



Industrial Maintenance Electrician Apprenticeship Program COURSE DESCRIPTIONS (ALPHABETICAL)

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.

If apprentice candidate has completed a DAS-Registered Industrial Electrical & Mechanical Pre-Apprenticeship, the following courses may be waived:

Basic Industrial Electricity
OSHA for Electricians

Total Required Hours: 280 hours
Related Courses as Necessary (not required to take all classes): 556 hours

AC & DC Variable Speed Drives (Period 3)**40 Hours****REQUIRED COURSE**

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.

Advanced Programmable Logic Controllers (PLCs) (Period 3)**32 Hours****REQUIRED COURSE**

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.

Analog Communications (Period 4)**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).

Basic Industrial Electricity/Electrical Theory (Period 1)**56 Hours****REQUIRED COURSE**

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, generators and transformers, and common industrial wiring devices. Additional training topics include: E&I Test Equipment and Intro to Troubleshooting. **Pre-Requisites: Electrical Blueprints & Drawings and ONE of: Industrial Safety for E&I Techs or OSHA or NFPA 70E.**

Basic PLCs (Period 2)**16 Hours****REQUIRED COURSE**

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

Basic Process, Control Elements, Transducers & Transmitters (Period 3)**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.

Cable Networking the Physical Layer (Period 4)**8 Hours**

Tool use and construction techniques for industry standards. Troubleshooting and repair for technicians in the cabling industry.

Clean, Purge, Test & Piping Systems (Period 1)**8 Hours**

Presents safe methods for cleaning, purging, blowing down, pressure testing, and leak testing tubing, piping, and hoses used in instrumentation.

Conductor Selection & Calculation (Period 4)**16 Hours**

Covers the types of conductors used in wiring systems, including insulation, current-carrying capacity, and temperature ratings.

Conductors (Period 1)**12****Hours**

Focuses on the types and applications of conductors and electrical cabling and covers proper wiring techniques. Describes methods of terminating and splicing conductors of all types and sizes. Additional NCCER training topics include: Conductor Terminations & Splices.

Distribution Equipment (Period 2)	16 Hours
Explains distribution equipment, including grounding, switchboard and ground fault maintenance, transformers, and electrical drawing identification.	
Electrical Blueprints & Drawings (Period 1)	16 Hours
Basic ladder diagrams, one-line diagrams, electrical symbols, hydraulic symbols & diagrams, floor and elevation plans. Additional training topics include: Instrument Drawings & Documents, Part 1 and E&I Drawings.	
Electronic Components (Period 1)	12 Hours
Introduces the principles of electronics and semiconductor theory, components, and applications.	
Electro-Pneumatics I & II (Period 2)	32 Hours
<i>REQUIRED COURSE</i>	
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.	
Fiber Optic Cabling the Physical Layer (Period 4)	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.	
Hand Bending (Period 4)	16 Hours
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.	
Hazardous Locations (Period 1)	8 Hours
Covers all classes of hazardous locations, including seals, components, and equipment approved for use in various hazardous locations.	
Hydraulics I & II (Period 2)	32 Hours
<i>REQUIRED COURSE</i>	
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.	
Industrial Safety for E&I Technicians (Period 1)	12 Hours
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.	
Instrumentation & Process Control I (Period 3)	36 Hours
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.	

Instrumentation & Process Controls II (Period 3)	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 (Period 4)	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.	
Introduction to the National Electrical Code (Period 1)	12 Hours
An in-depth look on NEC standards and how to access types of information in the book.	
Layout & Installation of Tubing and Piping Systems (Period 2)	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 (Period 4)	16 Hours
Covers all types of bends in all sizes of conduit up to six inches. Focuses on mechanical, hydraulic, and electrical benders.	
Motor-Operated Valves (Period 4)	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.	
Motors & Controls (Period 2)	48 Hours
<i>REQUIRED COURSE</i>	
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.	
NFPA 70B Electrical Equipment Maintenance (Period 4)	16 Hours
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.	
NFPA 70E Arc Flash Safety (Period 1)	8 Hours
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.	
OSHA for Electricians (Period 1)	16 Hours
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.	
Process Mathematics (Period 1)	24 Hours
Covers measurement of mass, weight and flow, conversion of units, and their application instrumentation.	

Standby & Emergency Systems (Period 4)	12 Hours
Explains the NEC® requirements for installation and control of emergency power and lighting systems, including batteries, generators, and uninterruptible power supplies.	
Temporary Grounding (Period 4)	16 Hours
Covers the methods used to eliminate or reduce electrical shock hazards to personnel working on electrical equipment.	
Transformer Applications (Period 2)	16 Hours
Discusses transformer types, construction, connections, protection, and grounding along with capacitors and rectifiers.	
Transition to Trainer & Mentor (Period 4)	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.	
Transistor Amplifier Circuits (Period)	24 Hours
Identify and isolate attenuator, common base/emitter, common collector, bias stabilization, RC coupling/Transformer coupling and direct coupling.	
Transistor Feedback Circuits (Period 4)	24 Hours
Perform practical exercises that demonstrate transistor feedback principals including series/shunt feedback, multistage feedback, and differential amplifier.	
Transistor Power Amplifiers (Period 4)	24 Hours
Identify and isolate single-ended power amplifier, phase splitter, push-pull power amplifier, attenuator, complementary power amplifier and Darlington pair.	
Troubleshooting Electrical Control Circuits (Period 4)	24 Hours
<i>REQUIRED COURSE</i>	
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.	
Tubing (Period 1)	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.	

Industrial Maintenance Electrician Training Modules

Required	Course	Hours	Period
*	AC & DC Variable Speed Drives	40	3
*	Advanced Programmable Logic Controllers (PLCs)	32	3
	Analog Communications	16	4
*	Basic Industrial Electricity/Electrical Theory	56	1
*	Basic PLCs	16	2
	Basic Process, Control Elements, Transducers & Transmitters	16	3
	Cable Networking the Physical Layer	8	4
	Clean, Purge, Test & Piping Systems	8	1
	Conductor Selection & Calculation	16	4
	Conductors	12	1
	Distribution Equipment	16	2
	Electrical Blueprints & Drawings	16	1
	Electronic Components	12	1
*	Electro-Pneumatics I&II/Pneumatic Controls	32	2
	Fiber Optic Cabling the Physical Layer	8	4
	Hand Bending	16	4
	Hazardous Locations	8	1
*	Hydraulics I&II	32	2
	Industrial Safety for E&I Technicians	12	1
	Instrumentation & Process Controls I	36	3
	Instrumentation & Process Controls II	56	3
	Introduction to Mechatronics	32	4
	Introduction to the National Electrical Code	12	1
	Layout & Installation of Tubing & Piping Systems	20	2
	Machine Bending of Conduit	16	4
	Motor-Operated Valves	16	4
*	Motors & Controls	48	2
	NFPA 70B Electrical Equipment Maintenance	16	4
	NFPA 70E Arc Flash Safety	8	1
	OSHA for Electricians	16	1
	Process Mathematics	24	1
	Standby & Emergency Systems	12	4
	Temporary Grounding	16	4
	Transformer Applications	16	2
	Transition to Trainer & Mentor	8	4
	Transistor Amplifier Circuits	24	4
	Transistor Feedback Circuits	24	4
	Transistor Power Amplifiers	24	4
*	Troubleshooting Electrical Control Circuits	24	4
	Tubing	16	1