Electrical Industry Construction Training Criteria

Condensed and Revised
December 12, 2000

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Introduction

The Electrical Industry Training Committee was charged, by the California Apprenticeship Council, with the task of developing uniform minimum training criteria for the Construction Industry's occupation of Electrician.

The Committee has used the CAC's Industry Training Criteria regulation (California Code of Regulations 212.01) as the basis for our work.

This document represents a consensus of a two-thirds majority of the Electrical Industry Training Committee.

At the beginning of our first meeting it was unanimous that the Electrical Industry needed to be divided into two groups. The first is the Commercial and Industrial segment. The second is the Residential segment.

We believe that, based on the data in this document, these are the Knowledge, Skill and Abilities that are required to be successful in a career as a Commercial/Industrial or Residential Construction Electrician. We have also included an outline that can be used as a basis for curriculum development.

The following is our response to the UNIFORM TRAINING CRITERIA OUTLINE issued to us by the California Apprenticeship Council.

- The Length of Training for an COMMERCIAL/INDUSTRIAL Electrical Apprentice shall be a minimum of 8,000 hours OJT and 800 hours of Related and Supplemental Instruction.
- The Length of Training for a RESIDENTIAL Electrical Apprentice shall be a minimum of 4800 hours OJT and 480 hours of Related and Supplemental Instruction.
- The Related and Supplemental Instruction is detailed in the curriculum outlines beginning on pages 6 and 11.
- On-The-Job Work processes are listed beginning on pages 4 and 10.
- Competency Testing is defined as:
    1. A competency exam must be passed prior to advancement to the next step and wage rerate.
    2. A favorable Journeyperson evaluation for OJT must be met prior to the next step in wage rate.
- Apprenticeship Completion percentages:
  The program must have a 75% completion of all apprentices that satisfactorily complete the program's probationary period.
- Procedures for Review and Revision of Training Criteria are:
  There shall be a review once every three years or at the call of the Chairman of the Industry Training Committee if issues arise.

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October 1999

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Commercial Training Criteria

WORK PROCESSES

Planning and Initiating Project

Establishing Temporary Power During Construction

Establishing Grounding System

Installing Service to Buildings and Other Structures

Establishing Power Distribution Within Project

Planning and Installing Raceway Systems

Installing New Wiring and Repairing Old Wiring

Providing Power and Controls to Motors, HVAC, and Other Equipment

Installing Receptacles, Lighting Systems, and Fixtures

Troubleshooting and Repairing Electrical Systems

Installing and Repairing Traffic Signals, Outdoor Lighting, and Outdoor

Power Feeders

Installing Fire Alarm Systems

Supervising ECW and Apprentices

Establishing OSHA and Customer Safety Requirements

Installing Instrumentation and Process Control Systems, Including Energy Management System

Erecting and Assembling Power Generation Equipment

Installing Security Systems

Installing, Maintaining and Repairing Lightning Protection Systems

Installing and Repairing Telephone and Data Systems

Commercial Training Criteria

CURRICULUM

SAFETY

A. General jobsite safety awareness
B. Emergency procedures
C. Compliance with OSHA and EPA regulations
D. Substance abuse

TOOLS, MATERIALS AND HANDLING

A. Proper tool management
B. Proper rigging methods
C. Proper digging techniques
D. Proper use of motorized tools (use of platform lifts, bucket trucks, and truck-mounted cranes)
E. Proper material management

MATH

A. Appropriate mathematical calculations to solve for related problems.

ELECTRICAL THEORY

A. Basic electrical theory
B. Ohm's Law, Kirchotr's Laws, Lenz's Law, Thevenin's and Nortons Therorems
C. Series circuits
D. Parallel circuits
E. Combination circuits
F. Characteristics of voltages in circuits
G. Characteristics of magnetism/electromagnetism
H. Theory of superposition and solving for multiple voltage sources circuits
I. Operation and characteristics of three wire systems
J. Operation and characteristics of three phase systems
K. AC Theory
L. Use of Electronics in the electrical industry.

CODE REQUIREMENTS

National Electrical Code and local codes

CONDUCTORS

A. General
B. Conductor installation techniques
C. Methods for selecting conductors
D. Cable fault situations

CONDUIT, RACEWAYS, PANELBOARDS AND SWITCHBOARDS

A. Terms associated with conduits and raceways
B. Conduit and wiring support systems recognized by Code
C. Procedures for laying out various types of bends
D. Procedures for making bends when fabricating conduits
E. Fabricating raceways and wiring support systems
F. Cable assembly wiring methods recognized by the Code
G. Function, operation and requirements for various panelboards and switch gear

LIGHTING SYSTEMS

A. Function, operations and characteristics of various lighting systems
B. Lighting distribution and layout
C. Installation and connection of fixtures

OVERCURRENT DEVICES

A. Function, operation and characteristics of overcurrent protection devices
B. NEC Requirements for O.C.P.

GROUNDING SYSTEMS

A. Functions, operation and characteristics of grounding systems
B. Sizing, layout and installation of grounding systems
C. Insulation, isolation and elevation
D. Ground, grounding, grounded, and bondied
E. Special circumstances

PRINTS AND SPECIFICATIONS

A. Creation of blueprints, plans, and specifications
B. Use of blueprints, plans, and specifications

MOTORS, MOTOR CONTROLLERS AND PROCESS CONTROLLERS

A. Function, operation and characteristics of various types of motors (AC, DC, dula voltage)
B. Proper techniques for motor installations
C. Motor controllers, control circuits and devices
D. Control Transformer, switches and relays
E. Mechanical connections to utilize motors
F. Process control systems and devices

GENERATORS AND POWER SUPPLIES

A. Principles of generating electricity
B. Types and configurations of uninterruptible power supplies (UPS)
C. Types and configurations of battery systems used for UPS systems

TRANSFORMERS

A. Functions, operation, and characteristics of transformers
B. Selection and installation of transformers
C. Distribution systems

PERSONAL DEVELOPMENT

A. Orientation to organization and structures.
B. Working with others
C. Economic considerations

JOBSITE MANAGEMENT

ELECTRICAL TESTING

A. Steps used for various testing processes
B. Utilizing the results of testing procedures

SPECIALTY SYSTEMS

A. Fire Alarms
B. Security Alarms
C. Voice, Data, TV, Signaling Systems
D. Lightning Protection Systems
E. Fiber Optic Systems
F. Heating, Air Conditioning and Refrigeration

Residential Training Criteria

WORK PROCESSES

Planning and Initiating Project

Establishing Temporary Power During Construction

Establishing Grounding System

Installing Underground System (slab/foundation)

Rough-in

Run Wire

Trim Out

Perform Hot Checks

Troubleshooting and Repairing Electrical Systems

Supervising ERCW and Apprentices

Install Service Extension (utility company)

Establishing OSHA and Customer Safety Requirements

Installing Swimming Pool Equipment

Installing, Maintaining and Repairing Security Systems

Installation of Home Automation/Energy Management Systems

Residential Training Criteria

CURRICULUM

SAFETY

A. General job site safety awareness
B. Emergency procedures
C. Compliance with OSHA and EPA regulations
D. Substance abuse

TOOLS, MATERIALS AND HANDLING

A. Proper tool management
B. Proper rigging methods
C. Proper digging techniques
D. Proper use of motorized tools (use of platform lifts, bucket trucks, and truck-mounted cranes)
E. Proper material management

MATH

A. Appropriate mathematical calculations to solve for unknowns

ELECTRICAL THEORY

A. Basic electrical theory
B. Ohm's Law, Kirchotr's Laws, Lenz's Law, Thevenin's and Nortons Theorems
C. Series circuits
D. Parallel circuits
E. Combination circuits
F. Characteristics of voltages in circuits
G. Characteristics of magnetism/electromagnetism
H. Theory of superposition and solving for multiple voltage sources circuits
I. Operation and characteristics of three wire systems
J. Operation and characteristics of three phase systems
K. AC Theory
L. Use of electronics

CODE REQUIREMENTS

A. National Electrical Code and local codes

CONDUCTORS

A. Various types of conductors
B. Conductor installation techniques
C. Methods for selecting conductors
D. Cable fault situations

CONDUIT, RACEWAYS, PANELBOARDS AND SWITCHBOARDS

A. Terms associated with conduits and raceways
B. Conduit and wiring support systems recognized by Code
C. Procedure for laying out various types of bends
D. Procedures for making bends when fabricating conduits
E. Fabricating raceways and wiring support systems
F. Cable assembly wiring methods recognized by the Code
G. Function, operation and requirements for various panelboards and switch gear

LIGHTING SYSTEMS

A. Functions, operation and characteristics of various lighting systems
B. Lighting distribution and layout
C. Installation and connection of fixtures

OVERCURRENT DEVICES

A. Function, operation and characteristics of overcurrent protection devices

GROUNDING SYSTEMS

A. Functions, operation and characteristics of grounding systems
B. Sizing, layout and installation of grounding systems
C. Difference between insulation, isolation and elevation
D. Difference between grounding, grounded, and bonding
E. Special circumstances

PRINTS AND SPECIFICATIONS

A. Creation of blueprints, plans, and specifications
B. Symbols used in electrical and related trades
C. Use of blueprints, plans, and specifications

MOTORS, MOTOR CONTROLLERS AND PROCESS CONTROLLERS

A. Function, operation and characteristics of various types of motors (AC, DC, dual voltage, repulsion, universal, 3 phase, squirrel cage, synchronous)
B. Proper techniques for motor installations
C. Functions, operations and characteristics of motor controllers, circuits and devices
D. Functions. operation and characteristics of switches and relays
E. Mechanical connections to utilize motors
F. Process control systems and devices

GENERATORS AND POWER SUPPLIES

A. Principles of electromotive force
B. Principles of generating electricity
C. Types and configurations of uninterruptible power supplies (UPS)
D. Types and configurations of battery systems used for UPS systems

TRANSFORMERS

A. Function, operation, and characteristics of transformers
B. Selection and installation of transformers
C. Distribution systems

PERSONAL DEVELOPMENT

A. Orientation
B. Methods of working with others
C. Economic considerations

JOBSITE MANAGEMENT

A. Coordinating tool needs with office of other jobs
B. Coordinating schedule with other crafts
C. Developing timetables and progress charts
D. Completing time sheets, logs and other necessary documentation
E. Clearances or permits if necessary
F. Inventory and order necessary equipment according to job needs
G. Developing alternative solutions and choose the best alternative
H. Planning and organizing tasks to meet deadlines
I. Supervising and monitoring others
J. Picturing the way the project will appear when completed

TESTING

A. Steps used for various testing processes
B. Utilizing the results of testing procedures

SPECIALTY SYSTEMS

A. Fire Alarms
B. Security Alarms
C. Voice, Data, TV, and Signaling Systems
D. Lightning Protection Systems
E. Fiber Optic Systems
F. Heating, Air Conditioning and Refrigeration

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Dear Bryan:

At the May 3, 1996 quarterly meeting of the California Statewide Electrical Workers JATC a motion was unanimously passed to adopt the Electrical Construction Occupations Handbook-Volume One, Electrical Construction Worker. This book is a product of the United States Electrical Construction Industry Skill Standards and Certification Project dated November, 1995. The motion is also to present to the Calif. Dept. of Apprenticeship Standards for adoption Statewide as the Standard for the Electrical Construction Industry.

Would you please present this to the appropriate individuals for consideration and adoption as State Standards for Construction Electrical Apprenticeship.

Thanks,

Jim Westfall

7/9/96

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October 11, 1999

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