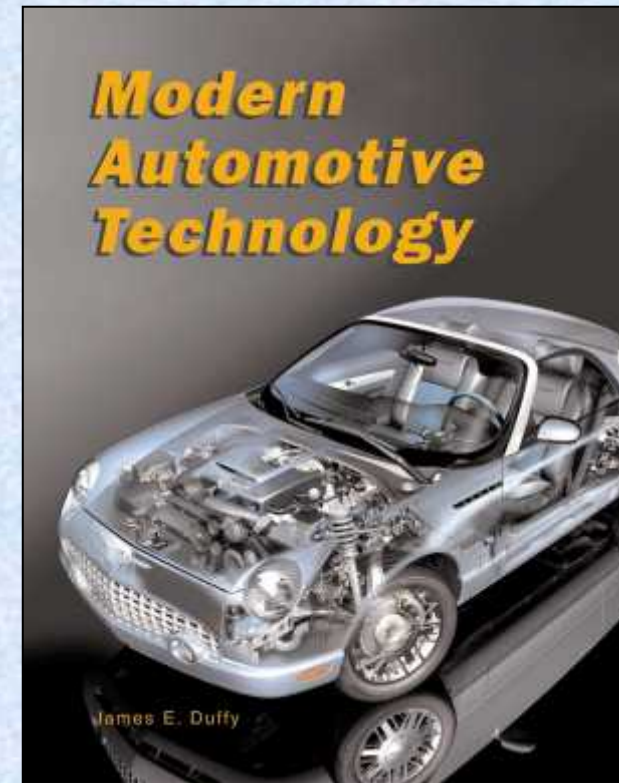


powerpoint for

Modern Automotive Technology

by

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Publisher
The Goodheart-Willcox Co., Inc.
Tinley Park, Illinois

Chapter 29

Automotive Batteries

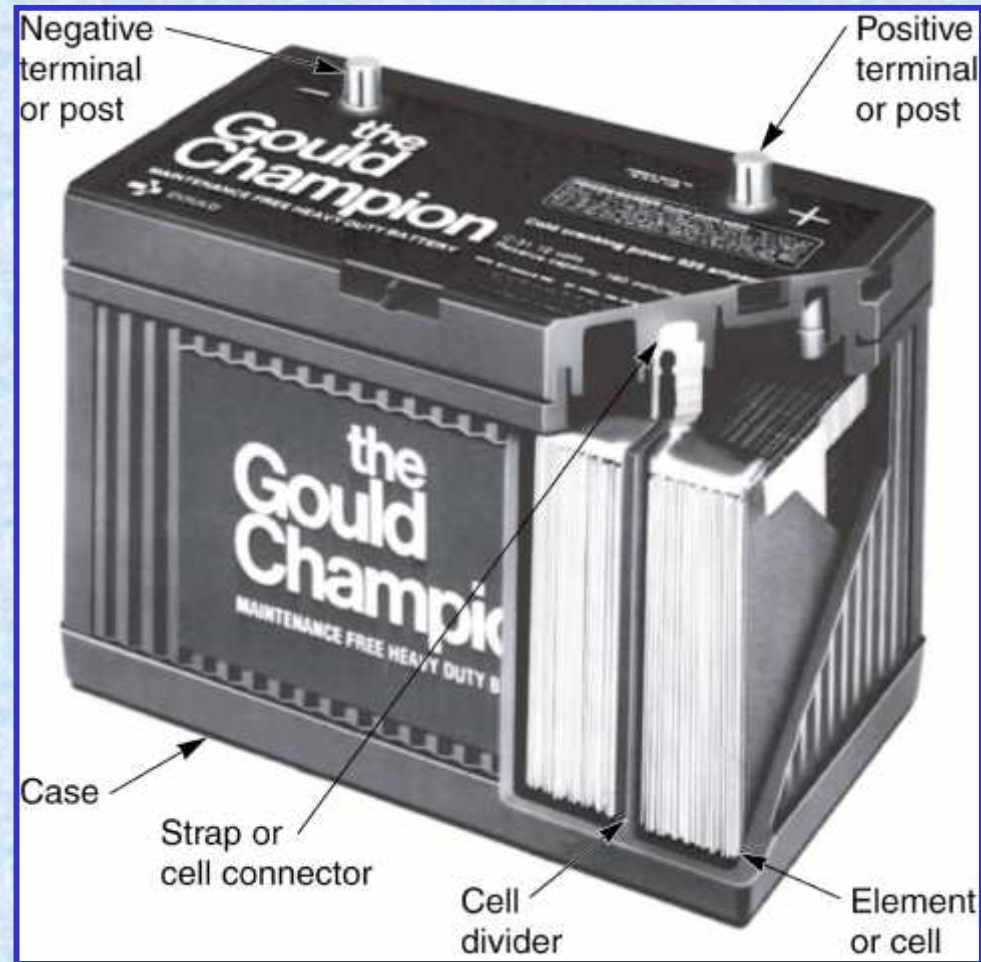
Contents

- Battery principles
- Battery functions
- Battery construction
- Wet- and dry-charged batteries
- Maintenance-free battery
- Battery ratings
- Battery temperature and efficiency

Battery Principles

- ❑ An automotive battery is an electrochemical device
- ❑ It produces and stores direct current electricity

Battery Parts



Discharging

- ❑ Changes chemical energy into electrical energy
- ❑ Stored energy is released

Charging

- ❑ Electrical energy is converted to chemical energy
- ❑ Energy is stored until needed

Battery Cycling

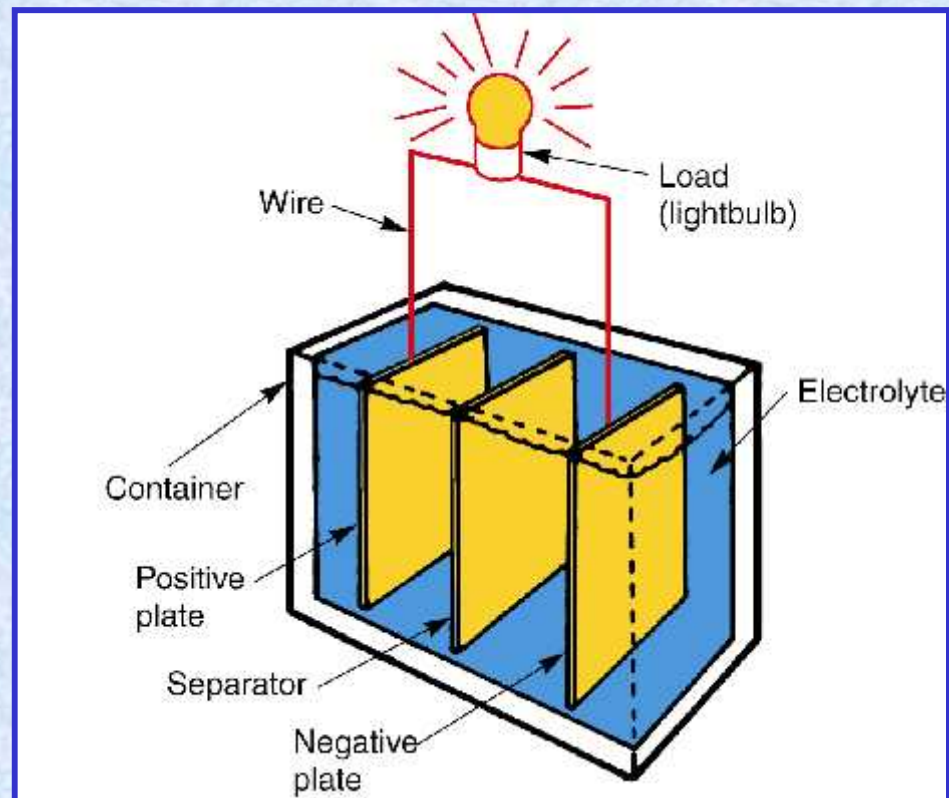
- ❑ Repeated charging and discharging
- ❑ Deep cycling
 - going from a very low charge to full charge
 - can shorten service life

Basic Battery Cell

- Contents:
 - negative plate
 - positive plate
 - container
 - electrolyte (battery acid)
- When a load is connected to the cell, current will flow through the load

Lead-Acid Battery Cell

Electrolyte causes a chemical reaction between the plates, producing 2.1 volts



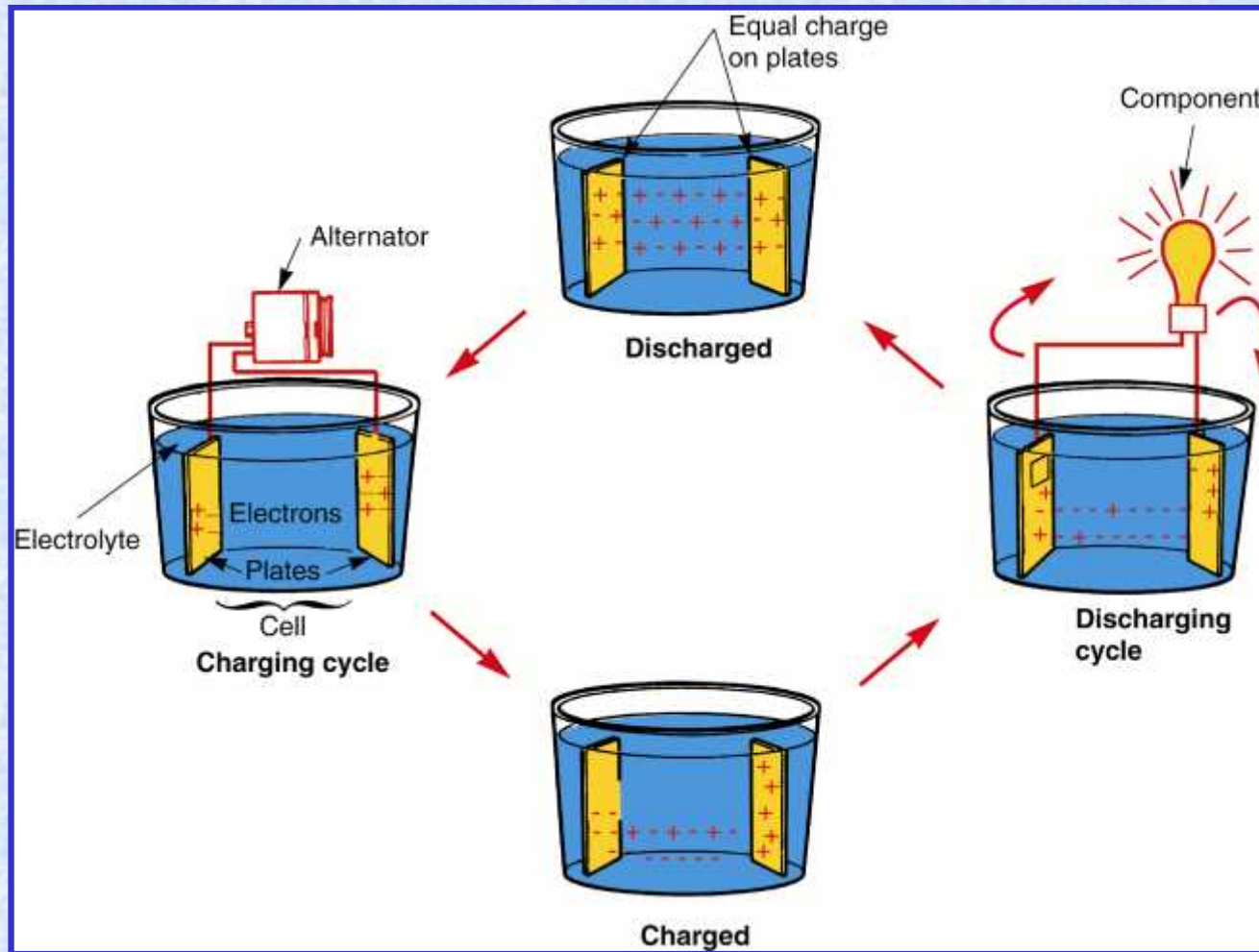
Cell Action (Charging)

- ❑ Alternator causes free electrons to be deposited on the negative (–) plate
- ❑ This causes the plates to have a difference in potential (voltage)

Cell Action (Discharging)

- ❑ Load is connected across the terminals
- ❑ Current flows through the load to equalize the difference in charges on the plates
- ❑ Excess electrons (current) move from the negative plate through the load to the positive plate

Battery Cycling



Battery Functions

- ❑ Operate the starter, ignition, and fuel injection during cranking
- ❑ Supply electrical power when the engine is not running
- ❑ Supply electrical power when current demands exceed alternator output
- ❑ Act as a capacitor (stabilize voltage)
- ❑ Store energy for extended periods

Battery Construction

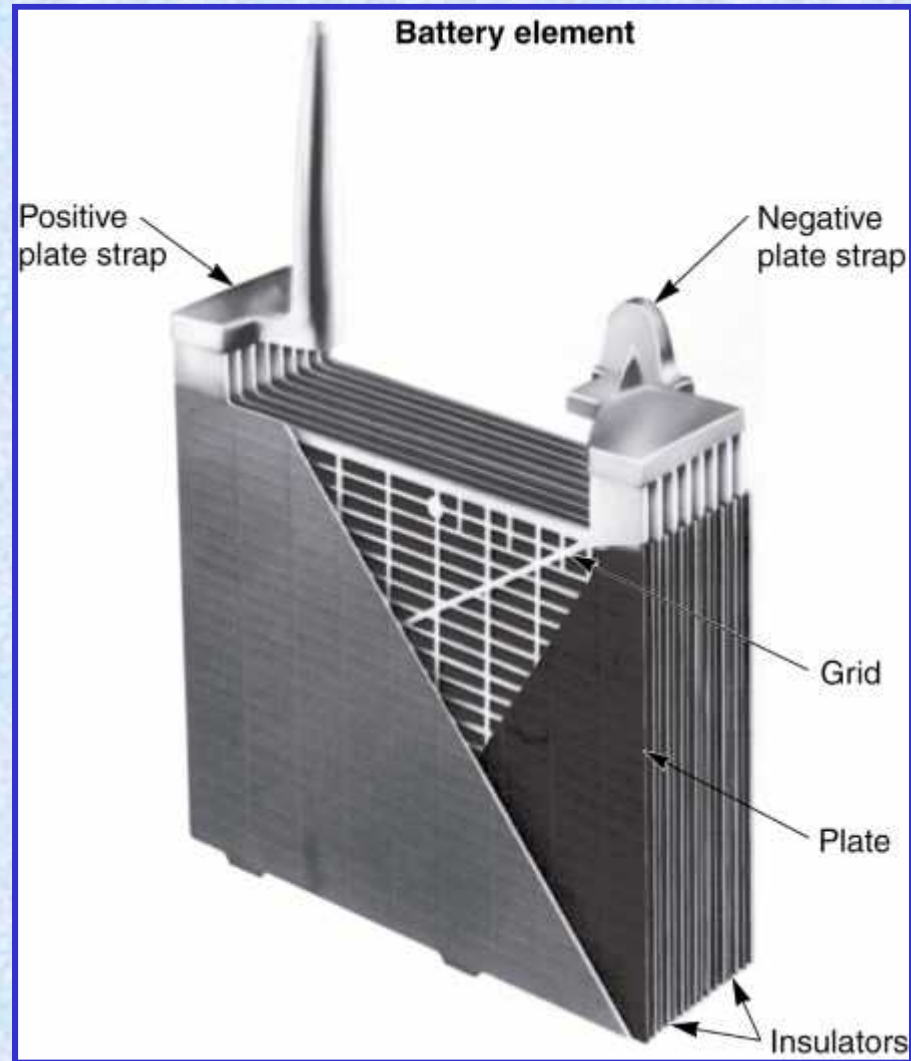
- ❑ Batteries must be built to withstand severe conditions:
 - severe vibration
 - extreme temperatures
 - corrosive chemicals
 - high current discharge
 - prolonged periods without use

Battery Element

- ❑ Battery plates
 - grid coated with porous lead
 - several in each cell
- ❑ Lead strap
 - one connects several negative plates
 - another connects several positive plates
- ❑ Separators
 - insulating material between plates that keep them from touching each other

Battery Element

Most automotive batteries have six elements

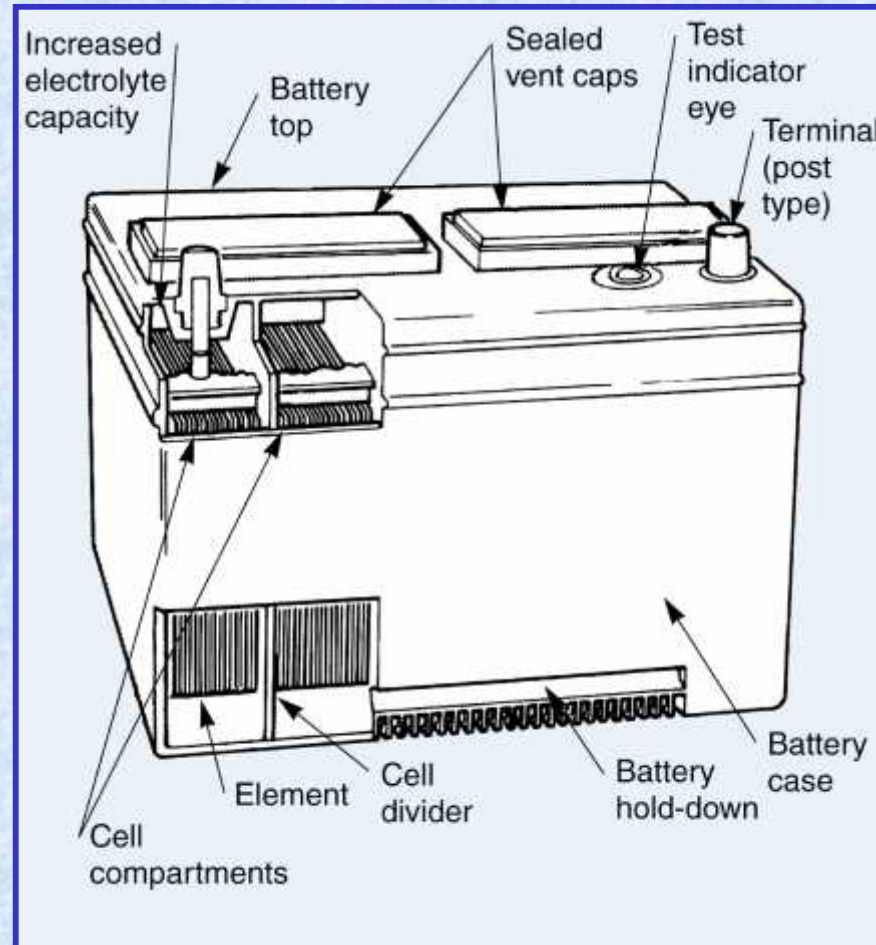


Case, Cover, and Caps

- ❑ Battery case
 - high-quality plastic, holds elements and electrolyte
- ❑ Battery cover
 - bonded to the top of the case
 - seals the top
- ❑ Battery caps
 - keep electrolyte from splashing out
 - serve as spark arrestors

Case, Cover, and Caps

Case holds the elements and electrolyte

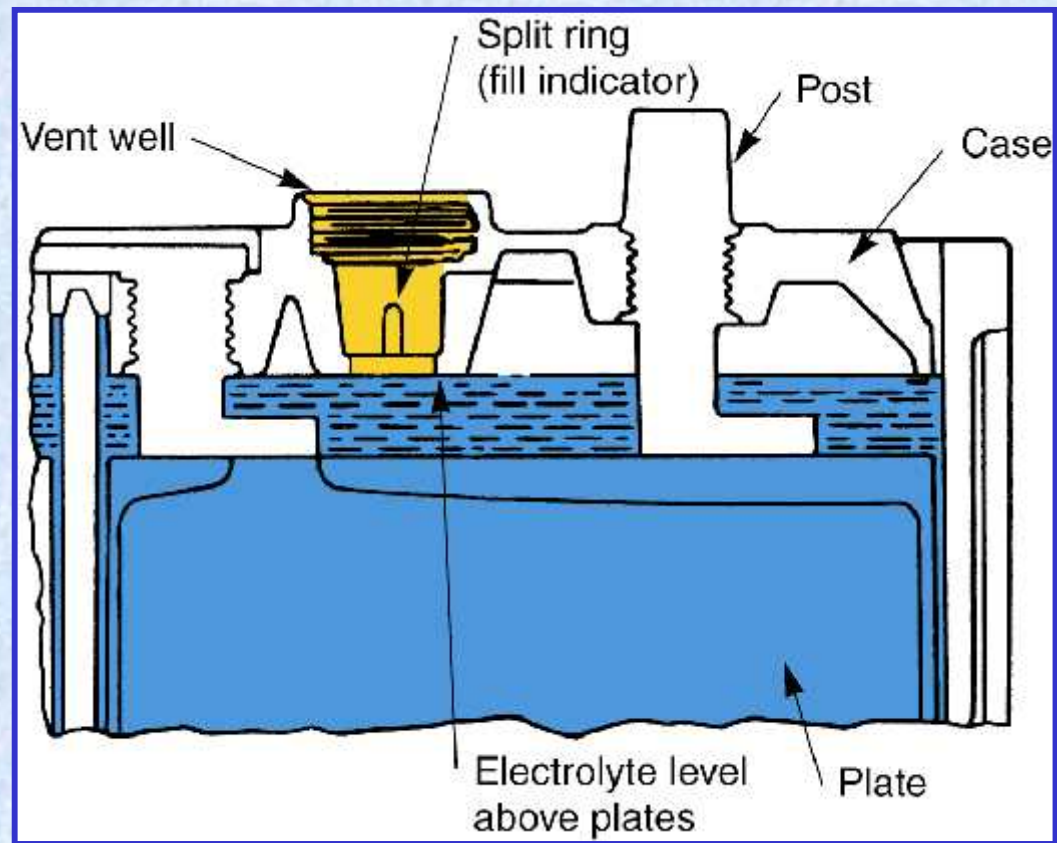


Electrolyte

- ❑ Mixture of sulfuric acid and distilled water
- ❑ Poured into each cell until plates are covered
- ❑ **Warning: electrolyte causes serious burns or blindness if it comes in contact with your skin or eyes!**

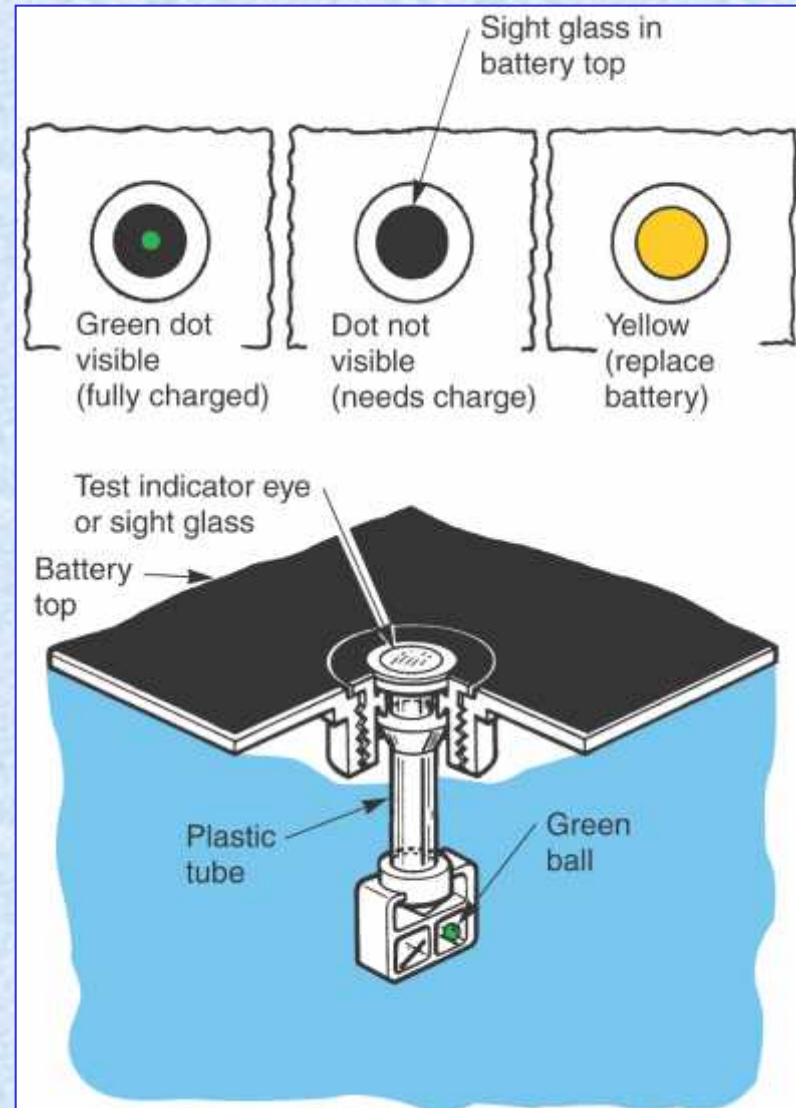
Electrolyte

Electrolyte should just touch the split ring in the top of the case



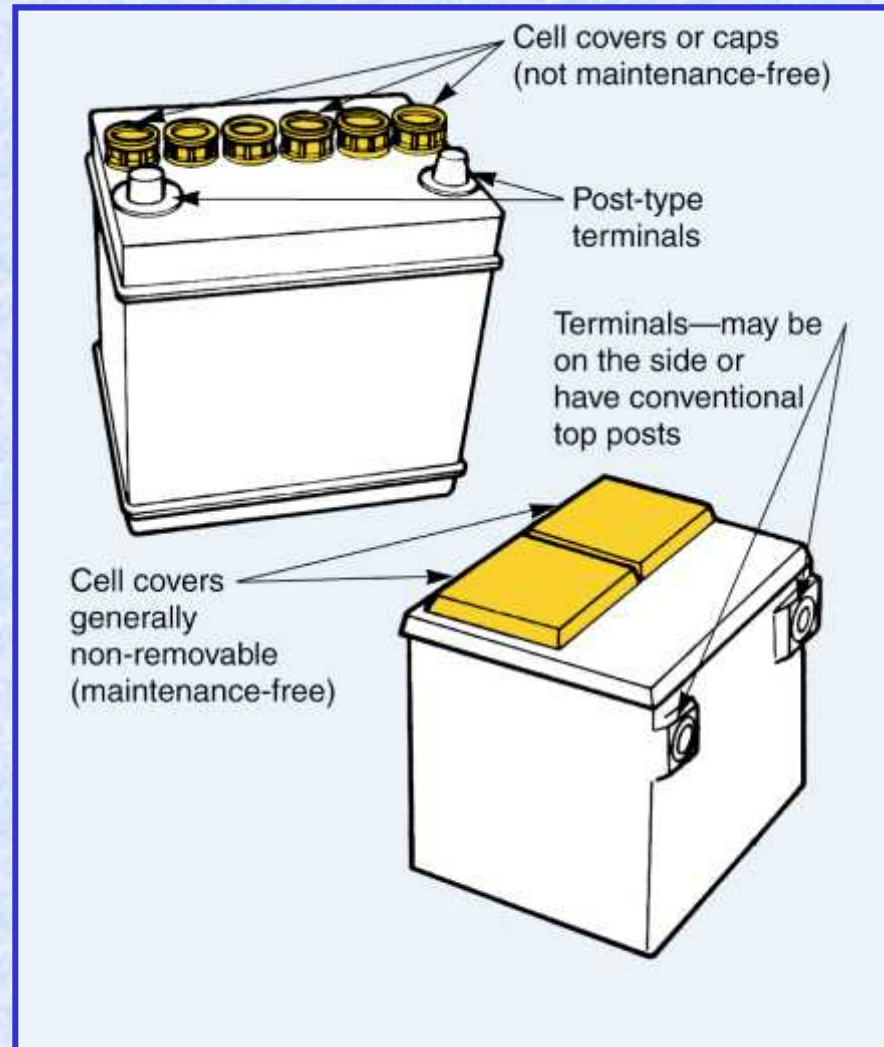
Charge Indicator

Changes color to show the general state of charge of the battery



Battery Terminals

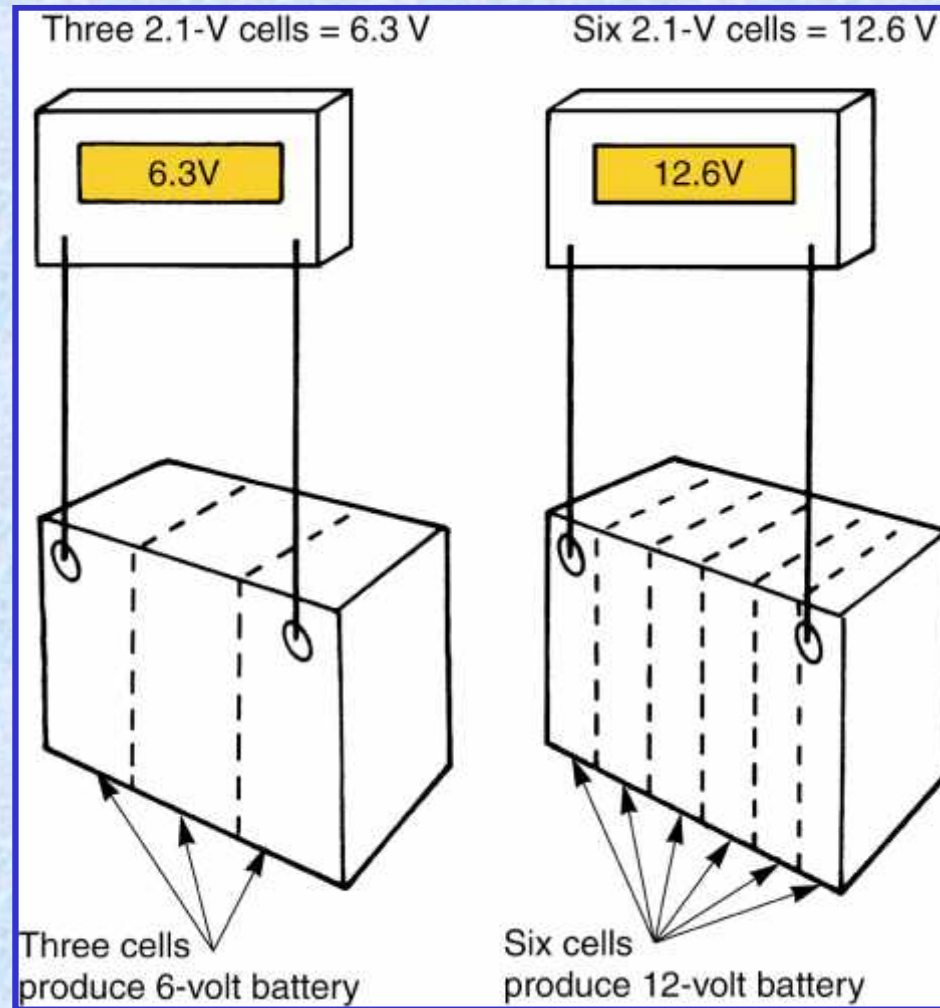
Means of connecting the battery to the vehicle's electrical system



Battery Voltage

- ❑ Open circuit cell voltage is 2.1 volts
- ❑ Cells are connected in series
- ❑ Battery voltage depends on the number of cells
- ❑ A 12-volt battery has 6 cells and an open circuit voltage 12.6 volts
- ❑ A 6-volt battery has 3 cells and an open circuit voltage 6.3 volts

Battery Voltage



Two-Battery Systems

□ Parallel

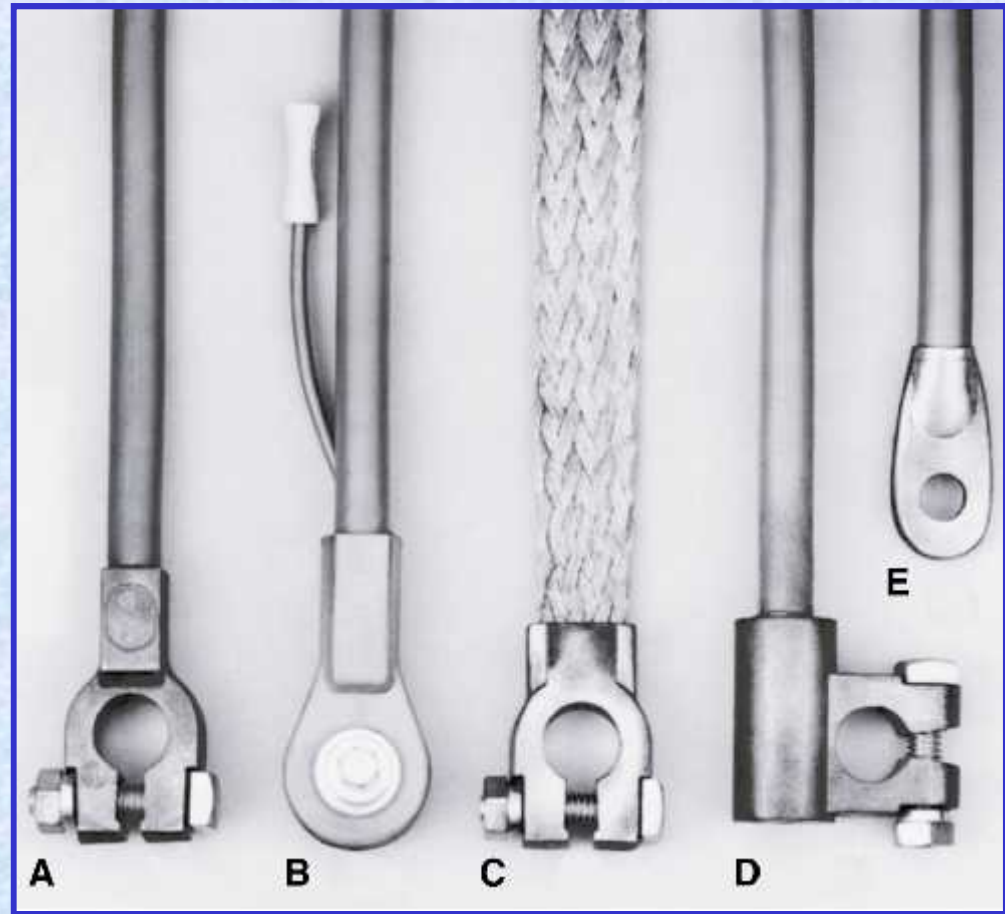
- connected negative to negative
- connected positive to positive
- two 12-volt batteries produce 12 volts, high current

□ Series

- connected positive to negative
- two 12-volt batteries produce 24 volts

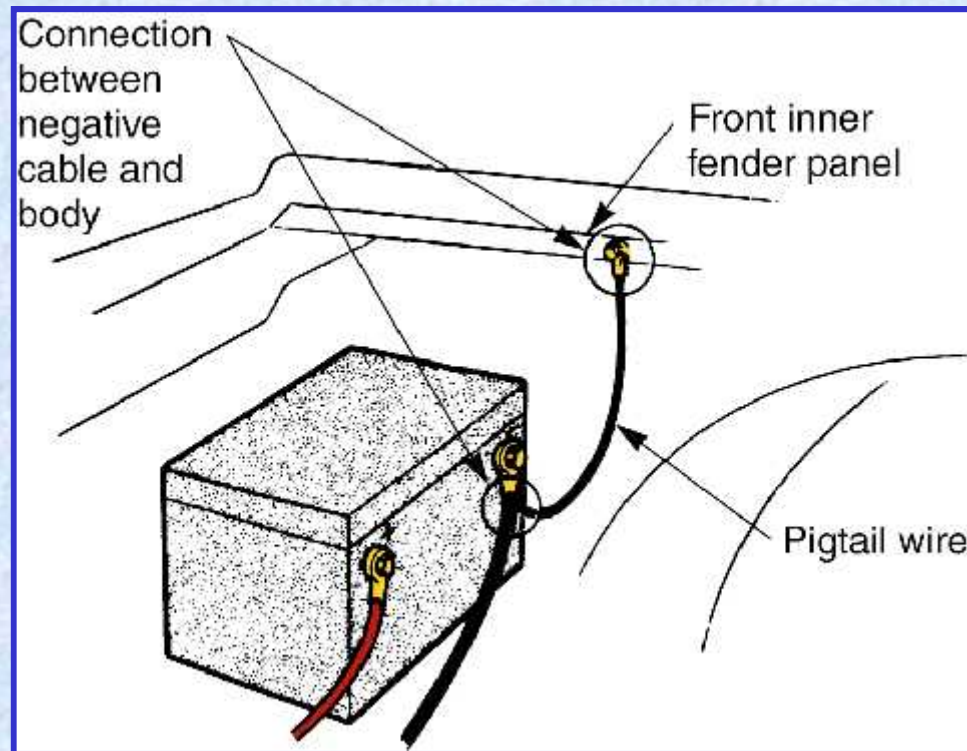
Battery Cables

- A. Post-type
- B. Side terminal
- C. Braided ground
- D. 90° post-type
- E. Solenoid to starter



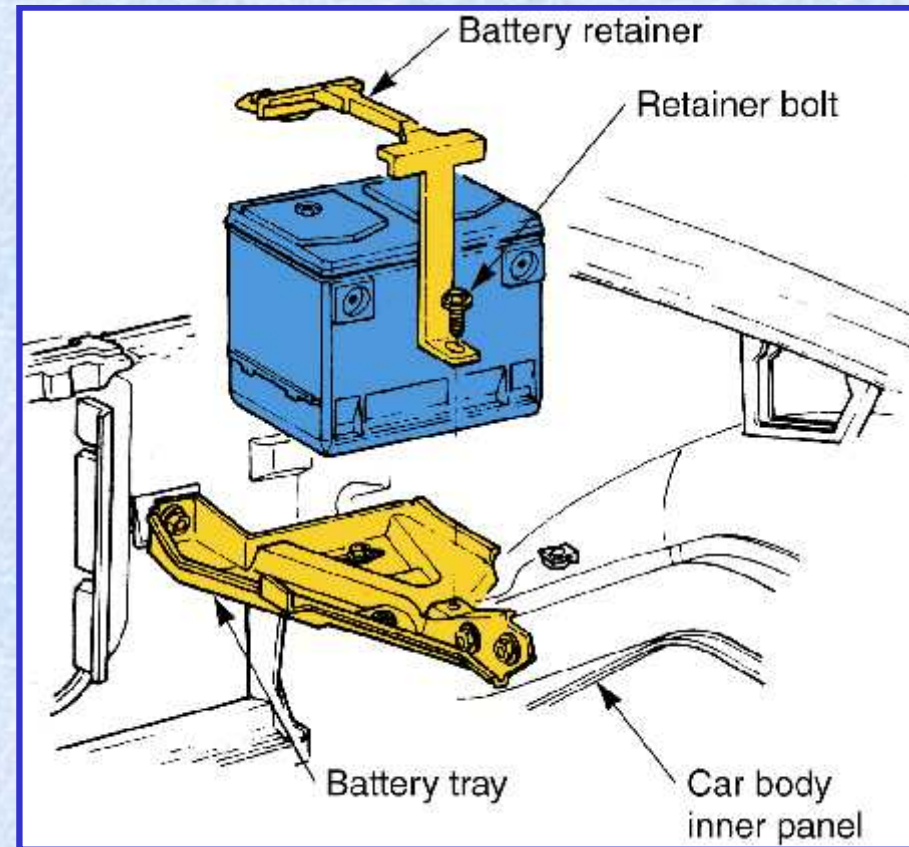
Cable Connections

The negative cable grounds on the engine block and the positive cable connects to the electrical system



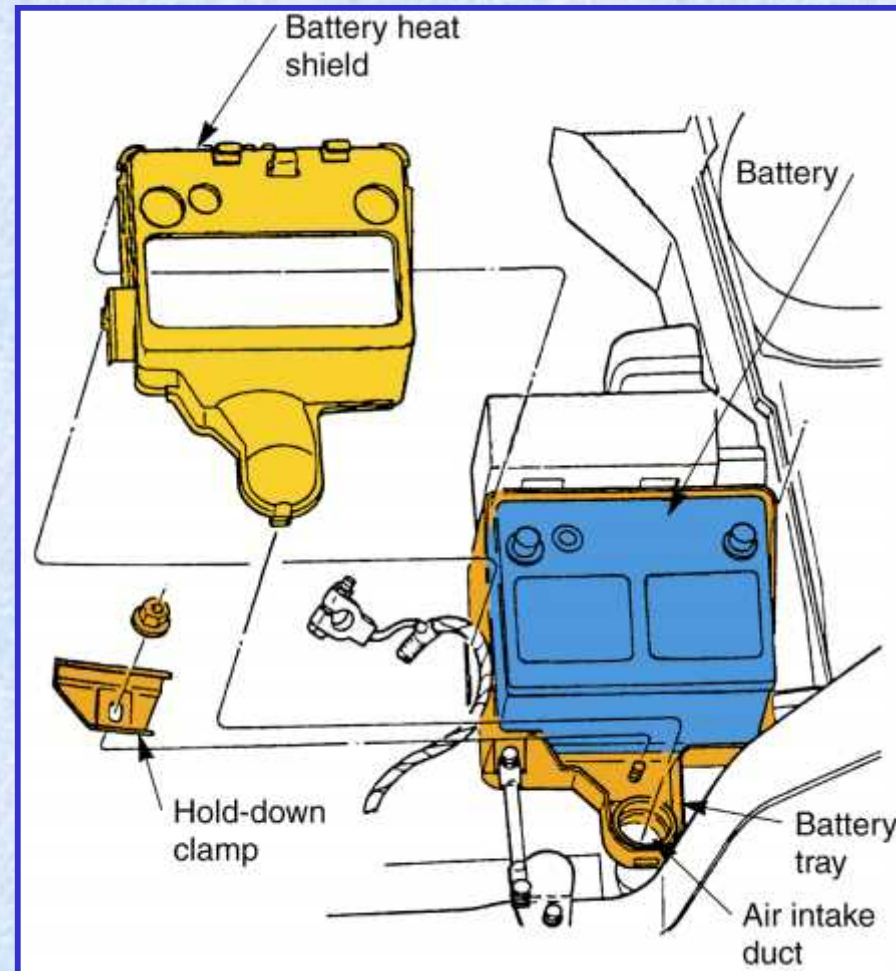
Battery Tray and Retainer

Holds battery securely in place
May house a battery temperature sensor



Battery Tray and Heat Shield

Protects battery from excess engine heat by routing air between heat shield and battery case



Wet- and Dry-Charged Batteries

❑ Wet-Charged Battery

- filled with electrolyte and charged at the factory
- very common in many locations

❑ Dry-Charged Battery

- contains fully charged elements
- does not contain electrolyte
- leaves the factory in a dry state
- has a long shelf life

Maintenance-Free Battery

- Does not use removable filler caps
- Calcium is used to make the plates, reducing gassing
- Reduced water loss decreases service requirements

Battery Ratings

- Cold cranking rating
- Reserve capacity rating
- Amp-hour rating

Cold Cranking Rating

- ❑ Determines the current that the battery can deliver for 30 seconds at 0 °F (-18 °C) while maintaining terminal voltage of 7.2 volts (1.2 volts per cell)
- ❑ Expressed as cold cranking amps (CCA)
- ❑ Indicates ability to crank the engine at cold temperatures
- ❑ Typical applications:
 - 305 CCA for small 4-cylinder engine
 - 450 CCA for 8-cylinder engine

Reserve Capacity Rating

- ❑ Time needed to lower battery terminal voltage below 10.2 volts (1.7 volts per cell) at a discharge rate of 25 amperes at 80 °F (27 °C)
- ❑ Expressed in minutes
 - example: If a battery is rated at 90 minutes and the charging system fails, the driver has approximately 90 minutes of driving time with a current use of 25 amperes before the battery voltage drops below 10.2 volts

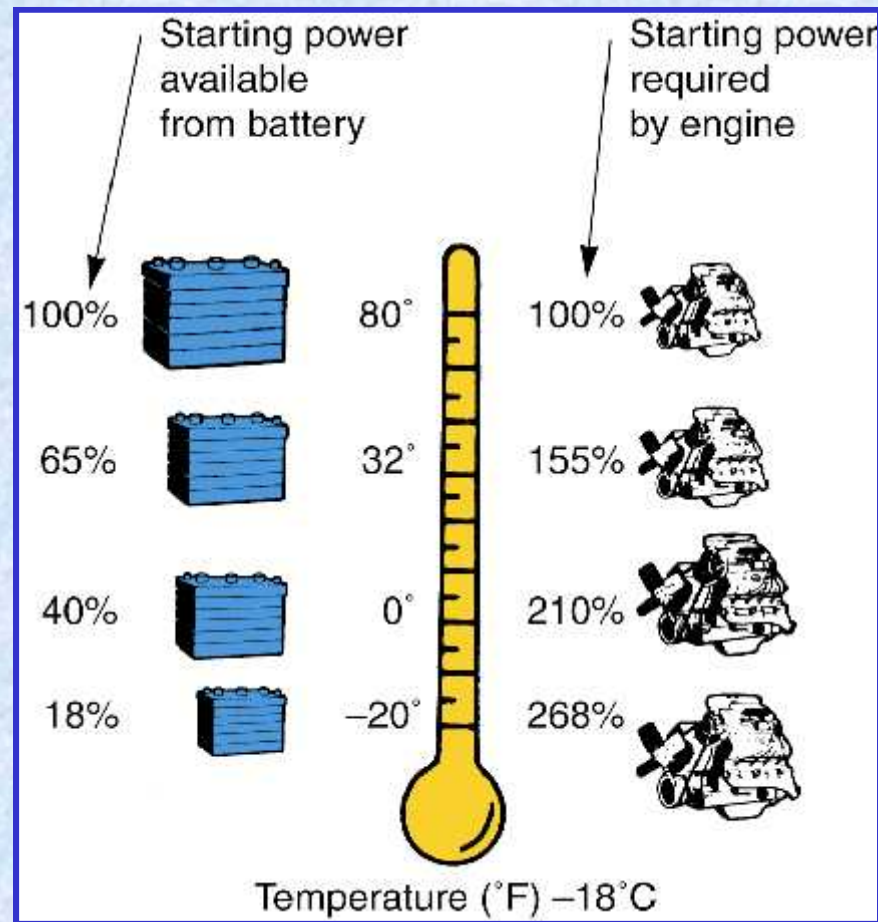
Amp-Hour Rating

- ❑ Once used to indicate battery power
- ❑ Measures current that the battery could produce for 20 hours at 80 °F (27 °C) with the battery voltage above 10.5 volts

Battery Temperature and Efficiency

- ❑ As battery temperature drops, output is reduced
 - chemical process is slowed
 - battery cannot produce as much current

Temperature versus Efficiency



Parasitic Loads

- ❑ Current draw present when engine and ignition are shut off
- ❑ Computers and clock require constant power
- ❑ Over prolonged periods, these may discharge the battery enough to prevent starting