



Industrial Maintenance Electrician Apprenticeship Program EDUCATION PLAN

for

Inland/Desert Non-Union Unilateral Multiemployer Apprenticeship Committee
Industrial Technical Learning Center (InTech)

Employers have the option to determine what modules best align with their company goals and needs. Based on the following, please choose which modules an apprentice at your company needs to be trained in. APPRENTICES NEED TO COMPLETE A MINIMUM OF 144 HOURS PER YEAR.

Total Required Hours: 280 hours

Related Courses as Necessary (not required to take all classes): 556 hours

Company:

Apprentice*:

* One Education Plan **must** be filled out for each apprentice.

Industrial Maintenance Electrician

REQUIRED HOURS

Basic Industrial Electricity/Electrical Theory

56 Hours

A refresher of the basics of industrial electricity. In addition to basic theories and laws, this class will also cover an overview of electrical safety, protective devices, generators and transformers, and common industrial wiring devices. Additional training topics include: E&I Test Equipment and Intro to Troubleshooting.

Motors & Controls

48 Hours

Principles of motor operation, beginning with DC motor theory and moving into AC theory. Study of sine waves through phasors and trigonometry theory. Series and parallel AC circuits, motors, generators, and transformers. Includes a hands-on lab using rotating equipment. Additional NCCER training topics include: Alternating Current and Motor Controls.

Basic PLCs

16 Hours

Introduces the basics of programmable logic controllers (PLCs) and how the computer control system relates to industrial electrical machines in manufacturing.

AC & DC Variable Speed Drives

40 Hours

Types of DC and AC motors; DC generic control requirements; Effects of operating on variable frequency; Types of variable speed drives; Operation, set-up, and maintenance of variable speed drives. Hands-on lab exercises include programming drive parameters, drive control wiring, and drive diagnostics.

Hydraulics I & II

32 Hours

Fundamentals of hydraulic power: pressure limitations, pressure and force, flow rate and velocity, work and power. Basic circuits: cylinder control, cylinders in series and parallel, regenerative circuits. Functional circuits: accumulators, hydraulic motor circuits, pressure reducing valves, remote controlled pressure relief valves. Troubleshooting: hydraulic pumps, directional valve testing, flow meter accuracy. Electrical control of hydraulic systems. Functional systems: hydraulic sequence of cylinders, speed regulation and braking of hydraulic motors. Troubleshooting: electrical control circuits, and electrically controlled hydraulic systems.

Electro-Pneumatics I & II

32 Hours

Introduction to pneumatics; relationships between pressure vs. force, pressure vs. volume, pressure drop vs. flow; vacuum generation; basic controls of cylinders; directional control valves; cylinders in series and parallel; controls of pneumatic motors. Electrical control of pneumatics systems; industrial type electro-pneumatic circuits; troubleshooting in electro-pneumatic circuits.

Troubleshooting Electrical Control Circuits

24 Hours

A summary class reviewing all of the above topics and designed to bridge the gap between theoretical knowledge and practice. Includes troubleshooting with PLCs. Additional topic includes: Troubleshooting Industrial Controls.

Advanced Programmable Logic Controllers (PLCs)

32 Hours

PLC concepts, basic operation and logic, programming tools, basic editing, and diagnostic capabilities. Types and classes of I/O interfaces, Different types of programming languages. Hands-on work with PLC's, learning programming tools.

Industrial Maintenance Electrician Related Courses as Necessary

- | | | |
|---|---|-----------------|
| <input type="checkbox"/> | Process Mathematics | 24 Hours |
| <p>Covers measurement of mass, weight and flow, conversion of units, and their application instrumentation.</p> | | |
| <input type="checkbox"/> | Industrial Safety for E&I Technicians | 12 Hours |
| <p>Covers safety rules and regulations for electrical workers, the necessary precautions to take for various electrical hazards found on the job, and the OSHA-mandated lockout/tagout procedure.</p> | | |
| <input type="checkbox"/> | Introduction to the National Electrical Code | 12 Hours |
| <p>An in-depth look on NEC standards and how to access types of information in the book.</p> | | |
| <input type="checkbox"/> | Electrical Blueprints & Drawings | 16 Hours |
| <p>Basic ladder diagrams, one line diagrams, electrical symbols, hydraulic symbols, hydraulic diagrams, floor and elevation plans. Additional NCCER training topics include: Instrument Drawings and Documents, Part 1 and E&I Drawings.</p> | | |
| <input type="checkbox"/> | NFPA 70E Arc Flash Safety | 8 Hours |
| <p>Introduction to electrical safety and the basic principles of maintaining a safe electrical workplace. Includes the protective devices used to protect people and their limitations. Also explains what creates an arc flash and why it is so damaging.</p> | | |
| <input type="checkbox"/> | NFPA 70B Electrical Equipment Maintenance | 16 Hours |
| <p>NFPA 70B details preventative maintenance for electrical, electronic, and communication systems and equipment – such as those used in industrial plants, institutional and commercial buildings and large multi-family residential complexes – to prevent equipment failures and worker injuries.</p> | | |
| <input type="checkbox"/> | OSHA for Electricians | 16 Hours |
| <p>Industry safety and health standards, taught in accordance with Occupational Safety and Health Administration (OSHA) requirements. Upon completion, students receive the OSHA (10-hour) card.</p> | | |
| <input type="checkbox"/> | Conductors & Cables | 12 Hours |
| <p>Focuses on the types and applications of conductors and electrical cabling and covers proper wiring techniques. Stresses the applicable NEC® requirements. Describes methods of terminating and splicing conductors of all types and sizes, including preparing and taping conductors. Additional NCCER training topics include: Conductor Terminations & Splices.</p> | | |
| <input type="checkbox"/> | Instrumentation & Process Control I | 36 Hours |
| <p>Open and closed loop controls, feedback and feed forward controls, stand alone controllers, pressure controls, level measurements, differential pressure, and microprocessor based controllers. Additional NCCER training topic includes: Flow, Pressure, Level & Temperature.</p> | | |
| <input type="checkbox"/> | Hand Bending | 16 Hours |
| <p>Provides an introduction to conduit bending and installation. Covers the techniques for using hand-operated and step conduit benders, as well as cutting, reaming, and threading conduit.</p> | | |

- Tubing** **16 Hours**
Introduces a variety of tubing, tubing materials, tools, and work practices. Covers proper storage and handling, cutting, deburring, reaming, bending, and flaring of tubing.
- Clean, Purge, Test & Piping Systems** **8 Hours**
Presents safe methods for cleaning, purging, blowing down, pressure testing, and leak testing tubing, piping, and hoses used in instrumentation.
- Electronic Components** **12 Hours**
Introduces the principles of electronics and semiconductor theory, components, and applications.
- Distribution Equipment** **16 Hours**
Explains distribution equipment, including grounding, switchboard and ground fault maintenance, transformers, and electrical drawing identification.
- Transformer Applications** **16 Hours**
Discusses transformer types, construction, connections, protection, and grounding along with capacitors and rectifiers.
- Conductor Selection & Calculation** **16 Hours**
Covers the types of conductors used in wiring systems, including insulation, current-carrying capacity, and temperature ratings.
- Motor-Operated Valves** **16 Hours**
Covers motor-driven valves, ranging from the small, servo-mechanical actuators to the very large valves that could only be operated by several people if they were not motor driven. Includes electrical, pneumatic, and hydraulic operators.
- Hazardous Locations** **8 Hours**
Covers all classes of hazardous locations, including seals, components, and equipment approved for use in various hazardous locations.
- Temporary Grounding** **16 Hours**
Covers the methods used to eliminate or reduce electrical shock hazards to personnel working on electrical equipment.
- Layout & Installation of Tubing and Piping Systems** **20 Hours**
Introduces piping and tubing layout procedures. Explains the steps in creating a hand-sketched isometric drawing that can be applied in the piping and tubing installation. Introduces methods and procedures used to measure, cut, bend, and support piping and tubing.
- Machine Bending of Conduit** **16 Hours**
Covers all types of bends in all sizes of conduit up to six inches. Focuses on mechanical, hydraulic, and electrical benders.
- Instrumentation & Process Controls II** **56 Hours**
Continuing from Instrumentation & Process Controls I, this course adds troubleshooting and configuration of process controls and regulating systems (speed regulators, current regulators, etc.). Additional topics include: Instrument Calibration & Configuration; Control Valves, Actuators & Positioners; Performing Loop Checks; Troubleshooting and Commissioning a Loop; Data Networks; and Distributed Control Systems.

- Introduction to Mechatronics** **32 Hours**
Introduces basics of mechanical electronics, PLCs, pick and place feeding, event sequencing, indexing, parts sorting and storage, robotics and Servo robot material handling.
- Standby & Emergency Systems** **12 Hours**
Explains the NEC® requirements for installation and control of emergency power and lighting systems, including batteries, generators, and uninterruptible power supplies.
- Basic Process, Control Elements, Transducers & Transmitters** **16 Hours**
Defines and introduces common instrumentation elements and their principles of operation. Covers identification of variables measured by each element and selection of the proper types of devices in an instrument loop using the device's technical manuals, specification sheets, pictures, or actual samples.
- Transition to Trainer & Mentor** **8 Hours**
Prepares a soon-to-be journey person in how to be a successful mentor to new apprentices and employees. They will learn about the best tools to handle conflict and how to guide others to success.
- Cable Networking the Physical Layer** **8 Hours**
Tool use and construction techniques for industry standards. Troubleshooting and repair for technicians in the cabling industry.
- Fiber Optic Cabling the Physical Layer** **8 Hours**
Fiber Optic theory, tool use, and construction techniques. Troubleshooting and repair for technicians in the network cabling industry, with emphasis on fiber optics.
- Transistor Amplifier Circuits** **24 Hours**
Identify and isolate attenuator, common base/emitter, common collector, bias stabilization, RC coupling/Transformer coupling and direct coupling.
- Transistor Power Amplifiers** **24 Hours**
Identify and isolate single-ended power amplifier, phase splitter, push-pull power amplifier, attenuator, complementary power amplifier and Darlington pair.
- Transistor Feedback Circuits** **24 Hours**
Perform practical exercises that demonstrate transistor feedback principals including series/shunt feedback, multistage feedback, and differential amplifier.
- Analog Communications** **16 Hours**
Configure, operate and troubleshooting the following circuits: Amplitude modulation (AM) transmitter and receiver, single-sideband (SSB) transmitter and receiver, frequency modulator (FM), phase modulator (PM) and phase locked loop (PLL).

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