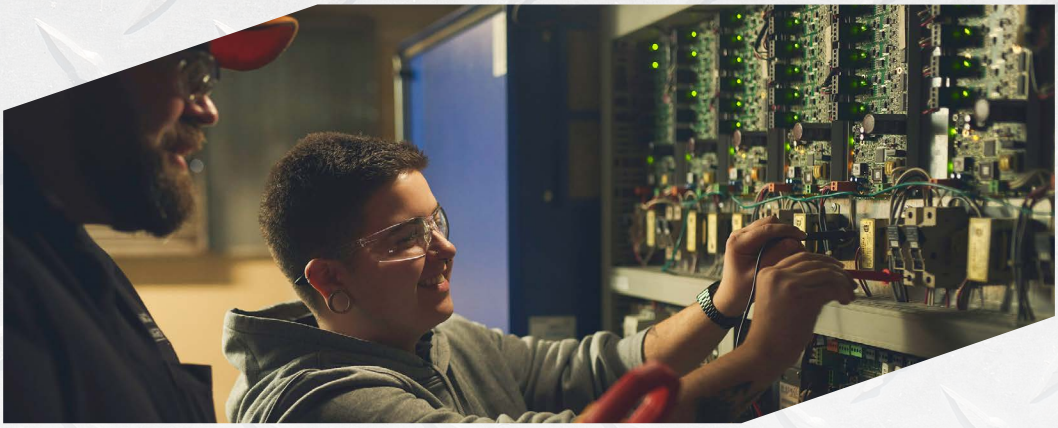
Curriculum Standard Plan of Training

Tower Crane Operator

March 2024



Newfoundland & Labrador

PLAN OF TRAINING

Tower Crane Operator

March 2024

Newfoundland & Labrador

Government of Newfoundland and Labrador
Department of Immigration, Population Growth and Skills
Apprenticeship and Trades Certification Division

Approved by:

Chairperson, Provincial Apprenticeship and Certification Board

Date: July 9, 2024

Preface

This curriculum standard is aligned with the 2023 Red Seal Occupational Standard (RSOS) for the Tower Crane Operator trade. It describes the curriculum content for the Tower Crane Operator apprenticeship training program.

Acknowledgements

The Provincial Trade Advisory Committee (PTAC), industry representatives, instructors and apprenticeship staff provided valuable input to the development of this provincial plan of training. Without their dedication to quality apprenticeship training, this document could not have been produced.

We offer you a sincere thank you.

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Approved - Final	June 2024	September 2024	Update to align with 2023 RSOS and National Harmonization Sequencing

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A. RSOS Comparison Chart

RSOS 2023 Tasks		2024 POT	
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		LC1105	Crane Operation Safety
1.03	Uses documentation	LC1105	Crane Operation Safety
		LC1115	Crane Maintenance
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4.04	Monitors equipment performance and conditions	LC1105	Crane Operation Safety
4.05	Monitors structural and support components	LC1105	Crane Operation Safety

RSOS 2023 Tasks		2024 POT	
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		TC1140	Mechanical Systems
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		TC1150	Tower Crane Load Charts
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		TC1150	Tower Crane Load Charts
8.03	Plans work procedures	LC1135	Crane Operations
		TC1150	Tower Crane Load Charts
8.04	Prepares for specialty lifts	LC1135	Crane Operations
		LC1260	Rigging for Crane Operators
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		TC1190	Specialty Crane Operations
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12.04	Hoists load	LC1135	Crane Operations

RSOS 2023 Tasks		2024 POT	
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		TC1190	Specialty Crane Operations
12.06	Performs functions simultaneously	LC1135	Crane Operations
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13.02	Operates in multi-crane site	TC1190	Specialty Crane Operations
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B. Program Structure

For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable

The order of course delivery within each level can be determined by the educational agency, as long as pre-requisite conditions are satisfied.

Upon completion of an entry-level program, individuals may be required to complete other certifications (employer or job site specific) in order to gain employment.

Course No.	Course Name	Hours	Pre-Requisite(s)
LC1045	Shop Fundamentals for Crane Operators	15	None
LC1105	Crane Operation Safety	15	None
LC1135	Crane Operations	48	LC1105 LC1115 LC1200
LC1200	Hydraulics and Applications to Crane Control	15	LC1045
LC1260	Rigging for Crane Operators	60	None
TC1115	Tower Crane Components	15	TC1105
TC1125	Access Equipment	15	TC1105
TC1160	Assembly and Disassembly	30	None
TC1210	Crane Reconfiguration	6	None
TC1170	Pre-lift Planning	6	TC1160
AM1341	Hoisting Math Fundamentals	42	None*
TC1220	Self-Erecting Cranes	6	TC1160
LC1115	Crane Maintenance	30	None
TC1130	Electrical Systems	15	TC1115 TC1125
TC1140	Mechanical Systems	15	TC1115 TC1125
TC1150	Tower Crane Load Charts	60	TC1130 TC1140
TC1180	Climbing and Lowering	6	TC1170

Course No.	Course Name	Hours	Pre-Requisite(s)
TC1190	Specialty Crane Operations	6	TC1170
TC1200	Tower Crane Profiles	9	TC1170
TC1300	Workplace Mentoring	6	None
Level Total		420	

REQUIRED WORK EXPERIENCE

*The prerequisite for AM1101 - Math Essentials is waived for direct entry apprentices only.

LC1045 Shop Fundamentals for Crane Operators

Learning Outcomes:

- Demonstrate knowledge of various shop tools and equipment and their applications.
- Demonstrate knowledge of safety regulations in the operation and maintenance of shop tools.
- Demonstrate knowledge of the use of shop tools in a safe and competent manner.
- Demonstrate knowledge of operating oxy-fuel heating and cutting equipment.

Duration: 15 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Describe shop safety practices.
   - i. safe work habits
   - ii. required personal safety equipment for crane operators
   - iii. implementing exhaust control procedures
   - iv. effects of excessive noise on hearing
   - v. factors that contribute to spontaneous combustion
   - vi. potential hazards to personal safety
   - vii. unsafe work conditions
   - viii. importance of reporting accidents

2. Identify fasteners.
   - i. types
     - rivets
     - nails
     - wood screws
     - sheet metal screws
     - bolts
     - nuts
     - washers
     - masonry anchors
     - shields
   - i. fastener sizes
   - ii. bolt grades
   - iii. miscellaneous anchoring devices

1. Describe the procedures to select, use, and maintain hand tools.
   - i. screwdrivers
     - standard
     - phillips
     - robertson
     - torx
   - i. pliers
     - combination
     - gripping
     - cutting
     - vise-grips
     - snap ring
     - needle nose
   - ii. special hose clamp tools
   - iii. wrenches
     - open-end
     - box ends
     - ratcheting box ends
     - special purpose (box)
     - adjustable
     - pipe
     - spanner
     - Allen and multi-spline (metric and imperial)
   - iv. sockets and drives (metric and imperial)
     - drive sizes
     - socket points
     - deep sockets
     - flexible sockets
     - drive handles
     - speed handles
     - ratchets
     - universal joints
     - adapters
     - extensions
   - v. hammers
     - ball peen
     - cross peen
     - plastic tip
     - brass-headed
     - rubber mallets
     - dead blow
     - sledge hammers
     - hammer handles
   - vii. punches
     - starting

- pin
- centre
- aligning

viii. torque wrenches
- types
- sizes
- purpose

ix. torque multiplier

x. hacksaws
- types and designs
- blade classification and selection

xi. files

4. Describe the procedures to select, safely use and maintain power tools.
   i. portable
   ii. cleaning equipment
   iii. drilling equipment
   iv. metal cutting
   v. grinders

5. Identify types of compressors.

6. Describe the procedures to select, safely use, and maintain compressors.

7. Describe the procedures to select, safely use, and store shop equipment.
   i. jacks
   ii. shop cranes
   iii. chain hoists
   iv. steam cleaners
   v. solvent cleaning tanks

8. Describe the procedures to select, safely use, and maintain measuring tools.
   i. calipers
   ii. measuring tapes
   iii. wire rope gauges
   iv. sheave gauges
   v. anemometers
   vi. feeler gauges

9. Describe procedures to operate oxy-fuel heating and cutting equipment to remove and/or install parts.
   i. safety precautions
      - safety apparel
      - storage and handling of welding gases
      - pre-operational inspection
   ii. equipment set up

- cylinders
- gauges
- regulators
- valves-flame arrestor
- torches and tips
- hoses
- testing for leaks

iii. operate the torch
- lighting procedures
- types of flames and effect on materials
- shutting down procedures

10. Describe procedures to perform braze welding using oxy-acetylene equipment.

11. Describe procedures to perform flame cutting with oxy-acetylene equipment.

Practical Requirements:

1. Use and maintain personnel protective equipment.

2. Complete a shop safety inspection.

3. Use and store tools.
   i. hand tool
   ii. cutting tool
   iii. power tool
   iv. compressor air system

4. Attach fastener.

5. Use oxy-fuel welding and cutting equipment.
   i. pre-check, light and adjust
   ii. perform flame cutting
   iii. shut down procedures

LC1105 Crane Operation Safety

Learning Outcomes:

- Demonstrate knowledge of various codes and regulations required for the safe operation of cranes.
- Demonstrate knowledge of good safety practices in crane operations.

Duration: 15 Hours

Pre-requisite(s): None

Objectives and Content:

1. Identify PPE required for crane operators.
   i. C.S.A. codes for compulsory safety gear
   ii. replacement of safety items

2. Identify warning signs, symbols and danger tags.
   i. location and identification
   ii. procedure warning tag or symbol is discovered or when an operator is required to attach a warning tag or symbol to a machine

3. Describe procedure to mount and dismount equipment.
   i. safety grab-irons
   ii. handrails
   iii. steps
   iv. foot-pegs

4. Describe safe clearance in work areas.
   i. minimum safe operating clearance for the overhead, sides, forward and rearward clearance of obstacles
   ii. conditions for determining equipment operating clearances on the job

5. Describe dangerous operating situations.
   i. factors that lead to dangerous operating situations:
      - physiological (body)
      - psychological (mental)
      - mechanical failures,
      - meteorological (weather)
      - terrestrial (land) conditions
   ii. operational malpractice and poor habits that lead to accidents

6. Describe the safety procedures when running an engine in an enclosed area.

i. toxic fumes from engine exhaust gases
ii. hoses and attachments connecting engine exhaust pipe to central ventilation system
iii. devices to control exhaust fumes in underground work site

7. Fire prevention.
   i. fire triangle
   ii. types of fire extinguishers

8. Environmental concerns and safe practices regarding work site.
   i. provincial regulations governing exhaust flame or spark arrestor
   ii. overhead/underground services found on federal, provincial, municipal, and private lands
   iii. containing and reporting spills

Practical Requirements:

1. Obtain certificates.
   i. Professional Driver Improvement
   ii. Transportation of Dangerous Goods
   iii. Powerline Hazards
   iv. Traffic Control and Flagging

2. Clean and inspect safety gear.

3. Adjust and fasten fall arrest equipment (seat belts & safety harnesses).

4. Mount/dismount equipment.

5. Demonstrate the use of a fire extinguisher.

LC1135 Crane Operations

Learning Outcomes:

- Demonstrate knowledge of various codes and regulations required for operating cranes.
- Demonstrate knowledge of good safety practices when operating cranes.
- Demonstrate knowledge of conservation and environmental issues related to crane operations.
- Demonstrate knowledge of new crane technology.
- Demonstrate knowledge of computer assisted safety devices, LMI/Load Indicators and procedures for use.

Duration: 48 Hours

Pre-Requisites: LC1105**,** LC1115, LC1200

Objectives and Content:

1. Describe the crane operator occupation.
   i. working conditions
   ii. responsibilities of all parties involved with crane operation

2. Describe cranes.
   i. identify types and uses of cranes
   ii. describe various crane attachments

3. State the characteristics of lattice boom cranes.

4. Explain the principles of leverage associated with crane operation.
   i. leverage and stability
   ii. forward and backward stability factors
   iii. rotation of upperworks (leverage and capacity)
   iv. leverage calculations

5. Describe the purpose and applications of signaling.
   i. crane hand signals
   ii. construction hand signals
   iii. interpret signals
   iv. audible signals for cranes

6. Define quadrants of operation.
   i. division of sweep area into quadrants

7. Interpret load charts for pre-lift planning and hoisting operations.
   i. configuration of crane bases and booms
   ii. quadrants of operation and their effects on load charts
   iii. boom lengths and their effects on load charts
   iv. effects on values of boom angle, boom length, and load radius for chart listings

8. Define jib and jib offset.
   i. fixed jibs
   ii. luffing jibs

9. Identify the differences between gross capacity versus net capacity load on a crane.
   i. range diagrams

10. Identify the factors that reduce capacity.
   i. effects of increased load radius
   ii. effects of rapid swing rate
   iii. effects of impact loading and rapid acceleration or deceleration of load
   iv. effects of high wind speeds
   v. duty cycle operations

11. Describe safety considerations for short-term and long-term shutdowns.

12. Describe structural failure and stability failure.

13. Identify conditions of a load chart.
   i. calculate parts of line
   ii. calculate weight of line
   iii. weight of hook block

14. Identify main boom capacities.
   i. list capacity deductions
   ii. calculate net capacities

15. Describe the principles of crane operation.
   i. define leverage and stability
   ii. perform leverage calculation
   iii. describe changes in crane leverage and capacity during rotation of upper works.
   iv. describe forward and backward stability factors
   v. describe structural failure
   vi. describe wire rope safety factors for crane running and stationary ropes

16. Describe inspection procedures for a crane carrier.

17. Describe procedures for starting, moving, and proper shut down of a crane carrier.

18. Describe procedures to transport and operate cranes.
    i. safety pre-cautions for preparing and travelling cranes
    ii. municipal considerations for travelling cranes
    iii. operator's responsibility to prevent accidents, and the need for safety when travelling and operating cranes
    iv. manufacturer's recommendations or special precautions regarding travelling of cranes to and from job sites
    v. maximum allowable ground speed while travelling, corresponding to the cranes that are selected
    vi. warning sign(s) attached to cranes while travelling to and from job sites
    vii. clearances required for transporting and operating cranes

19. Describe conditions which prohibit crane operation.
    i. machine configurations that do not meet specifications
    ii. proper use of outriggers
    iii. crane levelling and the potential danger of instability
    iv. crane leveling procedures
    v. ground conditions and blocking procedures
    vi. weather and atmospheric conditions that restrict crane operation
    vii. eccentric reeving

20. Plan for performing a lift.
    i. evaluate work to be performed
    ii. considerations influencing lifting procedures
    iii. analyze factors influencing equipment selection
    iv. interpret an engineered lift
    v. plan a multiple crane lift

21. Identify and describe new model cranes.
    i. range of capacities available
    ii. range of boom lengths available
    iii. manufacturers
    iv. advantages/disadvantages

22. Describe the upper structure characteristics of new model cranes.
    i. boom technology
    ii. telescoping and pinning systems

Practical Requirements:

1. Inspect, start-up and shut down a crane.

2. Prepare and perform a crane lift.

LC1200 Hydraulics and Applications to Crane Control

Learning Outcomes:

- Demonstrate knowledge of the principles of hydraulic systems.
- Demonstrate knowledge required for inspecting and maintaining crane hydraulic systems.
- Demonstrate knowledge of good safety practices when inspecting and maintaining hydraulic systems.
- Demonstrate knowledge of conservation and environmental issues.

Duration: 15 Hours

Pre-Requisite(s): LC1045

Objectives and Content:

1. Describe the principles of power transfer through hydraulic systems.
   i. basic principles of hydraulics
   ii. hydraulic system operation
   iii. open and closed systems
   iv. implications for crane hydraulics

2. Describe the transmission of engine power to hydraulic power.
   i. swinging/slewing
   ii. boom/up/down
   iii. hydraulic pumps and motors

3. Describe the construction and operation of a basic hydraulic system.

4. Describe how hydraulic fluid is used in operations.
   i. valves
   ii. pumps
      - displacement of pumps
   iii. hydraulic cylinders
      - piston cylinders
      - cylinders on cranes

5. Describe the operation of hydraulic system components.
   i. motors
   ii. accumulators
   iii. filters
   iv. reservoirs
   v. monitoring devices

vi. hoses and fittings
vii. adapters
viii. SAE O-ring
ix. flangeheads
x. seals

6. Describe the qualities and properties of hydraulic fluids.

7. Describe the effect of cold weather and contaminants in a system.

8. Describe the maintenance of fluid levels and precautions when checking.

9. Describe the relationship of electric systems to hydraulic systems.

10. Identify crane components and describe how they are tested.
    i. controls
    ii. basic components
        - solenoids
        - relays
    iii. components and spools

11. Identify hydraulic systems used for all types of cranes.
    i. closed centre systems
    ii. open centre systems
    iii. speed-o-matic system (Link Belt)
    iv. hydraulically-powered (lattice boom cranes
    v. independent systems
    vi. combined systems
    vii. independent clutch
    viii. independent steering
    ix. hydraulic systems
        - boom lift system-hydraulic boom
        - swing system
        - hoist system
        - outrigger system
        - hydraulic counter-weight exterior system
    x. lattice boom crane upperworks
        - independent hydraulic system (gantry operation)
        - independent hydraulic system (boom operation)
        - independent hydrostatic drive system

Practical Requirements:

1. Perform routine maintenance and inspections for crane hydraulic systems.
   - i. general safety precautions
   - ii. cleanliness and inspection
   - iii. reservoir inspection
   - iv. inspection for leaks
   - v. leakdown
     - outrigger
     - boom hoist cylinders
     - boom extension cylinders

2. Test and replace components.
   - i. controls
   - ii. solenoids
   - iii. relays
   - iv. spools

LC1260 Rigging for Crane Operators

Learning Outcomes:

- Demonstrate knowledge of the procedures to use safety harnesses.
- Demonstrate knowledge of the procedures to perform rigging operations.

Course Duration: 60 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Describe the responsibilities of riggers.

2. Identify and describe the composition of wire rope.
   - i. wire
   - ii. strand
   - iii. core
     - fibre
     - wire
     - strand

3. Interpret and describe rope lay.
   - i. regular
   - ii. lang
   - iii. right and left
   - iv. alternate
   - v. herringbone
   - vi. twin strand
   - vii. specialty ropes

4. Identify specialty ropes, their use and limitations.

5. Describe and interpret sizes, grades and construction of rigging and hoisting ropes.

6. Identify and compare preformed vs. non-preformed types of ropes.

7. Identify and describe the fatigue and abrasion resistance of wire ropes.

8. Identify safety factors.
   i. rigging slings (IWRC and anti-rotation)
   ii. running ropes
   iii. standing ropes
   iv. hoisting personnel

9. Calculate safe working loads.

10. Identify rope classification groups.

11. Identify and describe uses for non-rotation and rotating resistant ropes.

12. Describe installation procedures for all types of wire rope.

13. Explain the importance of lubricating and cleaning wire ropes.

14. Identify characteristics and installation procedures for end fittings and connections.

15. Identify the minimum rope wraps on a drum that is to be maintained.

16. Identify grades of chain.
   i. strength
   ii. inspection
   iii. care and use

17. Describe reeving.

18. Identify the parts of line required.

19. Describe the effect of winch diameter.
   i. multi-layer (wire rope)
   ii. line speed vs. torque

20. Compare the SWL of rope vs. line pull.

21. Describe the effect of sheave friction during a lift.

22. Identify the mechanical advantage of reeving.

23. Describe wire block reeving methods.
   i. lacing
   ii. square or angle
   iii. skip

24. Identify and describe types and configurations for slings.
    i. wire rope
    ii. synthetic web
    iii. jacketed round synthetic
    iv. metal mesh
    v. chain
    vi. sling configurations
    vii. single vertical hitch
    viii. bridle hitch
    ix single and double basket hitch
    x. double wrap basket hitch
    xi. single and double choker hitch
    xii. double wrap choker hitch
    xiii. endless slings or grommet
    xiv. braided
    xv. sling angles
    xvi. safe working loads

25. Describe manufacturer identification tags.

26. Describe rigging precautions when using synthetic and specialty slings.

27. Describe the importance of removing frayed, cut, damaged and worn equipment from service.

28. Describe rigging procedures and perform rigging calculations.

29. Determine load weights.

30. Identify the centre of gravity for various loads.

31. Identify tensions on sling legs.

Practical Requirements:

1. Plan a rigging operation.
    i. calculate safe working loads and sling angles
    ii. calculate loads on equalizer beams

2. Signal a hoisting procedure.

3. Install multiple parts of line.
    i. lacing
    ii. reeving (square or angle/skip)

4. Inspect, use, handle, maintain and install a wire rope.
   i. lubricate
   ii. clean

5. Install wire rope wedge socket end termination.

6. Use crane components.
   i. drums and winches
   ii. sheaves
   iii. hooks
   iv. rings, links and swivels
   v. shackles
   vi. eye bolts and lugs
   vii. turnbuckles
   viii. come-a-long and chain hoist
   ix. spreader and equalizer beams
   x. crane blocks
   xi. wire rope blocks
   xii. snatch block
   xiii. block and tackle
   xiv. wire rope clips

7. Select and assemble rigging for a job.

8. Maintain and store rigging.

9. Complete a rigging calculation and perform a rigging procedure.

TC1115 Tower Crane Components

Learning Outcomes:

- Demonstrate knowledge of tower crane components, their characteristics and applications.
- Demonstrate knowledge of procedures used to troubleshoot, maintain, inspect and store tower crane components.

Duration: 15 Hours

Pre-Requisite(s): TC1105

Objectives and Content:

1. Define terminology associated with tower crane components.
   i. hammerhead
   ii. luffing
   iii. self-erecting

2. Identify hazards and describe safe work practices pertaining to tower crane components.

3. Interpret codes, standards and regulations pertaining tower crane components.
   i. manufacturers' specifications
   ii. CSA Z248
   iii. jurisdictional regulations

4. Identify types of tower crane components and describe their characteristics and applications.
   i. structural
   ii. support
   iii. track or travel
   iv. cab
   v. safety/access

5. Describe the procedures used to inspect connections of tower crane components and their accessories.

6. Describe the procedures used to troubleshoot tower crane components and accessories for various configurations.

7. Describe the procedures used to inspect, maintain and store tower crane components and their accessories.

Practical Requirements:

1. Locate and identify tower crane components.

2. Complete an inspection of a tower crane.
   i. pre-operational
   ii. post-operational

3. Store tower crane components.

TC1125 Access Equipment

Learning Outcomes:

- Demonstrate knowledge of access equipment, their applications, limitations and procedures for use.
- Demonstrate knowledge of procedures used to inspect and maintain access equipment.

Duration: 15 Hours

Pre-Requisite(s): TC1105

Objectives and Content:

1. Define terminology associated with access equipment.

2. Identify hazards and describe safe work practices pertaining to access equipment.

3. Identify codes, standards and regulations pertaining to access equipment.
   i. training and certification requirements
   ii. jurisdictional requirements

4. Identify types of access equipment and describe their characteristics and applications.
   i. ladders
   ii. catwalks
   iii. scaffolding

5. Identify types of fall protection and fall arrest equipment and describe their applications and procedures for use.

6. Describe the procedures used to erect and dismantle access equipment.
   i. manufacturers' specifications
   ii. professional engineer specifications

7. Describe the procedures used to inspect and maintain access equipment.

Practical Requirements:

1. Use access equipment.

TC1160 Assembly and Disassembly

Learning Outcomes:

- Demonstrate knowledge of tower cranes and their associated components.
- Demonstrate knowledge of the procedures used for the assembly and disassembly of tower cranes and their components.

Duration: 30 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Define terminology associated with the assembly and disassembly of tower cranes.

2. Identify hazards and describe safe work practices pertaining to the assembly and disassembly of tower cranes.

3. Identify tools and equipment related to the assembly and disassembly of tower cranes and describe their applications and procedures for use.

4. Interpret codes, standards and regulations pertaining to the assembly and disassembly of tower cranes.
   i. permits

5. Interpret charts, drawings and specifications related to the assembly and disassembly of tower cranes.
   i. manufacturers' specifications
   ii. professional engineer specifications

6. Identify tower crane components requiring assembly and disassembly.
   i. mast/tower
   ii. boom/trolley
   iii. counter-jib
   iv. counter-weight
   v. apex/tower top

7. Describe the procedures used to assemble tower cranes and their components.

8. Describe the procedures used to disassemble tower cranes and their components.

9. Describe the procedures used for the assembly and disassembly of specialty equipment and their attachments.

10. Describe the procedures used to transport tower crane components and self-erecting tower cranes.

Practical Requirements:

1. Perform a function test.

2. Perform a load test.

TC1210 Crane Reconfiguration

Learning Outcomes:

- Demonstrate knowledge of tower cranes, their components, characteristics applications and operation
- Demonstrate knowledge of performing crane reconfiguration
- Demonstrate knowledge of regulatory requirements pertaining to crane reconfiguration

Duration: 6 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Identify standards and regulations pertaining to crane reconfiguration.

2. Identify tools and equipment used to perform crane reconfiguration, and describe their procedures for use.

3. Identify hazards and describe safe work practices to perform crane reconfiguration.

4. Describe procedures to verify that reconfiguration is allowable by manufacturer or professional engineer.

5. Describe procedures to perform crane reconfiguration.

6. Describe effects of weather conditions on crane reconfiguration

Practical Requirements:

None.

TC1170 Pre-lift Planning

Learning Outcomes:

- Demonstrate knowledge of the steps required for pre-lift activities.
- Demonstrate knowledge of procedures used to perform pre-lift (warm-up) activities.
- Demonstrate knowledge of the procedures used to prepare worksite for tower crane operations.

Duration: 6 Hours

Pre-Requisite(s): TC1160

Objectives and Content:

1. Define terminology associated with pre-lift planning.

2. Identify hazards and describe safe work practices pertaining to pre-lift planning.

3. Identify tools and equipment relating to pre-lift planning and activities and describe their applications and procedures for use.

4. Interpret codes, standards and regulations pertaining to pre-lift planning.
   i. jurisdictional requirements
   ii. job site/company policies

5. Interpret information pertaining to lifting operations found on drawings and specifications.
   i. lift plans
   ii. manufacturers' specifications

6. Identify the considerations and requirements for completing pre-lift planning.
   i. risk assessment (job site hazard analysis)
   ii. site assessment
      - site/soil conditions
      - crane access
      - obstructions
      - electrical hazards
   iii. worksite preparation

7. Describe the procedures used to prepare worksite for crane operations.

8. Describe the procedures used to perform final site inspection.

Practical Requirements:

None.

AM1341 Hoisting Math Fundamentals

Learning Outcomes:

- Demonstrate knowledge of mathematical concepts in the performance of trade practices.
- Demonstrate knowledge of mathematics as a critical element of the trade environment.
- Solve mathematical word problems.
- Demonstration knowledge of mathematical principles for the purposes of problem solving, job and materials estimation, measurement, calculation, system conversion, diagram interpretation and scale conversions, formulae calculations, and geometric applications.

Duration: 42 Hours

Pre-Requisite(s): None (for direct entry apprentices only)

Objectives and Content:

The instructor is required to use trade specific examples to reinforce the course objectives.

1. Describe percent/decimal/fraction conversions and comparisons in trade specific situations.

2. Describe ratios and proportions as they relate to trade specific problems.

3. Describe the use of the Imperial and Metric measurement systems in trade specific applications.

4. Describe Imperial and Metric conversions in trade specific situations.
   i. convert between imperial and metric measurements
   ii. convert to another unit within the same measurement system

5. Describe how to manipulate formulas using cross multiplication, dividing throughout, elimination, and substitution to solve trade specific problems.
   i. right angle triangles
   ii. area
   iii. volume
   iv. perimeter
   v. density

6. Identify calculations involving geometry that are relevant to the trade.

i. angle calculations
ii. circle calculations

7. Identify math processes used to complete administrative trade tasks.
   i. material estimation
   ii. material costing
   iii. time & labour estimates
   iv. taxes & surcharges
   v. markup & projecting revenue

Practical Requirements:

1. To emphasize or further develop specific knowledge objectives, students will be asked to complete practical demonstrations which confirm proper application of mathematical theory to job skills.

Note: This course is **non-transferable** to other trades programs, and **not eligible for prior learning assessment**. Students completing training in this trade program are required to complete this math course. Apprentice transfers under Provincial / Territorial Mobility agreements may be exempt from this requirement.

TC1220 Self-Erecting Cranes

Learning Outcomes:

- Demonstrate knowledge of self-erecting tower cranes, their components, characteristics, applications and operation
- Demonstrate knowledge of training and certification requirements pertaining to transportation of self-erecting tower cranes
- Demonstrate knowledge of regulatory requirements pertaining to transportation of self-erecting tower cranes
- demonstrate knowledge of procedures to transport self-erecting tower cranes
- demonstrate knowledge of procedures for assembly and disassembly of self-erecting tower cranes

Duration: 6 Hours

Pre-Requisites: TC1160

Objectives and Content:

1. Identify self-erecting tower cranes and their components, and describe their characteristics and applications.

2. Identify standards, restrictions and regulations pertaining to assembly , disassembly and transportation of self-erecting tower cranes.

3. Identify hazards and describe safe work practices to assemble, disassemble and transport self-erecting tower cranes.

4. Identify tools and equipment used to assemble and disassemble self-erecting tower cranes, and describe their procedures for use.

5. Identify training and certification requirements pertaining to assembly, disassembly and transportation of self-erecting tower cranes.

6. Interpret information pertaining to self-erecting tower cranes and their components found in specifications.

7. Interpret charts, drawings and specifications relating to self-erecting crane transportation.

8. Identify types of map tools used for pre-trip planning, and describe their characteristics and applications.

9. Identify factors for selecting transportation routes.

10. Describe procedures to secure self-erecting tower cranes.

11. Describe procedures to transport self-erecting tower cranes.

12. Describe procedures to assemble and disassemble self-erecting tower cranes.

13. Describe operating principles of self-erecting tower cranes.

Practical Requirements:

None

LC1115 Crane Maintenance

Learning Outcomes:

- Demonstrate knowledge of various codes and regulations required for inspecting and maintaining cranes.
- Demonstrate knowledge of good safety practices when maintaining cranes.
- Demonstrate knowledge of conservation and environmental issues when maintaining cranes.

Duration: 30 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Describe service manuals.
   - i. sections
     - maintenance
     - servicing
     - lubrication procedures
   - ii. interpreting information
   - iii. complying with service manuals

2. Describe the procedure to order parts.
   - i. locate machine serial number or Vehicle Identification Number (VIN)
   - ii. locate engine specifications plate and serial number
   - iii. complete order form

3. Identify lubricants and describe their purposes.
   - i. lubrication system components and servicing periods
   - ii. oil grades and uses under various temperature conditions
   - iii. grease types and performance under extreme load and heat
   - iv. functions of engine oil
   - v. advantages and disadvantages of additives used in engine oil
   - vi. characteristics of gear lubricants
   - vii. American Petroleum Institute (A.P.I) Engine Service Classification

4. Describe the crane log book.
   - i. service meter

5. Describe the procedures to service and charge batteries.
   - i. care and maintenance
   - ii. clean and service
   - iii. measure electrolyte

iv. charger connections

6. Describe the procedures to maintain fuel systems.
   i. components
   ii. priming
   iii. servicing
   iv. refueling process and precautions

7. Describe the procedures to maintain cooling systems.
   i. components
   ii. classification of coolant
   iii. testing coolant

8. Identify start-up and shut down procedures as prescribed in the service manual.

9. Identify attachments available, and their purpose and maintenance.

10. Describe the procedures to maintain and adjust tracks, tires and wheels.

Practical Requirements:

1. Follow a maintenance procedure.

2. Assist in changing transmission fluid, engine oil and related filters.

3. Select tools and grease a piece of equipment.

4. Affix a warning sign where it can be easily recognized on a piece of equipment.

5. Assist in priming and servicing a fuel system, then refuel a machine.

6. Service and charge a storage battery.

TC1130 Electrical Systems

Learning Outcomes:

- Demonstrate knowledge of electrical systems, their purpose and operation.
- Demonstrate knowledge of electrical system components, their characteristics and applications.
- Demonstrate knowledge of procedures used to inspect, maintain and troubleshoot electrical systems and their components.

Duration: 15 Hours

Pre-Requisite(s): TC1115, TC1125

Objectives and Content:

1. Define terminology associated with electrical systems.

2. Identify hazards and describe safe work practices pertaining to electrical systems and their components.

3. Identify tools and equipment relating to electrical systems and components and describe their applications and procedures for use.

4. Interpret codes, standards and regulations pertaining to electrical systems.
   i. training and certification requirements
   ii. manufacturers' specifications

5. Identify types of electrical systems and describe their purpose and operation.
   i. digital
   ii. analog
   iii. control voltage
   iv. supply voltage

6. Identify electrical system components and describe their applications.
   i. limit switches
   ii. grounding
   iii. supply cables
   iv. disconnect switches
   v. strain relief devices (power cable supports)
   vi. power supply
   vii. motors
   viii. digital drives

7. Describe the procedures used to troubleshoot electrical systems and their components.

8. Describe the procedures used to maintain electrical systems and their components.

9. Describe the procedures used to inspect electrical systems and their components.

Practical Requirements:

1. Inspect an electrical system and its components.

TC1140 Mechanical Systems

Learning Outcomes:

- Demonstrate knowledge of mechanical systems, their purpose and operation.
- Demonstrate knowledge of mechanical system components, their characteristics and applications.
- Demonstrate knowledge of procedures used to inspect, maintain and troubleshoot mechanical systems and their components.

Duration: 15 Hours

Pre-Requisite(s): TC1115, TC1125

Objectives and Content:

1. Define terminology associated with mechanical systems.

2. Identify hazards and describe safe work practices pertaining to mechanical systems and their components.

3. Identify tools and equipment relating to mechanical systems and components and describe their applications and procedures for use.

4. Interpret codes, standards and regulations pertaining to mechanical systems.

5. Identify types of mechanical systems and describe their purpose and operation.

6. Identify mechanical system components and describe their applications.
   i. winches
   ii. sheaves
   iii. slewing drives
   iv. brakes
   v. gear boxes
   vi. mechanical safety devices
   vii. trolley components
   viii. lines and ropes

7. Describe the procedures used to troubleshoot mechanical systems and their components.

8. Describe the procedures used to maintain mechanical systems and their components.
   i. lubricate

ii. torque bolts
iii. mark bolts

9. Describe the procedures used to inspect mechanical systems and their components.

2. Describe the procedures used to inspect structural and support components.

Practical Requirements:

1. Inspect a mechanical system and its components.

TC1150 Tower Crane Load Charts

Learning Outcomes:

- Demonstrate knowledge of tower crane load charts, their characteristics and applications.
- Demonstrate knowledge of tower crane capacity, tower crane component capacity and working radius for lifting operations.

Duration: 60 Hours

Pre-Requisite(s): TC1130, TC1140

Objectives and Content:

1. Define terminology associated with tower crane load charts.

2. Interpret codes, standards and regulations pertaining to tower crane load charts.
   i. CSA Z248
   ii. jurisdictional regulations

3. Identify parts of a tower crane load chart and describe their characteristics and applications.
   i. notes
   ii. capacity charts
   iii. range diagram
   iv. technical data
   v. factors reducing capacity

4. Interpret data from tower crane load charts required to plan lifts.
   i. reeving requirements
   ii. parts of line
   iii. quadrants of operation
   iv. capacity reductions for various configurations

5. Identify factors (i.e. weather) that influence tower crane capacity in lifting operations and describe their impact.
   i. size and/or weight of load
   ii. environmental conditions

Practical Requirements:

1. Interpret load chart data and calculate tower crane capacities.

TC1180 Climbing and Lowering

Learning Outcomes:

- Demonstrate knowledge of climbing and lowering components and their applications.
- Demonstrate knowledge of the procedures used for climbing and lowering operations.

Duration: 6 Hours

Pre-Requisite(s): TC1170

Objectives and Content:

1. Define terminology associated with climbing and lowering.

2. Identify hazards and describe safe work practices pertaining to climbing and lowering.

3. Interpret codes, standards and regulations pertaining to climbing and lowering.

4. Interpret charts, drawings and specifications relating to climbing and lowering.

5. Identify types of climbing and lowering components and describe their applications.

6. Identify the considerations and requirements for climbing and lowering tower cranes according to manufacturer’s specifications..

7. Describe the procedures used to perform bottom-climbing operations.

8. Describe the procedures used to perform top-climbing operations.

9. Describe the procedures used to perform lowering operations

Practical Requirements:

None.

TC1190 Specialty Crane Operations

Learning Outcomes:

- Demonstrate knowledge of specialty crane operations, their characteristics and applications.
- Demonstrate knowledge of the procedures used to perform specialty crane operations.

Duration: 6 Hours

Pre-Requisite(s): TC1170

Objectives and Content:

1. Define terminology associated with specialty crane operations.

2. Identify hazards and describe safe work practices pertaining to specialty crane operations.

3. Interpret codes, standards and regulations pertaining to specialty crane operations.

4. Interpret charts, drawings and specifications pertaining to specialty crane operations.

5. Identify specialty crane operations and describe their characteristics and applications.
   i. multi-crane lifts
   ii. hoisting personnel
   iii. evacuation procedures
   iv. critical capacity lifts
   v. professional engineer specifications
   vi. travels crane

6. Describe the procedures used to attach equipment to cranes for specialty operations.

7. Describe the procedures used to perform specialty crane operations.

Practical Requirements.

None.

TC1200 Tower Crane Profiles

Learning Outcomes:

- Demonstrate knowledge of hammer head, luffing jib and self-erecting tower cranes, their applications and operation.
- Demonstrate knowledge of the procedures used to operate hammer head, luffing jib and self-erecting tower cranes and their attachments.

Duration: 9 Hours

Pre-Requisite(s): TC1170

Objectives and Content:

1. Define terminology associated with hammer head, luffing jib and self-erecting tower crane operations.

2. Identify hazards and describe safe work practices pertaining to hammer head, luffing jib and self-erecting tower crane operations.
   i. personnel
   ii. equipment
   iii. environmental

3. Interpret codes, standards and regulations pertaining to hammer head, luffing jib and self-erecting tower crane operations.
   i. site-specific
   ii. jurisdictional regulations

4. Interpret charts, drawings and specifications pertaining to hammer head, luffing jib and self-erecting tower crane operations.
   i. lift plans
   ii. manufacturers' specifications

5. Describe the procedures used to operate hammer head, luffing jib and self-erecting tower cranes and their attachments.

Practical Requirements.

None.

TC1300 Workplace Mentoring

Learning Outcomes:

- Demonstrate knowledge of strategies for learning skills in the workplace.
- Demonstrate knowledge of strategies for teaching workplace skills.

Duration: 6 Hours

Pre-Requisite(s): None

Objectives and Content:

1. Describe the importance of individual experience.

2. Describe the shared responsibilities for workplace learning.

3. Describe the importance of determining individual learning preferences and how these relate to learning new skills.

4. Identify different learning styles.
   i. seeing it
   ii. hearing it
   iii. trying it

5. Identify different learning needs and strategies to meet learning needs.
   i. learning disabilities
   ii. learning preferences
   iii. language proficiency

6. Identify strategies to assist in learning a skill.
   i. developing coaching skills
   ii. being mature and patient
   iii. providing feedback

7. Identify different roles played by a workplace mentor.

8. Identify importance of a lesson to the mentoring process.
   i. determine the point of a lesson.
   ii. choose a good time to present a lesson
   iii. link the lesson to trade knowledge and skills

9. Describe the importance of different types of skills in the workplace.

10. Identify the components of a skill (context) and describe considerations in setting up opportunities for skill practice.

11. Explain the importance of providing feedback and identify techniques for giving effective feedback.

12. Describe a skills assessment and identify methods of assessing progress.

Practical Objectives:

None

C. Conditions Governing Apprenticeship Training

1.0 General

The following general conditions apply to all apprenticeship training programs approved by the Provincial Apprenticeship and Certification Board (PACB) in accordance with the **Apprenticeship Training and Certification Act (1999)**. If an occupation requires additional conditions, these will be noted in the specific Plan of Training for the occupation. In no case should there be a conflict between these conditions and the additional requirements specified in a certain Plan of Training. All references to Memorandum of Understanding will also apply to Letter of Understanding (LOU) agreements.

2.0 Entrance Requirements

2.1 Entry into the occupation as an apprentice requires:

Indenturing into the occupation by an employer who agrees to provide the appropriate training and work experiences as outlined in the Plan of Training.

2.2 Notwithstanding the above, each candidate must have successfully completed a high school program or equivalent, and in addition may be required to have completed certain academic subjects as specified in a particular Plan of Training. Mature students, at the discretion of the Director of Apprenticeship and Trades Certification, may be registered. A mature student is defined as one who has reached the age of 19 and who can demonstrate the ability and the interest to complete the requirements for certification.

2.3 At the discretion of the Director of Apprenticeship and Trades Certification, credit toward the apprenticeship program may be awarded to an apprentice for previous work experience and/or training as validated through prior learning assessment.

2.4 An Application for Apprenticeship form must be duly completed along with a Memorandum of Understanding as applicable to be indentured into an Apprenticeship. The Memorandum of Understanding must contain signatures of an authorized employer representative, the apprentice and an official representing the Provincial Apprenticeship and Certification Board to be valid.

2.5 A new Memorandum of Understanding must be completed for each change in an employer during the apprenticeship term.

3.0 Probationary Period

The probationary period for each Memorandum of Understanding will be six months or 900 employment credit hours. Within that period the memorandum may be terminated by either party upon giving the other party and the PACB one week notice in writing.

4.0 Termination of a Memorandum of Understanding

After the probationary period referred to in Section 3.0, the Memorandum of Understanding may be terminated by the PACB by mutual consent of the parties involved, or cancelled by the PACB for proper and sufficient cause in the opinion of the PACB, such as that stated in Section14.

5.0 Apprenticeship Progression Schedule, Wage Rates and Advanced Training Criteria

Progression Schedule

Tower Crane Operator-3000 Hours			
Apprenticeship Level and Wages			
Year	Wage Rate At This Level	Requirements for progression to next level of apprenticeship	When requirements are met, the apprentice will progress to…
1st	60%	▪ Completion of Level 1 training ▪ Pass Level 1 Exam ▪ Minimum 1000 hours of combined relevant work experience and training	2nd Year
2nd	75%	▪ Minimum 2000 hours of combined relevant work experience and training	3rd Year
3rd	90%	▪ Minimum 3000 hours of combined relevant work experience and training ▪ Sign-off of all workplace skills in the apprentice logbook ▪ Pass certification exam	Journeyperson Certification

Wage Rates

- Rates are percentages of the prevailing journeyperson's wage rate in the place of employment of the apprentice.
- Rates must not be less than the wage rate established by the Labour Standards Act (1990), as now in force or as hereafter amended, or by other order, as amended from time to time replacing the first mentioned order.
- Rates must not be less than the wage rate established by any collective agreement which may be in force at the apprentice's workplace.
- Employers are free to pay wage rates above the minimums specified.

Level Exams

- This program may **not** currently contain Level Exams, in which case this requirement will be waived until such time as Level Exams are available.

Tower Crane Operator-3000 Hours		
Class Calls (After Apprenticeship Registration)		
Call Level	Requirements for Class Call	Hours Awarded for In-School Training
Direct Entry Level 1	▪ Minimum of 1800 hours of relevant work experience ▪ Prior Learning Assessment (PLA) at designated college (if applicable)	420
Class Calls at Minimum Hours: ▪ Class calls may not always occur at the minimum hours indicated. Some variation is permitted to allow for the availability of training resources and apprentices.		

6.0 Tools

Apprentices shall be required to obtain their own hand tools applicable for the designated occupation of registration or tools as specified by the PACB.

7.0 Periodic Examinations and Evaluation

7.1 Every apprentice shall submit to such occupational tests and examinations as the PACB shall direct. If after such occupational tests and examinations the apprentice is found to be making unsatisfactory progress, his/her apprenticeship level and rate of wage shall not be advanced as provided in Section 5 until his/her progress is satisfactory to the Director of Apprenticeship and Trades Certification and his/her date of completion shall be deferred accordingly. Persistent failure to pass required tests shall be a cause for revocation of his/her Memorandum of Understanding.

7.2 Upon receipt of reports of accelerated progress of the apprentice, the PACB may shorten the term of apprenticeship and advance the date of completion accordingly.

7.3 For each and every course, a formal assessment is required for which 70% is the pass mark. A mark of 70% must be attained in both the theory examination and the practical project assignment, where applicable as documented on an official transcript.

7.4 Course credits may be granted through the use of a PACB approved matrix which identifies course equivalencies between designated trades and between current and historical Plans of Training for the same trade.

8.0 Granting of Certificates of Apprenticeship

Upon the successful completion of apprenticeship, the PACB shall issue a Certificate of Apprenticeship.

9.0 Hours of Work

Any hours employed in the performance of duties related to the designated occupation will be credited towards the completion of the term of apprenticeship. Appropriate documentation of these hours must be provided.

10.0 Copies of the Registration for Apprenticeship

The Director of Apprenticeship and Trades Certification shall provide copies of the Registration for Apprenticeship form to all signatories to the document.

11.0 Ratio of Apprentices to Journeypersons

Under normal practice, the ratio of apprentices to journeypersons shall not exceed two apprentices to every one journeyperson employed. Other ratio arrangements would be determined and approved by the PACB.

12.0 Relationship to a Collective Bargaining Agreement

Where applicable in Section 5 of these conditions, Collective Agreements take precedence.

13.0 Amendments to a Plan of Apprenticeship Training

A Plan of Training may be amended at any time by the PACB.

14.0 Employment, Re-Employment and Training Requirements

14.1 The Plan of Training requires apprentices to regularly attend their place of employment.

14.2 The Plan of Training requires apprentices to attend training for that occupation as prescribed by the PACB.

14.3 Failure to comply with Sections 14.1 and/or 14.2 will result in cancellation of the Memorandum of Understanding. Apprentices may have their MOUs reinstated by the PACB but would be subject to a commitment to complete the entire program as outlined in the General Conditions of Apprenticeship. Permanent cancellation in the said occupation is the result of non-compliance.

14.4 Cancellation of the Memorandum of Understanding to challenge journeyperson examinations, if unsuccessful, would require an apprentice to serve a time penalty of two (2) years before reinstatement as an apprentice or qualifying to receive a class call to training as a registered Trade Qualifier. Cancellation must be mutually agreed upon by the employer and the apprentice.

14.5 An employer shall ensure that each apprentice is under the direct supervision of an approved journeyperson supervisor who is located at the same worksite as the apprentice, and that the apprentice is able to communicate with the journeyperson with respect to the task, activity or function that is being supervised.

14.6 Under the Plan of Training the employer is required to keep each apprentice employed as long as work is available, and if the apprentice is laid off due to lack of work, to give first opportunity to be hired before another is hired.

14.7 The employer will permit each apprentice to attend training programs as prescribed by the PACB.

14.8 Apprentices who cannot acquire all the workplace skills at their place of employment will have to be evaluated in a simulated work environment at a PACB authorized training institution and have sign-off done by instructors to meet the requirements for certification.

15.0 Appeals to Decisions Based on Conditions Governing Apprenticeship Training

Persons wishing to appeal any decisions based on the above conditions must do so in writing to the Minister of Education and Early Childhood Development within 30 days of the decision.

D. Requirements for Red Seal Endorsement

1. Evidence the required work experiences outlined in this Plan of Training have been obtained. This evidence must be in a format clearly outlining the experiences and must be signed by an appropriate person or persons attesting that these experiences have been obtained to the level required.

2. Successful completion of all required courses in the program.

3. A combination of training from an approved training program and suitable work experience totaling 3000 hours.

4. Completion of a National Red Seal examination, to be set at a place and time determined by the Apprenticeship and Trades Certification Division.

E. Roles and Responsibilities of Stakeholders in the Apprenticeship Process

The apprenticeship process involves a number of stakeholders playing significant roles in the training of apprentices. This section outlines these roles and the responsibilities resulting from them.

The Apprentice:

- completes all required technical training courses as approved by the PACB.
- finds appropriate employment.
- completes all required work experiences in combination with the required hours.
- ensures work experiences are well documented.
- approaches apprenticeship training with an attitude and commitment that fosters the qualities necessary for a successful career as a qualified journeyperson.
- obtains the required hand tools as specified by the PACB for each period of training of the apprenticeship program.

The Employer:

- provides high quality work experiences in an environment conducive to learning.
- remunerates apprentices as set out in the Plan of Training or Collective Agreements.
- provides feedback to training institutions, Apprenticeship and Trades Certification Division and apprentices in an effort to establish a process of continuous quality improvement.
- where appropriate, releases apprentices for the purpose of returning to a training institution to complete the necessary technical courses.
- ensures work experiences of the apprentice are documented.
- ensures a certified journeyperson is currently on staff in the same trade area as the apprentice and whose certification is recognized by the NL Department of Education and Early Childhood Development.

The Training Institution:

- provides a high quality learning environment.
- provides the necessary student support services that will enhance an apprentice's ability to be successful.
- participates with other stakeholders in the continual updating of programs.

The Apprenticeship and Trades Certification Division:

- establishes and maintains program advisory committees under the direction of the PACB.
- promotes apprenticeship training as a viable career option to prospective apprentices and other appropriate persons involved, such as career guidance counsellors, teachers, parents, etc.
- establishes and maintains a protocol with training institutions, employers and other appropriate stakeholders to ensure the quality of apprenticeship training programs.
- ensures all apprentices are appropriately registered and records are maintained as required.
- schedules all necessary technical training periods for apprentices to complete requirements for certification.
- administers level, provincial and interprovincial examinations.

The Provincial Apprenticeship and Certification Board:

- sets policies to ensure the provisions of the **Apprenticeship and Certification Act (1999)** are implemented.
- ensures advisory and examination committees are established and maintained.
- accredits institutions to deliver apprenticeship training programs.
- designates occupations for apprenticeship training and/or certification.

Department of Education and Early Childhood Development
Apprenticeship and Trades Certification Division

Newfoundland & Labrador