



ApprenticeshipArizona



Appendix A

WORK PROCESS SCHEDULE AND RELATED INSTRUCTION OUTLINE FOR ELECTRICIAN



Appendix A

WORK PROCESS SCHEDULE

ELECTRICIAN

O*NET-SOC CODE: 47-2111.00 RAPIDS CODE: 0159

This schedule is attached to and a part of these Standards for the above identified occupation.

1. APPRENTICESHIP APPROACH

- Time-based
 Competency-based
 Hybrid

2. TERM OF APPRENTICESHIP

The term of the apprenticeship is *four (4) to five (5) year(s)* with an On-the-Job Learning (OJL) attainment of a minimum of *8,000* hours, supplemented by the minimum required 576 hours of related instruction.

3. RATIO OF APPRENTICES TO JOURNEYWORKERS

The apprentice to journeyworker ratio is: one (1) Apprentice(s) to one (1) Journeyworker(s).

4. APPRENTICE WAGE SCHEDULE

Apprentices shall be paid a progressively increasing schedule of wages based on either a percentage or a dollar amount of the current hourly journeyworker wage rate, which is on file with the Registration Agency:

4 – 5 Year Program

1 st	6 months and 1000 hours	60%	2 nd	6 months and 1000 hours	64%
3 rd	6 months and 1000 hours	68%	4 th	6 months and 1000 hours	72%
5 th	6 months and 1000 hours	76%	6 th	6 months and 1000 hours	80%
7 th	6 months and 1000 hours	84%	8 th	6 months and 1000 hours	88%

5. PROBATIONARY PERIOD

Every applicant selected for apprenticeship will serve a probationary period of *1000 hours of OJT*.

6. SELECTION PROCEDURES

See page A-9



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ON-THE-JOB LEARNING OUTLINE

ELECTRICIAN

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APPRENTICE SHALL RECEIVE APPROXIMATELY

PROCESS:	HOURS
A. Residential Wiring	1000
B. Underground	1000
C. Branch Conduit	1000
D. Branch Wiring	1000
E. Lighting	1000
F. Control Systems	800
G. Grounding Systems	400
H. Distribution	1000
I. Special Systems	800
	8,000
TOTAL HOURS	8,000

The above schedule is recognized as sufficiently flexible to be changed if accumulated experience indicates that changes will be to the advantage of the Sponsor and the Apprentice.



Appendix A

RELATED INSTRUCTION OUTLINE

ELECTRICIAN

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SCHEDULE OF RELATED INSTRUCTION

In accordance with these registered program standards, each apprentice shall participate in related theoretical training, for a minimum of 144 hours, in the areas and subjects identified below:

SUBJECT/COURSES/CLASSES

First Year:

- 101 Orientation, Electricity Principles
- 102 Hand Tools, Fasteners, Blueprint Processes, Assessment Inventories
- 103 First Aid/CPR/AED Safety
- 104 First Aid/CPR/AED Electrical Charges, Basic Math
- 105 Applied Math, Circuit Theory, Plans and Specs
- 106 Applied Math, Ohm's Law, Electrical Symbols, Boxes
- 107 Conduit Bending
- 108 Dwelling Circuit Requirements
- 109 Conductor Types
- 110 Voltage Drop, Cable, Conduit , Tubing
- 111 **Mid-Term Exam**
- 112 Conductor Terminology, Switches, Receptacles
- 113 GFCI, AFCI, and other Special Purpose Receptacles
- 114 Luminaires, Ballasts, Lamps
- 115 Box Fill and Intro to Series Circuits
- 116 Box Sizing and Series Circuits Review
- 117 Lighting and Small Appliance Branch Circuits
- 118 **First Semester Final Exam**



First Year Second Semester

- 119 Track Lighting, Dimmers, Parallel Circuits
- 120 Laundry and Bathroom Receptacles, Parallel Circuits
- 121 Garage and Garage Door Circuits, Underground Installations
- 122 Appliance and Special Purpose Outlets
- 123 Ranges, Oven, Counter Mounted Cooking Units, Small Appliances
- 124 Bathrooms, Exhaust Fans, Hydromassage Tubs
- 125 Heating and Air Conditioning
- 126 Residential Limited Energy Systems
- 127 **Mid Term Exam**
- 128 Multiwire Branch Circuits, Combination Circuits
- 129 Combination Circuits, Conductor Ampacity Correction
- 130 Services and Service Equipment
- 131 Grounding and Bonding, Specialty Tools
- 132 Overcurrent Protection and Circuit Conditions
- 133 Service Entrance Calculations
- 134 Swimming Pools, Spas, and Hot Tubs
- 135 Home Automation, Photovoltaic Systems
- 136 **First Year Final Exam**

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Second Year:

201	Construction Materials
202	Print Reading, Project Design, Development, Specs
203	Print Reading Basics
204	Electrical Part 1 Service, Distribution, Panel Schedules
205	Electrical Part 2 Lighting, Power, Other Associated Drawings
206	Site/Civil and Structural Drawings
207	Mechanical and Plumbing Materials and Drawings
208	Architectural Drawings
209	Mid-Term Review and Exam
210	Code Study NEC Intro. Chapter 1 Chapter 2 Articles 90,100, 110, 200
211	Code Study NEC Chapter 2 Articles 210
212	Code Study NEC Chapter 2 Articles 215, 220, 225, 230
213	Code Study NEC Chapter 2 Articles 240, 242, 250
214	Code Study NEC Chapter 3 Articles 300, 310
215	Code Study NEC Chapter 3 Articles 312, 314
216	Code Study NEC Chapter 3 Articles 320-393
217	Review
218	First Semester Final Exam
219	Introduction to AC Theory
220	AC Theory: Inductive and Capacitive Reactance
221	AC Theory: Impedance and Power Factors
222	Single Phase Transformers: Theory, Types, Calculations
223	Power Generation, Transmission and Distribution,
224	30 Transformers
225	Buck Boost Transformers: Single Phase Connections and Applications
226	Balancing 3 Phase Loads, Nonlinear Loads, Three Phase Fault Currents
227	Mid-Term Review and Exam
228	Code Study NEC Chapter 4 Articles 400-408, 410, 422, 424
229	Code Study NEC Chapter 4 Articles 430, 440, 445, 450, 482
230	Code Study NEC Chapter 5 Articles 500-506, 511-516
231	Code Study NEC Chapter 5 Articles 517-590
232	Code Study NEC Chapter 6 Articles 600-604, 620-645, 680
233	Code Study NEC Chapter 6 Articles 690, 695
234	Code Study NEC Chapter 7 Articles 700-705, 722, 724, 725, 760
235	Second Semester Review
236	Second Semester Final Exam



Third Year:

- 301 Test Instruments, OSHA, NFPA 70 E, & Test Instrument Safety
- 302 First Aid/CPR Review Intro to Grounding and Bonding
- 303 System Grounding: Grounded Conductors, Required/Not Permitted
- 304 System Grounding: Separately Derived Systems, Main Bonding Jumpers
- 305 Grounding Electrode Systems, Grounding Electrode Conductors
- 306 Supply Side and Load Side Bonding Jumpers
- 307 Equipment Grounding and Equipment Grounding Conductors
- 308 Grounding of Specific Equipment and Conditions
- 309 **Review & Midterm Exam**
- 310 DC Motors, AC Single Phase and Polyphase Motors
- 311 Motors: General Knowledge & Size Branch Circuit Conductors
- 312 Sizing Motor Short Circuit & Ground-Fault Protection, Locked Rotor Current
- 313 Sizing Motor Overloads and Disconnects
- 314 Motor Feeder Conductors, OCPDs, and Tap Conductors
- 315 Adjustable Speed Drive Systems, Code & Intro to Motor Speed Control Methods
- 316 AC Equipment, Fire Pumps
- 317 **Review**
- 318 Final Exam
- 319 Intro to Ladder Logic, Pushbuttons
- 320 Manual Control Devices Hands on Activity
- 321 Automatic Control Devices Hands on Activity
- 322 Relays, Solid State Relays, Contactors Hands on Activity
- 323 Holding Circuits Hands on Activity
- 324 Time Relays: On delay, Interval, Recycle
- 325 Time Relays: Off Delay, One Shot, Multi Function Hands on Activity
- 326 Ladder Logic Diagram Critical Thinking Activity
- 327 **Review and Mid-Term Exam**
- 328 Magnetic Motor Systems, Control Circuit Overview Hands on Activity
- 329 Motor Power Connections NEMA Enclosures Hands on Activity
- 330 Motor reversing: Controllers and Connections Hands on Activity
- 331 Jogging Circuits, Latching Relays, Alternating Relays, Phase Loss Relays, Hands on Activity
- 332 Intro to Limited Energy/Low Voltage Systems
- 333 Building the Foundation of the Productive Worker
- 334 Transition to Supervisor
- 335 Review
- 336 **Third Year Exam**



Fourth Year:

- 401 Energized Electrical Work Relative to NFPA 70E
- 402 Introduction to Programmable Logic Controllers and Relays
- 403 Introduction to Programming PLRs
- 404 Variable Frequency Drives (VDFs), Motor Starting Methods, Accelerate/Decelerate
- 405 Power Quality
- 406 Introduction to Solar Photovoltaics
- 407 Introduction to Electric Vehicles and Electric Vehicle Charging Station
- 408 Introduction to Supervision
- 409 **Mid-Term Review and Exam**
- 410 Intro to Limited Energy Systems, Structured Cabling
- 411 Home Automation, Audio Sound Systems, Video Surveillance Systems
- 412 PoE and Lighting Systems
- 413 Introduction to Building Automation Systems (BAS)
- 414 Fire Alarm Systems
- 415 Predictive and Preventive Maintenance
- 416 Troubleshooting
- 417 **Review**
- 418 **Final Exam**
- 419 Using and Applying NEC 90, 100 and 110
- 420 Branch Circuits and Feeders NEC 210 and 215
- 421 Load Calculations NEC 220 Part 1
- 422 Load Calculations NEC 220 Part 2
- 423 Services, NEC 230
- 424 Conductors and Overcurrent NEC 100, 110, 240, 310
- 425 Grounding, NEC 250
- 426 Wiring Methods NEC Chapter 3
- 427 **Midterm Exam**
- 428 Switches, Switchgear, Panelboard, NEC 404 & 408
- 429 Equipment for General Use NEC 400, 406, 410, 422
- 430 Equipment for General Use NEC 430, 440, 445, 695
- 431 Transformers NEC 450
- 432 Special Locations NEC 500-504, 511, 514, 517, 590
- 433 Renewable Energy NEC 625, 690, 691, 694, 705, 706
- 434 Electrical License Exam Prep
- 435 **Review**
- 436 **Final Exam**



Appendix A

SELECTION PROCEDURES

ELECTRICIAN

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Sponsor must select one (1) of the following:

1. ***Alternative selection methods***

The sponsor may select apprentices by any other method, including its present selection method, provided that the sponsor meets the requirements listed in 29 CFR § 30.5(b)(4).

2. ***Selection on basis of rank from pool of eligible applicants***

The sponsor may select apprentices from a pool of eligible applicants on the basis of the rank order of their scores on one or more qualification standards where there is a significant statistical relationship between rank order of scores and performance in the apprenticeship program. The selection of any qualification standards beyond minimum legal working age, the use of oral interviews, the notification of applicants, and the establishment of goals for the admission of minorities and women (minority and nonminority) into the pool of eligibles must proceed in accordance with the requirements of 29 CFR § 30.5(b)(1).

3. ***Random selection from pool of eligible applicants***

The sponsor may select apprentices from a pool of eligible applicants on a random basis. The method of random selection is subject to approval by the U.S. Department of Labor. Supervision of the random selection process shall be by an impartial person or persons selected by the sponsor but not associated with the administration of the apprenticeship program. The time and place of the selection, and the number of apprentices to be selected, shall be announced. The place of the selection shall be open to all applicants and the public. The names of apprentices drawn by this method shall be posted immediately following the selection at the program sponsor's place of business.

4. ***Selection from pool of current employees***

The sponsor may select apprentices from an eligibility pool of the workers already employed by the program sponsor or by the sponsor's established promotion policy. The sponsor adopting this method of selecting apprentices shall establish goals for the selection of minority and female apprentices, unless the sponsor concludes, in accordance with the provisions of 29 CFR §§ 30.4(d), (e), and (f) that it does not have deficiencies in terms of underutilization of minorities and/or women (minority and nonminority) in the apprenticeship of journeyworker occupations represented by the program.



SECTION I - DIRECT ENTRY

Sponsors that wish to invoke the direct entry provision may do so without regard to the existing selection procedure or minimum qualifications used for entry into the apprenticeship program. Individuals selected into the apprenticeship program via direct entry shall include only those individuals described below who have received training or employment in an occupation directly or indirectly related to the occupation(s) registered in these standards. The sponsor will award credit for previous experience in accordance with Section XII of these standards and will pay each apprentice at the wage rate commensurate with his or her skill attainment. The credit for previous experience shall be awarded without regard to race, color, religion, national origin, or sex. The methods for direct entry are as follows:

Sponsor must select the ones they will use

- A. A youth who has completed a Job Corps training program in any occupation covered in these standards and who meets the minimum qualifications of the apprenticeship program may be admitted directly into the program, or if no apprentice opening is available, the Job Corps graduate may be placed at the top of the current applicant ranking list and given first opportunity for placement. The sponsor will evaluate the Job Corps training received to grant appropriate credit on the term of apprenticeship. Entry of Job Corps graduates will be done without regard to race, color, religion, national origin, or sex. ***(Note: This is a method of direct entry into the apprenticeship program.)***

- B. A youth who has completed a YouthBuild training program in any occupation covered in these standards and who meets the minimum qualifications of the apprenticeship program may be admitted directly into the program, or if no apprentice opening is available, the YouthBuild graduate may be placed at the top of the current applicant ranking list and given first opportunity for placement. The sponsor will evaluate the YouthBuild training received to grant appropriate credit on the term of apprenticeship. Entry of YouthBuild graduates will be done without regard to race, color, religion, national origin, or sex. ***(Note: This is a method of direct entry into the apprenticeship program.)***

- C. A military veteran who is registered with the Helmets to Hardhats program or has completed military technical training school and/or participated in a registered apprenticeship program or related occupation while in the military in the occupations registered may be given direct entry into the apprenticeship program. The sponsor shall evaluate the military training received for granting appropriate credit on the term of apprenticeship and the appropriate wage rate. The sponsor will determine what training requirements the veteran needs to meet to ensure he or she receives all necessary training for completion of the apprenticeship program. Applicants must submit a DD-214 to verify military training and/or experience if they are a veteran and wish to receive consideration for such training/experience. Entry of military veterans shall be done without regard to race, color, religion, national origin, or sex. ***(Note: This is a method of direct entry into the apprenticeship program.)***



- D. A former inmate of the U.S. Department of Justice Bureau of Prisons (BOP) who has participated in or successfully completed a specific BOP apprenticeship program may be given direct entry into the apprenticeship program. Sponsors agreeing to admit such individuals into apprenticeship must do so without regard to present minimum qualifications, eligibility lists, or scores on written apprenticeship entrance tests. Entry into the program by this method shall be done without regard to race, color, religion, national origin, or sex. ***(Note: This is a method of direct entry into the apprenticeship program.)***
- E. A senior citizen who has completed a Senior Community Service Employment Program (SCSEP) pre-apprenticeship training program in any health care occupation covered in these standards and who meets the minimum qualifications of the apprenticeship program may be admitted directly into the program, or if no apprentice opening is available, the SCSEP graduate may be placed at the top of the current applicant ranking list and given first opportunity for placement. The sponsor will evaluate the SCSEP training received to grant appropriate credit on the term of apprenticeship. Entry of SCSEP graduates will be done without regard to race, color, religion, national origin, or sex. ***(Note: This is a method of direct entry into the apprenticeship program for the health care industry.)***
- F. An individual who has completed a structured pre-apprenticeship training program that meets the requirements outlined in Training and Employment Notice 13-12, Defining a Quality Pre-Apprenticeship Program and Related Tools and Resources, in any occupational area covered in these standards of apprenticeship and who meets the minimum qualifications of the apprenticeship program may be admitted directly into the program. The candidate shall provide official documentation confirming that he or she fulfilled the specific requirements of the pre-apprenticeship program, such as completion/graduation certificates, transcripts, notarized letters of confirmation, and sworn statements. The sponsor will evaluate the training received to grant appropriate credit on the term of apprenticeship. Entry of pre-apprenticeship candidates shall be done without regard to race, color, religion, national origin, or sex. ***(Note: This is a method of direct entry into the apprenticeship program.)***

SECTION II - COMPLAINT PROCEDURE

- A. Any apprentice or applicant for apprenticeship who believes that he/she has been discriminated against on the basis of race, color, religion, national origin, or sex with regard to apprenticeship or that the equal opportunity standards with respect to his/her selection have not been followed in the operation of an apprenticeship program may, personally or through an authorized representative, file a complaint with the Arizona Apprenticeship Office (Registration Agency) or, at the apprentice or applicant's election, with the private review body established by the sponsor (if applicable).
- B. The complaint will be in writing and will be signed by the complainant. It must include the name, address, and telephone number of the person allegedly discriminated against, the sponsor involved, and a brief description of the circumstances of the failure to apply equal opportunity standards.



- C. The complaint must be filed not later than 180 days from the date of the alleged discrimination or specified failure to follow the equal opportunity standards. In the case of a complaint filed directly with the review body designated by the sponsor to review such complaints, any referral of such complaint by the complainant to the Registration Agency must occur within the time limitation stated above or 30 days from the final decision of such review body, whichever is later. The time may be extended by the Registration Agency for good cause shown.
- D. Complaints of discrimination and failure to follow equal opportunity standards in the apprenticeship program may be filed and processed under 29 CFR § 30 and the procedures as set forth above.
- E. The sponsor will provide written notice of its complaint procedure to all applicants for apprenticeship and all apprentices.

SECTION III - MAINTENANCE OF APPLICATION AND SELECTION RECORDS

The sponsor will keep adequate records, including a summary of the qualifications of each applicant; the basis for evaluation and for selection or rejection of each applicant; the records pertaining to interviews of applicants; the original application for each applicant; information relative to the operation of the apprenticeship program, including, but not limited to, job assignment, promotion, demotion, layoff, or termination; rates of pay or other forms of compensation or conditions of work; hours including hours of work and, separately, hours of training provided; and any other records pertinent to a determination of compliance with 29 CFR § 30, as may be required by the U.S. Department of Labor. The records pertaining to individual applicants, selected or rejected, will be maintained in such manner as to permit the identification of minority and women (minority and nonminority) participants.

Each sponsor must retain a statement of its affirmative action plan for the prompt achievement of full and equal opportunity in apprenticeship, including all data and analyses made pursuant to the requirements of 29 CFR § 30.4. Each sponsor also must maintain evidence that its qualification standards have been validated in accordance with the requirements set forth in 29 CFR § 30.5(b).

If applicants are interviewed during the selection process, adequate records include a brief summary of each interview and the conclusions on each of the specific factors - e.g., motivation, ambition, and willingness to accept direction - that are part of the total judgment.

Records will be maintained for 5 years from the date of last action and made available upon request to the Arizona Apprenticeship Office and or the U.S. Department of Labor or other authorized representative.



ApprenticeshipArizona



SECTION VI - OFFICIAL ADOPTION OF SELECTION PROCEDURES

(Sponsor) hereby officially adopts these selection procedures on this 6 th day of September, 2024.

Sponsor(s) may designate the appropriate person(s) to sign the standards on their behalf.

Margaret Bieberstein

Signature of Sponsor (designee)

Signature of Sponsor (designee)

Margaret Bieberstein

Printed Name

Printed Name