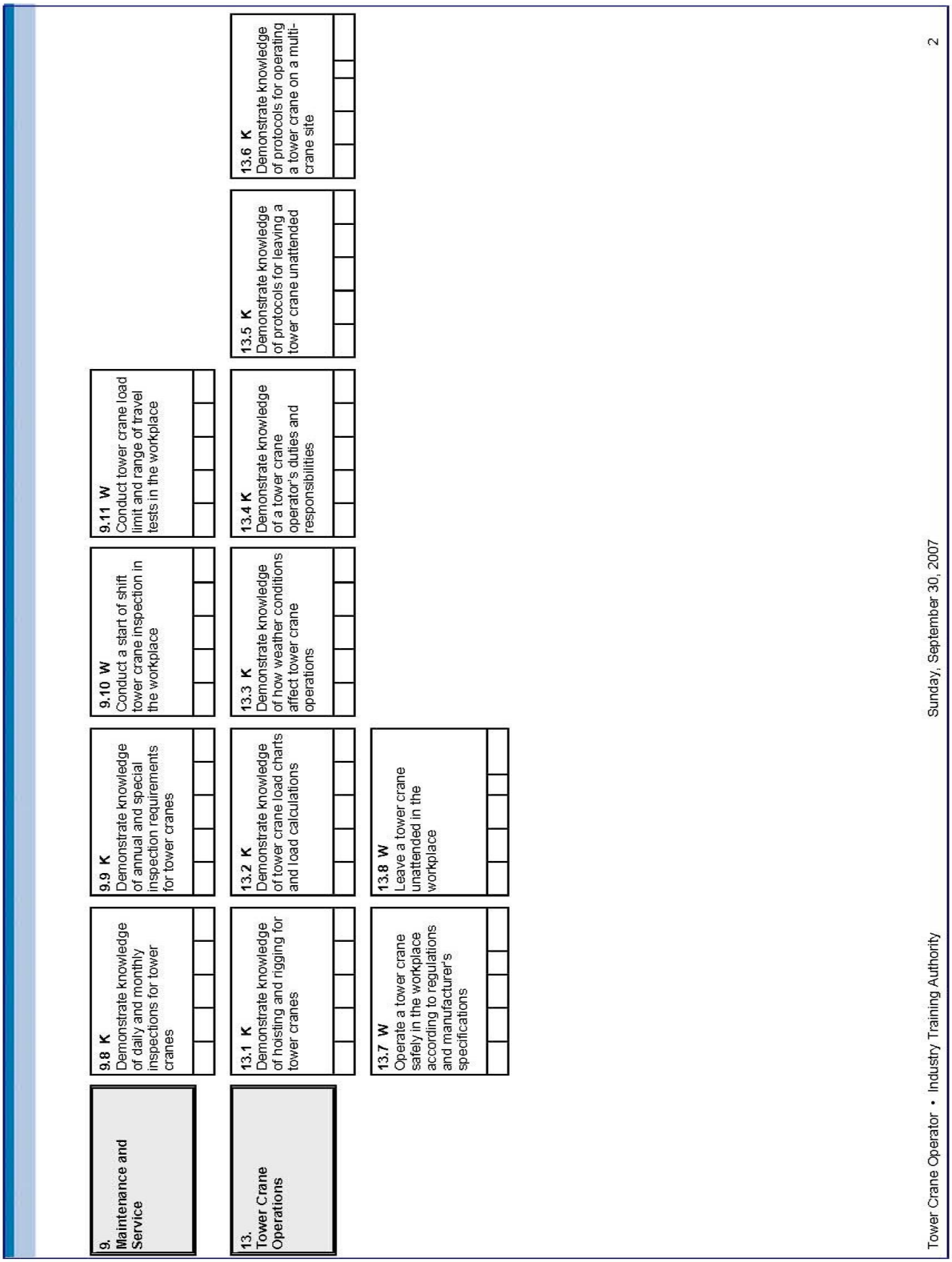
1. Safety	**1.7 K** Demonstrate knowledge of tower crane specific PPE	**1.8 K** Demonstrate knowledge of regulations, standards, and documentation relevant to tower crane operations	**1.9 K** Demonstrate knowledge of regulations and protocols for operating a tower crane in proximity to power lines, cable hazards, and high and low voltage equipment	**1.10 W** Demonstrate knowledge of documentation for the site and the operator's tower crane
2. Communications	**2.8 K** Demonstrate knowledge of tower crane hand signals	**2.9 K** Demonstrate knowledge of tower crane radio protocols and vocabulary	**2.10 W** Interpret tower crane hand signals in the workplace	**2.11 W** Use tower crane radio protocols and vocabulary in the workplace
3. Cranes	**3.8 K** Demonstrate knowledge of the training and certification process for tower crane operators	**3.9 K** Demonstrate knowledge of tower crane applications	**3.10 K** Demonstrate knowledge of tower crane types and configurations	**3.11 K** Demonstrate knowledge of the erection and dismantling processes for tower cranes
	3.14 K Demonstrate knowledge of drives, controls, and safety devices for tower cranes	**3.15 W** Identify and describe the function of the drives, controls, and safety devices on the operator's tower crane		

3.12 K Demonstrate knowledge of components and their functions for different types tower cranes	**3.13 K** Demonstrate knowledge of tower crane climbing and lowering methods and hazards	

Tower Crane Operator • Industry Training Authority Sunday, September 30, 2007 1

TOWER CRANE OPERATOR

Competency Profile Chart (page 2 of 2)



PART 3

Tower Crane Operator
WORKPLACE LEARNING GUIDE

Section 1

SAFETY

UNIT STANDARD 1.5 W (CORE)

Comply with WorkSafeBC OHS Regulations

Purpose

This unit is included in every assessment and should underpin every activity done when working with or around cranes or worksites. There is a portion for sign off on each individual assessment that allows for the Mentor to verify that you followed the necessary WorkSafeBC and OHS requirements. These rules are in place for the safety of all employees on the worksite. The equipment you operate must be safe and in good working order. All cranes must have a current Certificate of Inspection. It is an offence to knowingly operate a crane that does not meet safety standards and for employers it is an offence to make employees work in unsafe work conditions.

Be mindful of the safety of yourself and others at all times while operating a crane or being on a worksite.

If you are ever asked to perform a task for assessment purposes or at any other time that does not follow the safety rules and regulations, you have the right to refuse to perform the task and you are obligated to report unsafe practices. It is only through constant adherence to safety requirements that crane operators will have the opportunity to work in safer environments. It is up to each employee to uphold the safety requirements and for employers to provide safe working conditions that comply with the regulated requirements.

> On October 31, 2000, one worker was killed and another injured while working from a work platform suspended from a crane.
>
> Before workers use a platform suspended from a crane, a trial lift must be performed with the platform empty to ensure it is safe for workers.

WorkSafeBC Bulletin WS 05-02

The requirements of this assessment will be checked in every assessment task you complete throughout your training. Additionally, you will be expected to operate within the safety guidelines and regulations for the rest of your career to ensure professional conduct and safety for the industry.

UNIT STANDARD 1.10 W

Demonstrate knowledge of documentation for the site and the operator's tower crane

Purpose

The purpose of this unit is for you to demonstrate your knowledge of site documents which provide information and guidelines important to tower crane operation.

You will be asked to demonstrate your knowledge of working at a safe distance from power lines, cable hazards, and high and low voltage equipment and to describe how it applies at your site.

You will be asked to describe the procedure to follow in an emergency evacuation of personnel at your site.

Assessor References

Prior to the assessment, the assessor will check the site safety board and list items important to the tower crane operator. He will locate the following specific documents if they are not posted on the site safety board:

- WCB tower crane report
- Site schematic (30M33 form)
- DEP emergency procedures

He will also review the crane logbook and your operator logbook. It is important that site policy is followed and that all entries are easy to read and accurate. **Legible** writing (or printing) is important.

Prior to the assessment, the assessor will record the location of the DEP, its drop-off location, and site protocols for emergency evacuation of personnel. The assessor may obtain this information from the site safety board, the site emergency plan, or during site orientation.

Prior to the assessment, the assessor will review the site schematic (30M33 form) and identify the location of transformers and power lines in your crane's work radius. The assessor will also visually note any additional lines and/or cables that are not shown on the site schematic.

Task 1

List and describe site-specific documents important to operating the tower crane.

1. You will be asked to describe the importance of the crane logbook in tower crane operation.
   - Type of information recorded in logbook
   - Significance in tracking inspection and maintenance

2. You will be asked to describe the importance of the crane manufacturer's manual and outline the information it provides. Read the crane manufacturers manual to have a clear understanding of your tower crane's features, capabilities and limitations. Keep a copy in the operator's cab for easy reference during daily operations.

3. You will be asked to list documents posted on the site safety board and describe their significance. Check the board frequently and be aware of any new postings

4. You will be asked where the WCB tower crane report is located and to describe its contents.

5. If a site schematic is not posted on the site safety board, you will be asked to identify its location and to describe its significance. This document contains the following important information:
   - Crane's work radius
   - Power lines and cable hazards

6. If the DEP emergency procedure is not posted on the site safety board, you will be asked to identify its location and to describe its significance. It contains procedures for the tower crane operator to follow in emergency evacuation of personnel

7. Ask your workplace mentor if there are other site policies and procedures which you need to be aware of.

Task 2

Describe the contents and significance of the crane logbook and the operator's logbook.

The assessor will review the crane logbook and your operator's logbook as part of this assessment. **Legible** writing (or printing) is important.

1. You will be asked to describe the crane logbook as defined by CSA Standards
   - Identify where it is normally located
   - Describe the type of information recorded in it
   - You will be asked to describe 4 entries (selected at random by the assessor)
   - The assessor will check to ensure you consistently make the required entries (daily, weekly and monthly inspections)

2. You will be asked to describe the operator's logbook
   - Describe the type of information recorded
   - Describe why it is important
   - You will be asked to describe 4 entries (selected at random by the assessor)
   - The assessor will check to ensure you consistently make the required entries (daily activities, signed off by supervisor)

Task 3

Describe the procedure for the tower crane operator to follow during emergency evacuation of personnel.

1. You will be asked to describe connecting to the DEP
   - Learn any the site specific radio protocol for DEP evacuation of personnel
   - Always drop off (cut) rigging prior to connecting DEP
   - Know the location of the DEP
   - Always connect DEP with appropriate rigging hardware (pigtail, whip, etc.)

2. You will be asked to describe the procedure for lifting the DEP and placing it near an injured person.
   - Do not lift until instructed
   - Always confirm that safety line of person(s) being lifted is connected to the block
   - Learn how to safely land near an injured person as directed
   - Learn safety precautions to follow when lifting and transporting an injured person

3. You will be asked to describe lifting the DEP with an injured person aboard and placing it in the drop-off location.
   - Do not lift until instructed
   - Handle DEP carefully
   - Know designated drop-off location

The key items that the assessor will be looking for in this Unit Standard are that you know how to correctly hook up the DEP, know the pick-up and drop-off locations, and follow protocol.

Task 4

Identify and describe the Limits of Approach for nearby power lines, cable hazards, and high and low voltage equipment.

4. You will be asked to point out the boom marker and describe its purpose.
   - Know the location of the boom marker
   - Know how the boom marker aids you in maintaining Limits of Approach.
   - Boom marker indicates the Limits of Approach. DO NOT work past the boom marker!

5. You will be asked to identify the location of power lines and transformers in your crane's work radius and describe the limits of approach.
   - Learn Limits of Approach as defined in WorkSafeBC
   - Learn Limits of Approach as defined in CSA Z248 standard 8.13
   - Know where to find site documentation that identifies power lines and cable hazards (30M33 form).
     Note: 30M33 is normally posted on the Site Safety Board.
   - Know the location of power lines, cable hazards, and high or low voltage equipment in your crane's work radius.
   - Know the location of transformers in your crane's work radius.

6. You will be asked to point out any energized cable hazards that do not appear on the 30M33 form.
   - The location of some energized cable hazards changes during different construction phases. *Examples: Raised cab tire, Cables connected to satellite power panels, etc.*
   - Check daily for any new cable hazards in your crane's work radius.

Manufacturer's Equipment Manuals

(WCB - Tower Cranes Manual of Standard Practices)

A crane manufacturer's equipment manual must be provided with each crane and be available on the site.

The manual must include:

- Equipment designation or type
- Name of manufacturer or designer
- Model number and serial number
- Year of original manufacture
- Weight of each structural component, mechanical component and individual counterweights
- Load charts for all combinations or variations incapacities and geometry
- Inspection and maintenance procedures including:
  - Material specifications on structural elements
  - Welding specifications for all structural components
  - Bolting and torquing specifications
- Lifting tackle specification
- Erection procedures
- Climbing procedures
- Operating precautions
- Dismantling procedures

Crane Log Books

(WCB - Tower Cranes Manual of Standard Practices)

A crane log book must be maintained and kept on site (normally in the crane operator's cab). Log book entries must include inspections, tests, repairs and maintenance.

All entries must be dated and signed by the operator, the person doing repairs or the supervisor. The crane owner must ensure that the log boom remains with the crane from job to job and be kept up to date throughout the working life of the crane.

The log book must be examined regularly by the site management, in accordance with WCB regulations, to ensure that it is being properly maintained, and that all appropriate corrective measures, maintenance or repairs have been performed.

WorkSafeBC
Regulation Part 14: Cranes and Hoists

GENERAL REQUIREMENTS

14.12 Manual

(1) The manufacturer's manual for each crane and hoist must be reasonably available to the workplace where the equipment is being used.

(2) The manual must show the approved methods of erection, dismantling, maintenance and operation of the component parts and of the assembled crane or hoist.

(3) The portions of the manufacturer's manual, or a copy of them, related to safe operation of the crane or hoist must be available at the workplace where the equipment is being used.

WorkSafeBC
Regulation Part 14: Cranes and Hoists

TOWER CRANES

14.79 Manual and records

The manufacturer's manual and current records pertaining to operation, inspection and repair of a tower crane must be kept at the workplace while the crane is erected.

CSA Z248-04 **Code for tower cranes**

6.2 Crane logs

6.2.1 General

Two crane logs shall be maintained for each machine in accordance with the following:

(a) The owner's crane log shall contain a complete history of the machine up to but not including erection at the current job site.

(b) The operator's crane log shall contain machine history developed at the current job site.

6.2.2 Owner's crane log

The owner's crane log shall

(a) be prepared, kept, and maintained to provide the means of establishing and maintaining a positive and complete machine history for each individual machine;

(b) be considered to be a standard part of the crane equipage and shall be transferred to each subsequent new owner at the time of the sale;

(c) be readily available for examination by the inspectors of the local authority having jurisdiction; and

(d) contain the complete history of the unit up to but not including erection at the current job site.

6.2.3 Operator's crane log

The operator's crane log shall

(a) be prepared, kept, and maintained to provide a means of establishing and maintaining a history of the crane at its current location;

(b) be designed to provide the information in a logical and chronological sequence;

(c) show in detail all tests (nondestructive or other), inspections, maintenance, repairs, revisions, and modifications carried out as required in Clause 6.4. It shall show the date on which such work was performed and by whom, together with the total hours of service recorded on the machine;

(d) include all incidents of misadventure and all damage sustained and subsequent repairs recorded in detail; and

(e) contain the name of the person/company installing the rope and the date of installation.

WorkSafeBC
Regulation Part 32: Evacuation and Rescue

32.2 Training

(1) Workers designated to provide rescue or evacuation services must be adequately trained.

(2) The training program must include simulated rescue or evacuation exercises and regular retraining, appropriate to the type of rescue or evacuation being provided, and training records must be kept.

32.3 Equipment

(1) Workers performing rescue or evacuation must wear personal protective clothing and equipment appropriate to the hazards likely to be encountered.

(2) Harnesses must meet the requirements of the applicable standards or code issued by the International Union of Alpinist Associations, National Fire Protection Association or Canadian Standards Association.

(3) Repealed. [B.C. Reg. 312/2003, effective October 29, 2003.]

(4) When a platform suspended from a crane or hoist or attached to a crane boom is used for rescue, an injured worker on the platform is not required to use a personal fall protection system, if

(a) the worker is belted to a stretcher and the stretcher is securely fastened to the platform floor, and

(b) the platform has a safety strap that will prevent the platform from falling more than 15 cm (6 in) if the platform becomes dislodged from the hook.

[Amended by B.C. Reg. 312/2003, effective October 29, 2003.]

*See also sections 4.3 and 4.4 of the OHS Regulation.

32.1 Risk assessment

(1) Ropes and associated rigging equipment used only for rescue or evacuation or training in such procedures must

(a) be of low stretch (static) kernmantle construction or equivalent,

(b) when new, have a minimum safety factor of 10 to 1, based upon a one-person load of 140 kilograms (300 pounds), and

(c) be replaced at intervals stated by the manufacturer, but not exceeding 5 years.

(2) A worker suspended on a rope for rescue purposes other than from a helicopter must where practicable be secured to an independent lifeline or belay line.

Note: Ropes used for purposes other than just rescue are required to meet the applicable requirements provided in the other parts of this Regulation. For example, Part 11 addresses ropes used for fall protection and work positioning; Part 15 addresses rigging.

32.5 Inspection of equipment

(1) Ropes and associated equipment must be inspected visually and physically by qualified workers after each use for rescue, evacuation or training purposes.

(2) Equipment must not be used after it

(a) has been overstressed,

(b) has been subject to temperatures above 150°C (300°F), or

(c) shows significant damage due to contact with chemicals or due to any other cause.

32.6 Maintenance records

(1) Repealed. [B.C. Reg. 312/2003, effective October 29, 2003.]

(2) Maintenance records must be kept, including but not limited to

(a) the name of manufacturer,

(b) the type of equipment,

(c) the date put into service,

(d) when and for what purpose the equipment has been used,

(e) the date of the last inspection and name of the inspecting person,

(f) any damage suffered, and

(g) the date and nature of any of maintenance.

(3) Maintenance records must be available upon request to any worker concerned with the safe operation of the equipment or to an officer.

[Amended by B.C. Reg. 312/2003, effective October 29, 2003.]

* See section 4.3 of the OHS Regulation.

32.7 First aid

At least one member of a rescue team must be a first aid attendant trained to immobilize an injured worker.

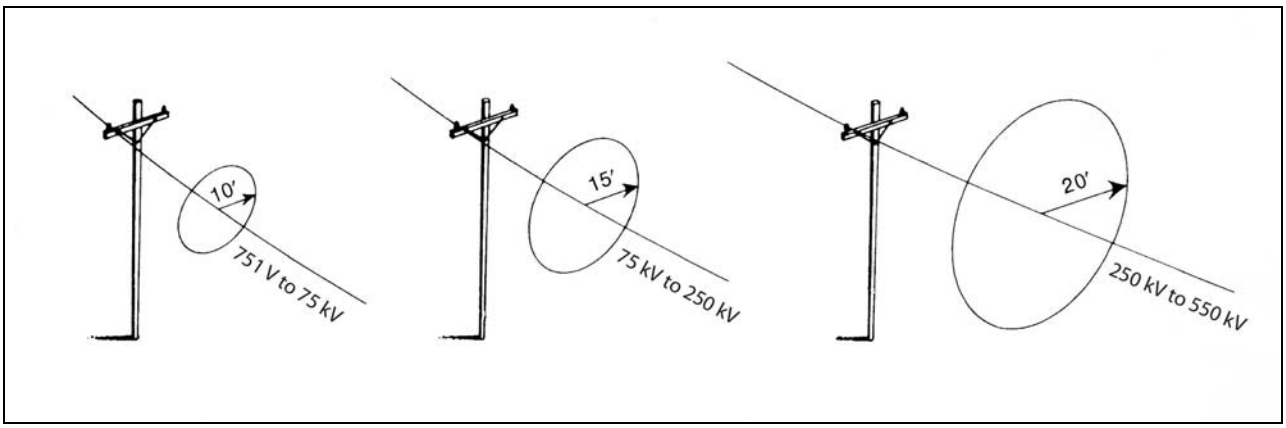
[Amended by B.C. Reg. 348/2003, effective March 30, 2004.]

32.8 Communications

Effective communications must be maintained between the workers engaged in rescue or evacuation and support persons.

The Limits of Approach to Electrical Conductors Must Not be Encroached Upon

(WCB - Tower Cranes Manual of Standard Practices)



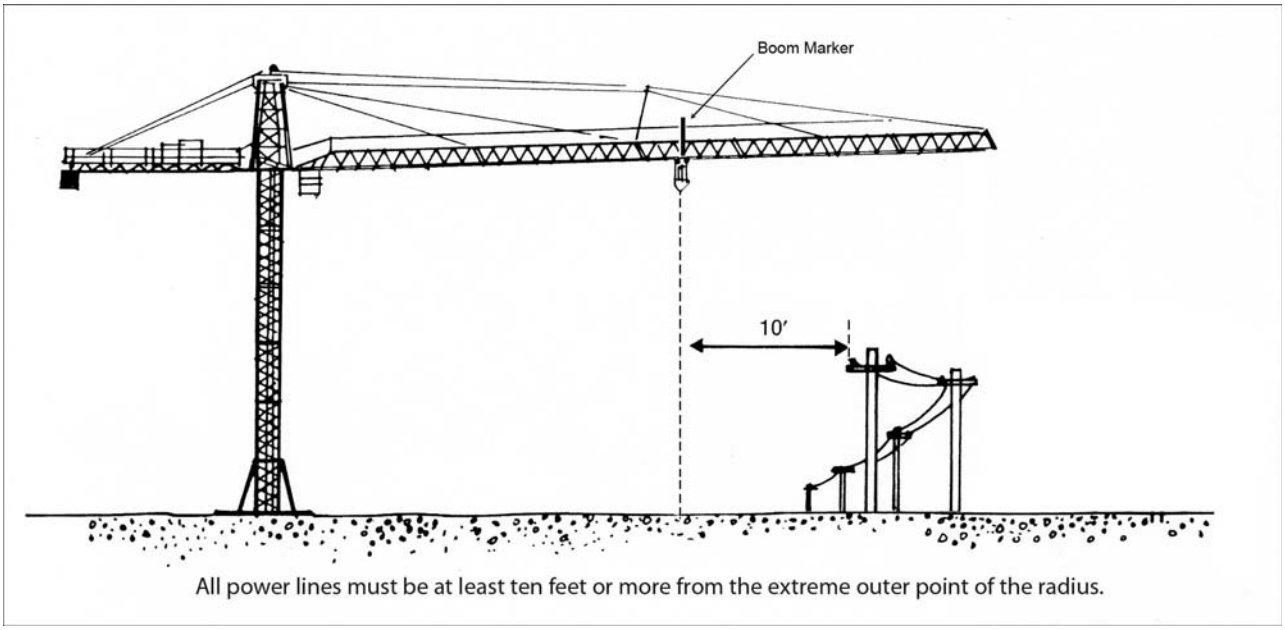
Do not come closer to power lines than the above distances

Specific Actions

- The limits of approach vary with the line voltage.

VOLTAGE (phase to phase)	MINIMUM DISTANCE feet	(meters)
751 V to 75 kV	10	(3)
over 75 kV to 250 kV	15	(4.6)
over 250 kV to 550 kV	20	(6.1)

- Treat all overhead lines as live until reliable information to the contrary is received, in writing, at the site.
- Do not operate the crane until proper precautions have been taken to prevent contact with energized high voltage electrical conductors.
- When work is to be performed within or close to the limit of approach, notify the power authority as to the work to be done. They can arrange to have the electrical line(s) de-energized, guarded or rerouted from the work area. A WCB form 30M33 is used for this purpose. This form must be filled out and posted at the job site.
- If guarding is used, a content safety watcher must be assigned to assist in controlling the approach of the equipment and loads to prevent contact with the guarding.
- Do not stockpile, load or unload any material near power lines.



All power lines must be at least ten feet or more from the extreme outer point of the radius.

WorkSafeBC
Regulation Part 19: Electrical Safety

Working close to energized lines

19.24 Minimum clearance

(1) The employer must ensure that at least the minimum applicable distance specified in Table 19-1 is maintained between exposed, energized high voltage electrical equipment and conductors and any worker, work, tool, machine, equipment or material, unless otherwise permitted by this Part.

(2) The employer must accurately determine the voltage of any energized electrical equipment or conductor and the minimum distance from it required by subsection (1).

Table 19-1: General limits of approach

Voltage Phase to phase	Minimum distance	
	Metres	Feet
Over 750 V to 75 kV	**3**	10
Over 75 kV to 250 kV	**4.5**	15
Over 250 kV to 550 kV	**6**	20

CSA Z248-04 **Code for tower cranes**

8.13 Operations near energized conductors

8.13.1 General

8.13.1.1

Before starting operations near electrical lines, the person responsible for the job shall notify the owners of the lines or their authorized representatives to coordinate appropriate safety measures.

8.13.1.2

Any overhead wire shall be considered to be an energized line unless the person owning such line or the electrical utility authorities verify that it is not an energized line.

8.13.1.3

Exceptions to Clause 8.13, if approved by the owner of the electrical lines, may be granted by the administrative or regulatory authority if the alternative procedure provides protection and is set forth in writing.

8.13.1.4

When a crane is installed in proximity to power lines, durable signs shall be installed at the operator's station and on the base of the crane warning that electrocution or serious bodily injury may occur unless a minimum clearance of 3 m (10 ft) is maintained between the crane, or the load being handled, and energized power lines. Greater clearances are required because of higher voltage, as stated in Clause 8.13.2. These signs shall be revised when the authority having jurisdiction requires greater clearances.

8.13.2 Limits of approach

A tower crane shall be operated so that no part of the crane or load enters into the danger zone created by energized conductors as shown in Table 3 or as identified by the authority having jurisdiction. When it is possible that the tower crane's part or load may enter into the danger zone, the following shall be ensured:

(a) the electrical distribution and transmission lines have been de-energized in accordance with the authority having jurisdiction; or

(b) insulating barriers have been erected to prevent physical contact with the lines.

Caution shall be exercised when working near overhead lines because they can move horizontally or vertically due to wind, moving the danger zone to new positions.

8.13.3 Spotter

A qualified spotter shall be assigned to observe the clearance when any portion of the load or load line moves close to the hazard area limits.

8.13.4 Safety devices

If cage-type boom guards, insulating links, or proximity warning devices are used on cranes, such devices shall not be a substitute for the requirements of Clause 8.13.2.

Table 3

Required clearance for operation near energized conductors (See Clause 8.13.2.)

Voltage, v, kV (phase to phase)	Minimum required clearance, m (ft)
$v \leq 50$	3.0 (10)
$50 < v \leq 200$	4.6 (15)
$200 < v \leq 250$	7.6 (25)
$250 < v \leq 750$	10.7 (35)
$750 < v$	13.7 (45)

Section 2

COMMUNICATIONS

UNIT STANDARD 2.10 W

Interpret tower crane hand signals in the workplace

Purpose

In this unit you will demonstrate your ability to interpret hand signals. Hand signals are a vital part of safe tower crane operations and a key requirement of any competent tower crane operator.

Assessor Reference

NA

Task 1

Respond to hand signals during routine tower crane operations.

1. The assessor will observe you during routine operation, watching for you to correctly respond to the following specific hand signals
   - Stop
   - Emergency Stop
   - Dog everything
   - Lower load
   - Raise load
   - Move slowly (raise load)
   - Move slowly (lower load)
   - Trolley out
   - Trolley in
   - Swing left
   - Swing right
2. You will be asked to demonstrate the hand signals that the assessor does not observe during routine operations.
3. Clarify instructions (hand signals) as required.
4. If you are operating a Luffing Crane you will also be asked to demonstrate the following 4 hand signals.
   - Boom up or trolley in
   - Boom down or trolley out
   - Boom up and lower load
   - Boom down and raise load
5. If you are operating a Traveling Crane you will also be asked to demonstrate the following 2 hand signals.
   - Travel forward
   - Travel backward

Task 2

Describe protocols for taking hand signals as defined by WorkSafeBC regulations.

You will be asked to describe protocols for taking hand signals as defined by WorkSafeBC.

- Taking hand signals from one person only
- Protocol for stop signal

BASIC TOWER CRANE HAND SIGNALS

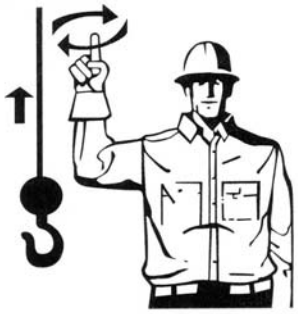
Stop

Emergency stop

Dog everything

Lower load

Move slowly
(lower load)



Raise load

Move slowly
(raise load)

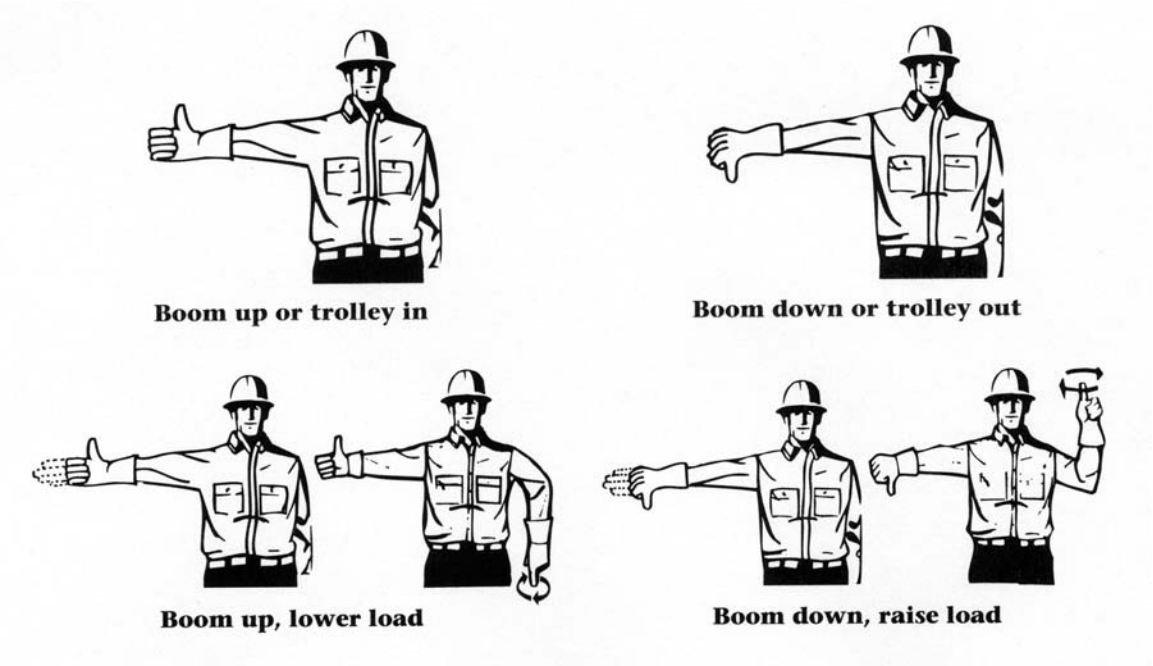
Trolley out

Trolley in

Swing left

Swing right

LUFFING TOWER CRANE HAND SIGNALS



Maintain Good Communication with the Signaller or Hook Tenders

(WCB - Tower Cranes Manual of Standard Practices)

Specific Action

- A competent signaler and/or hook tender who can communicate with the operator must be assigned to work with the operator of the crane.
- When the operator is unable to see the hook and load, the signaler must be in a position to view the load at all times.
- If the crane operator loses contact with the signaler for any reason, all movement of the crane must be stopped until communication is restored.
- Where loads are picked up at one point and lowered at another, two signalers may be required, one to direct the lift, and one to direct the descent.
- Should there be any change in the established signal system, all hoisting must be stopped until the matter is clarified.
- Two-way radios are recommended.
- Adequate lighting arrangements must be provided for night operations.

Signaling

(WCB - Tower Cranes Manual of Standard Practices)

Signallers and/or qualified hook tenders must:

- Keep the load in full view at all times
- Be experienced with the operation
- Be competent in rigging and slinging work
- Have clear communication with the crane operator
- Be able to control all traffic within the loading and unloading areas of the crane
- Be familiar with the approved code of hand signals
- When radio communication is used, the radio systems used must be acceptable to WCB

WorkSafeBC
Regulation Part 14: Cranes and Hoists

EQUIPMENT OPERATION

14.47 Signals

(1) The operator of a crane or hoist must act only on directions from a designated and competent signaller whenever the operator does not have a clear and unobstructed view of the load hook and load throughout the whole range of the hoisting operation.

(2) Repealed. [B.C. Reg. 312/2003, effective October 29, 2003.]

* See section 15.20 of the OHS Regulation.

CSA Z248-04 — Code for tower cranes

8.8.1 Designated signaller

8.8.1.1

Where signals are required to control hoisting operations, the contractor or person in charge of the operations shall ensure that a qualified signaller, visually designated by some means, is assigned to work with the crane within the signaller's area of responsibility.

8.8.1.2

Except for a "stop" signal (see Clause 8.8.2), the tower crane operator shall respond only to signals from the designated signaller. Under normal conditions, only one qualified signaller shall be responsible for giving signals to the operator at any one time.

8.8.1.3

The signaller shall have the authority to keep the work area clear of unauthorized persons.

8.8.2 Signals

8.8.2.1

Hand signals shall be in accordance with Annex A and shall be posted at the job site unless voice communication equipment (telephone, radio, or equivalent) is used. Signals shall be discernible or audible at all times. No crane motion shall be made unless signals are clearly understood.

8.8.2.2

When loading and unloading, movement of the crane shall be made only in response to a signal. When the operator considers that a movement may be unsafe, the signaller shall be notified and corrective measures taken.

8.8.2.3

The operator shall maintain constant contact with the signaller when lifting blind. When contact is lost, the operator shall stop all movement of the crane.

8.8.2.4

For special conditions that occur from time to time, additions to or modifications of the standard signals may be required. In such cases, these special signals shall be agreed upon in advance by the operator and the signaller and should not be in conflict with standard signals.

8.8.2.5

A "stop" signal from any person shall be obeyed.

UNIT STANDARD 2.11 W

Use tower crane radio protocols and vocabulary in the workplace

Purpose

In this unit you will demonstrate your ability to use radio communication in the workplace.

Two-way radios are used between the tower crane operator and the rigger to communicate lift information, to clarify hand signals, and to provide direction when working in the blind.

Assessor References

NA

Task 1

Demonstrate the procedure for working in the blind.

1. Your assessor will ask you to perform a lift while working in the blind. If conditions exist that prevent performing a blind lift, the assessor will ask you to simulate the procedure, relying entirely on radio communication.

2. Your assessor will be watching for the following key points:
   - Using consistent terminology
   - Relaying clear, concise, relevant information
   - Confirming and clarifying to ensure understanding
   - Using measurements to clarify distance
   - Using North, South, East, and West (or clock-face positions) to aid in giving and interpreting directions
   - Having rigger call out height as load is lowered

WorkSafeBC
Regulation Part 14: Cranes and Hoists

EQUIPMENT OPERATION

14.48 Alternative to hand signals

(1) Two-way radio or other audio or video systems acceptable to the Board must be used if distance, atmospheric conditions or other circumstances make the use of hand signals hazardous or impracticable.

(2) Audio and video communication systems used in a hoisting operation must be designed, installed, operated and maintained according to a standard acceptable to the Board.

14.49 Dedicated radio system

(1) A two-way radio system used to direct crane or hoist movement must operate on an ultra-high frequency, and at a transmitter power assigned and coordinated by the Board.

(2) Multi-channel radios are not permitted for use to direct crane or hoist movement.

WorkSafeBC
Regulation Part 14: Cranes and Hoists

TOWER CRANES

14.87 Communication

Each tower crane operator must have effective two-way voice communication with any other tower crane or equipment operator if contact between the tower crane and any other tower crane or equipment could occur.

CSA Z248-04 — Code for tower cranes

8.12 Visibility

8.12.2 Blind lifts

When the operator is unable to see the load in all its positions, two or more signallers may be required to relay signals to the operator throughout the full travel of the load.

Section 3

CRANES

UNIT STANDARD 3.15 W

Identify and describe the function of the drives, controls, and safety devices on the operator's tower crane

Purpose

The purpose of this unit is for you to demonstrate your knowledge of drives, controls, and safety devices specific to the tower crane at the worksite.

Assessor Reference

Prior to the assessment, the assessor will review the Crane Manufacturer's Manual and record the location and function of the crane's safety components and types of drives. This assessment focuses on your familiarity with the operating characteristics of the crane you are operating at the worksite.

Your workplace mentor will cover this information during your training. You can find additional information in your Crane Manufacturer's Manual.

Task 1

Point out safety devices on the operator's tower crane and describe their functions.

1. You will be asked to identify the physical location of the crane's hoist limits and describe their function.
   - Maximum pull
   - Tip limit
   - Gear load limits
2. You will be asked to identify the physical location of the trolley limits and describe their function.
   - Trolley in limit
   - Trolley out limit
3. You will be asked to describe deadman switch operation and explain why it is an important control feature
4. You will be asked to identify the location of the emergency stop buttons
5. You will be asked to describe the emergency braking systems on the tower crane
6. You will be asked to identify the anemometer and its associated equipment and describe its operation
   - Anemometer (wind meter)
   - Gauges, alarm, etc.
   - Wind speed warning and shutdown limits

Task 2

Describe the hoist drive and its operating characteristics.

You must know the type of hoist drive in your tower crane and be able do describe its operation.

- Type of drive (frequency, gear)
- AC or DC
- Changeable gear box
- Multiple parts of line
- Number of motor steps
- Hoist holding brake

Task 3

Describe the trolley drive and its operating characteristics.

You must know the type of trolley drive in your tower crane and be able do describe its operation.

- Gear change options
- Trolley brakes

Task 4

Describe the slew drive and its operating characteristics.

You must know the type of slew drive in your tower crane and be able do describe its operation.

- Type of drive (AC, frequency)
- Type of braking (eddie current, holding brake)

WorkSafeBC
Regulation Part 14: Cranes and Hoists

TOWER CRANES

14.81 Limit devices

(1) A tower crane must have automatic travel limit switches and automatic overload protection devices that prevent overloading at any trolley position, the load block from travelling beyond the highest allowable position specified by the manufacturer and the trolley from travelling beyond the allowable limit specified by the manufacturer.

(2) Limit devices on a tower crane must be tested at the beginning of each work shift or more frequently if specified by the crane manufacturer.

(3) Any malfunction of an automatic limit or safety device on a tower crane must be remedied before the crane is used.

WorkSafeBC
Regulation Part 14: Cranes and Hoists

TOWER CRANES

14.92 Wind limitations

(1) An anemometer must be mounted on the crown, apex or operator's cab of each tower crane.

(2) The readout for the anemometer required by subsection (1) must be readable by the operator while at the crane controls.

(3) Tower crane operations must stop when a load cannot be handled safely because of wind.

(4) In the absence of the manufacturer's specifications for maximum permitted wind speed during crane operation, the maximum allowable wind speed in which a tower crane may be used is 50 km/h (30 mph), or less if a load cannot be handled safely because of wind.

[Amended by B.C. Reg. 312/2003, effective October 29, 2003.]

* See also section 4.3 of the OHS Regulation.

Section 9

MAINTENANCE & SERVICE

UNIT STANDARD 9.10 W

Conduct a start of shift tower crane inspection in the workplace

Purpose

The purpose of this unit is for you to demonstrate your ability in performing routine inspections.

The emphasis is on your ability to perform daily pre-start inspections (crane off) according to the Crane Manufacturer's Manual and the site checklist. You will also be assessed on your ability to perform weekly and monthly inspections.

To successfully complete this assessment you must perform the inspections and make the necessary entries in your crane logbook. It is important that site policy is followed and that all entries are easy to read and accurate. **Legible** writing (or printing) is important.

Assessor Reference

Prior to the assessment, the assessor will review the Crane Manufacturer's Manual and the site policies and procedures. Your assessor will customize WorkSafeBC Standard Tower Crane "Start of Shift Inspection" and "Weekly and Monthly Inspection" checklists to match the crane manufacturer and site requirements for your tower crane.

Task 1

Conduct and describe pre-start inspection according to the crane manufacturer's manual and site procedures.

Your assessor will ask you to conduct a pre-start inspection as you would on a typical day and to describe what type of damage, wear, etc. you are looking for. Load limit and range of travel tests are assessed separately in Unit Standard 9.11 W.

The WorkSafeBC "Start of Shift Inspection" checklist sets the minimum inspection requirements. You must also conduct any additional pre-start inspections set out by the crane manufacturer and site.

- Know how to conduct all inspections listed on the WorkSafeBC "Start of Shift Inspection" form
- Always conduct all start of shift inspection requirements listed in the crane manufacturer's manual and those defined by the site
- Notify supervisor of defects or faults
- Record inspection daily in the crane logbook

Task 2

Conduct and describe weekly inspection for tower crane according to the crane manufacturer's manual and site procedures.

You will be asked to conduct the weekly inspection requirements for your tower crane. The WorkSafeBC "Weekly Inspection" checklist sets the minimum inspection requirements. You must also conduct any additional weekly inspections set out by the crane manufacturer and site.

- Know how to conduct all inspections listed on the WorkSafeBC “Weekly Inspection” form
- Always conduct all weekly inspection requirements listed in the crane manufacturer’s manual and those defined by the site
- Notify supervisor of defects or faults
- Record inspection weekly in the crane logbook

Task 3

Demonstrate use of harness and lanyard for safety while conducting two weekly inspections.

Your assessor will select two weekly inspections at random which require the use of harness and lanyard for security. He will ask you to demonstrate proper use of harness and lanyard, as defined by WorkSafeBC, while conducting the inspections. You will be assessed on use of one type of safety gear only:

- Double lanyard (connect to a safe point on structure, safely pass suspension points)
- Rope grab (securely fasten rope grab)

Task 4

Conduct monthly inspection requirements for tower crane according to crane manufacturer’s manual.

The WorkSafeBC “Monthly Inspection” checklist sets the minimum inspection requirements. You must also conduct any additional monthly inspection requirements set out by the crane manufacturer and site.

- Know how to conduct all inspections listed on the WorkSafeBC “Monthly Inspection” form
- Always conduct all weekly inspection requirements listed in the crane manufacturer’s manual and those defined by the site
- Notify supervisor of defects or faults
- Record inspection monthly in the crane logbook

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STANDARD TOWER CRANE "START OF SHIFT INSPECTION"

Lessee: _____ **Week of:** _____ **Year:** _____

Project: _____ **Crane Owner:** _____

Site Address: _____

Crane Make: _____ **Model:** _____ **Serial #:** _____

☑ Checked, approved, and in good working order ☒ Checked, found faulty, notified supervisor (details required under remarks) ⊟ Not applicable to this item

#	Standard Tower Crane Operator	Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	Electrical power cords – main feed – junction box/splice							
2	Ground fault circuit interrupter (GFCI)							
3	ON/OFF switch (main disconnect)							
4	Crane base inspection							
5	Inspect walkways, handrails, guards, ladders, and perimeter barricade							
6	Inspect structure, pins, keepers, and mast bolts							
7	Ensure all tower wedges or tie backs are in place and tight							
8	Ensure all doors, panels, and covers are in place and weather-tight							
9	Operators controls functioning adequately							
10	Load moment hoist limit							
11	Load moment trolley limit							
12	Maximum load (line pull)							
13	Trolley out							
14	Trolley in							
15	Hoist up deceleration limit							
16	Hoist upper limit							
17	Hoist down limit or slack line							
18	Ensure all audio/visual indicators are functioning properly							
19	Anemometer							
20	Hoist brake is functioning							
21	Slewing brake is functioning							
22	Trolley brake							
23	Visually inspect load block and hook							
24	Travel brake to rail where applicable							
25	Rail travel forward and reverse operation and limit							
26	Inspect tracks for loose connections, proper drainage, subsidence and bogie wear on travelling cranes, rail clamps, and end stops							
27	Housekeeping: concrete debris, rebar dowels, signage lights, access/egress, etc.							
28	Supervisor notified of defects or faults							
29	Operator to initial daily							

Remarks: _____

Weekly Supervisor and Operator signatures indicating inspections have been completed

Operator's Signature: _____ Operator's Name: _____ (PRINT) Certificate No. _____

Supervisor's Signature: _____ Supervisor's Name: _____ (PRINT)

This checklist is a minimum standard. Manufacturer/supplier may require more.

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TOWER CRANE "WEEKLY and MONTHLY INSPECTION"

This checklist is a minimum standard. Manufacturer/supplier may require more.

Lessee: _____ **Month of:** _____ **Year:** _____

Project: _____ **Crane Owner:** _____

Site Address: _____

Crane Make: _____ **Model:** _____ **Serial #:** _____

☑ Checked, approved, and in good working order ☒ Checked, found faulty, notified supervisor (details required under remarks) ⊟ Not applicable to this item

WEEKLY INSPECTION

#		Week 1	Week 2	Week 3	Week 4
1	Trolley rollers, tracks, slewing rings, and rollers				
2	Sheaves, bushings, and pins				
3	Jib backstops (boom stop) if applicable (luffing only)				
4	Boom hoist brake (luffing only)				
5	Guy ropes, pendant lines, cable clips, thimbles, and ferrules				
6	All rope attachments (dead end)				
7	Inspect load line, trolley line, and boom hoist rope, if applicable				
8	Tie-ins to slabs or other bracing systems if used				
9	Machine is properly lubricated and oil reservoirs checked				
10	Inspection of all drive components				
11	Counterweight supports and brackets are secure				
12	Anchor bolts/pins				
13	Tower bolts/pins				
14	Track level, parallel				
15	Supervisor notified of defects or faults				
16	Operator to initial weekly				

MONTHLY INSPECTION

Date_____

1	Bogie wear (travelling cranes)	
2	All belts for tension, alignment, and signs of chaffing	
3	All brakes for adjustment and wear	
4	Load line path: drums, sheave wear, bearings, and mounts	
5	Trolley line path: drums, sheave wear, bearings, and mounts	
6	Fire extinguisher	
7	Windows and guards (visibility)	
8	Heater	
9	Cab supports	
10	Pendent line connections	
11	Supervisor notified of defects or faults	
12	Operator to initial monthly	

Remarks: _____

Weekly Supervisor and Operator signatures indicating inspections have been completed

Operator's Signature: _____ Operator's Name: _____ (PRINT) Certificate No. _____

Supervisor's Signature: _____ Supervisor's Name: _____ (PRINT)

INSPECTION REQUIREMENTS

It is important to conduct daily, weekly and monthly inspections according to your crane manufacturer's manual and following both CSA and WorkSafeBC standards. Review these documents with your workplace mentor to determine the required inspections for the tower crane you are operating.

WorkSafeBC
Regulation Part 14: Cranes and Hoists

GENERAL REQUIREMENTS

14.13 Inspection and maintenance

(1) Each crane and hoist must be inspected and maintained at a frequency and to the extent required to ensure that every component is capable of carrying out its original design function with an adequate margin of safety.

(2) A crane or hoist must not be used until any condition that could endanger workers is remedied.

(3) Any repair to load bearing components of a crane or hoist must be certified by a professional engineer or the original equipment manufacturer as having returned the component to a condition capable of carrying out its original design function with an adequate margin of safety.

14.14 Inspection and maintenance records

Records of inspection and maintenance meeting the requirements of Part 4 (General Conditions) must be kept by the equipment operator and other persons inspecting and maintaining the equipment, for

(a) a crane or hoist with a rated capacity of 1 000 kg (2 200 lbs) or more,

(b) a crane or hoist used to support a worker,

(c) a tower crane,

(d) a mobile crane, boom truck or aerial ladder crane,

(e) a side boom tractor or pipe layer,

(f) a construction material hoist,

(g) a chimney hoist, and

(h) any other type of hoisting equipment specified by the Board.

Minimum Inspection Requirements During Operations

(WCB - Tower Cranes Manual of Standard Practices)

Daily Inspections

The crane operator must carry out daily inspections using the crane manufacturer's manual as a guide. Daily inspections must ensure that:

- The base of the crane is kept free from standing water and waste material.
- All shoring and bracing is in place
- The tower support beams are not deformed
- The bearing floors are not cracking
- All tower wedges are secure and undamaged
- All guy wires are correctly tensioned
- All rigging equipment and attachments are in good condition
- The jib and tower are straight and there is no evidence of physical damage such as cracking, bending or other deformation of the steel elements or welds
- The crane mast is clean of concrete accumulation
- All tower and jib base bolts and pins are in place (when tightening the tower bolts, slew the jib so that the counterweight is over the corner being tightened) with particular attention given to all the slewing ring bolts
- Slewing rings, gears and gusset plates in the tower ring are not cracked
- Electrical cables are free of obstacles and do not twist or bend over sharp edges
- The machine is sufficiently lubricated and oil reservoirs are filled to their correct levels as prescribed in the crane manufacturer's manual
- Ensure there are no fluid leaks visible on the machine deck
- All brakes and clutches re functioning within manufacturer's specifications
- The hoist rope is spooling properly on the drum and runs freely over the sheaves
- All wire ropes are visually examined for damage and deterioration
- All rope sheaves run true, easily and smoothly and are not damaged
- The trolley rope is properly tensioned
- All limit switches are properly set and functioning
- All guards are in place
- The test weights are lifted at the beginning of each shift to check the overload limits.

Monthly Inspections

Using the crane manufacturer's manual as a guide, on a monthly basis check:

- The entire crane for structural damage (all welded connections for cracks, plus the main chords and lacings and other structural items for paint flaking and cracking, dents, bends, abrasions and corrosion)
- Sheaves and drums for cracks and wear
- Parts such as pins, bearings, shafts, gears and rollers for cracks, wear or distortion
- Brake and clutch system parts and lining for excessive wear
- Relays and all other electrical equipment for loose screws, broken parts, or damaged cables
- All belts for tension, alignment and signs of chaffing and cuts (a whole set of belts must be replaced when one is found damaged)
- Mounting bolts on all motors, pumps and gear reducers
- All couplings
- All running ropes for condition and lubrication
- All hoses, fittings and tubing for damage or leaks

Recording Inspection Results

The results of all inspections and examinations must be carefully recorded in the logbook, in full detail, and must be dated and signed by the person doing the inspection. The logbook should normally be kept in the crane operator's compartment except as required for the periodic review of the entries.

CSA Z248-04 **Code for tower cranes**

6.4 Inspections

6.4.1 General

Maintenance procedures, greasing, lubrication, and electrical checks shall be carried out at regular intervals as recommended by the manufacturer or as called for in this Standard, whichever is more frequent. These functions shall be performed by the crane operator or qualified service personnel on a scheduled basis.

6.4.4 Daily inspections

6.4.4.1 By the operator

The operator shall carry out the following daily inspection activities:

(a) Ensure that all wedges in slab openings are in place and are tight.

(b) Ensure that all guy lines and all guy line connections, if used, are acceptable.

(c) Inspect mast bolts and anchor bolts.

(d) Ensure that all limit switches (except line pull limit switch), signal lights, audio and visual indicators, and brakes are functioning properly.

(e) Inspect load hoist and boom hoist ropes according to Clause 6.5.

(f) Inspect grounding connections.

(g) Inspect the tracks for loose connections, proper drainage, subsidence, and bogie wear on traveling cranes.

(h) Inspect rail clamps, if used, daily or each time their application is made.

6.4.4.2 By the rigger

The rigger shall

(a) check all slings and rigging used with the crane prior to use;

(b) inspect the test block-lifting hardware prior to lifting the test block; and

(c) inspect the load block and hook.

6.4.5 Weekly inspections

The following shall be inspected weekly:

(a) structural pins and keepers;

(b) trolley rollers, tracks, slewing rings, and rollers;

(c) gear shaft and belt drives;

(d) sheaves, bushings, and pins;

(e) guy ropes, pendant lines, cable clips, thimbles, and ferrules;

(f) jib backstops (boom stops);

(g) all rope attachments;

(h) walkways, handrails, and ladders;

(i) the locations in the structure where accumulation of water could result in damage, to ensure that such water is drained; and

(j) tie-ins to slabs or other bracing systems where used.

6.4.6 Monthly inspections

The following shall be inspected monthly:

(a) all running ropes, in accordance with Clause 6.5.1.3, to check for all types of deterioration;

(b) mast and boom structure for cracks or buckling;

(c) bogie wear on travelling cranes;

(d) counterweight supports;

(e) brake adjustment (wear); and

(f) drums, sheaves, bearings, and mounts.

6.4.7 Annual inspections

After a crane has been in service for 12 months, it shall undergo

(a) visual inspection of the structure with nondestructive inspection according to Clause 6.3.1 on suspect areas;

(b) inspection of all load-carrying equipment, including sheaves, blocks, rings, shackles, hooks, chains, and slings;

(c) inspection of all fixed ropes according to Clause 6.5.1.3 for all types of deterioration;

(d) inspection of all running ropes according to Clause 6.5.1.3 for all types of deterioration;

(e) operational tests according to Clause 6.3.2; and

(f) a load test according to Clause 6.3.3.

6.4.8 Special inspections

Note: Special inspections are inspections conducted following shock loading, electrical contact, other misadventures, repairs, alterations, or prolonged shutdown.

WorkSafeBC
Regulation Part 11: Fall Protection

FALL PROTECTION

11.1 Definitions

In this Part

"**anchor**" means a secure point of attachment for a lifeline or lanyard;

"**fall arrest system**" means a system that will stop a worker's fall before the worker hits the surface below;

"**fall protection system**" means

(a) a fall restraint system,

(b) a fall arrest system, or

(c) work procedures that are acceptable to the Board and minimize the risk of injury to a worker from a fall;

"**fall restraint system**" means a system to prevent a worker from falling from a work position, or from travelling to an unguarded edge from which the worker could fall;

"**full body harness**" means a body support device consisting of connected straps designed to distribute the force resulting from a fall over at least the thigh, shoulders and pelvis, with provision for attaching a lanyard, lifeline or other components;

"**horizontal lifeline system**" means a system composed of a synthetic or wire rope, installed horizontally between 2 anchors, to which a worker attaches a personal fall protection system;

"**lanyard**" means a flexible line of webbing, or synthetic or wire rope, that is used to secure a safety belt or full body harness to a lifeline or anchor;

"**lifeline**" means a synthetic or wire rope, rigged from one or more anchors, to which a worker's lanyard or other part of a personal fall protection system is attached;

"**personal fall protection system**" means a worker's fall restraint system or fall arrest system composed of

(a) a safety belt or full body harness, and

(b) a lanyard, lifeline and any other connecting equipment individual to the worker

that is used to secure the worker to an individual point of anchorage or to a horizontal lifeline system;

"**safety belt**" means a body support device consisting of a strap with a means for securing it about the waist and attaching it to other components;

WorkSafeBC
Regulation Part 11: Fall Protection

FALL PROTECTION

11.2 Obligation to use fall protection

(1) Unless elsewhere provided for in this Regulation, an employer must ensure that a fall protection system is used when work is being done at a place

(a) from which a fall of 3 m (10 ft) or more may occur, or

(b) where a fall from a height of less than 3 m involves a risk of injury greater than the risk of injury from the impact on a flat surface.

(2) The employer must ensure that guardrails meeting the requirements of Part 4 (General Conditions) or other similar means of fall restraint are used when practicable.

(3) If subsection (2) is not practicable, the employer must ensure that another fall restraint system is used.

(4) If subsection (3) is not practicable, the employer must ensure that a fall arrest system is used.

(5) If the use of a fall arrest system is not practicable, or will result in a hazard greater than if the system was not used, the employer must ensure that work procedures are followed that are acceptable to the Board and minimize the risk of injury to a worker from a fall.

(6) Before a worker is allowed into an area where a risk of falling exists, the employer must ensure that the worker is instructed in the fall protection system for the area and the procedures to be followed.

(7) A worker must use the fall protection system provided by the employer.

11.3 Fall protection plan

(1) The employer must have a written fall protection plan for a workplace if

(a) work is being done at a location where workers are not protected by permanent guardrails, and from which a fall of 7.5 m (25 ft) or more may occur, or

(b) section 11.2(5) applies.

(c) Repealed. [B.C. Reg. 420/2004, effective January 1, 2005.]

(2) The fall protection plan must be available at the workplace before work with a risk of falling begins.

(3) Repealed. [B.C. Reg. 420/2004, effective January 1, 2005.]

11.4 Selection of harness or belt

(1) A worker must wear a full body harness or other harness acceptable to the Board when using a personal fall protection system for fall arrest.

(2) A worker must wear a safety belt, a full body harness or other harness acceptable to the Board when using a personal fall protection system for fall restraint.

11.5 Equipment standards

Equipment used for a fall protection system must

(a) consist of compatible and suitable components,

(b) be sufficient to support the fall restraint or arrest forces, and

(c) meet, and be used in accordance with, an applicable CSA or ANSI standard in effect when the equipment was manufactured, subject to any modification or upgrading considered necessary by the Board.

11.6 Anchors

(1) In a temporary fall restraint system, an anchor for a personal fall protection system must have an ultimate load capacity in any direction in which a load may be applied of at least

(a) 3.5 kN (800 lbs), or

(b) four times the weight of the worker to be connected to the system.

(2) Each personal fall protection system that is connected to an anchor must be secured to an independent point of anchorage.

(3) In a temporary fall arrest system, an anchor for a personal fall protection system must have an ultimate load capacity in any direction required to resist a fall of at least

(a) 22 kN (5 000 lbs), or

(b) two times the maximum arrest force.

(4) A permanent anchor for a personal fall protection system must have an ultimate load capacity in any direction required to resist a fall of at least 22 kN (5 000 lbs).

11.7 Temporary horizontal lifelines

A temporary horizontal lifeline system may be used if the system is

(a) manufactured for commercial distribution and installed and used in accordance with the written instructions from the manufacturer or authorized agent, and the instructions are readily available in the workplace,

(b) installed and used in accordance with written instructions certified by a professional engineer, and the instructions are readily available in the workplace, or

(c) designed, installed and used in a manner acceptable to the Board.

11.8 Certification by engineer

The following types of equipment and systems, and their installation, must be certified by a professional engineer:

(a) permanent anchors,

(b) anchors with multiple attachment points,

(c) permanent horizontal lifeline systems, and

(d) support structures for safety nets.

11.9 Inspection and maintenance

Equipment used in a fall protection system must be

(a) inspected by a qualified person before use on each workshift,

(b) kept free from substances and conditions that could contribute to its deterioration, and

(c) maintained in good working order.

11.10 Removal from service

After a fall protection system has arrested the fall of a worker, it must

(a) be removed from service, and

(b) not be returned to service until it has been inspected and recertified as safe for use by the manufacturer or its authorized agent, or by a professional engineer.

WorkSafeBC
Regulation Part 14: Cranes and Hoists

TOWER CRANES

14.89 Jib access

Each tower crane jib must have a continuous catwalk from the mast to the tip, meeting the following requirements:

(a) the catwalk must be at least 30 cm (12 in) wide and constructed with a non-skid surface;

(b) a handline approximately 1 m (39 in) high and a midline must be provided on both sides of the catwalk not more than 30 cm (12 in) from the outside edge of the catwalk and supported at intervals not exceeding 3 m (10 ft);

(c) the handline and midline must be wire rope of at least 1 cm (3/8 in) diameter;

(d) if adequate handlines are not provided, alternative means of fall protection, such as a horizontal lifeline system, must be provided in accordance with the requirements of Part 11 (Fall Protection).

UNIT STANDARD 9.11 W

Conduct tower crane load limit and range of travel tests in the workplace

Purpose

The purpose of this unit is for you to demonstrate your skills in conducting load limit and range of travel tests.

The emphasis is on your ability to conduct daily (start of shift) load limit and travel tests.
You will also be required to describe other load limit and travel tests not conducted every day.

To successfully complete this assessment you must conduct each start of shift load limit and travel test and make entries in the crane logbook.

Assessor Reference

WorkSafeBC sets the minimum load limit and range of travel test requirements. You must also conduct any additional load limit and range of travel tests set out by the crane manufacturer and site.

Prior to the assessment, the assessor will review the Crane Manufacturer's Manual and the crane logbook. He will write down the limits and customize the test lists as required.

Task 1

Conduct and describe trolley travel tests and hoist height limit tests according to crane manufacturer's manual.

1. You will be asked to conduct and describe your start-of-shift trolley travel tests. Your assessor will be watching for you to correctly conduct the following tests:
   - Trolley out
   - Trolley in
   - High speed
2. You will be asked to conduct and describe your hoist height limit tests. Your assessor will be watching for you to correctly conduct the following tests:
   - Hoist up deceleration limit
   - Hoist upper limit
   - Hoist down limit or slack line
3. You will be asked to conduct and describe rail travel tests (if applicable). Your assessor will be watching for you to correctly conduct the following tests:
   - Rail travel forward limit
   - Rail travel reverse limit
   - Rail travel brakes

Task 2

Conduct and describe load limit tests according to crane manufacturer's manual.

1. You will be asked to conduct a load moment tests.
   - Hoist limit
   - Trolley limit

2. You will be asked to conduct a maximum load test (line pull at drum). This is also called an overload test, maximum pick, or max, lift. If there is no block on site, the assessor will ask you to describe the procedure and to demonstrate how to check that the switch is working.

3. You will be asked several questions to ensure you correctly interpret the crane load chart.

WorkSafeBC
Part 14 Cranes and Hoists

EQUIPMENT OPERATION

14.35 Start of shift inspection

(1) The operator must inspect the crane or hoist at the beginning of each shift and must test control and safety devices as specified by the manufacturer and the applicable safety code and regulations.

(2) Any defects found during inspection or use of a crane or hoist must be recorded in the inspection and maintenance record system and be reported immediately to the supervisor, who must determine the course of action to be taken.

(3) If a defect affects the safe operation of the crane or hoist, the equipment must not be used until the defect has been remedied.

WorkSafeBC
Regulation Part 14: Cranes and Hoists

TOWER CRANES

14.82 Test blocks

(1) Blocks for testing overload protection devices on a tower crane must be available at the tower crane site.

(2) The weights of test blocks required by subsection (1) must be as specified by the crane manufacturer, and the weight accurately determined and durably and legibly marked on each block.

(3) Lifting eyes in test blocks for a tower crane must conform to the requirements of Part 15 (Rigging).

CSA Z248-04 — Code for tower cranes

8.33 Limit switches and safety devices

8.3.3.1

Only qualified persons shall adjust limit switches and safety devices.

8.3.3.2

Limit switches and safety devices that are not functioning properly shall be adjusted or repaired by a qualified person so that they function properly before the crane is put into operation.

8.3.3.3

A safety or limiting device shall not be used as an operating stop.

8.3.3.4

A tower crane operator shall not operate a crane in which any overload protection device required by this Standard has been rendered inoperable except under the supervision of a qualified person and with the authorization of the crane manufacturer or a professional engineer.

8.3.3.5

A tower crane operator shall not operate a crane in which any motion-limiting safety device required by this Standard has been rendered inoperable except under controlled conditions and when a qualified person has authorized the temporary disabling of the device.

Section 13

Tower Crane Operations

UNIT STANDARD 13.7 W

Operate a tower crane safely in the workplace according to regulations and manufacturer's specifications

Purpose

The emphasis of this unit is for you to demonstrate your tower crane operating skills while performing routine lifts. The assessor will also be checking your knowledge of changing gears and/or parts of line..

Assessor Reference

The assessor will review the crane's load chart to determine suitable weight ranges. He will also review the lift schedule for assessment day for lift types suitable for light, medium and heavy lifts. Prior to the assessment, the assessor will review the crane manufacturer's manual for a clear understanding of gear selection on the specific crane you are operating.

Task 1

Perform basic tower crane moves.

The assessor will observe you during routine operations for one hour. You will be assessed on a variety of criteria, including communication, assessing lifts, selecting appropriate gear and/or parts of line, performing basic tower crane moves, making adjustments for weather conditions, and placing the load. This part of the assessment integrates all the components you have covered in previous unit standards.

1. You will be assessed on selecting appropriate gear and/or parts of line for all lifts

2. You will be assessed on use of Hoist, including:
   - Smooth gear operation – hoisting and lowering
   - Using appropriate speed – hoisting and lowering
   - Allowing ample braking time – hoisting and lowering

3. You will be assessed on use of Trolley, including:
   - Smooth trolley operation
   - Ability to "catch" a swinging load

4. You will be assessed on use of Slew, including:
   - Smooth slewing operation
   - Coasting
   - Appropriate use of foot brake
   - Using reverse current for slowdown
   - Ability to "catch" a swinging load

5. You will be assessed on other operating considerations, including:
   - Determining safest route
   - Always being aware of obstacles
   - Maintaining clear communication
   - Adjusting crane operation for weather conditions
   - Maintaining Limits of Approach

6. You will be asked to demonstrate use of the safety horn and explain when you would use it.

Task 2

Handle a variety of tower crane loads of significantly different weights.

Based on the crane's load limits, the assessor will determine light, medium and heavy weight ranges for your crane prior to your assessment. To reduce the impact on production, he will try to use loads scheduled for the day as part of this assessment and observe them during routine operations.

During routine operations, he will write in the actual weight and type of load observed for each weight range.

You will be required to demonstrate your knowledge of when it is appropriate to change gears.

If any weight range is not handled during routine operations, you will be asked to demonstrate it near the end of your assessment.

Task 3

Describe the crane's capabilities and limitations by interpreting the crane load chart.

- Know the tip capacity and the maximum load for your crane.
- Your assessor will ask questions to ensure you know how to read your crane load chart

Task 4

Describe changing gears and/or parts of line

1. You will be asked to describe the advantages of using the currently selected gear and/or parts of line. Gears and/or parts of line are often left in one configuration for long periods of time. You must be able to explain why this configuration is appropriate for the type of work you are currently doing.

2. You will be asked to describe why you would select the lowest gear.

   Learn the advantages and disadvantages of selecting the lowest gear and be prepared to provide examples of when it would be appropriate. Some reasons include; .slowing block down, precision placement, and handling structural steel.

3. You will be asked to describe why you would select the highest gear.

   Learn the advantages and disadvantages of selecting the highest gear and be prepared to provide examples of when it would be appropriate. One reason is to increase hook speed.

4. You will be asked to describe changing gears and/or parts of line.
   - Read the crane manufacturer's manual for procedures on changing gears and/or parts of line.
   - Ask your workplace mentor to demonstrate changing gears and/or parts of line.
   - Practice changing gears and/or parts of line.
   - Knowing how to change gears is an important part of crane operation and you must be able to demonstrate that you have acquired the skills to do so.

5. You will be asked to demonstrate changing parts of line (if applicable to your crane).
   - Read the crane manufacturer's manual for procedures on changing gears and/or parts of line.
   - Practice changing parts of line.
   - You must know how to change from 2 part line to 4 parts of line.
   - You must know how to change from 4 parts of line to 2 part line.

UNIT STANDARD 13.9 W

Leave a tower crane unattended in the workplace

Purpose

The purpose of this unit is for you to demonstrate leaving a tower crane unattended according to the crane manufacturer's manual and site protocol.

Pre-Assessment Activities

The assessor will review the crane manufacturer's manual and site policies and procedures and customize the list for your site and crane.

Task 1

Leave the tower crane unattended according to crane manufacturer's specifications and to site protocol.

The assessor will ask you to shut down the crane and leave it unattended as you would normally at the end of your shift. The list below will be customized for your crane and site. You may be asked to explain the significance of any of the steps.

- Trolley in to minimum radius prior to limits
- Raise hook to maximum height prior to limits
- Power off
- General housekeeping
- Security – lock cab
- Check for loose items outside cab
- Release swing brakes
- Implement tie-downs (if required)
- **Any site specific requirements – discuss with your workplace mentor*

You will be asked to describe best practices regarding limits

- Stopping prior to limits
- Impact of freezing temperatures on limits

CSA Z248-04 **Code for tower cranes**

8.33 Limit switches and safety devices

8.3.3.1

Only qualified persons shall adjust limit switches and safety devices.

8.3.3.2

Limit switches and safety devices that are not functioning properly shall be adjusted or repaired by a qualified person so that they function properly before the crane is put into operation.

8.3.3.3

A safety or limiting device shall not be used as an operating stop.

8.3.3.4

A tower crane operator shall not operate a crane in which any overload protection device required by this Standard has been rendered inoperable except under the supervision of a qualified person and with the authorization of the crane manufacturer or a professional engineer.

8.3.3.5

A tower crane operator shall not operate a crane in which any motion-limiting safety device required by this Standard has been rendered inoperable except under controlled conditions and when a qualified person has authorized the temporary disabling of the device.

CSA Z248-04 **Code for tower cranes**

8.7 Leaving the crane unattended

8.7.1 Out-of-service configuration

8.7.1.1

When the crane is taken out of service, it shall be done in accordance with the crane manufacturer's instructions or as approved by a professional engineer.

8.7.1.2

The operator shall leave the crane free to weathervane unless provisions for non-weathervaning have been specified by the manufacturer or a professional engineer.

8.7.1.3

In the case of luffing jib and similar tower cranes, the manufacturer's instructions or the instructions of a professional engineer concerning the angle of the jib for out-of-service purposes shall be observed.

8.7.2 Warning lights

Warning lights shall be fitted to the tower, boom, or jib, where necessary, and shall be used when required.

8.7.3 Travel brakes

The operator shall secure the tower crane against inadvertent travel.

8.7.4 Disconnecting the power supply

8.7.4.1

Before closing the power disconnecting means, the operator shall ensure that all controls are in the OFF or neutral position and that all personnel are in the clear.

8.7.4.2

The tower crane operator shall ensure that stationary or remote controls are locked at the completion of operations and that the power source is cut off from the crane through a main disconnect switch that can be locked out when the crane is not in use. When a power supply is required to be maintained overnight for cab or control cabinet heaters, lights, etc., separate arrangements shall be made for the isolation of the power supply to the machinery.

8.7.4.3

The operator shall stop the internal combustion engine, when provided.

8.7.4.4

The operator shall disengage the master clutch, when provided.

8.7.5 Secured access

Access to the crane shall be by authorized persons only.

For Further Reading

The Construction Safety Association of Ontario's Crane Manual Part 2: Tower Cranes is a valuable reference.

It is unfortunately out of print. Fulford CraneSafe Certification process has obtained permission form the CSAO to reproduce Part 2 of the Crane Manual and will post this reproduction on its website (www.fulford.ca) in Spring 2009/

PART 4

References

GLOSSARY

Assessor	The Assessor is the BCACS Assessor who is responsible for the final assessment of the Trainee (student) against a knowledge or workplace unit standard
BCACS	BC Association for Crane Safety
Common Core of Competence Standards	The Common Core of Competence Standards are the Knowledge and Workplace unit standards that must be completed by all students before they can undertake further specialized training for certification on a specific type of crane.
Certification	Upon successful completion of the Crane Common Core and successful completion of one further advanced module, the Trainee will receive a 'Certificate of Certification – (Crane Type)'.
Imperial Ton (short ton & long ton)	The standard ton in the U.S. measurement system is the "short ton", equal to 2000 pounds (exactly 907.18474 kg). Both long and short tons are defined as 20 hundredweights, but a hundredweight is 112 pounds in the Imperial system (long or gross hundredweight) and 100 pounds in the US system (short or net hundredweight). The spelling "tonne" denotes the metric tonne of 1000 kilograms (approximately 2204.623 pounds). Long Ton (L/T sometimes known as a Gross Ton, Weight Ton, or Imperial Ton) is the name for the unit called the "Ton" in the Avoirdupois or Imperial system of measurements, as formerly used in the United Kingdom and several other Commonwealth countries. It has been replaced by the metric tonne. It is equal to 2240 pounds (exactly 1016.0469088 kilograms). A long ton-force is 2,240 pounds-force (9,964 new tons).
ITA	Industry Training Authority
Knowledge Unit Standards of Competence	The theoretical component of Crane Certification is made up of the Knowledge Units, which: ▪ can be taught in a classroom setting by a qualified instructor ▪ delivered on line ▪ learned through self study on line or through printed materials
Mentor	A mentor is a journeyperson who is the student/trainee's on-the-job coach, and is responsible for day-to-day assessment of the Trainee's work and for coaching, training and supervision on-the-job.

Metric tonne	A tonne (t) or metric ton (M/T), sometimes referred to as a metric tonne, is a measurement of mass equal to 1,000 kilograms. A tonne (t) or metric ton (M/T), sometimes referred to as a metric tonne, is a measurement of mass equal to 1,000 kilograms.2
Operator Logbook	The Operator Logbook is a Work Record book (a journal) with pages in which the Trainee documents the dates and details of the practice tasks he has performed leading up to the assessment. The amount of time a Trainee must demonstrate the tasks prior to being assessed is stipulated in the Workplace Assessment Documents. It also contains an Evidence section – in which the Trainee inserts the pieces of evidence that are requested in the Workplace Assessment Document.
Workplace Units Standards of Competence	The practical component of Tower Crane Certification is made up of the Workplace Units, which: ▪ require hands on experience ▪ are assessed on the job by a Registered Workplace Assessor ▪ are assessed for credit in the workplace

METRIC CONVERSION HELP

For an online Metric Converters try:

http://www.worldwidemetric.com/metcal.htm

http://www.sciencemadesimple.com/weight_conversion.php

General Weight Equivalence

Imperial		Metric
1 ounce	=	28.375 grams
1 pound	=	454 grams
1 short ton (2K)	=	907 kilograms
1 metric ton (2.2K)	=	1,000 kilograms (1 megagram)

Metric		Imperial
1 gram	=	0.0352 ounces
1 kilogram	=	2.204 pounds (= 1000 grams)
1 metric ton	=	2,204 pounds

METRIC CONVERSION CHART

Converts WEIGHT from Imperial-to-Metric and Metric-to-Imperial

1 lb = 0.454 kg
1 kg = 2.204 lbs

1 S. Ton = 907 kg
1 Metric Tonne = 1,000 kg

Light to Medium Weights

Imperial to Metric		Metric to Imperial	
Pounds	Kilos	Kilos	Pounds
1	0.454	1	2.204
2	0.91	2	4.41
3	1.36	3	6.61
4	1.82	4	8.82
5	2.27	5	11.02
6	2.72	6	13.22
7	3.18	7	15.43
8	3.63	8	17.63
9	4.09	9	19.84
10	4.54	10	22.04
20	9.08	20	44.08
30	13.62	30	66.12
40	18.16	40	88.16
50	22.70	50	110.2
60	27.24	60	132.24
70	31.78	70	154.28
80	36.32	80	176.32
90	40.86	90	198.36
100	45.40	100	220.40
200	90.80	200	440.80
500	227.00	500	1,102.00
1000	454.00	1000	2,204.00

Heavy Weights

Imperial to Metric		Metric to Imperial	
Pounds	Kilos	Kilos	Pounds
1	0.907	1	1.102
2	1.81	2	2.20
3	2.72	3	3.31
4	3.63	4	4.41
5	4.54	5	5.51
6	5.44	6	6.61
7	6.35	7	7.71
8	7.26	8	8.82
9	8.16	9	9.92
10	9.07	10	11.02
20	18.14	20	22.04
30	27.21	30	33.06
40	36.28	40	44.08
50	45.35	50	55.1
60	54.42	60	66.12
70	63.49	70	77.14
80	72.56	80	88.16
90	81.63	90	99.18
100	90.70	100	110.20
200	181.40	200	220.10
500	453.50	500	551.00
1000	907.00	1000	1,102.00

CRITERIA FOR REGISTERED ASSESSORS

Introduction

Assessment of learning is a critical component to any qualification. Training can take place in numerous locations in school or in the workplace using a variety of methods, however, it is only through sound assessment processes and policies that learning can be measured. Training without valid and complete assessment may net few results unless learning is checked. Learning the theory and applying it by demonstrating sound practices in the workplace are both extremely important.

Having qualified and experienced assessors using comprehensive assessment tools is essential to maintaining the quality and integrity of the qualification. In competency based training the workplace assessors are responsible for assessing whether a trainee can perform the required tasks to a particular level of performance. The performance standards specify how well a task must be done and what things must be included while completing the task. By assessment tools aligned with well documented Unit Standards of Competence assessors throughout the Province are able to measure the same things in a consistent manner. This is crucial to the success of a standards based competency program.

A vital step to the success of the qualification is the selection of qualified assessors who have a high level of industry experience. The criteria used to determine the suitability of an assessor to the job has both tangible and intangible elements. Having the right people consistently performing a thorough job throughout the Province is what will bring credibility and reliability to the qualification. As assessors work with the trainees and collect relevant evidence of the trainee's demonstrated performance a documented trail is developed. This evidence trail that can be scrutinized at any time is the information that provides for a provincial comparison. This is an important part of the quality assurance process.

Many people who have amassed experience in their careers feel qualified to become assessors. They feel their judgement, knowledge and experience is sound and that is what is needed. While all of those things may be true a Registered Assessor must assess against the Provincial standards as outlined in the Unit Standards of Competence and not his or her own standards. The experience and knowledge of an assessor is not dismissed instead it is enhanced by providing them documented assessment tools and standards of performance. Competency based training insists on trainees demonstrating their competence and it is up to the assessors to ensure there is an auditable trail of evidence to prove this. An assessor, or any supervisor prior to assessment, "signing off" a trainee must feel 100% confident that the trainee can safely and consistently repeat the task to the standard outlined in the qualification. If there is doubt the trainee should not be "signed off" An assessor must feel confident that should an accident occur in the future he has significant documented evidence to prove the trainee was competent and did deserve to be "signed off".

If, in a quality assurance check, or an accident investigation, there is inadequate documentation to verify the trainee's competence in the assessment tasks there may be liability issues. Having anything but qualified and well trained Registered Assessors will be detrimental to the qualification throughout the Province in addition to marring the progress needed to ensure a safe, competent and properly qualified workforce for the future.

Qualities of a Good Assessor

Qualities inherent in assessors who demonstrate sound assessment practices are listed below.

1. The assessor is fair and honest.
2. The assessor provides constructive information to assist a trainee who is unable to demonstrate competence at the time – allowing the trainee to attempt the assessment again at a later stage trainee for any reason.
3. The assessor is patient.
4. The assessor is able to maintain a level of confidentiality.
5. The assessor has a keen eye for detail and uses thorough work practices.
6. The assessor ensures the assessment is conducted safely.
7. The assessor follows all regulatory requirements.
8. The assessor is able to complete and return the required documentation and maintain accurate files of evidence.
9. The assessor does not exercise favouritism or punitive practices.
10. The assessor does not hold a trainee back if the evidence is sound.
11. The assessor does not rely purely on his or her judgment or experience.
12. The assessor does not impose unfair requirements or stipulate practices or demonstration that are outside that required in the assessment tool.
13. The assessor does not discriminate against anyone.

Assessor Criteria

To become a Registered Assessor for the British Columbia Tower Crane Operator's Qualification the minimum suggested requirements are:

1. A minimum of 5 years working as a tower crane operator. This experience must be current and should have been acquired after 1994.

2. Be registered with the British Columbia Association of Crane Safety and/or the ITA as a Workplace Assessor.

3. Hold a recognized British Columbia qualification as a Registered Assessor or complete the course prior to assessing within the required timeframe. This is a 2 day course available in British Columbia after May 2007, operated in conjunction with BCACS.

4. Two letters of recommendation from two companies with which they have worked, attesting to their experience and knowledge on the job.