LESSON

Home Wiring

BIG IDEA(S)

Understanding the basics of safely and effectively navigating home wiring requires both broad and detailed knowledge of how home electrical systems work.

BRIGHT SOLAR FUTURES

SOLAR

TOPIC OF STUDY

Home Wiring

3 HOURS
(2 SESSIONS)

OBJECTIVES

Students will be able to:

- Describe the 2 most common home service entrance sizes (100A & 200A)
- Know the most common service entrance wiring and sizes (#2 & 4/0 wire SEU cable)
- Understand the purpose and location of the main service disconnect
- Describe where & why neutral and ground are bonded (in the main service panel)
- Describe how branch circuits and OCPD function in a house
- Describe different cable types, wire, sizes, and why they are important (Romex, MC Cable, #10, #12,#14)
- Describe the purpose and grounding and bonding
- Demonstrate a broad understanding of how home electrical systems work

TASK LIST SUBCATEGORY

703 Read an electrical diagram

705 Describe the elements of an electrical service

708 Describe National Electrical Code wire sizing calculations with conditions of use factors

KEY TERMS

amp
service panel
neutral
ground
branch circuit
low-voltage
breaker

OVERVIEW

Electricity has become an essential part of contemporary life, energizing lights, appliances, heat, air conditioning, televisions, telephones, computers, and many other modern conveniences.

Electricity arrives at your house from your local utility company by a power line or underground through a conduit. Most homes have three-wire service—two hot wires and one neutral.

Throughout the house, one hot wire and one neutral wire power conventional 120-volt lights and appliances. Both hot wires and the neutral wire make a 240-volt circuit for large appliances such as air conditioners and electric furnaces.

An electric meter, monitored by your electric utility company, is mounted where the electricity enters your house.

The main panel is usually right next to or under the meter. This is the central distribution point for the electrical circuits that run to lights, receptacles, and appliances throughout the house.

A circuit, by definition, is a circular journey that begins and ends at the same place, and this is essentially how electricity works. Current begins at a power source, powers the appliance or device along the circuit, and then returns to the power source. Any interruption in this path will render the circuit dead.

OVERVIEW - CONTINUED

A circuit consists of a hot (usually black) wire that goes from the main panel to a series of lights, receptacles, or appliances, and a neutral (usually white) wire that returns to the main panel. In addition to the neutral wire, a grounding wire also returns to the main panel and, from there, to the earth. The purpose of the ground is to divert electricity from any short-circuiting hot wires into the earth, preventing electric shock.

Subpanels in other locations of the house are connected to the main panel. These provide power to areas that have a number of different branch circuits or large appliances, such as the kitchen and laundry room. They also are equipped with a secondary set of circuit breakers.

Low-voltage electrical systems are also common in houses for powering doorbells, intercoms, sprinkler timers, outdoor lighting, and some types of low-voltage indoor lighting. With these, a transformer reduces the home's 120-volt electricity down to 12 volts. Relative to conventional voltage wiring, these systems are much safer for homeowners to work on.

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STANDARDS

PA

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

ET S1.B. Developing Possible Solutions.When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts **(HS-ETS1-3)**

Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. **(HS-ETS1-4)**

IMPLEMENTATION (LESSON PLAN)

DISCUSSION

- Our home electrical system as the "central nervous system" for the house.
  - How does electricity arrive at the house?
  - How is electricity brought into the house? From the meter using service entrance cables
  - Common service sizes are 200A and 100A. A home can go up to 400A (really 320A) with a single phase service. After that you have to move to 3 phase service.
  - The service size determines the wire size. 4/0 or #2 wire. Discussion of aluminum wire v. copper wire. Stranded v. solid

LECTURE & DISCUSSION

- Grounding and bonding in homes. Why do we do it and how does it work?
- What is a main disconnect, how does it work and how many can there be?
- The main service panel is the central nervous system for electricity in your home.
- Describe the purpose and function of OCPDs

IMPLEMENTATION (LESSON PLAN) - CONTINUED

ACTIVITY

- Take apart and put back together a main service panel
  - Have students use common electricians tools to strip wires
  - Demonstrate how wire sizes relate to OCPD sizes
  - Show 2 pole (240V) breakers, single pole, twin breakers
  - Show the bonding of ground and neutral
  - Explain Noalox anti-oxidant and why we use it
  - Explain branch circuits and feeder circuits
  - Explain subpanels

RESOURCES/LINKS

Understanding Your Home's Electrical System: The Main Panel
https://www.youtube.com/watch?v=0B0JK2FZ_tQ

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