SKILLEDTRADESBC

PROGRAM OUTLINE

Tower Crane Operator

Implementation date: October 1, 2024

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TOWER CRANE OPERATOR
PROGRAM OUTLINE

APPROVED BY INDUSTRY
JULY 2024

IMPLEMENTATION DATE OCTOBER 1, 2024

THIS BC PROGRAM HAS BEEN HARMONIZED AND IS BASED ON RSOS 2023

Developed by
SkilledTradesBC
Province of British Columbia

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Section 1

INTRODUCTION

Tower Crane Operator

Foreword

This revised Program Outline is intended as a guide for instructors, apprentices, and employers of apprentices as well as for the use of industry organizations, regulatory bodies, and provincial and federal governments. It reflects updated standards based on the 2023 Red Seal Occupational Standard (RSOS). It was developed by British Columbia industry and instructor subject matter experts.

Practical instruction by demonstration and student participation should 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 should be stressed throughout the apprenticeship.

This Program Outline includes a list of recommended reference textbooks that are available to support the learning objectives and the minimum shop requirements needed to support instruction.

Competencies are to be evaluated through written exams and practical assessments. A passing grade is achieved by getting an overall mark of 70%. See the Assessment Guidelines in Section 4 for more details.

Achievement Criteria are included for competencies that require a practical assessment. The intent of including Achievement Criteria in the Program Outline is to ensure consistency in training across training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the learner's ability to apply the theory to practice. It is important that these performances be observable and measurable and that they reflect the skills spelled out in the competency. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the evaluation criteria.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure similar skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

SAFETY ADVISORY

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

Acknowledgements

Industry and Instructor Subject Matter Experts retained to assist in the development and review of this Program Outline:

- Wes Bauder — WorkSafeBC
- Brad Heddle — International Union of Operating Engineers (IUOE) Local 115
- Erick Jique — International Union of Operating Engineers (IUOE) Local 115
- Andrew Knight — Two Pillars Construction Ltd.
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- Jen Mutas — BC Crane Safety
- Dana Tosoni — Two Pillars Construction Ltd.
- Doug Younger — WorkSafeBC

SkilledTradesBC would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the training requirements of the Tower Crane Operator occupation.

Previous Contributors

Industry and Instructor Subject Matter Experts retained to assist in the development and review of the 2016 Program Outline:

- Ryan Burton — Bigfoot Crane Employer
- Clinton Connell — Eagle West Truck & Crane
- Steve Gibson — Kiewit
- Jason Gilmore — Phoenix Truck and Crane
- Michael Goett — Shell Canada Ltd.
- Jeff Gorham — IUOE
- Chris Grajek — Allteck Line Contractors Inc.
- Gary Hamata — Vancouver Pile Driving
- Gordon Lindberg — GL Training Services Ltd.
- Shawn Lynch — Convoy Supply Ltd.
- Ken Morland — Sterling Crane
- Corey Sedgwick — Teck Metals

How to Use this Document

This Program Outline has been developed for the use of individuals from several different audiences. The table below describes how each section can be used by each intended audience.

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Program Credentialing Model	Communicates program length and structure, and all pathways to completion	Illustrates the length and structure of the program	Illustrates the length and structure of the program, and pathway to completion	Illustrates the challenger pathway to Certificate of Qualification
OAC	Communicates the competencies that industry has defined as representing the scope of the occupation	Displays the competencies that an apprentice is expected to demonstrate in order to achieve certification	Displays the competencies apprentices will achieve as a result of program completion	Displays the competencies challengers must demonstrate in order to challenge the program
Training Topics and Suggested Time Allocation	Shows proportionate representation of general areas of competency (GACs) at each program level, the suggested proportion of time spent on each GAC, and percentage of time spent on theory versus practical application	Shows the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Shows the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Shows the relative weightings of various competencies of the occupation on which assessment is based
Program Content	Defines the objectives, learning tasks, high level content that must be covered for each competency, as well as defining observable, measurable achievement criteria for objectives with a practical component	Identifies detailed program content and performance expectations for competencies with a practical component	Provides detailed information on program content and performance expectations for demonstrating competency	Allows individual to check program content areas against their own knowledge and performance expectations against their own skill levels
Assessment Guidelines	Shows the general areas of competency covered in each level of technical training, the theory and practical grading weight, and the calculation method for final percentage marks	Shows the general areas of competency covered in the technical training, the grading weight for each GAC, and the percentage of that time spent on theory versus practical application	Shows the general areas of competency covered in each level of technical training, the theory and practical grading weight, and the calculation method for final percentage marks	Shows the relative weightings of various general areas of competency within the occupation on which assessment is based

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Training Provider Standards	Defines the facility requirements, tools and equipment, reference materials (if any) and instructor requirements for the program	Identifies the tools and equipment an apprentice is expected to have access to; which are supplied by the training provider and which the student is expected to own	Provides information on the training facility, tools and equipment provided by the school and the student, reference materials they may be expected to acquire, and minimum qualification levels of program instructors	Identifies the tools and equipment a tradesperson is expected to be competent in using or operating; which may be used or provided in a practical assessment
Appendix A – Acronyms and Abbreviations	Defines program specific acronyms and abbreviations	Defines program specific acronyms and abbreviations	Defines program specific acronyms and abbreviations	Defines program specific acronyms and abbreviations
Appendix B – Glossary	Defines program specific terms	Defines program specific terms	Defines program specific terms	Defines program specific terms
Appendix C – Summary of Achievement Criteria	Summarizes and organizes expected practical assessments by level		Summarizes and organizes expected practical assessments by level	

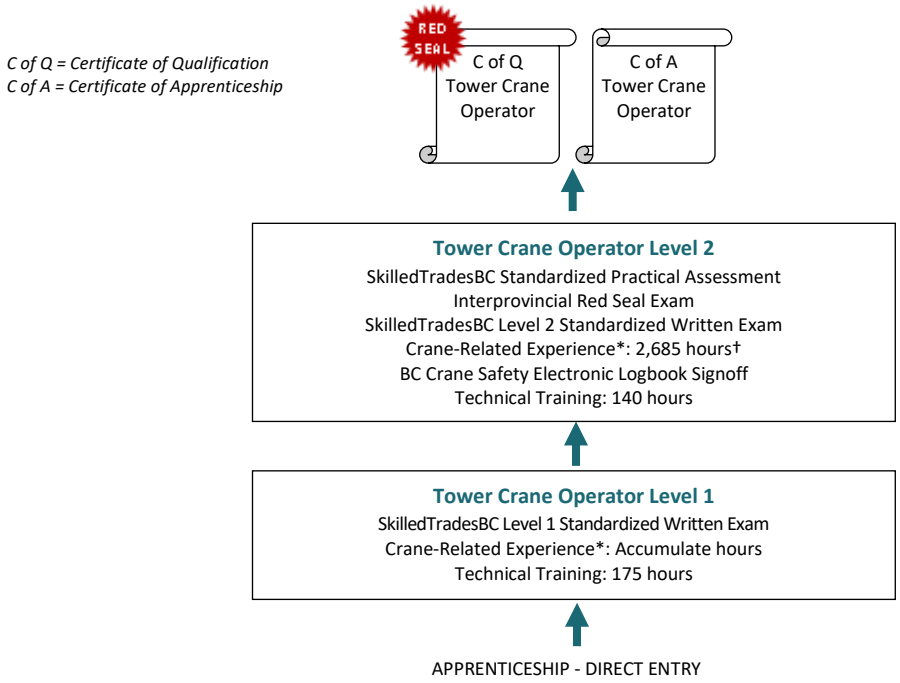
Section 2

PROGRAM OVERVIEW

Tower Crane Operator

Program Credentialing Model

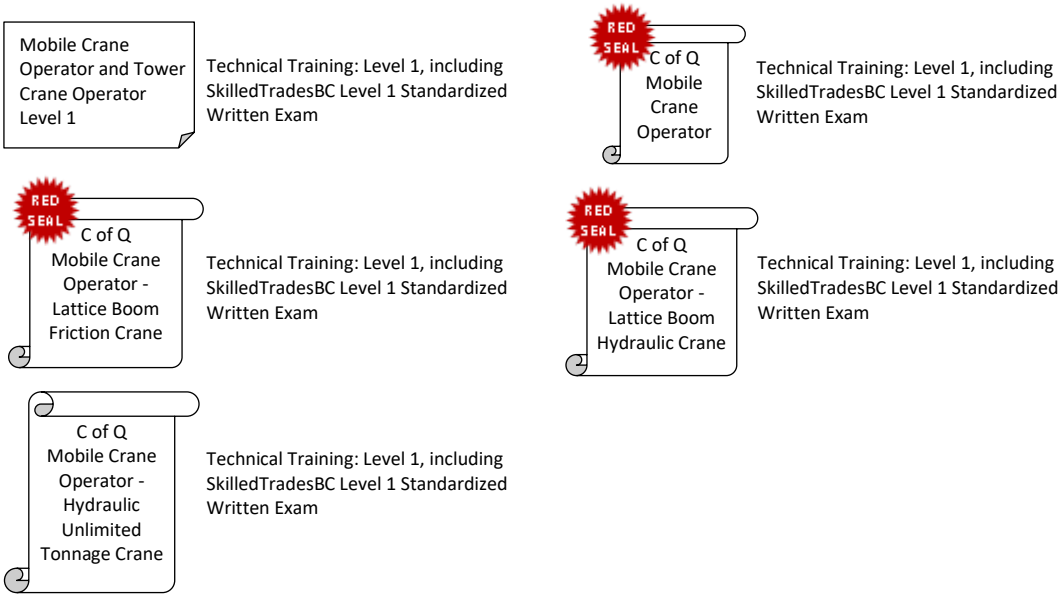
This graphic provides an overview of the Tower Crane Operator apprenticeship pathway.



**Crane-related experience as entered in the operator's BC Crane Safety electronic logbook*
†The 2,685 hours include:

- A minimum of 1,000 hours of documented rigging time
- A minimum of 1,000 hours operating tower crane equipment with a minimum mast height of 90 ft.

CROSS-PROGRAM CREDITS
Individuals who hold certification or partial credit in a crane program and plan to move to an alternate crane program



Occupational Analysis Chart

TOWER CRANE OPERATOR

Occupation Description: "Tower Crane Operator" means a person who operates tower cranes (including luffing jib and articulated jib tower cranes) to perform lifts and hoist loads, and has experience with rigging practices and procedures.

USE COMMON OCCUPATIONAL SKILLS **A**	Comply with regulations, policies, and manufacturers' manuals A1	Maintain a safe working environment A2	Follow emergency procedures A3	Awareness of energized systems A4	Practice effective worksite communications A5
	1	1	1	1	1 2
DEFINE CRANE TYPES AND TERMINOLOGY **B**	Define crane types B1	Use crane terminology B2			
	1	1			
DEFINE SYSTEMS AND COMPONENTS **C**	Describe structural, mechanical, and electrical system components and functions C1	Describe support equipment components and functions C2	Describe track (rail) travel components and functions C3	Describe cab, safety, and access components and functions C4	
	1	1	1	1	
USE RIGGING **D**	Identify types of slings and rigging hardware D1	Inspect slings and rigging hardware D2	Maintain and store slings and rigging hardware D3	Perform rigging D4	
	1	1	1	1 2	
PERFORM HOISTING CALCULATIONS **E**	Determine load weights E1	Use a crane capacity chart E2			
	1 2	1 2			

PERFORM CRANE INSPECTION AND MAINTENANCE F	Use tools for basic crane maintenance F1	Perform basic crane maintenance F2	Identify pre-operational inspection components F3	Perform pre-operational inspection F4	Inspect, maintain, and use crane wire rope F5
	1	1	1	1 2	1
PLAN A LIFT G	Describe ordinary lift planning G1	Perform engineered and critical lift plan G2			
	1	2			
PERFORM COMMON CRANE OPERATIONS H	Interpret operator manuals H1	Perform tower crane operations and hoisting techniques H2	Monitor conditions H3	Secure crane H4	
	1	1 2	1	1	
DESCRIBE TOWER CRANE ASSEMBLY, DISASSEMBLY, RECONFIGURATION, AND TRANSPORT I	Describe assembly and raising procedures for a bottom climbing tower crane I1	Describe assembly and raising procedures for a top climbing tower crane I2	Describe crane reconfiguration I3	Describe assembly, disassembly, and transport of a self-erect tower crane I4	
	2	2	2	2	
USE SPECIALIZED OPERATIONS J	Operate with a suspended work platform J1	Perform engineered and critical lifts J2	Perform multiple crane lifts J3		
	1 2	2	2		

Training Topics and Suggested Time Allocation – Level 1

TOWER CRANE OPERATOR – LEVEL 1

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line A	**USE COMMON OCCUPATIONAL SKILLS**	**13%**	**80%**	**20%**	**100%**
A1	Comply with regulations, policies, and manufacturers' manuals		✓		
A2	Maintain a safe working environment		✓	✓	
A3	Follow emergency procedures		✓		
A4	Awareness of energized systems		✓		
A5	Practice effective worksite communications		✓	✓	
Line B	**DEFINE CRANE TYPES AND TERMINOLOGY**	**5%**	**80%**	**20%**	**100%**
B1	Define crane types		✓		
B2	Use crane terminology		✓		
Line C	**DEFINE SYSTEMS AND COMPONENTS**	**11%**	**70%**	**30%**	**100%**
C1	Describe structural, mechanical, and electrical system components and functions		✓		
C2	Describe support equipment components and functions		✓		
C3	Describe track (rail) travel components and functions		✓		
C4	Describe cab, safety, and access components and functions		✓		
Line D	**USE RIGGING**	**16%**	**60%**	**40%**	**100%**
D1	Identify types of slings and rigging hardware		✓	✓	
D2	Inspect slings and rigging hardware		✓	✓	
D3	Maintain and store slings and rigging hardware		✓	✓	
D4	Perform rigging		✓	✓	
Line E	**PERFORM HOISTING CALCULATIONS**	**17%**	**80%**	**20%**	**100%**
E1	Determine load weights		✓		
E2	Use a crane capacity chart		✓	✓	
Line F	**PERFORM CRANE INSPECTION AND MAINTENANCE**	**22%**	**70%**	**30%**	**100%**
F1	Use tools for basic crane maintenance		✓	✓	
F2	Perform basic crane maintenance		✓	✓	
F3	Identify pre-operational inspection components		✓		
F4	Perform pre-operational inspection		✓	✓	
F5	Inspect, maintain, and use crane wire rope		✓	✓	
Line G	**PLAN A LIFT**	**2%**	**80%**	**20%**	**100%**
G1	Describe ordinary lift planning		✓		
Line H	**PERFORM COMMON CRANE OPERATIONS**	**13%**	**50%**	**50%**	**100%**
H1	Interpret operator manuals		✓		
H2	Perform tower crane operations and hoisting techniques		✓	✓	
H3	Monitor conditions		✓	✓	
H4	Secure crane		✓	✓	
Line J	**USE SPECIALIZED OPERATIONS**	**1%**	**80%**	**20%**	**100%**
J1	Operate with a suspended work platform		✓		
	Total Percentage for Tower Crane Operator Level 1	**100%**			

Training Topics and Suggested Time Allocation – Level 2

TOWER CRANE OPERATOR – LEVEL 2

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line A	**USE COMMON OCCUPATIONAL SKILLS**	**4%**	**100%**	**0%**	**100%**
A5	Practice effective worksite communications		✓		
Line D	**USE RIGGING**	**13%**	**20%**	**80%**	**100%**
D4	Perform rigging		✓	✓	
Line E	**PERFORM HOISTING CALCULATIONS**	**9%**	**20%**	**80%**	**100%**
E1	Determine load weights		✓	✓	
E2	Use a crane capacity chart		✓	✓	
Line F	**PERFORM CRANE INSPECTION AND MAINTENANCE**	**11%**	**20%**	**80%**	**100%**
F4	Perform pre-operational inspection		✓	✓	
Line G	**PLAN A LIFT**	**3%**	**50%**	**50%**	**100%**
G2	Perform engineered and critical lift plan		✓	✓	
Line H	**PERFORM COMMON CRANE OPERATIONS**	**31%**	**10%**	**90%**	**100%**
H2	Perform tower crane operations and hoisting techniques		✓	✓	
Line I	**DESCRIBE TOWER CRANE ASSEMBLY, DISASSEMBLY, RECONFIGURATION, AND TRANSPORT**	**14%**	**90%**	**10%**	**100%**
I1	Describe assembly and raising procedures for a bottom climbing tower crane		✓		
I2	Describe assembly and raising procedures for a top climbing tower crane		✓		
I3	Describe crane reconfiguration		✓		
I4	Describe assembly, disassembly, and transport of a self-erect tower crane		✓		
Line J	**USE SPECIALIZED OPERATIONS**	**15%**	**60%**	**40%**	**100%**
J1	Operate with a suspended work platform		✓	✓	
J2	Perform engineered and critical lifts		✓	✓	
J3	Perform multiple crane lifts		✓		
	Total Percentage for Tower Crane Operator Level 2	**100%**			

Section 3

PROGRAM CONTENT

Tower Crane Operator

Level 1

Tower Crane Operator

Line (GAC): A USE COMMON OCCUPATIONAL SKILLS

Competency: A1 Comply with regulations, policies, and manufacturers' manuals

Objectives

To be competent in this area, the individual must be able to:

- Locate information related to crane operations from government regulations, manufacturers' manuals, and training provider references and policies.

LEARNING TASKS	CONTENT
1. Describe and identify the structure and general content of books, manuals, and sources of information related to crane operations	• Current regulations and standards • WorkSafeBC regulations • Workers compensation act • Canadian Standards Association (CSA) Z248 • IHSA Hoisting and Rigging Safety Manual • IPT training manual • Manufacturers' manuals including user and maintenance manuals • Training provider training references and policies • ASME standards
2. Locate, identify, interpret, and use specific items of information in documents related to crane operations	• Safe operating practices • Safety devices • Crane load charts • Crane set-up instructions • Documentation

Line (GAC): A USE COMMON OCCUPATIONAL SKILLS

Competency: A2 Maintain a safe working environment

Objectives

To be competent in this area, the individual must be able to:

- Work safely at the work site in accordance with Occupational Health and Safety Regulations, site policies, and training provider policies.

LEARNING TASKS	CONTENT
1. Identify the operator's responsibilities in maintaining a safe work environment	• Qualified operator • Full control of equipment controls • Hoist within limits • Safe handling of loads/right to refuse • Secure loads • Safe use and operation of equipment
2. Understand how to maintain and when to remove PPE from service	• Hard hat • Boots • Eyewear • Hearing protection • Fall protection • High-visibility clothing

3. Describe safe crane set-up	• Blocking (Self-erect)
	• Crane contact prevention/zone limiting devices
	• Swing hazard
	• Traffic and pedestrians
	• Crane as per manufacturers' specifications
	  ○ Level (Self-erect)
	  ○ Configuration

4. Use documentation	• Safety
	  ○ Crane-specific fall protection plan
	  ○ Blind lift procedures
	  ○ Equipment lock-out procedures
	  ○ Overlap procedure
	  ○ FLRA
	  ○ Incident report
	  ○ Notification to supervision
	  ○ 30M33 – limits of approach
	  ○ SDS

LEARNING TASKS	CONTENT
	○ High angle rescue – THARRP (Technical high angle rope rescue program) ○ AAF (Aeronautical assessment form) • Crane ○ Logbook ○ Maintenance request ○ NDT documentation ○ Lift plan – Critical lifts – Engineered lifts ○ Rigging and attachments certification ○ Erection report
5. Identify potential hazards	• Unsafe workplace conditions ○ Energy source hazards ○ Site ○ Obstructions ○ Mobile machinery hazards ○ Rotating equipment hazards ○ Hydraulic fluid ○ Access hazards – Guardrails – Ladders – Platforms ○ Environmental conditions • Regulations • Manufacturers' manuals • Employer policy
6. Use the 3-point contact method when climbing ladder	• Manufacturer specific access systems • Handholds and step ladders • Security of components • Safe access to equipment
7. Incident and equipment failure reporting	• Reporting procedures • Report within allotted time • Employer requirements • WorkSafeBC requirements

Line (GAC): A USE COMMON OCCUPATIONAL SKILLS

Competency: A3 Follow emergency procedures

Objectives

To be competent in this area, the individual must be able to:

- Follow emergency procedures in accordance with Occupational Health and Safety Regulations, site policies, and training provider policies.

LEARNING TASKS	CONTENT

1. Describe recommended fire safety procedures	• Fire extinguishers
	  ○ Types and capacities
	  ○ Servicing
	  ○ Use
	• Fighting electrical fires
	  ○ Power isolation
	  ○ Appropriate firefighting equipment
	• Fire emergency response and evacuation procedures in accordance with industry practice

2. Describe recommended first-aid procedures	• First aid kit • Air horn • Radio
3. State the requirements for fall protection training on the worksite	• WorkSafeBC regulations • Employer policy
4. State the procedure for an emergency rescue from a crane	• DEP (Dedicated Evacuation Platform) rescue procedure • High angle rescue procedure • Call 911

Line (GAC): A USE COMMON OCCUPATIONAL SKILLS

Competency: A4 Awareness of energized systems

To be competent in this area, the individual must be able to:

- Define the limits of approach on how to operate a crane in proximity to energized equipment.
- Assess and determine safest operating procedures.
- Identify safeguards and regulations when operating near energized equipment.
- Review applicable limits of approach document.

LEARNING TASKS	CONTENT
1. Describe the procedures for operating in proximity of energized equipment	• Limits of approach • Required documentation • Assurance in writing • Tag lines • Nature of electricity • Electrical control panels • Powerline guarding
2. Define safe limits of approach to energized equipment	• Power Authority • WorkSafeBC regulations
3. Describe the procedures recommended in the event of contact with energized equipment	• Safe exit (if possible) • Remain at a safe distance • Contact proper authorities
4. State the procedure for reporting contact with energized equipment	• WorkSafeBC regulations • Call the Power Authority
5. Interpret signage related to energized equipment	• WorkSafeBC regulations • Limits of approach signage • Line voltage
6. Review applicable limits of approach document	• WorkSafeBC regulations • Associated Power Authority

Line (GAC): A USE COMMON OCCUPATIONAL SKILLS

Competency: A5 Practice effective worksite communications

Objectives

To be competent in this area, the individual must be able to:

- Demonstrate hand signals.
- Demonstrate use of radio crane communication.

LEARNING TASKS	CONTENT
1. Explain the requirements for a signaller	• Accurate descriptions • Identification and interpretation • Signal relaying for a blind lift • Regulations

2. Describe personnel involved in crane operations	• Crane operator
	• Signal person
	• Site supervisor
	• Rigger
	  ○ Definitions
	  – Qualified
	  – Competent
	• Construction Safety Officer (CSO)

3. Interpret worksite audio signals	• Horn signals
4. Demonstrate and interpret standard hand signals used during crane operations	• WorkSafeBC regulations
5. Demonstrate the use of two-way electronic voice communication devices	• Regulations ○ Designated frequency • Worksite procedure • Basic functions of the radio communication devices • Language and terminology • Requirement to stop operation due to lost contact or interference
6. Demonstrate effective oral communications	• Listening skills • Tact • Diplomacy • Assertiveness

LEARNING TASKS	CONTENT
7. Demonstrate effective written communications	• Report writing • Recording • Logbook • Communication plan • FLRA • Critical lift

Achievement Criteria

Performance	The learner will be able to direct a crane with hand signals and radio communications.
Conditions	The learner will be given • Regulations • A crane to direct (operated by qualified operator) • Radio.
Criteria	The learner will be evaluated on • Correct use of hand signals and radio communication etiquette.

Line (GAC): B DEFINE CRANE TYPES AND TERMINOLOGY

Competency: B1 Define crane types

Objectives

To be competent in this area, the individual must be able to:

- Identify common crane types.

LEARNING TASKS	CONTENT

1. Identify types of tower cranes	• Hammerhead
	  ○ Flat top
	• Luffing jib
	  ○ Articulating
	• Self-erect cranes

2. Identify crane type for scope of work	• Site conditions
	  ○ Air rights
	  ○ Proximity to obstructions

Line (GAC): B DEFINE CRANE TYPES AND TERMINOLOGY

Competency: B2 Use crane terminology

Objectives

To be competent in this area, the individual must be able to:

- Interpret common crane terminology.

LEARNING TASKS	CONTENT
1. Define terms related to tower cranes components	• Wire rope assemblies • Fittings • Drums • Hooks • Sheaves • Block • Winch • Slew • Hoists • Trolley • Luffing • Jib • Counter Jib • Pendants • Anti-collision systems • Centre of gravity • Electrical • Apex • Mast • Machine deck • Counterweight • Superstructure • Cab • Outrigger • Ballast • Climbing unit • Tie-back collar

2. Interpret terms related to load charts	• Load
	  ○ Net
	  ○ Gross
	• Capacity
	  ○ Net
	  ○ Gross
	• Jib angle
	• Jib length
	• Radius
	• Parts of line

Line (GAC): C DEFINE SYSTEMS AND COMPONENTS

Competency: C1 Describe structural, mechanical, and electrical system components and functions

Objectives

To be competent in this area, the individual must be able to:

- Describe the function of structural components.
- Describe the function of mechanical components.
- Describe the function of electrical components.

LEARNING TASKS	CONTENT
1. Describe structural components	• Manufacturers' manual • Mast • Jib • Luffing boom • Apex • Gantry • Counter jib • Pendant lines • Base/foundation design • Base components • Climbing components ○ Hydraulic • Anchor • Tower bolts • Jib pins • Turntable • Bolts • Counterweights • Trolley • Block • Chassis • Pins • Keepers
2. Describe the function of structural components	• Manufacturers' manual • Positioning • Stability • Mechanical advantage • Configuration

LEARNING TASKS	CONTENT

3. Describe mechanical components	• Manufacturers' manual
	• Mechanical safety devices
	• Trolley and hoisting components
	  ○ Winches
	  ○ Sheaves
	  ○ Brakes
	  – Electric
	  – Hydraulic
	  ○ Gear boxes
	  ○ Guide rollers
	  ○ Hook block
	• Slewing components
	  ○ Swing motors
	  ○ Ring gears
	  ○ Gear boxes
	  ○ Swing brakes
	• Luffing components
	  ○ Luffing winch
	  ○ Sheaves
	  ○ Brakes
	  ○ Gear boxes

4. Describe the function of mechanical components	• Manufacturers' manual • Hoisting load • Travelling crane • Rotating crane
5. Describe electrical components	• Manufacturers' manual • Limit switches • Grounding • Supply cables • Disconnect switches • Crane control panels • Strain relief devices ○ Power cable supports • Power supply • Zoning and anti-collision component • Slip ring (collector)
6. Describe the function of electrical components	• Manufacturers' manual • Safe operation • Providing power to electrical systems • Providing method of controlling electrical systems

Line (GAC): C DEFINE SYSTEMS AND COMPONENTS

Competency: C2 Describe support equipment components and functions

Objectives

To be competent in this area, the individual must be able to:

- Describe the function of support components.

LEARNING TASKS	CONTENT
1. Describe support components	• Manufacturers' manual • Outriggers ○ Self-erect tower crane • Arms • Support mechanisms • Beams • Wedges • Shoring • Ladders • Hydraulic pumps • Support arms • Tie-ins • Anchor shoes • Collars • Chassis • Cross base • Ballast
2. Describe the function of support components	• Manufacturers' manual • Increasing lifting capacity • Providing a stable base • Levelling

Line (GAC): C DEFINE SYSTEMS AND COMPONENTS

Competency: C3 Describe track (rail) travel components and functions

Objectives

To be competent in this area, the individual must be able to:

- Describe the function of track (rail) travel components.

LEARNING TASKS	CONTENT
1. Describe track (rail) travel components	• Manufacturers' manual • Stops • Ballast • Limit switches • Structural supports • Rail trucks (bogies) • Rail wheels • Rail stops • Ties • Clamps • Track • Spikes • Travelling undercarriage wheel brakes • Wheel guards • Electrical cable components • Tie-downs
2. Describe the function of track (rail) travel components	• Manufacturers' manual • Stability • Mechanical advantage • Mobility

Line (GAC): C DEFINE SYSTEMS AND COMPONENTS

Competency: C4 Describe cab, safety, and access components and functions

Objectives

To be competent in this area, the individual must be able to:

- Describe the function of cab, safety, and access components.

LEARNING TASKS	CONTENT
1. Describe cab components	• Manufacturers' manual • Load Moment Indicator (LMI) • Control levers • Validation of movement button (deadman switch) • Windows • Foot pedals • Anemometer • Windshield wipers • Gauges • Cab door • Heating and air conditioning • Display for anti-collision system • Thermometer • Radio • Horn
2. Describe the function of cab components	• Manufacturers' manual • Safe operation • Working conditions
3. Describe access components	• Manufacturers' manual • Ladders • Hatches • Platforms • Railings • Catwalks • Anchorage points • Guards over moving parts • Fall restraint systems • Safety alarms • Latches

LEARNING TASKS	CONTENT
	• Locks • Trolley basket
4. Describe the function of access components	• Manufacturers' manual • WorkSafeBC regulations • Safe operation

5. Describe safety components and devices	• Manufacturers' manual
	• Zoning and anti-collision devices
	• Deadman switch
	• Safety guards
	• Covers
	• Load weighing devices
	  ○ LMI
	  ○ Load indicator
	  ○ Rated capacity indicator
	  ○ Rated capacity (load) limiter
	• Jib angle indicator
	• Jib stops
	• Drum rotation indicator
	• Limit switches
	• Emergency stop buttons

6. Describe the function of safety components and devices	• Manufacturers' manual • Prevent overloading of crane components • Ensure crane movement is within manufacturers' specification • Prevent inadvertent movement

Line (GAC): D USE RIGGING

Competency: D1 Identify types of slings and rigging hardware

Objectives

To be competent in this area, the individual must be able to:

- Identify slings and rigging hardware.

LEARNING TASKS	CONTENT
1. Identify sling types	• Chain • Wire rope • Synthetic web • Synthetic rope • Synthetic round
2. Identify hitch configurations	• Vertical • Choker • Basket • Bridle

3. Identify rigging hardware	• Hooks
	• Shackles
	• Eye bolts
	• Hoist rings
	• Turnbuckles
	• Cable clamps
	• Softeners/sling protection
	• Lifting clamps
	• Below hook lifting device
	• Specialty attachments
	  ○ Pallet forks
	  ○ Spreader beams
	  ○ Engineered

4. Interpret the manufacturers' ID tag and manuals for slings and rigging hardware	• Correct usage • Capacities • User warnings • Temperature restrictions

Line (GAC): D USE RIGGING

Competency: D2 Inspect slings and rigging hardware

Objectives

To be competent in this area, the individual must be able to:

- Inspect slings and rigging hardware.
- Identify rejection criteria for slings and rigging hardware.

LEARNING TASKS	CONTENT
1. Describe the inspection for slings and rigging hardware	• Regulations • Manufacturers' manuals • Employer policy • Rejection criteria

2. Inspect slings and rigging hardware for defects	• Regulations
	• Manufacturers' manuals
	• Employer policy
	• Criteria
	  ○ Inspection
	  ○ Rejection

3. Describe procedure for removing damaged slings and/or rigging hardware from service	• Regulations • Manufacturers' manuals • Employer policy
4. Report damaged slings and rigging hardware to appropriate personnel	• Requirements for reporting defects • Regulations • Manufacturers' manuals • Employer policy

Achievement Criteria

Performance — The learner will be able to inspect rigging components

Conditions — The learner will be given:

- Rigging to inspect
- Regulations and standards
- Manufacturers' manual (when required)

Criteria — The learner will be evaluated on:

- Ability to identify rejection criteria, including defects
- Removing damaged or defective parts from service if required
- Following proper recording and reporting procedures

Line (GAC): D USE RIGGING

Competency: D3 Maintain and store slings and rigging hardware

Objectives

To be competent in this area, the individual must be able to:

- Describe proper storage and maintenance of slings and rigging hardware.

LEARNING TASKS	CONTENT

1. Describe how to perform routine maintenance on slings	• Regulations
	• Manufacturers' manual
	• Employer policy
	• Wire rope
	  ○ Lubrication
	• Synthetic
	• Chain
	  ○ Record testing
	• Environmental conditions

2. Describe how to perform routine maintenance on various types of rigging hardware	• Regulations
	• Manufacturers' manual
	• Employer policy
	• Common
	  ○ Shackles
	  ○ Hooks
	  – Latch repair
	• Below hook lifting devices
	• Environmental conditions

3. Describe the criteria for storing slings and rigging hardware	• Regulations • Manufacturers' manual • Employer policy • Environmental conditions

Line (GAC): D USE RIGGING

Competency: D4 Perform rigging

Objectives

To be competent in this area, the individual must be able to:

- Determine rigging capacity.
- Determine rigging appropriate for load composition.
- Perform rigging on a basic load.

LEARNING TASKS	CONTENT
1. Determine load weight	• Marked on load • Documents • Calculations
2. Identify centre of gravity	• Centre of gravity theory • Mark on load • Documents

3. Determine sling type, hardware, and capacity	• Regulations
	• Manufacturers' manual
	• Employer policy
	• Weight of load
	• Working Load Limit (WLL) calculations
	  ○ Sling angle
	  ○ Number of slings
	  ○ Type of hitches
	• Manufacturers' ID tag
	• Rigging guides
	• Manual calculations

4. Verify any special lift instructions	• Lift plan
	  ○ Engineered
	  ○ Critical
	• Supplier specifications

5. Perform rigging	• Regulations • Manufacturers' manual • Employer policy • Lift plan • Rigging

Achievement Criteria

Performance	The learner will be able to rig a basic load.
Conditions	The learner will be given • Regulations • Hoisting device • Rigging • Lift plan • Load.
Criteria	The learner will be evaluated on • Rigging the load as per regulations and industry standards.

Line (GAC): E PERFORM HOISTING CALCULATIONS

Competency: E1 Determine load weights

Objectives

To be competent in this area, the individual must be able to:

- Determine weight of basic-shaped load.
- Determine crane loads.

LEARNING TASKS	CONTENT
1. Demonstrate the functions of a scientific calculator to perform mathematical calculations	• Manufacturers' instructions
2. Perform fundamental mathematical functions	• Formulas • Number rounding • Fraction to decimal conversion • Metric and imperial conversion • Pythagorean theorem
3. Determine and apply formula needed for basic object shapes	• Circumference • Area • Volume
4. Determine ground bearing capacity for a self-erect tower crane	• Supporting surface • Crane force/exertion
5. Identify factors that contribute to load weight	• Ice • Water • Mud • Snow • Load frozen to ground • Submerged load
6. Calculate load weights	• Unit of measurement • Volume of an object • Weight of a cubic unit of an object • Gross weight of a load
7. Verify load weights	• Engineer's drawing • Blueprint • Bill of lading • Calculation

Line (GAC): E PERFORM HOISTING CALCULATIONS

Competency: E2 Use a crane capacity chart

Objectives

To be competent in this area, the individual must be able to:

- Use a hammerhead tower crane capacity chart to determine gross capacity and net capacity for a lift.
- Use a luffing jib tower crane capacity chart to determine gross capacity and net capacity for a lift.

LEARNING TASKS	CONTENT
1. Establish hook radius required to lift a load	• Crane load chart • Net weight of load • Gross weight of load • Parts of line • Gear capacity
2. State the elements of a crane capacity chart	• Boom length/Jib length • Jib angle • Attachments • Radius • Gear capacity • Parts of line
3. Locate information in a crane capacity chart	• Boom length/Jib length • Jib angle • Attachments • Radius • Gear capacity • Parts of line
4. Verify lift is within manufacturers' specifications	• Capacity chart for crane configuration • Weight of the load • Weight of the rigging • Line weight deduction (if applicable) • Gear capacity

Line (GAC): F PERFORM CRANE INSPECTION AND MAINTENANCE

Competency: F1 Use tools for basic crane maintenance

Objectives

To be competent in this area, the individual must be able to:

- Select appropriate tools to perform basic maintenance on a crane.

LEARNING TASKS	CONTENT
1. Identify the tools required to perform basic maintenance	• PPE • Grease gun • Adjustable wrenches • Combination wrenches • Sockets • Mallets • Screwdrivers • Hammers • Vice grips • Pliers • Rags • Pry bars • Ladders • Measuring devices
2. Describe the function of the tools required for basic maintenance	• Manufacturers' manual • Supplier's information • Employer policy
3. Select the appropriate tools for an application	• Manufacturers' manual • Supplier's information • Employer policy

Line (GAC): F PERFORM CRANE INSPECTION AND MAINTENANCE

Competency: F2 Perform basic crane maintenance

Objectives

To be competent in this area, the individual must be able to:

- Perform basic maintenance on a crane.

LEARNING TASKS	CONTENT
1. Describe factors of the operator's maintenance responsibilities	• Regulations • Manufacturers' manual • Employer policy • Environmental
2. Interpret maintenance information from manufacturers' manuals	• Inspection frequency • Servicing schedules • Fluid and lubricant selection • Employer policy

3. Inspect structural components	• Manufacturers' manuals
	  ○ Bolts
	  ○ Wedges
	  ○ Cotter keys
	  ○ Cotter pins
	  ○ Guard rails
	  ○ Welds

4. Perform preventative crane maintenance	• Manufacturers' manuals
	  ○ Grease fittings
	  ○ Open gears
	  ○ Fluid levels
	  ○ Belt maintenance
	  ○ Outrigger and stabilizer maintenance
	  ○ Sheaves
	  ○ Swivels
	  ○ Drums
	  ○ Control mechanisms
	  – Rollers
	  – Cables
	  – Brakes

LEARNING TASKS	CONTENT
5. Clean crane components	• Batteries • Cab • Windows • Excess oil and grease
6. Repair or replace defective components	• Manufacturers' manuals • Employer policy
7. Report defects and deficiencies to supervisor	• Regulations • Employer policy
8. Record maintenance performed and requested in the logbook	• Regulations • Employer policy • Manufacturers' manuals

Line (GAC): F PERFORM CRANE INSPECTION AND MAINTENANCE

Competency: F3 Identify pre-operational inspection components

Objectives

To be competent in this area, the individual must be able to:

- Identify pre-operational inspection components.
- Identify component defects and malfunctions.

1. Identify structural components that require pre-operational inspection	• Manufacturers' manual • Employer policy • Mast • Jib • Luffing jib • Apex • Gantry • Counter jib • Pendant lines • Trolley • Chassis • Hook blocks • Signs • Windsails • Keepers • Base • Base components • Climbing components ○ Hydraulic • Anchor • Tower bolts • Jib pins • Turntable • Bolts • Counterweights • Lighting brackets • Defects and malfunctions
2. Identify mechanical components that require pre-operational inspection	• Manufacturers' manual • Employer policy • Mechanical safety devices • Trolley and hoisting components ○ Winches

- Sheaves
- Brakes
  - Electric
  - Hydraulic
- Gear boxes

- Slewing components
  - Swing motors
  - Ring gears
  - Gear boxes
  - Swing brakes
- Luffing components
  - Luffing winch
  - Sheaves
  - Brakes
  - Gear boxes
- Weather vane
- Defects and malfunctions

3. Identify electrical components that require pre-operational inspection

- Manufacturers' manual
- Employer policy
- Limit switches
- Grounding
- Supply cables
- Disconnect switches
- Crane control panels
- Strain relief devices
  - Power cable supports
- Power supply
- Zoning and anti-collision components
- Slip ring (collector)
- Defects and malfunctions

4. Identify support components that require pre-operational inspection

- Manufacturers' manual
- Employer policy
- Outriggers
  - Self-erect tower crane
- Arms
- Support mechanisms
- Beams
- Wedges
- Shoring
- Ladders

- Hydraulic pumps
- Support arms
- Tie-ins
- Anchor shoes
- Collars
- Defects and malfunctions

5. Identify track (rail) travel components that require pre-operational inspection

- Manufacturers' manual
- Employer policy
- Stops
- Ballast
- Limit switches
- Structural supports
- Rail trucks (bogies)
- Rail wheels
- Rail stops
- Ties
- Clamps
- Track
- Spikes
- Travelling undercarriage wheel brakes
- Wheel guards
- Electrical cable components
- Tie-downs
- Defects and malfunctions

6. Identify cab components that require pre-operational inspection

- Manufacturers' manual
- Employer policy
- LMI
- Control levers
- Deadman switch
- Windows
- Foot pedals
- Anemometer
- Windshield wipers
- Gauges
- Cab door
- Heating and air conditioning
- Display for anti-collision system
- Thermometer
- Radio

- Horn
- Defects and malfunctions

7. Identify access components that require pre-operational inspection

- Manufacturers' manual
- Employer policy
- Ladders
- Hatches
- Platforms
- Railings
- Catwalks
- Anchorage points
- Guards over moving parts
- Fall restraint systems
- Safety alarms
- Latches
- Locks
- Defects and malfunctions

8. Identify safety components and devices that require pre-operational inspection

- Manufacturers' manual
- Employer policy
- Safety guards
- Covers
- Deadman switch
- Load weighing devices
  - LMI
  - Load indicator
  - Rated capacity indicator
  - Rated capacity (load) limiter
- Jib angle indicator
- Jib stops
- Limit switches
- Emergency stop buttons
- Trolley cable safety device
- Drum rotation indicator
- Weather vane
- Defects and malfunctions

Line (GAC): F PERFORM CRANE INSPECTION AND MAINTENANCE

Competency: F4 Perform pre-operational inspection

Objectives

To be competent in this area, the individual must be able to:

- Describe a pre-operational inspection for a:
  - Hammerhead tower crane
  - Luffing jib tower crane
  - Self-erect tower crane
- Perform a basic pre-operational inspection.

LEARNING TASKS	CONTENT
1. State the recommended sequence of inspection	• Manufacturers' manual
2. Verify that all the operator aids for the crane are in place	• Manufacturers' manual
3. Confirm that all reports are completed and filed	• Periodic inspections • Erection reports • WorkSafeBC regulations • Employer policy
4. Confirm that all safety and emergency devices are in place and operational	• Manufacturers' manual • WorkSafeBC regulations
5. Locate all controls and system gauges	• Manufacturers' manual
6. Perform a pre-operational inspection	• Manufacturers' procedures
7. Perform a function test on the operating controls	• Manufacturers' procedures
8. Perform basic repairs and maintenance	• Manufacturers' manual • Employer policy
9. Report any defects or deficiencies to the supervisor	• Manufacturers' manual • Employer policy • WorkSafeBC regulations
10. Record any defects or deficiencies in the crane log book	• Employer policy • WorkSafeBC regulations
11. Record all repairs or maintenance in the appropriate crane log book	• Employer policy • WorkSafeBC regulations

Achievement Criteria

Performance	The learner will be able to perform a basic pre-operational inspection.
Conditions	The learner will be given • Manufacturers' manual • Tower crane (hammerhead or luffing jib)
Criteria	The learner will be evaluated on • Successfully completing basic pre-operation inspection points.

Line (GAC): F PERFORM CRANE INSPECTION AND MAINTENANCE

Competency: F5 Inspect, maintain, and use crane wire rope

Objectives

To be competent in this area, the individual must be able to:

- Describe types and applications of crane wire rope.
- Inspect and maintain crane wire rope.

LEARNING TASKS	CONTENT

1. Describe types of crane wire rope	• Running line
	• Standing line
	• Cable
	  ○ Construction
	  ○ Application
	  ○ Classification

2. Describe crane wire rope applications	• Manufacturers' manual • Regulations • Employer policy
3. Inspect crane wire rope	• Manufacturers' manual • Regulations • Employer policy • Defects and malfunctions
4. Maintain crane wire rope	• Manufacturers' manual • Regulations • Employer policy

Line (GAC): G PLAN A LIFT

Competency: G1 Describe ordinary lift planning

Objectives

To be competent in this area, the individual must be able to:

- Describe ordinary lift planning.

LEARNING TASKS	CONTENT

1. Describe site assessment	• Hazard
	  ○ Identification
	  ○ Minimization
	  ○ Elimination
	• Regulations
	  ○ Limits of approach
	  ○ Supporting surfaces (self-erect)
	  – Load bearing capacity
	  – Size of blocking
	• Access/egress

2. Describe ordinary lift planning	• Manufacturers' manual • Employer policy • Designated load flight path • Regulations
3. State elements of an ordinary lift plan	• Routine to move load • Crane capacity requirements to pick, move and place the load • Load flight path • Signal person • Rigging required
4. State the purpose of site blueprints in preparing an ordinary lift plan	• Placement of load • Placement of crane • Ground bearing capacity of the area • Operating hazards • Overhead obstructions • Load details • Crane capacity requirements to pick, move and place the load • Rigging required

LEARNING TASKS	CONTENT
5. Determine the requirement for communications, signal persons, signallers, traffic control, barriers, grounding, and bonding	• WorkSafeBC regulations • Employer policy • Operating clearance • Traffic control • Pedestrian traffic

Line (GAC): H PERFORM COMMON CRANE OPERATIONS

Competency: H1 Interpret operator manuals

Objectives

To be competent in this area, the individual must be able to:

- Locate information in manufacturers' manual.
- Interpret information in manufacturers' manual.

LEARNING TASKS	CONTENT

1. Locate information in manufacturers' manual	• Inspection
	• Set-up
	• Operation
	  ○ Start up procedure
	  – Limits testing
	  ○ Shut down procedure
	• Safety
	• Maintenance

2. Interpret information in manufacturers' manual	• Inspection
	• Set-up
	• Operation
	  ○ Start up procedure
	  – Limits testing
	  ○ Shut down procedure
	• Safety
	• Maintenance

Line (GAC): H PERFORM COMMON CRANE OPERATIONS

Competency: H2 Perform tower crane operations and hoisting techniques

Objectives

To be competent in this area, the individual must be able to:

- Perform a function test.
- Operate a crane without a load.

LEARNING TASKS	CONTENT
1. Ensure that the supporting surface is adequate (self-erect tower crane)	• Type of blocking and mats (if applicable) • Size of blocking and mats (if applicable) • Travelling base level (if applicable) • Types of soil • Engineer's report
2. Perform crane start-up procedures	• Manufacturers' specifications
3. Verify safety devices working according to manufacturers' recommendations	• Load monitoring and indicating systems • Limit switches • Manufacturers' manuals

4. Describe function test	• Manufacturers' specifications
	• Tip test
	• Inline pull
	• Load moment (when applicable)
	• Max height
	• Anti-collision
	• Swing/slew left
	• Swing/slew right
	• Brakes
	• Luff up (luffing jib)
	  ○ High speed to slow
	  ○ Final
	• Luff down (luffing jib)
	  ○ High speed to slow
	  ○ Final
	• Hoist up
	  ○ High speed to slow
	  ○ Final
	• Hoist down
	  ○ High speed to slow
	  ○ Final
	• Trolley in

LEARNING TASKS	CONTENT
	○ High speed to slow ○ Final • Trolley out ○ High speed to slow ○ Final
5. Perform function test with a load	• Manufacturers' specifications • Tip test • Function test • Load moment • Inline pull • Max height • Anti-collision • Swing/slew left • Swing/slew right • Brakes • Luff up (luffing jib) ○ Slow ○ Final • Luff down (luffing jib) ○ Slow ○ Final • Hoist up ○ High speed to slow ○ Final • Hoist down ○ High speed to slow ○ Final • Trolley in ○ High speed to slow ○ Final • Trolley out ○ High speed to slow ○ Final
6. Operate a crane without a load	• Manufacturers' specifications • Trolley in and out • Swing/slew clockwise and counterclockwise • Hoist up and down • Luff up and down (luffing jib)

Achievement Criteria

Performance	The learner will be able to perform a function test.
Conditions	The learner will be given • Manufacturers' manual • Tower crane (hammerhead or luffing jib) • Regulations
Criteria	The learner will be evaluated on crane function test as per • Manufacturers' manual • Regulations

Line (GAC): H PERFORM COMMON CRANE OPERATIONS

Competency: H3 Monitor Conditions

Objectives

To be competent in this area, the individual must be able to:

- Monitor weather conditions.
- Monitor site conditions.
- Monitor equipment performance and conditions.
- Monitor structural and support components.

LEARNING TASKS	CONTENT

1. Monitor weather conditions	• Manufacturers' specifications
	• Regulations
	• Employer policy
	• Weather conditions
	  ○ Wind
	  – Effects on load
	  ○ Rain
	  ○ Temperature
	  ○ Snow
	  ○ Lightning
	  ○ Hoar frost
	  ○ Fog
	  ○ Humidity
	• Methods of identification
	  ○ Gauges
	  ○ Visual and auditory assessments
	  ○ Weather forecasts

2. Monitor site conditions	• Regulations
	• Employer policy
	• Changes to site
	  ○ New equipment
	  ○ Height of obstructions
	  ○ Overhead obstructions
	  ○ Overlaps of other cranes
	  ○ Excavation of site
	• Ground conditions
	  ○ Bearing surface compaction
	  ○ Standing water
	  ○ Location of underground utilities
	  ○ Grade

LEARNING TASKS	CONTENT
	○ Possible ground disturbances ○ Soil type ○ Ground thaw
3. Monitor equipment performance and conditions	• Manufacturers' specifications • Lines, wire ropes, and hoisting system components ○ Malfunctions • Gauges and warning systems ○ Jib angle indicator • Malfunctions ○ Overheating ○ Vibration ○ Electrical motor failure ○ Debris build-up in sheaves ○ Abnormal smells and noises ○ Ice and snow buildup ○ Brake failure ○ Defective electronic display
4. Monitor structural and support components	• Structural components • Support components • Malfunctions

Line (GAC): H PERFORM COMMON CRANE OPERATIONS

Competency: H4 Secure crane

Objectives

To be competent in this area, the individual must be able to:

- Secure a crane for short term periods.
- Secure a crane for shutdown.

LEARNING TASKS	CONTENT
1. State the procedure for securing a crane for short periods of time	• Duration • Manufacturers' specifications • No load on the hook • Hook elevation • Jib angle (luffing jib) • Power source turned off • Swing brake application (if applicable) • Weathervaning (if applicable)
2. State the procedure for securing a crane for shutdown	• Manufacturers' specifications • No load on the hook • Hook elevation • Jib angle (luffing jib) • Power source turned off • Swing brake application (if applicable) • Weathervaning (if applicable) • Access prevention to crane
3. Perform shutdown procedure	• Shut down and secure equipment as per manufacturer and site policy • Housekeeping tasks • Post-operational inspection

Achievement Criteria

Performance	The learner will be able to secure a crane for short-term periods and shutdown.
Conditions	The learner will be given • Regulations • Employer policy • Manufacturers' manual • Crane.
Criteria	The learner is able to • Perform correct procedure for securing the unattended crane for short-term periods and shutdown.

Line (GAC): J USE SPECIALIZED OPERATIONS

Competency: J1 Operate with a suspended work platform

Objectives

To be competent in this area, the individual must be able to:

- Describe operating with a suspended work platform in a safe and efficient manner in accordance with the lift instructions, manufacturers' recommendations, and WorkSafeBC regulations.

LEARNING TASKS	CONTENT
1. Describe the regulations regarding suspended work platforms	• Regulations • Manufacturers' manual • Employer policy
2. Describe operating with a suspended work platform	• Regulations • Manufacturers' manual • Employer policy • Lift plan

Level 2

Tower Crane Operator

Line (GAC): A USE COMMON OCCUPATIONAL SKILLS

Competency: A5 Practice effective worksite communications

Objectives

To be competent in this area, the individual must be able to:

- Demonstrate effective mentoring techniques and communication practices.

LEARNING TASKS	CONTENT

1. Describe effective mentoring techniques	• Active listening
	• Interpretation of instructions
	• Patience
	• Demonstration of skill or task
	• Learning styles
	• Learning needs
	• Core values
	  ○ Communication
	  ○ Integrity
	  ○ Honesty
	  ○ Commitment
	  ○ Accountability

2. Demonstrate effective communication practices	• Verbal and non-verbal communication • Positive work ethic • Personal responsibilities and attitudes • Harassment and discrimination

Line (GAC): D USE RIGGING

Competency: D4 Perform rigging

Objectives

To be competent in this area, the individual must be able to:

- Determine rigging configuration for a non-symmetrical load.
- Use rigging on a non-symmetrical load.

LEARNING TASKS	CONTENT
1. Determine load weight	• Mark on load • Documents • Calculations
2. Calculate centre of gravity for non-symmetrical load	• Offset centre of gravity theory • Mark on load • Documents • Calculations • Test lift

3. Determine sling type, hardware, and capacity for non-symmetrical load	• Regulations
	• Manufacturers' manuals
	• Employer policy
	• Weight of load
	• WLL calculations
	  ○ Sling angle
	  ○ Number of slings
	  ○ Type of hitches
	• Manufacturers' ID tag
	• Rigging guides
	• Manual calculations

4. Use rigging for non-symmetrical load	• Load weight • Centre of gravity • Capacity ○ Sling type • Hardware
5. Verify any special lift instructions	• Lift plan • Supplier specifications

Achievement Criteria

Performance	The learner will be able to calculate and install rigging on a non-symmetrical load.
Conditions	The learner will be given: • Rigging selection • Non-symmetrical load • Hoisting device.
Criteria	The learner will be evaluated on: • Correct load calculations • Rigging the load as per regulations and industry standards.

Line (GAC): E PERFORM HOISTING CALCULATIONS

Competency: E1 Determine load weights

Objectives

To be competent in this area, the individual must be able to:

- Identify factors contributing to load weights.
- Determine weight of load for a complex-shaped object.

LEARNING TASKS	CONTENT
1. Determine and apply formula needed for complex object shape	• Circumference • Area • Volume
2. Calculate load weights	• Unit of measurement • Volume of an object • Weight of a cubic unit of an object • Gross weight of a load
3. Verify load weights	• Engineer's drawing • Blueprint • Bill of lading • Calculation

Line (GAC): E PERFORM HOISTING CALCULATIONS

Competency: E2 Use a crane capacity chart

Objectives

To be competent in this area, the individual must be able to:

- Use a hammerhead tower crane capacity chart to determine gross capacity, net capacity, and maximum radius for a lift.
- Use a luffing jib tower crane capacity chart to determine gross capacity, net capacity, and maximum radius for a lift.

LEARNING TASKS	CONTENT
1. Establish hook radius required to lift a load	• Crane load chart • Net weight of load • Gross weight of load • Parts of line • Gear capacity
2. State the elements of a crane capacity chart	• Boom length/Jib length • Jib angle • Attachments • Radius • Gear capacity • Parts of line
3. Locate information in a crane capacity chart	• Boom length/Jib length • Jib angle • Attachments • Radius • Gear capacity • Parts of line
4. Verify lift is within manufacturers' specifications	• Capacity chart for crane configuration • Weight of the load • Weight of the rigging • Line weight deduction (if applicable) • Gear capacity

Achievement Criteria

Performance	The learner will be able to use a crane capacity chart to determine gross capacity, net capacity, and maximum radius for a lift
Conditions	The learner will be given • Crane capacity chart • Calculator
Criteria	The learner will be evaluated on • Ability to interpret a crane capacity chart • Ability to verify lift is within manufacturers' specifications

Line (GAC): F PERFORM CRANE INSPECTION AND MAINTENANCE

Competency: F4 Perform pre-operational inspection

Objectives

To be competent in this area, the individual must be able to:

- Perform a complete pre-operational inspection.

LEARNING TASKS	CONTENT
1. State the recommended sequence of inspection	• Manufacturers' manual
2. Verify that all the operator aids for the crane are in place	• Manufacturers' manual
3. Confirm that all reports are completed and filed	• Periodic inspections • Erection reports • WorkSafeBC regulations • Employer policy
4. Confirm that all safety and emergency devices are in place and operational	• Manufacturers' manual • WorkSafeBC regulations
5. Locate all controls and system gauges	• Manufacturers' manual
6. Perform a pre-operational inspection	• Manufacturers' procedures
7. Perform a function test on the operating controls	• Manufacturers' procedures
8. Perform basic repairs and maintenance	• Manufacturers' manual • Employer policy
9. Report any defects or deficiencies to the supervisor	• Manufacturers' manual • Employer policy • WorkSafeBC regulations
10. Record any defects or deficiencies in the crane log book	• Employer policy • WorkSafeBC regulations
11. Record all repairs or maintenance in the appropriate crane log book	• Employer policy • WorkSafeBC regulations

Achievement Criteria

Performance	The learner will be able to perform a complete pre-operational inspection.
Conditions	The learner will be given • Manufacturers' manual • Tower crane (hammerhead or luffing jib)
Criteria	The learner will be evaluated on • Successfully completing all pre-operation inspection points.

Line (GAC): G PLAN A LIFT

Competency: G2 Perform engineered and critical lift plan

Objectives

To be competent in this area, the individual must be able to:

- Perform engineered and critical lift planning.

LEARNING TASKS	CONTENT

1. Describe site assessment	• Hazard
	  ○ Identification
	  ○ Minimization
	  ○ Elimination
	• Regulations
	  ○ Limits of approach
	  ○ Supporting surfaces (self-erect)
	  – Load bearing capacity
	  – Size of blocking
	• Access/egress

2. Describe engineered and critical lift planning	• Manufacturers' manual • Employer policy • Designated load flight path • Regulations
3. State elements of engineered and critical lift plans	• Identified lift planning personnel • Crane capacity requirements to pick, move, and place the load • Load flight path • Signed by operator • Signed by lift plan supervisor • Signed by rigger • Signal person • Rigging required
4. State the purpose of an engineered drawing in preparing an engineered and critical lift plan	• Placement of load • Placement of crane • Ground bearing capacity of the area • Operating hazards • Overhead obstructions • Load details

LEARNING TASKS	CONTENT
	• Crane capacity requirements to pick, move, and place the load • Rigging required
5. Determine the requirement for communications, signal persons, signallers, traffic control, barriers, grounding and bonding	• WorkSafeBC regulations • Employer policy • Operating clearance • Traffic control • Pedestrian traffic
6. Complete a critical lift plan	• Regulations • Employer policy

Achievement Criteria

Performance	The learner will be able to complete a critical lift plan.
Conditions	The learner will be given • Regulations • Employer policy • Critical lift scenario.
Criteria	The learner will be evaluated on • Compliance with regulations and/or employer policy.

Line (GAC): H PERFORM COMMON CRANE OPERATIONS

Competency: H2 Perform tower crane operations and hoisting techniques

Objectives

To be competent in this area, the individual must be able to:

- Perform a function test.
- Operate a crane with a load.

LEARNING TASKS	CONTENT
1. Ensure that the supporting surface is adequate (self-erect tower crane)	• Type of blocking and mats (if applicable) • Size of blocking and mats (if applicable) • Travelling base level (if applicable) • Types of soil • Engineer's report
2. Perform crane start-up procedures	• Manufacturers' specifications
3. Verify safety devices working according to manufacturers' recommendations	• Load monitoring and indicating systems • Limit switches • Manufacturers' manuals

4. Perform function test	• Manufacturers' specifications
	• Tip test
	• Inline pull
	• Load moment (when applicable)
	• Max height
	• Anti-collision
	• Swing/slew left
	• Swing/slew right
	• Brakes
	• Luff up (luffing jib)
	  ○ High speed to slow
	  ○ Final
	• Luff down (luffing jib)
	  ○ High speed to slow
	  ○ Final
	• Hoist up
	  ○ High speed to slow
	  ○ Final
	• Hoist down
	  ○ High speed to slow

LEARNING TASKS	CONTENT
	○ Final • Trolley in ○ High speed to slow ○ Final • Trolley out ○ High speed to slow ○ Final
5. Operate a crane with a load	• Trolley in and out • Boom up and down • Swing/slew left and right • Hoist up and down • Luff up and down (luffing jib)
6. Maintain control of the hook block during all functions	• Trolley in and out • Swing/slew clockwise and counterclockwise • Hoist up and down • Luff up and down (luffing jib)
7. Monitor equipment performance	• Unusual noises/vibrations • Operator aids
8. Troubleshoot equipment problems	• Manufacturers' manuals
9. Move the load to the destination	• Safe load lifting and placement • Secure load before unhooking
10. Perform a post-operational procedure	• Employer policy

Achievement Criteria

Performance	The learner will be able to operate a tower crane with a load.
Conditions	The learner will be given • Tower crane (hammerhead or luffing jib) • Load • Manufacturers' manual • Regulations.
Criteria	The learner will be evaluated on crane operation as per • Safe hoisting technique • Industry best practices • Manufacturers' manual • Regulations.

Line (GAC): I DESCRIBE TOWER CRANE ASSEMBLY, DISASSEMBLY, RECONFIGURATION, AND TRANSPORT

Competency: I1 Describe assembly and raising procedures for a bottom climbing tower crane

Objectives

To be competent in this area, the individual must be able to:

- Describe procedures to assemble and raise a bottom climbing tower crane in accordance with manufacturers' specifications.

LEARNING TASKS	CONTENT

1. Locate information in manufacturers' manuals	• Assembly and raising procedures
	• Erection procedure and sequence
	• Balancing requirements during raising
	• Inspection of raising components
	• Wind speed limitations
	  ○ Operation
	  ○ Change of configuration
	  ○ Comparison to WorkSafeBC regulation
	  ○ Other
	• Ballast (counterweight) composition

2. Interpret information in manufacturers' manuals	• Assembly and raising procedures
	• Erection procedure and sequence
	• Balancing requirements during raising
	• Inspection of raising components
	• Wind speed limitations
	  ○ Operation
	  ○ Change of configuration
	  ○ Comparison to WorkSafeBC regulation
	  ○ Other
	• Ballast (counterweight) composition

3. List components of a bottom climbing tower crane	• Hydraulic components
	• Jacking components
	• Electrical system components
	  ○ Power cables
	  ○ Grounding
	• Tie-in assembly
	• Wedges
	• Safety devices

LEARNING TASKS	CONTENT
4. Describe assembly procedures for a bottom climbing tower crane	• Manufacturers' manual • Erection procedure and sequence • Qualified personnel • Written procedure • Communication procedure • Required inspection reports

5. List function tests that are required prior to operation	• Limiting devices
	  ○ Trolley
	  ○ Hoist
	  ○ Overload
	  ○ Luff
	• Load weighing devices
	• Operator aids
	• Safety devices

Line (GAC): I DESCRIBE TOWER CRANE ASSEMBLY, DISASSEMBLY, RECONFIGURATION, AND TRANSPORT

Competency: I2 Describe assembly and raising procedures for a top climbing tower crane

Objectives

To be competent in this area, the individual must be able to:

- Describe procedures to assemble and raise a top climbing tower crane in accordance with manufacturers' specifications.

LEARNING TASKS	CONTENT
1. Locate information in manufacturers' manuals	• Assembly and raising procedures • Erection procedure and sequence • Balancing requirements during raising • Inspection of raising components • Wind speed limitations • Ballast (counterweight) composition
2. Interpret information in manufacturers' manuals	• Assembly and raising procedures • Erection procedure and sequence • Balancing requirements during raising • Inspection of raising components • Wind speed limitations • Ballast (counterweight) composition
3. Describe components of a top climbing tower crane	• Climbing frame • Hydraulic components • Electrical system components • Power cables • Tie-in assembly • Safety devices
4. Describe assembly procedures for a top climbing tower crane	• Manufacturers' manual • Erection procedure and sequence • Qualified personnel • Written procedure • Communication procedure • Required inspection reports

5. Describe function tests that are required prior to operation	• Limiting devices
	  ○ Trolley
	  ○ Hoist
	  ○ Overload
	  ○ Luff
	• Load weighing devices
	• Operator aids
	• Safety devices

Line (GAC): I DESCRIBE TOWER CRANE ASSEMBLY, DISASSEMBLY, RECONFIGURATION, AND TRANSPORT

Competency: I3 Describe crane reconfiguration

Objectives

To be competent in this area, the individual must be able to:

- Describe crane reconfiguration.

LEARNING TASKS	CONTENT
1. Locate and interpret information in manufacturers' manuals	• Reconfiguration procedure and sequence • Engineered specifications
2. Describe procedures for reconfiguration	• Manufacturers' manual • Documentation

Line (GAC): I DESCRIBE TOWER CRANE ASSEMBLY, DISASSEMBLY, RECONFIGURATION, AND TRANSPORT

Competency: I4 Describe assembly, disassembly, and transport of a self-erect tower crane

Objectives

To be competent in this area, the individual must be able to:

- Describe assembly and disassembly of a self-erect tower crane.
- Describe transport of a self-erect tower crane.

LEARNING TASKS	CONTENT
1. Locate and interpret information in manufacturers' manuals	• Assembly and raising procedures • Erection procedure and sequence • Balancing requirements during raising • Inspection of raising components • Wind speed limitations

2. Describe assembly procedure	• Regulations
	• Manufacturers' manual
	• Erection procedure and sequence
	  ○ Ground conditions
	• Qualified personnel
	• Written procedure
	• Communication procedure
	• Required reports
	  ○ Inspection
	  ○ Engineered geotechnical
	  ○ NDT
	  ○ Electrical

3. Describe function tests that are required prior to operation	• Manufacturers' manual
	• Limiting devices
	  ○ Trolley
	  ○ Hoist
	  ○ Overload
	  ○ Boom cut-out
	• Load weighing devices
	• Operator aids
	• Safety devices

4. Describe transport procedures	• Regulations • Manufacturers' manual • Qualified personnel

Line (GAC): J USE SPECIALIZED OPERATIONS

Competency: J1 Operate with a suspended work platform

Objectives

To be competent in this area, the individual must be able to:

- Operate with a suspended work platform in a safe and efficient manner in accordance with the lift instructions, manufacturers' recommendations, and WorkSafeBC regulations.

LEARNING TASKS	CONTENT
1. Operate with a suspended work platform	• Regulations • Manufacturers' manual • Employer policy • Follow lift plan

Achievement Criteria

Performance	The learner will be able to operate with a suspended work platform.
Conditions	The learner will be given • Regulations • Manufacturers' manuals • Employer policy • Tower crane (hammerhead or luffing jib) and suspended work platform • Lift plan • Qualified Supervisor.
Criteria	The learner will be evaluated on • Adherence to regulations and employer policy • Safe work procedures.

Line (GAC): J USE SPECIALIZED OPERATIONS

Competency: J2 Perform engineered and critical lifts

Objectives

To be competent in this area, the individual must be able to:

- Describe the performance of an engineered lift in a safe and efficient manner in accordance with the lift instructions, manufacturers' recommendations, and WorkSafeBC regulations.
- Perform an engineered lift in a safe and efficient manner in accordance with the lift instructions, manufacturers' recommendations, and WorkSafeBC regulations.
- Describe the performance of a critical lift in a safe and efficient manner in accordance with the lift instructions, manufacturers' recommendations, and WorkSafeBC regulations.
- Perform a critical lift in a safe and efficient manner in accordance with the lift instructions, manufacturers' recommendations, and WorkSafeBC regulations.

LEARNING TASKS	CONTENT

1. Describe the procedure for an engineered lift	• Regulations
	• Communication
	• Designation
	• Responsibilities
	• Reviewing engineered lift plan
	  ○ Procedure
	• Performing engineered lift plan
	  ○ Moving the load to the intended destination

2. Perform an engineered lift	• Regulations • Communication • Designation • Reviewing engineered lift plan • Performing engineered lift plan ○ Moving the load to the intended destination

3. Describe the procedure for a critical lift	• Regulations
	• Communication
	• Designation
	• Responsibilities
	• Reviewing critical lift plan
	  ○ Procedure
	  ○ Pre-job meeting
	• Performing critical lift plan
	  ○ Moving the load to the intended destination

LEARNING TASKS	CONTENT

4. Perform a critical lift	• Regulations
	• Communication
	• Designation
	• Reviewing critical lift plan
	  ○ Procedure
	  ○ Pre-job meeting
	• Performing critical lift plan
	  ○ Moving the load to the intended destination

Line (GAC): J USE SPECIALIZED OPERATIONS

Competency: J3 Perform multiple crane lifts

Objectives

To be competent in this area, the individual must be able to:

- Describe the performance of a multiple crane lift in a safe and efficient manner in accordance with the lift instructions, manufacturers' recommendations, and WorkSafeBC regulations.

LEARNING TASKS	CONTENT
1. Describe the procedure for a multiple crane lift	• WorkSafeBC regulations • Employer policy • Professional Engineer certification • Monitoring • Reactions on cranes performing task
2. Describe monitoring the load on each crane during a multiple crane lift	• Attachment points • Centre of gravity • Criteria for aborting lift
3. Plan various lifts	• Standing up a horizontal object • Laying down a vertical object • Lifting an object • Lifting an object with offset centre of gravity

Section 4

ASSESSMENT GUIDELINES

Assessment Guidelines – Level 1

Level 1 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	TOWER CRANE OPERATOR LEVEL 1		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
A	USE COMMON OCCUPATIONAL SKILLS	10%	5%
B	DEFINE CRANE TYPES AND TERMINLOGY	5%	0%
C	DEFINE SYSTEMS AND COMPONENTS	5%	0%
D	USE RIGGING	20%	25%
E	PERFORM HOISTING CALCULATIONS	10%	0%
F	PERFORM CRANE INSPECTION AND MAINTENANCE	15%	30%
G	PLAN A LIFT	10%	0%
H	PERFORM COMMON CRANE OPERATIONS	20%	40%
J	USE SPECIALIZED OPERATIONS	5%	0%
	Total	**100%**	**100%**
In-school theory/practical subject competency weighting		70%	30%
Final in-school percentage score		IN-SCHOOL %	

All apprentices who complete Level 1 of the Tower Crane Operator program with a FINAL level mark of 70% or greater will write the Tower Crane Operator SkilledTradesBC Level 1 Standardized Written Exam as their final assessment.

SkilledTradesBC will enter the apprentices' Tower Crane Operator SkilledTradesBC Level 1 Standardized Written Exam mark in SkilledTradesBC Portal. A minimum mark of 70% on the examination is required for a pass.

Assessment Guidelines – Level 2

Level 2 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	TOWER CRANE OPERATOR LEVEL 2		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
A	USE COMMON OCCUPATIONAL SKILLS	5%	0%
D	USE RIGGING	10%	18%
E	PERFORM HOISTING CALCULATIONS	25%	12%
F	PERFORM CRANE INSPECTION AND MAINTENANCE	12%	30%
G	PLAN A LIFT	10%	5%
H	PERFORM COMMON CRANE OPERATIONS	28%	30%
I	DESCRIBE TOWER CRANE ASSEMBLY, DISASSEMBLY, RECONFIGURATION, AND TRANSPORT	5%	0%
J	USE SPECIALIZED OPERATIONS	5%	5%
	Total	**100%**	**100%**
In-school theory/practical subject competency weighting		30%	70%
Final in-school percentage score		IN-SCHOOL %	

All apprentices who complete Level 2 of the Tower Crane Operator program with a FINAL level mark of 70% or greater will write the Tower Crane Operator SkilledTradesBC Level 2 Standardized Written Exam and the Interprovincial Red Seal examination as their final assessments.

SkilledTradesBC will enter the apprentice's Tower Crane Operator Level 2 Standardized Written Exam and Red Seal Interprovincial examination marks in the SkilledTradesBC Portal. A minimum mark of 70% on both examinations is required for a pass.

Section 5

TRAINING PROVIDER STANDARDS

Facility Requirements

Classroom Area

- 400 square feet of classroom space (40 square feet per student).
- Temperature, noise, ventilation, and lighting are maintained at appropriate levels.
- Storage space is functional and sufficient for instructional materials, supplies, and equipment.
- Facilities have adequate floor area and ceiling height.
- Lighting control (windows and fixtures) for screen viewing.
- Tables, comfortable chairs.
- Whiteboards with marking pens and erasers.

Shop Area

- Has access to sufficient land necessary to operate multiple pieces of equipment at the same time (suggested minimum of 2 acres per tower crane).
- Covered area to store rigging and equipment
- A safety review of the program's facility and equipment is conducted annually and meets applicable safety standards/regulations.
- Clear of all hazards (power lines, underground services, etc.)

Lab Requirements

- This section does not apply.

Student Facilities

- Facilities shall offer a safe and productive learning environment.
- Meets applicable zoning bylaws for technical instruction and education.
- Meets WorkSafeBC requirements.
- Meets Private Training Institutions Branch (PTIB) requirements.

Instructor's Office Space

- Meets applicable zoning bylaws for technical instruction and education.
- Meets WorkSafeBC requirements.

Other

- This section does not apply.

Tools and Equipment

The crane and equipment used for training should be representative of the appropriate crane certification classification.

Personal Protective Equipment (PPE) (provided by student)

- Coveralls
- Gloves
- Safety boots

Personal Protective Equipment (PPE) (provided by training provider)

- Ear plugs
- Safety glasses
- Hard hat
- Masks (particle/vapour)
- Fall protection
- High visibility vest

Safety Equipment

- Fire extinguishers
- First aid kit
- AED (Automated external defibrillator)
- Spill kit
- Air horn
- Eyewash station

Hand Tools

- Adjustable wrench
- Combination wrenches
- Ratchet and socket set
- Pliers (various types)
- Screwdrivers (various types)
- Tape measure
- Vice grips
- Hammers
- Pry bar
- Grease gun
- Wear gauge (wire rope & sheave)
- Wire brush
- Cable cutter
- Shovel

Miscellaneous Props for Training

- Two-way radios
- Objects to lift
- Slings (various types)
- Rigging hardware (various types)
- Tag line
- Carpenter level
- Pallet fork
- Concrete bucket
- Targets (various types, e.g. form work)

Other (recommended)

- Tower crane simulator

Minimum Crane Requirements

- One tower crane (hammerhead or luffing jib) with:
  - Minimum mast height of 90 ft.
  - Minimum jib length of 145 ft.
  - Anti-collision system
  - Cab mounted controls

Recommended Crane Equipment

- Remote mounted controls
- Top climbing unit

Reference Materials

Required Resources

- WorkSafeBC Occupational Health and Safety Regulation (OHSR)
- Current CSA Standard Z248, Code for Tower Cranes
- ANSI Standard ANSI/ASME B30.3, Tower Cranes
- ANSI Standard ANSI/ASME B30.9, Slings
- ANSI Standard ANSI/ASME B30.10, Hooks
- ANSI Standard ANSI/ASME B30.20, Below-the-Hook Lifting Devices

Recommended Resources

- Rigging Manual, by Donald E. Dickie, P. Eng.
  Publisher: Construction Safety Association of Ontario
- Crane Handbook, by Donald E. Dickie, P. Eng.
  Publisher: Construction Safety Association of Ontario
- IHSA Hoisting and Rigging Safety Manual http://www.ihsa.ca/
- IPT's Crane and Rigging Handbook/Training Manual by Ronald G. Garby
  Publisher: IPT Publishing and Training Ltd. http://www.iptbooks.com

Instructor Requirements

Occupation Qualification

The instructor must possess:

- Tower Crane Operator Certificate of Qualification with Interprovincial Red Seal Endorsement.

Work Experience

The instructor must have:

- Minimum of five years' experience working as a journeyperson Tower Crane Operator.

Instructional Experience and Education

It is preferred that the instructor possesses:

- An Instructor's Diploma or equivalent.

Appendices

Appendix A
Acronyms and Abbreviations

30M33	WorkSafeBC assurance of compliance with occupational health and safety regulation, part 19
AAF	Aeronautical assessment form
ANSI	American national standards institute
ASME	American society of mechanical engineers
C of A	Certificate of apprenticeship
C of Q	Certificate of qualification
CSA	Canadian standards association
CSO	Construction safety officer
DEP	Dedicated evacuation platform
FLRA	Field level risk assessment
IHSA	Infrastructure health and safety association
IUOE	International union of operating engineers
LMI	Load moment indicator
NDT	Nondestructive testing
OHSR	WorkSafeBC occupational health and safety regulation
PPE	Personal protective equipment
RSOS	Red seal occupational standard
SDS	Safety data sheet
THARRP	Technical high angle rope rescue program
WLL	Working load limit

Appendix B
Glossary

Note: this glossary is sourced from the 2023 Red Seal Occupational Standard (RSOS) as a reference.

anemometer	instrument for measuring and indicating the force or speed of the wind
apex	point of the tower crane at the top where the pendants or top chords meet so that gravitational forces act on the tower, not on the jib or counter jib
ballast	stabilizing component usually placed at the base of a tower crane; does not rotate when the crane swings
becket	small eye for fastening hoist line
bird caging	form of deficiency in wire rope where the strands are separated from the core
catwalk	accessible elevated walkway on the crane structure
controls	all levers, brakes, dogs, switches, buttons, and other devices that the crane operator physically manipulates
counterjib	part of the crane that extends out from the tower to support counterweights and hoisting machinery
counterweight	heavy metal or concrete attachments secured to the counter jib to offset the weight of the extended jib and load and increase lift capacity; it rotates when the crane swings
drum	cylindrical component that is used to store and dispense line; the line is wound or spooled onto the drum when the operator causes the drum to rotate
gantry	component of a luffing tower crane that supports the jibs so that gravitational forces act on the tower, not on the jibs
gross capacity	maximum amount of weight that a specific crane and boom configuration can lift
gross load	weight of the load plus other items, such as the hook block, hoist lines and rigging
hardware	usually refers to rigging hardware, which can be any of a wide range of bolts, hooks, chains, shackles, clamps and other mechanical devices used to secure or attach to loads in preparation for hoisting
hoist line	a line that may be attached to a ball, lift hook or other assembly; the term hoist line may also be used to describe the compound assembly of lines running through the hook block
hoisting	act of manipulating the crane controls to raise or lower a load
hook block	heavy metal block containing sheaves or pulleys; the hook block is equipped with a hook for attachment of loads
hydraulic system	any system that relies on pressurized hydraulic oil to make it function
jib	part of the crane that extends out from the tower and supports the line or lines to which the load is attached
logbook	typically, a book in which the operator is required to record information, such as inspection, equipment certifications, maintenance, locations, hours worked, as well as damage and repair details
multi-crane lifts	in some instances, it is impossible to accomplish certain lifts using only one crane; in these circumstances, two or more cranes may be attached to the same load, and they are used simultaneously to perform the task. Multi-crane lifts must have an engineered lift plan

outriggers	supports that extend from the carrier vehicle to the ground to provide stability; outriggers are composed of beams and jacks
pads (mats)	wood, metal, or synthetic assemblies that are placed under the adjustable ends of the outriggers or tracks; these items increase the amount of bearing and support given by the outriggers or the tracks to the crane
pendant	cable or steel bar which attaches the jib or counter jib to the apex or gantry
radius	horizontal distance from the centre of rotation of a crane to the CoG of a load
reeving	wire rope system in which wire rope travels around sheaves to gain a mechanical advantage
rigger	designated individual whose duty it is to ensure that loads are appropriately attached or rigged
rigging	components and actions used to secure and attach loads to be lifted
self-erect crane	tower crane in which tower and jib elements are not disassembled into component sections, and which can be transported between sites as a complete unit; the erection and dismantling processes are an inherent part of the crane's function
sheaves	pulleys located in a hook block, boom heads, or other parts of the crane jib on which the line runs
shock loading	the effect of sudden weight change (release or application) that creates a "sudden shock" in the crane
signaller	designated individual who relays information to the crane operator
sling	any metal or synthetic flexible device used to cradle or support a load
spooling	process of winding line either onto or off of a drum on which it is stored
swing (slew)	rotating the upper works horizontally left or right
track (rail)	rail system on which a travelling undercarriage operates
weathervaning	act of releasing slew brakes to allow the crane to free swing
wire rope	often referred to as cable, this material is made of many extremely strong and flexible metal alloy wires wound in various configurations to suit a range of conditions

Appendix C
Summary of Achievement Criteria

Achievement Criteria are included for competencies that require a practical assessment. The intent of including Achievement Criteria in the Program Outline is to ensure consistency in training across the many training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the learner's ability to apply the theory to practice. It is important that these performances be observable and measurable and that they reflect the skills spelled out in the competency. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the evaluation criteria.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure similar skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

The following tables summarize the practical assessments for each level. **For details, please refer to the Achievement Criteria following the competency in the Program Content section.**

TOWER CRANE OPERATOR – LEVEL 1 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
A5 Practice effective worksite communications	The learner will be able to direct a crane with hand signals and radio communications.
D2 Inspect slings and rigging hardware	The learner will be able to inspect rigging components.
D4 Perform rigging	The learner will be able to rig a basic load.
F4 Perform pre-operational inspection	The learner will be able to perform a basic pre-operational inspection.
H2 Perform tower crane operations and hoisting techniques	The learner will be able to perform a function test.
H4 Secure crane	The learner will be able to secure a crane for short-term periods and shutdown.

Note to instructor: achievement criteria may be combined across competencies

TOWER CRANE OPERATOR – LEVEL 2 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
D4 Perform rigging	The learner will be able to calculate and install rigging on a non-symmetrical load.
E2 Use a crane capacity chart	The learner will be able to use a crane capacity chart to determine gross capacity, net capacity, and maximum radius for a lift.
F4 Perform a pre-operational inspection	The learner will be able to perform a complete pre-operational inspection.
G2 Perform engineered and critical lift plan	The learner will be able to complete a critical lift plan.
H2 Perform tower crane operations and hoisting techniques	The learner will be able to operate a tower crane with a load.
J1 Operate with a suspended work platform	The learner will be able to operate with a suspended work platform.

Note to instructor: achievement criteria may be combined across competencies