



**COMMERCIAL/INDUSTRIAL
ELECTRICAL INDUSTRY
CONSTRUCTION TRAINING
CRITERIA**

0*NET CODE 47-2111.00

**Revised
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INTRODUCTION

The Electrical Industry Training Committee is appointed by the California Apprenticeship Council (CAC) with the assigned task of scheduled and periodic reviews of the uniform Minimum Industry Training Criteria for the occupation of Commercial/Industrial Electrician. During this review process, the Committee's responsibility is to recommend updates and revisions to the CAC. This will insure the minimum training criteria for all Electrical Apprenticeships within California are current and relevant to the Electrical Construction Industry. We believe this document contains the current knowledge, skills, and abilities required to be successful in a career as a Commercial/Industrial Construction Electrician.

LENGTH OF TRAINING

Program sponsors shall establish a minimum of a four (4) year program of not less than 8,000 hours of on-the-job training and 720 hours of classroom instruction both of which are further detailed below.

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".

ON-THE-JOB TRAINING

On-the-Job Hands-on Skill Training shall be as continuous as possible throughout the program and shall be no less than 8,000 hours. This training must include, at a minimum, the processes listed in Exhibit "B".

COMPETENCY TESTING

All apprentices must prove a satisfactory competency of prior skills and knowledge at the time of their advancement to the next higher level. The tests shall be based on all Related and Supplemental Instruction and hands-on manipulative skills. Periodic testing shall be done during each level of coursework and apprentices shall not advance to the next level unless they have achieved an average total score of 70% or higher.

COMPLETION PERCENTAGES

Program sponsors must have a 65% graduation rate of all apprentices who satisfactorily complete the first year of their program

EXHIBIT A

COMMERCIAL/INDUSTRIAL ELECTRICAL CONSTRUCTION INDUSTRY ELECTRICAL WORKER TRAINING CRITERIA

RELATED SUPPLEMENTAL INSTRUCTION

Safety

- A. General job-site safety awareness
- B. First Aid/CPR Certification
- C. Emergency Procedures
- D. Compliance with OSHA, NFPA and EPA Regulations
- E. Substance Abuse Awareness

Tools, Materials and Handling

- A. Proper care and use of hand and power tools
- B. Proper rigging methods
- C. Proper digging techniques
- D. Proper use of stationary and mobile elevated work platforms
- E. Proper material lifting and handling

Math

- A. Appropriate mathematical calculations to solve for related problems.

Electrical Theory

- A. Basic electro -magnetic principals
- B. Ohm's Law
- C. AC/DC Theory
- D. Series, Parallel and Combination Circuits
- E. Characteristics of circuits; voltage, current, power, resistance, impedance, capacitance and reactance.
- F. Theory of superposition and solving for multiple voltage-sourced circuits
- G. Operation and characteristics of three-wire systems
- H. Operation and characteristics of three-phase systems
- I. Use of electronics in the electrical industry

Code Requirements

- A. National Electrical Code and Local Codes
- B. NFPA 70E
- C. Title 24 Part 6 Building Energy Efficiency Standard

Conductors

- A. General characteristics
- B. Conductor installation codes and techniques
- C. Methods for selecting proper size and type of conductors

Conduit and Raceways

- A. Terms associated with conduits and raceways
- B. Procedures for laying out various types of bends
- C. Procedures for making proper bends when fabricating conduits
- A. B. Conduit support systems recognized by Code

Lighting Systems

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

Over-current Devices

- A. Function, operation and characteristics of over-current protection devices
- B. NEC requirements for over-current protection devices
- C. NEC requirements for ground-fault and arc-fault protection

Grounding Systems

- A. Functions, operation and characteristics of grounding systems
- B. Sizing, layout and installation of grounding systems
- C. Insulation and isolation
- D. Proper grounding and bonding techniques
- E. Special circumstances

Services and Distribution Systems

- A. Function, operation and requirements for various panel boards and switch gear
- B. Grounding requirements
- C. Code requirement

Prints and Specifications

- A. Creation of blueprints, plans and specification
- B. Use of blueprints, plans and specification
- C. Recognizing information contained within blueprints
- D. Building Information Modeling (BIM)

Motors, Motor Controllers and Process Controllers

- A. Function, operation and characteristics of motors (AC, DC, Dual-Voltage)
- B. Proper motor installations
- C. Motor controllers, control circuits and control devices
- D. Control Transformers, switches and relays
- E. Instrumentation, process control systems and devices
- F. Fundamentals of Programming of Electronic Devices

Generation and Power Supplies

- A. Principles of generating electricity

- B. Principles of Alternative Energy Generating Systems
- C. Installation and maintenance of uninterruptible power supplies (UPS)
- D. Installation and maintenance of emergency battery systems
- E. Photo-Voltaic Systems
- F. Energy Storage and Micro Grids

Transformers

- A. Function, operation, and characteristics of transformers
- B. Selection and installation of transformer types
- C. Transformer grounding techniques
- D. Harmonics and power quality

Personal Development

- A. Orientation to organization and structures
- B. Working with others
- C. Personal financial development
- D. Anti-Harassment Training

Electrical Testing

- A. Steps used for various testing processes
- B. Proper selection and use of test meters
- C. Utilizing the results of testing procedures

Specialty Systems

- A. Fire Alarms
- B. Security Systems

EXHIBIT B

COMMERCIAL/INDUSTRIAL ELECTRICAL CONSTRUCTION INDUSTRY ELECTRICAL WORKER TRAINING CRITERIA

WORK PROCESSES

1. Planning and Initiating a Project
2. Implementing Conservation and Recycling Practices on a Project
3. Establishing OSHA and Customer Safety Requirements
4. Establishing temporary power during construction
5. Establishing Power Distribution within a Project
6. Installing Service to Buildings and Other Structures
7. Installing and Maintaining Alternative Energy Generation Systems
8. Establishing a Grounding System
9. Planning and Installing Raceway Systems
10. Installing Electrical Systems
11. Installing Indoor and Outdoor Receptacles, Lighting Circuits and Fixtures
12. Providing Power and Controls to Motors, HVAC and Other Equipment
13. Energy-Efficient Lighting and Equipment Control Systems
14. Installing Instrumentation and Process Control Systems
15. Installing and Maintaining Emergency Power Generation Equipment
16. Troubleshooting and Repairing Electrical Systems
17. Installing Fire Alarm Systems

By signature of the Chair and Co-Chair below, we jointly confirm the Electrical Minimum Industry Training Criteria Committee recommends approval of this document by a greater than the required two-thirds majority.

Respectfully submitted to the California Apprenticeship Council,

Name: **Christine Hall**

Signature

Date: May 18, 2020

Name: **Kathleen Barber**

Signature

Date: May 18, 2020