



## Batteries and DC Circuits

### Course 202: Batteries and DC Circuits

Covers how electrochemical action is used. Covers batteries, electrolytic action, electroplating, characteristics of storage batteries, application and maintenance of lead-acid, nickel-alkaline, and nickel-cadmium batteries, putting batteries in service, charging batteries, maintaining records, fundamentals of DC circuits, and using Ohm's Law to solve problems in DC series, parallel, and series-parallel circuits.

TPC Training is accredited by IACET to offer **1.0 CEU** for this program.



#### Lesson 1: Electrochemical Action

##### Topics

History of Batteries; Battery Characteristics; Electrochemical Action; Cell Chemistry; Electrolysis; Electroplating; Extracting and Refining Metals; Electrolytic Corrosion; Electrolytes; Choosing a Battery; Battery Power

##### Objectives

- State the difference between a primary cell and a secondary cell.
- Discuss electrochemical action.
- Explain how battery polarization works.
- State the definition of an electrolyte.
- List the factors to consider in selecting a battery.

#### Lesson 2: Battery Characteristics

##### Topics

Cells in Batteries; Construction of Dry Cells; Characteristics of Dry Cells; Care and Maintenance of Dry Cells; Kinds of Primary Cells; Secondary Cells; Stationary Batteries; Construction of Storage Cells; Rating Storage Batteries

##### Objectives

- List advantages of dry cells.
- State the characteristics of dry cells.
- Explain how to create a six-volt battery from 1.5 volt dry cells.
- Name the basic kinds of storage cells in use today.
- Explain how to calculate the rating required in a battery for a specific application.

#### Lesson 3: Kinds of Batteries

##### Topics

Lead-Acid Batteries; Lead-Acid Battery Construction; Forming the Plates; Discharging; Recharging; Lead-Calcium Batteries; Cell Voltage; Specific Gravity; Capacity of Storage Batteries; Nickel-Iron Alkaline Cell; Construction of Nickel-Iron Cells; Voltage in Nickel-Iron Cells; Electrolyte in Nickel-Iron Cells; Nickel-Cadmium Cell; Chemical Action in a Nicad Cell; Construction of the Nicad Cell; Nicad Cell Characteristics

##### Objectives

- Name the items necessary to form a cell.
- Explain how plates in a cell are commonly assembled.
- List the advantages of nickel-cadmium battery.
- Discuss the construction of storage cells.

#### Lesson 4: Maintaining Lead-Acid Batteries

##### Topics

Inspecting New Batteries; Lead-Acid Battery Construction; Forming the Plates; Discharging; Recharging; Lead-Calcium Batteries; Cell Voltage; Specific Gravity; Capacity of Storage Batteries; Nickel-Iron Alkaline Cell; Construction of Nickel-Iron Cells; Voltage in Nickel-Iron Cells; Electrolyte in Nickel-Iron Cells; Nickel-Cadmium Cell; Chemical Action in a Nicad Cell; Construction of the Nicad Cell; Nicad Cell Characteristics

##### Objectives

- List the steps in placing a new dry-charged battery in service.
- Name the three basic methods of charging batteries.
- Explain how to measure a cell's specific gravity.
- List causes of low specific gravity in a cell.
- Tell how to clean a wet, dirty battery cover.

#### Lesson 5: Charging Lead-Acid Batteries

##### Topics

Principles of Battery Charging; Initial Charge; Normal Charge; Equalizing Charge; Trickle Charge; Emergency Charge; Boost Charge; Freshening Charge; Battery Test Discharge; Cell Failure; Mixing Electrolyte; Battery Charging Test; Battery Charging Source; Safety During Battery Charging; Battery Records

##### Objectives

- Explain how to conduct an initial charge.
- Discuss the different types of battery charges.
- List the common causes of cell failure.
- Explain how to mix electrolyte correctly.
- Explain how to treat both skin and eyes that have been splashed with acid.

#### Lesson 6: Solving Problems in DC Circuits

##### Topics

Sources of DC Electricity; Ohm's Law; Work; Torque; Power; Efficiency; Branch Points and Loops

##### Objectives

- Define Ohm's Law and use it to solve a problem.
- State the definition of a branch point.
- Solve a problem using the power formula.
- State the definition of Kirchhoff's rules.
- Define work, power, torque, and efficiency.

## Batteries and DC Circuits

### Lesson 7: DC Series Circuits

#### Topics

Characteristics of a Series Circuit; Ohm's Law for Series Circuits; Current Control; Voltage Drop; Problems in Voltage Drop; Using Equations; Practice Problems; Using Kirchhoff's Rules; Power Equations

#### Objectives

- Describe a series circuit.
- Solve for E, I, and R in series circuits.
- State the basic rule you must follow when making changes in an equation.

### Lesson 8: Parallel Circuits

#### Topics

Definition of a Parallel Circuit; Recognizing Parallel Circuits; Resistance in Parallel Circuits; Calculating Resistance; Voltage Drop in Parallel Circuits; Current in Parallel Circuits; Conductance; Calculating Power; Practice Problems

#### Objectives

- State the definition of a parallel circuit.
- Explain how to calculate the current in each branch of a parallel circuit.
- Explain how to calculate resistance in a parallel circuit.
- Calculate power in a parallel circuit.
- Find the reciprocal of any value.

### Lesson 9: Series-Parallel Circuits

#### Topics

Complex Circuits; Examples of Series-Parallel Circuits; Kirchhoff's Rule; Series-Parallel Resistances; Two Resistors in Parallel; Redrawing Circuits; Tracing Circuits; Steps in Calculating Resistance; Calculating Circuit Values

#### Objectives

- State the definition of a series-parallel circuit.
- Identify series, parallel, and series-parallel circuits.
- Explain how to calculate resistances in a series-parallel circuit.
- Demonstrate how to trace and simplify a circuit.

### Lesson 10: DC Circuits in Use

#### Topics

DC Motors and Generators; Internal Resistance of a Generator; Field Windings in DC Motors; Controlling a DC Shunt Motor; Voltage Dividers; Lighting Circuits; Three-Way Switch Circuits; Four-Way Switch Circuits

#### Objectives

- Explain how the three types of dc motors differ.
- Demonstrate how to increase and decrease the speed of a dc motor by adding resistors.
- Identify a three-way switch.
- Calculate current and resistance using voltage divider circuits.