



NCCER

13614 Progress Blvd, Alachua, Florida 32615
Phone: (888) 622-3720 E-mail: info@nccer.org

PIPELINE ELECTRICAL & INSTRUMENTATION

Competencies / Objectives

Level One

MODULE 66101-02 – INTRODUCTION TO THE PIPELINE INDUSTRY

1. Explain the basic functions and purposes of pipelines and facilities and identify the characteristics and hazards of common pipeline products.
2. Identify maps and drawings used to depict pipelines and facilities.
3. Explain the roles of control personnel and equipment in the overall operation of a pipeline.
4. Explain liquid pipeline hydraulics and gas pipeline pneumatics.
5. Explain the types and purposes of pipeline equipment.
6. Explain pipeline electrical power systems and corrosion control.
7. Review operations, maintenance, and emergency procedures and perform documentation required for pipeline operations.

MODULE 66102-02 – LIQUID PIPELINE GENERAL ABNORMAL OPERATING CONDITIONS

1. Recognize and react to abnormal facility conditions.
2. Recognize and react to activation of a safety device.
3. Recognize and react to communications failures.
4. Recognize and react to power interruptions.
5. Respond appropriately to fire, explosions, and natural disasters.
6. Recognize and react to pipeline system damage.
7. Recognize and react to unexpected hazardous liquid or carbon dioxide (CO₂) leaks.
8. Recognize and react to unexplained pressure deviations.

MODULE 64102-02 – PIPELINE E&I SAFETY

1. Explain the company safety manual.
2. Describe required personal protective equipment.
3. Describe E&I safety-related tools.
4. Explain safety rules and regulations.
5. Recognize work-site hazards.

MODULE 64103-02 – TRADE MATH

1. Solve instrumentation formulas and equations.
2. Perform three-phase power calculations.
3. Perform pipeline-specific calculations.

MODULE 64104-02 – ELECTRICAL THEORY

1. Explain the difference between conductors and insulators.
2. Define voltage, current, and resistance, and explain how these properties of electricity are related by performing Ohm's law calculations.
3. Explain the different types of meters used to measure voltage, current, and resistance.
4. Calculate the amount of power used by a circuit using the power formula.
5. Explain the basic characteristics of a series circuit, a parallel circuit, and a series-parallel circuit.
6. Calculate, using Kirchhoff's voltage law and current law, the voltage drop and total current in series, parallel, and series-parallel circuits.
7. Find the total amount of resistance in a series circuit, a parallel circuit, and a series-parallel circuit.

MODULE 64105-02 – TOOLS OF THE TRADE

1. Use and maintain hand tools.
2. Use and maintain power tools.
3. Use and maintain test equipment.
4. Use and maintain portable communication devices.

MODULE 64106-02 – PIPELINE OPERATIONS

1. Explain pipeline system hydraulics.
2. Explain ANSI ratings and standards.
3. Explain station control systems.
4. Recognize abnormal operating conditions.
5. Explain pigging operations.
6. Explain proving process meters.

MODULE 64107-02 – PIPELINE E&I DRAWINGS

1. Explain drawing classifications and written specifications.
2. Read and interpret electrical drawings.
3. Read and interpret piping and instrumentation diagrams.
4. Read and interpret special drawings and diagrams.
5. Read and interpret pipeline maps and alignment sheets.

MODULE 64108-02 – UNDERSTANDING THE NATIONAL ELECTRICAL CODE®

1. Explain the purpose and history of the National Electrical Code® (NEC®).
2. Describe the layout of the NEC®.
3. Navigate the NEC®.
4. Describe the purpose of the National Electrical Manufacturers Association (NEMA) and the National Fire Protection Association (NFPA).
5. Explain the role of testing laboratories.

MODULE 64109-02 – FASTENERS AND ANCHORS

1. Identify and explain the use of threaded, nonthreaded, and special threaded fasteners.
2. Identify and explain the use of anchors.
3. Install fasteners and anchors.

Level Two

MODULE 64201-02 – ELECTRICAL INSTALLATIONS IN CLASSIFIED AREAS

1. Explain Class 1 pipeline areas.
2. Describe intrinsically safe devices and systems and explain ratings.
3. Describe allowable conduits and fittings and describe explosion-proof boxes and fixtures.
4. Describe personal protective equipment, and explain how to approach and leave a classified area.

MODULE 64202-02 – USE OF METERS AND TEST EQUIPMENT

1. Explain general E&I safety, test equipment safety, and the use of personal protective equipment.
2. Explain measuring current using an ammeter and a multimeter.
3. Explain measuring voltage using a voltmeter and a multimeter.
4. Explain measuring resistance using an ohmmeter and a multimeter.
5. Explain specialty electrical and instrumentation test equipment used on pipelines.
6. Explain the use of oscilloscopes to measure waveforms and electrical signals.

MODULE 64203-02 – GROUNDING

1. Explain the basics of grounding.
2. Explain types of grounding systems.
3. Explain NEC® requirements for grounding.
4. Explain equipment grounding.
5. Explain bonding service equipment.
6. Explain effective grounding paths.
7. Explain grounding conductors.
8. Explain separately derived systems.
9. Explain grounding at more than one building.
10. Explain systems over 1,000 volts.
11. Test for effective grounds.
12. Measure earth resistance.
13. Perform three-point testing.
14. Explain tank grounding.

MODULE 64204-02 – PROCESS CONTROL THEORY

1. Define process measurement and control.
2. Discuss process characteristics that demand process control.
3. Describe the elements of an instrumentation control loop, including:
 - Detector (sensor)
 - Transducer
 - Amplifier or signal conditioner
 - Transmitter
 - Controller
 - Final element (control valve)
4. Define and describe process control loop types, including:
 - Feedforward
 - Feedback
 - Cascade
 - Ratio
5. Define and describe process controller modes, including:
 - On-off control (two-position control)
 - Modulating control
 - Proportional (P)
 - Integral (I)
 - Derivative (D)
 - Proportional and integral (PI)
 - Proportional and derivative (PD)
 - Proportional, integral, and derivative (PID)
6. Discuss various types of process control applications and loops.

MODULE 64205-02 – SUPERVISORY CONTROL SYSTEMS

1. Explain pipeline supervisory control systems.
2. Explain programmable logic controllers (PLCs), human-machine interfaces (HMIs), and remote terminal units (RTUs).
3. Explain data highways and protocols.
4. Explain Supervisory Control and Data Acquisition (SCADA) related communications.

MODULE 64206-02 – SWITCHES AND TRANSMITTERS (CT 25, 30, AND 31)

1. Explain and use types of pipeline switches.
2. Explain and use types of pipeline transmitters.
3. Perform testing, repairs, inspection, and maintenance on switches and transmitters (CT 25, 30, and 31).
4. Explain and use pig and sphere detectors.
5. Explain and use recorders.
6. Explain DOT coverage and regulations.
7. Explain and use NGL systems.

MODULE 64207-02 – CONTROLLERS (CT 26)

1. Explain control and PID loops.
2. Verify and set protection parameters (CT 26).
3. Troubleshoot control loops.
4. Tune loops.

MODULE 64208-02 – VALVE ACTUATORS (CT 19.5)

1. Identify actuator components.
2. Identify valve actuator/operator types.
3. Explain valve actuator symbols and schematics.
4. Explain setting valve limits.
5. Explain valve actuator interfaces.
6. Install, repair, and maintain valve actuators (CT 19.5).

MODULE 64209-02 – PRODUCT MEASUREMENT (CT 44.1 AND 44.2)

1. Explain custody transfer.
2. Test, repair, install, and maintain custody transfer equipment and devices (CT 44.1 and 44.2).
3. Test, repair, install, and maintain prover equipment (CT 44.1).
4. Test, repair, install, and maintain process measurement equipment.
5. Test, repair, install, and maintain flow measurement equipment (CT 44.1 and 44.2).

MODULE 64210-02 – ANALYTICAL EQUIPMENT (CT 55)

1. Identify types of pipeline analytical equipment.
2. Explain and maintain hydrogen sulfide (H₂S) and sulfur analyzers.
3. Explain and maintain chromatographs.
4. Explain and maintain moisture analyzers.
5. Explain and maintain vapor and combustible gas detectors (CT 55).
6. Explain and maintain continuous emissions monitoring systems.
7. Explain and maintain centrifuges.

Level Three

MODULE 64301-02 – TRANSFORMERS

1. Describe power systems.
2. Describe the function of transformers.
3. Identify transformer types.
4. Explain transformer connections.
5. Maintain and test transformers.

MODULE 64302-02 – SWITCHGEAR AND MCCS

1. Explain voltage levels (low, medium, and high).
2. Explain switchgear components.
3. Explain characteristics of low- and medium-voltage MCCs.
4. Explain the difference between switchgear and MCCs.
5. Explain the cause and consequences of poor power factor and describe a solution.
6. Explain the types of cables used in pipeline facilities, including shielded and nonshielded.
7. Test and maintain switchgear, MCCs, and cable.
8. Make a high-voltage splice or termination.

MODULE 64303-02 – LOW-VOLTAGE AND STANDBY POWER

1. Identify and explain the function of standby generators on pipeline systems; perform the maintenance and testing relevant to generators.
2. Identify and explain the function of batteries on a pipeline system; perform the maintenance and testing relevant to batteries.
3. Identify and explain the function of battery chargers on a pipeline system; perform the maintenance and testing relevant to chargers.
4. Identify and explain the function of inverters on a pipeline system; perform the maintenance and testing relevant to inverters.
5. Identify and explain the function of converters on a pipeline system; perform the maintenance and testing relevant to converters.
6. Identify and explain the function of rotary and static UPSs on pipeline systems; perform the maintenance and testing relevant to UPSs.

MODULE 64304-02 – POWER QUALITY

1. Define power quality in terms of clean, constant power.
2. Explain the power systems used at pipeline facilities.
3. Identify the different types of power quality defects and explain their effects on power quality.
4. Identify power system protection and conditioning equipment and explain its function.
5. Explain the different types of electrical noise, the problems it poses for pipeline electrical equipment, and ways to minimize it.
6. Explain different solutions for electrical noise problems.
7. Explain static electricity and the effect it has on sensitive electronic equipment.
8. Explain the different types of system verification testing.
9. Explain equipment maintenance.

MODULE 64305-02 – PRIME MOVERS

1. Describe electric motors.
2. Explain engines.
3. Explain turbines.

MODULE 64306-02 – FACILITY AUXILIARY SYSTEMS

1. Identify and explain building systems.
2. Identify and explain fire systems.
3. Identify and explain security systems.
4. Identify and explain vapor recovery systems.
5. Identify and explain injection systems.
6. Identify and explain water treatment systems.
7. Identify and explain cathodic protection systems.
8. Identify and explain blend systems.

MODULE 64307-02 – SCADA

1. Explain the functions and importance of control systems in pipeline operations.
2. Explain the various methods of communication used on the pipeline system.
3. Explain the functions and components of the Supervisory Control and Data Acquisition (SCADA) system.
4. Explain the functions and components of programmable logic controller (PLC) systems.
5. Explain the functions and methods for redundant systems.
6. Explain troubleshooting methods for pipeline control systems.



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PIPELINE ELECTRICAL & INSTRUMENTATION

Materials and Equipment

Level One

MODULE 64102-02 - PIPELINE E&I SAFETY

- Transparencies
- Markers/chalk
- Blank acetate sheets
- Transparency pens
- Pencils and scratch paper
- Module Examinations
- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate personal protective equipment
- Copies of your company's policy and procedures manual
- Copies of a company safety manual (one per group or student)
- Various types of safety equipment, including eye, face, and hand protection and respirators
- A variety of hot sticks and shotguns
- Various tags used in tagouts (new and/or used)
- Pictures demonstrating the use of color codes in a pipeline facility
- Several MSDSs
- Posterboard
- Colored markers

MODULE 64103-02 – TRADE MATH

- Transparencies
- Markers/chalk
- Blank acetate sheets
- Transparency pens
- Pencils and scratch paper
- Module Examinations
- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate personal protective equipment
- Copies of your company's policy and procedures manual
- Copies of the National Electric Code®, latest edition

MODULE 64104-02 – ELECTRICAL THEORY

Transparencies

Markers/chalk

Blank acetate sheets

Transparency pens

Pencils and scratch paper

Module Examinations

Performance Profile Sheets

Overhead projector and screen

Whiteboard/chalkboard

Appropriate personal protective equipment

Copies of your company's policy and procedures manual

Colored markers (optional)

Posterboard or large sheets of paper (optional)

Various resistors, both wire-wound and carbon (one per trainee)

MODULE 64105-02 – TOOLS OF THE TRADE

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils/scratch paper
Module Examinations
Performance Profile Sheets
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of your company's policy and procedures manual
A copy of National Electrical Code® (NEC) Articles 345, 346, and 347 or the entire NEC®
Benders
Scrap pieces of conduit or electrical metallic tubing
Hickeys (several sizes)
Lengths of conduit (various sizes)
Reamer
Threader
Cable cutters
Scrap pieces of cable
Conduit pistons
Straight wrenches
Stillson wrenches
Electrical wire
Fish tape
Portable band saw
Assorted blades for the band saw
Soldering iron
Tips for the soldering iron
Insulation-resistance tester
RF wattmeter
Frequency counter
Oscilloscope
Precision test gauge
Smart transmitter communicator
Clamp-on ammeter
Breakout box
Digital calibrator
Decade boxes
Signal generator
Typical relay tester
UV/IR guns
IR guns
Matches
Candles
Power quality analyzer
Assorted multimeters
Assorted cell phones, two-way radios, and pagers

MODULE 64106-02 - PIPELINE OPERATIONS

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Copies of the Quick Quiz
Module Examinations
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of your company's policy and procedures manual, including responses to AOCs
Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
Colored markers
Posterboard or large pieces of paper
Several kinds of scraper pigs or pictures of them
One of each type of batch separator or pictures of them
Turbine meter or picture of one
Positive displacement meter or picture of one
Photo of a K-factor stamped on a meter
Examples or photos of proving instruments

MODULE 64107-02 - PIPELINE E&I DRAWINGS

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Copies of the Quick Quiz
Module Examinations
Performance Profile Sheets
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of your company's policy and procedures manual
Sample elevation views
Copies of drawings with complete title blocks, one copy per trainee
Copies of drawings with complete approval blocks, one copy per trainee
Sample drawings that use the lines listed in Figures 8 and 9, one copy per trainee
Rulers (English)
Architect's scales, including triangular scale and flat scale, preferably one per trainee
Engineer's scales, preferably one per trainee
Calculator (optional)
Copies of architectural drawings drawn to scale
Copies of electrical drawings that use a variety of abbreviations and symbols and contain a legend
Copies of a piping and instrumentation diagram that has lines, line numbers, match lines, and piping component symbols, one copy per trainee
Copies of sample instrument location drawings, instrument installation drawings, loop sheets, flow drawings, and instrument data sheets, one of each per trainee
Copies of a survey map, topographic map, profile, and strip map, one of each per trainee
Examples of drawings, some but not all of which are alignment sheets

MODULE 64108-02 - UNDERSTANDING THE NATIONAL ELECTRICAL CODE®

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of your company's policy and procedures manual
A copy of the National Electrical Code®

MODULE 64109-02 - FASTENERS AND ANCHORS

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of your company's policy and procedures manual
Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
Assorted threaded fasteners
Samples of the three series of threads
Assorted bolts and screws
Assorted machine screws
Assorted cap screws
Assorted set screws
Assorted concrete/masonry, deck, and drywall screws
Regular and semi-finished nuts
Finished nuts
Jam nut (with standard bolt and nut)
Standard nut (to be installed as jam nut)
Castellated and slotted nuts
A square key, a Pratt and Whitney key, a Gib head key, and a Woodruff key
Shaft keyseat (if separate from keys)
Assorted pin fasteners
Assorted yoke clamps
Assorted spacer clamps
A bundle lock application
A blind rivet application
Thread insert
Assorted washers
Assorted tie wraps
Assorted eye and J-bolts
Hammer-driven pins and studs (and equipment needed to install them)
Powder-actuated tool
Assorted one-step anchors
Equipment for installing each type of one-step anchor
Equipment for installing each type of bolt anchor
Assorted screw anchors
Assorted screw, self-drilling, and hollow-wall anchors
Equipment for installing epoxy anchoring systems
Equipment for installing threaded fasteners
Equipment for installing blind rivets
Equipment for installing toggle bolts
Equipment for a hardened concrete installation (wedge anchors)

Level Two

MODULE 64201-02 - ELECTRICAL INSTALLATIONS IN CLASSIFIED AREAS

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Copies of Quick Quiz
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of the National Electrical Code® Article 504 and/or ANSI/ISA RP 12.6-1987
Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
Copies of API Recommended Practice
Copies of your company policy and procedures manual
Sample documentation for a classified area
Listing of approved equipment and devices from the Underwriters Laboratory or Factory Mutual Research Corporation
Working drawings for an electrical system in a hazardous location
Seal-off fittings for vertical and horizontal runs
Sealing compound kits
Several fittings and a variety of sealing compound kits
Rigid metal conduit nipples, sealing fittings, No.12 THHN conductors, and packing fiber/sealing kit
Samples of a general safe work permit
Samples of damaged protective equipment.

MODULE 64202-02 - USE OF METERS AND TEST EQUIPMENT

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
Copies of your company policy and procedures manual
Electrical meters and test equipment
Rubber gloves, sleeves, and blankets
A moving-coil meter movement and/or a d'Arsonval meter movement
DC ammeters
Test equipment
Clamp-on ammeters
Digital and analog multimeters
Multimeter batteries and fuses
Voltmeters
Ohmmeters
Megohmmeters
Handheld calibrator
HART communicator
Dead weight testers
Decade box
Analog oscilloscope
A variety of test instruments, including:
Hi-pot testers
Recording meters
Dead weight gauges
Pneumatic signal simulators
Fluidized sand baths
Dry block calibrators
Continuity testers
Sound-activated phones

MODULE 64203-02 - GROUNDING

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Overhead projector and screen
Whiteboard/chalkboard
Calculators
Appropriate personal protective equipment
Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
Copies of your company policy and procedures manual
Copies of the 2002 (or latest) edition of the National Electrical Code®
Copies of API Recommended Practices 2003
Various electrodes that meet the requirements for ground rods
Grounding electrode conductors, No. 4 grounding wire, ground rods, and panelboard
Grounding outlet boxes and devices
Nonmetallic-sheathed cable
Grounding clips
Grounding conductors, grounding wire, and metallic boxes
Earth ground resistance tester
Several ground testers and the necessary test equipment

MODULE 64204-02 - PROCESS CONTROL THEORY

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Copies of Quick Quiz
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
Copies of your company policy and procedures manual
Copies of the 2002 (or latest) edition of the National Electrical Code®
Copies of API Recommended Practices 2003
Drawing paper
A variety of detectors/sensors
Sample valve characteristic curves
Calculators

MODULE 64205-02 - SUPERVISORY CONTROL SYSTEMS

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
Copies of your company policy and procedures manual
Copies of ANSI C37.1
Sections of shielded and unshielded twisted pair wiring, coaxial cable, and fiber-optic cable
Sample drawings of data flow systems
Sample block diagrams of SCADA systems
Large sheets of plain drawing paper

MODULE 64206-02 - SWITCHES AND TRANSMITTERS (CT 25, 30, AND 31)

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
Copies of your company policy and procedures manual
Trace paddle switches
Level switches
Copies of Figure 18 with the callouts covered
Common measuring elements
Chart paper for a mechanical recorder
Sample recorder calibration chart
Sample records for documenting the testing, repair, and maintenance of switches and transmitters
Copies of the Performance Verifications for Covered Tasks 25.1, 25.2, 3.0.0, and 3.1.0

MODULE 64207-02 - CONTROLLERS (CT 26)

- Transparencies
- Markers/chalk
- Blank acetate sheets
- Transparency pens
- Pencils and scratch paper
- Module Examinations
- Performance Profile Sheets
- Copies of Quick Quiz
- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate personal protective equipment
- Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
- Copies of your company policy and procedures manual
- Sample system diagrams, prints, or schematics
- Sample P&IDs
- Calculators
- Copies of the Performance Verifications for Covered Task 26

MODULE 64208-02 - VALVE ACTUATORS (CT 19.5)

- Transparencies
- Markers/chalk
- Blank acetate sheets
- Transparency pens
- Pencils and scratch paper
- Module Examinations
- Performance Profile Sheets
- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate personal protective equipment
- Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
- Copies of your company policy and procedures manual
- Copies of Figures 3 through 10 without their titles
- Valve actuator components (or photos of valve actuator components)
- Copies of Figure 17 with the callouts covered
- Sample valve maintenance log
- Actuator installation manuals
- Grease brush and/or grease gun
- Stem-type valves
- Gearbox case
- Copies of the Performance Verification for Covered Task 19.5

MODULE 64209-02 - PRODUCT MEASUREMENT (CT 44.1 AND 44.2)

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and paper
Module Examinations
Performance Profile Sheets
Copies of Quick Quiz
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)
Copies of your company policy and procedures manual
Copies of the 2002 (or latest) edition of the National Electrical Code®
Copies of API Recommended Practices 2003
Valve alignment chart
Printed and handwritten delivery tickets
Receipt logs and delivery tickets
Copies of the Performance Verifications for Covered Tasks 44.1 and 44.2†
Transducer output readings and manufacturer's manuals
Pycnometer
Several product samples that have and have not been placed in a centrifuge
Copies of Figure 25 with the callouts covered
Orifice plates
Manufacturer's instruction manuals for flow measurement equipment, including
Mass flowmeters
Pressure transmitters
Pneumatic calibrators
Vortex flowmeters
Orifice meters
Calculators
Sample worksheets, tables, and charts, including
Frequency comparison worksheets
Comparison calibration worksheets
Square root extractor worksheets
Digital voltmeter comparison charts
Voltage output charts
Differential pressure tables
Photographs of a variety of types of flow measurement equipment

MODULE 64210-02 - ANALYTICAL EQUIPMENT (CT 55)

Transparencies

Markers/chalk

Blank acetate sheets

Transparency pens

Pencils and scratch paper

Module Examinations

Performance Profile Sheets

Overhead projector and screen

Whiteboard/chalkboard

Appropriate personal protective equipment

Copies of 49 CFR Part 192 (Gas) and/or 49 CFR Part 195 (Liquid)

Copies of your company policy and procedures manual

Copies of the 2002 (or latest) edition of the National Electrical Code®

Copies of API Recommended Practices 2003

Portable analyzers

Personal analyzers

Lists of randomly ordered procedures for chromatograph testing, repair, installation, and maintenance

Copies of Figure 12 with the callouts covered

Samples of manufacturer's instructions for a variety of chromatographs

Engineering designs

Copies of the Clean Air Act Amendments of 1990

Copies of the Performance Verification for Covered Task 55

Level Three

MODULE 64301-02 - TRANSFORMERS

- Transparencies
- Markers/chalk
- Blank acetate sheets
- Transparency pens
- Pencils and scratch paper
- Module Examinations*
- Performance Profile Sheets*
- Overhead projector and screen
- Whiteboard/chalkboard
- Appropriate personal protective equipment
- Copies of your local code
- Copies of your company's policy and procedures manual
- Copies of the National Electrical Code®, latest edition
- Various types of transformers and equipment for examining and inspecting them
- Equipment for adjusting taps
- Sample electrical diagrams
- Potential and current transformers and instruments
- Equipment necessary for connecting transformers
- Transformer nameplates (or pictures of them)
- Testing equipment and transformers to test
- Transformer bushings and oil

MODULE 64302-02- SWITCHGEAR AND MCCS

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of your local code
Copies of your company's policy and procedures manual
Copies of National Electrical Code® articles on cable or the entire NEC®
Various types of cables, cable cutters, and AWG gauge
IEEE Recommended Practice for Electric Power Distribution for Industrial Plants
Photos or drawings of several types of MCCs
Copies of Figure 8 with all text covered
Copies of a motor control schematic and wiring diagram
Materials and equipment required for splicing cables
Spliced cables with each type of termination
Equipment for examining a switchboard
Equipment for maintaining and inspecting switchgear
Equipment for maintaining and inspecting circuit breakers
Equipment for maintaining, testing, and inspecting MCCs

MODULE 64303-02 - LOW-VOLTAGE AND STANDBY POWER

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Copies of Quick Quiz
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of your local code
Copies of your company's policy and procedures manual
Copies of the National Electrical Code®
Standby generator and equipment required for inspection of standby generators
Equipment for measuring specific gravity
Batteries and equipment required for load and impedance tests
Batteries for inspection and necessary equipment
Charger and necessary equipment for floating and equalizing voltage on a charger
Charger and necessary equipment for maintenance and testing
Inverters and necessary equipment for maintenance and testing
Converter and necessary equipment for inspection
UPS system and necessary equipment for maintenance and testing

MODULE 64304-02 - POWER QUALITY

Transparencies
Markers/chalk
Blank acetate sheets
Transparency pens
Pencils and scratch paper
Module Examinations
Performance Profile Sheets
Copies of Quick Quiz
Overhead projector and screen
Whiteboard/chalkboard
Appropriate personal protective equipment
Copies of your local code
Copies of your company's policy and procedures manual
Copies of the National Electrical Code®, latest edition
Photos of voltage regulators
Photo or drawing of a power center
Several grounding wrist straps
Power quality equipment, manufacturers' recommendations, and necessary materials or tools

MODULE 64305-02 - PRIME MOVERS

Transparencies

Markers/chalk

Blank acetate sheets

Transparency pens

Pencils and scratch paper

Module Examinations

Performance Profile Sheets

Overhead projector and screen

Whiteboard/chalkboard

Appropriate personal protective equipment

Copies of your local code

Copies of your company's policy and procedures manual

Copies of the National Electrical Code®, latest edition

Sample frame sizes and any necessary tables

Necessary materials, equipment, and company / manufacturer procedures for

Verifying the proper operation of space heaters

Verifying protection systems

Connecting an electric motor for the correct rotation

Electrically testing motor bearings

Motor, oil, and necessary equipment for changing bearing oil in a motor

MODULE 64306-02 - FACILITY AUXILIARY SYSTEMS

Transparencies

Markers/chalk

Blank acetate sheets

Transparency pens

Pencils and scratch paper

Module Examinations

Performance Profile Sheets

Copies of Quick Quiz

Overhead projector and screen

Whiteboard/chalkboard

Appropriate personal protective equipment

Copies of your local code

Copies of the National Electrical Code®, latest edition

Photo of a pipeline facility building

Necessary equipment, company policy and procedures, and documentation forms for rectifier maintenance and blend system maintenance

Module 64307-02SCADA

Transparencies

Markers/chalk

Blank acetate sheets

Transparency pens

Pencils and scratch paper

Module Examinations

Performance Profile Sheets

Copies of Quick Quiz**

Copies of your company's policy and procedures manual

Overhead projector and screen

Whiteboard/chalkboard

Appropriate personal protective equipment

Copies of your local code

A variety of SCADA screenshots

Documentation of an actual or hypothetical troubleshooting procedure



Level One

MODULE 66101-02 – INTRODUCTION TO THE PIPELINE INDUSTRY

Task Number	Item	Date(s)	Recorded By
This is a knowledge-based module; there is no performance testing.			

MODULE 66102-02 – LIQUID PIPELINE GENERAL ABNORMAL OPERATING CONDITIONS

Task Number	Item	Date(s)	Recorded By
This is a knowledge-based module; there is no performance testing.			

MODULE 64102-02 – PIPELINE E&I SAFETY

Task Number	Item	Date(s)	Recorded By
This is a knowledge-based module; there is no performance testing.			

MODULE 64103-02 – TRADE MATH

Task Number	Item	Date(s)	Recorded By
This is a knowledge-based module; there is no performance testing.			

MODULE 64104-02 – ELECTRICAL THEORY

Task Number	Item	Date(s)	Recorded By
64104-1	Use the formula for Ohm's law to calculate unknown values for current, resistance, and voltage.		
64104-2	Given different resistors, identify the correct resistance value and tolerance using the color code.		
64104-3	Draw basic voltmeter and ohmmeter circuits and explain how they operate.		
64104-4	Use the power formula to calculate the amount of power used by a circuit.		
64104-5	Use a variation of the power formula to calculate the maximum current a resistor can carry based on the resistor's value and power rating.		
64104-6	Calculate the total resistance for selected series, parallel, and series-parallel circuits.		
64104-7	Use Kirchhoff's current law to calculate the total and unknown currents in parallel and series-parallel circuits.		
64104-8	Use Kirchhoff's voltage law to calculate voltage drops in series, parallel, and series-parallel circuits.		

MODULE 64105-02 – TOOLS OF THE TRADE

Task Number	Item	Date(s)	Recorded By
64105-1	Identify a given hand tool, state its application, and describe its safe use and maintenance.		
64105-2	Demonstrate the use of a given hand tool, according to the standards given by the instructor.		
64105-3	Identify a given power tool, state its application, and describe its safe use and maintenance.		
64105-4	Demonstrate the use of a given power tool, according to standards given by the instructor.		
64105-5	Identify a given kind of test equipment, state its application, and describe its safe use and maintenance.		
64105-6	Demonstrate the use of a given kind of test equipment, according to standards given by the instructor.		
64105-7	Identify a given kind of portable communication equipment, state its application, and describe its safe use and maintenance.		
64105-8	Demonstrate the use of a given kind of portable communication equipment, according to standards given by the instructor.		

MODULE 64106-02 – PIPELINE OPERATIONS

Task Number	Item	Date(s)	Recorded By
<hr/> This is a knowledge-based module; there is no performance testing. <hr/>			

MODULE 64107-02 – PIPELINE E&I DRAWINGS

Task Number	Item	Date(s)	Recorded By
64107-1	Identify a given type of drawing, state its application, and describe its use.		
64107-2	Identify common drawing components, such as the title block, legend, and drafting lines, and describe their use.		
64107-3	Read and interpret electrical drawings.		
64107-4	Read and interpret piping and instrumentation diagrams.		
64107-5	Read and interpret special drawings and diagrams.		
64107-6	Read and interpret pipeline maps and alignment sheets.		

MODULE 64108-02 – UNDERSTANDING THE NATIONAL ELECTRICAL CODE®

Task Number	Item	Date(s)	Recorded By
64108-1	Use NEC® Article 90 to determine the scope of the NEC®, and state what is covered by the NEC® and what is not.		
64108-2	Find the definition of the term feeder in the NEC®.		
64108-3	Look up the NEC® specifications one would need to follow when installing an outlet near a fire pump or water pump house.		
64108-4	Find the minimum wire bending space required if two No. 1/0 AWG conductors were to be installed in a junction box or cabinet.		

MODULE 64109-02 — FASTENERS AND ANCHORS

Task Number	Item	Date(s)	Recorded By
64109-1	From a selection of threaded fasteners, select the correct fastener(s) for one or more applications specified by the instructor.		
64109-2	From a selection of nonthreaded fasteners, select the correct fastener for one or more applications specified by the instructor.		
64109-3	Install a nut and bolt and torque them to a torque value specified by the instructor.		
64109-4	Install a blind rivet using a rivet gun.		
64109-5	Drill a hole and install a toggle bolt.		

Level Two

MODULE 64201-02 – ELECTRICAL INSTALLATIONS IN CLASSIFIED AREAS

Task Number	Item	Date(s)	Recorded By
64201-1	Determine if a fitting would be usable in a classified area.		
64201-2	Using two rigid metal conduit nipples, a sealing fitting, three pieces of No. 12 THHN conductors, and a packing fiber/sealing kit, perform the following operations: <ul style="list-style-type: none">• Secure a conduit nipple in each end of the seal.• Make sure the required amount of threads are engaged.• Pull the three THHN conductors through the nipples and seal so that about 6" are protruding from each nipple.• Pack the fiber as per instructions furnished with the sealing kit.• Mix the sealing compound.• Position the unit in the required location and pour in the sealing compound.		
64201-3	Identify a minimum of three different covers for explosion-proof fittings.		
64201-4	Remove the inspection cover on an explosion-proof fitting and check for moisture.		
64201-5	Install a barrier system.		

MODULE 64202-02 – USE OF METERS AND TEST EQUIPMENT

Task Number	Item	Date(s)	Recorded By
64202-1	Use a clamp-on ammeter to measure current.		
64202-2	Use an analog or digital multimeter to measure AC/DC voltage, AC/DC current, and resistance.		
64202-3	Use a HART digital communicator to configure and calibrate a smart-capable device.		
64202-4	Use a calibrator to zero and spin a current-loop device.		
64202-5	Use an oscilloscope to measure various waveforms and electrical signals.		

MODULE 64203-02 – GROUNDING

Task Number	Item	Date(s)	Recorded By
64203-1	Using the proper fittings, connect one end of a No. 4 AWG bare copper grounding wire to a copper ground rod and the other end to the correct terminal in a main panelboard.		
64203-2	Measure the resistance of ground electrodes using the fall-of-potential method.		
64203-3	Explain and properly terminate an equipment ground.		
64203-4	Explain and properly terminate a shield.		
64203-5	At an existing installation, point out the bonding between noncurrent-carrying metal parts.		

MODULE 64204-02 – PROCESS CONTROL THEORY

Task Number	Item	Date(s)	Recorded By
64204-1	Draw and accurately label a block diagram for a typical basic process control loop.		
64204-2	Identify the major components and signals in a given set of P&IDs.		
64204-3	Satisfactorily identify the accuracies, ranges, spans, and/or linearities of given instrumentation from typical documentation.		
64204-4	Tune a control loop as set up by the instructor.		

MODULE 64205-02 – SUPERVISORY CONTROL SYSTEMS

Task Number	Item	Date(s)	Recorded By
64205-1	Identify symbols typically used in a ladder logic drawing.		
64205-2	Discuss the importance of protocols.		
64205-3	Draw a block diagram of a typical SCADA system.		
64205-4	Identify and discuss components of a data flow system from a drawing provided by the instructor.		

MODULE 64206-02 – SWITCHES AND TRANSMITTERS (CT 25, 30, 31)

Task Number	Item	Date(s)	Recorded By
64206-1	Inspect, test, and calibrate pressure switches (CT 25.1).		
64206-2	Inspect, test, and calibrate pressure transmitters (CT 25.2).		
64206-3	Test overflow protective devices (CT 30.0).		
64206-4	Inspect and calibrate overflow protective devices (CT 31.0).		
64206-5	Inspect, test, and calibrate temperature and differential pressure switches, as applicable.		

MODULE 64207-02 – CONTROLLERS (CT 26)

Task Number	Item	Date(s)	Recorded By
64207-1	Verify or set protection parameters for programmable controllers and/or other instrumentation control loops (CT 26).		
64207-2	Troubleshoot a loop.		
64207-3	Tune a loop.		

MODULE 64208-02 – VALVE ACTUATORS (CT 19.5)

Task Number	Item	Date(s)	Recorded By
64208-1	Adjust and set actuator limit switches to obtain proper valve positioning (CT 19.5).		
64208-2	Verify proper actuator torque switch function (CT 19.5).		
64208-3	Test and verify proper operation of the actuator.		

MODULE 64209-02 – PRODUCT MEASUREMENT (CT 44.1, 44.2)

Task Number	Item	Date(s)	Recorded By
64209-1	Handline a tank and set the level transmitter.		
64209-2	Prove a meter.		
64209-3	Test, repair, install, and maintain prover equipment.		
64209-4	Inspect, test, and calibrate leak detection equipment (CT 44.1).		
64209-5	Verify that the leak detection system meets design parameters (CT 44.2).		
64209-6	Test, repair, install, and maintain process measurement equipment.		

MODULE 64210-02 – ANALYTICAL EQUIPMENT (CT 55)

Task Number	Item	Date(s)	Recorded By
64210-1	Use and maintain analytical equipment as directed by your instructor.		
64210-2	Maintain fixed gas detection equipment (CT 55).		

Level Three

MODULE 64301-02 – TRANSFORMERS

Task Number	Item	Date(s)	Recorded By
64301-1	Make tap adjustments.		
64301-2	Demonstrate the ability to connect instruments to potential and current transformers.		
64301-3	Connect transformers in different configurations.		
64301-4	Test for an open winding.		
64301-5	Test for grounded winding.		

MODULE 64302-02 – SWITCHGEAR AND MCCS

Task Number	Item	Date(s)	Recorded By
64302-1	Make a high-voltage splice or termination.		
64302-2	Test and maintain switchgear.		
64302-3	Test and maintain cables.		
64302-4	Test and maintain MCCs.		

MODULE 64303-02 – LOW-VOLTAGE AND STANDBY POWER

Task Number	Item	Date(s)	Recorded By
64303-1	Adjust the frequency of the output voltage of a generator set.		
64303-2	Take specific gravity readings.		
64303-3	Clean and maintain batteries.		
64303-4	Measure cell voltage.		
64303-5	Adjust float and equalize voltage on a charger.		
64303-6	Connect AC and DC power to an inverter.		

MODULE 64304-02 – POWER QUALITY

Task Number	Item	Date(s)	Recorded By
64304-1	Install and test surge arrestors.		
64304-2	Given one or more situations involving poor power quality and the related cause, select the appropriate system protection and/or conditioning device used to correct the problem.		
64304-3	Demonstrate the ability to test a UPS system.		

MODULE 64305-02 – PRIME MOVERS

Task Number	Item	Date(s)	Recorded By
64305-1	Verify space heaters are working.		
64305-2	Verify and calibrate protection systems.		
64305-3	Connect an electric motor for the correct rotation.		
64305-4	Change the bearing oil in a motor.		
64305-5	Perform insulation resistance testing on a motor.		
64305-6	Identify components of systems discussed in the module.		

MODULE 64306-02 – FACILITY AUXILIARY SYSTEMS

Task Number	Item	Date(s)	Recorded By
64306-1	Maintain a rectifier.		
64306-2	Identify any of the auxiliary systems found at a given pipeline facility.		

MODULE 64307-02 – SCADA

Task Number	Item	Date(s)	Recorded By
64307-1	Draw a block diagram of a SCADA system.		
64307-2	Given a set of circumstances, react to a communications failure.		
64307-3	Identify the four major hardware components of a PLC.		
64307-4	Troubleshoot a SCADA system using the 7-step procedure.		