



Tower Crane Operator **On-the-Job Training Guide**

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Recognition:

To promote transparency and consistency, this document has been adapted from the 2012 Tower Crane Operator National Occupational Analysis (Employment and Social Development Canada).

A complete version of the Occupational Analysis can be found at www.red-seal.com

STRUCTURE OF THE ON-THE-JOB TRAINING GUIDE

To facilitate understanding of the occupation, this on-the-job training guide contains the following sections:

Task Matrix: a chart which outlines graphically the Blocks, tasks and sub-tasks of this standard detailing the essential skills and the level of training where the content is covered. The Task Matrix is broken down into the following:

Block: the largest division within the standard that is comprised of a distinct set of trade activities.

Task: distinct actions that describe the activities within a Block.

Sub-task: distinct actions that describe the activities within a task.

Training Profile Chart: a chart which outlines the model for Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training.

Technical Training Course Content for the Tower Crane Operator trade: a chart which outlines the model for SATCC technical training sequencing.

TRAINING REQUIREMENTS FOR THE TOWER CRANE OPERATOR TRADE

To graduate from each level of the apprenticeship program, an apprentice must successfully complete the required technical training and compile enough on-the-job experience to total at least 1500 hours each year. Total trade time required is 3000 hours and at least 2 years in the trade.

Journeyman to apprentice ratio for this trade is: 1:2

The information contained in this document serves as a guide for employers and apprentices. Apprenticeship training is mutually beneficial to both employer and apprentice. The employer's investment in training apprentices results in skilled and certified workers. The document summarizes the tasks to be covered by the apprentice during their on-the-job portion of apprenticeship training. An apprentice spends approximately 85% of their apprenticeship term training on-the-job.

It is the employer's or journeyman's responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.

EMPLOYER TRAINING RESPONSIBILITY

- promote a safety-conscious workplace
- provide mentored, hands-on practice in the use of rigging equipment
- demonstrate calculations of the load weights, rigging capacities and crane capacities
- demonstrate set-up of tower cranes
- provide the opportunity for apprentices to perform minor maintenance on tower cranes
- further the apprentice's ability to complete pre-operational inspections, checks and regular inspections
- ensure that the apprentice can perform craning operations

Employers should make every effort to expose their apprentices to work experience in as many areas of the trade as possible.

In the On-the-Job Training Guide, in-school instruction is listed first; on-the-job suggestions to help employers assist the apprentice to prepare for in-school training are listed next.

The content of the training components is subject to change without notice.

TOWER CRANE OPERATOR TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2012 National Occupational Standard (NOA). Each sub-task details the corresponding essential skill and level of training where the content is covered. *

* Sub-tasks with numbers in the boxes is where the content will be delivered in training.

A - Common Occupational Skills

13%

A-1 Performs safety-related functions	A-1.01 Uses personal protective equipment (PPE) and safety equipment 1, 2	A-1.02 Maintains safe work environment 1, 2
A-2 Contributes to workplace organization	A-2.01 Communicates with others 1, 2	A-2.02 Uses documentation 1, 2

B - Crane Inspection and Maintenance

20%

B-3 Performs pre-operational checks and regular inspections	B-3.01 Inspects structural components 1, 2	B-3.02 Inspects mechanical components 1, 2	B-3.03 Inspects lines and wire ropes 1, 2	B-3.04 Inspects hydraulic system components 1, 2	B-3.05 Inspects electrical system components 1, 2
	B-3.06 Inspects support components 1, 2	B-3.07 Inspects track travel components 1, 2	B-3.08 Inspects cab components 1, 2	B-3.09 Inspects safety and access components 1, 2	B-3.10 Completes inspection documentation 1, 2

B-4 Performs continual checks	B-4.01 Monitors site conditions 1, 2	B-4.02 Monitors lines and wire ropes 1, 2	B-4.03 Monitors equipment performance and conditions 1, 2	B-4.04 Monitors structural and support components 1, 2
B-5 Performs minor crane maintenance	B-5.01 Maintains mechanical components 1, 2	B-5.02 Lubricates wire ropes and crane components 1, 2		

C – Crane Set-up, Hoisting Calculations and Lift Planning

21%

C-6 Participates in tower crane assembly, disassembly and transportation	C-6.01 Participates in crane assembly 1,2	C-6.02 Participates in crane disassembly 1,2	C-6.03 Transports self-erecting tower crane 2 (Not Common Core)	C-6.04 Participates in assembly and disassembly of self-erecting tower cranes 2 (Not Common Core)
C-7 Plans lifts	C-7.01 Interprets load charts 1, 2	C-7.02 Plans work procedures 1, 2	C-7.03 prepares for specialty lifts 1, 2	

D – Rigging

14%

D-8 Inspects and maintains rigging equipment	D-8.01 Identifies deficiencies in slings and hardware 1, 2	D-8.02 Lubricates slings and hardware 1, 2	D-8.03 Store rigging equipment 1, 2
D-9 Manages rigging	D-9.01 Selects required rigging equipment 1, 2	D-9.02 Rigs load 1, 2	D-9.03 Monitors rigging 1, 2

E – Crane operations

32%

E-10 Performs pre-lift (warm-up) activities	E-10.01 Performs function test 1, 2	E-10.02 Confirms limits 1, 2			
E-11 Operates tower cranes	E-11.01 Trolleys carriage 1, 2	E-11.02 Booms (luffs) up and down 1, 2	E-11.03 Swings (slews) jib 1, 2	E-11.04 Hoists load 1, 2	E-11.05 Travels crane 1, 2
E-11.06 Performs functions simultaneously 1, 2					

E-12 Climbs (raises) tower cranes

E-12.01 Performs bottom-climbing procedures

1, 2

E-12.02 Performs top-climbing procedures

1, 2

E-13 Performs specialty tower crane operations

E-13.01 Participates in multi-crane lifts

2

E-13.02 Operates in multi-crane site

2

E-13.03 Hoists personnel

2

E-14 Shuts down and secures tower cranes

E-14.01 Secures crane while leaving controls

1

E-14.02 Secures crane while unattended

1

E-14.03 Secures crane for extended periods

1

TRAINING PROFILE CHART

This Training Profile Chart represents Saskatchewan Apprenticeship and Trade Certification Commission (SATCC) technical training at the topic level.

Tower Crane Operator technical training for levels 1 and 2 are provided in alternative delivery. This method uses a combination of in-class training and at-home course work between training sessions. As a result, hours are listed below for a specific training level, but not for individual courses.

Technical training for levels 1 and 2 are both equivalent to 8 weeks in length.

Level One	Hours
Safety/Tools and Equipment	
Introduction to Rigging	
Introduction to Tower Crane Operations	
Introduction to Load Charts	
Introduction to Load Weight Calculations	
	240 hours

Level Two	Hours
Advanced Rigging	
Advanced Load Weight Calculations	
Advanced Load Charts	
Advanced Tower Crane Setup	
Advanced Tower Crane Operations	
Non-routine Pre-operational Checks, Inspections and Maintenance	
	240 hours

ON-THE-JOB AND IN-SCHOOL TRAINING CONTENT FOR THE TOWER CRANE OPERATOR TRADE

This chart outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for the topics of technical training. Topics of technical training are provided with the associated learning outcomes.

Level One	8 weeks equivalent (3, 3, 3, and 4 days of training over 4 months)	240 hours
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Safety/Tools and Equipment

- types of Personal Protective Equipment (PPE) and safety equipment, their applications, limitations, maintenance and inspection requirements, storage and procedures for use
- identify workplace hazards, safe work practices and regulatory requirements regarding pre-lift planning and mobile crane operation
- identify electrical hazards and the effect on the job planning
- techniques for effective verbal and non-verbal communication
- applicable hand signals used during craning operations
- identify trade related documents and describe their applications
- hand, power and measuring tools and describe their applications, procedures for use
- retaining devices and describe their applications and procedures to install and remove

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring the apprentice follows safe work practices and has knowledge of CSA standards, OH&S regulations and company safety policies*
- *demonstrating the use of safety equipment such as PPE, first aid kits, fire extinguishers and spill kits*
- *allowing apprentice to attend company safety meetings*
- *demonstrating crane safety and possible hazards*
- *demonstrating, then supervising the apprentice using hand signalling procedures during actual lifts of materials and equipment*
- *explaining safety procedures as it relates to high voltage electrical equipment*
- *explaining limits of approach when working near high voltage equipment*
- *ensuring the apprentice knows the safety procedures associated with electrical contact*
- *reviewing and explaining technical information from manufacturer's manuals*
- *explaining the personal responsibility for crane operators to maintain logbooks*
- *demonstrating the use of the crane logbook*
- *allowing the apprentice to use written communication, such as logbook time sheets and accident reports*
- *ensuring the apprentice has knowledge of various hand and power tools*
- *ensuring the apprentice is exposed to various types of crane hardware/fasteners and their usages*

Introduction to Rigging

- codes, standards and regulations pertaining to wire ropes, rigging hardware and slings
- wire ropes, rigging hardware and slings and describe their applications, limitations and procedures for use and storage
- procedures used to select, install and connect wire ropes, rigging hardware and slings
- procedures used to troubleshoot issues with wire rope, slings and rigging components
- procedures used to dispose of damaged rigging components
- information pertaining to rigging and hoisting found on drawings and specifications
- procedures used to calculate sling angles and their effect on sling capacities
- procedures used to determine the appropriate sling size for a given load
- considerations and calculations used to determine WLLs

Mentors can assist the apprentice to prepare for this section of technical training by:

- *demonstrating inspection procedures and identify damage to wire rope*
- *allowing the apprentice to choose the appropriate hardware for various lifts*
- *identifying various block classifications and their applications*
- *discussing the effects of sling angles*
- *exposing the apprentice to lifts requiring different sling configurations*
- *allowing the apprentice to choose the rigging configuration for a basic lift such as sling type, size, use of hardware and quantity*
- *discussing the effects of different types of sling configurations such as vertical, choker, basket hitch and two-leg bridle*

Introduction to Load Weight Calculations

- identify the weight of basic shaped loads
- procedures used to calculate the weight of basic shaped loads
- procedures to determine the center of gravity

Mentors can assist the apprentice to prepare for this section of technical training by:

- *allowing the apprentice to calculate load weights for basic shaped loads*
- *allowing the apprentice to determine and calculate center of gravity*

Introduction to Load Charts

- basic load charts, their characteristics and applications
- crane capacity, crane component capacity and working radius for basic lifting operations
- regulatory requirements pertaining to the application of load charts

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring apprentice is aware of factors reducing capacities such as wind, weather and ground conditions*
- *allowing the apprentice to use basic load charts*

Introduction to Tower Crane Operations

- lifting theory and forces
- units of measure and symbols regarding lifting plans and load charts
- basic crane operations, configurations, applications and procedures
- procedures used to perform pre/post-operational inspections and basic maintenance
- crane computers and integrated computerized components, their applications and procedures for use
- procedures used to plan and organize job tasks
- tower cranes, their characteristics and applications
- procedures to load/unload cranes and components for transport
- regulations pertaining to transporting cranes on public and private roadways
- procedures to prepare a crane for transport and perform pre-trip planning
- operational controls, their purpose, and their application intro to operation
- monitoring of gauges, warning systems, hoist lines and running lines
- procedures and regulatory requirements for storing a crane short and long term

Mentors can assist the apprentice to prepare for this section of technical training by:

- *discussing the components of leverage and their applications*
- *having the apprentice look through manufacturer's manuals*
- *allowing the apprentice to interpret technical information gathered from multiple sources*
- *demonstrate the quadrants of operation and the effects of lifting over the different quadrants*
- *demonstrating operating procedures such as swing, hoist up/down and using multiple functions at the same time*
- *ensuring the apprentice has basic crane operations such as programming range limiting devices and use of LMI*
- *explaining job site layouts and hazards to consider*
- *allowing the apprentice to attend a site meeting*
- *supervising the apprentice during the completion of a walk around inspection prior to operation*

Level Two**8 weeks equivalent**
(3, 3, 3, 4 days of training)**240 hours**

Advanced Rigging

- non-routine rigging and lifts, their applications, limitations and procedures
- non-routine rigging and lift techniques
- reeving operations
- methods and equipment used for reeving operations
- multi-crane lifts and their applications
- procedures used for multi-crane lifts

Mentors can assist the apprentice to prepare for this section of technical training by:

- *identifying the various types of hoist blocks such as ball, block, and snatch block*
 - *ensuring the apprentice can select the rigging configuration for various lifts*
 - *demonstrating the use of equalizer beams and spreader bars*
 - *discussing lubrication needs for wire rope slings*
 - *allowing the apprentice to install various parts of line*
 - *allowing the apprentice to seize and braze wire rope*
 - *supervising the apprentice during the preparation and setup of a multi-crane lift*
-

Advanced Load Weight Calculations

- identify the weight of irregularly shaped loads
- procedures used to calculate the weight of irregular shaped loads
- procedure to calculate center of gravity and its effect on the load

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring the apprentice can complete basic load weight calculations*
 - *supervising the apprentice when needing to calculate load weights requiring multi-step calculations*
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Advanced Load Charts

- advanced load charts, their characteristics and applications
- crane capacity, crane component capacity and working radius for non-routine lift operations

Mentors can assist the apprentice to prepare for this section of technical training by:

- *ensuring the apprentice can gather information from multiple locations within a load chart*
 - *discussing the factors reducing rated capacities such as wind, weather, ground conditions and personnel experience*
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Advanced Tower Crane Operations

- tower cranes, their applications and operation
- procedures used to operate tower cranes and their attachments
- multi-crane lift operations, their characteristics, applications and procedures
- operation on a multi-crane jobsite
- specialty hoisting applications with a tower crane

Mentors can assist the apprentice to prepare for this section of technical training by:

- *allowing the apprentice to operate various types of tower cranes*
- *explaining the level of awareness required while operating a crane such as consistently monitoring gauges, watching load and the surrounding environment*
- *discussing specialty craning operations such as multi-crane lifts and personnel hoisting*

Non-Routine Pre-Operational Checks, Inspections and Maintenance

- engines and drive systems, components, their purpose and operation
- procedures used to inspect, maintain and troubleshoot drive systems
- mechanical systems, components, their purpose and operation
- procedures used to inspect, maintain and troubleshoot mechanical systems and their components
- procedures used to inspect, maintain and troubleshoot electrical systems and their components
- hydraulic systems, components, their purpose and operation
- procedures used to inspect, maintain and troubleshoot hydraulic systems and their components
- procedures used to perform continual checks

Mentors can assist the apprentice to prepare for this section of technical training by:

- *having the apprentice view the crane manufacturer's requirements for inspections/maintenance*
- *exposing the apprentice to maintenance procedures and checklists for rigging, pre-lift planning, crane setup and crane maintenance*
- *supervising the apprentice conducting crane preventative maintenance tasks*
- *demonstrating daily interval checks such as ground conditions, outriggers remain set and crane condition*

Advanced Tower Crane Set-up

- tower cranes and their associated components
- procedures used for the assembly and disassembly of tower cranes and their components
- procedures used to prepare cranes for transport
- procedures used to transport cranes, their components and accessories
- steps required for pre-lift planning
- procedures used to determine crane positioning and setup
- procedures used to prepare worksite for crane operations

Mentors can assist the apprentice to prepare for this section of technical training by:

- *supervising the apprentice while positioning the crane, making sure the apprentice considers radii, voltage/obstacle clearances, crane dimensions and load dimension/weight*
- *allowing the apprentice to help in the assembly/disassembly of various tower cranes and attachments*
- *discussing permit requirements for transport of cranes on various methods of carriers*
- *discussing the various methods of transporting a crane*
- *having the apprentice visit the job site to determine if it is favourable for setup*
- *allowing the apprentice to attend pre-lift planning meetings and completing a lift plan form*
- *describing the importance of site meetings*
- *discussing potential site hazards such as overhead and underground obstructions and ground conditions*

Consider apprenticeship training as an investment in the future of your company and in the future of your workforce. Ultimately, skilled and certified workers increase your bottom line.

Get involved in the apprenticeship training system. Your commitment to training helps to maintain the integrity of the trade.

Do you have employees who have been working in the trade for a number of years but don't have trade certification? Contact your local apprenticeship office for details on how they might obtain the certification they need.

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