



# Pipeline Electrical & Instrumentation

## L1 PIPELINE ELECTRICAL & INSTRUMENTATION

LEVEL 1

### Curriculum Notes

- 287.5 Hours (Includes 72.5 hours of Core Curriculum which is a prerequisite for Level 1 completion and must be purchased separately. See p. 10 for ordering information.)
- Published: 2002
- Instructor's Guide includes access code to download TestGen software, module exams, and performance profiles from [www.nccerirc.com](http://www.nccerirc.com).

### PAPERBACK

ISBN

Trainee Guide: \$100

978-0-13-046688-4

Instructor's Guide: \$100

978-0-13-046689-1

### MODULES

All of the modules listed below are included in the Trainee and Instructor Guide(s) listed above. The following ISBN and pricing information is for ordering individual modules only.

#### Introduction to the Pipeline Industry (15 Hours)

(Module ID 66101-02; Pipeline Core ; see p. 77)

Trainee \$20

ISBN 978-0-13-038223-8

Instructor \$20

ISBN 978-0-13-038234-4

#### Liquid Pipeline General Abnormal Operating Conditions (5 Hours)

(Module ID 66102-02; Pipeline Core ; see p. 78)

Trainee \$20

ISBN 978-0-13-038224-5

Instructor \$20

ISBN 978-0-13-038235-1

#### Pipeline E&I Safety (15 Hours)

Trainee \$20

ISBN 978-0-13-038376-1

Instructor \$20

ISBN 978-0-13-038385-3

(Module ID 64102-02) Describes the types and uses of personal protective equipment and covers hazard communications. Covers lockout/tagout and MSDS requirements; safety rules, regulations, and tools; and work-site hazards.

#### Trade Math (40 Hours)

Trainee \$20

ISBN 978-0-13-038377-8

Instructor \$20

ISBN 978-0-13-038386-0

(Module ID 64103-02) Presents instrumentation formulas and equations. Explains how to calculate load and ampacity, and perform pipeline-specific E&I calculations. Also provides a description of conductors.

#### Electrical Theory (40 Hours)

Trainee \$20

ISBN 978-0-13-038378-5

Instructor \$20

ISBN 978-0-13-038387-7

(Module ID 64104-02) Introduces the electrical concepts used in Ohm's law as applied to DC series circuits. Discusses atomic theory, electromotive force, resistance, and electric power equations. Also introduces series, parallel, and series-parallel circuits. Covers resistive circuits, Kirchhoff's voltage and current laws, and circuit analysis.

#### Tools of the Trade (15 Hours)

Trainee \$20

ISBN 978-0-13-038379-2

Instructor \$20

ISBN 978-0-13-038388-4

(Module ID 64105-02) Identifies hand tools used in the pipeline E&I trade. Also explains trade-specific power tools, test equipment, and communication equipment.

#### Pipeline Operations (40 Hours)

Trainee \$20

ISBN 978-0-13-038370-9

Instructor \$20

ISBN 978-0-13-038389-1

(Module ID 64106-02) Describes pipeline system hydraulics and ASME ratings and standards. Discusses station control systems and recognizing and responding to AOCs. Also covers pigging operations and proving process meters.

#### Pipeline E&I Drawings (30 Hours)

Trainee \$20

ISBN 978-0-13-038382-2

Instructor \$20

ISBN 978-0-13-038380-8

(Module ID 64107-02) Identifies drawing classifications and written specifications. Describes the uses of electrical drawings and piping and instrumentation drawings. Also covers special drawings and documentation as well as pipeline maps and alignment sheets.

#### Understanding the National Electrical Code® (7.5 Hours)

Trainee \$20

ISBN 978-0-13-038383-9

Instructor \$20

ISBN 978-0-13-038391-4

(Module ID 64108-02) Provides a map for using the NEC®. Introduces the layout and the types of information found within the code book. Presents an easy-to-follow procedure for finding information in the NEC®.

#### Fasteners and Anchors (7.5 Hours)

Trainee \$20

ISBN 978-0-13-038384-6

Instructor \$20

ISBN 978-0-13-038392-1

(Module ID 64109-02) Introduces hardware and systems used to mount and support boxes, receptacles, and other electrical components. Covers types of anchors and supports, their applications, and their safe installation.

## L2 PIPELINE ELECTRICAL & INSTRUMENTATION

LEVEL 2

### Curriculum Notes

- 265 Hours
- Published: 2002
- Instructor's Guide includes access code to download TestGen software, module exams, and performance profiles from [www.nccerirc.com](http://www.nccerirc.com).

### PAPERBACK

ISBN

Trainee Guide: \$100

978-0-13-046691-4

Instructor's Guide: \$100

978-0-13-046692-1

### MODULES

All of the modules listed below are included in the Trainee and Instructor Guide(s) listed above. The following ISBN and pricing information is for ordering individual modules only.

#### Electrical Installations in Classified Areas (40 Hours)

Trainee \$20

ISBN 978-0-13-038393-8

Instructor \$20

ISBN 978-0-13-038404-1

(Module ID 64201-02) Explains Class I, II, III, and IV pipeline areas. Describes intrinsically safe devices and systems and their ratings. Also covers allowable conduits and fittings, and explosion-proof enclosures. Explains safe work practices in classified areas, including barriers, PPE, monitoring requirements, and gas detectors.

#### Use of Meters and Test Equipment (15 Hours)

Trainee \$20

ISBN 978-0-13-038394-5

Instructor \$20

ISBN 978-0-13-038405-8

(Module ID 64202-02) Explains general, personal, and test equipment for E&I safety. Covers measuring current, voltage, and resistance and the types of meters used. Includes specialty instruments such as calibrators, simulators, and gauges. Includes sections on oscilloscope operation, waveform characteristics, and measurement techniques.

#### Grounding (30 Hours)

Trainee \$20

ISBN 978-0-13-038395-2

Instructor \$20

ISBN 978-0-13-038406-5

(Module ID 64203-02) Explains grounding basics, system types, NEC® requirements, equipment grounding, and how to bond service equipment. Includes discussion of effective grounding paths, conductors, separately derived systems, grounding at more than one building, and systems over 1,000 volts. Describes how to test grounding and measure earth resistance, three-point testing, and tank grounding.

#### Process Control Theory (40 Hours)

Trainee \$20

ISBN 978-0-13-038396-9

Instructor \$20

ISBN 978-0-13-038408-9

(Module ID 64204-02) Explains process characteristics and control systems. Describes control loop components and control loops and modes. Discusses types of control applications, including temperature, pressure, flow, and level control.

#### Supervisory Control Systems (15 Hours)

Trainee \$20

ISBN 978-0-13-038397-6

Instructor \$20

ISBN 978-0-13-038409-6

(Module ID 64205-02) Explains pipeline supervisory control systems, PLCs, HMIs, and RTUs. Describes data highways and protocols, including data transfer methods, and SCADA-related communications, including transfer media, wireless radios, and Ethernet, and transmission and interface methods.

#### Switches and Transmitters (CT 25, 30, 31) (15 Hours)

Trainee \$20

ISBN 978-0-13-038398-3

Instructor \$20

ISBN 978-0-13-038400-3

(Module ID 64206-02) Discusses pipeline pressure, flow, level, and temperature switches and pneumatic, electronic, and optical transmitters. Explains how to test, repair, inspect, and maintain switches and transmitters. Describes pigs and sphere detectors and recorders. Explains DOT coverage and regulations.

#### Controllers (CT 26) (15 Hours)

Trainee \$20

ISBN 978-0-13-038390-7

Instructor \$20

ISBN 978-0-13-038411-9

(Module ID 64207-02) Explains control and PID loops and verifying and setting protection parameters. Includes information on proper procedures and potential AOCs. Explains how to troubleshoot and tune open and closed loops.

#### Valve Actuators (CT 19.5) (15 Hours)

Trainee \$20

ISBN 978-0-13-038401-0

Instructor \$20

ISBN 978-0-13-038412-6

(Module ID 64208-02) Explains valve actuator components, including switches, power mechanisms, and heaters. Describes valve actuator types, symbols and schematics, uses, and actuator interfaces. Describes setting valve limits, and installing, repairing, and maintaining actuators.



## Pipeline Electrical & Instrumentation Level 3 (continued)

### Product Measurement (CT 44.1, 44.2) (40 Hours)

Trainee \$20 ISBN 978-0-13-038402-7  
Instructor \$20 ISBN 978-0-13-038413-3  
(Module ID 64209-02) Explains custody transfer and how to test, repair, install, and maintain custody transfer equipment and devices. Covers testing, repairing, installing, and maintaining prover equipment, process measurement equipment, and flow measurement equipment.

### Analytical Equipment (CT 55) (40 Hours)

Trainee \$20 ISBN 978-0-13-038403-4  
Instructor \$20 ISBN 978-0-13-038415-7  
(Module ID 64210-02) Identifies pipeline analytical equipment. Explains the maintenance of hydrogen sulfide and sulfur analyzers. Explains how to maintain chromatographs, moisture analyzers, vapor and combustible gas detectors, continuous emissions monitoring systems, and centrifuges.

## L3 PIPELINE ELECTRICAL & INSTRUMENTATION

### LEVEL 3

#### Curriculum Notes

- 185 Hours
- Published: 2002
- Instructor's Guide includes access code to download TestGen software, module exams, and performance profiles from [www.nccerirc.com](http://www.nccerirc.com).

#### PAPERBACK

#### ISBN

Trainee Guide: \$100 978-0-13-101082-6  
Instructor's Guide: \$100 978-0-13-101083-3

### MODULES

All of the modules listed below are included in the Trainee and Instructor Guide(s) listed above. The following ISBN and pricing information is for ordering individual modules only.

#### Transformers (25 Hours)

Trainee \$20 ISBN 978-0-13-103140-1  
Instructor \$20 ISBN 978-0-13-103148-7  
(Module ID 64301-02) Describes power systems and explains transformer construction, taps, installation requirements, and connections. Describes power distribution, instruments, control, and isolation transformer types. Also covers transformer maintenance and testing.

#### Switchgear and MCCs (25 Hours)

Trainee \$20 ISBN 978-0-13-103141-8  
Instructor \$20 ISBN 978-0-13-103149-4  
(Module ID 64302-02) Explains power factor and medium versus low-voltage cable and MCCs. Describes types of switchgear and cables, feeders, bussing, and bracing. Includes testing and maintenance on switchgear and MCCs and associated components.

#### Low-Voltage and Standby Power (25 Hours)

Trainee \$20 ISBN 978-0-13-103142-5  
Instructor \$20 ISBN 978-0-13-103150-0  
(Module ID 64303-02) Explains pipeline system standby generators, batteries, chargers, inverters, converters, and rotary and static UPSs. Also addresses the maintenance and testing of each.

### Power Quality (25 Hours)

Trainee \$20 ISBN 978-0-13-103143-2  
Instructor \$20 ISBN 978-0-13-103152-4  
(Module ID 64304-02) Explains power quality and types of defects, power systems, protection, and conditioning equipment. Discusses types of electrical noise and related problems, and possible solutions. Describes static electricity and its effect, system verification testing, and equipment maintenance.

### Prime Movers (32.5 Hours)

Trainee \$20 ISBN 978-0-13-103145-6  
Instructor \$20 ISBN 978-0-13-103153-1  
(Module ID 64305-02) Describes various electric motors and drives and their components. Discusses their maintenance and testing. Explains engine types, cooling and lubrication systems, turbine operation, fuel sources, and controls.

### Facility Auxiliary Systems (22.5 Hours)

Trainee \$20 ISBN 978-0-13-103146-3  
Instructor \$20 ISBN 978-0-13-103154-8  
(Module ID 64306-02) Includes information on pipeline facility buildings and related systems, including fire, security, vapor recovery, injection, water treatment, cathodic protection, and blending systems.

### SCADA (30 Hours)

Trainee \$20 ISBN 978-0-13-103147-0  
Instructor \$20 ISBN 978-0-13-103155-5  
(Module ID 64307-02) Explains pipeline operations systems, including control, communications, SCADA, and PLCs. Explains redundant systems and control system troubleshooting.