Electricity III

8535 36 weeks / 280 hours

Table of Contents

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Course Description

Suggested Grade Level: 12
Prerequisites: 8534

Through hands-on experiences, students continue building skills in the installation, operation, maintenance, and repair of electrical systems, with emphasis on industrial applications. They also study lighting fixtures, overcurrent protection, service equipment, motor controls, transformers, grounding, and the National Electrical Code (NEC) Book.

"Electricity III" may be offered as a complement to an existing concentration sequence in any CTE program area. In some instances, where noted, it may be combined with specific courses to create concentration sequences.

As noted in Superintendent's Memo #058-17 (2-28-2017), this Career and Technical Education (CTE) course must maintain a maximum pupil-to-teacher ratio of 20 students to one teacher, due to safety regulations. The 2016-2018 biennial budget waiver of the teacher-to-pupil ratio staffing requirement does not apply.

Task Essentials List

- Tasks/competencies designated by plus icons (⊕) in the left-hand column(s) are essential
- Tasks/competencies designated by empty-circle icons (○) are optional
- Tasks/competencies designated by minus icons (⊖) are omitted
- Tasks marked with an asterisk (*) are sensitive.

Task Number	8535	Tasks/Competencies
Applying Basic Construction Safety Standards (Core Safety)		
39	⊕	Comply with federal, state, and local safety legal requirements.
40	⊕	Maintain a safe working environment.
41	⊕	Explain safe working practices around electrical hazards.
42	⊕	Inspect course-specific hand and power tools to visually identify defects.
43	⊕	Report injuries.
44	⊕	Report personal, environmental, and equipment safety violations to the appropriate authority.
45	⊕	Pass safety exam.
Using Tools and Materials		
46	⊕	Use the various types of hand tools used by electricians.
47	⊕	Use the various types of power tools used by electricians.
48	⊕	Use a variety of meters to take readings.
49	⊕	Identify commonly used materials by name and by regional variance of terminology.
Solving Mathematical Problems Related to Electricity		
50	○	Convert numbers to scientific notation.
51	⊕	Use calculators to solve electrical problems, including load calculations and service calculations.
52	⊕	Use calculators to solve conduit bending problems.
Installing Conductors		
53	⊕	Explain the steps for pulling cable into a raceway in a commercial or industrial setting.
54	⊕	Install conductors.
55	⊕	Identify the color codes for phasing wires.
56	⊕	Identify material associated with conduits and raceways.
Examining Lighting, Communication, and Power Systems		
57	○	Explain functions, operation, and characteristics of various lighting systems.
58	○	Design lighting distribution and layout of fixtures.
59	○	Explain functions, operation, and characteristics of various communication systems.
60	○	Design communication distribution and layout of outlets.
61	○	Install communication devices.
62	○	Design power distribution and layout outlets.
Interpreting Prints and Specifications		
63	⊕	Draw a residential electrical plan.
64	⊕	Read electrical drawings, including schematics and specifications.
65	⊕	Draw a control ladder diagram.
Installing Service Equipment		
66	⊕	Install service entrance equipment.

Task Number	8535	Tasks/Competencies
Installing and Maintaining Motors and Drives, Motor Controllers, and PLC (Programmable Logic Controllers)		
67	○	Identify function, operation, and characteristics of various motors.
68	○	Demonstrate techniques for various motor installations.
69	○	Identify function, operation, and characteristics of motor controllers, circuits, process control systems, and devices.
70	○	Wire a control circuit, given a ladder diagram.
71	○	Wire a multiple start/stop push-button station.
72	○	Wire a control relay.
73	○	Wire a two-wire motor control circuit.
Describing Generators and Power Supplies		
74	○	Identify types and configurations of uninterruptible power supplies (UPS).
Exploring Transformers		
75	⊕	Identify function, operation, and characteristics of transformers.
76	⊕	Describe the components of electrical distribution systems.

Legend: ⊕Essential ○Non-essential ⊖Omitted

Curriculum Framework

Applying Basic Construction Safety Standards (Core Safety)

Task Number 39

Comply with federal, state, and local safety legal requirements.

Definition

Compliance should include the identification of the Hazard Communication Standard, the information included on safety data sheets (SDS), and the responsibilities of employers and employees under HazCom.

Compliance should also include the Occupational Safety and Health Administration (OSHA), the Virginia Occupational Safety and Health Compliance Program (VOSH), and the Environmental Protection Agency (EPA).

Process/Skill Questions

- Where should hazardous materials be stored?
- What information can be found on an SDS?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

Task Number 40

Maintain a safe working environment.

Definition

Maintenance should be ongoing and include regular inspection of the work environment. Maintenance should result in identifying potential hazards on a job site or in the lab, such as unstable or improperly erected scaffolding, electrical hazards, job site debris, improperly stored materials, and air quality hazards. When present, hazards must be remedied by appropriate measures and comply with school and instructor's guidelines.

Process/Skill Questions

- What are some examples of job site hazards?
- Why is it important to use good housekeeping standards on a job site?
- Why is it important to store materials and tools in their proper places?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

Task Number 41

Explain safe working practices around electrical hazards.

Definition

Explanation should include

- identifying equipment used to test electrical circuits
- describing safe working conditions
- demonstrating safe work habits

according to industry standards and instructor's guidelines.

Process/Skill Questions

- What is the definition of *proximity work*?
- What are safe working clearances according to the National Electric Code (NEC)?
- What are considered safe working conditions and safe working habits?
- What is the unseen hazard with electrical work?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

Task Number 42

Inspect course-specific hand and power tools to visually identify defects.

Definition

Inspection of power tools should include

- identifying components of machinery (e.g., guards, blades, moving parts, start/stop switches)
- identifying standard safety procedures (i.e., lab practices and manufacturer's recommendations)
- observing a demonstration of the safe operation and use of each piece of machinery in lab.

Inspection of hand tools should include identification of tool defects.

Process/Skill Questions

- What are some of the basic power tools used in construction?
- What are the proper actions to take before using a power circular saw?
- Why should a power tool always be grounded?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

Task Number 43

Report injuries.

Definition

Report should consist of an immediate oral statement of the job-related or non-job-related injury to the instructor or supervisor, and may be followed by a written confirmation reporting date, extent of injury, and circumstances of the accident.

Process/Skill Questions

- Why is it important to report injuries?
- What are common reporting procedures?
- Why is it important to report an injury promptly, before leaving the job site?
- What is workers' compensation?
- What are the key components of a report?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

Task Number 44

Report personal, environmental, and equipment safety violations to the appropriate authority.

Definition

Report should include an oral or written statement identifying the violation and the date it was observed and should be given to the instructor, supervisor, or local OSHA inspector.

Process/Skill Questions

- What ethical considerations might be involved when reporting coworkers?
- Why is it important to follow reporting procedures?
- What is liability?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

Task Number 45

Pass safety exam.

Definition

The passing of the exam should demonstrate participation in safety training programs, including attending safety meetings and completing periodic demonstration of knowledge and skills gained from program topics (e.g., interpretation of SDS).

Process/Skill Questions

- How often should one participate in safety training programs? Why?
- How does insurance impact the requirement for continuous retraining for safety?
- What is workers' compensation?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

Using Tools and Materials

Task Number 46

Use the various types of hand tools used by electricians.

Definition

Use should include

- various types of hand tools (hand threader, RG6 crimp tool, coax stripper, punchdown tool, RJ45 crimp tool)
- identification of correct usage
- citing the maintenance associated with each tool

and safely using these tools in accordance with the manufacturer’s instructions and government regulations, and by following the instructor's guidelines.

Process/Skill Questions

- Why is hand tool safety important?
- What is considered inappropriate behavior?
- Why should workers properly care for and maintain hand tools?
- How does the condition and maintenance of hand tools affect safety?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00103-09 Introduction to Hand Tools

Task Number 47

Use the various types of power tools used by electricians.

Definition

Use should include

- various types of power tools (mechanical and hydraulic benders, power threaders, power ponies)
- identification of correct usage
- citing the maintenance associated with each tool

and safely using these tools in accordance with the manufacturer’s instructions and government regulations, and by following the instructor's guidelines.

Process/Skill Questions

- Why should you inspect every power tool prior to using it?

- What is the difference between a double-insulated drill and a grounded power tool?
- Why is it important to know operating instructions before using a power tool?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00104-09 Introduction to Power Tools

Task Number 48

Use a variety of meters to take readings.

Definition

Meter must be selected, set, and adjusted properly for a specified test or measurement (voltage, amperage, resistance, and continuity). Scales must be read correctly on digital and analog meters.

Process/Skill Questions

- What are the common types of meters used in the electricity trade? What do they measure?
- Why is it important to have the meter set to the proper function before taking a reading?
- Why should the meter leads be inspected before taking a reading?
- How is a meter verified?

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

Task Number 49

Identify commonly used materials by name and by regional variance of terminology.

Definition

Identification should consist of naming electrical materials and supplies associated with different wiring systems, including

- nonmetallic sheathed (NM) cabling
- armored cable/BX cable
- metal clad (MC) cable
- Cat5/6 cable
- coaxial cable

- conduit
- raceways

and others, as specified by the instructor.

Process/Skill Questions

- What is a Madison strap?
- What is a 1900?
- What is an 8-B box?

NCCER Electrical Standards, 2011

26108-11 Raceways and Fittings

Solving Mathematical Problems Related to Electricity

Task Number 50

Convert numbers to scientific notation.

Definition

Problems requiring the conversion of numbers to scientific notation (e.g., converting kilowatt units) must be solved according to instructor's guidelines.

Process/Skill Questions

- Why is scientific notation used in the electrical trade?
- What is 10 cubed?
- What is a coulomb?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00102-09 Introduction to Construction Math

Task Number 51

Use calculators to solve electrical problems, including load calculations and service calculations.

Definition

Calculator must be used to solve instructor-assigned problems according to manufacturer's instructions.

Process/Skill Questions

- What types of problems can calculators solve?
- What are simple symbols on a calculator?
- What is the sine symbol on a calculator?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00102-09 Introduction to Construction Math

Task Number 52

Use calculators to solve conduit bending problems.

Definition

Use includes applying the Pythagorean Theorem to calculate a rolling offset.

Process/Skill Questions

- What is a box offset?
- What is a three bend saddle?
- What is a back-to-back 90-degree bend?
- What are concentric bends?
- What is a stub up?

NCCER Electrical Standards, 2011

26108-11 Raceways and Fittings

26204-11 Conduit Bending

Installing Conductors

Task Number 53

Explain the steps for pulling cable into a raceway in a commercial or industrial setting.

Definition

Explanation may include

- setting up a power puller
- setting up wire stands
- installing a pull line for cable pulling
- preparing the conduit.

Process/Skill Questions

- What is a wire basket/Kellem grip?
- What is wire lubricant?
- What is a fish tape (or draw tape)?

NCCER Electrical Standards, 2011

26106-11 Device Boxes

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26206-11 Conductor Installations

Task Number 54

Install conductors.

Definition

Installation should include various wiring methods and industry-accepted testing procedures in accordance with NEC standards.

Process/Skill Questions

- What is the abbreviated terminology for copper and aluminum?
- What is a bending radius?
- Why is it important to support a conductor properly?
- What are some consequences of failing to communicate effectively when installing conductors?

NCCER Electrical Standards, 2011

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26111-11 Residential Electrical Services

26206-11 Conductor Installations

Task Number 55

Identify the color codes for phasing wires.

Definition

Identification should include colors from different voltages for both single-phase and three-phase wiring.

Task Number 56

Identify material associated with conduits and raceways.

Definition

Identification should include connectors, fittings (including seal-offs and explosion-proof), and supports for various conduit and raceway wiring systems, according to instructor's guidelines.

NCCER Electrical Standards, 2011

26106-11 Device Boxes

26107-11 Hand Bending

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26111-11 Residential Electrical Services

26205-11 Pull and Junction Boxes

26207-11 Cable Tray

Examining Lighting, Communication, and Power Systems

Task Number 57

Explain functions, operation, and characteristics of various lighting systems.

Definition

Explanation should include

- identifying material common to different lighting systems
- identifying different types of lighting, including
    - incandescent
    - fluorescent
    - light emitting diode (LED)
    - solar
    - metal halide
    - mercury vapor
    - high-pressure sodium
    - low-pressure sodium
- stating how each is best-suited for their application
- identifying various fluorescent tube sizes
- distinguishing among industrial, commercial, and residential lighting systems according to manufacturer's manuals and instructor's guidelines.

Process/Skill Questions

- What is an electrical ballast?
- With what material are fluorescent bulbs coated?
- Why do incandescent bulbs need ballasts?

NCCER Electrical Standards, 2011

26111-11 Residential Electrical Services

26203-11 Electric Lighting

26211-11 Control Systems and Fundamental Concepts

Task Number 58

Design lighting distribution and layout of fixtures.

Definition

Design consists of

- drawing a basic lighting plan on an instructor-provided floor plan
- selecting the proper lighting for the given application
- compiling a list of materials based on the developed lighting plan
- estimating the cost of completing the assigned job according to instructor's guidelines.

Process/Skill Questions

- Why have compact fluorescent bulbs become widely used?
- What is a foot-candle?
- How is light intensity for a room determined?

NCCER Electrical Standards, 2011

26110-11 Basic Electrical Construction Drawings

26111-11 Residential Electrical Services

26203-11 Electric Lighting

Task Number 59

Explain functions, operation, and characteristics of various communication systems.

Definition

Explanation should include

- identifying components used in telephone, intercom, signaling, and networking systems
- stating why each is best-suited for its application
- describing how is routed for each application, and the importance of linear separation from power cabling
- identifying the proper termination of each type of cabling

according to manufacturer's manuals and instructor's guidelines.

Process/Skill Questions

- What NEC article covers communications?
- What is the symbol for a phone jack in a house?
- Why is it important to differentiate between symbols on electrical plans?
- Can communication and line voltage share the same raceway?

NCCER Electrical Standards, 2011

26109-11 Conductors and Cables

26111-11 Residential Electrical Services

26112-11 Electrical Test Equipment

26208-11 Conductor Terminations and Splices

26209-11 Grounding and Bonding

26211-11 Control Systems and Fundamental Concepts

Task Number 60

Design communication distribution and layout of outlets.

Definition

Design should consist of

- drawing a basic communication plan on an instructor-provided floor plan
- selecting the proper materials for the given application
- compiling a list of materials based on the developed communication plan
- estimating the cost of completing the assigned job according to instructor guidelines.

Process/Skill Questions

- What is the symbol for *speaker*?
- What is a hybrid fiber-coaxial (HFC) cable, and when is it used?
- Do electricians typically install communications systems?

NCCER Electrical Standards, 2011

26208-11 Conductor Terminations and Splices

26209-11 Grounding and Bonding

26211-11 Control Systems and Fundamental Concepts

Task Number 61

Install communication devices.

Definition

Installation should include

- choosing the proper components used in the assigned communications layout
- routing cable properly, observing correct linear separation from power cabling
- installing the proper termination for each type of cabling
- connecting the devices
- testing for proper operation and troubleshooting as necessary

according to industry-accepted procedures.

Process/Skill Questions

- What is a phone jack?
- What are the color codes in communications systems?
- Why is low voltage dangerous?

NCCER Electrical Standards, 2011

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26208-11 Conductor Terminations and Splices

26209-11 Grounding and Bonding

26211-11 Control Systems and Fundamental Concepts

Task Number 62

Design power distribution and layout outlets.

Definition

Design should consist of

- drawing a basic power plan on an instructor-provided floor plan
- selecting the proper materials for the given application
- compiling a list of materials based on the developed power plan
- estimating the cost of completing the assigned job according to instructor’s guidelines.

Process/Skill Questions

- What is the six-foot rule?

- How is the service resized?
- What is a branch circuit? What is its purpose?

NCCER Electrical Standards, 2011

26106-11 Device Boxes

26108-11 Raceways and Fittings

26208-11 Conductor Terminations and Splices

26209-11 Grounding and Bonding

26210-11 Circuit Breakers and Fuses

Interpreting Prints and Specifications

Task Number 63

Draw a residential electrical plan.

Definition

Drawing should include a floor plan where switches, outlets, and wiring are placed in their appropriate positions. Drawing should use accepted drafting standard symbols and NEC minimum guidelines, as assigned by instructor.

Process/Skill Questions

- What is a legend on an electrical plan?
- Why should the drawing have a scale?
- How is the scale interpreted?

NCCER Electrical Standards, 2011

26104-11 Electrical Theory

26110-11 Basic Electrical Construction Drawings

Task Number 64

Read electrical drawings, including schematics and specifications.

Definition

Reading should include components used in construction, as shown by drafting standards and by developing a list of materials from plans and specifications, in accordance with instructor's guidelines.

Process/Skill Questions

- What is a specificatio*n*? What is the purpose of specifications?
- Why are symbols used on electrical drawings?
- What is the importance of a ladder diagram?
- What is the difference between line voltage and control voltage?

NCCER Electrical Standards, 2011

26104-11 Electrical Theory

26110-11 Basic Electrical Construction Drawings

Task Number 65

Draw a control ladder diagram.

Definition

Drawing should include

- wire numbers
- cross-reference numbers
- line numbers
- standard industrial wiring symbols.

Process/Skill Questions

- What is the purpose of line numbers on a ladder diagram? Cross-reference numbers?
- How do you read a ladder diagram?
- What are the differences between a ladder diagram and a wiring diagram?

Installing Service Equipment

Task Number 66

Install service entrance equipment.

Definition

Installation should include

- identification of types of service equipment
- locations of service equipment
- number of services (i.e., different locations)
- service changes
- service upgrades
- clearances
- service grounding and bonding
- generator backup/emergency panel/systems according to NEC standards and Authority Having Jurisdiction (AHJ).

Process/Skill Questions

- What is a transfer switch?
- What is the difference between a manual transfer switch and an automatic transfer switch?
- What is the difference between a main breaker panel and a main lug panel?
- What is the difference between a single-phase and a three-phase distribution system?
- How is color coding used in identifying phase conductors?

NCCER Electrical Standards, 2011

26105-11 Introduction to the National Electrical Code

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26110-11 Basic Electrical Construction Drawings

26111-11 Residential Electrical Services

26206-11 Conductor Installations

26208-11 Conductor Terminations and Splices

26209-11 Grounding and Bonding

26210-11 Circuit Breakers and Fuses

Installing and Maintaining Motors and Drives, Motor Controllers, and PLC (Programmable Logic Controllers)

Task Number 67

Identify function, operation, and characteristics of various motors.

Definition

Identification includes

- describing the function, operation, and characteristics of a variety of motors such as alternating current (AC), direct current (DC), dual voltage, single-phase, and three-phase motors
- naming physical parts of various motors
- using plans, schematics, and motor nameplates to gain information.

Process/Skill Questions

- What is the difference between single-phase and three-phase motors?
- What is a double pole?
- How is the rotation of the three-phase motor changed?

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

26104-11 Electrical Theory

26105-11 Introduction to the National Electrical Code

26106-11 Device Boxes

26107-11 Hand Bending

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26110-11 Basic Electrical Construction Drawings

26111-11 Residential Electrical Services

26112-11 Electrical Test Equipment

26202-11 Motors: Theory and Application

Task Number 68

Demonstrate techniques for various motor installations.

Definition

Demonstration should include

- installing a dual voltage motor for single-phase operation
- installing a dual voltage motor for three-phase operation
- using the NEC to calculate electrical requirements
- identifying procedures for motor lead connections
- testing for proper operation and troubleshooting, if necessary.

Motors must operate correctly and be installed according to common trade practices and NEC requirements.

Process/Skill Questions

- What is the difference between a sealed motor and an open motor?
- How is a motor changed from 120V to 240V?
- What is a squirrel cage rotor?

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

26104-11 Electrical Theory

26105-11 Introduction to the National Electrical Code

26106-11 Device Boxes

26107-11 Hand Bending

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26110-11 Basic Electrical Construction Drawings

26111-11 Residential Electrical Services

26112-11 Electrical Test Equipment

26202-11 Motors: Theory and Application

26206-11 Conductor Installations

26209-11 Grounding and Bonding

Task Number 69

Identify function, operation, and characteristics of motor controllers, circuits, process control systems, and devices.

Definition

Identification should include

- explaining the operation of manual and automatic controllers as related to process systems
- describing the function, operation, and characteristics of sensors and transmitters
- designing basic schematics depicting proper usage of controllers, sensors, and transmitters

according to manufacturers' specifications.

Process/Skill Questions

- What is the primary use of a motor control?
- What is the primary use of a magnetic motor control?
- What is a programmable logic controller (PLC)?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

00102-09 Introduction to Construction Math

00103-09 Introduction to Hand Tools

00104-09 Introduction to Power Tools

00106-09 Basic Rigging

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

26104-11 Electrical Theory

26105-11 Introduction to the National Electrical Code

26106-11 Device Boxes

26107-11 Hand Bending

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26110-11 Basic Electrical Construction Drawings

26111-11 Residential Electrical Services

26112-11 Electrical Test Equipment

26202-11 Motors: Theory and Application

26206-11 Conductor Installations

26209-11 Grounding and Bonding

Task Number 70

Wire a control circuit, given a ladder diagram.

Definition

Wiring may include

- wire numbers
- selecting required components
- proper terminations.

Process/Skill Questions

- How are wire numbers used?
- How are cross-reference numbers used?
- What are some examples of symbols commonly used in control diagrams?

Task Number 71

Wire a multiple start/stop push-button station.

Definition

Wiring may include

- wire numbers
- cross-reference numbers
- control devices.

Process/Skill Questions

- Are stop buttons normally closed or opened? Why?
- Are start buttons normally closed or opened? Why?
- What is the purpose of a holding circuit?
- How are multiple start/stop buttons wired?

Task Number 72

Wire a control relay.

Definition

Wiring may include

- wiring devices
- relay and relay base
- describing contact configuration.

Process/Skill Questions

- Why are control relays used?
- What happens if you exceed the maximum voltage rating of a relay coil?

Task Number 73

Wire a two-wire motor control circuit.

Definition

Wiring may include

- selector switch
- motor starter coil
- overload contact
- pilot light.

Process/Skill Questions

- How is a two-wire control circuit different from a three-wire control circuit?
- What is a maintained contact device?
- What is the purpose of the overload contact?

Describing Generators and Power Supplies

Task Number 74

Identify types and configurations of uninterruptible power supplies (UPS).

Definition

Identification includes correctly labeling the parts of DC and AC power supplies.

Process/Skill Questions

- Where are UPSs normally used?
- Where is power stored in the UPS?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

00102-09 Introduction to Construction Math

00103-09 Introduction to Hand Tools

00104-09 Introduction to Power Tools

00105-09 Introduction to Construction Drawings

00106-09 Basic Rigging

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

26105-11 Introduction to the National Electrical Code

26106-11 Device Boxes

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26110-11 Basic Electrical Construction Drawings

26111-11 Residential Electrical Services

Exploring Transformers

Task Number 75

Identify function, operation, and characteristics of transformers.

Definition

Identification includes

- naming the components of a transformer
- discussing and explaining the principles of induced voltage
- discussing and explaining the principles of transformer operation
- differentiating between step-up and step-down transformers

in accordance with instructor's guidelines.

Process/Skill Questions

- What is a step-down transformer?
- How does ratio relate to transformers?
- What is an auto-transformer?
- Why do large transformers contain oil?
- What are some types of transformers?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

00102-09 Introduction to Construction Math

00103-09 Introduction to Hand Tools

00104-09 Introduction to Power Tools

00105-09 Introduction to Construction Drawings

00106-09 Basic Rigging

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

26104-11 Electrical Theory

26105-11 Introduction to the National Electrical Code

26106-11 Device Boxes

26107-11 Hand Bending

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26110-11 Basic Electrical Construction Drawings

26111-11 Residential Electrical Services

26112-11 Electrical Test Equipment

Task Number 76

Describe the components of electrical distribution systems.

Definition

Description includes

- identifying from drawings, aerial pictures, or observations, the components of a distribution system
- outlining the functions of the components in an electrical distribution system

in accordance with instructor's guidelines.

Process/Skill Questions

- What are the height requirements for installing an overhead line?
- What is the clearance for 3400V line?
- What is the difference between a service panel and a subpanel?

NCCER Core Curriculum: Introductory Craft Skills, 2009

00101-09 Basic Safety

00102-09 Introduction to Construction Math

00103-09 Introduction to Hand Tools

00104-09 Introduction to Power Tools

00105-09 Introduction to Construction Drawings

00106-09 Basic Rigging

NCCER Electrical Standards, 2011

26102-11 Electrical Safety

26104-11 Electrical Theory

26105-11 Introduction to the National Electrical Code

26106-11 Device Boxes

26107-11 Hand Bending

26108-11 Raceways and Fittings

26109-11 Conductors and Cables

26110-11 Basic Electrical Construction Drawings

26111-11 Residential Electrical Services

26112-11 Electrical Test Equipment

SOL Correlation by Task

39	Comply with federal, state, and local safety legal requirements.	English: 12.5 History and Social Science: GOVT.9, GOVT.15, GOVT.16 Science: BIO.1a, CH.1b
40	Maintain a safe working environment.	
41	Explain safe working practices around electrical hazards.	English: 12.5 History and Social Science: GOVT.9, GOVT.15, GOVT.16
42	Inspect course-specific hand and power tools to visually identify defects.	English: 12.5
43	Report injuries.	English: 12.6 History and Social Science: GOVT.16
44	Report personal, environmental, and equipment safety violations to the appropriate authority.	English: 12.6 History and Social Science: GOVT.9, GOVT.15, GOVT.16
45	Pass safety exam.	English: 12.5
46	Use the various types of hand tools used by electricians.	English: 12.5
47	Use the various types of power tools used by electricians.	English: 12.5
48	Use a variety of meters to take readings.	

49	Identify commonly used materials by name and by regional variance of terminology.	
50	Convert numbers to scientific notation.	Science: CH.1g, PH.1c
51	Use calculators to solve electrical problems, including load calculations and service calculations.	English: 12.5
52	Use calculators to solve conduit bending problems.	History and Social Science: WHI.5 Mathematics: G.8
53	Explain the steps for pulling cable into a raceway in a commercial or industrial setting.	
54	Install conductors.	English: 12.5
55	Identify the color codes for phasing wires.	
56	Identify material associated with conduits and raceways.	English: 12.5
57	Explain functions, operation, and characteristics of various lighting systems.	English: 12.5
58	Design lighting distribution and layout of fixtures.	
59	Explain functions, operation, and characteristics of various communication systems.	English: 12.5 History and Social Science: VUS.8 Science: PH.4a
60	Design communication distribution and layout of outlets.	English: 12.5, 12.6
61	Install communication devices.	
62	Design power distribution and layout outlets.	English: 12.5, 12.6
63	Draw a residential electrical plan.	Science: PH.4a, PH.11c
64	Read electrical drawings, including schematics and specifications.	English: 12.5 Science: PH.11c
65	Draw a control ladder diagram.	Science: PH.11c
66	Install service entrance equipment.	English: 12.5
67	Identify function, operation, and characteristics of various motors.	English: 12.5 Science: PH.1a
68	Demonstrate techniques for various motor installations.	English: 12.5 Science: PH.10b
69	Identify function, operation, and characteristics of motor controllers, circuits, process control systems, and devices.	English: 12.5 Science: PH.10b, PH.11c
70	Wire a control circuit, given a ladder diagram.	Science: PH.4a
71	Wire a multiple start/stop push-button station.	Science: PH.4a
72	Wire a control relay.	Science: PH.4a
73	Wire a two-wire motor control circuit.	Science: PH.4a
74	Identify types and configurations of uninterruptible power supplies (UPS).	
75	Identify function, operation, and characteristics of transformers.	English: 12.5 Science: PH.7b
76	Describe the components of electrical distribution systems.	English: 12.5

Green Building Infusion Units

The Green Building Infusion Unit (GBIU) was designed to encourage teachers to infuse instructional units on green building knowledge and skills into designated CTE courses. The infusion unit is not mandatory, and, as such, the tasks/competencies are marked as "optional," to be taught at the instructor's discretion. Teachers can find the infusion/unit in the course listing.

Entrepreneurship Infusion Units

Entrepreneurship Infusion Units may be used to help students achieve additional, focused competencies and enhance the validated tasks/competencies related to identifying and starting a new business venture. Because the unit is a complement to certain designated courses and is not mandatory, all tasks/competencies are marked "optional." Teachers can find the infusion/unit in the course listing.

Appendix: Credentials and Career Cluster Information

Industry Credentials: Only apply to 36-week courses

- Certified Satellite Installer (CSI) Examination
- College and Work Readiness Assessment (CWRA+)
- Core: Introductory Craft Skills Entry-Level Assessment
- Customer Service Examination
- Customer Service Specialist (CSS) Examination
- Data Cabling Installer (DCI) Examination
- Electric Power and Distribution Assessment
- Electrical Construction Technology Assessment
- Electrical Construction Wiring (Residential Wiring) Examination
- Electrical Occupations Assessment
- Electrician Level One Entry-Level Assessment
- Fiber Optics Installer (FOI) Examination
- HBI/NAHB Residential Construction Academy (RCA) Series Student Certification Assessments
- ICC Certificates of Completion Examinations
- International Code Council Residential Electrical Inspector (E1) Examination
- National Career Readiness Certificate Assessment
- Network Cabling Specialist Certification Examinations
- Photovoltaic Installer - Level 1 (PVI1) Examination
- Pre-Apprenticeship Certificate Training (PACT) Core Examinations
- Professional Communications Certification Examination
- Workplace Readiness Skills for the Commonwealth Examination

Career Cluster: Architecture and Construction	
Pathway	**Occupations**
Construction	**Construction Manager** **Electrician** **General Contractor**
Design/Pre-Construction	**Building Code Inspector** **Cost Estimator** **Electrical Engineering Technician**