ADDENDIX A

WORK PROCESS SCHEDULE AND RELATED INSTRUCTION OUTLINE
CURRICULUM

Elevator Constructor Mechanic
Alternative Title: Mechanic

O*NET-SOC CODE: 47-4021.00       RAPIDS CODE: 0173

This occupation specific schedule is attached to and is part of these Apprenticeship Standards for the above listed occupation.

1. **Term of Apprenticeship:**
The term of the occupation shall be four (4) years with an On-the-Job-Learning (OJL) attainment of 6,800 hours, which shall be supplemented by the required hours of instruction.

2. **Ratio of Apprentices to Journeyworkers:**
The ratio of apprentice worker to the skilled journeyworker shall be determined by the local collective bargaining agreement. The ratio of apprentices to journeyworkers will be one (1) apprentice to one (1) journeyworker.

3. **Apprentice Wage Schedule:**
All apprentices shall be paid a progressively increasing schedule of wages and fringe benefits based on a percentage of the current journeyworker rate wage rate or as defined by the local collective bargaining agreement.

   - **Probationary Apprentice,** (0-6 months): 50% of Mechanic's Rate.
   - **First-Year Apprentice,** (upon completion of, and including the hours accrued in, the probationary period through 1700 hours): 55% of Mechanic's Rate, plus fringe benefits as provided by the collective bargaining agreement.
   - **Second-Year Apprentice,** (1700-3400 hours): 65% of Mechanic's Rate, plus fringe benefits as provided by the collective bargaining agreement.
   - **Third-Year Apprentice,** (3400-5100 hours): 70% of Mechanic's Rate, plus fringe benefits as provided by the collective bargaining agreement.
   - **Fourth-Year Apprentice,** (5100-6800 hours): 80% of Mechanic's Rate, plus fringe benefits as provided by the collective bargaining agreement.

4. **Schedule of Work Experience: (See attached Work Process Schedule)**
Each apprentice shall receive instruction and work experience in all aspects of the occupation as listed in the work process schedule, which is attached, and made a part of, these standards. To permit the flexibility necessary to the
sponsor's normal business operation, work process activities need not occur precisely in the order listed, nor do the scheduled hours in any activity need to be continuous. A record of work and training hours under each category of the work process shall be maintained for every apprentice. The JAC may modify or alter the work processes to meet specific local needs prior to submitting these Standards to the appropriate Registration Agency for approval.

5. Schedule of Related Instruction: (See attached Related Instruction Outline)
Each apprentice shall be required to receive at least 144 hours of related instruction (RI) in subjects related to the occupation for each year of training on the job. The apprentice may or may not be compensated for hours spent in RI outside of regular working hours. RI will be provided by NEIEP utilizing various methods of instruction such as traditional classroom (lecture, discussion), electronic media (including, but not limited to: on-line training, distance learning) and practical (hands on) learning. Related instruction will include a mechanism to verify satisfactory understanding (assessment) of the subject matter. Curriculum will be both skill and knowledge based upon accepted industry standards and practices. Each apprentice shall maintain an achievement grade in related instruction of at least 70%, in order to advance to each level of the apprenticeship.
WORK PROCESS SCHEDULE
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APPROXIMATE HOURS

A. CONSTRUCTION/MODERNIZATION 2300 hrs

1. SAFETY
   - Identify job hazards
   - What proper safety equipment to wear and use
   - Common sense safety around elevators and escalators
   - Fundamentals of first aid & Material Safety Data Sheets information
   - Avoiding electric shock, Ground Fault Circuit Interrupter
   - Codes that apply to the elevator industry

2. PRINT READING
   - Read prints
   - Survey the hoist way for new installation and modernization
   - Convert to meter equivalents

3. HANDLING MATERIALS & TOOLS: RIGGING & HOISTING
   - Safety Procedures
   - Properly handle and store elevator/escalator equipment
   - 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
   - Testing of pit equipment for proper operation

5. GUIDE RAILS
   - Safety Procedures
   - Prepare rails and rail runs
   - Build templates, drop lines and plumb hoist ways 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 hoist way 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 3500 hrs

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?

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 Silicone Controlled Rectifiers 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

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

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: 6,800 hrs
Apprenticeship Curriculum

RELATED INSTRUCTION OUTLINE
Elevator Constructor Mechanic
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100 Trade Skills
- Introduction to Safety
- Safety During Construction and Modernization
- Safety During Maintenance and Repairs
- Alcohol and Other Drugs
- Introduction to OSHA
- Hazard Communication
- Personal Protective Equipment
- Materials Handling
- Electrical Safety
- Tool Safety
- Fall Protection
- Stairways and Ladders
- Confined Spaces
- Motor Vehicle Safety
- Ergonomics
- Fire Safety
- Scaffold Safety
- Competent Person Training for Framed Scaffolds
- Training Program for Suspended Scaffolds
- Harassment and Discrimination in the Workplace
- Diversity and Success
- Case Studies
- Customer Relations
- Labor History and IUEC History
- Basic Mathematic Concepts
- Measurement
- Introduction to Installation Drawings
- Detail Drawings and Material Specifications

72 Hours

200 Hoistway Structures
- Tools and Material Handling
- Rigging and Hoisting
- Crosby Fasteners
- Pit Structures
• Introduction to Guide Rails
• Installation of Guide Rails
• Machine and Sheave Installation
• Elevator Control Equipment Installation
• Car and Counterweight Assembly and Roping
• Elevator Rope and Roping
• Reroping
• Elevator Cab Modernization, Refinishing and Floor Covering

300 Electrical Fundamentals
• Signed Numbers and Powers of 10
• The Metric System
• Equations and Formulas
• Ratio and Proportion
• Electrical Safety
• Basic Electricity Introduction
• Understanding the Relationship between Voltage, Current, and Resistance
• Basic Electrical Circuit Components
• Series and Parallel DC Resistive Circuits
• Alternating Current Theory
• Magnetism and Electromagnetism

400 Electrical Theory & Application
• Introduction to Analog and Digital Meters
• Transformers
• DC Generator and Motor Theory
• Components of DC Motors and Generators
• Types of DC Motors and Generators
• Maintenance and Service
• AC Motors

500 Installations
• Planning, Piping and Wiring
• Piping and Wiring the Machine Room and Hoistway
• Piping and Wiring the Car
• Start-up Procedures
• Passenger Elevator Door and Entrance Installation
• Elevator Cab Assembly and Door Operators
• Freight Elevator Doors and Gates
• Freight Door Operators

72 Hours
- Dumbwaiters
- Machine Room Maintenance
- Hoistway Maintenance
- Asbestos Awareness

600 Solid State
- Mathematics for Ohm's Law
- Basic Components and Series and Parallel Resistance
- Magnetism, Electromagnetism, AC Theory and Transformer
- Capacitors and Capacitance
- Inductors and Inductance
- Diodes
- Transistors and Thyristors
- Analog Integrated Circuits
- Digital Integrated Circuits

700 Power and Logic
- Introduction to Circuit Tracing
- Relays and Timers
- Power and Power Control
- Logic Controls
- Constant Pressure Push Button Systems & Single Automatic Push Button Systems
- Collective Systems
- Variable Voltage Selective-Collective Control Systems

800 Advanced Topics in Elevators
- Installing and Servicing the Jack
- Piping and Temporary Operation
- Basic Hydraulic Theory
- Hydraulic Elevator Maintenance
- Escalator Components and Installation Procedures
- Moving Walk Components and Installation Procedures
- Service, Maintenance, and Repair
- Residential and Limited Use Limited Access (LULA) Elevators
- Residential and LULA Platform and Chair Lifts
- Rack and Pinion Hoists

TOTAL: 576 Hours