ONTARIO COLLEGE OF TRADES

ORDRE DES MÉTIERS DE L'ONTARIO

Apprenticeship Curriculum Standard

Elevating Devices Mechanic

Trade Code: 636E

Development Date: 2005

Please Note:

Apprenticeship Training and Curriculum Standards were developed by the Ministry of Training, Colleges and Universities (MTCU). As of April 8th, 2013, the Ontario College of Trades (College) has become responsible for the development and maintenance of these standards. The College is carrying over existing standards without any changes.

However, because the Apprenticeship Training and Curriculum Standards documents were developed under either the *Trades Qualification and Apprenticeship Act* (TQAA) or the *Apprenticeship and Certification Act, 1998* (ACA), the definitions contained in these documents may no longer be accurate and may not be reflective of the *Ontario College of Trades and Apprenticeship Act, 2009* (OCTAA) as the new trades legislation in the province. The College will update these definitions in the future.

Meanwhile, please refer to the College's website (www.collegeoftrades.ca) for the most accurate and up-to-date information about the College. For information on OCTAA and its regulations, please visit: www.collegeoftrades.ca/about/legislation-and-regulations.

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Preface

This Elevating Devices Mechanic Curriculum Training Standard has been developed in keeping with the Common Format Guidelines prescribed by the Ministry of Training, Colleges and Universities (MTCU) from the trade workplace Performance Objectives (636E). The Curriculum Standard reflects the content necessary for appropriate progression through each level of the Elevating Devices Mechanic in-school apprenticeship program. This Curriculum Standard is currently delivered by the Canadian Elevating Industry Educational Program (CEIEP) in four sessions over four years and Durham College of Applied Arts and Technology in three sessions over a six month time frame.

For easy reference, a time allocation has been included for each respective reportable subject and units, along with a breakdown of theory and application in the delivery of the performance objectives.

The continual introduction of innovative techniques and more complex equipment is resulting in increasing demands for service technicians who are not only skilled in the practical aspects of the trade, but who also have a sound theoretical knowledge of the testing, diagnosing and servicing requirements. The Curriculum Standard has been developed to provide this theoretical knowledge and to offer some practical applications to complement the on-the-job work experience of the Elevating Devices Mechanic.

The Curriculum Standard has been designed to give the instructor every opportunity for flexibility and innovation without significant departures from content. Since the scope of the prescribed Curriculum Standard is quite extensive, the apprentice will be expected to reinforce the acquired knowledge through regular independent out-of-classroom assignments.

The Curriculum Standard includes specific references to the apprenticeship on-the-job Training Standard. While terminal performance objectives in the Training Standard have been linked to the respective in-school learning outcomes and learning content objectives, employers should not assume complete coverage in all aspects of the objectives. The in-school delivery focuses primarily on the knowledge required and fundamental skills that support the respective performance objectives outlined in the workplace Training Standard. Employers are expected to complete the delivery of these objectives by ensuring the prescribed in-school knowledge is applied to the practical learning experiences in the work setting.

Regular evaluations of an apprentice's learning achievements must be performed in both theory and practical applications throughout the program.

Participation by Stakeholders

KRH Group, Durham College of Applied Arts and Technology, and the Canadian Elevating Industry Education Program (CEIEP) working in collaboration with the Ministry of Training, Colleges and Universities and Industry Stakeholders, participated in the development of this document. The development was based on the schedule of training that was developed by the Ministry of Training and the Elevating Devices industry advisory group in 2001 and the in-school curriculum revised in 2002. The development was completed using the process and format approved by the Ministry of Training Colleges and Universities (MTCU).

Training Delivery Agents

- Durham College
- Canadian Elevating Industry Educational Program (CEIEP)

Industry

- Canadian Elevator Contractors Association (CECA)
- Independent Elevator Contractors Association (IECA)
- International Union of Elevator Constructors (IUEC)
- Otis Canada Inc.
- Thyssen Krupp Elevators
- National Elevator and Escalator Association (NEEA)
- Technical Safety Standards Authority (TSSA)

IMPLEMENTATION DATE: June 2005

Summary of Total Program In-School Training Hours

Reportable Subjects	Total	Theory	Application
1. Safety	24	24	0
2. Introduction to Elevating Devices	21	21	0
3. Mechanical Print Reading	15	6	9
4. Ladders, Scaffolding and Work Platforms	6	5	1
5. Rigging and Hoisting	12	9	3
6. Introduction to B44 Code Book	6	2	4
7. Mechanical Practice	30	21	9
8. Traction Elevator Installation	78	58	20
9. Basic Hydraulics	9	9	0
10. Elevator Hydraulic Systems	36	28	8
11. Hydraulic Elevator Installation	21	17	4
12. Basic Electricity	60	42	18
13. Industrial Electricity for Elevating Devices	54	43	11
14. Motors, Generators, Controls and AC Drives	57	57	0
15. Solid State Electronics	69	47	22
16. Circuit Tracing	66	26	40
17. Escalators and Moving Walks Installation	15	11	4
18. Lifts for Persons with Physical Disabilities	21	19	2

Reportable Subjects	Total	Theory	Application
19. General Preventive Maintenance	15	12	3
20. CSA-B44 Section C.8.6.12 and Appendix J	15	6	9
21. Elevator Machine Room Equipment Maintenance	39	24	15
22. Elevator Car Equipment Maintenance	12	8	4
23. Elevator Hoistway and Pit Equipment Maintenance	15	13	2
24. Escalator and Moving Walk Maintenance	9	7	2
25. Elevator Modernization/Alterations	15	10	5
Total	**720**	**525**	**195**

Number: **1**

Title: **SAFETY**

Duration: 24 Total Hours Theory: 24 Hours Application: 0 Hours

Prerequisites: None

Cross Reference to Performance Objectives: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 4.0

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to practice workplace safety in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

1.1 – Define the fundamentals of personal protective equipment.

1.2 – Describe the dangers of asbestos, synthetic mineral fibres and silica.

1.3 – Define the fundamentals of hand and power tool safety.

1.4 – Define the fundamentals of hazards in the hoistway, machine room and Pit.

1.5 – Define the fundamentals of electrical safety.

1.6 – Define the fundamentals of safety when babbitting.

1.7 – Define the fundamentals of safety when using oxy-acetylene equipment for heating and flame cutting.

1.8 – Define the fundamentals of environmental hazards.

1.9 – Define the fundamentals of Material Handling.

1.10 – Describe the safety issues relating to substance abuse.

1.11 – Describe the role of the Workplace Safety & Insurance Board (W.S.I.B.)

1.12 – Describe the workplace fire safety and prevention requirements.

1.13 – Define the essential workplace housekeeping procedures.

1.14 – Describe the types and applications of effective communication techniques.

1.15 – Identify the required Ministry of Labour and TSSA procedures for accidents and unsafe working conditions.

1.16 - Describe the public safety requirements for the workplace.

LEARNING CONTENT:

1.1 Define the fundamentals of personal protective equipment. [1.5 /0]

- personal protective equipment
  - head guarding
  - problems for hair and jewellery
  - guarding eyes, ears, hands and feet
  - use of respirators
  - protective clothing
  - use of fall arrest devices and travel restraint as per the requirements of the Occupational Health and Safety Act
  - use of back belts
  - code reference: OHSA (C) Section 28-35

1.2 Describe the dangers of asbestos, synthetic mineral fibres and silica. [1 /0]

- dangers of asbestos, synthetic products and Silica
  - recognize the toxic effects
  - define the types of potential exposure
  - use of P.P.E. to minimize effects of exposure
  - responsibilities and action procedures

1.3 Define the fundamentals of hand and power tool safety. [2/0]

- hand tool safety
  - safe use and application of hand tools
  - maintenance of hand tools
  - safe storage of hand tools
- power tool safety
  - inspection
  - operation
  - maintenance
  - storage
  - electrical safety
  - Code reference: OHSA (C) Section 103, 119, 134, 136

1.4 Define the fundamentals of hazards in the hoistway, machine room and pit. [5/0]

- identify hazards when removing elevating device from service and positioning in hoistway.
- identify hazards of placing the elevating device back into normal service.
- Identify hazards of stored mechanical energy

- Identify hazards of stored pneumatic energy
- identify hazards of using hoistway access switches and unlocking devices
- identify hazards of Gaining Access to and Egress from the elevating device car pit.
- identify hazards from overhead deflector sheaves, traction sheaves and deflector sheaves on car.
- identify hazards associated with moving counterweights when on car top and in the pit.
- identify hazards associated with vanes and other devices that present a shear hazard in the hoistway.
- code reference: OHSA (C) Section 201-206
- identify hazards caused from falling objects
- identify hazards of falling and exposure to electric shock
- identify hazards of moving on uneven or unstable surfaces
- identify slippery conditions
  - dirt
  - oil grease
  - ice and water
- identify hazards of working around rotating or moving equipment
- code reference: OHSA (C) Section 201-206

1.5 Define the fundamentals of electrical safety.
[3/0]

- define “tag and lockout procedures”
  - verify NO POWER
- describe the use of electrical meters and instruments
  - testing for presence of electricity
- define the hazards from stored electrical energy and other sources
  - capacitors
  - inductors
  - interconnections
- directors ruling 106/93 & 01/82
- define the safe use of jumpers
  - appropriate use
  - potential hazards
- code reference: OHSA (C) Section 100 – 105
- CSA B44 2.2 6.1. 5.8 & 8.6.1.6.3

1.6 Define the fundamentals of safety when babbitting.
[1/0]

- identify the requirements for Personal Protective Equipment P.P.E.
- identify the requirements for clean clothing
- define the specified Babbitt composition

- identify the required babbitting equipment
- identify the hazards associated with heating babbitt
  - use of heating equipment
  - handling molten Babbitt
- identify the dangers of moisture in babbitting
- identify the dangers of fumes in babbiting

1.7 Define the fundamentals of safety when using oxy-acetylene equipment for heating and flame cutting.
[1/0]

- define the requirements of wearing Personal Protective Equipment (P.P.E.).
- identify the safe handling methods and storage requirements of oxy-acetylene equipment.
  - turning on and off equipment
  - hazards of using oxygen around lubricating oil or grease
  - explosion hazards
  - equipment storage and transportation
  - regulator adjustment
- interpret code reference: OHSA (C) Section 97 – 99

1.8 Define the fundamentals of environmental hazards. [1/0]

- chemical hazards
- physical hazards
- biological hazards
- toxic substances

1.9 Define the fundamentals of material handling. [1/0]

- planning storage
- specified PPE
- warm up
- adequate lighting
- communication
- use of dollies
- lifting techniques

1.10 Describe the safety issues relating to substance abuse. [1/0]

- describe alcohol, prescription and non-prescription drug abuse
- recognize symptoms
- awareness of programs and counseling

1.11 Describe the role of the Workplace Safety and Insurance Board (W.S.I.B.)
[1/0]

- define the role of the W.S.I.B
- define the role and responsibilities of the employer and employee

1.12 Describe the workplace fire safety and prevention requirements.
[1/0]

- interpret the Occupational Health and Safety Act (O.H.S.A.)
- identify potential fire hazards
- identify the class of fires and the application of the appropriate fire extinguisher
- develop an emergency action plan including evacuation procedures
- describe the use of extinguishers, respirators, stretchers and fire blankets
- describe the factors that determine when a fire should not be fought
- interpret code Reference: O.H.S.A. (C) Section 52 - 55

1.13 Define the essential workplace housekeeping procedures. [1/0]

- Identify hazardous areas in the workplace
  - wet floors and liquid spills
  - poor illumination
  - debris in walking area
  - loose carpet and uneven surfaces
  - storage of tools and equipment

1.14 Describe the types and applications of effective communication techniques.
[.5/0]

- identify the four types of communication and situational applications
  - Verbal
  - Written
  - Visual
  - Body language

1.15 Identify the required reporting procedures for accidents and unsafe working conditions.
[2/0]

- define the procedures for identifying and reporting unsafe conditions
- describe how to attend to injured workers

- practice writing an accident and incident report that complies with the Ministry of Labour and TSSA Accident Reporting Procedures
- review the TSSA “Emergency Evacuation Training and Certification Policy”

1.16 Describe the public safety requirements for the workplace.
[1/0]

- define the method of notifying building personnel of elevating device shut- down or reinstatement to service.
- define the reasons for notifying building personnel that the elevating device has been shut down or returned to service
- define the requirement for and location of “maintenance in progress” signs
- define the equipment requirements and procedure for barricading entrances.
- define the requirements for barricading
- minimizing hazards associated with public contact with tools or materials in the work area

Evaluation Structure:

Theory Testing	Application Experiences	Final Assessment
70%	0%	30%

NUMBER **2**

TITLE: **INTRODUCTION TO ELEVATING DEVICES**

Duration: 21 Total Hours Theory: 21 Hours Application: 0 Hours

Prerequisites: 1

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the introductory information of the elevating devices industry in accordance with historical and current elevating systems.

2.1 – History and Terminology of Vertical Transportation

2.2 – Other Elevating Devices

2.3 – Acts, Regulations, Standards and Codes

2.1 History and Terminology of Vertical Transportation

Duration: Total Hours 3 Theory: 3 hours Application: 0 hours

Cross-Reference to Performance Objectives: 1.7, 3.1, 4.1, 5.1, 6.1, 7.1, 8.1, 9.1, 10.1, 11.1, 12.1, 13.1, 14.1

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the history and terminology of vertical transportation and the evolution to the modern elevating devices in accordance with government safety regulations, manufacturers' recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

2.1.1 - Describe the need for elevators and how this need caused the evolution in elevating devices from the simplest to the most technologically advanced.

2.1.2 - Describe terminology concerning elevators, escalators and other elevating devices.

LEARNING CONTENT

2.1.1 Describe the need for elevators and how this need caused the evolution in elevating devices from the simplest to the most technologically advanced. [1/0]

- the origin of elevating devices
- early modern elevators
- modern elevators

2.1.2 Describe terminology concerning elevators, escalators and other elevating devices.
[2/0]

- identify a glossary of elevating devices terms:
  - machine room equipment
  - hoistway equipment
  - car assembly equipment
  - pit equipment

2.2 Other Elevating Devices

Duration: 9 Total Hours Theory: 9 hours Application: 0 hours

Cross-Reference to Performance Objectives: 1.0, 14.0

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe other elevating devices covered under the Elevating Devices Regulations in accordance with manufacturer's design features.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

2.2.1 Define the fundamentals of dumbwaiters.

2.2.2 Define the fundamentals of material lifts.

2.2.3 Define the fundamentals of sidewalk elevators.

2.2.4 Define the fundamentals of incline lifts.

2.2.5 Define the fundamentals of lifts for persons with physical disabilities.

2.2.6 Define the fundamentals of manlifts.

2.2.7 Define the fundamentals of construction hoists.

2.2.8 Define the fundamentals of passenger ropeways.

2.2.9 Define the fundamentals of stage lifts.

2.2.10 Define the fundamentals of special application elevators.

2.2.11 Define the fundamentals of elevators with other types of driving machines.

LEARNING CONTENT

2.2.1 Define the fundamentals of dumbwaiters.
[1.5/0]

- Ontario Regulations, Section 1. and Section 2.3
- Code Adoption Document Part 3
- B44 Code, Section 7.1, 7.2, 7.3, 7.8
- Types and applications
- Basic construction features and operation

2.2.2 Define the fundamentals of material lifts. (Freight Platform Lifts).
[1.5/0]

- Ontario Regulation, Section 1 and Section 2.3 (see freight platform lifts).
- Code Adoption Document Part 3
- B44 Code, Section 7.4, 7.5, 7.6, 7.7, 7.9, 7.10, 7.11
- Outline the essential differences from elevators.
  - lifting mechanism
  - controls

2.2.3 Define the fundamentals of sidewalk elevators.
[.5/0]

- Ontario Regulation, Section 1
- B44 Code, Section 5.5

2.2.4 Define the fundamentals of inclined travel elevators.
[1/0]

- Ontario Regulation, Section 1
- B44 Code, Section 5.1, 5.4

2.2.5 Define the fundamentals of lifts for persons with physical disabilities.
[1.5/0]

- Ontario Regulation, Section 1 and Section 2
- Code Adoption Document Part 7
- CSA B355
- CSA B613

2.2.6 Define the fundamentals of manlifts.
[.5/0]

- Ontario Regulation, Section 1 and Section 2
- Code Adoption Document Part 4
- B311 Code

2.2.7 Define the fundamentals of construction hoists.
[.5/0]

- Ontario Regulation, Section 1 and Section 2
- Code Adoption Document Part 6
- Z185 (Workers hoists) and Z256 Codes (Material Hoists)

2.2.8 Define the fundamentals of passenger ropeways. (Note that the Elevating Device Mechanic is not certified to work on a Passenger Ropeway as identified in the Ontario Regulation 18603 for Ski Lift machine Requirements).
[.5/0]

- Ontario Regulation, Section 1 and Section 2
- Code Adoption Document Part 5
- Z98 Code (Passenger Ropeways)

2.2.9 Define the fundamentals of stage lifts.
[.5/0]

- Ontario Regulation, Section 1 and Section 2
- B44 Code (Stage lifts) General rules applicable to elevators

2.2.10 Define the fundamentals of Special Application Elevators.
[.5/0]

- CSA B44 Code Part 5, Section 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.8, 5.10
- Ontario Acts / Regulations

2.2.11 Define the fundamentals of elevators with other types of driving machines. [.5/0]

- CSA B44 Part 4, Section 4.1, 4.2, 4.3
- Ontario Acts / Regulations

2.3 Acts, Regulations, Standards and Codes

Duration: 9 Total Hours Theory: 9 hours Application: 0 hours

Cross-Reference to Performance Objectives: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe acts, regulations, standards and codes in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

2.3.1 Identify the basic differences between acts, regulations, standards and codes.

2.3.2 Describe the essentials of the Technical Standards and Safety Act, Regulations, Code Adoption Document, Policies and Procedures.

2.3.3 Interpret the essentials of the Ontario Building Code Act and Regulations.

2.3.4 Define the essentials of the Ontario Health and Safety Act (Construction/ Industrial) as it applies to this trade.

2.3.5 Describe the essentials of W.H.M.I.S. as it applies to this trade and industry.

2.3.6 Define the essentials of the various Codes and Standards as they apply to elevating devices.

2.3.7 Identify the legal responsibilities as they apply in the various acts, regulations, standards and codes and how they affect this trade.

2.3.8 Identify the fundamentals of the TSSA Directors rulings.

LEARNING CONTENT

2.3.1 Identify the basic differences between acts, regulations, standards and codes. [1/0]

- basic information concerning the differences between the topics covered in acts, those covered in regulations and those in standards.
- explanation of the relationship between acts, regulations and standards.
- review Code adoption documents.

2.3.2 Describe the essentials of the Technical Standards and Safety Act, Regulations and Code Adoption Document Policies and Procedures.
[2/0]

- Basic information (overview) concerning topics in the Technical Standards and Safety Act and Regulations and Training and Certification of Mechanics.

2.3.3 Interpret the essentials of the Ontario Building Code Act and Regulations. [1/0]

- Overview of the topics which are directly relevant to elevating devices.

2.3.4 Define the essentials of the Ontario Health and Safety Act (Construction/ Industrial) as it applies to this trade.
[1/0]

2.3.5 Describe the essentials of W.H.M.I.S. as it applies to this trade and industry. [1/0]

2.3.6 Define the essentials of the various Codes and Standards as they apply to elevating devices.
[1.5/0]

- CSA B44, Safety Code for Elevators
- CSA C22.1 Part I, Canadian Electrical Code (Section 38)
- Overview only of the following standards:
  - CSA B311, Safety Code for Manlifts
  - CSA Z185, Safety Code for Personnel Hoists
  - CSA Z256, Safety Code for Material Hoists
  - CSA B613 Lifts for persons with physical disabilities in private residences
  - ASME A17.4 Guide for Emergency personnel

2.3.7 Identify the legal responsibilities as they apply in the various acts, regulations, standards and codes and how they affect this trade.
[.5/0]

- Identify the legal responsibilities:
  - Apprentice
  - Journeyperson
  - Elevating devices mechanic

2.3.8 Identify the fundamentals of the TSSA Directors rulings.
[1/0]

- refer to the TSSA web site (www.tssa.org)
- identify the legal responsibilities
- explain the reasons for directors rulings

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
70%	0%	30%

NUMBER **3**

TITLE: **MECHANICAL PRINT READING**

Duration: 15 Total Hours Theory: 6 Hours Application: 9 Hours

Prerequisites: 2

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to interpret mechanical print reading in accordance with manufacturer's recommendations and specifications and approved industry standards.

3.1 – Architectural/Structural Prints

3.2 – Elevating Device Layout Prints

3.3 – Elevating Devices Mechanical Print Reading

3.1 Architectural/Structural Prints

Duration: 3 Total Hours Theory: 3 hours Application: 0 hours

Cross-Reference to Performance Objectives: 1.7, 2.1

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to interpret architectural/structural prints in accordance with manufacturer's recommendations and specifications and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

3.1.1 Identify the fundamentals of architectural/structural prints.

3.1.2 Describe the construction features of architectural/structural prints.

3.1.3 Locate and identify key elements on an architectural/structural print relating to the construction/installation of an elevating device.

LEARNING CONTENT

3.1.1 Identify the fundamentals of architectural/structural prints.
[.5/0]

- identify the type and application of architectural/structural drawings
- drawing type
- location of identifying information
  - building address
  - drawing number
  - plan views
  - elevation views
  - drawing scale
  - specifications

3.1.2 Describe the construction features of architectural/structural prints.
[.5/0]

- nomenclature relating to sectional views
- number of landings and floor elevations
- symbols relating to :
  - doors
  - windows
  - structural beams
  - beam connections
  - fasteners
  - poured concrete
  - concrete blocks
  - masonry
  - timber
  - drywall
  - footings reinforcing rods
  - anchors
  - concrete inserts
  - through bolts
  - heating cooling and ventilation ducts
  - exhaust fans
  - plumbing
  - sanitary drains
  - sump holes
  - cored holes

3.1.3 Locate and identify key elements on an architectural/structural print relating to the construction/installation of an elevating device.
[2/0]

- location of elevating device in the plan views
- location of elevation views and determine floor heights and number of landings
- determine the travel, pit depth and overhead
- locate the system of grid lines on the drawings and relate position of elevating device to the grid lines
- determine the thickness and type of finished walls for the hoistway
- determine the location of fixtures forming part of the elevating device control equipment and other ancillary fixtures.
  - Communications and Fire Control (CAFC) room
  - lobby dispatch panel
  - recall switches
  - smoke and heat sensors
  - sprinkler heads
  - CRT systems
- locate the elevating device entrances
- locate the elevating device machine room
  - machine room configuration
  - secondary level configuration
  - special trenches or tunnels for:
    - oil lines
    - electrical conduit

3.2 Elevating Device Layout Prints

Duration: 8 Total Hours Theory: 0 hours Application: 8 hours

Cross-Reference to Performance Objectives: 1.7, 2.1, 3.2, 4.2, 5.2, 6.2, 6.4, 7.2, 8.2, 9.2, 10.2, 11.2, 12.2, 13.2, 14.2

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe elevating device layout prints in accordance with manufacturer's recommendations and specifications and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

3.2.1 Interpret the information on an elevating device print.

3.2.2 Identify the key aspects of elevating device print reading.

3.2.3 Locate and identify positioning of components

3.2.4 Locate and identify clearances

3.2.5 Locate and identify power requirements

LEARNING CONTENT

3.2.1 Interpret the information on an elevating device print.
[0/2]

- location of identifying information
  - building address
  - drawing number
  - plan and elevation views
  - drawing scale

3.2.2 Identify the key aspects of elevating device print reading.
[0/1]

- location and depth of pit
- identify the normal travel of the elevating device
- locate and identify the overhead and related dimensions
- locate the width and depth of the hoistway in the plan view

3.2.3 Locate and identify positioning of components
[0/2]

- locate and identify position of guide rails
- identify the size and orientation of the car frame
- locate and identify pit equipment:
  - buffers
  - rail foot brackets
  - pit channels
  - compensating sheave
  - pit ladder
  - pit stop switch
  - pit light and light switch

3.2.4 Locate and identify clearances
[0/1]

- locate and identify 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

3.2.5 Locate and identify power requirements
[0/2]

- identify the correct location of main electrical components
  - main disconnect switches
  - car light disconnect / power supply
  - signal switches
  - dispatcher disconnect switches
- confirm the elevating device power requirements
  - voltage
  - amperage

3.3 Elevating Devices Mechanical Print Reading

Duration: 4 Total Hours Theory: 3 hours Application: 1 hours

Cross-Reference to Performance Objectives: 1.7, 2.1, 3.2, 4.2, 5.2, 6.2, 6.4, 7.2, 8.2, 9.2, 10.2, 11.2, 12.2, 13.2, 14.2

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to explain elevating device mechanical print reading procedures in accordance with manufacturer's recommendations and specifications and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

3.3.1 Describe the fundamentals of drawing title blocks, notes and abbreviations.

3.3.2 Describe the fundamentals of visualization, projection and views.

3.3.3 Explain the fundamentals of dimensioning.

3.3.4 Identify typical machine elements associated with elevating devices.

LEARNING CONTENT

3.3.1 Describe the fundamentals of drawing title blocks, notes and abbreviations.
[1/0]

- drawing title blocks
  - drawing name
  - number system
  - revisions
  - dates
- reading notes
  - importance of recognition
  - data
- understanding abbreviations
- scale indication and measuring scales

3.3.2 Describe the fundamentals of visualization, projection and views.
[1/0]

- orientation of objects
- third vs. first angle of projection
- basic arrangement of views
- transference of dimensions
- auxiliary and section views
- isometric and exploded views

3.3.3 Explain the fundamentals of dimensioning.
[1/0]

- definition and requirements of dimensioning
- dimensioning systems
- rules for dimensioning
- checking dimensions
- English vs. metric system of units

3.3.4 Identify typical machine elements associated with elevating devices.
[0/1]

- structural steel sections
- shafts, keys and pins
- fasteners
  - types
  - thread nomenclature
- weld symbols

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
40%	30%	30%

NUMBER: **4**

TITLE: **LADDERS, SCAFFOLDING AND WORK PLATFORMS**

Duration: 6 Total Hours Theory: 5 Hours Application: 1 Hours

Prerequisites: 1, 2

Evaluation & Testing:
- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 1.4,1.5,1.6

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to explain the use of ladders, scaffolding and work platforms in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

4.1 – Describe the fundamentals of using ladders.

4.2 – Explain the fundamentals of using scaffolding.

4.3 – Explain the fundamentals of using work platforms.

LEARNING CONTENT

4.1 Describe the fundamentals of using ladders.
[.5/.5]

- ladder angle limits
- ensure secure footing
- determine the required height
- define correct positioning
- guard area in vicinity of ladder
- tie-off the ladder as required
- load limits
- maintenance and storage
- materials used to construct ladders
- code reference: OHSA (C) Section 68-75
- C.S.A Certification and Duty Ratings

4.2 Explain the fundamentals of using scaffolding.
[1.5/.5]

- OHSA requirements (construction)
- Identify when scaffolding requires engineering
- methods of assembly and disassembly
- recognizing hazards and obstructions
- leveling
- bracing and tying-off
- guarding the work area
- installing the planking and railings
- personal protective equipment
- recognize load limits
- inspect scaffolding
- perform maintenance
- storage of scaffolding and planks
- differences between hoistway and exterior scaffolding
- code reference: OHSA (C) Section 76-87

4.3 Explain the fundamentals of using work platforms.
[3/0]

- work platforms v/s false cars
- advantages and disadvantages of each
- assembly and disassembly of each type
- overhead protection requirements

- false cars
  - drawing name
  - ensure safeties are correct size for rail
  - test safeties
  - maintain logbook of false car use/problem/repairs
- guard work area
- use of railings and kickboards
- personal protective equipment
- check safe load limits
- inspect work platforms and false cars
- maintain work platforms and false cars
- correct storage methods]
- code reference: OHSA Act Chap. O.1 Section 31

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
60%	10%	30%

NUMBER: **5**

TITLE: **RIGGING AND HOISTING**

Duration: 12 Total Hours Theory: 9 Hours Application: 3 Hours

Prerequisites: 1, 2, 4

Evaluation & Testing:
- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives**:** 2.1, 2.2, 2.3, 2.4

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the safe use of rigging and hoisting equipment in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

5.1 – Define the fundamentals and types of rigging and hoisting equipment

5.2 – Describe the construction features and application of rigging and hoisting equipment.

5.3 – Explain the operating principles of rigging and hoisting equipment.

5.4 – Describe the safe use in the workplace of rigging and hoisting equipment.

5.5 – Define the fundamentals of hardware for hoisting equipment.

LEARNING CONTENT

5.1 Define the fundamentals and types of rigging and hoisting equipment [2/0]

- chain block
- come-along
- tugger hoist
- cat-head
- electrical devices
- hydraulic devices
- pneumatic devices

5.2 Describe the construction features and application of rigging and hoisting equipment.
[2/0]

- equipment assembly
- limitations on the use of cat-heads
- slings and sling arrangements
  - ratings
  - wire rope v/s nylon rope
- securing and balancing a load
- test lifts
- estimating weights of equipment
- load capacities of lifting equipment

5.3 Explain the operating principles of rigging and hoisting equipment. [1/1]

- limitations on the use of cat-heads
- slings, sling arrangements, applications
  - ratings
  - soft slings
  - wire rope
- chain block
- come-along
- tugger hoist
- cat-head
- electrical devices
- hydraulic devices
- pneumatic devices

5.4 Describe the safe use in the workplace of rigging and hoisting equipment [2/2]

- guarding the work area
- awareness of pinch points
- safety in the lifting area
- communications
  - verbal
  - hand signals
- ventilation and lighting
- personal protective equipment
- inspection, maintenance and repair of equipment
- recommended storage of equipment
- maintaining logbooks
- code reference: OHSA (C) Section 144-152
- OHSA Act Chap. 0.1 Section 31

5.5 Define the fundamentals of hardware for hoisting equipment. [2/0]

- hooks and mousing
- eye bolts and shackles
- tag lines
- shims
- fillers
- spacers
- jacks
- spreader bars

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
50%	20%	30%

NUMBER **6**

TITLE: **INTRODUCTION TO THE CSA B44 CODE BOOK**

Duration: 6 Total Hours Theory: 2 Hours Application: 4 Hours

Prerequisites: 1, 2

Evaluation & Testing:
- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: None

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is capable of describing the fundamentals of locating, accessing and interpreting the information contained within the CSA B44 Standard.

6.1 – Define the introductory information of the development of codes and standards for the CSA B44 code book.

6.2 – Define the history of the harmonized North American Elevator Code system.

6.3 – Describe the format of standards and conventions used for codes.

6.4 – Perform the procedure to access information from the CSA B44 code book.

LEARNING CONTENT

6.1 Define the introductory information of the development of codes and standards for the CSA B44 code book.
[1/0]

- the hierarchy of Standards Canada, Canadian Standards Association (CSA) and other code writing bodies.
- CSA and technical committees
- B44 Technical committee and sub-committees
  - recommended reading of the code making process at CSA
    - hierarchy
    - policies and procedures
    - organizational charts

6.2 Define the history of the harmonized North American Elevator Code system. [.5/0]

- the ASME A17.1 American Elevator Standard
- NAFTA as a catalyst for harmonization
- Harmonization commencement date
- Harmonized completed with publication of the 2000 edition

6.3 Describe the format of standards and conventions used for codes. [.5/0]

- the numbering system
- terminology for:
  - differences between a “code” and a “Standard”
  - interpretations
  - inquiries
  - ballots
  - letter ballots
  - define “consensus”

6.4 Perform the procedure to access information from the CSA B44 code book. [0/4]

- search for keywords
- process of elimination
  - the hierarchal approach
- use of trade terms
- searching with the index
- search levels and cross references

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
25%	45%	30%

NUMBER **7**

TITLE: **MECHANICAL PRACTICES**

Duration: 30 Total Hour Theory: 21 Hours Application: 9 Hours

Prerequisites: 3

Cross Reference to Performance Objectives: 1.7, 2.4, 3.3, 4.3, 5.3, 6.3, 7.3, 8.3, 10.3, 11.3, 12.3, 13.3, 14.3

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the mechanical practice procedures for elevating device maintenance in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

7.1 – Define the fundamentals of mechanical print reading, associated mathematics and science.

7.2– Describe the fundamentals of power transmission components.

7.3 – Describe the basic introductory information and fundamentals of bearings and seals.

7.4 – Describe the fundamentals of precision measurements.

7.5 – Describe the fundamentals of materials and fastening technology.

7.6 – Describe the basic introductory information and fundamentals of lubrication.

7.7 – Describe the fundamentals of test instruments.

LEARNING CONTENT

7.1 Define the fundamentals of mechanical print reading, associated mathematics and science. [7.5/0]

- drawing types
  - orthographic
  - isometric
- drawing views of machine components
  - multi-view
  - auxiliary views
  - assembly
  - detail drawings
  - bills of materials
  - title block
  - change orders
  - dimensions
  - tolerances
  - notes
- applied mathematics
  - adding, subtracting, multiplying, dividing
  - conversion of fractions
  - algebra
  - trigonometry
- strength of materials
  - tensile strength
  - hardness
  - corrosion protection
  - safety factors
- heat transfer
  - convection
  - radiation
  - conduction

7.2 Describe the fundamentals of power transmission components. [4.5/3]

- V-belts
- belt sheaves
- taper bushings
- chains and sprockets
- gear and rear reducers
- couplings, keys, pins and set screws
- belt alignment
  - tools
  - procedure

7.3 Describe the fundamentals of bearings and seals. [4/2]

- bearing types
  - sleeve (journal) bearings
  - anti-friction bearings
    - ball
    - taper
    - roller
    - thrust
  - mounted bearings
    - pillow blocks
    - flange cartridges
- causes of bearing failures
  - lack of lubrication
  - contamination
  - overloading
  - overheating
  - electrolysis
- identification of bearing failures
  - scoring
  - galling
  - corrosion
  - pitting
- bearing removal procedures
  - pullers
  - press
- bearing lubrication procedures
  - cleaning
  - repacking
  - grease gun
- identify seals
  - static
  - dynamic
  - application
- procedure for removal and installation of seals
  - pullers
  - drivers

7.4 Describe the fundamentals of precision measurements. [.5/2.5]

- inch and metric measurements
  - imperial system
  - metric system
- describe precision measuring tool construction features
  - micrometers
  - calipers
  - dial indicators
  - feeler gauges
  - levels
  - scribing tools
- describe precision measuring tool use
  - micrometers
  - calipers
  - dial indicators
  - feeler gauges
  - levels
  - scribing tools
- describe precision measuring tool maintenance and storage procedures
  - lubrication
  - accuracy checks
  - corrosion protection
  - storage location and method

7.5 Describe the fundamentals of materials and fastening technology. [3/0]

- identify and describe properties and application for:
  - ferrous metals
  - non-ferrous metals
  - alloys
- identify and describe application for non-metallic materials
  - neoprene
  - plastics
  - composites
- define the mechanical properties of metals and alloys
  - tensile strength
  - yield strength
  - hardness
  - elongation rate
- identify and select fasteners for specific applications
  - bolts
  - through bolts
  - nuts

  - lock washers
  - flat washers
  - bevel washers
  - pins
  - dowels
  - retaining rings
  - screws
  - mechanical anchors
  - chemical anchors
  - shields
  - inserts
- identify thread types
  - UNC
  - UNF
  - Metric
  - NPT
  - NPTF
- identify grade of fasteners
  - head markings
  - strength of materials
  - reference CSA B44 Section 9.1

7.6 Describe the fundamentals of lubrication.
[1.5/.5]

- lubricant types and properties
  - oil
  - grease
  - solids
  - gases
- use of lubrication devices
  - grease guns
  - oil cans
  - mechanical
- storage of lubrications
  - fire protected
  - ventilation
  - temperature
  - containers
  - location
- disposal requirements

7.7 Describe the fundamentals of test instruments.
[0/1]

- use test instruments
  - stopwatches
  - tachometers
  - pressure gauges
  - torque wrenches

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
40%	30%	30%

NUMBER **8**

TITLE: **TRACTION ELEVATOR INSTALLATION**

Duration: 78 Total Hours Theory: 58 Hours Application: 20 Hours

Prerequisites: 1, 2, 3, 4, 5, 6, 7

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the construction and installation procedures for traction elevators in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

8.1 – Site Planning

8.2 – Hoistway Plumbing

8.3 – Rails, Brackets and Guide Rails

8.4 – Machine Room Equipment

8.5 – Pit Structures

8.6 – Car Assemblies, Counterweight Assemblies and Wire Ropes

8.7 – Door Frames, Hoistway Doors and Lock Assemblies

8.8 – Duct Risers, Conduit, Wiring and Hoistway Switches

8.9 – Car Cab Assemblies and Traveling Cables

8.10 – Special Emergency Service & Start Up-Procedures

8.11 – Preparing and Testing for Inspection

8.1 Site Planning

Duration: 5 Total Hours Theory: 5 hours Application: 0 hours

Cross-Reference to Performance Objectives: 1.7, 2.1

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the fundamentals, features and application of site planning in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.1.1 – Define the fundamentals of site planning.

8.1.2 – Describe the construction features and application of site planning.

LEARNING CONTENT

8.1.1 Define the fundamentals of site planning.
[2/0]

- Verify if the site is ready for installation:
  - report to the site superintendent or General Contractor (GC**)**
  - visually inspect site
  - review the owners requirements
  - scheduling of equipment
  - review equipment check list
  - planning job safety
  - arrange storage space
  - confirm the integrity of all fastening points

8.1.2 Describe the construction features and application of site planning. [3/0]

- identify features and application procedures
  - organize tools
  - organize the equipment availability in conjunction with the delivery schedules and installation sequence
  - heating and cooling requirements
  - main line disconnect switch location
  - electrical supply
  - machine room access
  - rail fastening points
  - steel beams
  - pockets
  - communication process
  - pit and machine room lighting
  - pit ladders and location
  - housekeeping

8.2 Hoistway Plumbing

Duration: 4 Total Hours Theory: 4 hours Application: 0 hours

Cross-Reference to Performance Objectives: 2.1, 2.2, 2.3, 3.1, 3.2, 3.3, 7.1, 7.2, 7.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the fundamentals of plumbing the hoistway in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.2.1 – Define the objectives of plumbing the hoistway.

8.2.2 – Describe the procedures of plumbing the hoistway.

LEARNING CONTENT

8.2.1 Define the objectives of plumbing the hoistway.
[1/0]

- assure required dimensions of hoistway
- assure hoistway is vertically plumb

8.2.2 Describe the procedures of plumbing the hoistway.
[3/0]

- describe the procedures to install lifelines
- describe the procedure to install fall arrest system
  - review company fall arrest documentation
- check and verify overhead protection
- positioning of dividing beams
  - reference grid lines
- perform measurement calculations main layout
- establish working lines
- templates
- plumb lines
- use of dimensional measuring devices
  - DBG gauges
  - Bayonet gauges
  - Calipers
  - describe operation, maintenance and storage
- erecting and installing temporary and/or working platforms
  - ensuring the safeties are the required size for the rail size
  - ensuring the unit has been serviced correctly
  - testing the safeties
  - identify when engineers approved drawings are required
- code reference: B44 Clause 2.1

8.3 Rails, Brackets and Guide Rails

Duration: 6 Total Hours Theory: 6 hours Application: 0 hours

Cross-Reference to Performance Objectives: 9.1, 9.2, 9.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the fundamentals of installing rails, brackets and guide rails in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.3.1 – Define the fundamentals of installing false cars.

8.3.2 – Define the fundamentals of installing guide rails.

LEARNING CONTENT

8.3.1 Define the fundamentals of installing false cars. [1/0]

- installing safeties
  - correct size for rail size
  - installing safeties
  - testing safeties
  - ensure unit has been serviced according to the manufacturer
  - code reference: B44 Clause 2.1

8.3.2 Define the fundamentals of installing guide rails. [5/0]

- planning guide rail runs
- preparing rails
- stacking rails
- fish plates
- rail clips
- rail alignment
- shimming
- tipping
- kicking
- rail gauges
- finishing rails
- jack bolts
- blocking
- code reference: B44 Clause 3.2

8.4 Machine Room Equipment

Duration: 10 Total Hours Theory: 7 hours Application: 3 hours

Cross-Reference to Performance Objectives: 7.1, 7.2, 7.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the installation procedures for machine room equipment in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.4.1 – Define the fundamentals of installing machine room equipment.

8.4.2 – Define the fundamentals of wiring machine room equipment.

LEARNING CONTENT

8.4.1 Define the fundamentals of installing machine room equipment. [4/1]

- verify that the specified equipment is on site before hoisting
- locate rope and wire way holes
- hoisting of the machine room equipment
- position secondary level equipment
- outline installation and setting procedures for:
  - machine beams
  - machine
  - sheaves
  - deflector
  - governors
  - controllers
  - car position devices
    - CPI
    - HPI
  - direct drives
  - monitoring devices
  - encoders
  - machine room less equipment (MLR)
- code reference: B44 Clause 2.7, 2.8, 2.9

8.4.2 Define the fundamentals of wiring machine room equipment. [3/2]

- interpret and follow electrical field wiring diagrams
- identify required wire ways and conduit
- plan raceway layout
- produce wire run sheets
- identify required wire sizes and conduit sizes
- identify grounding requirements
- use of specialized hand tools:
  - wire strippers
  - crimping tools
  - terminal ends
- code reference: B44 Clause 2.7, 2.8, 2.9

8.5 Pit Structures

Duration: 4 Total Hours Theory: 3 hours Application: 1 hours

Cross-Reference to Performance Objectives: 5.1, 5.2, 5.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the introductory information and fundamentals of installing pit structures in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.5.1 – Identify pit equipment components.

8.5.2 – Describe the methods to install pit structure.

LEARNING CONTENT

8.5.1 Identify pit equipment components.
[2/0]

- identify pit equipment components:
  - channels
  - compensating sheaves
  - buffers
  - governor tension sheaves
  - pit switches
  - counterweight guards
  - ladders
  - sundry pit equipment
  - access doors

8.5.2 Describe the methods to install pit structure.
[1/1]

- describe installation procedures
  - support angles
  - work platforms
  - compensating sheaves
  - channels
  - buffers
    - spring
    - elastomeric (limited use/application elevators) CSA B44 5.2.1.22.1
    - oil
  - governor tension sheaves
  - pit switch and other safety switches
  - counterweight guards
  - ladders
  - consider sundry pit equipment
  - pit access doors
  - code reference: B44 Clause 2.2

8.6 Car Assemblies, Counterweight Assemblies and Wire Rope

Duration: 9 Total Hours Theory: 6 hours Application: 3 hours

Cross-Reference to Performance Objectives: 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 12.1,12.2

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the installation procedures for car and counterweight assemblies and wire ropes in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.6.1 – Describe the fundamentals of installing car and counterweight assemblies.

8.6.2 – Describe the fundamentals of installing wire ropes.

LEARNING CONTENT

8.6.1 Describe the fundamentals of installing car and counterweight assemblies. [4/0]

- outline the installation procedures for:
  - car frames
  - platforms and isolation
  - sheaves and rope hitches
- identify safety types
- installation of guide shoes and roller guides
- installation of toe guards
- static and dynamic balancing procedures
- building of the counterweight frame
- positioning procedures for car and counterweight assemblies
- procedure to balance the car and counterweight
- installing idler sheaves
- installing freight cars
- installing corner post elevators
- code reference: B44 Clause 2.3, 2.4, 2.5, 2.14, 2.15, 2.21

8.6.2 Describe the fundamentals of installing wire ropes. [2/3]

- identify general considerations
  - care and handling of wire rope
  - rope inspection for defects
- identify types of rope and other suspension devices
  - rope lay
  - rope material
  - wire count
  - strand count
  - applications
- identify characteristics of wire rope
  - rope lays
  - rope size
  - rope stretch
- identify types of sheaves
  - roping 1:1
  - roping 2:1
- installation of wire ropes
  - shortening ropes
  - seizing rope
  - cutting ropes
  - making a rosette

  - governor ropes
  - belt ropes
  - compensating ropes
  - compensating chains
  - rope tensioning
  - rope lubrication
  - rope termination devices
  - rope lubrication procedures
  - rope clip and eyebolt requirements
  - wedge clamp shackles
  - run-by clearances
- recording of rope data C8.6.12.4.4.3
- code reference: B44 Clause 2.20

8.7 Door Frames, Hoistway Doors and Lock Assemblies

Duration: 10 Total Hours Theory: 7 hours Application: 3 hours

Cross-Reference to Performance Objectives: 10.1, 10.2, 10.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the installation procedures for door frames, hoistway doors and lock assemblies in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.7.1 – Describe the fundamentals of installing door frames.

8.7.2 – Describe the fundamentals of installing hoistway doors and lock assemblies.

LEARNING CONTENT

8.7.1 Describe the fundamentals of installing door frames. [2/1]

- identify procedure to establish the elevation of the finished floors
- building procedure for door frames
  - struts
  - headers
  - jams
  - sills
- identify types of sills

- describe installation procedure for:
  - door frames
  - plumbing and alignment
  - hall fixture mountings
  - lobby panels and fixtures
    - fire service
    - emergency power
    - hoistway access switches

8.7.2 Describe the fundamentals of installing hoistway doors and lock assemblies. [5/2]

- identify types of:
  - doors
  - door locks
  - access devices
  - door closures
- describe installation procedures for:
  - doors
  - door locks
  - access devices
  - door closures
  - aircord
  - eccentrics
  - retainers (Directors Ruling 109/93; 97/92; 61/88 RB)
  - gibs and fire gibs
  - fire rating
  - facia plates
  - bi-parting doors
  - vertical gates
  - dumb waiter doors and locks
  - retiring cams
  - code reference: B44 Clause 2.11 and 2.12

8.8 Duct Risers, Conduit, Wiring and Hoistway Switches

Duration: 4 Total Hours Theory: 2 hours Application: 2 hours

Cross-Reference to Performance Objectives: 3.1, 3.3, 4.1, 4.3, 6.1, 6.3, 6.4, 6.5

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe fundamentals of installing duct risers, and conduit, wiring and hoistway switches in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.8.1 – Describe the fundamentals of installing duct risers and conduit.

8.8.2 – Describe the fundamentals of installing wiring and hoistway switches.

LEARNING CONTENT

8.8.1 Describe the fundamentals of installing duct risers and conduit. [1/1]

- interpret field wiring diagrams
- identify wire ways
- identify conduit layout and fittings
- review installation planning procedures
- identify raceway layout
  - wire
  - duct sizes and numbering of conductors
- describe grounding and bonding procedures
- use of strain blocks and fish paper
- Code reference: C22.1 Part I (CEC) Section 38

8.8.2 Describe the fundamentals of installing wiring and hoistway switches. [1/1]

- interpret wiring diagrams
- determine wiring requirements

8.9 Car Cab Assemblies and Traveling Cables

Duration: 14 Total Hours Theory: 10 hours Application: 4 hours

Cross-Reference to Performance Objectives: 3.1, 3.2, 3.3, 4.1, 4.3, 6.4

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe fundamentals of installing car cab assemblies in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.9.1 – Describe the fundamentals of installing traveling cables.

8.9.2 – Describe the fundamentals of installing car cab assemblies.

8.9.3 – Describe the fundamentals of installing car door systems.

LEARNING CONTENT

8.9.1 Describe the fundamentals of installing traveling cables. [1.5/.5]

- identify types of traveling cables
  - wire
- identify cable handling techniques
  - tools
  - personal protective equipment (P.P.E.)
- identify cable installation techniques
  - tools
  - prevention of kinking or birdcaging
  - hanger types and applications
  - protection for traveling cables
  - replacement practices
- code reference: C22 Part I (CEC) Section 38

8.9.2 Describe the fundamentals of installing car cab assemblies. [4/1]

- identify parts of cab assembly
- describe cab assembly installation procedures for:
  - threshold, extension and guard
  - positioning of the canopy
  - assembly of wall panels
  - fascia and canopy
  - cab steadier
  - car operating panels
  - panels and hand railings
  - ceilings and fixtures
  - laying of tile floors
  - top of car equipment
  - emergency power supply
  - alarm bell
  - top of car inspection station
  - door circuit bypass switch
  - emergency exit
  - wiring methods
    - field wiring diagram
    - top of car electrical devices
    - car operating panel
    - car positioning indicator
- code reference: B44 Cause 2.14

8.9.3 Describe the fundamentals of installing car door systems. [4.5/2.5]

- identify types of car doors
- identify parts of car door systems
- describe car door system installation procedures for:
  - door operators
    - special hospital service
    - code reference: B44 Clause 2.14
  - wiring methods
  - hanger and tracks
  - linkages
  - aircord
  - eccentrics
  - gate switches
  - vanes and clutches
  - door restrictors
  - clearance checks and adjustments
- describe car door opening devices installation procedures for:
  - mechanical safety edges
  - multi-beam devices
  - detectors
  - photo eyes
  - proximity devices
  - kinetic energy measurement and requirements
  - code reference: B44 Clause 2.14

8.10 Start- Up Procedures and Special Emergency Service

Duration: 6 Total Hours Theory: 4 hours Application: 2 hours

Cross-Reference to Performance Objectives: 1.1, 4.1, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3, 6.6, 7.2, 7.3, 13.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe start-up procedures and special emergency service in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.10.1 – Describe the fundamentals of start-up procedures.

8.10.2 – Describe the fundamentals of special emergency service.

LEARNING CONTENT

8.10.1 Describe the fundamentals of start-up procedures. [2/2]

- describe the brake hold adjustment procedure
- interpret electrical schematic wiring diagrams
- checking fusing protection
- checking of safety circuits
- safe use of temporary jumpers and wiring
- car counterweight balancing check

8.10.2 Describe the fundamentals of special emergency service. [2/0]

- describe the emergency recall system
- describe firemen's services
- define S.E.S. phase I and II
- describe the sequence of operation when on emergency power
- describe special hospital service requirements
- code reference: B44 Clause 2.27

8.11 Preparing for Inspection and Testing

Duration: 6 Total Hours Theory: 4 hours Application: 2 hours

Cross-Reference to Performance Objectives: 1.7, 2.1, 3.2, 4.2, 5.2, 6.2, 7.2, 8.2, 9.2, 10.2, 11.2, 12.2, 13.2, 14.2

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the preparation for inspection and testing of traction elevators in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

8.11.1 – Describe the fundamentals of preparing the elevating device for inspection.

8.11.2 – Describe the fundamentals of performing tests for inspection.

LEARNING CONTENT

8.11.1 Describe the fundamentals of preparing the elevating device for inspection. [2/1]

- describe procedure to remove from temporary operation
- remove all temporary jumpers
- describe procedure to set-up communication links
- describe procedure to test all safety and door lock circuits
- setting door operation (CSA B44 Clause 2.13)
  - opening speed
  - closing speed
  - closing force
- setting contract, leveling and inspection speeds (CSA B44 Clause 2.13)
- describe completion procedure for field tests and data reports

8.11.2 Describe the fundamentals of performing tests for inspection. [2/1]

- describe elevating devices branch inspection procedure
- define the inspection check list: (review TSSA inspection forms)
  - check building to assure it is ready for inspection
    - lighting
    - tripping hazards
    - provide contractor with deficiency list
  - full load safety test
  - full load buffer test (oil buffers)
  - full load running test
  - check run-by distances and clearances
  - check door operating times and closing force
  - perform ground test on primary safety circuit
  - identification of machine room equipment
  - perform final clean-up activities
  - turnover inspection
    - perform all redundancy tests as per manufacturer's submission
  - code reference: B44 Clause 8.10.1; 8.10.2

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
50%	20%	30%

NUMBER **9**

TITLE: **BASIC HYDRAULICS**

Duration: 9 Total Hours Theory: 9 Hours Application: 0 Hours

Prerequisites: None

Evaluation & Testing:
- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 7.1, 7.2, 7.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the fundamentals, construction and operating principles of basic hydraulic systems in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

9.1 – Define the fundamentals and types of hydraulic systems.

9.2 – Describe the construction features and applications of hydraulic systems and components.

9.3 – Explain the operating principles of hydraulic systems and components.

LEARNING CONTENT

9.1 Define the fundamentals and types of hydraulic systems. [3/0]

- describe the advantages of using hydraulics for elevating devices
- identify hydraulic system types
  - open system
  - closed system
- define the properties of hydraulic fluids:
  - viscosity
  - fire resistance
  - lubricity
  - contamination from foreign particles, air and water
- define basic principles for force, work and power.
  - weight and specific gravity
  - pressure and force
  - static pressure
  - gauge pressures in English and Metric units
  - Pascal's Law
  - conversion of energy and hydraulic power
  - pressure losses

9.2 Describe the construction features and applications of hydraulic systems and components. [3/0]

- tanks and reservoirs
  - materials used
  - location
  - capacities
- distribution systems
  - pipes
  - tubing
  - flexible hoses and fittings
  - couplings
    - grooved
    - threaded
    - crimped
  - pressure ratings of pipes, hoses, couplings and fittings
- pumps
  - gear
  - vane
  - screw
- pump drives

  - electric motors
  - couplings
- plungers and cylinders
  - plunger stop ring
  - plunger coupling
  - cylinders
    - above ground
    - below ground
    - gland, seal (packing), wiper ring
- control valves
  - relief valve
  - manual lowering valve
  - shut off valve
  - pipe rupture valve
  - flow control devices
- pressure switches
- pressure gauges
- jacks
  - types
  - capacities

9.3 Explain the operating principles of hydraulic systems and components. [3/0]

- tanks and reservoirs
- distribution systems
  - pipes
  - tubing
  - flexible hoses and fittings
  - couplings
- pumps
- pump drives
  - electric motors
- plungers and cylinders
  - plunger stop ring
  - plunger coupling
  - cylinders
    - above ground
    - below ground
    - gland, seal (packing), wiper ring
- valve control of flow direction, rate, and pressure
  - relief valve
  - manual lowering valve
  - shut off valve
  - pipe rupture valve
  - flow control devices

- pressure switches
- pressure gauges
- jacks
  - conversion of pressure and flow to linear force

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
70%	0%	30%

NUMBER **10**

TITLE: **ELEVATOR HYDRAULIC SYSTEMS**

Duration: 36 Total Hours Theory: 28 Hours Application: 8 Hours

Prerequisites: 1, 2, 7, 9

Evaluation & Testing:
- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 5.1, 5.2, 5.3, 7.1, 7.2, 7.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to perform the inspection, testing, troubleshooting and adjustment procedures of elevator hydraulic systems in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

10.1 – Describe the construction features and applications of elevator hydraulic pumping systems and components.

10.2– Describe the construction features and applications of typical elevator hydraulic jacking systems and components.

10.3 – Explain the operating principles of elevator hydraulic systems and components.

10.4 – Inspect, test and troubleshoot elevator hydraulic systems.

10.5– Perform adjustment procedures for elevator hydraulic systems.

LEARNING CONTENT

10.1 Describe the construction features and applications of typical elevator hydraulic pumping systems and components. [6/0]

- tanks and reservoirs
  - level gauge
  - filler cap/breather
  - oil heater/cooler
  - oil filter/strainer
- distribution systems
  - pipes
    - short run
    - under-ground
  - tubing
  - flexible hoses and fittings and limitations according to code
  - couplings
    - grooved e.g.(Victaulic, Grinnel)
    - threaded, NPT and NPTF
    - isolation
  - pressure ratings of pipes, hoses, couplings and fittings
  - sound isolation
- pumps
  - gear
  - vane
  - screw
- pump drives
  - couplings
  - electric motors
    - submersed
    - non-submersed
- plungers and cylinders
  - plunger stop ring
  - plunger coupling
  - cylinders
    - above ground & below ground
    - gland, seal (packing), wiper ring
- control valves
  - makes: (e.g. Maxton, Blain, Beringer, GMV)
  - relief valve
  - manual lowering valve
  - shut off valve
  - pipe rupture valve
  - flow control devices

- muffler
- pressure switches
- pressure gauges

10.2 Describe the construction features and applications of typical elevator hydraulic jacking systems and components.
[4/0]

- telescoping jack unit
  - plunger
  - piston steadiers (followers)
  - cylinder
    - end treatment for in-ground or above ground
  - head (gland) arrangements
  - corrosion protection
    - corrosion
    - electrolysis
    - passive and active cathodic protection
    - PVC protection
- CSA B44 3.18, 3.8

10.3 Explain the operating principles of elevator hydraulic systems and components. [6/0]

- fluid level indicators
- fluid filters
- distribution systems
  - hydraulic fluid circuits
  - hydraulic fluid flow rates
- pumps
  - gear
  - vane
  - screw
- pump drives
  - electric motors
- plungers and cylinders
  - plunger stop ring
  - plunger coupling
  - cylinders
    - above ground
    - below ground
    - gland, seal (packing), wiper ring
- valve control of flow direction, rate, and pressure
  - flow requirements
  - relief valve

  - manual lowering valve
  - shut off valve
  - pipe rupture valve
  - flow control devices
  - pressure compensation
- pressure switches
- pressure gauges
- telescoping jacks
  - conversion of pressure and flow to linear force
  - check valve operation
  - piston and rod seal operation
- safeties
- roped hydraulics

10.4 Inspect, test and troubleshoot elevator hydraulic systems. [6/4]

- visual inspection
  - fluid leaks
  - loose fasteners or brackets
  - corrosion
- testing
  - determine cause of fault:
    - discuss case studies
    - hydraulic defects
    - electrical defects
    - mechanical defects
- troubleshooting
  - isolating the fault
    - primary cause
    - secondary cause
  - unexplained loss of oil in the hydraulic system
  - trapped air problems
  - excessive high or low oil temperatures

10.5 Perform adjustment procedures for elevator hydraulic systems. [6/4]

- control valve set-up procedure
  - use manufacturer's data
- operating sequence for valve solenoids
  - use manufacturer's data
- relief valve set-up
  - use manufacturer's data
- packing (seal) friction

  - use manufacturer's data
- effects of oil temperature on control valve performance

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
55%	15%	30%

NUMBER **11**

TITLE: **HYDRAULIC ELEVATOR INSTALLATION**

Duration: 21 Total Hours Theory: 17 Hours Application: 4 Hours

Prerequisites: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 1.1, 1.2, 1.3, 1.4, 1.5, 1.7, 2.1, 2.2, 2.3, 2.4, 5.1, 5.2, 5.3, 7.1, 7.2, 7.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the installation procedures for hydraulic elevators in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

11.1 – Identify the differences between the installation of traction and hydraulic elevators.

11.2 – Define the fundamentals of installing jack units.

11.3 – Define the fundamentals of installing oil lines.

11.4 – Define the fundamentals of installing the pumping unit.

11.5 – Define the fundamentals of adjusting the control valve.

11.6 – Define the fundamentals of establishing the working pressure and performing relief valve tests.

11.7 – Define the fundamentals of completing field test and data reports.

11.8 – Define the fundamentals of performing tests for inspection.

LEARNING CONTENT

11.1 Identify the differences between the installation methods of traction and hydraulic elevators.
[1/0]

- drive components
- Jack units
- oil lines
- pumping units
- installation sequences & differences
- site planning
- plumbing in ground and above ground cylinders
- plumbing hoistway

11.2 Define the fundamentals of installing jack units.
[2.5/0]

- identify the features of in-ground jack units
  - one piece
  - two piece
  - telescopic
  - plumbing
    - cylinder
    - hoistway
- identify the features of above ground jack units
  - one piece
  - two piece
  - telescopic
  - plumbing
    - cylinder
    - hoistway
  - roped hydraulics
- describe the alignment procedure for jack units

11.3 Define the fundamentals of installing oil lines.
[1.5/1]

- describe the installation procedures for:
  - oil lines with grooved couplings
  - oil lines with grooved fittings
  - oil lines with threaded fittings
  - oil lines using flexible hoses and fittings
  - victaulic couplings
  - mufflers

  - oil supports
- describe the procedures to bleed air from the hydraulic system
- Refer to Code: B44 Clause 3.19

11.4 Define the fundamentals of installing the pumping unit.
[3.5/0]

- outline the important issues regarding the work area around the pump unit
- discuss the orientation of the pumping unit vs the oil line direction
- describe the method to secure the pump unit to the floor
- refer to code: B44 clause 4.18

11.5 Define the fundamentals of adjusting the control valve.
[1.5/1.5]

- outline the control valve adjustment procedures following the manufacturer's recommendations
- identify the process of co-ordination with the electrical controls

11.6 Define the fundamentals of establishing the working pressure and performing relief valve tests.
[3.5/0]

- define working pressure
- describe manufacturer's relief valve test procedures
- refer to code: B44 clause 4.19

11.7 Define the fundamentals of completing field test and data reports.
[1/1]

- describe the field testing procedures for:
  - car speeds
  - up/down
  - rated load/empty
  - safety testing (roped hydraulics)
  - working pressure
  - relief pressure
  - supply voltage at motor with full current load
  - disconnect fuse rating and overload setting

11.8 Define the fundamentals of performing tests for inspection.
[2.5/.5]

- outline the details of a TSSA elevating device inspection
  - define the inspection checklist

- full load safety test (roped hydraulics)
- full load running test
- redundancy check
- run-by distance and clearance checks
- door opening times and closing force
- ground tests of primary safety circuit
- identification of machine room equipment
- final clean up procedures
- turnover inspection
- mechanical stored energy
  - pipe stands
  - rail clamps

- refer to code: B44 clause 8.10.1; 8.10.3

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
55%	15%	30%

NUMBER	**12**		
TITLE:	**BASIC ELECTRICITY**		
Duration:	60 Total Hours	Theory: 42 Hours	Application: 18 Hours
Prerequisites:	None		

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 1.1, 1.7, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe basic fundamentals of electricity and related electrical circuits in accordance with manufacturer's recommendations and specifications and approved industry standards.

12.1 – Review basic mathematics.

12.2 – Describe the fundamentals of electricity and relation to the structure of matter.

12.3 – Define the fundamentals and work with direct current electrical circuits.

12.4 – Define the fundamentals and work with alternating current electrical circuits.

12.5 – Describe voltage, current and resistance measurements.

12.6 – Define the principles of permanent magnetism.

12.7 – Define the principles of electromagnetism.

LEARNING CONTENT

12.1 Review of basic mathematics
[5/0]

- review number systems
  - whole numbers
  - decimals
  - fractions
  - reciprocals
  - percent
  - powers
  - roots
  - ratio
  - proportion

12.2 Describe the fundamentals of electricity and relation to the structure of matter.
[2/0]

- atomic structure of matter
  - free electrons
  - source of electricity
  - define nature of electricity
  - static electricity

12.3 Define the fundamentals and work with direct current electrical circuits.
[15/9]

- define direct current
- electrical terms
  - voltage
  - amperage
  - resistance
  - Electro Motive Force (EMF)
  - Potential Difference (PD)
  - ohm's law
- electrical circuits
  - build and observe characteristics of electrical circuits
    - series circuits
    - parallel circuits
    - series/parallel circuits
    - Kirchoff's law
    - power and heat loss
- electrical components

- observe the operating characteristics of electrical components
- resistors
  - series
  - parallel
  - colour coding
  - wattage
  - potentiometers/rheostats
- capacitors
  - types
  - series/parallel
  - colour coding
  - ratings
  - timing circuits
  - uses
- diodes
  - types
  - identification
  - uses
  - capacities
  - series/parallel

12.4 Define the fundamentals and work with alternating current electrical circuits. [14/4]

- define alternating current
- electrical terms
- electrical symbols
  - sine wave
- RMS value of voltage and current
  - inductance
  - capacitance
  - impedance
- AC power

12.5 Describe voltage, current and resistance measurements. [2/3]

- Identify precautions
  - switching from ohmmeter to voltage and amperage scales
  - moisture
  - electrical shock prevention
- measure AC and DC voltage and amperage
  - analog meters
  - digital meters
- measure resistance
  - ohmmeter
  - multi-meter

12.6 Define the principles of permanent magnetism.
[2/1]

- define and observe characteristics of permanent magnetism
  - properties of permanent magnets
  - action of magnetic poles
  - magnetic fields
  - magnetic properties

12.7 Define the principles of electromagnetism.
[2/1]

- define and observe characteristics of electromagnetism
  - properties of electromagnets
  - action of magnetic fields around a conductor
  - principles of induced voltage
  - effects of motion on induced voltage
  - factors that affect induced voltage
  - define Lenz's Law

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
50%	20%	30%

NUMBER **13**

TITLE: **INDUSTRIAL ELECTRICITY FOR ELEVATING DEVICES**

Duration: 54 Total Hours Theory: 43 Hours Application: 11 Hours

Prerequisites: Reportable Subjects: 1, 2, 12

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the fundamentals of industrial electricity as applied to elevating devices in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

13.1 – Electrical System Control Devices

13.2 – Transformers

13.3 – Electrical Distribution and Control Systems

13.4 – Electrical Schematic Diagrams

13.5 – Electrical Circuit Conductors, Wiring Devices & Methods

13.1 Electrical System Control Devices

Duration: 11 Total Hours Theory: 8 hours Application: 3 hours

Cross Reference to Performance Objectives: 1.1, 1.7, 4.1, 4.2, 6.1, 6.2, 8.1, 8.2, 14.1, 14.2, 14.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the construction, operation and identify schematic symbols of electrical system control devices as applied to elevating devices in accordance with government safety regulations, manufacturers' recommendations and specifications and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

13.1.1 – Describe the construction features of electrical system control devices, and identify their corresponding schematic symbols.

13.2.2 – Explain the operating principles of electrical system control devices.

LEARNING CONTENT

13.1.1 Describe the construction features of electrical system control devices, and identify their corresponding schematic symbols. [6/2]

- switches
  - switch notation
  - contacts and ratings
  - pushbutton type
  - toggle switch
  - rotary switch
  - snap action switch
  - limit switches (positive acting)
  - dual in line switches (DIP)
- relays
  - basic relay
    - coils
    - types of contacts
  - types of relays
    - AC v/s DC relays
    - plug in relays
    - reed relays
    - memory relays (set/reset, mechanical latching)
    - reverse phase relays
    - solid state
    - Normally Open (N/O) contacts
    - Normally Closed (N/C) contacts
    - power contacts
- relay ratings
- identify common relay circuits
  - relay interlocks (electrical and mechanical interlock)
  - self holding contacts
  - diode controlled relay
- solenoids
- timers
  - air and oil dashpot
  - motor driven
  - thermal or bimetallic
  - solid state timers
- contactors
- main line disconnect switches
  - purpose
  - ratings
  - auxiliary contacts

- circuit protection devices
  - fuses (ratings, types)
  - circuit breakers
  - overload relays
  - over temperature sensing devices
- rectifiers

13.1.2 Explain the operating principles of electrical system control devices. [2/1]

- switches
  - effects of operation under load
  - DIP/switch settings/operation
- relays
  - contact wipe
  - contact gap
  - contact material
  - contact conditions
  - mechanical operating principles
  - electrical operating principles
  - magnetic operating principles
- solenoids
  - mechanical vs. electrical operation
- timers
  - on delay/off delay
  - adjustment
- contactors
  - contact wipe
  - contact gap
  - contact material
  - contact conditions
  - mechanical operating principles
  - electrical operating principles
  - magnetic operating principles
- main line disconnect switches
  - types
  - hazards
- circuit protection devices
  - adjustment
- rectifiers
  - heat dissipation

13.2 Electrical Transformers

Duration: 7 Total Hours Theory: 6 hours Application: 1 hours

Cross Reference to Performance Objectives: 1.1, 6.1, 6.2, 11.1, 11.2,

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GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the fundamentals of electrical transformers in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

13.2.1 – Define the fundamentals of electrical transformers.

13.2.2 – Describe the construction features of electrical transformers.

13.2.3 – Explain the principles of operation of electrical transformers.

LEARNING CONTENT

13.2.1 Define the fundamentals of electrical transformers.
[2/0]

- transformer fundamentals:
  - transformer action
  - moving magnetic fields
  - transformer losses
  - transformer ratings
- transformer types
  - air core
  - iron core
  - auto transformers

13.2.2 Describe the construction features of electrical transformers.
[2/.5]

- transformer construction features
  - primary windings
  - secondary windings
  - winding turns/voltage ratio
  - nameplate data
- transformer voltage, current and power ratings
- practical transformers

13.2.3 Explain the principles of operation of electrical transformers.
[2/.5]

- transformer operation
  - primary windings
  - secondary windings
  - moving magnetic fields
  - transformer losses
  - DC injection
- application for electrical isolation and spike removal

13.3 Electrical Distribution and Control Systems

Duration: 12 Total Hours Theory: 12 hours Application: 0 hours

Cross Reference to Performance Objectives: 1.1, 1.7, 6.1, 6.2, 8.1, 8.2, 14.1, 14.2, 14.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the fundamentals of electrical distribution and control systems in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

13.3.1 – Describe the construction features of electrical distribution and control systems.

13.3.2 – Explain the operating principles of electrical distribution and control systems.

13.3.3 – Define the installation code requirements pertaining to CEC Section 38.

LEARNING CONTENT

13.3.1 Describe the construction features of electrical distribution and control systems. [8/0]

- distribution systems
  - single phase two and three wire
  - three phase
  - three phase star and delta connections
- neutral and ground connections
- bonding
- control systems
  - grounded and ungrounded control systems
    - grounded controlled
    - ungrounded controlled
- electrical power circuits
  - motor start circuits
  - power circuits
- motion control systems
  - single speed AC motors
  - two speed AC motors
  - AC induction motors
  - hydraulic elevator motion controls
  - ward-Leonard drives
  - static drives
  - variable voltage- Variable frequency drives
- brake controls
  - DC
  - AC
  - brake cooling through resistance

13.3.2 Explain the operating principles of electrical distribution and control systems. [3/0]

- distribution systems
  - voltage relationship
    - phase to phase
    - phase to ground
  - integrity of mechanical connections
- control systems
  - grounded
  - ungrounded
- electrical power circuits
  - motor start circuits
  - power circuits

- motion control systems
  - single and two speed AC motors
  - ward-Leonard drives
  - solid state drive
  - variable voltage- Variable frequency drives
- brake controls
  - DC
  - AC
  - brake cooling through resistance

13.3.3 Define the installation code requirements pertaining to CEC Section 38. [1/0]

- refer to code reference:
  - C22.1 Part (CEC) Section 38

13.4 Electrical Schematic Diagrams

Duration: 5 Total Hours Theory: 3 hours Application: 2 hours

Cross Reference to Performance Objectives: 1.7, 4.2, 5.2, 6.2, 6.4, 7.2, 8.2, 11.2, 13.2, 14.2

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the fundamentals and draw electrical schematic diagrams in accordance with code requirements and manufacturer's symbols.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

13.4.1 – Define, interpret and draw the fundamentals of electrical schematic diagrams.

13.4.2 – Identify power control functions in electrical schematic diagrams.

LEARNING CONTENT

13.4.1 Define, interpret and draw the fundamentals of electrical schematic diagrams. [1/1]

- define electrical schematic diagram nomenclature
- read and interpret electrical schematic diagrams
- draw electrical schematic diagrams

13.4.2 Identify power control functions in electrical schematic diagrams. [2/1]

- locate and identify power and control functions in an electrical schematic diagram.
  - power circuit
  - rotating equipment
  - power supplies
  - fuses and breakers
  - overload/overheat devices
  - safety circuit
  - direction circuit
  - brake circuit
  - door operating circuit
  - door position monitoring system
  - signals
  - valve solenoids (hydraulic)
  - car and hoistway door interlocks

13.5 Electrical Circuit Conductors, Wiring Devices and Methods

Duration: 19 Total Hours Theory: 14 hours Application: 5 hours

Cross Reference to Performance Objectives: 1.1, 1.7, 3.2, 4.1, 4.2, 5.2, 6.4, 6.1, 6.2, 7.2, 8.1, 8.2, 11.2, 13.2, 14.2, 14.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the fundamentals of electrical circuit conductors and safety systems in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

13.5.1 – Define the basic fundamentals of electrical circuit conductors, wiring devices and methods.

13.5.2 – Define the application and use of electrical circuit conductors, wiring devices and methods.

LEARNING CONTENT

13.5.1 Define the basic fundamentals of electrical circuit conductors, wiring devices and methods. [5/3]

- electrical conductors
  - solid
  - stranded
  - insulating materials and ratings
- American wire gauge numbers (AWG)
- current carrying capacity of conductors (Ampacity)
- thermal rating and designations for conductors
- stripping and connecting wires
- determining wire sizes
- construction Wiring
  - raceways
  - duct (electrical wireway)
  - risers
  - conduit

    rigid
    - EMT
    - Flex
    - Liquid tight Flex
  - fittings
  - enclosures and connectors
  - routing and bracketing
  - handling materials and tools
- survey and planning
- making pull sheets
  - for traveling cables
  - from field wiring diagrams
  - from straight line wiring diagrams

[3/0]

- Wiring the hoistway and machine room
  - wiring tools
  - wiring materials
  - wiring hardware
  - hoistway devices
    - interlocks
    - safety circuit
    - direction limits
    - access switches

  - buffer switch
  - compensating sheave switch
  - emergency terminal slowdown switches
- marking wires and cables
- pulling hoistway wires
  - high rise installation
  - branch runs
  - using a running car
- pulling machine room wires
- connecting machine room wires
- connecting hoistway wires

[3/0]

- Traveling Cables
  - general description
  - construction of traveling cables
  - proper handling
  - preparation
  - installation
  - replacement
  - protection

[2/0]

- Piping and wiring the car
  - Car fixtures and equipment
  - Car junction box
  - Piping the car
  - Junction box on top of the car
  - Junction box under the car
  - Junction box inside the car operating panel
  - Devices and switches

13.5.2 Define the application and use of electrical circuit conductors, wiring devices and methods.
[1/2]

- electrical conductors
- American wire gauge numbers (AWG)
- current carrying capacity of conductors (Ampacity)
- thermal rating and designations for conductors
- stripping and connecting wires
- determining wire sizes

- construction Wiring
- survey and planning
- making pull sheets

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
55%	15%	30%

NUMBER **14**

TITLE: **MOTORS, GENERATORS, CONTROLS AND AC DRIVES**

Duration: 57 Total Hours Theory: 57 Hours Application: 0 Hours

Prerequisites: Reportable Subjects: 1, 2, 7, 12, 13

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the fundamentals of electrical generator and motor systems as applied to elevating devices in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

14.1 – Generator Principles

14.2 – Motor Principles

14.3 – DC Generators and Motors

14.4– AC Motors, Drives and Controls

14.1 Generator Principles

Duration: 7 Total Hours Theory: 7 hours Application: 0 hours

Cross Reference to Performance Objectives: 1.1, 6.1, 6.2, 6.3, 6.4,

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GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the fundamentals of generators for elevating devices in accordance with government safety regulations, and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

14.1.1 – Define the fundamentals of generators for elevating devices.

14.1.2 – Explain the operating principles of generators for elevating devices.

LEARNING CONTENT

14.1.1 Define the fundamentals of generators for elevating devices. [3/0]

- electromagnetism pertaining to motor generator action.
  - induction
  - factors that determine induced EMF strength
  - effects of motion on direction of current

14.1.2 Explain the operating principles of generators for elevating devices. [4/0]

- elementary generator operation
  - components of an elementary generator
    - loop of wire
    - field poles
    - slip rings
  - principles of operation
    - direction of induced voltage
    - Fleming's right hand rule
    - induced voltage and current
  - voltage output waveform
  - commutator segments, brushes and brush rigging
  - commutation
  - armature of a DC Generator
  - field structure of a DC Generator

14.2 - Motor Principles

Duration: 7 Total Hours Theory: 7 hours Application: 0 hours

Cross Reference to Performance Objectives: 1.1, 1.7, 6.1, 6.2, 6.3, 6.4, 11.1, 11.2, 11.3, 14.1, 14.2, 14.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the fundamentals of motors for elevating devices in accordance with government safety regulations, and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

14.2.1 – Describe the fundamentals of electric motors.

14.2.2 – Explain the basic fundamentals and operating principles of electric motors.

LEARNING CONTENT

14.2.1 Describe the fundamentals of electric motors.
[4/0]

- motor Action
- counter Electromotive force (CEMF)
- speed of a motor
- efficiency
- hysteresis Loss
- armature Eddy current loss
- pole face Eddy currents
- types of Motors
- speed and torque in a compound motor
- cumulative Compound Motors
- differential Compound motors

14.2.2 Explain the basic fundamentals and operating principles of electric motors. [3/0]

- motor Action
- counter Electromotive force (CEMF)
- speed of a motor
- efficiency
- hysteresis Loss
- armature Eddy current loss
- pole face Eddy currents
- types of Motors
- speed and torque in a compound motor
- cumulative Compound Motors
- differential Compound motors

14.3 DC Generators and Motors

Duration: 19 Total Hours Theory: 19 hours Application: 0 hours

Cross Reference to Performance Objectives: 1.1, 1.7, 6.1, 6.2, 6.4, 6.5, 8.1, 8.2, 11.1, 11.2, 14.1, 14.2,

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GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the fundamentals of DC Motors and Generators for elevating devices in accordance with government safety regulations, and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

14.3.1 – Define the fundamentals and applications of DC generators and motors for elevating devices.

14.3.2 – Describe the construction features of DC generators and motors for elevating devices.

14.3.3 – Explain the operating principles of DC generators and motors for elevating devices.

14.3.4 – Describe the DC motor control systems for elevating devices.

LEARNING CONTENT

14.3.1 Define the fundamentals and applications of DC generators and motors for elevating devices.
[3/0]

- review of DC generator circuits
  - field windings
  - current flow
- review of DC motor circuits
  - series
  - shunt
  - compound
  - field windings

14.3.2 Describe the construction features of DC generators and motors for elevating devices.
[4/0]

- describe the construction features of DC generators and motors:
  - main frame
  - pole pieces
  - field windings
  - types of field windings
    - series
    - shunt
  - end bells
  - armature assemblies
    - armature core
    - laminations
    - windings
      lap
      wave
    - commutator
    - Brush rigging
    - Bearings (roller, ball, sleeve)
    - Cooling
    - Balancing
  - exciters
  - name plate data

14.3.3 Explain the operating principles of DC generators and motors for elevating devices.
[5/0]

- DC generator operating characteristics
  - output voltage and amperage
  - wave forms
  - voltage and amperage limits
- DC motor operating characteristics
  - input voltage and amperage
  - loop circuit
    - lifting loads
    - lowering loads
    - resistance
  - performance of motor applications
    - expected (smooth ride, leveling accuracy)
    - specified (flight time)
    - predictable (repeatability)
  - torque
  - current draw
  - load and speed compensation
  - motors for other elevating devices
    - door motors
    - other DC motors

14.3.4 Describe the DC motor control systems for elevating devices.
[7/0]

- describe the Ward-Leonard System
  - loop circuits
  - reason and method of compounding
- describe the control system types
  - DC with SCR inverter (tachometer)
  - DC with ward-Leonard system (series field)
  - DC with ward- Leonard system (tachometer)
- describe the speed control for:
  - open loop
  - closed loop
- describe SCR/Transistor drives
  - two quadrant
  - four quadrant
- describe the speed sensing devices
  - tachometers
  - encoders
- describe the electronic drive safety features

14.4 AC Motors, Drives and Controls

Duration: 24 Total Hours Theory: 24 hours Application: 0 hours

Cross-Reference to Performance Objectives: 1.1, 1.7, 6.1, 6.2, 6.4, 6.5, 7.1, 8.1, 8.2, 11.1, 11.2, 14.1, 14.2,

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GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the fundamentals of AC motors, drives and controls for elevating devices in accordance with government safety regulations, and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

14.4.1 – Define the fundamentals and applications of AC motors for elevating devices.

14.4.2 – Describe the construction features of AC motors for elevating devices.

14.4.3 – Explain the operating principles of AC motors for elevating devices.

14.4.4 – Describe AC motor drive and control systems for elevating devices.

LEARNING CONTENT

14.4.1 Define the fundamentals and applications of AC motors for elevating devices. [6/0]

- review of DC motors
- motor action (AC)
- rotating field
- armature rotation
- simple AC motors
  - induction motors
  - capacitance in an AC circuit
  - split phase and capacitor start motors
  - synchronous motors
  - AC series motors
  - three phase motors
  - two speed three phase motors
  - slip ring motors
  - variable frequency motors

14.4.2 Describe the construction features of AC motors for elevating devices. [2/0]

- AC motor construction features:
  - main frame
  - pole pieces
  - stator
  - rotating field winding
    - "WYE" connections
    - "Delta" connections
    - Proper wiring of connections
    - Reversing direction of rotation
  - brush assemblies
  - slip rings
  - rotor
  - name plate data

14.4.3 Explain the operating principles of AC motors for elevating devices. [2/0]

- AC motor performance characteristics
  - torque
  - current draw

14.4.4 Describe AC motor drive and control systems for elevating devices. [11/0]

- drives and control systems
  - AC with DC injection
  - AC with wound-rotor induction
  - AC hydraulic pump motor (full or reduced starting voltage)
    - soft start
  - AC VVVF (or Vector) inverter
  - Types of motor control
    - open loop VF
    - closed loop VF
    - flux Vector
    - open loop Vector
  - encoders
  - braking circuit and DC Buss
  - controlled frequency
  - Insulated Gate Bipolar Transistor (IGBT) [3/0]
- motors for other elevating devices
  - Escalators
  - Hydraulic elevators
  - Door motors
  - Other AC motors

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
70%	0%	30%

NUMBER **15**

TITLE: **SOLID STATE ELECTRONICS**

Duration: 69 Total Hours Theory: 47 Hours Application: 22 Hours

Prerequisites: 1, 2, 12, 13

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the fundamentals of solid state electronic devices as applied to elevating devices in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

15.1 – Electronic fundamentals

15.2 – Diodes

15.3 – Transistors

15.4 – Thyristors

15.5 – Analogue Integrated Circuits

15.6 – Power Supplies and Operational Amplifiers

15.7 – Digital Systems

15.1 Electronic Fundamentals

Duration: 3 Total Hours Theory: 3 hours Application: 0 hours

Cross-Reference to Performance Objectives: 1.7, 6.1, 6.2, 6.3, 6.5,

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GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the electronic fundamentals in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

15.1.1 – Identify solid state electronic components used in elevating devices.

15.1.2 – Define the fundamentals of solid state electronic devices.

LEARNING CONTENT

15.1.1 Identify solid state electronic components used in elevating devices. [1/0]

- diodes
- transistors
- thyristors
- integrated circuits
  - analogue
  - digital

15.1.2 Define the fundamentals of solid state electronic devices.
[2/0]

- define the introductory information of solid state electronic devices
  - review atomic theory of matter
  - define semiconductor material
  - identify the advantages and disadvantages of semi-conductor materials
  - define semiconductor crystals
- define conduction in intrinsic germanium and silicon
  - low temperature characteristics
  - high temperature characteristics
  - hole theory
  - current flow
- define conduction in doped germanium and silicon
  - “N” type semiconductors
  - “P” type semiconductors
- define precautions in the care and handling of solid state devices
  - static discharge
  - excessive heat
  - ultra violet light
  - radio frequency induction

15.2 Diodes

Duration: 9 Total Hours Theory: 4 hours Application: 5 hours

Cross-Reference to Performance Objectives: 1.7, 6.1, 6.2, 6.3, 6.5

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the construction, operation and testing procedures for diodes in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

15.2.1 – Define the construction features and operating characteristics of diodes

15.2.2 – Perform the testing procedures for diodes.

LEARNING CONTENT

15.2.1 Describe the construction features and operating characteristics of diodes. [4/2]

- define the purpose and function of diodes
- define the characteristics of semiconductor diodes
  - PN junction
  - ions
  - junction diodes
  - depletion region
  - barrier voltage
- define diode forward and reverse biasing
- define the characteristics of germanium diodes
  - forward characteristics
  - reverse characteristics
- define the characteristics of silicon diodes
  - forward characteristics
  - reverse characteristics
- define diode ratings
  - temperature considerations
- identify diode symbols
- identify diode applications in AC and DC elevator circuits
- define rectifiers
  - half wave
  - full wave
  - three phase
- define the characteristics of zener diodes
  - voltage-current characteristics
  - zener voltage
  - power distribution
  - power-temperature curves
- identify zener diode packages
- define voltage regulation with zener diodes
- identify zener diode applications in elevator circuits
- define varistors
- define light emitting diodes (LED)
  - LED construction features
  - circuit operation
  - application in elevator circuits
- define photodiodes
  - application in elevator circuits

15.2.2 Perform the testing procedures for diodes.
[0/3]

- test diodes and rectifiers
  - electrical resistance test
  - voltage tests
- test zener diodes
  - electrical resistance test
  - voltage tests
- test light emitting diodes (LED)
  - electrical resistance test
  - voltage tests

15.3 Transistors

Duration: 10 Total Hours Theory: 6 hours Application: 4 hours

Cross-Reference to Performance Objectives: 1.7, 6.1, 6.2, 6.3, 6.5

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the construction, operation and perform testing procedures of transistors in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

15.3.1 – Define the construction features and operating characteristics of transistors.

15.3.2 – Perform the testing procedures for transistors.

LEARNING CONTENT

15.3.1 Describe the construction features and operating characteristics of transistors. [5/3]

- define the purpose and function of transistors
- define the configuration of transistors
  - PNP junction
  - NPN junction
- define construction process
  - construction techniques
  - packaging
- define the operating characteristics of transistors
  - biasing action for NPN transistors
  - biasing action for PNP transistors
  - transistor amplification
- identify transistor circuit arrangements
  - common emitter
  - common base
  - common collector
- define junction FET
- define insulated gate FET
- define FET circuit arrangements
- describe transistor applications in elevator circuits

15.3.2 Perform the testing procedures for transistors [1/1]

- testing procedures:
  - resistance
  - voltage
  - amperage

15.4 Thyristors

Duration: 5 Total Hours Theory: 3 hours Application: 2 hours

Cross-Reference to Performance Objectives: 1.7, 6.1, 6.2, 6.3, 6.5

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the construction features and operating characteristics of thyristors in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

15.4.1 – Describe the construction features of thyristors.

15.4.2 – Explain the operating characteristics and application of thyristors.

LEARNING CONTENT

15.4.1 Describe the construction features of thyristors.
[2/0]

- define the purpose and function of thyristors
- define the purpose and function of bi-directional triode thyristors
- define the configuration of thyristors
  - silicon controlled rectifiers (SCR'S)
- describe the basic construction features of thyristors
  - silicon controlled rectifiers (SCR'S)
- describe the basic construction features of bi-directional triode thyristors

15.4.2 Explain the operating characteristics and application of thyristors.
[1/2]

- describe the basic operation of thyristors
  - silicon controlled rectifiers (SCR'S)
  - voltage-current characteristics
- describe the practical application of SCR'S
- define the configuration of bi-directional triode thyristors
- describe the basic operation of bi-directional triode thyristors
- describe the practical application of bi-directional triode thyristors

15.5 Analogue Integrated Circuits

Duration: 5 Total Hours Theory: 3 hours Application: 2 hours

Cross-Reference to Performance Objectives: 1.7, 6.1, 6.2, 6.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the fundamentals and characteristics of analogue integrated circuits in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

15.5.1 – Define the fundamentals and characteristics of analogue integrated circuits.

15.5.2 – Explain the operating characteristics of analogue integrated circuits.

LEARNING CONTENT

15.5.1 Describe the fundamentals and characteristics of analogue integrated circuits. [2/0]

- define the purpose and function of analogue integrated circuits
- define the development of analogue integrated circuits
- describe analogue integrated circuit packaging
  - dual in-line packaging (DIP)
  - surface mount technology (SMT)
  - heat sink
- describe the application of integrated circuits in elevators
  - basic power supplies
  - regulated power supplies
  - operational amplifier (OP AMP)

15.5.2 Explain the operating characteristics of analogue integrated circuits. [1/2]

- describe analogue integrated circuit packaging
  - dual in-line packaging (DIP)
  - surface mount technology (SMT)
  - heat sink
- describe the application of integrated circuits in elevators
  - basic power supplies
  - regulated power supplies
  - operational amplifier (OP AMP)

15.6 Power Supplies and Operational Amplifiers

Duration: 9 Total Hours Theory: 7 hours Application: 2 hours

Cross-Reference to Performance Objectives: 1.7, 6.1, 6.2, 6.3, 6.5

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the fundamentals of power supply and operational amplifier systems for solid state electronic devices in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

15.6.1 – Define the fundamentals and characteristics of power systems for solid state electronic devices.

15.6.2 – Define the fundamentals and characteristics of operational amplifiers for solid state electronic devices.

15.6.3 – Describe the testing procedures of power systems for solid state electronic devices.

LEARNING CONTENT

15.6.1 Define the fundamentals and characteristics of power systems for solid state electronic devices.
[3/1]

- define the purpose and function of power supply systems
- define the application of power supply systems in elevator electronic systems
- describe the design features of power supply devices
  - power transformers
  - rectifiers
    - half wave
    - full wave
    - full wave bridge
  - voltage multipliers
  - half wave voltage doubler
  - full wave voltage doubler
  - ripple
  - filter networks
  - regulators
    - voltage regulators
    - zener diode regulators
    - series pass transistor regulators
    - integrated circuit regulators
  - circuit protection
  - types of power supplies used in the elevator industry

15.6.2 Define the fundamentals and characteristics of operational amplifiers for solid state electronic devices.
[3/1]

- define the purpose and function of operational amplifiers
- describe the application of operational amplifiers
- describe the construction features of operational amplifiers
- identify the power supplies for operational amplifiers
- define the term gain as applied to operational amplifiers

15.6.3 Describe the testing procedures of power systems for solid state electronic devices.
[1/0]

- identify the recommended testing equipment
- outline the recommended testing procedures

15.7 Digital Systems

Duration: 28 Total Hours Theory: 21 hours Application: 7 hours

Cross-Reference to Performance Objectives: 1.7, 3.2, 6.1, 6.2, 6.3, 6.5, 6.6, 7.2, 11.1,11.2

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the fundamentals, testing of digital systems for solid state electronic devices in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

15.7.1 – Define the fundamentals and characteristics of numbering systems for solid state electronic devices.

15.7.2 – Define the fundamentals of digital integrated circuits for solid state electronic systems.

15.7.3 – Define the fundamentals of microprocessors for solid state electronic systems.

15.7.4 – Describe the testing procedures of power systems for solid state electronic devices.

15.7.5 – Describe the programmable logic control (P.L.C.) system for microprocessors.

LEARNING CONTENT

15.7.1 Define the fundamentals and characteristics of numbering systems for solid state electronic devices.
[5/0]

- define the fundamentals of the numbering system
  - decimals
  - binary
  - octal
  - hexadecimal

15.7.2 Define the fundamentals of digital integrated circuits for solid state electronic systems.
[6/0]

- define the fundamentals, purpose and function of:
  - gates
  - digital integrated circuits
  - printed circuit boards
    - handling procedures
    - inspection procedures
  - memory elements
    - flip flops
    - counters
    - registers
    - memory
    - SMI, MSI, LSI, VLSI, devices
  - define memory terms
    - ROM, RAM, PROM, EPROM, EEPROM, EAPROM

15.7.3 Define the fundamentals of microprocessors for solid state electronic systems.
[1/0]

- define the fundamentals, purpose and function of microprocessors
- define the terms relating to microprocessors
  - hardware
  - software
  - CPU

15.7.4 Describe the troubleshooting procedures for solid state electronic devices. [2/0]

- testing procedures for integrated circuits
- troubleshooting procedures for microprocessors

- fault logs
- error codes

15.7.5 Describe the programmable logic control system for microprocessors. [7/7]

- define Programmable Logic Control (PLC)
- describe the features of the programmable logic control
- identify the applications for programmable logic control
- outline the function of the programmable logic control feature

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
65%	5%	30%

NUMBER	**16**		
TITLE:	**CIRCUIT TRACING**		
Duration:	66 Total Hours	Theory: 26 Hours	Application: 40 Hours
Prerequisites:	1, 2, 7, 8, 10, 12, 13,	14, 15	

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to trace and diagnose elevating devices electrical/electronic circuits in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

16.1 – Fundamentals of Circuit Tracing

16.2 – Elevating Devices System Control Circuit Tracing

16.3 – Electrical/Electronic Test Equipment

16.4 – Troubleshooting Procedures

16.1 Fundamentals of Circuit Tracing

Duration: 3 Total Hours Theory: 3 hours Application: 0 hours

Cross-Reference to Performance Objectives: 1.7, 3.2, 4.2, 5.2, 6.2, 7.2, 8.2, 10.2, 11.2, 13.2, 14.2

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the fundamentals of circuit tracing electrical schematic diagrams in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

16.1.1 – Review electrical/electronic wiring diagram nomenclature.

16.1.2 – Define the fundamentals of circuit tracing.

LEARNING CONTENT

16.1.1 Review electrical/electronic wiring diagram nomenclature.
[2/0]

- review electrical/electronic schematic wiring diagram nomenclature
- review reading and interpreting procedures for electrical/electronic schematic wiring diagrams

16.1.2 Define the fundamentals of circuit tracing.
[1/0]

- review electrical/electronic schematic wiring diagram nomenclature
- review reading and interpreting procedures for electrical/electronic schematic wiring diagrams
- locate and identify features of electrical/electronic wiring diagrams:
  - field wiring
  - straight line (schematics)
  - identify wiring diagram symbols used by major manufacturers
  - nomenclature
- draw a basic car door closer circuit
- draw a simple automatic traction schematic

16.2 - Elevator Devices System Control Circuit Tracing

Duration: 31 Total Hours Theory: 9 hours Application: 22 hours

Cross-Reference to Performance Objectives: 1.1, 1.7, 3.2, 4.2, 5.2, 6.2, 6.4, 7.2, 8.2, 10.2, 11.2, 13.2

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the procedure to perform circuit tracing of elevating devices system wiring diagrams in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

16.2.1 – Define the procedure to perform circuit tracing of Constant Pressure relay, P.L.C. and microprocessor based Control Systems.

16.2.2 – Define the procedure to perform circuit tracing of Single Automatic Push Button relay, P.L.C. and microprocessor based Control Systems.

16.2.3 – Define the procedure to perform circuit tracing of collective relay, P.L.C. and microprocessor based Control Systems.

16.2.4 – Define the procedure to perform circuit tracing of relay, P.L.C. and microprocessor based Duplex Operating Systems.

LEARNING CONTENT

16.2.1 Define the procedure to perform circuit tracing of Constant Pressure relay, P.L.C. and microprocessor based Control Systems.
[2/3]

- review electrical/electronic schematic wiring diagrams for elevating device constant pressure control systems
- identify the main system components
- trace the circuit from the power source through the wiring, connections, electrical/electronic devices and return ground path

16.2.2 Define the procedure to perform circuit tracing of Single Automatic Push Button relay, P.L.C. and microprocessor based Control Systems.
[2/6]

- review electrical/electronic schematic wiring diagrams for elevating device single automatic button control systems
- identify the main system components
- trace the circuit from the power source through the wiring, connections, electrical/electronic devices and return ground path

16.2.3 Define the procedure to perform circuit tracing of collective relay, P.L.C. and microprocessor based Control Systems.
[4/10]

- review electrical/electronic schematic wiring diagrams for elevating device collective control systems
- identify the main system components
- trace the circuit from the power source through the wiring, connections, electrical/electronic devices and return ground path
  - power control
    - "wye"-delta starting
    - pump motor connections
  - logic functions
    - selector circuits
    - call registration
    - direction selection
    - call cancellation
    - starting and acceleration
    - stepping circuits
    - stopping circuits
    - door operation
  - safety circuits
  - firefighters service

- phase I
- phase II

16.2.4 Define the procedure to perform circuit tracing of relay, P.L.C. and microprocessor based Duplex Operating Systems.
[1/3]

- review electrical/electronic schematic wiring diagrams for elevating device duplex control systems
- identify the main system components
- trace the circuit from the power source through the wiring, connections, electrical/electronic devices and return ground path

16.3 Electrical/Electronic Diagnostic Test Equipment

Duration: 4 Total Hours Theory: 3 hours Application: 1 hours

Cross-Reference to Performance Objectives: 1.1, 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3, 6.4, 6.5, 7.2, 7.3, 8.2, 8.3, 10.2, 10.3, 11.2, 11.3, 13.2, 13.3, 14.2, 14.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the function, construction features, operation and use of electrical/electronic diagnostic test equipment in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

16.3.1 – Define the purpose and fundamentals of diagnostic test equipment.

16.3.2 – Define the construction features, types and applications of diagnostic test equipment.

16.3.3 – Explain the principles of operation of diagnostic test equipment.

16.3.4 – Perform inspection and testing procedures using diagnostic test equipment in accordance with the manufacturer's recommendations.

LEARNING CONTENT

16.3.1 Define the purpose and fundamentals of diagnostic test equipment.
[.5/0]

- electric meters (analog v/s digital)
- safety when testing electrical/electronic circuits

16.3.2 Define the construction features, types and applications of diagnostic test equipment.
[1/0]

- ammeter
- voltmeter
- ohmmeter
- digital multi-meter (DMM)
- continuity circuit tester
- high and low impedance multi-meters
- current probe
- induction pickup

16.3.3 Explain the principles of operation of diagnostic test equipment. [1/0]

- ammeter
- voltmeter
- ohmmeter
- high and low impedance multi-meters
- meggers

16.3.4 Perform inspection and testing procedures using diagnostic test equipment in accordance with the manufacturer's recommendations.
[.5/1]

- ammeter, voltmeter, ohmmeter
- continuity circuit tester
  - high and low impedance multi-meters
  - current probe
- induction pickup

16.4 Troubleshooting Procedures

Duration: 28 Total Hours Theory: 11 hours Application: 17 hours

Cross-Reference to Performance Objectives: 1.1, 1.7, 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3, 6.4, 6.5, 7.2, 7.3, 8.2, 8.3, 10.2, 10.3, 11.2, 11.3, 13.2, 13.3, 14.2, 14.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe and carry out the trouble shooting procedures of electrical/electronic circuits in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

16.4.1 – Describe electrical/electronic circuit trouble shooting procedures.

16.4.2 – Perform trouble shooting procedures on elevating device electrical/electronic control circuits.

LEARNING CONTENT

16.4.1 Describe electrical/electronic circuit trouble shooting procedures.
[5/2]

- describe the various troubleshooting processes
- explain the Ward-Leonard process

16.4.2 Perform trouble shooting procedures on elevating device electrical/electronic control circuits.
[6/15]

- perform troubleshooting procedures on constant pressure, relay, P.L.C. and microprocessor based control circuits
- perform troubleshooting procedures on single automatic push button relay, P.L.C. and microprocessor based control circuits
- perform troubleshooting procedures on collective system relay, P.L.C. and microprocessor based control circuits
- perform troubleshooting procedures on safety, relay, P.L.C. and microprocessor based control circuits

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
30%	40%	30%

NUMBER **17**

TITLE: **ESCALATORS AND MOVING WALKS INSTALLATION**

Duration: 15 Total Hours Theory: 11 Hours Application: 4 Hours

Prerequisites: 1, 2, 3, 4, 5, 6, 7, 12, 13, 14, 15, 16

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 1.1, 1.2, 1.3, 1.4, 1.7, 2.1, 2.2, 2.3, 2.4, 14.1, 14.2, 14.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to explain the operating principles and installation procedures for escalators and moving walks in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

17.1 – Define the fundamentals of escalators and moving walks.

17.2 – Describe the operating principles and safety considerations of escalators and moving walks.

17.3 – Define the fundamentals of preparing for installation/construction of an escalator and moving walk.

17.4 – Define the fundamentals of installation/construction methods for an escalator and moving walk.

17.5 – Define the fundamentals of adjusting, testing and completion of an escalator and moving walk installation.

LEARNING CONTENT

17.1 Define the fundamentals of escalators and moving walks. [1/0]

- identify the historical aspects of escalators
- identify the applications of escalators

17.2 Describe the operating principles and safety considerations of escalators and moving walks.
[1/0]

- explain the operating principles
  - overview of main components
  - drive mechanisms
- explain safety considerations
  - moving belts
- refer to code: B44 clause 6.1 & 6.2

17.3 Define the fundamentals of preparing for installation/construction of an escalator and moving walk.
[4/1]

- report to site superintendent or general contractor
- verify that the site is ready for installation
  - visually inspect site area
  - check location
  - check size of wells
  - check bearing surfaces
  - check the accessibility
  - check readiness to receive the units
- outline the planning and organization requirements
  - arrange equipment delivery
  - establish and check the scheduling details
  - plan the requirements to ensure job safety
- arrange for appropriate storage space
  - dry location
  - secure area
- outline the rigging and hoisting truss procedures
  - slings
  - chain falls
  - A-frames and gantries
  - Cranes

17.4 Define the fundamentals of installation/construction methods for an escalator and moving walk.
[3/2]

- describe the procedure to establish working lines
  - main layout drawings
  - center line stands
  - piano wire
- describe procedure to use a plumb bob
  - measuring devices
  - adjusting center line to center marks on truss
- describe the procedure for setting truss
  - jack and leveling equipment
  - building of grid lines
  - finishing floor elevations
- describe the procedure to set tracks and brackets
  - use of measuring devices
  - referencing the center line
  - leveling the tracks
- describe the procedure to set machine, bull gear and tension carriage
  - use of hoisting equipment
  - positioning
- describe the procedure to install and wire the electrical components
  - reference main layout drawings
  - reference field wiring diagrams
- describe the procedure to install chains and or belts
- describe the procedure to install steps, pallets or belts
  - fastening techniques
  - shimming
- describe the procedure to install skirting and decking
  - aligning and fastening
  - butt joints and clearances
- describe the procedure to install newels and tracks
  - fitting and securing
- describe the procedure to install handrails and guide assemblies
  - fitting and securing

17.5 Define the fundamentals of adjusting, testing and completion of an escalator and moving walk installation.
[2/1]

- describe the procedure to make the specified equipment adjustments
  - setting all safety switches
  - testing all safety switches

  - adjusting brake control
- describe the procedure to complete the field test and data reports
- reference code: B44 clause 8.10.4

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
45%	25%	30%

NUMBER **18**

TITLE: **LIFTS FOR PERSONS WITH PHYSICAL DISABILITIES**

Duration: 21 Total Hours Theory: 19 Hours Application: 2 Hours

Prerequisites: 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Cross Reference to Performance Objectives: 1.1 – 1.5, 1.7, 3.1 – 3.3, 4.1 – 4.3, 5.1 – 5.3, 6.1 – 6.6, 7.1 – 7.3, 8.1 – 8.3, 9.1 – 9.3, 10.1 – 10.3, 11.1 – 11.3, 12.1 – 12.3, 13.1 – 13.3

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the construction, operation, installation and inspection procedures of lifts for persons with physical disabilities in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

18.1 – Define the fundamentals of lifts for persons with physical disabilities.

18.2 – Describe the construction features of lifts for persons with physical disabilities.

18.3 – Explain the operating principles of lifts for persons with physical disabilities.

18.4 – Describe the installation and construction procedures of lifts for persons with physical disabilities.

18.5 – Describe the inspection and testing procedures of lifts for persons with physical disabilities.

LEARNING CONTENT

18.1 – Define the fundamentals of lifts for persons with physical disabilities. [2/2]

- interpret the elevating devices code adoption document, Part VII
  - B355 code
  - B613 code
  - Code adoption Document Part VII

18.2 – Describe the construction features of lifts for persons with physical disabilities. [5/0]

- describe the basic construction features of the following lift devices
  - stair chair lifts
  - stair platform lifts enclosed
  - stair platform lifts unenclosed
  - vertical platform lifts enclosed
  - vertical platform lifts unenclosed

18.3 – Explain the operating principles of lifts for persons with physical disabilities. [5/0]

- identify the lift control methods for all types of lift devices
- explain lift operating procedures
- types of drives

18.4 – Describe the installation and construction methods of lifts for persons with physical disabilities.
[4/0]

- installation procedures
- construction methods

18.5 – Describe the inspection and testing procedures of lifts for persons with physical disabilities.
[3/0]

- visual inspection
- test procedures

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
70%	0%	30%

NUMBER **19**

TITLE: **GENERAL PREVENTIVE MAINTENANCE**

Duration: 15 Total Hours Theory: 12 Hours Application: 3 Hours

Prerequisites: 1, 2, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the general maintenance procedures and safety procedures for the installation, service, repair, modernization or alterations to elevating devices in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

19.1 – Public Safety

19.2 – Liability Concerns

19.3 – Preventive Maintenance Practice

19.1– Public Safety

Duration: 2 Total Hours Theory: 2 hours Application: 0 hours

Cross Reference to Performance Objectives: 1.1, 1.2, 1.3, 6.6

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the requirements to secure a work area in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

19.1.1 Define the need to notify building personnel of elevating device shut- down or reinstatement to service.

19.1.2 Define the requirement for and location of using "maintenance in progress" signs.

19.1.3 Define the equipment requirements and procedure for barricading entrances.

19.1.4 Define the importance of effective communication, courtesy and personal appearance when dealing with the public in occupied buildings and worksites.

LEARNING CONTENT

19.1.1 Define the method of notifying building personnel of elevating device shut-down or reinstatement to service.
[.5/0]

- define the reasons for notifying building personnel that the elevating device has been shut down or returned to service

19.1.2 Define the requirement for and location of using “maintenance in progress” signs.
[.5/0]

- define the requirement for “maintenance in progress” signs
- define the location for “maintenance in progress” signs

19.1.3 Define the equipment requirements and procedure for barricading entrances.
[.5/0]

- define the requirements for barricading entrances
- define the equipment requirements for barricading

19.1.4 Define the importance of effective communication, courtesy and personal appearance when dealing with the public in occupied buildings and worksites.
[.5/0]

- describe what is meant by effective communication
- define examples of courtesy to the public
- define what is meant by appropriate appearance

19.2– Liability Concerns

Duration: 3 Total Hours Theory: 3 hours Application: 0 hours

Cross Reference to Performance Objectives: 1.1, 1.2

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the liability concerns for installing/constructing, servicing, repairing, maintaining, or modernizing elevating devices in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

19.2.1 Define the relevant information and specific details regarding the difference between an incident and an accident.

19.2.2 Define the relevant information and specific details regarding securing the site and witnesses following an accident.

19.2.3 Describe the procedure to follow regarding the requirements to notify company officials and the TSSA officials following an incident or accident.

19.2.4 Describe the relevant information and specific details regarding the method of recording observations and obtaining all available information.

19.2.5 Explain the difference between the responsibilities of the owner and that of the contractor.

LEARNING CONTENT

19.2.1 Define the relevant information and specific details regarding the difference between an incident and an accident.
[.5/0]

- define an incident
- define an accident

19.2.2 Define the relevant information and specific details regarding securing the site and witnesses following an accident.
[.5/0]

- define the procedure to secure a site
- define the procedure to document details about a witness

19.2.3 Describe the procedure to follow regarding the requirements to notify company officials and the TSSA following an incident or accident.
[.5/0]

- describe the procedure to notify company officials
- describe the procedure to notify the TSSA

19.2.4 Describe the relevant information and specific details regarding the method of recording observations and obtaining all available information.
[1/0]

- describe the method to record observations following an incident or accident
- describe the method to obtain all available information following an incident or accident

19.2.5 Explain the difference between the responsibilities of the owner and that of the contractor.
[.5/0]

- define the owner responsibilities
- define the contractor responsibilities
- explain the differences in responsibilities between each
- review the TSSA accident/ incident report form
- reference directors ruling 117 / 95

19.3– Preventive Maintenance Practice

Duration: 10 Total Hours Theory: 7 hours Application: 3 hours

Cross Reference to Performance Objectives: 1.1, 1.2, 4.3, 5.3, 6.3, 6.6, 7.3, 8.3, 9.3, 10.3, 11.3, 12.3, 13.3, 14.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the general preventative maintenance practices for elevating devices in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

LEARNING OUTCOMES:

Upon successful completion, the apprentice is able to:

19.3.1 Define the relevant information and specific details pertaining to working in occupied buildings.

19.3.2 Define the relevant information and specific details regarding observations of elevating device equipment and performance during site visits.

19.3.3 Define the relevant information and specific details regarding taking the elevating device out of service and lock-out procedures.

19.3.4 Define the relevant information and specific details regarding the procedure for re-instatement of the elevating device back into service for public use.

19.3.5 Define the relevant information and specific details regarding the use of remote monitoring.

19.3.6 Define the relevant information and specific details regarding log books.

19.3.7 Describe the procedures for service and repair.

LEARNING CONTENT

19.3.1 Define the relevant information and specific details pertaining to working in occupied buildings.
[1/0]

- safe use of jumpers (CSA 2.26.1.5.8 & 8.6.1.6.3 D.R. 106/93 & 01/82)
- securing the work area
- appropriate personal appearance in occupied areas
- maintain acceptable condition of the work site
- refrain from using abusive language
- minimize the effects of objectionable noise levels
- place tools, material and equipment in locations that minimize disruption and safety hazards to occupants of the building

19.3.2 Define the relevant information and specific details regarding observations of elevating device equipment and performance during site visits.
[1/2]

- check all safety circuits & devices
- check mechanical operating components
- check electrical operating components
- check for abnormal noises or odours
- check condition of all equipment
- check condition of drive equipment
- check operation and condition of fixtures
- observe appearance and cosmetic details
- observe operation

19.3.3 Define the relevant information and specific details regarding taking the elevating device out of service and lock-out procedures.
[1/0]

- describe how to use the maintenance operation in controller
- describe the method of ensuring the device is unoccupied
- describe method of locking main disconnect switch in the off position
- describe the method of assuring the device is mechanically secured

19.3.4 Define the relevant information and specific details regarding the procedure for re-instatement of the elevating device back into service for public use.
[1/0]

- describe the procedure to follow that ensures that the electrical protective devices are operating normally

- follow the specified procedure that will ensure all equipment is restored to normal operation
- describe the procedure to test and verify the correct operation prior to returning to service

19.3.5 Define the relevant information and specific details regarding the use of remote monitoring.
[1/0]

- describe the procedure to use modems
- outline how to read and interpret information provided by computer monitor systems
- produce and interpret a diagnostic screen or printer
- using display management technique

19.3.6 Define the relevant information and specific details regarding log books. [1/0]

- identify historical introduction of log book
- outline the value and advantages of log books
- define the purpose of the log book
- identify the information that must be entered into the log book
- use of log books for extra relevant information
- provide example of typical log book
- reference the Ontario Elevating Devices Regulations, Section 22, (operation and maintenance)

19.3.7 Describe the procedures for service and repair.
[1/1]

- follow safety rules for working in machine rooms, on car tops and in the hostway or pit
- follow the specified procedure when taking equipment out of service, in order not to endanger building occupants and elevating device users
- follow the accepted procedure when reinstating equipment back into service
  - ride the elevating device to ensure it is operating according to specifications prior to releasing it for public use
- observe the location of smoke and heat detector when using heat and smoke generating equipment and procedures
- prevent dropping items from car tops or hall entrances when doors are open
- provide protection for floors and carpets from
  - oil
  - grease
  - moving heavy equipment
- reference code: CSA-B44 clause 12.5

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
60%	10%	30%

NUMBER **20**

TITLE: **CSA-B44 SECTION C.8.6.12 AND APPENDIX J**

Duration: 15 Total Hours Theory: 6 Hours Application: 9 Hours

Prerequisites: 19, 20

Evaluation & Testing:
- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.6, 7.1 – 7.3, 8.1 – 8.3, 10.1 – 10.3, 11.1 – 11.3, 12.1 – 12.3, 13.1 – 13.3, 14.1 – 14.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the CSA-B44 Section C .8.6.12 and appendix "J" legislated mandatory maintenance of elevators, dumbwaiters, escalators and moving walkways in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

20.1 – Define the relevant information and specific details concerning the maintenance requirements outlined in Section C .8.6.12 and appendix "J".

20.2 – Define the relevant information and specific details concerning the procedures outlined in Section C .8.6.12 and appendix "J".

20.3 – Define the relevant information and specific details concerning the examinations and tests outlined in Section C .8.6.12 and appendix "J".

LEARNING CONTENT

20.1 – Define the relevant information and specific details concerning the maintenance requirements for all installations outlined in Section C .8.6.12 and appendix "J". [2/3]

- identify the general maintenance requirements

20.2 – Define the relevant information and specific details concerning the procedures outlined in Section C .8.6.12 and appendix "J".
[2/3]

- identify the procedures

20.3 – Define the relevant information and specific details concerning the examinations and tests outlined in Section C .8.6.12 and appendix "J".
[2/3]

- define the specific details regarding examinations and tests for elevators, dumbwaiters, escalators and moving walks
- define the specific details regarding repairs and replacements for elevators and dumbwaiters, escalators and moving walks

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
30%	40%	30%

NUMBER **21**

TITLE: **ELEVATOR MACHINE ROOM EQUIPMENT MAINTENANCE**

Duration: 39 Total Hours Theory: 24 Hours Application: 15 Hours

Prerequisites: 1, 2, 6, 7, 8, 10, 11, 12, 13, 14, 19, 20

Evaluation & Testing:
- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives 1.1, 1.2, 1.3, 1.4, 1.5, 2.2, 2.4, 3.1, 3.2, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.3, 6.6, 7.3, 8.1, 8.2, 8.3, 12.1, 12.2, 12.3, 13.1, 13.2, 13.3,

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to define the maintenance procedures for the machine room in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

21.1– Define the safety requirements when working around moving equipment.

21.2– Define the maintenance requirements for motors and generators.

21.3– Define the maintenance requirements for drive machines.

21.4– Define the maintenance requirements for sheaves and drums.

21.5– Define the maintenance requirements for machine brakes.

21.6– Define the maintenance requirements for over speed safety devices.

21.7– Define the maintenance requirements for control equipment.

21.8– Define the maintenance requirements for wire rope.

21.9– Describe the procedure to perform pressure tests on hydraulic systems.

LEARNING CONTENT

21.1– Define the safety requirements when working around moving equipment. [1/1]

- identify the required personal protective equipment (PPE)
- identify the clearance requirements around equipment
- define the required condition for the floor surface
- identify any overhead obstructions or projections

21.2– Define the maintenance requirements for motors and generators. [2/1]

- identify the relevance of using human senses to identify abnormal conditions
  - odors relating to electrical problems, overheating, etc.
  - touch for heat, cold, vibration etc.
  - sight of visual problems
  - sounds normal and abnormal
- identify evidence of carbon contamination
- identify worn or sticking brush gear
- identify loose connections
- check bearing oil levels
- check for excessive heat and unexplained noise
- inspect condition of commutators
- reference: National Brush Digest, Union Carbide Corp.

21.3– Define the maintenance requirements for drive machines. [6/2]

- identify the features machine types:
  - geared
  - gearless
  - drum
- identify the condition of machine parts:
  - gearing and backlash
  - gear and bearing lubricant quality
  - bearings and seals
  - thrust bearings
  - mating machined surfaces
  - shafts and supports anchor bolts
    - basement machines
  - machine isolation
  - hydraulic pump units
  - drive components
  - control valves and oil distribution system

  - hydraulic oil and level
- identify source of hydraulic oil loss
  - review oil unit record logs
- refer to code: CSA B-44 clause 2.24 and 3.18

21.4– Define the maintenance requirements for sheaves and drums. [3/2]

- identify the types of roping arrangements
  - straight
  - long wrap
  - double wrap
- identify the types of sheaves
  - traction
  - deflector
- identify the types of sheave materials
- identify the types of traction sleeve grooves
  - U – groove (undercut)
  - V - groove
- identify the condition of sheave grooves
  - normal wear
  - abnormal wear
  - brinelling
- identify if the wire rope is tracking correctly
- identify the features of sheave groove non-metallic liners
- identify rope creep and slip conditions
- identify the integrity of sheave shafts/bearings
- identify the integrity of torque transmitting elements to drive sheaves
  - keys
  - fitted bolts
  - etc.
- identify the integrity of wire rope fastenings on drums

21.5– Define the maintenance requirements for machine brakes. [3/2]

- identify the safety precautions that require use of Personal Protective Equipment (PPE)
  - vapours
  - heat
  - dust and dirt
  - asbestos precautions
- identify types of brake systems
- identify types of brake release and application methods
- perform brake action checks

- describe brake system cleaning procedures
- describe brake system lubricating procedures
- describe brake system adjustment and alignment procedures
  - brake
  - brake core lift
  - shoe to drum contact
  - brake torque
- describe brake system testing procedures
- reference code: CSA-B-44 clause 2.2 , 4.8

21.6– Define the maintenance requirements for machine safety devices. [4/2]

- identify the type and make of the machine governor
- describe the principle of operation of a machine governor
- describe the operation and testing procedures of governor system components
  - electrical switches
  - tripping switches
  - tripping speed and pull through force
- outline the procedure to spin test governors with a tachometer
- define the TSSA governor seal and application
- describe the cleaning and lubrication procedure of a governor
- describe the construction features, operation and maintenance requirements of rope brakes
- describe the construction features, operation and maintenance requirements of traction sheave jamming devices
- identify causes of uncontrolled motion
- reference code: CSA-B-44 clause 2.18, CSA-B44 clause 2.19

21.7– Define the maintenance requirements for control equipment. [2/2]

- identify the integrity and condition of control equipment
  - connections
  - contacts
  - leads
  - relays
  - contactors
  - solid-state components
  - fuses
  - circuit breakers
  - overload/overheat protection devices
  - drive unit
- describe the importance and method of cleaning control equipment

- describe the maintenance requirements for electromechanical components and assemblies
  - lubrication
  - adjustment
  - replacement of worn or defective components

21.8– Define the maintenance requirements for wire rope. [2/2]

- review wire rope nomenclature:
  - types
  - classification
  - sizes
  - materials
- identify applications for wire rope:
  - traction
  - governor
  - compensating
  - roped hydraulics
- identify cleaning and lubricating requirements for wire rope
- identify the characteristics of wire rope
- describe the inspection procedure for wire rope
- describe the checking and adjusting tension procedure for wire rope
- describe the measuring procedure for wire rope
- prevention of wire rope corrosion (rust)
- checking integrity of wire rope termination
- reference code: CSA-B44 clause 2.20

21.9– Describe the procedure to perform pressure tests on hydraulic systems. [1/1]

- perform visual inspection for fluid leaks
- perform pressure tests according to the specified procedure
- code reference: CSA-B44 Clause 8.11, 3.2
- Note: reference for entire reportable subject to CSA-B44 Appendix I

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
45%	25%	30%

NUMBER **22**

TITLE: **ELEVATOR CAR EQUIPMENT MAINTENANCE**

Duration: 12 Total Hours Theory: 8 Hours Application: 4 Hours

Prerequisites: Reportable Subjects: 1, 2, 6, 7, 8, 10, 11, 12, 13,19, 20

Evaluation & Testing:
- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 1.1, 1.2, 1.3, 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 11.1, 11.2, 11.3, 12.1, 12.2, 12.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the maintenance procedures for elevator cars in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

22.1 – Define the maintenance procedures for elevator car doors and gates.

22.2 – Define the maintenance procedures for elevator enclosures.

22.3 – Define the maintenance procedures for elevator car tops.

22.4 – Define the maintenance procedures for elevator car bottoms.

22.5 – Define the maintenance procedures for elevator car safeties.

LEARNING CONTENT

22.1 – Define the maintenance procedures for elevator car doors and gates. [1/1]

- identify the checks required for car doors and gates
  - door operation
  - door re-opening devices
  - gib wear, eccentric adjustment and retainers
  - skates, vanes and clutches
  - gate switches and operating rollers
  - linkage arms and assemblies
  - re-opening device cabling
  - air cords
  - sills

22.2 – Define the maintenance procedures for elevator enclosures. [1/0]

- identify the checks required for car inside car components
  - call buttons
  - alarm button (including emergency power supply)
  - key switches
  - other fixtures and bulbs
  - operation of communication system
  - audible devices
  - cab interior
  - emergency lighting

22.3 – Define the maintenance procedures for elevator car tops. [2/1]

- identify the checks required for car top components
  - load weighing devices
  - guides
    - shoes
    - slippers
    - rollers
  - clean adjust and lubricate guides as required
  - retiring cams and motors
  - clean adjust and lubricate as required
  - wire rope shackles, hitches and springs
  - door operators, cam assemblies and resistors
  - sheaves, guards and shafts
  - data plates

- electrical switches and switch assemblies
- governor rope hitch, release carriers, levers, arms, return springs, etc.
- car top cleaning
- escape hatch

22.4 – Define the maintenance procedures for elevator car bottoms. [2/1]

- identify the checks required for car bottom components
  - safeties
  - load weighing devices
  - guide shoes, slippers, rollers
    - clean, adjust and lubricate as required
  - isolation devices
  - traveling cable attachments
  - compensating rope and chain attachments
  - buffer striker plates
  - platen and plunger attachments (hydraulic)
  - reference code: CSA-B44 8.10.2.2.5 (1) (Buffer tests)
  - mechanical stored energy
    - pipe stands
    - rail clamps

22.5 – Define the maintenance procedures for elevator car safeties. [2/1]

- define types and application of safeties
  - type A
  - type B
  - type C
  - type D
- describe the principles of operation for the safety types
- describe the method of disassembling, cleaning, lubricating, reassembling and adjusting safeties
- define the tests required to ensure a safety is operating correctly
- reference code: CSA B44 8.10.2.2.2 (1) + (2) + (3) + (4) (Car safeties)

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
50%	20%	30%

NUMBER **23**

TITLE: **ELEVATOR HOISTWAY AND PIT EQUIPMENT MAINTENANCE**

Duration: 15 Total Hours Theory: 13 Hours Application: 2 Hours

Prerequisites: 1, 2, 6, 7, 8, 10, 11, 12, 13,19, 20

Evaluation & Testing:
- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.3, 6.4, 8.1, 8.2, 8.3, 9.1, 9.2, 9.3,10.1, 10.2, 10.3, 12.1, 12.2

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the maintenance procedures for elevator hoistways in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

23.1 – Define the safety requirements when performing maintenance in hoistways.

23.2 – Define the maintenance procedures for elevator hoistway door equipment.

23.3 – Define the maintenance procedures for the elevator hoistway counter weight assembly.

23.4 – Define the maintenance procedures for elevator hoistway vanes and switches.

23.5 – Define the maintenance procedures for elevator hoistway counter balance ratio.

23.6 – Define the maintenance procedures for elevator hoistway governor rope.

23.7 – Define the maintenance procedures for elevator hoistway traveling cable suspension and potential interference with the building structure.

23.8 – Define the maintenance procedures for elevator hoistway car top sheave clearances, including deflector sheave mounted under machine beams.

23.9 – Define the maintenance procedures for elevator hoistway pit equipment.

LEARNING CONTENT

23.1 – Define the safety requirements when performing maintenance in hoistways. [2/0]

- working around moving equipment
- fireproofing materials
  - beware of asbestos

23.2 – Define the maintenance procedures for elevator hoistway door equipment. [2/1]

- identify the required door component checks
  - locking equipment
  - pick-up rollers
  - gibs
  - sight guards
  - retainers
  - eccentrics
  - tracks
  - hangers
  - hanger rollers
- describe the door component cleaning procedures
- describe the door component lubricating procedures
- describe the door adjustment procedures

23.3 – Define the maintenance procedures for the elevator hoistway counter weight assembly.
[2/0]

- identify the required condition checks for counter weight assembly components
  - rope hitch
  - shackles
  - springs
  - guide rollers
  - slippers
  - buffer
  - buffer striker plate
  - rods
- reference code: CSA-B4 clause 2.21

23.4 – Define the maintenance procedures for elevator hoistway vanes and switches. [1/0]

- identify the required condition checks for vanes and switches

- operation
- clearance between vanes and switches

23.5 – Define the maintenance procedures for elevator hoistway counter balance ratio. [2/0]

- identify the requirements to check counter balance ratio
  - after cab renovations
  - after replacement of traveling cables

23.6 – Define the maintenance procedures for elevator hoistway governor rope. [1/0]

- identify the required checks and maintenance of ropes
  - normal and abnormal wear
  - breaks
  - clean and lubricate as required

23.7 – Define the maintenance procedures for elevator hoistway traveling cable suspension and potential interference with the building structure. [1/0]

- identify the required checks and maintenance of traveling cable suspension
  - normal and abnormal wear
  - traveling cable hang loop
  - provide beam pads as required

23.8 – Define the maintenance procedures for elevator hoistway car top sheave clearances, including deflector sheave mounted under machine beams. [1/0]

- identify the required checks and maintenance of car top clearances and deflector sheave
  - normal and abnormal wear
  - car top clearance and run-by (especially after replacing ropes)
  - overhead deflector sheave, shaft and bearings
  - clean and lubricate as required

23.9 – Define the maintenance procedures for elevator hoistway pit equipment. [1/1]

- identify the required checks and maintenance of pit equipment
  - governor tension sheave
  - compensating sheave (including tie-down)
  - oil buffers (B44 code ref: 2.22.4
  - buffer mounting arrangements

  - car counterweight run-by
  - limit and other EPD switches
  - tape sheaves and tensioning assemblies
  - pit light and light switch
  - pit ladders
  - inspection platforms
  - pit stop switches
  - hydraulic cylinders, oil lines and pipe rupture valves
  - code reference: CSA-B44 clause 2.2
- describe the cleaning, lubricating and adjusting procedures

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
60%	10%	30%

NUMBER **24**

TITLE: **ESCALATOR AND MOVING WALK MAINTENANCE**

Duration: 9 Total Hours Theory: 7 Hours Application: 2 Hours

Prerequisites: Reportable Subjects: 1, 2, 6, 7, 12, 13, 14, 16, 17, 19, 20

Evaluation & Testing:
- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 14.1, 14.2, 14.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe the maintenance procedures for escalators and moving walks in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

24.1 – Review the basic principles of escalator and moving walk operation, nomenclature, purpose of major components and safety devices.

24.2 – Define the relevant information and specific details pertaining to safe working practice, including public safety, during maintenance of escalator and moving walk equipment.

24.3 – Define the relevant information and specific details pertaining to maintenance examination of escalators and moving walks.

LEARNING CONTENT

24.1 – Review the basic principles of escalator and moving walk operation, nomenclature, purpose of major components and safety devices. [4/0]

- define the purpose of major components
  - drive mechanism
  - steps, pallets, and belt type treadway
  - power systems
  - handrail systems
  - balustrades
- identify the nomenclature of escalators and moving walks
- describe the basic operating principles
  - drive mechanism
  - power requirements
- identify the electrical protective devices of escalators and moving walks
  - emergency stop buttons
  - speed governors
  - broken step chain device
  - stop switch in machinery spaces
  - skirt obstruction device
  - escalator egress restriction device
  - reverse stop device
  - step up thrust device
  - disconnect motor safety device
  - step level device
  - handrail entry device
  - comb-step impact device
  - step lateral displacement device
  - stop switch in inspection controls
  - handrail speed monitoring device
  - missing step device
- other protective devices
  - step demarcation lights
  - caution signs
  - comb plates
  - ceiling guards
  - anti-slide devices
  - deck barricades

24.2 – Define the relevant information and specific details pertaining to safe working practice, including public safety, during maintenance of escalator and moving walk equipment.
[1/1]

- identify the required safe working procedures
  - barricades
  - protection for carpets and floors
  - storage of steps
  - control and minimizing noise levels
  - control of odours from cleaning solvents
  - correct location of smoke and heat detectors
  - abstaining from use of coarse language

24.3 – Define the relevant information and specific details pertaining to maintenance examination of escalators and moving walks.
[2/1]

- define the required procedures to follow when performing an escalator or moving walk maintenance examination
  - visual inspection
  - performance
  - inspection control
- reference CSA-B44 Section 12 (Escalators and moving walks)
- directors ruling 150/00-R2
- CSA B44 Section 6.1 & Section 6.2

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
55%	15%	30%

NUMBER **25**

TITLE: **MODERNIZATION / ALTERATIONS**

Duration: 15 Total Hours Theory: 10 Hours Application: 5 Hours

Prerequisites: 1 - 24

Evaluation & Testing:

- Assignments related to theory and appropriate application skills.
- Minimum of one mid-term test during the term.
- Final exam at end of term.
- Periodic quizzes.

Cross Reference to Performance Objectives: 1.1, 1.2, 1.3, 1.4, 1.7, 2.1, 2.2, 2.3, 2.4, 3.3, 4.3, 5.3, 6.3, 6.4, 6.5, 6.6, 7.3, 8.3, 9.3, 10.3, 11.3, 12.3, 13.3

GENERAL LEARNING OUTCOME:

Upon successful completion of this reportable subject, the apprentice is able to describe elevating device modernizations and alteration procedures in accordance with government safety regulations, manufacturer's recommendations and specifications and approved industry standards.

25.1– Identify the relevant information pertaining to modernization and alterations to elevating devices.

25.2– Define the fundamentals of performing a modernization or alteration in an occupied building.

LEARNING CONTENT

25.1– Identify the relevant information pertaining to modernization and alterations to elevating devices.
[4/5]

- Code requirements:
  - major alterations
  - minor alterations
  - minor alteration type A
  - minor alteration type B
  - code reference: Regulations Section 1-(1) 23 & 26
- ruling 164 and 171 cab mods
- ruling 175 fire safety
- fire rating of new cab panels
- counterbalancing ratios
- changes to loading on safeties
- sheave shaft load
- groove loading
- rope loading
- submissions to the TSSA
- safety factors pertaining to hydraulic elevators

25.2– Define the fundamentals of performing a modernization or alteration in an occupied building.
[6/0]

- communication with building personnel
- working in occupied buildings
- planning
- site conditions
- housekeeping
- jumpers
- temporary controls
- safety precautions
  - asbestos
  - guarding the work areas
- delivery/storage & hoisting of new equipment
- dismantling & removal of old equipment
- interfacing old equipment with new equipment
- replacing selenium rectifiers with silicon type (internal resistance)
- dangers of overbalance of counterweight during cab removal
- grounding
- building power requirements

- control wiring requirements
- integrity of rail fastenings

Evaluation Structure

Theory Testing	Application Experiences	Final Assessment
50%	20%	30%

MINIMUM EQUIPMENT & SUPPLIES FOR EACH PROGRAM REPORTABLE SUBJECT

Provide Examples of the following items

1. Safety:
- Code Books, B44; B355; B613; C22.1
- Acts and Regulations
- Code Adoption
- Policies and Procedures

2. Introduction to Elevating Devices:
- Fall Arrest Harness
- Personal Protective Equipment (PPE)
- Oxy-Acetylene simulator
- Fire extinguisher for A,B,C
- WSIB reporting forms
- OHSA construction

3. Mechanical Print Reading:
- Architectural, Structural and Mechanical Prints

4. Ladders, Scaffolding and Work Platforms:
- Various types of Ladders
- Scaffolding and Planks
- Various types of rope fastening devices
- Beam clamps
- Crosby clips
- Rigging hardware
- Rope terminations

5. Rigging and Hardware:
- Come along
- Small manual chain block
- Assorted slings

6. Introduction to B44 Code Book:
- The Current CSA B44 code book with updates

7. Mechanical Practice:
- Assorted components of belt, chain and power transmission systems
- Assorted bearings, bushings and seals
- Precision measuring tools and instruments
- Assorted mechanical test instruments

8. Traction Elevator Installation:

- Various rail sizes and fastening devices
- Rail alignment tools/gauges
- MR layout drawings
- MR floor layout template
- Typical MR equipment
- Various wiring devices, tools and components
- Typical Pit equipment components
- Wire rope, fastenings and terminations
- Typical entrance frame and door components
- Typical hoistway door interlocks
- Duct and conduit systems
- Typical hoistway switches
- Typical travelling cables and fastening devices
- Car top inspection station; COP
- Typical car door operators
- Typical door protective devices
- Typical car door components
- Typical TSSA inspection forms

9. Basic Hydraulics:

- No additional equipment required

10. Elevator Hydraulic Systems:

- Typical elevator hydraulic pumping system components
- Typical jack unit
- Hydraulic pressure gauge

11. Hydraulic Elevator Installation:

- Cylinder plumbing devices
- Typical hydraulic oil line fastenings and couplings

12. Basic Electricity:

- Various electrical components
- Hand tools and electrical testing devices
- Permanent magnets and electro-magnetic components

13. Industrial Electricity for Elevating Devices:

- Typical electrical control devices
- Various types of transformers
- Typical electrical schematic drawings
- Various types of circuit conductors and wiring devices
- Wiring tools, materials and hardware

14. Motors, Generators, Controls and AC Drives:

- No additional equipment required

15. Solid State Electronics:

- Various types of solid state electronic components
- Various PLC's and microprocessor controls

16. Circuit Tracing:

- Typical relay control systems
- Typical power control drive systems

17. Escalators and Moving Walks Installation:

- Electrical diagnostic equipment
- Typical site layout drawings for escalators and moving walks
- Typical escalator and moving walk components

18. Lifts for Persons with Physical Disabilities:

- Typical installation and electrical drawings

19. General Preventive Maintenance:

- Typical log books as required by provincial regulations
- Typical test equipment

20. CSA-B44 Section C.8.6.12 and Appendix J:

- No additional equipment required

21. Elevator Machine Room Equipment Maintenance:

- Brush gear
- Typical code required oil record logs
- Typical brake components
- Typical over-speed and uncontrolled motion devices and / or components
- Typical rope lubricating devices
- Rope tags

22. Elevator Car Equipment Maintenance:

- Typical car safeties and/or components
- Car guides

23. Elevator Hoistway and Pit Equipment Maintenance:

- No additional equipment required

24. Escalator and Moving Walk Maintenance:

- Typical escalator and moving walk barricades
- Typical escalator log sheets as required by the provincial government

25. Elevator Modernization/Alterations:

- No additional equipment required