

Apprenticeship and Industry Training

Crane and Hoisting Equipment Operator - Tower Crane

Curriculum Guide

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Apprenticeship
and Industry
Training

ALBERTA ADVANCED EDUCATION

Crane and hoisting equipment operator tower crane: apprenticeship education program curriculum guide

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**Crane and Hoisting Equipment Operator - Tower Crane
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Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding a sponsor. Sponsors guide apprentices, and support on-the-job learning through provision of mentorship. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyman or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution (PSI) – usually a college or technical institute.

To receive their post-secondary credential, apprentices must learn theory and skills, and they must pass examinations. Criteria for the program—including the content and delivery of technical training—are developed and updated by the Registrar.

The graduate of the Crane and Hoisting Equipment Operator - Tower Crane apprenticeship program is an individual who will be able to:

- responsibly do all work tasks expected of a journeyman
- correctly use and care for tools and materials which are required to carry out the normal service and maintenance of the machines of the industry
- operate and describe functions of the major and minor components of boom trucks
- recognize and identify malfunctions and the proper procedures related thereto
- recognize and evaluate conditions which are potentially hazardous to safe machine operation
- interpret and apply load chart and related documentation
- work in conjunction and communicate with other trades, employers and customers
- interpret and apply visual and audio communication
- perform assigned tasks in accordance with quality and production standards required by industry

Apprenticeship and Industry Training System

Alberta's apprenticeship programs are supported by industry stakeholders that ensures a highly skilled, internationally competitive workforce in the province. The Registrar establishes the educational standards and provides direction to the system supported by industry and the PSI's. The Ministry of Advanced Education provides the legislative framework and administrative support for the apprenticeship and industry training system.

Special thanks are offered to the following industry members who contributed to the development of the standard:

Mr. B. Mahon.....Onoway
Mr. G. AlexanderCoalhurst
Mr. M. DanderferBeaumont
Mr. S. GibsonEdmonton
Mr. D. SecordSpruce Grove
Mr. D. Grenier.....Edmonton
Mr. R. Titcomb.....Edmonton

Alberta Government

Alberta Advanced Education works with industry, sponsor and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and sponsors
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, sponsors, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

Occupational Health and Safety

Persons engaged in, or supporting an individual in an experiential learning environment are often exposed to more worksite hazards than in other forms of traditional post-secondary education and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Occupational Health and Safety-OHS (a division of Alberta Labour and Immigration) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.alberta.ca/occupational-health-safety.aspx

Technical Training

Apprenticeship technical training is delivered by the PSI's throughout Alberta. The PSI's are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All PSI's place a strong emphasis on safety that complements safe workplace practices towards the development of a culture of safety for all professions.

The PSI's work with industry and Alberta Advanced Education to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs across the province. They develop curriculum from the curriculum guides established by the Registrar in consultation with the PSI's and industry and provide the technical training to apprentices.

The following PSI's deliver Crane and Hoisting Equipment Operator - Tower Crane trade apprenticeship technical training:

Keyano College

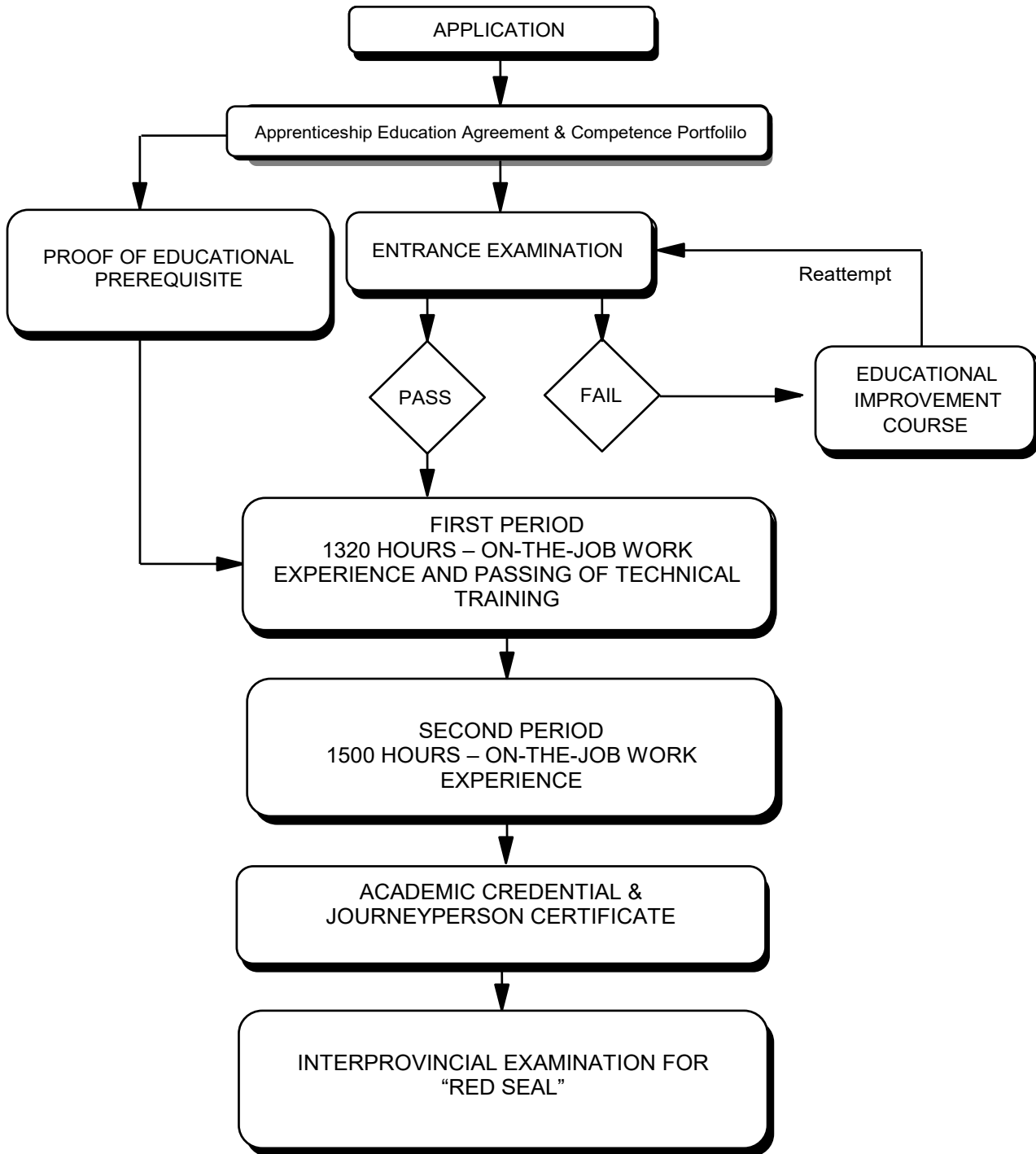
Procedures for Recommending Revisions to the Curriculum Guide

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

Registrar of Apprenticeship Education Programs
c/o Apprenticeship Delivery and Industry Support Services
Apprenticeship Delivery and Industry Support
Advanced Education
19th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used.

Apprenticeship Route toward Academic Credential



Crane and Hoisting Equipment Operator - Tower Crane Training Profile
FIRST PERIOD
(6 Weeks - 30 Hours per Week – Total of 180 Hours)

SECTION ONE

STANDARD WORKPLACE SAFETY 6%	A	B	C
	Safety Legislation, Regulations & Industry Policy in the Trades 40%	Climbing, Lifting, Rigging and Hoisting 30%	Hazardous Materials & Fire Protection 30%

SECTION TWO

TOWER CRANE THEORY AND PRACTICAL 44%	A	B	C
	Tower Cranes and Components and Terms 9%	Basic Math Concepts 4%	Trade Math 4%
	D	E	F
	Common Tower Crane Maintenance 8%	Basic Hydraulic Systems 7%	Basic Electrical Systems 5%
	G	H	I
	Tower Crane Documentation 3%	Pre-Operational Inspection 12%	Leaving Crane Unattended 3%
	J	K	
	Crane Operation 35%	Crane Leverage 10%	

SECTION THREE

LOAD CHARTS 19%	A	B	C
	Basic Terms and Conditions 18%	Configuration of Crane 70%	Pre Lift Planning and Load Chart Calculations 12%

SECTION FOUR

OPERATING PROCEDURES 20%	A	B	C
	Job Condition Assessment 40%	Operation of Crane 34%	Crane Set Up 14%
	D	E	
	Multi-Crane Sites 6%	New Technology 6%	

SECTION FIVE

RIGGING PRACTICES AND PROCEDURES 8%	A
	Rigging Practices 100%

SECTION SIX

WORKPLACE COACHING SKILLS 3%	A	B
	Workplace Coaching Skills 50%	Interprovincial Standards Red Seal Program 50%

**FIRST PERIOD TECHNICAL TRAINING
CRANE AND HOISTING EQUIPMENT OPERATOR - TOWER CRANE TRADE
CURRICULUM GUIDE**

*UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO
PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.*

SECTION ONE:STANDARD WORKPLACE SAFETY6%

A. Safety Legislation, Regulations & Industry Policy in the Trades 40%

Outcome: ***Apply legislation, regulations and practices ensuring safe work in this trade.***

1. Demonstrate the application of the Occupational Health and Safety Act, Regulation and Code.
2. Describe the sponsor's and employee's role with Occupational Health and Safety (OH&S) regulations, Worksite Hazardous Materials Information Systems (WHMIS), fire regulations, Workers Compensation Board regulations and related advisory bodies and agencies.
3. Describe industry practices for hazard assessment and control procedures.
4. Describe the responsibilities of worker and sponsors to apply emergency procedures.
5. Describe tradesperson attitudes with respect to housekeeping, personal protective equipment and emergency procedures.
6. Describe the roles and responsibilities of sponsors and employees with the selection and use of personal protective equipment (PPE).
7. Maintain required PPE for tasks.
8. Use required PPE for tasks.

B. Climbing, Lifting, Rigging and Hoisting 30%

Outcome: ***Use industry standard practices for climbing, lifting, rigging and hoisting in this trade.***

1. Describe manual lifting procedures.
2. Describe rigging hardware and associated safety factors.
3. Select equipment for rigging loads.
4. Describe hoisting and load moving procedures.
5. Maintain personal protective equipment (PPE) for climbing, lifting and load moving equipment.
6. Use PPE for climbing, lifting and load moving equipment.

C. Hazardous Materials & Fire Protection 30%

Outcome: ***Apply industry standard practices for hazardous materials and fire protection in this trade.***

1. Describe roles, responsibilities, features and practices related to the Workplace Hazardous Materials Information System (WHMIS) program.
2. Describe three key elements of WHMIS.
3. Describe handling, storing and transporting procedures for hazardous material.
4. Describe venting procedures when working with hazardous materials.
5. Describe hazards, classes, procedures and equipment related to fire protection.

SECTION TWO: TOWER CRANE THEORY AND PRACTICAL 44%

A. Tower Cranes and Components and Terms9%

Outcome: ***Demonstrate knowledge of tower crane types and components.***

1. Identify common structural and operational characteristics for different types of tower cranes.
2. Describe the function of a counter jib or ballast system.
3. Describe the function of a jib and counterweights.
4. Describe the components and functions of a main hoist system.
5. Describe the components and functions of a trolley system.
6. Describe the components and functions of a mast.
7. Describe the components and functions of outriggers for tower cranes and self-erect tower cranes.
8. Describe the types of swing configurations and components.
9. Describe the components used for the base support section.
10. Describe the functions of a control system.
11. Describe the functions of load moment devices, limit switches and lockouts.

B. Basic Math Concepts4%

Outcome: ***Solve basic math problems in the metric and imperial systems of measurement.***

1. Describe the imperial and metric (SI) measurement systems.
2. Use a calculator to solve basic math problems.
3. Convert fractions to decimals and vice versa.
4. Convert measurements between imperial and metric values.

C. Trade Math4%

Outcome: ***Solve trade-related mathematical problems.***

1. Calculate the area, volume and mass of geometric shapes.
2. Calculate line and load calculations using industry-accepted formulas.
3. Calculate working load limits for slings.

D. Common Tower Crane Maintenance8%

Outcome: ***Describe maintenance procedures for tower cranes.***

1. Explain the limits of tower crane maintenance.
2. Inspect and maintain tower crane equipment as specified by the manufacturer.
3. Select the appropriate lubricant for the required application.

E. Basic Hydraulic Systems7%

Outcome: ***Explain operation of basic hydraulic systems.***

1. Identify components and their function in a basic hydraulic system.
2. Describe the basic principles of operation of a hydraulic system.

3. Describe the transmission of power through hydraulic power.
4. Determine the effects of cold weather and/or contaminants in the system.

F. Basic Electrical Systems.....5%

Outcome: *Explain the electrical system on a tower crane.*

1. Identify the major circuits of a tower crane electrical system.
2. List the electrical safety components of a tower crane electrical system.
3. Explain how the individual components function as a operational system.

G. Tower Crane Documentation3%

Outcome: *Use documentation related to the operation of a tower crane.*

1. Identify legislative documents related to tower crane operation.
2. Describe the use of the operators log book for inspection records.
3. Describe the use of a tower cranes log book for inspection and service records.
4. Use original equipment manufacturers manuals to explain the operation of tower cranes.

H. Pre-Operational Inspection 12%

Outcome: *Perform a daily pre-operational inspection.*

1. Inspect mechanical, structural, and electrical systems and support components.
2. Record inspection results in the logbook.
3. Describe procedures for reporting defects found during inspections.
4. Test limit switches.
5. Perform load tests.

I. Leaving Crane Unattended3%

Outcome *Secure an unattended tower crane.*

1. Demonstrate the procedure for leaving a tower crane unattended to meet industry standards.
2. Explain the differences between leaving a tower crane unattended for an extended period as opposed to a short period.
3. Explain the difference between weather-vaning and securing.
4. Describe job site requirements due to general hazards that may occur while leaving a tower crane unattended.

J. Crane Operation 35%

Outcome: *Operate a tower crane.*

1. Identify the key persons and their respective responsibilities involved in a lift.
2. Describe applicable legislation and codes affecting tower crane operation.
3. Describe the conditions that cause tower crane overloading.
4. Describe how to protect site personnel in the vicinity of the lift.
5. Explain the necessary precautions required when operating a tower crane near high voltage equipment.
6. Describe the procedures to follow if electrical contact is made with high voltage equipment.

7. Demonstrate communication during a lift.
8. Describe operating conditions that may affect tower crane capacity.
9. Operate a tower crane through all available motions and varying load conditions.

K. Crane Leverage 10%

Outcome: Describe principles of leverage.

1. Explain terms used in relation to the principles of leverage.
2. Identify factors that affect the centre of gravity of a tower crane and a load.
3. Identify the location of the center of gravity during rotation of the jib.
4. Define fulcrum and how it applies to crane operation.
5. Describe the basic mechanical advantage of leverage used in hoisting.
6. Describe the principles of load leverage.
7. Describe forward stability rating in percentage of tipping.
8. Describe backward stability for a crane.
9. Describe static load vs. dynamic load.
10. Describe the effect of winch diameter multi-layer wire rope, and line speed vs. torque.
11. Determine sheave loads.
12. Determine the WLL of rope vs. line pull.
13. Describe the effect of sheave friction during a lift.
14. Describe the mechanical advantage of reeving.

SECTION THREE:LOAD CHARTS 19%

A. Basic Terms and Conditions 18%

Outcome: Interpret load charts.

1. Describe the factors affecting capacity of a tower crane.
2. Explain the difference between gross capacity and net capacity.
3. Explain the difference between gross load and net load.

B. Configuration of Crane 70%

Outcome: Demonstrate planning and configuring the crane.

1. Describe required load radius.
2. Interpret load radius using chart listings.
3. Determine the parts of line required.
4. Describe mast, jib and counter jib configurations.

C. Pre Lift Planning and Load Chart Calculations 12%

Outcome: Perform load chart calculations.

1. Describe the factors that affect crane capacity with respect to operating conditions and crane configurations.
2. Perform load chart calculations by interpreting crane capacity charts.

SECTION FOUR: OPERATING PROCEDURES 20%**A. Job Condition Assessment..... 40%****Outcome: Demonstrate knowledge and skill in planning a lift.**

1. Interpret lift study drawings.
2. Assess the crane site to identify hazards.
3. Determine the crane type for the planned tasks and job scope in accordance with manufacturers' specifications and legislation.
4. Determine the set up location required for the planned tasks and job scope, in accordance with manufacturers' specifications and legislation.
5. Locate the crane on firm level ground as per manufacturer's specifications.
6. Explain outrigger loadings.
7. Describe necessary precautions when operating cranes in adverse weather conditions, in accordance with manufacturers' specifications and legislation.

B. Operating Procedures 34%**Outcome: Demonstrate operation of a crane.**

1. Determine weight of loads using available means.
2. Demonstrate the use of a site assessment to perform a set-up for any tower crane Determine the centre of gravity of the load.
3. Demonstrate use of trolley position indicators.
4. Identify reasons for slack rope on drums and uneven spooling.
5. Document procedures and responsibilities of individuals to protect personnel during operations.
6. Describe rigging procedures when lifting a personnel basket.
7. Describe the effect on the jib when the load contacts a crane.
8. Describe the effect of the jib touching or resting on a structure.
9. Describe jib design including compression vs. bending.
10. Demonstrate the use of hoisting hand and radio signals.
11. Demonstrate correct outrigger use.
12. Demonstrate use of a levelling device to ensure crane is level.

C. Crane Set Up..... 14%**Outcome: Describe the set-up of a tower crane.**

1. Describe proper set up of tower cranes including the crane base, swing clearance and power supply.
2. Describe the bolting procedures and safety precautions to erect and dismantle a crane.
3. Describe considerations for selecting type and configuration of tower crane.
4. Determine maximum radii at which given weights may be safely handled.

D. Multi-Crane Sites.....6%**Outcome: Explain factors affecting multi-crane conditions.**

1. Discuss hazards on multi-crane sites.
2. Describe communication between operators during multi-crane lifts.
3. Discuss legislative requirements during a multiple crane lift.

E. New Technology6%**Outcome: Identify new tower crane technology.**

1. Describe new technology.
2. Describe the use of latest crane technology.

SECTION FIVE:.....RIGGING PRACTICES AND PROCEDURES8%**A. Rigging Practices..... 100%****Outcome: Demonstrate rigging of a load.**

1. Describe different types of rigging hardware and equipment.
2. Demonstrate the uses of spreader bars and lifting beams.
3. Demonstrate the use of taglines to control the load.
4. Describe how loading is equalized by using devices such as turnbuckles, chain hoists and safety slings.
5. Describe procedures for reeving tower cranes.
6. Demonstrate how the relationship between sling diameter and load attachment can affect sling capacity.
7. Identify the different types and configurations and design factors for various slings.
8. Demonstrate the use of different sling arrangements and sling capacity for various slings.
9. Describe advantages and disadvantages of materials and constructions used in slings.
10. Explain when softeners or protection is required to protect slings.
11. Maintain and inspect rigging hardware.
12. Apply rejection criteria to rigging components.
13. Describe the types and use of wire rope clips.
14. Interpret wire rope manufacturer's ratings to determine the working load limit of wire rope used for hoist lines and slings.
15. Describe the effects of load centre of gravity on sling tension.
16. Describe sheave and drum standards and inspection criteria.
17. Describe wire rope characteristics and their effect on hoisting applications.
18. Describe the causes of wire rope damage and rejection criteria.
19. Identify safety factors for ropes and slings.
20. Demonstrate proper installation procedures for wire rope.

SECTION SIX:WORKPLACE COACHING SKILLS3%

A. Workplace Coaching Skills 50%

Outcome: Use coaching skills when training an apprentice.

1. Describe the process for coaching an apprentice.

B. Interprovincial Standards Red Seal Program 50%

Outcome: Use Red Seal products to challenge an Interprovincial examination.

1. Identify Red Seal products used to develop Interprovincial examinations.
2. Use Red Seal products to prepare for an Interprovincial examination.



Apprenticeship and Industry Training

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