

Elevator Constructor
Industry Training Criteria

O*NET CODE 47-402100

Elevator Constructor Industry Standards Criteria

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1. Length of Training

Program sponsors shall establish a minimum of a four (4) year program of not less than 6,800 hours of on-the-job training.

2. Related Supplemental Instruction

The required prescribed courses of related and supplemental instruction shall be no less than 144 hours per year. This instruction must include at a minimum the related and supplemental training processes listed in Exhibit "A".

3. On-the-Job Training

Skills to be learned. See Exhibit "B".

4. Competency Testing

All apprentices must pass a competency test prior to the time of their classification advancement to the next higher period. The tests shall be based on all Related and Supplemental Instruction and manipulative skills tests based on laboratory assignments.

5. Completion Percentages

Program sponsors must have a 55% graduation rate of all apprentices that satisfactorily complete the program's probationary period.

6. Revisions

The schedule for revisions to the Elevator Constructor Industry training criteria shall be in accordance with Labor Code Section 212.01.

EXHIBIT “A”

Related and Supplemental Instruction Topics

For Elevator Constructor Industry Criteria

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RELATED AND SUPPLEMENTAL INSTRUCTION

| Apprenticeship Courses | | |
|--------------------------------------------------------|----------------------------|-------------------------------------------------------------------------------------------|
| COURSE | UNIT | UNIT TITLE |
| 100 | Trade Skills | 105 Introduction to Safety |
| | | 110 Safety During Construction and Modernization |
| | | 115 Safety During Maintenance and Repairs |
| | | 120 Alcohol and Other Drugs |
| | | 125 Introduction to OSHA |
| | | 126 Hazard Communication |
| | | 127 PPE |
| | | 128 Materials Handling |
| | | 129 Electrical Safety |
| | | 130 Tool Safety |
| | | 131 Fall Protection |
| | | 132 Stairways and Ladders |
| | | 133 Confined Spaces |
| | | 134 Motor Vehicle Safety |
| | | 135 Ergonomics |
| | | 136 Fire Safety |
| | | 137 Scaffold Safety |
| | | 140 Competent Person Training for Framed Scaffolds |
| | | 145 Training Program for Suspended Scaffolds |
| | | 146 Going Green: Relevant Discussions on Green Technology in the Elevator Industry |
| | | 150 Harassment and Discrimination in the Workplace |
| | | 151 Diversity and Success |
| | | 152 Case Studies |
| | | 155 Customer Relations |
| | | 160 Labor History and IUEC History |
| | | 165 Basic Mathematic Concepts |
| 170 Measurement | | |
| 175 Introduction to Installation Drawings | | |
| 180 Detail Drawings and Material Specifications | | |
| | | Total: 72 Hours |
| 200 | Hoistway Structures | 205 Tools and Material Handling |
| | | 210 Rigging and Hoisting |
| | | 212 Crosby Fasteners (CD-ROM) |

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|------------|--------------------------------------------|------------|--------------------------------------------------------------------------------------------------|
| | | 215 | Pit Structures |
| | | 220 | Introduction to Guide Rails |
| | | 225 | Installation of Guide Rails |
| | | 230 | Machine and Sheave Installation a. Machine room-less elevators (MRL) |
| | | 235 | Elevator Control Equipment Installation |
| | | 240 | Car and Counterweight Assembly and Roping |
| | | 245 | Elevator Rope and Roping |
| | | 250 | Reroping |
| | | 255 | Elevator Cab Modernization, Refinishing and Floor Covering |
| | | | |
| | | | Total: 72 Hours |
| 300 | Electrical Fundamentals | 305 | Signed Numbers and Powers of 10 |
| | | 310 | The Metric System |
| | | 315 | Equations and Formulas |
| | | 320 | Ratio and Proportion |
| | | 325 | Electrical Safety |
| | | 330 | Basic Electricity Introduction |
| | | 335 | Understanding the Relationship Between Voltage, Current, and Resistance |
| | | 340 | Basic Electrical Circuit Components a. Energy efficient and environmentally friendly lighting |
| | | 345 | Series and Parallel DC Resistive Circuits |
| | | 350 | Alternating Current Theory |
| | | 355 | Magnetism and Electromagnetism |
| | | | |
| 400 | Electrical Theory & Application | 405 | Introduction to Analog and Digital Meters |
| | | 410 | Transformers |
| | | 415 | DC Generator and Motor Theory |
| | | 420 | Components of DC Motors and Generators |
| | | 425 | Types of DC Motors and Generators |
| | | 430 | Maintenance and Service |
| | | 435 | AC Motors |
| | | | |
| 500 | Installation | 505 | Planning, Piping and Wiring |
| | | 510 | Piping and Wiring the Machine Room and Hoistway |
| | | 515 | Piping and Wiring the Car |
| | | 520 | Start-Up Procedures |
| | | 525 | Passenger Elevator Door and Entrance Installation |
| | | 530 | Elevator Cab Assembly and Door Operators |
| | | 535 | Freight Elevator Doors and Gates |
| | | 540 | Freight Door Operators |
| | | 545 | Dumbwaiters |

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|------------|-------------------------------------|------------|-------------------------------------------------------------------------------------------------------------|
| | | 550 | Machine Room Maintenance a. Recycling lubricants |
| | | 555 | Hoistway Maintenance |
| | | 560 | Asbestos Awareness |
| | | | |
| | | | Total: 72 Hours |
| 600 | Solid State | 605 | Mathematics for Ohm's Law |
| | | 610 | Basic Components and Series and Parallel Resistance |
| | | 615 | Magnetism, Electromagnetism, AC Theory and Transformer |
| | | 620 | Capacitors and Capacitance |
| | | 625 | Inductors and Inductance |
| | | 630 | Diodes |
| | | 635 | Transistors and Thyristors |
| | | 640 | Analog Integrated Circuits |
| | | 645 | Digital Integrated Circuits |
| | | 646 | Solid State Student's Lab Manual |
| | | | |
| | | | Total: 72 Hours |
| 700 | Power & Logic | 705 | Introduction to Circuit Tracing |
| | | 710 | Relays and Timers |
| | | 715 | Power and Power Control a. Regenerative and stand-by power conserving systems |
| | | 720 | Logic Controls |
| | | 725 | Constant Pressure Push Button Systems & Single Automatic Push Button Systems |
| | | 730 | Collective Systems |
| | | 740 | Variable Voltage Selective-Collective Control Systems a. Destination dispatching for energy conservation |
| | | | |
| | | | Total: 72 Hours |
| 800 | Advanced Topics in Elevators | 805 | Installing and Servicing the Jack |
| | | 810 | Piping and Temporary Operation |
| | | 815 | Basic Hydraulic Theory |
| | | 820 | Hydraulic Elevator Maintenance a. Waste oil disposal and recycling |
| | | 825 | Escalator Components and Installation Procedures a. Passenger sensing smart drives |
| | | 830 | Moving Walk Components and Installation Procedures |
| | | 835 | Service, Maintenance, and Repair |
| | | 840 | Residential and LULA Elevators |
| | | 845 | Residential and LULA Platform and Chair Lifts |
| | | 850 | Rack and Pinion Hoists |
| | | | |
| | | | Total: 72 Hours |

EXHIBIT “B”

Work Process for

Elevator Constructor Industry Criteria

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WORK PROCESS

A. CONSTRUCTION/MODERNIZATION

1. SAFETY

- Identify job hazards
- What proper safety equipment to wear and use
- Common sense safety around elevators and escalators
- Fundamentals of first aid & MSDS information
- Avoiding electric shock, GFCI's
- Codes that apply to the elevator industry

2. PRINT READING

- Read prints
- Survey the hoistway for new installation and modernization
- Convert to meter equivalents

3. HANDLING MATERIALS & TOOLS: RIGGING & HOISTING

- Safety Procedures
- Properly handle and store elevator/escalator equipment
- Handling, storing, and recycling of hazardous wastes and oils
- Tie and identify knots, bends and hitches
- Safety procedures for hoisting heavy equipment
- Building a safe working platform & scaffolding
- Use all safety devices

4. PIT STRUCTURES

- Safety Procedures
- Introduction to the pit components and their purpose
- Install pit equipment: buffers, compensating sheaves, compensating ropes and chains
- Oil clean-up and disposal procedures
- Testing of pit equipment for proper operation

5. GUIDE RAILS

- Safety Procedures
- Prepare rails and rail runs
- Build templates, drop lines and plumb hoistways of single, multiple or corner post installations
- Install guide rails
- Use a rail gauge and align rails

6. MACHINE ROOM, ESCALATOR & OVERHEAD INSTALLATIONS

- Safety Procedures
- Layout and properly align & set equipment
- Properly align sheaves, tracks and gears

- Offset roping
- Calibrate and test
- Proper inspection and maintenance procedures for the equipment

7. CAR & COUNTERWEIGHT ASSEMBLY & ROPING

- Safety Procedures
- Assemble car and counterweight sling
- Why elevators use counterweights
- Proper handling & storage of wire ropes
- Plan a rope run and learn other methods of installing and reroping

8. WIRING INSTALLATION

- Safety Procedures
- Terminology for various tools and electrical equipment
- Plan and install raceway and conduit
- Bend conduit
- Plan wiring and pulling wires safely and efficiently
- Accurately prepare and install traveling cables
- Bonding and grounding equipment
- Prepare the elevator/escalator for running operation

9. DOOR INSTALLATION

- Safety Procedures
- Proper terminology for doors and relating equipment
- Install car and hoistway entrances and door equipment accurately
- Install & adjust elevator doors, gates for passenger, freight & dumbwaiter

10. HYDRAULICS

- Safety Procedures
- Drill a hole for a hydraulic jack
- Properly install and plumb the casing & jack with specific tools
- Layout a pipe run and connections to power unit and jack
- Hydraulic theory and valve operation
- Adjust the valves for proper operation
- Troubleshoot and isolate system problems

B. SERVICE/REPAIR/MODERNIZATION/CONSTRUCTION

1. BASIC WIRING/ELECTRICITY

- Procedures for working safely with electricity
- Principle on which all electrical concepts are based
- What is electricity and where does it come from?
- Selecting environmentally friendly replacement components

2. SOLID STATE ELECTRONICS/RELAY LOGIC

- Safety Procedures
- Terminology and safety equipment used on electronic devices
- Binary & hexadecimal systems are related to digital circuitry
- Capacitors and capacitance are used on elevator equipment
- Inductance and inductors are used in circuits
- How a semi-conductor works
- Diode, zener diodes, photodiodes and light emitting diodes

- Understanding transistors and how they operate
- How SCR's are operated and used in elevator circuits
- Various digital gates and their function
- The functions of integrated power supplies
- Different configurations and uses of the Op Amp
- Relay logic
- Stand-by power controls
- Destination dispatching controls

3. CIRCUIT TRACING/RELAY LOGIC

- Safety Procedures
- Read a wiring diagram symbol and apply it to the equipment on the job
- Sequence of operation of individual circuits such as starting, stopping car and hall call cancellation and direction selection
- Troubleshoot particular circuits that are malfunctioning
- Locate and repair electrical problems such as ground, opens, defective contacts and coils
- Troubleshoot electrical problems with confidence

C. GENERAL REPAIR/MODERNIZATION 1000 hrs

1. REROPING, RECABLING

- Safety Procedures
- Inspecting for defective rope, selector tape & cable
- Staging and routing ropes, tapes & cables
- Shackling and socketing
- Disposal of old cables

2. DOOR OPERATOR & RELATING EQUIPMENT

- Safety Procedures
- Passenger & freight door, gate repairs and replacements
- Door Operators, repair, replace and adjustments
- Door protective devices and troubleshooting

3. TRAVELING CABLE

- Safety Procedures
- Repair and replacement of traveler in existing hoistways

4. MOTORS, GENERATORS, BEARINGS, SHEAVES, DRIVERS

- Safety Procedures
- Cleaning and lubrication
- Testing and replacing motors, generators, bearings, sheaves and drivers
- Turn and undercut a commutator
- Test shunt and series field coils
- Learn how to check bearings and replace

5. ESCALATORS, MOVING WALKS & SIMILAR EQUIPMENT

- Safety Procedures
- Repair/replace equipment
- Clean and lubricate
- Maintenance on equipment

TOTAL HOURS: 6800 hrs