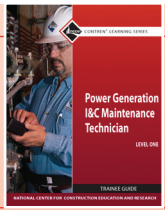
L1 POWER GENERATION I&C MAINTENANCE TECHNICIAN



LEVEL 1

Curriculum Notes

- 222.5 Hours
  - Includes 97.5 hours of *Power Industry Fundamentals*, which is a prerequisite for Level One completion and must be purchased separately.
    - Hardcover: $79.99, ISBN 978-0-13-466829-1
- Published: 2010
- Downloadable instructor resources are available.

PAPERBACK	ISBN
Trainee Guide: $74.99	978-0-13-215430-7

MODULES

The modules listed below are included in the Trainee Guide. The following ISBNs are for ordering individual modules only.

Tools of the Trade *(5 Hours)*
ISBN 978-0-13-614613-1
(Module ID 40102-07; from *Industrial Maintenance E&I Technician Level One)* Introduces the hand and power tools used in industrial maintenance. Covers safety procedures and proper use of these tools.

Fasteners and Anchors *(5 Hours)*
ISBN 978-0-13-614614-8
(Module ID 40103-07; from *Industrial Maintenance E&I Technician Level One)* Covers hardware and systems used in industrial maintenance. Describes anchors and supports, their applications, and how to install them safely.

Oxyfuel Cutting *(17.5 Hours)*
ISBN 978-0-13-614615-5
(Module ID 40104-07; *from Industrial Maintenance E&I Technician Level One)* Explains the safety requirements for oxyfuel cutting. Identifies oxyfuel cutting equipment and provides instructions for setting up, lighting, and using the equipment. Explains how to perform straight line cutting, piercing, beveling, washing, and gouging.

Gaskets and Packing *(10 Hours)*
ISBN 978-0-13-614616-2
(Module ID 40105-07; from *Industrial Maintenance E&I Technician Level One)* Introduces gaskets and gasket material, packing and packing material, and types of O-ring material. Explains the use of gaskets, packing, and O-rings, and how to fabricate a gasket.

Craft-Related Mathematics *(15 Hours)*
ISBN 978-0-13-614617-9
(Module ID 40106-07; *from Industrial Maintenance E&I Technician Level One)* Explains how to use ratios and proportions, solve basic algebra, area, volume, and circumference problems, and solve for right triangles using the Pythagorean theorem.

Construction Drawings *(12.5 Hours)*
ISBN 978-0-13-614618-6
(Module ID 40107-07; from *Industrial Maintenance E&I Technician Level One)* Introduces plot plans, structural drawings, elevation drawings, as-built drawings, equipment arrangement drawings, P&IDs, isometric drawings, basic circuit diagrams, and detail sheets.

Pumps and Drivers *(5 Hours)*
ISBN 978-0-13-614619-3
(Module ID 40108-07; from *Industrial Maintenance E&I Technician Level One)* Explains centrifugal, rotary, reciprocating, metering, and vacuum pump operation and installation methods, as well as types of drivers. Describes net positive suction head and cavitation.

Valves *(5 Hours)*
ISBN 978-0-13-614620-9
(Module ID 40109-07; from *Industrial Maintenance E&I Technician Level One)* Identifies different types of valves and describes their installation, storage, and handling.

Introduction to Test Instruments *(7.5 Hours)*
ISBN 978-0-13-614621-6
(Module ID 40110-07; from *Industrial Maintenance E&I Technician Level One)* Introduces test equipment for industrial maintenance, including tachometers, pyrometers, strobe meters, voltage testers, and automated diagnostic tools.

Material Handling and Hand Rigging *(15 Hours)*
ISBN 978-0-13-614622-3
(Module ID 40111-07; from *Industrial Maintenance E&I Technician Level One)* Introduces the equipment and techniques of material handling, and describes the procedures for rigging and communicating with riggers.

Mobile and Support Equipment *(10 Hours)*
ISBN 978-0-13-614623-0
(Module ID 40112-07; from *Industrial Maintenance E&I Technician Level One)* Introduces the safety procedures and methods of operation for motorized support equipment, including forklifts, manlifts, compressors, and generators.

Lubrication *(12.5 Hours)*
ISBN 978-0-13-614624-7
(Module ID 40113-07; from *Industrial Maintenance E&I Technician Level One)* Explains lubrication safety, storage, and classifications. Also explains selecting lubricants, additives, lubrication equipment, and lubricating charts.

SMAW Equipment and Setup *(5 Hours)*
ISBN 978-0-13-610533-6
(Module ID 29107-09; from *Welding Level One, Fourth Edition)* Describes SMAW welding and welding safety. Explains how to connect welding current and set up arc welding equipment. Also explains how to use tools for cleaning welds.

L2 POWER GENERATION I&C MAINTENANCE TECHNICIAN

LEVEL 2

Curriculum Notes

- 167.5 Hours
- Published: 2010
- Downloadable instructor resources are available.

PAPERBACK	ISBN
Trainee Guide: $99.99	978-0-13-215432-1

MODULES

The modules listed below are included in the Trainee Guide. The following ISBNs are for ordering individual modules only.

Industrial Safety for E&I Technicians *(12.5 Hours)*
ISBN 978-0-13-604701-8
(Module ID 40201-08; from *Industrial Maintenance E&I Technician Level Two)* Covers safety rules and regulations for electrical workers, precautions for electrical hazards on the job, and the OSHA-mandated lockout/tagout procedure.

Managing Electrical Hazards *(12.5 Hours)*
ISBN 978-0-13-608661-1
(Module ID 26501-09; from *Electrical, First Edition)* Introduces electrical hazards in the workplace and describes how to avoid them. Explains how to analyze and document shock and arc flash hazards, and how to plan and conduct work around them. Includes examples of how to complete an energized electrical work permit, and how to select the specialized personal protective equipment required for electrical work.

Introduction to the *National Electrical Code*® *(5 Hours)*
ISBN 978-0-13-604702-5
(Module ID 40202-08; from *Industrial Maintenance E&I Technician Level Two)* Provides a road map for using the *NEC*®. Introduces the layout and types of information found within the code book. Allows trainees to practice finding information using an easy-to-follow procedure.

Electrical Theory *(15 Hours)*
ISBN 978-0-13-604704-9
(Module ID 40203-08; from *Industrial Maintenance E&I Technician Level Two)* Introduces electrical concepts used in Ohm's law as applied to DC series circuits. Includes atomic theory, electromotive force, resistance, and electric power equations. Introduces series, parallel, and series-parallel circuits. Covers resistive circuits, Kirchhoff's voltage and current laws, and circuit analysis.

Continued on following page

Alternating Current *(20 Hours)*
ISBN 978-0-13-604705-6
(Module ID 40204-08; from *Industrial Maintenance E&I Technician Level Two)* Covers transformers, single-phase and three-phase power distribution, capacitors, the theory and operation of induction motors, and the instruments and techniques used in testing AC circuits and components.

E&I Drawings *(10 Hours)*
ISBN 978-0-13-604697-4
(Module ID 40303-09; from *Industrial Maintenance E&I Technician Level Three)* Explains how to read and interpret piping and instrumentation drawings, loop sheets, flow diagrams, isometrics, and orthographics, in order to identify types of instrumentation and the specifications for installation.

E&I Test Equipment *(10 Hours)*
ISBN 978-0-13-604706-3
(Module ID 40205-08; from *Industrial Maintenance E&I Technician Level Two)* Focuses on proper selection, inspection, and use of common electrical and instrumentation test equipment, including voltage testers, clamp-on ammeters, ohmmeters, multimeters, phase/motor rotation testers, data recording equipment, field communicators, pressure testers, and dead weight testers. Also covers safety precautions and meter category ratings.

Conductors and Cables *(10 Hours)*
ISBN 978-0-13-604714-8
(Module ID 40212-08; from *Industrial Maintenance E&I Technician Level Two)* Focuses on the types and applications of conductors and electrical cabling and covers proper wiring techniques. Stresses the applicable *NEC*® requirements.

Conductor Terminations and Splices *(10 Hours)*
ISBN 978-0-13-604715-5
(Module ID 40213-08; from *Industrial Maintenance E&I Technician Level Two)* Describes methods of terminating and splicing conductors of all types and sizes, including preparing and taping conductors.

Motor Controls *(15 Hours)*
ISBN 978-0-13-604698-1
(Module ID 40304-09; from *Industrial Maintenance E&I Technician Level Three)* Describes selecting, sizing, and installing motor controllers. Also covers control circuit pilot devices and basic relay logic.

Hydraulic Controls *(15 Hours)*
ISBN 978-0-13-604742-1
(Module ID 40311-09; from *Industrial Maintenance E&I Technician Level Three)* Introduces hydraulic principles and fluids, functions and controls of system devices, hydraulic symbols, and drawings. Covers safety considerations for hydraulic systems, as well as troubleshooting.

Pneumatic Controls *(15 Hours)*
ISBN 978-0-13-604739-1
(Module ID 40312-09; from *Industrial Maintenance E&I Technician Level Three)* Describes principles of atmospheric and compressed air gases, and how compressors transmit and treat compressed (pneumatic) air. Covers pneumatic system symbols, drawings, and system safety. Addresses the functions and control of pneumatic system components and provides guidelines for troubleshooting.

Programmable Logic Controllers *(17.5 Hours)*
ISBN 978-0-13-609136-3
(Module ID 40409-09; from *Industrial Maintenance E&I Technician Level Four)* Introduces the application of PLCs in industrial process control, as well as the binary numbering system used in computer-based control. Covers components of PLCs, including power supplies, I/O modules, processor modules, types of communication bus, and memory.

L3 POWER GENERATION I&C MAINTENANCE TECHNICIAN

LEVEL 3

Curriculum Notes

- 225.5 Hours
- Published: 2010
- Downloadable instructor resources are available.

PAPERBACK	ISBN
Trainee Guide: $99.99	978-0-13-215434-5

MODULES

The modules listed below are included in the Trainee Guide. The following ISBNs are for ordering individual modules only.

Instrumentation Electrical Circuitry *(25 Hours)*
ISBN 978-0-13-103301-6
(Module ID 12305-03; from *Instrumentation Level Three, Second Edition)* Describes various types of series and parallel circuits; resistance, inductance, and capacitance in AC circuits; DC power supplies; analog and digital signals; and common applications of electrical and electronic circuitry.

Process Mathematics *(15 Hours)*
ISBN 978-0-13-604708-7
(Module ID 40207-08; from *Industrial Maintenance E&I Technician Level Two)* Covers measurement of mass, weight, pressure, temperature, and flow, conversion of units, and their application to industrial maintenance.

Flow, Pressure, Level and Temperature *(15 Hours)*
ISBN 978-0-13-604707-0
(Module ID 40206-08; from *Industrial Maintenance E&I Technician Level Two)* Presents devices used to measure flow, pressure, level, and temperature, along with their principles of operation.

Instrument Drawings and Documents, Part One *(15 Hours)*
ISBN 978-0-13-604713-1
(Module ID 40211-08; from *Industrial Maintenance E&I Technician Level Two)* Introduces instrument symbols, abbreviations, and drawings and documents, including instrument indexes, installation detail drawings, location drawings, and control loops.

Electrical Systems for Instrumentation *(22.5 Hours)*
ISBN 978-0-13-868241-5
(Module ID 12104-01; from *Instrumentation Level One, Second Edition)* Covers basic electrical concepts and terms, DC circuit calculations, electrical measuring instruments, and electrical wiring.

Relays and Timers *(7.5 Hours)*
ISBN 978-0-13-103272-9
(Module ID 12208-03; from *Instrumentation Level Two, Second Edition)* Presents the principles of operation and applications of various relays and timers. Also reviews the selection process for these devices.

Switches and Photoelectric Devices *(5 Hours)*
ISBN 978-0-13-103273-6
(Module ID 12209-03; from *Instrumentation Level Two, Second Edition)* Covers the principles of operation and applications of switches and photoelectric devices in the instrumentation environment.

Tubing *(15 Hours)*
ISBN 978-0-13-604710-0
(Module ID 40209-08; from *Industrial Maintenance E&I Technician Level Two)* 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, and Test Tubing and Piping Systems *(7.5 Hours)*
ISBN 978-0-13-604711-7
(Module ID 40210-08; from *Industrial Maintenance E&I Technician Level Two)* Presents safe methods for cleaning, purging, blowing down, pressure testing, and leak testing tubing, piping, and hoses used in industrial maintenance.

Layout and Installation of Tubing and Piping Systems *(22.5 Hours)*
ISBN 978-0-13-604740-7
(Module ID 40309-09; from *Industrial Maintenance E&I Technician Level Three)* Introduces piping and tubing layout procedures. Explains the steps for creating a hand-sketched isometric drawing that can be applied to a piping and tubing installation. Introduces methods and procedures used to measure, cut, bend, and support piping and tubing.

Electronic Components *(10 Hours)*
ISBN 978-0-13-604696-7
(Module ID 40302-09; from *Industrial Maintenance E&I Technician Level Three)* Introduces the principles of electronics and semiconductor theory, components, and applications.

Panel-Mounted Instruments *(7.5 Hours)*
ISBN 978-0-13-103277-4
(Module ID 12212-03; from *Instrumentation Level Two, Second Edition)* Explains the selection of instruments to be panel-mounted, locating the instruments using drawings, and procedures for installing the instruments in the panels.

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Installing Field-Mounted Instruments *(25 Hours)*
ISBN 978-0-13-103278-1
(Module ID 12213-03; from *Instrumentation Level Two, Second Edition)* Covers selection and mounting of instruments at locations other than panels, including stand mounting, in-line mounting, structure mounting, strap mounting, and insertion mounting.

Grounding and Shielding of Instrumentation Wiring *(10 Hours)*
ISBN 978-0-13-103302-3
(Module ID 12306-03; from *Instrumentation Level Three, Second Edition)* Teaches the basic concepts of grounding and shielding, including wire and cable identification. Defines various types of noise that can be induced into instrumentation wiring and describes the methods used to reduce or eliminate it.

Analyzers *(20 Hours)*
ISBN 978-0-13-109619-6
(Module ID 12408-03; from *Instrumentation Level Four, Second Edition)* Defines various types of analyzers and their applications in industrial process control. Includes a discussion of analyzers that measure or monitor variables such as density, specific gravity, viscosity, turbidity, flashpoint, oxidation-reduction potential (ORP), pH, conductivity of a liquid, oxygen, carbon monoxide, carbon dioxide, hydrogen sulfide, total hydrocarbon content (THC), and particulates in a clean room. Also defines chromatography and ultraviolet and infrared analyzers.

L4 POWER GENERATION I&C MAINTENANCE TECHNICIAN

LEVEL 4

Curriculum Notes

- 210 Hours
- Published: 2010
- Downloadable instructor resources are available.

PAPERBACK	ISBN
Trainee Guide: $99.99	978-0-13-215437-6

MODULES

The modules listed below are included in the Trainee Guide. The following ISBNs are for ordering individual modules only.

Standby and Emergency Systems *(12.5 Hours)*
ISBN 978-0-13-609163-9
(Module ID 40401-09; from *Industrial Maintenance E&I Technician Level Four)* Explains the installation, utilization, and maintenance requirements for standby and emergency electrical systems.

Basic Process Control Elements, Transducers and Transmitters *(15 Hours)*
ISBN 978-0-13-609165-3
(Module ID 40402-09; from *Industrial Maintenance E&I Technician Level Four)* Discusses sensing and transmitting devices used in an instrumentation loop, along with the process variables measured by the detectors or sensors. Gives examples of technical manuals and specification sheets. Explains how control devices are selected, and how to draw basic control loop diagrams that include a measuring element, a transducer, and a transmitter.

Instrument Calibration and Configuration *(10 Hours)*
ISBN 978-0-13-609166-0
(Module ID 40403-09; from *Industrial Maintenance E&I Technician Level Four)* Introduces methods of instrumentation calibration, including the three- and five-point methods. Covers components that require calibration in pneumatic, analog, and smart loops, as well as methods used to calibrate these components.

Pneumatic Control Valves, Actuators and Positioners *(40 Hours)*
ISBN 978-0-13-609167-7
(Module ID 40404-09; *from Industrial Maintenance E&I Technician Level Four)* Covers the construction, operation, and uses of control valves, actuators, and positioners that are driven, and in some cases controlled by, compressed air. Explains the installation and maintenance of these devices, and includes alignment and troubleshooting procedures.

Performing Loop Checks *(7.5 Hours)*
ISBN 978-0-13-609168-4
(Module ID 40405-09; from *Industrial Maintenance E&I Technician Level Four)* Covers loop check steps, including verifying mechanical installation, validating that the loop has correct tag numbers, performing loop checks, and proving the loop.

Troubleshooting and Commissioning a Loop *(10 Hours)*
ISBN 978-0-13-609169-1
(Module ID 40406-09; from *Industrial Maintenance E&I Technician Level Four)* Teaches troubleshooting techniques used to locate problems in control loops, and how to isolate a loop in order to troubleshoot it. Covers commissioning of a loop once it is repaired, loop checked, and calibrated.

Process Control Theory *(20 Hours)*
ISBN 978-0-13-103267-5
(Module ID 12204-03; from *Instrumentation Level Two, Second Edition)* Describes the principles of process control and how various types of control loops are applied. Discusses ON-OFF and modulating control schemes. Explains how process control principles are applied to flow, level, temperature, and pressure control loops.

Process Control Loops and Tuning *(20 Hours)*
ISBN 978-0-13-609135-6
(Module ID 40407-09; from *Industrial Maintenance E&I Technician Level Four)* Describes control loops, devices, and terms. Introduces formulas and their applications to PID control. Offers a theory-based approach to PID control and its application in industrial process control. Addresses open, closed, and visual loop tuning.

Data Networks *(15 Hours)*
ISBN 978-0-13-609138-7
(Module ID 40408-09; from *Industrial Maintenance E&I Technician Level Four)* Introduces terms associated with data network devices and computers used in industrial facilities. Explains how data network devices and computers are interconnected for communication purposes. Describes how open connectivity is used in industrial data networks, and explores the hardware devices used in a data highway system.

Digital Logic Circuits *(10 Hours)*
ISBN 978-0-13-109610-3
(Module ID 12401-03; from *Instrumentation Level Four, Second Edition)* Introduces the basic ideas of digital electronics. Presents gates, combination logic, and truth tables. Addresses memory devices, counters, and arithmetic circuits as well as the numbering systems commonly used in digital systems.

Calibrate Supervisory Instrumentation Elements *(10 Hours)*
ISBN 978-0-13-266216-1
(Module ID 51401-10) Describes the sensing devices used to monitor key parameters, including vibration and speed sensors, eccentricity sensors, and thrust bearing wear detectors. Also covers the test instruments used to calibrate supervisory instrumentation, including shakers and Wobulators®, and explains how to use selected test instruments in the calibration process.

Boiler/HRSG Control *(12.5 Hours)*
ISBN 978-0-13-266217-8
(Module ID 51402-10) Covers the control devices, methods, and strategies used for boilers and Heat Recovery Steam Generators (HRSGs). Discusses fuel, air, oxygen, feedwater, and steam control, as well as the precautions and regulations related to burner and furnace fuel control.

Preventive and Predictive Maintenance *(10 Hours)*
ISBN 978-0-13-610445-2
(Module ID 32401-09; from *Industrial Maintenance Mechanic Level Four)* Explains preventive and predictive maintenance and non-destructive testing, and introduces the basic techniques for testing. Also describes lubricant analysis, and acoustic, infrared, and vibration testing.

Distributed Control Systems *(17.5 Hours)*
ISBN 978-0-13-609137-0
(Module ID 40410-09; from *Industrial Maintenance E&I Technician Level Four)* Describes how DCS was developed by combining the technologies of single loop control, direct digital control, and supervisory control. Covers DCS hardware requirements, how control loops are implemented into a DCS, types of data transmission used in DCS, communication protocols, and human interfaces.