

Introduction to Automotive Service


## **Electrical Systems**

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## **Basic Electricity**

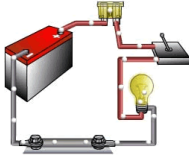
- Electrical Pressure
  - voltage - measured in volts
- Current Flow
  - amperage - measured in amps
- Opposition to Current Flow
  - resistance - measured in ohms



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## **Circuit Components**

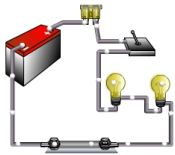
- Power Source
- Conductor
- Load
- Switch
- Circuit Protection



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## **Series Circuit**

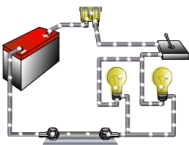
- One path for current flow
- Total circuit resistance is the sum of all the circuit's resistances
- The sum of the voltage drops equals source voltage



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## **Parallel Circuits**

- There are multiple paths for current flow
- Source voltage is dropped across each path
- Total current is equal to the sum of current flowing through all the branches
- Total circuit resistance is always less than the least resistive branch



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## **Units of Measurement**

- mega - M
  - multiply meter reading by 1,000,000
- kilo - k
  - multiply meter reading by 1,000
- milli - m
  - multiply meter reading by .001
- micro -  $\mu$ 
  - multiply meter reading by .000001

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## Digital Volt Ohm Meters


- Display
  - number of digits
  - V, A or  $\Omega$
  - units indicator
- Range Selection
  - auto-ranging
  - manual operation
- Test Lead Connection



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## Meter Operation

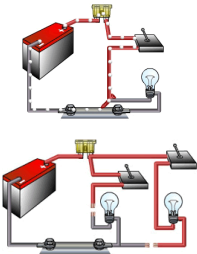
- voltage drop must be measured with the current flowing
- an ammeter must be in series with the circuit being tested
- an ohmmeter should be used only with the circuit or component removed from the circuit (no power applied)



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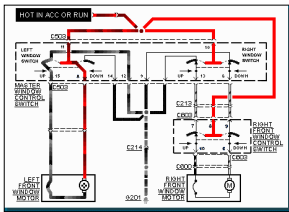
## Shorts and Opens

- Short
  - unwanted continuity exists between two or more circuits
  - the meter displays a resistance less than specifications
- Open
  - the desired continuity between two points in a circuit is not present
  - the meter shows OL



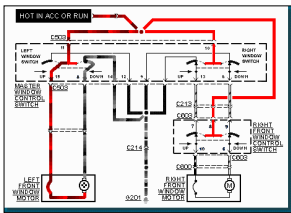
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## LF Power Window Down



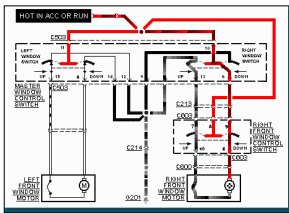
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## LF Power Window Up



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## RF Power Window Down



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### RF Power Window Up

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### RF Power Window Down

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### RF Power Window Up

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### Charging System

- Alternator
- Drive belt
- Voltage regulator
- Indicator lamp or gauge
- Battery
- Wiring and circuit protection

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### Starting System

- Starter
- Battery
- Cables and Wires
- Ignition switch
- Starter relay
- Starter solenoid
- Manual Lever Position switch
- Clutch Pedal Safety switch

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### Ignition System

1. Ignition switch
2. Spark plugs
3. Coil pack
4. Powertrain control module

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## Battery Rating Systems

- Reserve Capacity
  - Length of time a fully charged battery can deliver 25 amps at 80° F
- Ampere-Hour Rating
  - current the battery can deliver for 20 hours without the cell voltage dropping below 1.75 volts at 80° F
- Cold-Cranking Amps
  - number of amps a battery delivers for 30 seconds at 0° F without the cell voltage falling below 1.2 volts

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## Battery Load Test

- Open Terminal Voltage above 12.4 volts
- Load test the battery for 15 seconds at:
  - 3 times the amp hour rating
  - ½ the cold cranking amp rating
  - the battery's specified load test amperage
- The battery's voltage should not fall below 9.6 volts

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## Three Minute Charge Test

- Charge the battery at a rate of 30 to 40 amps
- The battery's terminal voltage should not exceed 15.5 volts in 3 minutes
- If the voltage does not exceed 15.5 volts charge the battery and re-conduct the battery load test

