Safety Authority

Do it right. Stay safe.

Class H
Elevating Devices Mechanic

PROGRAM OUTLINE

www.safetyauthority.ca Toll free: 1.866.566.7233

SAFETY NOTICE

Disclaimer:

Please note that references to the Acts, Regulations, and Codes throughout this document may not reflect the most recent versions available.

Also, the references in this outline are by no means an exhaustive list of all the situations that may apply to a particular situation.

Therefore, the user should make sure that references are current and relevant to any particular situation that they are dealing with.

The latest version of this document is available in PDF format on the BCSA website.**www.safetyauthority.ca**

TABLE OF CONTENTS

Section 1: Introduction

FOREWORD

The Elevating Devices Mechanic (Class H) 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 British Columbia industry and 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.

The Program Outline was prepared with the advice and assistance of the Elevating Devices Mechanic (Class H) Review Committee and will form the basis for further updating of the British Columbia Elevating Devices Mechanic (Class H) Program and learning resources by the BC Safety Authority.

Each competency is to be evaluated through the use of written examination in which the individual must achieve a minimum of 70% in order to receive a passing grade. The types of questions used on these exams must reflect the cognitive level indicated by the learning objectives and the Learning Tasks listed in the related competencies.

Workplace Achievement Criteria are included for those competencies that require a practical component.

The Elevating Devices Mechanic Personal Skills Passport will be used to verify the successful completion of all required tasks. Some competencies have more than one Achievement Criteria. Many of the Achievement Criteria require the passport holder to demonstrate the same competency on multiple setups over a period of time. A Certified Mechanic is required to initial each of the Learning Tasks and sign the bottom of the form for each Achievement Criteria.

ACKNOWLEDGMENTS

The Program Outline was prepared with the advice and direction of an industry steering committee convened initially by the BC Safety Authority (BCSA). Members include:

Dwight Kirkwood	Kirkwood Elevators Ltd
Roberta Kirkwood	Kirkwood Elevators Ltd
Don Molson	Seymour Engineering Ltd
Cam Pomeroy	Western Elevator Ltd.
Daniel Royston	BC Safety Authority
Don Sanchez	Garaventa Lift (Canada) Ltd.
Tim Thuler	Medichair Nanaimo

The BC Safety Authority would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the training requirements of the Elevating Devices Mechanic (Class H) occupation.

HOW TO USE THIS DOCUMENT

This Program Outline has been developed for the use of individuals from several different audiences.

This table describes how each audience can use the document.

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Program Requirements	Communicate program length and structure and all pathways to completion	Understand the length and structure of the program	Understand the length and structure of the program and pathway to completion	Understand challenger pathway to Certificate of Qualification
Program Assessment	Communicate program completion requirements and assessment methods	Understand the various assessment requirements for the program	Understand the various assessment requirements for the program	Understand the assessment requirements they would have to fulfill in order to challenge the program
Occupational Analysis Chart	Communicate the competencies that industry has defined as representing the scope of the occupation	Understand the competencies that an apprentice is expected to demonstrate in order to achieve certification	View the competencies they will achieve as a result of program completion	Understand the competencies they must demonstrate in order to challenge the program

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
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	Understand 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	Understand 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	Understand 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, measureable achievement criteria for objectives with a practical component	Identifies detailed program content and performance expectations for competencies with a practical component; may be used as a checklist prior to signing a recommendation for certification (RFC) for an apprentice	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
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 instructor	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

Section 2:
Program Overview

PROGRAM REQUIREMENTS FOR ELEVATING DEVICE MECHANIC (CLASS H) CERTIFICATE OF QUALIFICATION

Requirement	Path 1	Path 2	Path 3
Prerequisite Safety Training	Yes	Yes	Yes
Technical Training	Electrical Level 1 Millwright Level 1	Certified Accessibility Technician (CAT) Candidate Program	Recognized apprenticeship program by other Canadian jurisdictions
Supplementary Courses	BC Safety Standards Act; BC Elevating Devices Safety Regulations; and, BC Safety Standards General Regulation (4 hrs) B355 Lifts for Persons with Physical Disabilities (4 hrs) Reference Materials from CAT courses 1, 2, 3, 4, and 5 Produc-specific training for maintenance of elevating devices, cabs, carriages, and platform cabs (4 hrs) Product-specific training for repair of hydraulic systems (12 hrs)	BC Safety Standards Act; BC Elevating Devices Safety Regulations; and, BC Safety Standards General Regulation (4 hrs) B355 Lifts for Persons with Physical Disabilities (4 hrs) Canadian Electrical Code Section 38 (4 hrs) Product-specific training for maintenance of elevating devices, cabs, carriages, and platform cabs (4 hrs) Product-specific training for repair of hydraulic systems (12 hrs)	BC Safety Standards Act; BC Elevating Devices Safety Regulations; and, BC Safety Standards General Regulation (4 hrs)
Documented and verifiable hands-on work experience	4000 hrs	4000 hrs	4000 hrs
BCSA Certification Exam	Yes	Yes	Yes

PROGRAM ASSESSMENT

Apprentices will be assessed fairly and accurately throughout the program on the various skills required to be a professional Elevating Devices Mechanic (Class H). Assessment activities are designed to provide feedback and allow for further development of skills that have been identified as essential for on the job performance. The forms of assessment used in this program are described below.

Completion Requirement	Evidence of Achievement	Level of Achievement Required
Level 1 Technical Training	In-school testing and practical assessment	Minimum 70%
Level 2 Technical Training	In-school testing and practical assessment	Minimum 70%
Work-based Training Hours	Work-based training report completed by Sponsor or Employer	4000 hours completed
BCSA Exam	BCSA certification exam	Minimum 70%
BCSA Certificate of Qualification	Approval or sign-off by the BCSA	Certificate of Qualification

OCCUPATIONAL ANALYSIS CHART

Occupation Description:

"Elevating Devices Mechanic
(Class H)" means a person who designs, installs, constructs, alters, repairs, maintains or tests elevating devices for individuals with physical disabilities as defined in the latest edition of the *British Columbia Elevating Devices Safety Act and Regulation.*

Use Safe Work Practices **A**	Control Workplace Hazards A1	Comply with the OHS Regulation and WorkSafeBC Standards A2	Use WHMIS A3	Use Personal Protective Equipment A4	Apply Fire Prevention Practices A5	
	P	P	P	P	P	
Use Tools and Equipment **B**	Use Hand Tools B1	Use Power Tools B2	Use Measuring and Alignment Tools B3	Use Ladders, Scaffolding, and Platforms B5	Use Electrical Test Equipment B7	
	P	P	P	P	2	
Use Fundamental Skills **C**	Describe the Elevating Device Industry C1	Apply Mechanical Principles C3	Read Drawings and Specifications C4	Use Acts, Regulations, and Codes C5	Use Manufacturer and Supplier Documentation C6	Plan a Project C7
	1	1	1	1	1	1
	Apply Troubleshooting Techniques C8	Use Mathematics and Science (Level 1) C9				
	1	1				
Install Traction and Hydraulic Common Components **D**	Layout Hoistways D1	Install Guide Rails, Guide Rail Supports, and Fastenings D2	Install Wiring Raceways, Fixtures, and Wiring D5	Adjust and Commission Elevating Devices D7	Install Hoistway Doors and Lock Assemblies D8	
	1	1	2	2	2	

Install Hydraulic Elevators **F**	Describe the Principles of Hydraulic Systems F1	Install Pit Structures, Jacks, and Suspension Systems F2	Install Machine Room Equipment F3	Install the Hydraulic Piping System F4	
	1	1	2	2	
Apply the Principles of Electricity and Electronics **G**	Describe the Principles of Electricity G1	Read Electrical Drawings and Specifications G2	Install Electrical Systems G5	Describe Electrical and Electronic Systems (Level 1) G9	Maintain Electrical and Electronic Systems (Level 1) G10	Troubleshoot Electrical and Electronic Systems (Level 1) G11
	2	2	2	2	2	2
Maintain Elevating Systems **J**	Maintain Elevating Device Cabs, Carriages, and Platforms J7					
	1					
Repair Elevating Systems **K**	Repair Elevating Systems for Handicap Lifts K7					
	2					
Install Incline Lifts **M**	Describe the Layout for Inclined Lifts M1	Install Rail Systems M2	Install Carriage and Seat or Platform M3	Adjust and Commission Incline Lifts M4		
	1	1	1	1		
Install Other Accessibility Lifts **O**	Describe the Principles of Other Elevating Systems O1	Describe the Installation of Other Accessibility Lift Systems O2				
	1	1				

TRAINING TOPICS AND SUGGESTED TIME ALLOCATION SUMMARIZED BY GENERAL AREA OF COMPETENCY (GAC)

ELEVATING DEVICES MECHANIC (CLASS H)

Line A	Use Safe Work Practices	Hours	% of Total
A1	Control Workplace Hazards	4	
A2	Comply with the OHS Regulation and WorkSafeBC Standards	4	
A3	Use WHMIS	3	
A4	Use Personal Protective Equipment	4	
A5	Apply Fire Prevention Practices	1	
	Total Line A	**16**	**4%**

Line B	Use Tools and Equipment	Hours	% of Total
B1	Use Hand Tools	1	
B2	Use Power Tools	2	
B3	Use Measuring and Alignment Tools	1	
B5	Use Ladders, Scaffolding, and Platforms	4	
B7	Use Electrical Test Equipment	4	
	Total Line B	**12**	**3%**

Line C	Use Fundamental Skills	Hours	% of Total
C1	Describe the Elevating Industry	2	
C3	Apply Mechanical Principles	16	
C4	Read Drawings and Specifications	8	
C5	Use Acts, Regulations, and Codes	12	
C6	Use Manufacturer and Supplier Documentation	4	
C7	Plan a Project	8	
C8	Apply Troubleshooting Techniques	8	
C9	Use Mathematics and Science (Level 1)	8	
	Total Line C	**66**	**19%**

Line D	Install Traction and Hydraulic Common Components	Hours	% of Total
D1	Layout Hoistways	12	
D2	Install Guide Rails, Guide Rail Supports, and Fastenings	16	
D5	Install Wiring Raceways, Fixtures, and Wiring	16	
D7	Adjust and Commission Elevating Devices	12	
D8	Install Hoistway Door and Lock Assemblies	8	
	Total Line D	**64**	**18%**

Line F	Install Hydraulic Elevators	Hours	% of Total
F1	Describe the Principles of Hydraulic Systems	20	
F2	Install Pit Structures, Jacks, and Suspension Systems	20	
F3	Install Machine Room Equipment	12	
F4	Install the Hydraulic Piping System	12	
	Total Line F	**64**	**18%**

Line G	Apply the Principles of Electricity and Electronics	Hours	% of Total
G1	Describe the Principles of Electricity	34	
G2	Read Electrical Drawings and Specifications	16	
G5	Install Electrical Systems	16	
G9	Describe Electrical and Electronic Controls (Level 1)	12	
G10	Maintain Electrical and Electronic Systems (Level 1)	8	
G11	Troubleshoot Electrical and Electronic Systems (Level 1)	**8**	
	Total Line G	**94**	**26%**

Line J	Maintain Elevating Systems	Hours	% of Total
J7	Maintain Elevating Device Cabs, Carriages, and Platform Cabs	4	
	Total Line J	**4**	**1%**

Line K	Repair Elevating Systems	Hours	% of Total
K7	Repair Elevating Systems for Handicap Lifts	12	
	Total Line K	**12**	**3%**

Line M	Install Incline Lifts	Hours	% of Total
M1	Describe the Layout Procedures for Inclined Lifts	4	
M2	Install Rail Systems	4	
M3	Install Carriage and Seat or Platform	4	
M4	Adjust and Commission Incline Lifts	4	
	Total Line M	**16**	**4%**

Line O	Install Other Accessibility Lifts	Hours	% of Total
O1	Describe the Principles of Other Elevating Systems	4	
O2	Describe the Installation of Other Accessibility Lift Systems	4	
	Total Line O	**8**	**2%**

Grand Total	**356**	**100%**
Minus safety prerequisite	24	
Total In-Class Hours	**332**	

Section 3:
Program Content

Line (GAC): A Use Safe Work Practices
Competency: A1 Control Workplace Hazards

Objectives

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

- Describe workplace hazards.
- Apply strategies to minimize workplace hazards.
- Communicate workplace hazards to co-workers.

Learning Tasks		Content	
1	Describe general strategies to minimize workplace hazards and prevent workplace injuries	• Hazards - Identification - Reduction - Elimination - Isolation - Management	• Horseplay • Personal protective equipment • Worker training • Housekeeping • Ergonomics • Material handling and storage • Code requirements
2	Describe strategies to help ensure the well-being of the general public	• Signage • Barricading access	• Notification of elevating shutdown/return to service • Reasons for shutdown
3	Explain how environmental hazards pose a risk to a worker's health and safety	• Chemical materials • Physical materials	• Biological materials • Toxic materials
4	Describe the issues relating to substance abuse	• Substance types • Effects • Contributing factors	• Solutions • Policies
5	Describe strategies to minimize the risk of workplace accidents or illness	• Training • Communications • Hazard assessment • Hazard control	• Site planning • Work procedures • Code requirements
6	Describe the dangers of exposure to hazardous materials	• Materials • Types • Hazards • Toxic effect	• Types of exposure • Personal protective equipment • Responsibilities and procedures • Code requirements
7	Apply strategies to minimize workplace hazards	• Site orientation • Safety meetings • Worksite safety plan	• Lockout procedures • Guards and barricades • Code requirements

Line (GAC): A Use Safe Work Practices
Competency: A2 Comply with the OHS Regulation and WorkSafeBC Standards

Objectives

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

- Locate the relevant parts of the Occupational Health and Safety Regulation and WorkSafeBC Standard as it applies to an Elevating Devices Mechanic's workplace.
- Integrate the Occupational Health and Safety Regulation and WorkSafeBC Standard into their day-to-day work practices.

Learning Tasks		Content	
1	Describe the general health and safety policies relevant to the elevator trade	• OHS Regulation • Other agencies	• Company policies
2	Describe the rights and responsibilities of employers, managers, supervisors, and workers concerning health and safety in the workplace	• Due diligence	• Code requirements
3	Describe the procedures for reporting workplace incidents and accidents	• WorkSafeBC requirements	• Company requirements • Code requirements
4	Describe the core requirements of the Occupational Health and Safety Regulation.	• Regular inspections • Written instructions • Regular management meetings • Safety committees • Toolbox meetings	• Accident/injury investigations • Records and statistics • Instruction and supervision of workers • Code requirements
5	Describe WorkSafeBC's role in promoting workplace health and safety	• Awareness • Education	• Inspection • Enforcement
6	Apply the General Hazard Requirements of WorkSafeBC Regulations	• Chemical and biological substances • Substance specific requirements • Noise, vibration, radiation, and temperature • Personal protective clothing and equipment • Confined spaces • De-energizing and lockout	• Fall protection • Tools, machinery and equipment • Ladders, scaffolds, and temporary work platforms • Cranes and hoists • Rigging • Mobile equipment • Electrical safety • Code requirements
7	Describe how a workplace safety policy is established	• Hazard assessment • Conditions • Safety meeting requirements • Reporting hazards and incidents • Reporting injuries	• Accident/incident investigations • Employee orientation • First aid • Records and statistics • Non-compliance procedures

Line (GAC): A Use Safe Work Practices
Competency: A3 Use WHMIS

Objectives

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

- Describe the purpose of the Workplace Hazardous Materials Information System (WHMIS) Regulations.
- Explain the Contents of Material Safety Data Sheets (MSDS).
- Explain the Content of a WHMIS label.
- Apply WHMIS regulations in the workplace.

Learning Tasks		Content	
1	Explain the primary goals of WHMIS	• Reducing injuries and disease • Communicating information	• Reducing exposure to hazardous materials
2	Describe the rights and responsibilities of employers, suppliers, and workers under WHMIS legislation	• Recognition of rights - Workers - Employers - Suppliers • Legislation	• Availability and location of information • Updating • Code requirements
3	Describe the six hazard classes of WHMIS	• Hazard classes	
4	Describe the three main elements of WHMIS	• Labels • Material safety data sheets (MSDS)	• Education and training programs
5	Explain the requirements for WHMIS labels	• Supplier labels	• Workplace labels
6	Describe the primary information found on a Material Safety Data Sheet	• Product information • Hazardous ingredients • Physical data • Fire or explosion data	• Reactive data • Toxicological properties • Preventative measures • First aid measures • Preparation information

Line (GAC): A Use Safe Work Practices
Competency: A4 Use Personal Protective Equipment

Objectives

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

- Select appropriate personal protective equipment.
- Inspect and maintain personal protective equipment.
- Use personal protective equipment.

Learning Tasks		Content	
1	Select the proper personal protective equipment (PPE) for a specific task	• Footwear • Eye protection • Ear protection • Head protection • Respiratory protection • Protective clothing	• Lifting protection • Hair and jewelery • Fall protection • Company policy • Code requirements
2	Use personal protective equipment	• Selection • Purpose • Fitting • Operating procedures • Training programs	• Inspection • Maintenance • Storage • Code requirements
3	Use fall protection	• Types of equipment • Uses/purpose • Limitations	• Certification • Code requirements

Line (GAC): A Use Safe Work Practices
Competency: A5 Apply Fire Prevention Practices

Objectives

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

- Describe the chemical process of a fire.
- Select and use appropriate fire suppression equipment.
- Apply fire prevention procedures.
- Report fire incidents.

Learning Tasks		Content	
1	Describe the components necessary to sustain a fire	• Fuel • Heat	• Oxygen
2	Describe the five classes of fire extinguishers	• Class A • Class B • Class C	• Class D • Other
3	Outline strategies to reduce the risk of fire in the workplace	• Housekeeping • Inspection and maintenance of fire equipment • Electrical hazards • Storage of materials	• Precautions to prevent ignition • Fire/smoke alarms • Hot permit • Code requirements
4	Describe the proper use of a fire extinguisher	• Selecting extinguisher • Notifying occupants, co-workers, and emergency services	• Egress • Procedures/process

Line (GAC): B Use Tools and Equipment
Competency: B1 Use Hand Tools

Objectives

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

- Select appropriate hand tools.
- Use hand tools.
- Inspect and maintain hand tools.

Learning Tasks		Content	
1	Describe the hand tools commonly used in the elevator trade	• Cutting tools • Measuring and marking tools • Bracing and clamping tools • Hammering tools • Levelling tools • Wrenches • Sockets • Pliers • Screwdrivers	• Chiselling tools • Squaring tools • Threading tools • EMT benders • Crimping tools • Prying and alignment tools • Brushes • Tool box • Flashlight
2	Use hand tools	• Types • Selection - Use - Quality • Parts • Purpose/use • Procedures/operation	• Safety • Adjustment • Inspection • Maintenance • Cleaning • Storage • Code requirements

Line (GAC): B Use Tools and Equipment
Competency: B2 Use Power Tools

Objectives

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

- Describe the power tools commonly used in the elevating industry.
- Use power tools.
- Inspect and maintain power tools.

Learning Tasks		Content	

1	Describe the power tools commonly used in the elevating industry	• Types
		  - Electric
		  - Pneumatic
		  - Powder actuated
		• Certification requirements
		• Cutting tools
		• Grinding tools
		• Drilling and boring tools
		• Jack hammer
		• Stationary
		  - Roll groover
		  - Pipe threader
		  - Tugger
			• Specialty tools
			• Accessories
			• Power cords
			• Compressors
			• Air lines
			• Generators
			• Vacuums/blowers/fans

2	Use power tools in a safe and efficient manner	• Types
		• Selection
		  - Use
		  - Quality
		• Parts
		• Purpose/uses
		• Procedures/operations
		• Safety
			• Adjustment
			• Inspection
			• Maintenance
			• Cleaning
			• Storage
			• Code requirements

Line (GAC): B Use Tools and Equipment
Competency: B3 Use Measuring and Alignment Tools

Objectives

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

- Describe the measuring and alignment tools commonly used in the elevating industry.
- Use measuring and alignment tools.
- Inspect and maintain measuring and alignment tools.

Learning Tasks		Content	
1	Describe the measuring and alignment tools commonly used in the elevating industry	• Measuring tools - Tape measure - Scales - Calipers - Rope gauges - Pressure - Rope tension tool - Tachometer - Feeler gauges · Step gauges · Skirt gauges · Pin gauges - Dynamometer - Stop watch	• Alignment tools - Plumb bob - Dial gauges - Rail gauges - Lasers - Levels - Squares • Templates
2	Use measuring and alignment tools	• Types • Selection - Use - Quality • Parts • Purpose/use • Procedures/operation • Safety	• Adjustment • Inspection • Maintenance • Calibration • Cleaning • Storage • Accuracy • Unit conversion

Line (GAC): B Use Tools and Equipment
Competency: B5 Use Ladders, Scaffolding, and Platforms

Objectives

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

- Describe the use of ladders, scaffolding, and platforms.
- Use ladders, scaffolding, and platforms.
- Inspect and maintain ladders, scaffolding, and platforms.

Learning Tasks		Content	
1	Describe the use of ladders, scaffolding, and platforms	• Types • Usage • Selection • Safety	• Maintenance • Storage • Transportation • Inspection
2	Use an extension ladder	• Uses/limitations • Setup • Safety • Inspection • Maintenance	• Storage • CSA certification and duty rating • Company policy • Code requirements
3	Use a step ladder	• Uses/limitations • Setup • Safety • Inspection • Maintenance	• Storage • CSA certification and duty rating • Company policy • Code requirements
4	Use scaffolding	• Assembly and disassembly • Personal protective equipment • Hazards and obstructions • Levelling • Bracing and tying off • Guarding the work area • Installing the planking and railings • Load limits	• Engineering requirements • Inspection • Maintenance • Storage of scaffolding and planks • Safety • Signage • Fall protection • Code requirements
5	Use work platforms	• Assembly and disassembly • Load limits • Inspection • Maintenance	• Storage • Safety • Code requirements

Line (GAC): B Use Tools and Equipment
Competency: B7 Use Electrical Test Equipment

Objectives

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

- Describe the types of electrical test equipment.
- Describe the use of electrical test equipment.
- Use electrical test equipment.

Learning Tasks		Content	
1	Describe the types of electrical test equipment	• Types • Purpose	• Operation • Application
2	Describe the use of electrical test equipment	• Handling • Safety • Personal protective equipment • Equipment selection • Static electricity	• Calibration • Inspection • Procedure • Code requirements
3	Use electrical test equipment	• Safety • Planning • Procedure	• Personal protective equipment • Environmental considerations • Code requirements

Workplace Achievement Criteria

1. The individual use a multimeter to measure voltage, current, and resistance.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): C Use Fundamental Skills
Competency: C1 Describe the Elevating Device Industry

Objectives

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

- Describe the history and terminology of vertical transportation.
- Describe the principles of operation of vertical transportation systems.

Learning Tasks		Content	
1	Describe the history of vertical transportation	• Origin of elevating devices • Early modern elevators	• Modern elevators
2	Describe the types of elevating devices	• Traction elevators • Hydraulic elevators • Escalators and moving walks • Lifts for persons with physical disabilities • Specialty lifts	• Dumbwaiters • Material lifts • Incline lifts • Manlifts • Construction hoists

Line (GAC): C Use Fundamental Skills
Competency: C3 Apply Mechanical Principles

Objectives

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

- Describe mechanical principles as they relate to the elevating industry.

Learning Tasks		Content	
1	Describe the principles of power transmission components	• V-belts • Belt sheaves • Taper brushings • Chains and sprockets • Gear and gear reducers	• Couplings, keys, pins and set screws • Belt alignment
2	Describe the principles of bearings and seals	• Bearing types • Bearing failures • Replacing bearings • Lubricating bearings - Cleaning - Repacking	• Types of seals • Installing and removing seals - Pullers - Drivers
3	Describe the properties of materials and fastening technology	• Properties and applications - Ferrous metals - Non-ferrous metals - Alloys - Non-metallic materials • Mechanical properties of metals and alloys - Tensile strength - Yield strength - Hardness - Elongation rate - Conductivity	• Fasteners for specific applications • Threads types • Grades of fasteners - Head marking - Strength of materials • Flame spread • Reaction between dissimilar materials • Material profiles • Gauges of material
4	Describe the principles of lubrication	• Types and properties • Use of lubricating devices	• Storage • Disposal requirements
5	Describe the principles of mechanical advantage	• Levers • Pulleys	• Gear ratios

Line (GAC): C Use Fundamental Skills
Competency: C4 Read Drawings and Specifications

Objectives

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

- Describe the principles of visualization, projection, and views.
- Describe the principles of print reading.
- Describe information contained on elevating device drawings.
- Interpret information contained on drawings.

Learning Tasks		Content	
1	Describe the principles of visualization, projection and views	• Orientation of objects • Third vs. first angle of projection • Basic arrangement of views	• Transferring dimensions • Auxiliary and section views • Isometric and exploded views
2	Describe the principles of print reading	• Drawing types - Information contained • Views - Plan - Elevation - Cross-section	• Symbols • Scale • Specifications • Units of measure • Title blocks • Revisions • Dimensioning
3	Describe the information contained on elevating device drawings	• Main layout drawings - Plan views - Elevation views - Specifications - Position of elevating device to grid lines	• Supplemental drawings - Construction details
4	Interpret information with respect to the positioning of components	• Position of guide rails • Size and orientation of car frame • Pit equipment	• Machine room/space equipment • Control room/space equipment
5	Interpret information with respect to clearances	• Sill to sill running clearance • Car to car counterweight clearance • Car to hoistway wall clearance • Clearances at top and bottom of hoistway	• Run-by, buffer stroke, and clearances • Controller and main disconnect clearances
6	Interpret information with respect to power requirements	• Location of main electrical components - Main disconnect - Car light disconnect/power supply - Signal switches - Dispatcher disconnect switches	• Elevating device power requirements - Voltage - Amperage

Line (GAC): C Use Fundamental Skills
Competency: C5 Use Acts, Regulations, and Codes

Objectives

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

- Explain the relationship between Acts, Regulations, and Codes.
- Describe how the various Acts, Regulations, and Codes apply to the elevating industry.
- Locate information in the Acts, Regulations, and Codes.

Learning Tasks		Content	
1	Explain the relationship between Acts, Regulations and Codes	• Relationship between Acts, Regulations, and Codes	• Document information
2	Describe how the various Acts, Regulations, and Codes apply to the elevating industry	• Acts • Regulations • Codes • Scope • Reference publications • Definitions • Directives • Safety orders	• Information bulletins • Legal responsibilities - Apprentice - Certified Elevating Devices Mechanic - Contractor - Owner • Code requirements
3	Locate information in the Acts, Regulations, and Codes	• Scope • Parts/sections layout • Numbering system • Terminology • Definitions	• Table of Contents • Index • Appendices • Key word search • Code requirements

Line (GAC): C Use Fundamental Skills
Competency: C6 Use Manufacturer and Supplier Documentation

Objectives

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

- Use manufacturer and supplier documentation.
- Describe information contained in manufacturer and supplier documentation.
- Use the Internet to locate manufacturer's documentation.

Learning Tasks		Content	
1	Describe the purpose of documentation encountered in the elevator industry	• Handling • Parts • Installation instructions and requirements	• Operation and maintenance manuals • Product specifications • Warranty information
2	Use manufacturer's instructions	• Safety • Warnings • Adjustments • Maintenance • Part identification	• Parts replacement • Tool requirements • Procedures • Storage
3	Describe how to use the Internet to locate manufacturer's documentation	• Manufacturer's websites	• Search engines

Line (GAC): C Use Fundamental Skills
Competency: C7 Plan a Project

Objectives

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

- Describe how to plan and complete a small project.
- Schedule work sequence.
- Manage the basic elements of a project (time, resources, and scope).
- Plan and complete a project.

Learning Tasks		Content	
1	Describe the organization of a project	• Project specifications • Safety • Sequence of operations • Prioritization • Coordination with other trades • Estimating materials	• Tools and equipment • Inventory requirements - Timing of deliveries - Storage - Labeling materials - Consumables
2	Determine the project resources	• People • Equipment	• Materials
3	Create a detailed schedule	• Material delivery • Installation • Coordination with sub-trades	• Time estimates • Prioritization • Assigning tasks
4	Describe considerations when planning a project	• Coordination of all activities • Project communications	• Housekeeping • Scheduling
5	Secure approval and sign-off	• Inspections • Documents	• Fixing deficiencies

Line (GAC): C Use Fundamental Skills
Competency: C8 Apply Troubleshooting Techniques

Objectives

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

- Describe the process of troubleshooting.
- Troubleshoot problems.

Learning Tasks		Content	

1	Describe the process of troubleshooting	• Personal safety
		• Public safety
		• Safe work practices
		  - Jumper policy
		  - Precautions for multiple units
		• Investigative techniques
		• Collecting information
		  - Witnesses
		  - Leaving undisturbed
		  - Note taking
		  - History
		  - Compare to working system
		  - Consult resources
		  - Consult others
			• Analyze the information
			  - Overall system
			  - Mechanical or electrical
			• Isolating cause
			• Repairs
			• Validate the repair
			• Start-up procedures
			• Documentation

2	Troubleshoot problems	• Check history
		• Use of senses
		• Use of diagnostic equipment
		• Use of information
		  - Check cause and effect relationships
		  - Isolation
			• Use of procedures/ flowcharts
			• Consult support resources
			• Repair
			• Validate the repair
			• Documentation

Workplace Achievement Criteria

1. The individual will troubleshoot a system fault and document the repair.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): C Use Fundamental Skills
Competency: C9 Use Mathematics and Science (Level 1)

Objectives

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

- Use Mathematics and Science to solve problems common to the elevating industry.

Learning Tasks		Content	
1	Add, subtract, multiply and divide whole numbers, fractions, decimals, and percentages	• Whole numbers • Fractions	• Decimals • Percentages
2	Transpose formulas	• Introductory algebra	
3	Use formulas to calculate area	• Circles • Cylinders • Squares	• Rectangles • Triangles
4	Use formulas to calculate volume	• Cylinders • Square tanks	• Rectangular tanks
5	Use formulas to calculate capacity	• Imperial measure	• Metric measure
6	Convert units of measure	• Imperial measure	• Metric measure
7	Describe mechanical advantage as it relates to fluid power	• Hydraulics	• Hydrostatics
8	Describe the principles of hydraulics	• Principles of force, work and power - Weight and specific gravity - Pressure and force - Static pressure - Gauge pressure (Imperial and Metric) - Pascal's law - Conversion of energy and hydraulic power - Pressure losses	

Line (GAC): D Install Traction and Hydraulic Common Components
Competency: D1 Layout Hoistways

Objectives

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

- Describe how to lay out a hoistway.
- Lay out a hoistway.

Learning Tasks		Content	
1	Describe how to lay out a hoistway	• Survey the hoistway • Confirm travel, pit, and overhead dimensions • Template top and bottom	• Drop lines • Adjust top and bottom templates • Code requirements
2	Lay out a hoistway	• Planning • Tool use • Safety • Layout procedures	• Interpreting drawings • Problem solving • Code requirements

Workplace Achievement Criteria

1. The individual will interpret drawings and specifications to plan and lay out a hoistway.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): D Install Traction and Hydraulic Common Components
Competency: D2 Install Guide Rails, Guide Rail Supports, and Fastenings

Objectives

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

- Describe the components of guide rails, guide rail supports, and fastenings.
- Describe the installation of guide rails, guide rail supports, and fastenings.
- Install guide rails, guide rail supports, and fastenings.

Learning Tasks		Content	

1	Describe the components of guide rails, guide rail supports, and fastenings	• Rails
		  - Types
		  - Sizes
		• Rail clips
			• Fish plates
			• Wall and rail brackets
			• Saddle brackets
			• Hardware

2	Describe the installation of guide rails, guide rail supports, and fastenings	• Planning runs • Running lines • Fastening wall brackets • Installing rail brackets	• Preparing rails • Installing pit steel • Installing rails • Rail alignment
3	Install guide rails, guide rail supports, and fastenings	• Tool use • Safety • Scaffolding	• False car/temporary platform • Installation procedures • Alignment procedures

Workplace Achievement Criteria

1. The individual will install guide rails, guide rail supports, and fastenings.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): D Install Traction and Hydraulic Common Components
Competency: D5 Install Wiring Raceways, Fixtures, and Wiring

Objectives

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

- Describe the components of wiring raceways, fixtures, and wiring.
- Describe the installation of wiring raceways, fixtures, and wiring.
- Install wiring raceways, fixtures, and wiring.

Learning Tasks		Content	
1	Describe the components of wiring raceways, fixtures and wiring	• Types • Purpose	• Operation • Application
2	Describe the installation of wiring raceways, fixtures, and wiring	• Field wiring diagrams • Wireways • Conduit layout and fittings • Installation planning • Raceway layout • Raceway installation • Wire	• Duct sizes and number of conductors • Grounding and bonding procedures • Strain blocks and fish papers • Fixture types • Tools required • Code requirements
3	Install wiring raceways, fixtures, and wiring	• Planning • Tool use • Safety • Installation procedures	• Interpret installation drawings • Testing • Code requirements

Workplace Achievement Criteria

1. The individual will interpret drawings and specifications to install wiring raceways, fixtures, and wiring.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): D Install Traction and Hydraulic Common Components
Competency: D7 Adjust and Commission Elevating Devices

Objectives

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

- Describe adjustments made to traction elevator systems.
- Adjust traction elevator systems.
- Describe testing and commissioning procedures.

Learning Tasks		Content	
1	Describe adjustments made to elevator systems	• Mechanical - Car - Hoistway - Machine room - Code requirements	• Electrical - Car - Hoistway - Machine room - Controller - Code requirements
2	Adjust elevator systems	• Processes • Safety • Tools	• Tolerances • Specifications • Code requirements
3	Describe testing and commissioning procedures	• Purpose of commissioning - Process - Pre-inspection checklist - Test runs - Documentation - Code requirements	• Customer sign off

Workplace Achievement Criteria

1. The individual will interpret drawings and specifications to adjust an elevating device.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): D Install Traction and Hydraulic Common Components
Competency: D8 Install Hoistway Doors and Lock Assemblies

Objectives

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

- Describe the components of door frames, hoistway doors, and lock assemblies.
- Describe the installation of door frames, hoistway doors, and lock assemblies.
- Install door frames, hoistway doors, and lock assemblies.

Learning Tasks		Content	
1	Describe the components of door frames, hoistway doors, and lock assemblies	• Types • Purpose	• Operation • Application
2	Describe the installation of doorframes, hoistway doors and lock assemblies	• Unlocking devices	• Installation procedures
3	Install door frames, hoistway doors, and lock assemblies	• Planning • Tool use • Safety • Installation procedures	• Interpreting installation drawings • Alignment procedures • Testing • Code requirements

Workplace Achievement Criteria

1. The individual will interpret drawings and specifications to install hoistway doors and lock assemblies and test for proper operation.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): F Install Hydraulic Elevators
Competency: F1 Describe the Principles of Hydraulic Systems

Objectives

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

- Describe the components of a hydraulic system.
- Describe the purpose of hydraulic system components.
- Describe the principles of hydraulic systems.

Learning Tasks		Content	
1	Describe the components of hydraulic systems	• Purpose • Pumps - Positive - Displacement - Screw	• Jack assemblies • Tank • Pipes and flexible hose • Control valves • Safety devices
2	Describe the principles of operation of hydraulic systems	• Advantages of using hydraulics • Types of hydraulic systems	• Properties of hydraulic fluids

Line (GAC): F Install Hydraulic Elevators
Competency: F2 Install Pit Structures, Jack, and Suspension Systems

Objectives

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

- Describe the components of pit structures, jack, and suspension systems.
- Describe the installation of pit structures, jack, and suspension systems.
- Install pit structures, jack, and suspension systems.

Learning Tasks		Content	
1	Describe the components of pit structures, jack, and suspension systems	• Types • Purpose • Operation • Application	• Protection of components - Passive and active cathodic protection - PVC protection
2	Describe the installation of pit structures, jack, and suspension systems	• Planning • Installation procedures • Safety	• Jacks - In-ground jack units - Above-ground jack units - Multiple jack arrangements - Roped hydraulics - Alignment procedures for jack units • Suspension systems • Code requirements
3	Install pit structures, jack, and suspension systems	• Planning • Tool use • Safety • Handling procedures	• Installation procedures • Interpret installation drawings • Code requirements

Workplace Achievement Criteria

1. The individual will interpret drawings and specifications to install pit structures, jack, and suspension systems.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): F Install Hydraulic Elevators
Competency: F3 Install Machine Room Equipment

Objectives

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

- Describe the components of machine room equipment.
- Describe the installation of machine room equipment.
- Install machine room equipment.

Learning Tasks		Content	
1	Describe the components of machine room equipment	• Types • Purpose	• Operation • Application
2	Describe the installation of machine room equipment	• Handling and hoisting procedures • Access • Installation procedures • Safety	• Wireway holes • Equipment installed by others • Environmental considerations • Code requirements
3	Install machine room equipment	• Planning • Tool use • Safety • Handling procedures	• Installation procedures • Interpret installation drawings • Code requirements

Workplace Achievement Criteria

1. The individual will interpret drawings and specifications to install machine room equipment.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): F Install Hydraulic Elevators
Competency: F4 Install the Hydraulic Piping System

Objectives

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

- Describe the components of hydraulic piping systems.
- Describe the installation of hydraulic piping systems.
- Install hydraulic piping systems.

Learning Tasks		Content	
1	Describe the components of hydraulic piping systems	• Types • Purpose	• Operation • Application
2	Describe the installation of hydraulic piping systems	• Planning • Installation procedures • Connections and fittings • Safety components	• Safety • Environmental considerations • Code requirements
3	Install hydraulic piping systems	• Planning • Tool use • Safety • Handling procedures • Installation procedures	• Interpret installation drawings • Communication with the general contractor • Code requirements

Workplace Achievement Criteria

1. The individual will interpret drawings and specifications to install a hydraulic piping system.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): G Apply the Principles of Electricity and Electronics
Competency: G1 Describe the Principles of Electricity

Objectives

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

- Describe the principles of electrical safety.
- Describe the structure of matter.
- Describe the principles of DC circuits.
- Describe the principles of AC circuits.
- Describe the principles of magnetism and electromagnetism.
- Describe the principles of electrical measurement.

Learning Tasks		Content
1	Describe the principles of electrical safety	• Tag and lockout procedures • Hazards from stored electrical energy and other sources • Testing for presence of electricity • Use of jumpers
2	Describe the principles of electricity in relation to the structure of matter	• Atomic structure of matter - Free electrons - Sources of electricity - Describe nature of electricity - Static electricity
3	Describe the principles of direct current electrical circuits	• Terminology - Direct current - Voltage · Electro Motive Force (EMF) · Potential Difference (PD) - Current - Resistance - Ohm's law - Power - Watt's law • Symbols • Electrical circuits - Series circuits - Parallel circuits - Series/parallel circuits - Kirchhoff's laws - Power and heat loss • Electrical components - Resistors · Types · Series parallel · Colour coding · Ratings - Potentiometers/rheostats - Capacitors · Types · Series parallel · Colour coding · Ratings · Timing circuits · Uses - Diodes · Types identification · Uses · Capacities · Series/parallel • Measurement

Line (GAC): G Apply the Principles of Electricity and Electronics
Competency: G1 Describe the Principles of Electricity

Learning Tasks (continued)		Content (continued)	
4	Describe voltage, current and resistance measurements	• Precautions - Switching from ohmmeter to voltage and amperage scales - Moisture - Preventing electrical shock • Measure AC and DC voltage and amperage - Analog meters - Digital meters	• Measure resistance - Ohmmeter - Multi-meter - Meggar
5	Describe the principles of permanent magnetism	• Properties of permanent magnets • Action of magnetic poles	• Magnetic fields • Magnetic properties
6	Describe the principles of electromagnetism	• Properties of electromagnets • Action of magnetic fields around a conductor • Principles of induced voltage	• Factors that affect induced voltage • Lenz's law
7	Describe the principles of alternating current electrical circuits	• Terminology • Symbols • RMS value of voltage and current • Inductance	• Capacitance • Impedance • AC power • Rectifiers
8	Describe the operation of transformers	• Mutual induction • Construction • Turns ratio • Voltage changing	• Ratings • Types - Autotransformer - Isolation
9	Describe three-phase systems	• Supplies • Transformer connections	• Loads
10	Apply the principles of electricity to elevating devices	• Installation • Testing	• Code requirements

Line (GAC): G Apply the Principles of Electricity and Electronics
Competency: G2 Read Electrical Drawings and Specifications

Objectives

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

- Describe the purpose of wiring and schematic diagrams.
- Use wiring and schematic diagrams.
- Convert between wiring and schematic diagrams.

Learning Tasks		Content	
1	Identify common drawing symbols	• Components • Line weights	• Conventions • Labels
2	Describe the conventions used for schematic diagrams	• Use of lines • Arrangement of components	• Labels and identifications • Road map
3	Describe the conventions used for field wiring diagrams	• Use of lines • Arrangement of components	• Labels and identifications
4	Describe the conventions used for single-line (block) diagrams	• Use of lines • Arrangement of components	• Labels and identifications
5	Use diagrams to convey information	• Schematic • Wiring	• Care and handling • As built drawings
6	Convert between schematic and field wiring diagrams	• Diagram layouts	• Wiring diagrams
7	Interpret information with respect to power requirements	• Elevating device power requirements - Voltage - Amperage - Disconnect	

Line (GAC): G Apply the Principles of Electricity and Electronics
Competency: G5 Install Electrical Systems

Objectives

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

- Describe the installation of conductors.
- Describe the installation of raceways.
- Describe the installation of traveling cables.
- Describe the installation of elevator related circuits.
- Install raceways, conductors, and components.

Learning Tasks		Content	
1	Describe the installation of conductors	• Types • Materials • Gauge • Insulation (thermal rating)	• Ampacity • Termination • Marking
2	Describe the installation of raceways	• Types • Sizes • Support • Bending	• Planning runs • Raceway fill • Installation of conductors
3	Describe the installation of traveling cables	• Construction • Handling • Preparation	• Installation • Replacement • Protection
4	Describe elevator related circuits	• Electrical protective devices • Operation systems - Door operation - Direction selection - Acceleration - Deceleration - Final stop	• Safety circuit components • Interlocks • Normal terminal slow downs • Emergency terminal slow downs • Redundancy • Fire service and emergency power
5	Install raceways, conductors and components	• Raceway runs • Placement of boxes, fittings and supports • Number of conductors in runs • Conductor insulation rating and size	• Raceway size • Box and fitting sizes • Devices and switches • Code requirements

Workplace Achievement Criteria

1. The individual will interpret drawings and specifications to install a wiring raceway.
2. The individual will interpret drawings and specifications to install a fixture.
3. The individual will extract information from a wiring diagram to install wiring.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): G Apply the Principles of Electricity and Electronics
Competency: G9 Describe Electrical and Electronic Systems (Level 1)

Objectives

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

- Describe electrical control devices.
- Describe semiconductor power devices.
- Describe the operation of rectifiers and power supplies.
- Describe operational amplifiers and their applications.
- Describe digital logic devices and applications.
- Describe the operation of programmable relays and PLC's.
- Describe the operation of motor controls.

Learning Tasks		Content	
1	Describe electrical control devices	• Types - Switches - Relays/contactors - Solenoids - Timers - Circuit protection devices	• Symbols • Operation • Characteristics/ratings • Handling precautions • Testing • Applications
2	Describe semiconductor power devices	• Types - Diodes - Zener diodes - Photo diodes - Light emitting diodes - Varistors - Transistors · BJT's · FET's · IGBT's - Thyristors · SCR's · Triacs	• Symbols • Operation • Characteristics/ratings • Packaging • Handling precautions • Testing • Applications
3	Describe the operation of rectifiers and power supplies	• Purpose • Types - Half-wave - Full-wave - Three-phase - Filters - Regulators	• Operation • Characteristics/ratings • Packaging • Handling precautions • Testing • Applications

Learning Tasks (continued)		Content (continued)	
4	Describe operational amplifiers and their applications	• Purpose • Operation • Characteristics/ratings • Packaging	• Handling precautions • Testing • Applications
5	Describe digital logic devices and their applications	• Numbering systems • Types - Gates - Flip-flops - Registers - Memory - Counters - Timers - Microprocessors	• Operation • Characteristics/ratings • Packaging • Handling precautions • Testing • Applications
6	Describe the operation and programming of programmable relays and PLC's	• Features • Operation • Characteristics/ratings	• Packaging • Handling precautions • Testing

Line (GAC): G Apply the Principles of Electricity and Electronics
Competency: G10 Maintain Electrical and Electronic Systems (Level 1)

Objectives

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

- Perform maintenance checks.
- Describe the maintenance of motors.
- Maintain motors.

Learning Tasks		Content	
1	Perform maintenance checks	• Checks - Insulation condition - Termination tightness - Contacts - Heat - Interlocks - Verification of correct components - Verification of voltage levels - Grounding - Verification of inspection controls - Verification of safety circuits - Emergency lights - Communication equipment - Battery replacements	• Cleaning - Filters - Fans • Lubrication • Maintain logs • Code requirements
2	Describe the maintenance of motors and generators	• Lubrication • Bearings • Replacement	• Testing for grounds • Cleaning • Safety practices
3	Maintain motors	• Equipment • Procedures • Safety	• Environmental considerations • Manufacturer's specifications

Workplace Achievement Criteria

1. The individual will use maintenance procedures/check sheets to maintain an electrical system.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): G Apply the Principles of Electricity and Electronics
Competency: G11 Troubleshoot Electrical and Electronic Systems (Level 1)

Objectives

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

- Describe troubleshooting of electrical and electronic systems.
- Troubleshoot electrical and electronic systems.
- Describe troubleshooting techniques for AC machines.

Learning Tasks		Content	
1	Describe troubleshooting of electrical and electronic systems	• Use of drawings and other resources • Use of test equipment • Tracing techniques • Analyzing information • Rule out possibilities to narrow the focus	• Isolating the cause • Flow charts • Use of senses • History • Repair • Validate the repair
2	Troubleshoot electrical and electronic systems	• Procedure • Resources	• Repair • Test
3	Describe troubleshooting techniques for AC machines	• Loss of phase • Shorted windings • Grounded windings • Wiring and connections	• Contactors • Overloads • Over current devices

Line (GAC): J Maintain Elevating Systems
Competency: J7 Maintain Elevating Device Cabs, Carriages, and Platforms

Objectives

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

- Describe the maintenance of elevating device cabs.
- Maintain an elevating device cab.
- Describe the maintenance of carriage and platforms.
- Maintain carriages and platforms.

Learning Tasks		Content	
1	Describe the maintenance of elevating device cabs	• Personal safety • Public safety • Retiring cams • Car operating panel and fixtures • Car interior • Car top maintenance • Car guide maintenance • Mandatory maintenance tasks	• Company specific maintenance tasks • Housekeeping • Levelling devices • Safeties • Traveling cable • Suspension attachments
2	Maintain elevating device cabs	• Procedures	• Safety
3	Describe the maintenance of carriages and platforms	• Personal safety • Public safety • Operating panel and fixtures • Platforms • Seats • Carriages • Mandatory maintenance tasks	• Company specific maintenance tasks • Housekeeping • Levelling devices • Safeties • Traveling cable • Suspension attachments
4	Maintain carriages and platforms	• Procedures	• Safety

Workplace Achievement Criteria

1. The individual will plan and carry out the routine maintenance procedures for an elevating device cab.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): K Repair Elevating Systems
Competency: K7 Repair Elevating Systems for Handicap Lifts

Objectives

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

- Describe how to repair hydraulic systems for handicap lifts.
- Repair hydraulic systems for handicap lifts.
- Describe how to repair electrical systems for handicap lifts.
- Repair electrical systems for handicap lifts.

Learning Tasks		Content	
1	Describe how to repair hydraulic systems for handicap lifts	• Personal safety • Public safety • Materials • Shut down procedures • Work procedures • Shoring • Valve repair • Motor repair • Pump repair	• Jack unit packing • Piping seal replacement (victraulic) • Oil replacement • Testing requirements • Verify operation • Environmental considerations • Start-up procedures • Documentation
2	Repair hydraulic systems for handicap lifts	• Procedures • Safety	• Code requirements
	Describe how to repair electrical systems for handicap lifts	• Personal safety • Public safety • Verify correct material • Shut down procedures • Work procedures • Controller repair	• Motor repair • Fixture repair • Testing requirements • Verify operation • Start-up procedures • Documentation
3	Repair electrical systems for handicap lifts	• Procedures • Safety	• Code requirements

Workplace Achievement Criteria

1. The individual will replace the main contactor on the controller.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): M Install Incline Lifts
Competency: M1 Describe the Layout for Inclined Lifts

Objectives

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

- Describe how to layout an inclined lift.
- Layout an inclined lift.

Learning Tasks		Content	
1	Describe how to layout an inclined lift	• Preliminary site survey - Travel - Landings - Overhead obstructions	• Layout procedures
2	Layout an inclined lift	• Planning • Tool use • Safety	• Interpret layout drawings • Layout procedures • Problem solving

Line (GAC): M Install Incline Lifts
Competency: M2 Install Rail Systems

Objectives

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

- Describe the components of a guide rail system.
- Describe the installation of a guide rail system.
- Install a guide rail system.

Learning Tasks		Content	
1	Describe the components of a guide rail system	• Guide rail systems - Types - Sizes	• Wall and rail brackets • Hardware
2	Describe the installation of guide rail systems	• Planning • Fastening methods • Preparing rails	• Install rails • Rail alignment • Code requirements
3	Install guide rails systems	• Tool use • Safety	• Installation procedures • Alignment procedures

Workplace Achievement Criteria

1. The individual will layout and install a rail system.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): M Install Incline Lifts
Competency: M3 Install Carriage and Seat or Platform

Objectives

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

- Describe the carriage and its components.
- Describe the installation of the carriage and its components.
- Install a carriage and its components.

Learning Tasks		Content	
1	Describe the carriage and its components	• Types of carriages • Drive systems • Platforms	• Seats • Safety devices
2	Describe the installation of a carriage and its components	• Planning • Installation procedures • Carriage assembly • Seats and platforms	• Installation of guide shoes and roller guides • Suspension systems • Code requirements
3	Install a carriage and its components	• Tool use • Safety • Installation procedures	• Alignment procedures • Suspension systems

Workplace Achievement Criteria

1. The individual will interpret drawings and specifications to install a carriage and seat or a platform.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): M Install Incline Lifts
Competency: M4 Adjust and Commission Incline Lifts

Objectives

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

- Describe adjustments made to an incline elevating device.
- Adjust an incline elevating device.
- Describe testing and commissioning procedures.

Learning Tasks		Content	
1	Describe adjustments made to an incline elevating device	• Mechanical	• Electrical
2	Adjust an incline elevating device	• Processes • Safety • Tools	• Tolerances • Manufacturer's specifications
3	Describe testing and commissioning procedures	• Purpose of commissioning • Process - Pre-inspection checklist - Tests run - Verification of all code required functions - Documentation	• Customer sign-off

Workplace Achievement Criteria

1. The individual will interpret drawings and specifications to adjust and commission an incline lift.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Line (GAC): O Install Other Accessibility Lifts
Competency: O1 Describe the Principles of Other Elevating Systems

Objectives

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

- Describe the types of drives and their applications.
- Describe the principles of drives and their applications.

Learning Tasks		Content
1	Describe the types of drives and their applications	• Types of drives - Advantages - Applications
2	Describe principles of drives and their applications	• Types - Screw - Traction - Rack and pinion - Cable - Drum - Safety devices

Line (GAC): O Install Other Accessibility Lifts
Competency: O2 Describe the Installation of Other Accessibility Lift Systems

Objectives

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

- Describe the components of other accessibility lift systems
- Describe the installation of other accessibility lift systems.

Learning Tasks		Content	
1	Describe the components of other accessibility lift systems	• Types • Purpose • Operation	• Application • Protection of components • Safety devices • Governors
2	Describe the installation of other accessibility lift systems	• Planning • Extract information from drawings • Handling procedures • Installation procedures	• Safety • Code requirements • Suspension systems • Safety devices

Workplace Achievement Criteria

1. The individual will carry out upgrades to a car enclosure and complete required documentation and testing.

Passport sign-off by a Certified Mechanic for each workplace achievement criteria is required.

Section 4:
Training Provider Standards

FACILITY REQUIREMENTS

Classroom Area

- Minimum 22 square feet per student
- Comfortable seating and tables suitable for learning
- Compliance with the local and national fire code and occupational safety requirements
- Meets applicable municipal zoning bylaws for technical instruction and education facilities
- Overhead and multimedia projectors with a projection screen
- Whiteboard with marking pens and erasers
- Lighting controls to allow easy visibility of the projection screen while allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating/air conditioning for comfort all year round
- Acoustics in the room must allow audibility of the instructor

Shop Area

- Minimum 3,000 square feet of shop area including a tool crib and work stations
- Minimum 10 foot ceiling height in shop areas
- Minimum 8 foot ceiling in lab areas
- Adequate heating, lighting and ventilation
- Refuse and recycling bins for used shop materials
- First-aid equipment
- Shops will support practical requirements as outlined in the program outline

LAB REQUIREMENTS

Student Facilities

- Adequate eating area as per WorkSafeBC requirements (4.84 OHS Regulation and Guidelines)
- Adequate washroom facilities as per WorkSafeBC requirements (4.85 OHS Regulation and Guidelines)
- Personal storage lockers

Instructor's Office Space

- Adequate office space for student consultation
- Desk and filing space
- Computer
- Internet access
- Printer
- Adequate storage facilities for material and training aids
- Access to photocopier
- Telephone

TOOLS AND EQUIPMENT

HAND TOOLS

Alignment bar	Knife	Scrapers
Bench vice	Knock out set	Screwdrivers (complete set)
Breaker bar	Levels	Security screwdrivers
Broom and dust pan	Lubrication tools	Snips
Burrs	Lunar key (unlocking key)	Suction cups for lifting
Calculator	Pliers: • Crimpers • Linesman • Locking • Needle nose • Side cutters • Wire strippers • Snap ring • Water pump (slip joint)	Square
C-clamp		Tap and die set
Chisels		Thread chaser
Dollies		Thread files
EMT benders		Torque wrenches
Files		Wrenches: • Adjustable • Allen • Box end • Combination • Crows foot • Hook spanner • Open end • Pipe • Socket set • Strap
Flashlight		
Gear pullers		
Hammers: • Ball peen • Claw • Mallet • Sledge • Soft-faced mallet	Plumb bob	
	Pry bars	
	Punch	
	Riveting tools	
	Roller	
Handcart	Saws: • Hacksaw • Hand saw (wood)	
Helicoil		
Hex Keys (set)		

POWER HAND TOOLS

Angle drill	Drill bits	Lighting equipment
Angle grinder	Electric impact driver	Piping and threading equipment
Blower	Extension cords	Reciprocating saw
Concrete drill	Grinder	Soldering iron
Drill and cordless drills: • Electric • Cordless	Hole saw	Vacuum cleaner
	Hydraulic jacks	
	Hydraulic press	

LIFTING EQUIPMENT

A-Frames	Eye bolts	Nylon lifting straps
Beam clamps	Fibre rope	Pinch bar
Beam trolley	Fibre slings	Scaffolding
Block and tackle	Hand winches	Shackles (varying sizes)
Bridles	Hoist rings	Spreader bar
Chain hoists	Hooks	Tirfors
Chain slings	Hydraulic jack	Tripods
Come-a-longs	Jacks	Wire rope
Engine hoists	Ladders	Wire slings

PERSONAL PROTECTIVE EQUIPMENT

Coveralls	Fire extinguisher	Reflective vest
Ear muffs	First aid kit	Respirators
Ear plugs	Glasses	Safety boots
Electrical gloves	Goggles	Safety harness, lanyard and life line
Eye wash kit	Gloves	Welding gloves
Face shield	Hard hat	Welding mask
Fire blanket	Lock out equipment	

CUTTING AND JOINING EQUIPMENT

Copper tube cutter	Gas cylinders	Tube bender
Crimpers	Mechanical crimper	Tube cutter
Flaring tools	Oxy-acetylene cutting equipment	

REFERENCE MATERIALS

This section contains a summary of the important Codes, Regulations and Acts that apply to each competency in the Program Outline.

REFERENCES

Canadian Standards Association. (2006).
C22.1-06: Canadian Electrical Code, Part 1 (20th Ed.).
Mississauga, Ontario: Canadian Standards Association

Canadian Standards Association. (2007).
ASME A17.1-2007/CSA B44 07: Safety Code for Elevators and Escalators.
Toronto: Canadian Standards Association

Canadian Standards Association. (2002).
CAN/CSA–B355-00: Lifts for Persons with Physical Disabilities.
Toronto: Canadian Standards Association

Canadian Standards Association. (2001).
CAN/CSA–Z185-M87: Safety Code for Personnel Hoists.
Toronto: Canadian Standards Association

Elevator World Inc. (2010).
Elevator Industry Field Employee Handbook.
Elevator World Inc.: Mobile, Alabama

Province of British Columbia. (2010).
Safety Standards Act: Elevating Devices Safety Regulation.
Retrieved December 7, 2010 from
www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/13_101_2004

WorkSafeBC. *OHS Regulation*.
Retrieved December 7, 2010 from
www2.WorkSafeBC.com/Publications/OHSRegulation/Home.asp

WorkSafeBC. *Workers Compensation Act.*
Retrieved December7, 2010 from
www2.WorkSafeBC.com/Publications/OHSRegulation/WorkersCompensationAct.asp

ABBREVIATIONS USED IN CITING REFERENCES

FE	Field Employee's Handbook
OHS	Occupational Health and Safety
WCA	Workers Compensation Act
WSBC	WorkSafeBC

LINE A: USE SAFE WORK PRACTICES

A1: Control Workplace Hazards

- WCA Part 3, Division 3, Section 115 – 117
  – General Duties of Employers, Workers and Others
- OHS Regulation Part 5, Section 5.2
  – General Information Requirement
- OHS Regulation Part 6, Section 6.6
  – Assessment and Classification
- OHS Regulation Part 6, Section 6.8
  – Procedures
- FE Safety Handbook, Section 4.2 – 4.4
  – Fall Arrest
- FE Safety Handbook, Section 7
  – Lockout and Tagout

A2: Comply with the OHS regulation and WorkSafeBC standards

- WCA Part 3, Division 3, Section 115 – 117
  – General Duties of Employers, Workers and Others
- WCA Part 1, Division 5, Section 53
  – Worker Notification of Injury

A3: Use WHMIS

- Hazardous Products Act (Canada)
- WSBC Guideline G5.3-1
  – WHMIS Application

A4: Use Personal Protective Equipment

- OHS Regulation Part 8
  – Personal Protective Equipment and Clothing
- FE Safety Handbook, Section 3
  – Personal Protective Equipment

A5: Apply Fire Prevention Practices

- OHS Regulation Part 4, Section 4.32
  – Access to Work Area
- WSBC Guideline G5.97
  – Emergency Plan
- WSBC Guideline G5.99
  – Risk Assessment

LINE B: USE TOOLS AND EQUIPMENT

B1: Use Hand Tools
- FE Safety Handbook, Section 9.1
  – Hand Tools

B2: Use Power Tools
- FE Safety Handbook, Section 9.2
  – Portable Electrical Tools and Lights

B3: Use Measuring and Alignment Tools
- None

B5: Use Ladders, Scaffolding, and Platforms
- FE Safety Handbook, Section 10
  – Portable Ladders/Scaffolds/ Stationary Work Platforms
- OHS Regulation Part 13, Division 2 – 4
  – Ladders, Scaffolds and Temporary Work Platforms

B5: Use Electrical Test Equipment
- FE Safety Handbook, Section 5
  – Electrical Safety

LINE C: USE FUNDAMENTAL SKILLS

C1: Describe the Elevating Device Industry
- None

C3: Apply Mechanical Principles
- None

C4: Read Drawings and Specifications
- None

C5: Use Acts, Regulations, and Codes
- Safety Standards Act General Regulations

C6: Use Manufacturer and Supplier Documentation
- None

C7: Plan a Project
- None

C8: Apply Troubleshooting Techniques
- None

C9: Use Mathematics and Science (Level 1)
- None

LINE D: INSTALL TRACTION AND HYDRAULIC COMMON COMPONENTS

D1: Layout Hoistways
- None

D2: Install Guide Rails, Guide Rail Supports, and Fastenings
- B44 Section 2.23
  – Car and counterweight Guide Rail Support and Fastenings
- B44 Section 3.23
  – Guide Rail Support and Fastenings

D5: Install Wiring Raceways, Fixtures, and Wiring
- B44 Section 2.8.2.1 (CSA – C22.1)
  – Electrical Equipment and Wiring

D7: Adjust and Commission Elevating Devices
- B44 Section 8.10
  – Acceptance, Inspection and Test

D8: Install Hoistway Doors and Lock Assemblies
- TBA

LINE F: INSTALL HYDRAULIC ELEVATORS

F1: Describe the Principles of Hydraulic Systems
- None

F2: Install Pit Structures, Jack, and Suspension Systems
- B44 Section 3.18
  – Hydraulic Jacks

F3: Install Machine Room Equipment
- B44 Section 3.7
  – Machine Room Equipment

F4: Install the Hydraulic Piping Systems
- B44 Section 3.19
  – Valves, Pressure Piping and Fittings

LINE G: APPLY THE PRINCIPLES OF ELECTRICITY AND ELECTRONICS

G1: Describe the Principles of Electricity
- B44 Section 8.6.1.3
  – Electrical Safety
- FE Safety Handbook, Section 5
  – Electrical Safety

G2: Read Electrical Drawings and Specifications
- None

G4: Describe Electrical and Electronic Controls (Level 1)
- None

G5: Install Electrical Systems
- CEC Section 38
  – Elevating Devices

G10: Describe Electrical and Electronic Systems (Level 1)
- None

G11: Maintain Electrical and Electronic Systems (Level 1)
- TBD

G12: Troubleshoot Electrical and Electronic Systems (Level 1)
- None

LINE J: MAINTAIN ELEVATING SYSTEMS

J7: Maintain Elevating Device Cabs, Carriages, and Platforms
- B44.2

LINE K: REPAIR ELEVATING SYSTEMS

K7: Repair Elevating Systems for Handicap Lifts
- B355

LINE M: INSTALL INCLINE LIFTS

M1: Describe the Layout Procedures for Inclined Lifts
- B355 Section 5.1.4 – Enclosed Platform Lifts
- B355 Section 4.2.5 - Inclination

M2: Install Rail Systems
- B355 Section 5.1.4 – Enclosed Platform Lifts
- B355 Section 4.2.5 – Inclination
- B355 Section 4.4.2 - Carriages

M3: Install Carriage and Seat or Platform
- B355 Section 4.4.2 - Carriages

M4: Adjust and Commission Incline Lifts
- B355 Appendix A – Inspection and Testing

LINE O: INSTALL OTHER ACCESSIBILITY LIFTS

O1: Describe the Principles of Other Elevating Systems
- None

O2: Describe the Installation of Other Accessibility Lift Systems
- None

INSTRUCTOR REQUIREMENTS

Occupation Qualification

The instructor must possess one of the following:
- A BC Certificate of Qualification, or
- A Certificate of Qualification from another Canadian jurisdiction

Work Experience

The instructor must possess:
- A minimum of 5 years' experience working in the industry as a journeyperson

Instructional Experience and Education

It is preferred that the instructor also possesses one of the following:
- An Instructor Program Diploma, or equivalent
- A Bachelor's Degree in Education
- A Master's Degree in Education

Appendix A: Training Topics and Suggested Time Allocation by Level / Year

ELEVATING DEVICES MECHANIC (CLASS H) - PREREQUISITES

Line A	Use Safe Work Practices	Hours	% of Total
A1	Control Workplace Hazards	4	
A2	Comply with the OHS Regulation and WorkSafeBC Standards	4	
A3	Use WHMIS	3	
A4	Use Personal Protective Equipment	4	
A5	Apply Fire Prevention Practices	1	
	Total Line A	**16**	**3%**

Line B	Use Tools and Equipment	Hours	% of Total
B1	Use Hand Tools	1	
B2	Use Power Tools	2	
B3	Use Measuring and Alignment Tools	1	
B5	Use Ladders, Scaffolding, and Platforms	4	
	Total Line B	**8**	**2%**

TOTAL PREREQUISITES	20	5%

ELEVATING DEVICES MECHANIC (CLASS H) – LEVEL 1

Line C	Use Fundamental Skills	Hours	% of Total
C1	Describe the Elevating Industry	2	
C3	Apply Mechanical Principles	16	
C4	Read Drawings and Specifications	8	
C5	Use Acts, Regulations, and Codes	12	
C6	User Manufacturer and Supplier Documentation	4	
C7	Plan a Project	8	
C8	Apply Troubleshooting Techniques	8	
C9	Use Mathematics and Science (Level 1)	8	
	Total Line C	**66**	**19%**

Line D	Install Traction and Hydraulic Common Components	Hours	% of Total
D1	Layout Hoistways	12	
D2	Install Guide Rails, Guide Rail Supports, and Fastenings	16	
	Total Line D	**28**	**8%**

Line F	Install Hydraulic Elevators	Hours	% of Total
F1	Describe the Principles of Hydraulic Systems	20	
F2	Install Pit Structures, Jack, and Suspension Systems	20	
	Total Line F	**40**	**11%**

Line J	Maintain Elevating Systems	Hours	% of Total
J7	Maintain Elevating Device Cabs, Carriages, and Platform Cabs	4	
	Total Line J	**4**	**1%**

ELEVATING DEVICES MECHANIC (CLASS H) – LEVEL 1 (continued)

Line M	Install Incline Lifts	Hours	% of Total
M1	Describe the Layout Procedures for Inclined Lifts	4	
M2	Install Rail Systems	4	
M3	Install Carriage and Seat or Platform	4	
M4	Adjust and Commission Incline Lifts	4	
	TOTAL LINE M	**16**	**4%**

Line 0	Install Other Accessibility Lifts	Hours	% of Total
O1	Describe the Principles of Other Elevating Systems	4	
O2	Describe the Installation of Other Accessibility Lift Systems	4	
	TOTAL LINE O	**8**	**2%**

	TOTAL FOR LEVEL 1	162	46%

ELEVATING DEVICES MECHANIC (CLASS H) – LEVEL 2

LineB	Install Traction and Hydraulic Common Components	Hours	% of Total
B7	Use Electrical Test Equipment	4	
	Total Line B	**4**	**1%**

Line D	Install Traction and Hydraulic Common Components	Hours	% of Total
D5	Install Wiring Raceways, Fixtures, and Wiring	16	
D7	Adjust and Commission Elevating Devices	12	
D8	Install Hoistway Doors and Lock Assemblies	8	
	Total Line D	**36**	**10%**

Line F	Install Other Accessibility Lifts	Hours	% of Total
F3	Install Machine Room Equipment	12	
F4	Install the Hydraulic Piping System	12	
	Total Line F	**24**	**7%**

Line G	Apply the Principles of Electricity and Electronics	Hours	% of Total
G1	Describe the Principles of Electricity	34	
G2	Read Electrical Drawings and Specifications	16	
G5	Install Electrical Systems	16	
G9	Describe Electrical and Electronic Systems (Level 1)	12	
G10	Maintain Electrical and Electronic Systems (Level 1)	8	
G11	Troubleshoot Electrical and Electronic Systems (Level 1)	8	
	Total Line G	**94**	**26%**

Line K	Repair Elevating Systems	Hours	% of Total
K7	Repair Elevating Systems for Handicap Lifts	12	
	Total Line K	**12**	**3%**

	TOTAL FOR LEVEL 2	**174**	**49%**

GRAND TOTAL	**356**	**100%**
Minus safety prerequisite	24	
TOTAL IN-CLASS HOURS	**332**	

Safety Authority

Do it right. Stay safe.

The BC Safety Authority is an independent, self-funded organization mandated to oversee the safe installation and operation of technical systems and equipment. In addition to issuing permits, licences and certificates we work with industry to reduce safety risks through assessment, education and outreach, enforcement, and research.

Toll free: 1.866.566.7233
Phone: 778.396.2000
Fax: 778.396.2064

505 - 6th Street, Suite 200
New Westminster, BC V3L 0E1

www.safetyauthority.ca