Lesson Plans for Module 26401-17

Load Calculations – Feeders and Services

Module One (26401-17) examines basic load calculations for residential and commercial applications, including raceway fill, conductor derating, and voltage drop.

Objectives

Learning Objective 1

- Perform basic load calculations in accordance with National Electrical Code® (*NEC*®) requirements.
  a. Make adjustments in conductor size for various installations.
  b. Calculate feeder ampacity.
  c. Apply tap rules.
  d. Apply demand factors.

Learning Objective 2

- Make service calculations for residential installations.
  a. Calculate the minimum service size for simple electrical installations.
  b. Make service calculations for single-family dwellings.
  c. Make service calculations for multi-family dwellings.

Learning Objective 3

- Make service calculations for commercial installations.
  a. Size commercial and industrial lighting loads.
  b. Calculate loads for retail stores.
  c. Calculate loads for office buildings.
  d. Calculate loads for restaurants.
  e. Calculate loads for hotels and motels.
  f. Perform optional calculations for schools.
  g. Size shore power circuits for marinas and boatyards.
  h. Make farm load calculations.
  i. Size motor circuits.

Performance Tasks

This is a knowledge-based module. There are Performance Tasks.

Note

NFPA 70®, *National Electrical Code*® and *NEC*® are registered trademarks of the National Fire Protection Association, Quincy, MA.

Teaching Time: 20 hours

(Eight 2.5-Hour Sessions)

Session time may be adjusted to accommodate your class size, schedule, and teaching style.

Before You Begin

As you prepare for each session, allow sufficient time to review the course objectives, content, visual aids (including the PowerPoint® presentation), and these lesson plans, and to gather the required equipment and materials. Consider time required for demonstrations, laboratories, field trips, and testing.

Using your access code, download the PowerPoint® presentations and Performance Profile Sheets from **www.nccerirc.com**. For information and updates about accessing the Module Examinations, visit **www.nccer.org/testing.** The passing score for submission into NCCER's Registry is 70% or above for the written examination; performance testing is graded pass or fail.

Safety Considerations

This module covers material that relates to trainees working with and around electrical circuits and equipment used in residential and commercial applications. Safety must be emphasized at all times. Any trainees in an electrical environment should be carefully observed to ensure that they wear the proper PPE, follow safe practices, and give due respect to unseen hazards related to electrical circuits and equipment. Any deficiencies must be corrected to ensure the future safety of all trainees. Any practice sessions and Performance Tasks must be completed under your direct supervision.

Classroom Equipment and Materials

Whiteboard and markers

Pencils and paper

Electrical Level Four PowerPoint® Presentation

DVD player

LCD projector and screen

Computer

Internet access during class (optional)

Module Review answer key

Module Examinations

Additional Resources

This module presents thorough resources for task training. The following resource material is suggested for further study.

National Electrical Code® Handbook, Current Edition. Quincy, MA: National Fire Protection Association.

There are a number of online resources available for trainees who would like more information on load calculations for feeders and services. A search for additional information may be assigned as homework to interested trainees.

Instructors should view any videos that may be identified in the lesson plan before using them to ensure their suitability. The videos can provide teachable moments in both proper and improper work processes and behaviors. Be prepared to stop the videos at appropriate times to point out and discuss both proper and improper conduct and techniques.

Instructors are also encouraged to locate additional audiovisual aids available on the Internet, make personal videos, and take still pictures related to the subject matter and add them to the PowerPoint® presentations throughout the program.

Session Outline for Module 26401-17

Load Calculations – Feeders and Services

The Lesson Plan for this module is divided into eight 2.5-hour sessions.
This time includes 10 minutes for administrative tasks and a 10-minute break per session.

Session One

Session One covers Sections 1.0.0 through 1.1.3 and describes how to perform basic load calculations in accordance with *National Electrical Code*® (*NEC*®) requirements and make adjustments in conductor size.

1. Show the Session One PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with the calculations needed to determine load center length.
3. Explain how to make adjustments in conductor size for various installations.

Session Two

Session Two covers Sections 1.2.0 through 1.4.3 and describes how to calculate feeder ampacity and apply tap rules and demand factors.

1. Show the Session Two PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with the calculations needed to determine feeder ampacity.
3. Explain how to calculate feeder ampacity.
4. Explain how to apply tap rules.
5. Explain how to apply demand factors.

Session Three

Session Three covers Sections 2.0.0 through 2.1.2 and describes how to make service calculations for simple electrical installations.

1. Show the Session Three PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with using different multiplication factors when determining the general lighting load for different areas of a commercial facility.
3. Describe the steps for determining the service load for a building.
4. Explain how to calculate the load for a small rural pump house.
5. Explain how to calculate the load for a roadside vegetable stand.

Session Four

Session Four covers Sections 2.2.0 through 2.3.2 and describes how to make service calculations for residential installations.

1. Show the Session Four PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with factors that must be taken into consideration when calculating the area of occupancy (net living space) for the single-family dwelling.
3. Explain how to make service calculations for single-family dwellings.
4. Explain how to make service calculations for multi-family dwellings.

Session Outline for Module 26401-17

Load Calculations – Feeders and Services

Session Five

Session Five covers Sections 3.0.0 through 3.3.2 and describes how to size commercial and industrial lighting loads and calculate loads for retail stores and office buildings.

1. Show the Session Five PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with the basic load types identified by the *NEC*® that pertain to calculating loads for commercial occupancies.
3. Explain how to size commercial and industrial lighting loads.
4. Explain how to calculate loads for retail stores.
5. Explain how to calculate loads for office buildings.

Session Six

Session Six covers Sections 3.4.0 through 3.6.0 and describes how to make service calculations for restaurants, hotels and motels, and schools.

1. Show the Session Six PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with *NEC*® minimum load values that must be used during service calculations for commercial facilities.
3. Explain how to calculate loads for restaurants.
4. Explain how to calculate loads for hotels and motels.
5. Explain how to perform optional calculations for schools.

Session Seven

Session Seven covers Sections 3.7.0 through 3.9.0 and describes how to make service calculations for marinas and boatyards, farms, and motor circuits.

1. Show the Session Seven PowerPoint® presentation.
2. Use the Kickoff Activity to encourage trainees to familiarize themselves with applications where two or more motors are connected to the same feeder circuit to lower costs and maintain efficiency.
3. Explain how to size shore power circuits for marinas and boatyards.
4. Explain how to make farm load calculations.
5. Explain how to size motor circuits.

Session Eight

Session Eight is a review and testing session. Go over the Module Review questions and Supplemental Exercises in class prior to the exam and answer any questions that the trainees may have.

1. Have trainees complete the written examination.
2. Record the testing results as required for paper-based exams. The results for exams administered through online testing systems are recorded automatically in the Registry System.