

Apprenticeship and Industry Training

Elevator Constructor

Apprenticeship Course Outline

9718 (1988)



PREAMBLE

It is the intent of this analysis to reflect the majority of the tasks and the knowledge that is required to function as a competent journeyman in the Elevator Constructor Industry in the Province of Alberta.

PURPOSE OF THE ANALYSIS WAS PREPARED TO:

1. Inform the public of the nature and scope of the Elevator Constructor Trade and hopefully assist anyone who wishes to make the Elevator Constructor their vocation;
2. Give the industry a guideline relative to the progression of an improver's training so that the responsibilities assigned to him or her may be comparable to the amount of training the improver has received and by doing so make the work rewarding and meaningful;
3. Indicate to an improver the subjects and approximate time distributions for the technical training periods;
4. Assist the Provincial Apprenticeship Committee to develop a journeyman examination of proficiency for the Elevator Constructor.

ELEVATOR CONSTRUCTOR PROVINCIAL APPRENTICESHIP COMMITTEE MEMBERS

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ANALYSIS ELEVATOR CONSTRUCTOR

MODULES 1-7:..... INTRODUCTION TO ELEVATORS AND SAFETY 50 HOURS

Upon completion of this course the improver should have background information on Elevator history, the equipment and tools involved in installation, use and care of protective equipment and overall safe methods of operation in the Elevator industry.

Module 1:

Unit 1: INTRODUCTION OF ELEVATORS AND SAFETY

A. Birth and Growth of the Elevator

1. Manual powered
2. Machine powered

B. Other Equipment in the Elevator Industry

1. Escalators
2. Electric walks
3. Dumbwaiters

C. Elevator Installation

1. Brief overview

D. Elevator Industry Today

1. Union
2. National elevator industry history

E. What Does an Elevator Constructor Do

1. Construction
2. Modernisation
3. Service and Repair
4. Maintenance

Unit 2: SAFETY GENERAL

A. Accessories and Safety Equipment

B. Personal Protective Equipment C.S.A. Approved

1. Eye protection
2. Head protection
3. Foot protection
4. Respiratory equipment

C. Tools - Hand and Powered

1. Proper use of hand tools:
 - a) selecting the correct tools
 - b) using tools correctly
 - c) proper condition of tools
 - d) proper storage

TOPIC**COURSE OBJECTIVES**

- | | |
|---|--|
| <ul style="list-style-type: none"> 1. Grounding of power tools | <ul style="list-style-type: none"> 2. Proper use of powered tools <ul style="list-style-type: none"> a) portable grinders b) power hand saws c) portable drills 3. First Aid (practices) <ul style="list-style-type: none"> a) fractured bone <ul style="list-style-type: none"> i) splints b) mouth to mouth resuscitation c) cardiac resuscitation (C.P.R.) d) bleeding e) shock |
| <ul style="list-style-type: none"> 1. Grounding methods | |

Unit 3: SAFETY DURING CONSTRUCTION MODERNISATION**A. Good Housekeeping****B. Fires**

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Extinguishers | <ul style="list-style-type: none"> 1. Types: <ul style="list-style-type: none"> a) A class b) B class c) C class d) others |
|--|--|

C. Safety During Construction

- 1. Manual handling of materials
 - a) lifting
- 2. Storage of materials
- 3. Hoistway safety
- 4. Hoistway barricade
- 5. Overhead protection
- 6. Hoistway lighting
- 7. Electrical safety
- 8. Rigging and hoisting safety
- 9. Working on platform
- 10. Machine room safety
- 11. Safety of others

Unit 4: SAFETY AND SERVICE FUNCTION**A. Occupational Health and Safety Regulations****Module 2: FUNDAMENTALS OF PRINT READING****Unit 1: INTRODUCTION TO INSTALLATION DRAWINGS****A. Graphic Terminology**

- 1. Symbols
- 2. Abbreviations
- 3. Lines

TOPIC**COURSE OBJECTIVES****B. Drawing to Scale****C. Drawings**

1. Orthographic projection
2. Section views
3. Architectural drawings
4. Specifications
5. Installation drawings
6. Plan view
 - a) hoistway
 - b) machine room
7. Surveys

Unit 2:**DETAILED DRAWINGS AND STANDARDS****A. Detail Drawings**

Various Types

B. Fits

Various Types

C. Tolerance

Various Types

D. Screw Threads

Various Types

E. Common Fasteners

Various Types

F. Washers

Various Types

G. Introduction to Metric

1. Measurement units
2. Capacity units
3. Metric conversions B44 Code

Module 3:**Unit 1:****HANDLING MATERIALS AND TOOLS****A. Rules**

1. General handling and storing of elevator and escalator materials

B. Methods and Precautions

1. Unloading of materials

C. Basic Tools

TOPIC**COURSE OBJECTIVES**

1. Rigging and hoisting
2. Hand and power
 - a) safety methods

Unit 2:**RIGGING AND HOISTING****A. Fundamental Points of Rigging and Hoisting****B. Materials Used in Rigging**

1. Manila rope
 - a) storage and inspection
 - b) strength
 - c) method of whipping
 - d) various knots
2. Wire rope
 - a) storage and inspection
 - b) various attachments (clips)
 - c) hitches
3. Hoisting chains and hooks
 - a) safe loading
 - b) inspection
4. Timber
 - a) defects in wood
 - b) safe load, deflection, span and size of beams

C. Safety Devices - C.S.A. Approved

1. Safety belts
2. Life nets
3. Ladders
4. Hardware

D. General Safety

1. Proper use of safety equipment
2. Safety in rigging and hoisting (O.H. and S. Regulations)
3. Safety clothing - C.S.A. Approved
 - a) safety shoes
 - b) hard hats
 - c) safety glasses
 - d) gloves
 - e) dust masks

Module 4:**PIT STRUCTURES****Unit 1:****PIT STRUCTURES****A. Introduction of Pit Equipment****B. Buffers**

TOPIC**COURSE OBJECTIVES**

1. Spring buffers
 2. Oil buffers
 3. Physical appearance
 4. Basic components
 5. Specification and application of spring and oil buffers
- C. Governor Tension Sheaves and Frame**
1. Purpose and function of governor tension sheaves and frames
- D. Tension Sheaves for Selector and Floor Controller Drives**
1. Functions of the selector and floor controller drives
- E. Compensating Rope Sheaves**
1. The need and function of the compensating rope sheaves
 2. Need for tie-down devices
- F. Safety Switches**
1. Function of:
 - a) compensating sheaves switch
 - b) buffer switch
 - c) directional limit switch
 - d) final limit switch
 - e) stop switch
- G. Introduction to Component Installation**
1. Importance of hard hats
 2. When to install components
 3. Care to be taken when working in a waterproof pit
 4. Installation of buffers
 - a) components of buffers
 - b) step by step installation
 - c) testing of oil buffers
 5. Installation of governor tension sheaves and frame
 - a) checks to be made after installation
 6. Installation of tension sheaves for selector and floor controller devices
 7. Installation of compensating rope sheaves
 8. Safety guards and switches
 9. Pit maintenance
 - a) buffers (checklist)
 - b) compensating sheaves (checklist)
 - c) switches (checklist)

TOPIC**COURSE OBJECTIVES****Module 5:****GUIDE RAILS****Unit 1:****GUIDE RAILS****A. Guide Rails**

1. Safety
2. Rigging and tools required
3. Rail installation
4. Rail storage
5. Plumbing the hoistway
6. Main rail brackets for cornerpost elevators
7. Installing first brackets
8. Inserts
9. Self drilling anchors in concrete
10. Brackets
 - a) in brick
 - b) on intermediate floors
11. Stacking guide rails
12. Aligning rails
13. High-rise rail alignment
14. Filling rail joints

Module 6:**MACHINE ROOM AND OVERHEAD INSTALLATION****Unit 1:****MACHINE INSTALLATION****A. Introduction**

1. Sequence of installation
2. Sound isolation
3. Safety procedures
4. Secondary level

B. Machine Room Floor

1. Machine above installations
2. Machine below installations
3. Grating

C. Purpose of Machine Beams

1. Types of beams
2. Installation procedure - machine above
3. Installation procedure - machine below

D. Hoisting Machines

1. Geared machines
2. Uses of geared machines
3. Grooves for geared machines

TOPIC**COURSE OBJECTIVES**

4. Gearless machines
5. Grooves on gearless machine sheaves
6. Roping for gearless machine installations
7. Drum-type machines
 - a) dumb waiters
 - b) freight elevators w/o counter weight, max. lift 13 m, max. speed 0.25 m.p.s.

E. Machine Installations

1. Geared machines in machine above installation
2. Gearless machines in machine above installation
3. Machine below installation

G. Inspection and Maintenance

1. Geared machines
2. Gearless machines
3. Drum machines

Unit 2:**ACCESSORIES AND INSTALLATION****A. Deflector Sheaves**

1. General
2. Deflector sheaves turning on their shafts
3. Installing deflector sheaves
4. Inspection and maintenance

B. Secondary Sheaves

1. General information
2. Installations of secondary sheaves turning on their shafts
3. Maintenance of secondary sheaves

C. Governors

1. Purpose of governors
2. Types of governors
3. Centrifugal type of governors
4. Flyball type governors
5. Installation of governors
6. Inspection and maintenance of governors

D. Selectors

1. General
2. Type of selectors
3. Tape-driven selectors
4. Motor-driven selectors
5. Installation of selectors
6. Inspection and maintenance

TOPIC**COURSE OBJECTIVES****E. Controllers**

1. General information
2. Installation of controllers
3. Inspection and maintenance

F. Motor-Generator Sets

1. General information
2. Installation of the motor-generator set
3. Inspection and maintenance

G. Group Supervisory (Dispatch) Panel

1. General information
2. Installation of supervisory panel
3. Inspection and maintenance

Module 7:**CAR AND COUNTERWEIGHT****Unit 1:****ASSEMBLY****A. Introduction to Elevator Cars**

1. Definition of elevator
2. Passenger elevator
3. Freight elevators
4. Dumbwaiters

B. Basic Components of Cars

1. Introduction
2. Safety plank
3. Safeties
4. Instantaneous safety (type-A)
5. Wedge-clamp safety (type-B)
6. Flexible guide clamp safety
7. Type "C" safety (type "A" with oil buffers)
8. Safety operated switch
9. Nameplate with safety data
10. Additional equipment
11. Stiles
12. Crosshead
13. Guide shoes
14. Governor ropes
15. Data plate
16. Car door support arms and rail lubricators
17. Terminal motion switch

TOPIC**COURSE OBJECTIVES**

18. Levelling switches
19. Top-of-car inspection controls
20. Load weighing device
21. Additional equipment attached to the crosshead
22. Types of car platforms
23. Auxiliary parts
24. Car enclosures
 - a) passenger
 - b) freight

C. Car Construction and Assembly

1. General information
2. Isolation
3. Sequence of assembly
4. Safety equipment and procedure
5. Car sling assembly
6. Installation of car platforms
7. Assembly of car enclosures
 - a) passenger
 - b) freight

D. Car Floors

1. Introduction
2. Preparation of subfloors
3. Laying resilient tile and sheet flooring
4. Wood and metal floors

E. Car Counterweights

1. Introduction
2. Types of counterweights
3. Assembly procedure
4. Maintenance

Unit 2:**ELEVATORS ROPE AND ROPING****A. Introduction to Elevator Ropes**

1. Importance of elevator rope
2. Rope materials
3. Methods of manufacturing rope
4. Construction of ropes
 - a) Regular
 - b) Warrington
 - c) Seale
 - d) Tiller rope
5. Rope lay
6. Preformed rope

TOPIC**COURSE OBJECTIVES**

7. Rope diameter
8. Hoist ropes
9. Compensating rope
10. Governor ropes
11. Hand control ropes
12. Safety ropes
13. Drum and counterweight ropes
14. Proper handling of ropes
15. Unreeling wire rope
16. Uncoiling wire rope
17. Seizing for ends of wire rope
18. Socketing
19. Rope tension
20. Methods of testing rope tension
21. Adjusting tension
22. Lubrication
23. Maintenance
24. Wire rope inspection
25. New-rope data

B. Methods of Roping

1. Overhead machines
2. One-to-one and two-to-one roping
3. Basement machines
4. Installing single-wrap roping
5. Installing double-wrap roping

C. Governor Ropes

1. Introduction
2. Installation of governor ropes

D. Compensating

1. The purpose of compensation
2. Compensating chains
3. Compensating ropes
4. Installing compensating ropes
5. Installing compensating chains

E. Reroping

1. Preliminary procedure
2. Pulling in new rope

MODULE 8:BASIC ELECTRICITY 60 HOURS

Upon completion, the improver shall know the fundamentals of basic electricity and how it is applied to the Elevator industry.

Unit 1: REVIEW OF BASIC ELECTRICAL FUNDAMENTALS

A. Review of Basic Electrical Fundamentals

TOPIC**COURSE OBJECTIVES**

1. Introduction
2. Atomic structure
3. Energy and temperature
4. First rule of electricity
5. Electrical charges in motion
6. Conventional current flow
7. AC and DC
8. Measurement
9. The ampere
10. The coulomb
11. Voltage or difference of potential
12. Current, voltage resistance relationship
13. Power

Unit 2:**SERIES AND PARALLEL DC RESISTIVE CIRCUITS****A. Series DC Circuits**

1. Introduction
2. The series circuit
3. Rules for series circuit
4. Example series circuit problem
5. Kirchoff's law

B. Parallel DC circuits

1. The parallel circuit
2. Rules for parallel circuits
3. Series - parallel circuit combinations

Unit 3:**RESISTORS AND POTENTIOMETERS****A. Resistors**

1. Introduction
2. Effect of temperature
3. Fixed resistors
4. Adjustable resistors
5. Power rating
6. Carbon resistors
7. Tolerance
8. Colour code
9. Special types
10. Variable resistors

B. Potentiometers

TOPIC**COURSE OBJECTIVES**

1. Various types

Unit 4:**FUNDAMENTALS OF MAGNETISM****A. Magnetism**

1. Introduction
2. Theory of magnetism
3. Magnetic fields in magnets
4. Electromagnetism
5. Applications of DC electromagnetism
6. DC electric motors

Unit 5:**DC MOTORS AND GENERATOR****A. DC Motors and Generators**

1. Motor action
2. Commutator
3. Terms
4. DC generators
5. Motor types
6. Interpoles
7. Starters
8. Motor-generators

Unit 6:**ALTERNATING CURRENT THEORY****A. AC Theory**

1. Alternating current
2. The sine wave
3. Generation
4. AC terms
5. Effective values
6. Ohm's law

Unit 7:**THREE-PHASE AC THEORY****A. 3 Phase AC**

1. Single-phase AC
2. Three-phase generation
3. Power transmission
4. Wye and delta connections
5. Single-phase and three-phase distribution

Unit 8:**AC MOTORS****A. AC Motors**

1. Review of DC motors

TOPIC**COURSE OBJECTIVES**

2. Motor action
3. The rotating field
4. Armature rotation
5. Simple AC motors
6. Induction motors
7. Basic synchronous motors
8. Universal or AC series motors
9. Three-phase AC motors

Unit 9:**TRANSFORMERS****A. Transformers**

1. Moving magnetic fields
2. Air-core transformers
3. Iron-core transformers
4. Transformer voltages
5. Transformer currents
6. Practical transformers
7. Transformer connections
8. Autotransformers

Unit 10:**SWITCHES****A. Switches**

1. The basic switch
2. Switch notation
3. Contacts and contact ratings
4. Push button switches
5. Toggle switches
6. Rotary switches
7. Sensitive switches
8. Limit switches

Unit 11:**TEST EQUIPMENT****A. Test Equipment**

1. Basic principles
2. The DC instrument
3. Damping the meter movement
4. Current measurement
5. Voltage measurement
6. Alternating current measurement
7. Resistance measurement
8. Volt-ohmmeters
9. Care of instruments
10. Test equipment precautions

Unit 12:**ELECTRICAL SAFETY****A. Electrical Safety**

TOPIC**COURSE OBJECTIVES**

1. Electricity can kill you
2. Effect on the heart
3. Let-go current
4. High voltage
5. How electrical accidents happen
6. Defective equipment
7. Safe tools
8. How to be safe

B. Protective Devices

1. Fuses and circuit breakers
2. Electrical interlocks
3. Reverse-phase relays
4. Warning indicators
5. First aid
6. A responsibility

**MODULE 9:INTRODUCTION TO ELECTRONICS AND SOLID STATE 80 HOURS
(OPTIONAL) UPGRADING COURSE**

This course shall explain some of the effects, uses and devices of electronics with the emphasis on tubes and solid state devices used in the Elevator industry.

Unit 1:**INDUCTION****A. Inductance**

1. Introduction
2. Basic theory
3. Induction in DC circuits
4. Effects on coil operation
5. Induced voltage
6. Relay arcing and protection
7. Values and timing
8. Inductance in AC units
9. Reactance
 - a) current, voltage relationships
 - b) controlling factors

Unit 2:**CAPACITANCE****A. Capacitance**

1. Introduction
2. Basic theory
3. Capacitance unit
4. Charging and arc suppression

TOPIC**COURSE OBJECTIVES**

5. AC circuits
6. Reactance
7. Types
8. Troubleshooting

Unit 3:**IMPEDANCE****A. Impedance**

1. Introduction
2. Inductive reactance
3. Series R.L. circuits
4. Capacitive reactance
5. R.L. constants
 - a) charge
 - b) discharge
6. R.C. time constants

Unit 4:**RESONANCE****A. Resonance**

1. L.C. circuits
2. Forced resonance

Unit 5:**THEORY AND APPLICATION OF ELECTRON TUBES****A. Electron Tubes**

1. Construction
2. Diodes
 - a) operation
 - b) application
3. Triodes
4. Amplifiers
5. Biasing
6. Pentodes
7. Cold cathode

Unit 6:**RECTIFIERS****A. Rectifiers**

1. Half wave
2. Full wave
3. Bridge
4. Application

Unit 7:

THREE PHASE RECTIFIERS

A. Three Phase Rectifiers

1. Half wave
2. Full wave

Unit 8:

FILTERS

A. Filters

1. Capacitor
2. Full wave rectifier
3. Additional filtering

Unit 9:

THYRATRONS AND VOLTAGE REGULATED TUBES

A. Thyatron Tubes

1. Operation
2. Theory
3. Grid
4. Plate circuit
5. Motor control

B. V.R. Tubes

1. Operation

Unit 10:

PHOTOTUBES

A. Phototubes

1. Theory
2. Circuits
3. Load resistors
4. Relay circuits
5. Door applications

Unit 11:

SEMICONDUCTOR DIODES

A. Current Electron Flow

1. P.N. junction
2. Semi conductors
 - a) characteristics
 - b) applications

Unit 12:

FUNDAMENTALS OF TRANSISTORS

A. Transistors

1. Amplifiers
2. Circuits
3. Devices

Unit 13:

SILICON CONTROLLED RECTIFIERS

A. S.C.R.'s

1. Principles
2. Applications
3. Trigger circuits
4. Control of AC devices
5. Elevator circuits

Unit 14:

NUMBER SYSTEMS AND COUNTING

A. Systems

1. Binary
2. Decimal
3. Other

B. Elevator Applications

Unit 15:

GATES

A. Gates

1. Introduction
2. Types
3. Combinations
4. Positive and negative logic
5. Truth tables

Unit 16:

MEMORY ELEMENTS

A. Memory

1. Introduction
2. Memory elements
3. Types

Unit 17:

OPERATIONAL AMPLIFIERS

A. Amplifiers

1. Introduction
2. Input and feedback current
3. Inverting amplifiers
4. Noninverting amplifiers

MODULE 10: CIRCUIT TRACING 20 HOURS

This course will show, discuss and explain elevator electrical circuits from the simple AC circuits to the more complex AC - DC circuits that pertain to the operation and control of an elevator.

Unit 1: BASIC INTRODUCTION

A. Introduction

1. Evolution of the electric elevator
2. Purpose and scope
3. Safety
4. Circuit tracing defined
5. Main line switch
6. Fuses
7. Grounding
8. AC motors
9. Elevator control panel
10. Basic magnetic switch
11. The elevator brake

Unit 2: CONSTANT PRESSURE PUSH BUTTON CONTROL

A. Introduction

1. The constant pressure push button
2. Constant pressure elevator push button operation
3. Direction reverse circuit
4. Directional limits
5. The basic safety circuit-final limits
6. Emergency stop button
7. Door and gate contacts
8. Motor overload protection
9. Reverse phase relay

Unit 3: SINGLE AUTOMATIC PUSH BUTTON CONTROL

A. Introduction

1. Transformers
2. Development of automatic circuits
3. Self-holding relay circuit
4. Hall button operation
5. AC timers
6. Interlocks and retiring cam

Unit 4: COLLECTIVE CONTROL

A. Introduction

1. Rectifiers
2. DC capacitor timer
3. The DC brake

TOPIC**COURSE OBJECTIVES**

4. Selector
5. Collective elevator-mechanical selector
6. Collective elevator-electrical selector
7. Door operators
8. Collective elevator control

Unit 5:**SELECTIVE/COLLECTIVE CONTROL****A. Introduction**

1. Hall button circuits
2. Alert-to-stop circuits
3. Normal stopping circuits
4. Stopping in a reverse direction
5. Selective/collective control using mechanically driven selector
6. High call reversal with hook switch contact
7. The set/reset relay
8. DC door operators
9. Selective/collective final wiring diagram
10. Troubleshooting

MODULE 11:CONSTRUCTION WIRING 20 HOURS

This module will detail all the electrical work done by the Elevator Constructor on an elevator installation. This includes the installation of all conduit, duct, fittings, operating and signalling fixtures, wiring and connections between the different components of an elevator.

Unit 1:**PLANNING, PIPING AND WIRING****A. Introduction**

1. Familiarisation with the job
2. Materials
3. Conduit
4. Fittings
5. Making a wiring schedule
6. Determining wire size
7. Making a pull sheet from a field drawing
8. Colour scheme sheet for travelling cables
9. Making a pull sheet from a straight line wiring diagram

Unit 2:**PIPING MACHINE ROOM AND HOISTWAY****A. Introduction**

1. Basic tools
2. Safety
3. Hand tools

TOPIC**COURSE OBJECTIVES**

4. Installing hoistway raceway, switches and fixtures
5. Hoistway riser installation
6. Bending pipe
7. Machine room raceway installation
8. Grounding and bonding
9. Wiring hazardous locations

Unit 3:**TRAVELLING CABLE****A. Introduction**

1. The travelling cable
2. Stripping the cables
3. Supporting the cables
4. Hanging the cables
5. Protecting the travelling cable

Unit 4:**PULLING AND CONNECTING HOISTWAY AND MACHINE ROOM WIRING****A. Introduction**

1. Wiring tools and materials
2. Marking wires
3. Pulling the hoistway wires
4. Use of a drag line
5. Using a running car
6. Pulling and connecting machine room wires
7. Connecting the machine room and hoistway wiring

Unit 5:**PIPING AND WIRING THE CAR****A. Introduction**

1. Locating the car equipment
2. Car junction box
3. Installing the car riser and duct
4. Piping fixtures and switches
5. Pulling wires for the car
6. Connecting the car wiring
7. Wiring for multi-car high rise installations
8. Lobby-panels
9. Position indicators
10. Special signals
11. Switches to be wired

Unit 6: STARTING UP, AC AND DC

A. Introduction

1. Safety checklist
2. Methods of starting induction motors
3. Starting up AC
4. Starting up DC
5. Generator start circuit
6. Drive motor operation

MODULE 12:DOORS AND OPERATORS20 HOURS

This module will explain the installation of elevator hoistway entrances and doors, including car doors and operators and the principles of operations of various types of door operators.

Unit 1: FIRST STEPS IN INSTALLATION

A. Introduction

1. Passenger elevator hoistway entrances
 - a) single speed side opening
 - b) two speed side opening
 - c) single speed centre opening
 - d) two speed centre opening
 - e) three speed opening
 - f) single swing
 - g) double swing
2. Driving motor for passenger door operators
3. Freight elevator hoistway entrances (vertical bi-parting doors)
4. Dumbwaiter units
5. First steps in installation
6. Hoistway entrance materials
7. Hardware and tools
8. Variations in high rise installations
9. Installing entrances for banks of elevators
10. Building a template

Unit 2: PASSENGER ELEVATOR DOOR AND OPERATOR INSTALLATION

A. Introduction

1. Single speed side sliding door installation
2. Setting sill support brackets
3. Installing the sill
4. Installation of the frame
5. Installation of the struts and header

TOPIC**COURSE OBJECTIVES**

6. Plumbing the entrance unit
7. Installation of handling boxes
8. Hanging doors
9. Installing door closures
10. Installing interlocks
11. Car entrance assembly
12. Assembling the elevator cab
13. Hanging the car door
14. Clutch or vane installation
15. Car door operator
16. Door protection devices
17. Adjustment of interlocks, door driving devices
18. Facias, toe guards and dust covers
19. Installing hanger covers
20. Two-speed side sliding doors
21. Single speed centre opening doors
22. Two speed centre opening doors
23. Swing type doors

Unit 3:**FREIGHT ELEVATOR DOORS AND GATES****A. Introduction**

1. Frames and sills
2. Vertical bi-parting freight doors
3. Classification of bi-parting doors
4. Materials required
5. Location of door guide rails
6. Door guide rail installation
7. Installation of door panels
8. Installation of latches and interlocks
9. Car gate installation
10. Retiring cam
11. Power operation of freight doors
12. Individually motorised doors
13. Master control
14. Finishing up
15. Servicing power installations

Unit 4:**DUMBWAITER DOORS AND ENTRANCES****A. Introduction**

1. Types of dumbwaiter units
2. Distribution of materials

TOPIC**COURSE OBJECTIVES**

3. Determining proper location
4. Interlocks
5. Car gates
6. Cams
7. Power operated dumbwaiter doors
8. Car gate operator

MODULE 13:HYDRAULICS 20 HOURS

This module will define a hydraulic elevator, explain its operation and the installation of components of a hydraulic elevator.

Unit 1: DRILLING AND CASING THE JACK HOLE**A. Installation**

1. First use of hydraulic elevators
2. Comparison of oil hydraulic and traction elevators
3. Safety
4. Installation procedure
5. Digging the jack hole
6. Percussion drilling
7. Core drilling
8. Auger drilling
9. Summary of drilling
10. Casing the jack hole

Unit 2: INSTALLING THE JACK**A. Installation**

1. Receiving and storing materials
2. Check accuracy of
 - a) hole
 - b) elevator travel
 - c) jack length
3. Installation of guide rails and brackets
4. Basic parts of jack
5. Unpacking and handling jacks
6. Rigging and hoisting the jack
7. Handling a multi-section jack
8. Plumbing the jack
9. Backfilling the casing
10. Plunger assembly

Unit 3: INSTALLING AND PIPING THE POWER UNIT**A. Installation**

TOPIC**COURSE OBJECTIVES**

1. Power unit installation
2. Oil line
3. Cutting and threading pipe
4. Pipe line accessory items
5. Filling the system with oil

Unit 4:**CAR SLINGS, ENTRANCES AND DOORS, HOISTWAY WIRING****A. Installation**

1. Car slings and platform installation
2. Temporary operation
3. Installing entrances and doors
4. Hanging door panels
5. Wiring the hoistway
6. Making a wiring schedule (pull sheet)
7. Pulling the hoistway wires

Unit 5:**CAR ENCLOSURE, OPERATION, BASIC HYDRAULIC THEORY****A. Basic Hydraulic Theory**

1. Car enclosure
 - a) sill
 - b) canopy
2. Car panels
3. Car operating station
4. Doorheader, hangers and door panels
5. Car door operator
6. Door clutch
7. Safety edge
8. Car top selector
9. Levelling switch
10. Car wiring
11. Floor Covering
12. Hydraulic theory
13. Effect of flow
14. The effect of friction
15. Basic operation
16. Adjusting car operation
17. Adjusting control valves
18. Clean-up acceptance

MODULE 14: ESCALATORS..... 20 HOURS

This module examines the components of an escalator and the installation of these components.

Unit 1: INTRODUCTION AND INSTALLATION**A. Introduction**

1. Components
 - a) truss
 - b) drip pan
 - c) upper drive
 - d) lower carriage
 - e) tracks
 - f) machine
 - g) drive unit
 - h) controller
 - i) steps
 - j) step chain
 - k) link guide roller
 - l) step rollers
 - m) comb plate
 - n) floor plate
 - o) balustrades
 - p) skirt boards
 - q) side panels
 - r) newel wheels
 - s) hand rail
2. Tools required for installation
3. Safety
4. The layout drawing
5. Checking wellway dimensions
6. Checking measurements
7. Arrangements for unloading materials
8. Material handling
9. Moving materials in an existing building
10. Unloading
11. Moving material into a new construction job site
12. Material storage
13. Assembly sequence
14. The truss member
 - a) various escalator trusses
 - b) connecting tubular stress sections
 - c) assembly of the angle truss
 - d) assembly of the square tube/angle truss
 - e) assembly of the modular angle truss
 - f) assembly of the three-piece truss
 - g) assembly of the two-piece truss
 - h) hoisting the truss

Unit 2:

ESCALATOR ASSEMBLY: TRUSS ALIGNMENT TO TRACK SYSTEM

A. Introduction

1. Truss alignment
 - a) centre line
 - b) working angles
2. Worklines
3. Alignment of modular truss
4. Fastening the truss to the building
5. Upper drive sprocket assembly
6. Installing the upper drive sprocket
7. Installing the lower tension carriage
8. Machine (power drive unit)
9. Setting the machine
10. Preliminary machine room work
11. Governor
12. Nonreversing switch
 - a) modular speed switch
13. Controller
14. Conduit and field wiring
15. Track system
 - a) upper track
 - b) middle track
 - c) lower track
 - d) modular track system

Unit 3:

ESCALATOR ASSEMBLY: NEWELS TO COMPLETED UNIT

A. Installation

1. Newels
2. Deck brackets
3. Handrail tension device
4. Step chains
5. Lubrication
6. Wiring
7. Steps
8. Floor plates, comb plates and access door
9. Installing the floor plate assembly
10. Handrails
11. Skirt boards
12. Handrail guards
13. Wedge guards
14. Adjusting
 - a) adjusting and safety
 - b) adjusting procedures
15. Interior panels
16. Moulding (trim)

Unit 4: GLASS BALUSTRADES AND WALKS (RAMPS)

A. Ramps

1. Glass balustrade escalators
2. Moving walks (ramps)
3. Installations

MODULE 15: THIS MODULE IS RESERVED FOR FUTURE DEVELOPMENT

MODULE 16: SOLID STATE (OPTIONAL UPGRADING COURSE)..... 28 HOURS

This is an upgraded course available to journeyman. It is a review of electronics and introduces microprocessors and computers in the elevator industry.

Unit 1: PRINTED CIRCUIT BOARDS

A. Circuit Boards

1. Introduction
2. Definition of
3. Types
 - a) single sided
 - b) double sided
 - c) multi layered
4. Connections
5. Care and handling
6. Soldering techniques
7. Removing components

Unit 2: DIODES

A. Diodes

1. Definition
2. Types
 - a) Zener
 - b) light emitting
3. Applications
4. Troubleshooting
5. Replacement

Unit 3: TRANSISTORS AND THYRISTORS

A. Transistors

1. Definition
2. Types – Transistors
 - a) PNP
 - b) NPN
3. Transistor switches

TOPIC**COURSE OBJECTIVES**

4. Transistor amplifiers
5. Identifying leads
6. Testing
7. Replacement

B. Thyristors

1. Types of thyristors
 - a) SCR
 - b) TRIAC
2. SCR's
3. TRIACS
4. Troubleshooting
5. Replacement

Unit 4:**OPERATIONAL AMPLIFIER****A. Amplifier**

1. Definition
2. Inverting OP amplifier
3. OP amps with feedback
4. Troubleshooting and replacement

Unit 5:**NUMBER SYSTEMS AND COUNTING****A. Introduction**

1. Number system and types
 - a) decimal
 - b) binary
2. Conversion techniques
 - a) decimal to binary
 - b) binary to decimal
3. Encoding
4. Binary coded decimal code
5. Octal and hexadecimal systems

Unit 6:**GATES****A. Introduction**

1. Digital circuit
2. Gates
3. Types of gates
4. Combining gates
5. Logic gate specifications

Unit 7:**MICROPROCESSORS/MICROCOMPUTERS****A. Introduction**

1. Early mechanical counting machines

TOPIC**COURSE OBJECTIVES**

2. The electronic age
3. Microcomputers and how they operate
4. Microcomputers-software, program and hardware
5. Central processing unit
6. Memory structures and types

MODULE 17: ELEVATOR ROPE REPLACEMENT..... 10 HOURS

This module deals with the care and condition of wire rope and the methods for replacement of wire ropes and chains.

Unit 1: APPLICATIONS AND CARE OF WIRE ROPES**A. Updating**

1. Wire rope materials
2. Rope constructions
3. Types of rope lay
4. Applications
 - a) hoist
 - b) compensating
 - c) governor
 - d) hand control
 - e) safety
5. Inspection
6. Rope tension and equalising
7. Lubrication
8. Sheave groove wear
9. Handling and storage

Unit 2: PREPARATION FOR REROPING**A. Updating**

1. Planning and preparation
2. Safety
3. Handling
4. Seizing
5. Rope stretch allowance
6. Marrying ropes
7. Socketing
8. Tagging

Unit 3: REROPING PROCEDURES**A. Updating**

1. General procedure
2. Safety practices

TOPIC**COURSE OBJECTIVES**

3. Methods of roping
 - a) single or double wrap machines
 - b) basement machines
4. Replacement
 - a) governor
 - b) wedge clamp safety
 - c) overhead machines 1:1 and 2:1
 - d) basement machines 1:1 and 2:1
 - e) compensating
 - f) winding drum machines 1:1 and 3:1
5. Shortening

MODULE 18: ROTATING DC GENERATORS AND MOTORS (OPTIONAL UPGRADING) 20 HOURS

This module details the components of DC generators and motors and the proper care and servicing of same.

Unit 1:**DC MOTORS AND GENERATORS****A. Introduction**

1. Characteristics of generators, motors
2. Basic principles
 - a) magnetism
 - b) electromagnetism
 - c) induction
3. Generator
4. Commutation
5. Increasing the voltage
6. Left hand rule for generators
7. DC motor
8. Poles and current
9. Right hand rule for motors
10. Lenz's law
11. Armature reaction

Unit 2:**COMPONENTS OF ROTATING DC GENERATORS AND MOTORS****A. Components**

1. Frame
2. Poles
3. Field windings and types
4. End bells
5. Brush holders
6. Armature
7. Armature core and windings
8. Commutator
9. Brushes

TOPIC**COURSE OBJECTIVES**

- 10. Bearings
 - 1. Cooling
 - 2. Balance
- B. Care of**
- Unit 3: TYPES AND APPLICATIONS OF ROTATING DC GENERATORS AND MOTORS**
- A. Types**
- 1. Self-excited DC generator
 - 2. Separately-excited generator
 - 3. Series generator
 - 4. Series motor
 - 5. Shunt motor
 - 6. Compound generator
 - 7. Compound motor
- B. Applications and Safety Precautions**
- 1. Changing motor speed
 - 2. Reversing direction
 - 3. DC hoist motor control
 - 4. Circulating current and suicide circuit
 - 5. Multi-speed generators and regulators
 - 6. Exciters
 - 7. Small DC motors
- Unit 4: SERVICING ROTATING DC GENERATORS AND MOTORS**
- A. Testing**
- 1. Safety precautions
 - 2. Cleaning and lubrication
 - 3. Commutators and brushes
 - 4. Commutator problems and repairs
 - 5. DC equipment maintenance and troubleshooting
 - 6. Testing armatures
 - 7. Testing fields
 - 8. Generator and motor protection



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