California Vocational Agriculture Curriculum Guidelines Instructional Unit

BASIC ELECTRICITY

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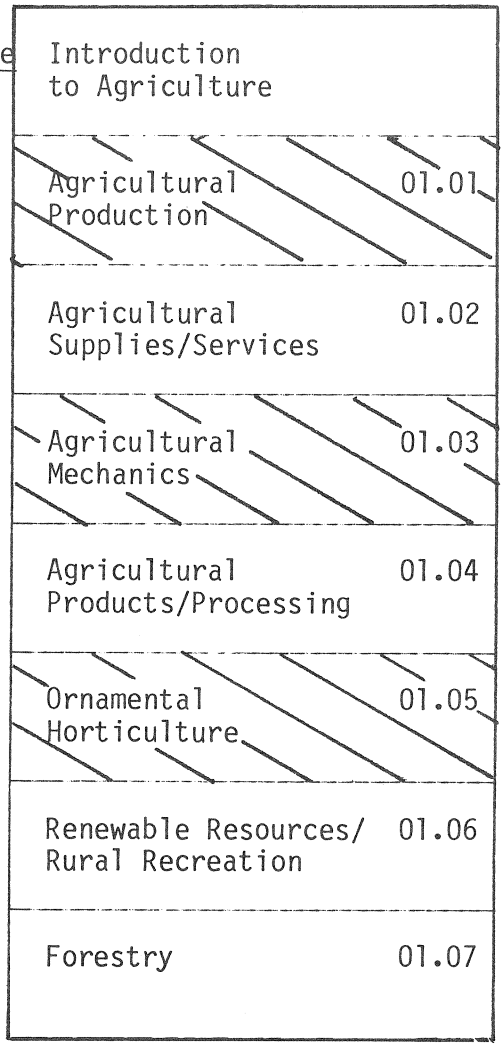


BASIC ELECTRICITY

Unit Goal

To increase the students' knowledge of basic electrical principles and applications.

Unit Objectives

Upon completion of this unit the student will be able to:

1. Use approved safety measures in electrical wiring.
2. Select correct fuse sizes for a given circuit.
3. Select wire sizes for a given circuit.
4. Differentiate between series and parallel circuits.
5. Design and build a simple electrical circuit.

Teaching Outline

I. Product Testing

A. Underwriters laboratories test sample products to see if they safely do the job for which they were intended.

B. U.L lists those products tested indicating they have safely performed. Not an endorsement or statement of quality.

C. Manufacturers of listed materials display a label indicating they have been tested and listed on the product.

II. National Electric Code

A. The National Electric Code is written by the National Fire Protection Association.

B. It is a code of minimum standards to be followed in electrical installation.

C. The N.E.C. is used as a guide by electrical inspectors but their interpretation of the code is the local requirement.

D. The N.E.C. is a minimum standard for safety but is not necessarily adequate or convenient.

III. AC and DC TM 1

A. DC (as supplied by battery)

1. Volts rise on connection to maximum pressure (12V in automotive system) and remain fairly constant as long as power supplied.

2. Current varies with demand, capacity of source and conductor.

B. AC (household electricity)

1. Volts continually rise from zero to maximum as if connected to battery then fall to 0 as if disconnected, then repeat as if wires were connected to reverse battery terminals.

2. Cycles or Hertz (hz) refers to the number of times the complete cycle as noted above occurs per second (normal house current 60 hz).

3. Current varies with demand, capacity of source, and conductor

IV. Current

A. Depends on pressure and resistance (pressure 1 volt through a resistance of 1 ohm = current 1 amp).

B. Current through resistance releases energy in heat. (Example: heating coil on stove)

SUGGESTED LEARNING ACTIVITIES			SUGGESTED RESOURCE MATERIALS
I.	1.	Demonstrate U.L. label on appliances and cables.	1. Local shop.
III.	2.	Demonstrate a test lamp attached to a battery -- lamp will light regardless of polarity.	2.
	3.	Reversal of test lamp leads provides alternating current -- have students count cycles.	3.
	4.	With test lamp -- no wire heating if auto head lamp is used with small wire, will notice heating of wires due to more current flow.	4.

C. Capacity of wires fuses etc. rated by current. (Example: fuse 20 amp -- #12 TW wire capacity 20 amp).

D. If capacity of fuse exceeded-a portion of the fuse overheats and melts -- opening the circuit.

E. If capacity of conductor exceeded -- first insulation deteriorates -- if current flow is great enough, it can cause a fire.

V. Terminology: TM 6

A. Shock: Electrical current passing through an animal or a person. TM 2

1. Stages of shock:

	milli amps
a. barely discernable	2
b. uncomfortable	5
c. muscular freeze	10
d. fatal	15

B. Short: A direct connection between a hot wire and a ground connection, allows amperage flow up to limits of fuse or wire.

C. Fault: A leakage of current (a high resistance connection) from hot wire to ground connection (may be such low amperage that circuit protection will not trip).

D. G.F.C.I. Ground Fault Circuit Interruption: a device that measures fault current and automatically opens the circuit at a pre-set value usually 5-7 milli amps. The purpose is to protect people from fatal shock.

VI. Transformer

A. Current flow induced from one coil into another because of proximity.

B. Must have change in flow to have induced current (Cannot use transformer in DC -- as current will flow momentarily in secondary only when flow from supply drops).

C. Induced current proportional to numbers of turns in primary and secondary coils.

D. When voltage goes up amps go down. Example: transformer 100 wraps primary -- 200 wraps secondary supply 100 volts 10 amps -- induced current 200 volts 5 amps.

VII. Overcurrent Protection

A. Fuses or circuit breakers are designed to limit the current allowed to flow in a circuit so that the current carrying capacity of the wire and device

SUGGESTED LEARNING ACTIVITIES		SUGGESTED RESOURCE MATERIALS
VI.	1. Show (pass around) fuses -- new and burned (different sizes and types).	
	2. Bell transformer can be used to demonstrate transforming 120V to 12V.	1. Local electrical repair shop.
	3. Shock hazard -- display.	2. Local power company representative sometimes will put on display.
	4. Have students wire 2 to 3 lights in a series and use bulbs of different wattage. Ask students why larger bulb is notlit. (Resistance additive in series -- current reduced to level that lowest wattage bulb only will light). Replace with bulbs of same wattage -- all will light but be less bright than normal. Remove one bulb and all go out. Repeat the exercise using parallel. Note the difference in lamp brilliance.	3. Class.

VII. A. are not exceeded. Excess current flow could lead to fire hazard.

B. Fuses must be selected considering wire capacity and device connected. (Example: a device drawing 20 amps must be protected by a fuse of 20 amps minimum and 30 amps maximum and connected with wire with a capacity of at least the fuse rating.

VIII. Circuits

A. Electricity must flow in a circle, from source through conductor, device and back to source.

B. Series wiring current flows (TM 3) through each device in turn. (Example: some Christmas tree lights) if one device fails, all go out.

C. Parallel Wiring

1. Current has a choice of paths to take.

2. Each device can be turned on or off independent of the others.

IX. Wire Sizes

A. Common Household Wiring

1. Size 0-14. 0 being the largest and 14 the smallest.

2. Use only even # in household wiring.

3. Odd # used in manufacturing coils, motors, etc.

B. Smaller sizes (up to # 6 solid wire, the larger sizes are stranded for flexibility.

C. The insulation used on the wire determines its use. (Example: weather resistance, and heat resistance).

D. Ampacity carrying capacity determined by diameter -- materials (copper, aluminum) insulation and use (in cable or free air).

X. Wire Connections

Use solderless connectors -- code prohibits soldered connections in certain locations because soldering has not been practiced lately and the joints are therefore not as consistant as solderless.

XI. Service Entrance

A. The wires and devices that connect the power suppliers lines to the building circuits are termed service entrance (most homes now have 100 amp

SUGGESTED LEARNING ACTIVITIES			SUGGESTED RESOURCE MATERIALS
VIII.	1.	Pass around short wire pieces of different sizes, insure size # is indicated on insulation.	1. Local electrician.
	2.	Field trip to a building under construction with wiring installed can be helpful.	2. Local electrician. Power company representative.
IX.	3.	Have students wire meters into simple circuit -- inspect before energizing to prevent shock hazard or damage to meter.	3. TM - 4
	4.	Wire motor through fuse that has running capacity of motor -- show that it will burn out with motor starting load. Repeat with time delay fuse or circuit breaker of same capacity -- these will handle starting current.	4. Class

XI. A. or larger service entrance)

B. The wires to the meter and main switch must be at least the ampacity of the main switch in the service entrance box.

C. The service entrance usually has a place for the watt meter installed by the power supplier to record the electrical power used.

D. The service entrance usually has circuit breakers to protect the circuits beyond the service entrance box.

XII. Branch Circuits

A. The circuits that lead from the entrance box to the household devices are called branch circuits.

1. 15 amp branch circuits lighting and small appliances (clocks, etc.)
2. 20 amps branch circuits, kitchen appliances, laundry, etc.
3. Special circuits -- serve one device;range, water pumps, etc. Amperage of circuit depends on wiring and load.

XIII. Outlet Boxes

A. Branch circuits pass through and terminate in outlet and switch boxes.

B. Boxes are selected according to use (switch, switch and receptacle, light, etc.) and size (the number of conductors entering a box require a certain number of cubic inches of space to prevent over crowding).

C. Any connections must be made in a box.

XIV. Meters

A. Watt Meter: installed by power supplier to measure electrical power consumption

B. Volt Meter: Used to measure electrical pressure between hot wire and ground circuit. TM 4

C. Amp Meter: Used to measure current flow, may be wired in or use clip on around one wire only.

D. Ohm Meter: Used to measure resistance in a conductor, device, or circuit.

Note: has its own power supply and must be used on a dead circuit only.

XV. Grounding

A. Ground Wire: (white) Carries current from device to ground -- connected to service entrance -- goes directly to device.

SUGGESTED LEARNING ACTIVITIES	SUGGESTED RESOURCE MATERIALS
XV. 1. Demonstrate how to disassemble, clean (with a soft brush) and lubricate a motor.	1. Local electrical repair shop.

XIV. B. Grounding wire (green, uninsulated) provides a path for fault currents to protect people from shock.

1. Grounding protection must be continuous
2. Grounding protection must be connected to metal box and green terminal
3. If a system is wired in metal conduit, the conduit serves as grounding protection.
4. Any building that houses livestock must have its own ground rod (electrode) connection at that building.
5. Barns must use non-metallic boxes and cable because the corrosive conditions rot conduit and interfere with grounding protection.

XV. Motors

A. Uses

1. Mancan do about 1/8 hp work continuously.
2. 1/8 hp electric motor is very small and can do that much work continuously for a long time.
3. Electric motors can be mounted in any position.
4. Has high current draw during starting -- average 4-6 X starting load.

B. Types

1. Split phase 1 Ø -- light duty fans, etc.
2. Capacitor 1 Ø-- heavier starting ability, more efficient, used on grinders, pumps, etc.
3. Repulsion start induction run 1 Ø -- heaviest starting loads, heavy duty applications -- most efficient. Quite expensive.
4. Universal 1 Ø-- variable speed, used on drills, etc.
5. Three phase motors, simplest, most efficient, but require 3 Ø power.

C. Service

1. Need to be clean to dissipate heat
2. Protect from rodents which could chew insulation.
3. Lubricate bearings -- sparingly -- do not want oil or grease to get into motor and attract dirt. (1-3 drops #10W oil once/year).

Suggested Learning Activities	Suggested Resource Materials

XV. C. 4. Keep motor dry.

XVI. Poly Phase Power TM 5

Three different power sources timed so that their power peaks are syncronized and occur sequentially giving a motor three times the number of rotational impulses as it would have with single phase. Three phase motors are more efficient than single phase but require three phase power.

XVII. Poly Phase Power, Transformer Connection TM 5a

A. Delta

B. Wye

Suggested Learning Activities	Suggested Resource Materials

Student Evaluation

1. What does the U.L. label on an electrical appliance indicate?

2. The National Electric Code serves as a guide to electrical inspectors to insure _____ _____ for electrical _____.

3. DC refers to _____ _____.

4. AC refers to _____ _____.

5. 60 hz means 60 _____ per _____.

6. If you want to use a transformer to change 60V power to 24V the power must be _____.

7. A fuse protects the wires in a circuit by _____ _____.

8. What is a short circuit?

9. What is a fault current?

10. List two bad features of series wiring.
    a.
    b.

11. List two good features of parallel wiring.
    a.
    b.

12. Number 13 wire is _____ than number 10 wire.

13. Why are larger sizes of wires stranded?

14. What three things determine the ampacity of wire?
    a.
    b.
    c.

15. Outlet boxes are selected according to _____ and _____ of conductors entering the box.

16. Name three things that must be done to help an electric motor provide continuous service.

    a.

    b.

    c.

17. True _____ or False _____: 208V single phase power can only be delivered by a Y connected 3ϕ transformer system.

18. A circuit wired with #12 TW wire and a load of 16 amps should have what size fuse or breakers?

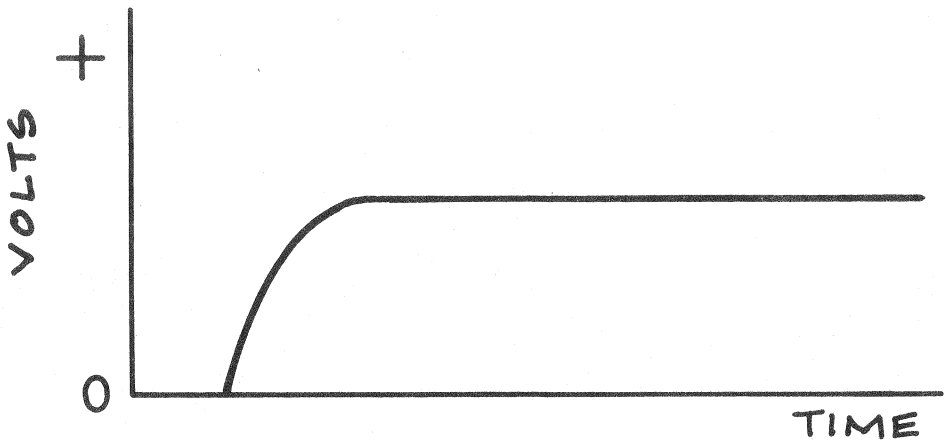
Student Evaluation

ANSWERS:

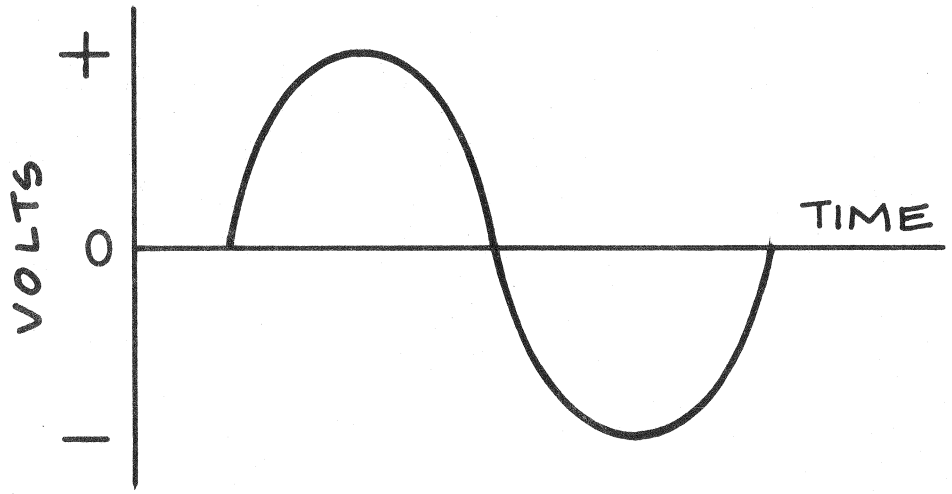
1. The appliance has been tested by U.L. and found to perform the functions for which designed safely or listed by U.L.
2. Minimum standards -- installations.
3. Direct current.
4. Alternating current.
5. Cycles - second.
6. AC
7. Destroying itself -- burning out.
8. A direct connection between hot wire and ground connection.
9. A high resistance connection between hot wire and ground -- a leak to ground.
10. Resistance additive or low current flow,one lamp bad and all go out.
11. Current has alternate path to follow,lamps can be switched independent of each other.
12. Smaller.
13. Flexibility.
14. 1. Diameter
    2. Insulation (type)
    3. Use (free air or cable).
15. Use number.
16. Clean, protect, keep dry, lubricate.
17. False.
18. 20 amps.

ALTERNATING AND DIRECT CURRENTS

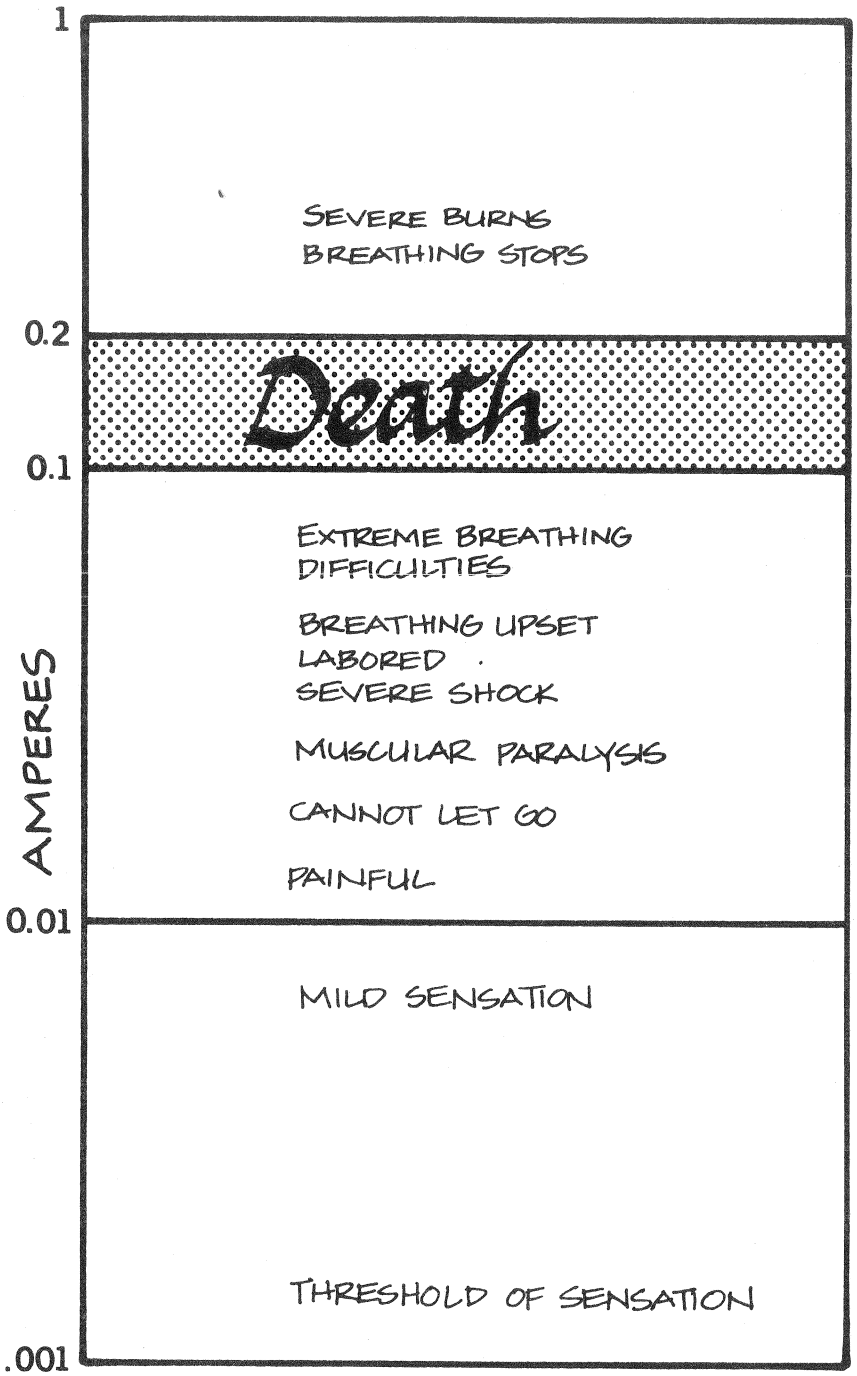
DIRECT CURRENT



ALTERNATING CURRENT

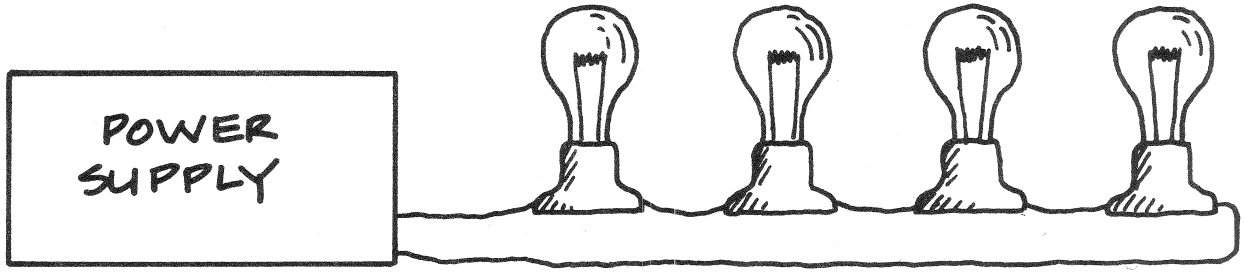


PHYSIOLOGIC EFFECTS OF ELECTRIC CURRENTS



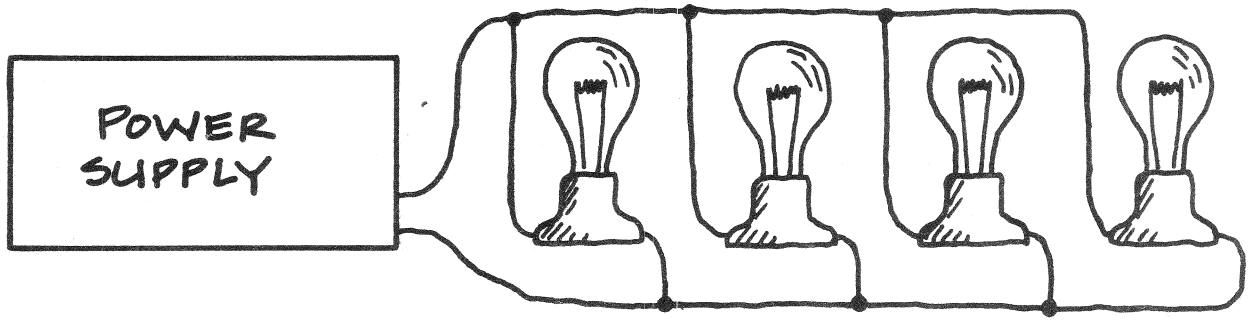
SERIES AND PARALLEL WIRING

SERIES WIRING (4 LIGHTS IN SERIES)



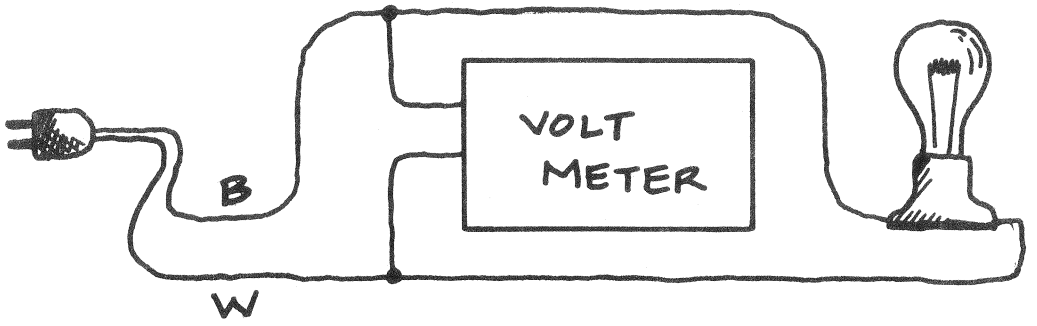
(RESISTANCE ADDITIVE – THE MORE LAMPS ADDED THE LESS CURRENT WILL FLOW)

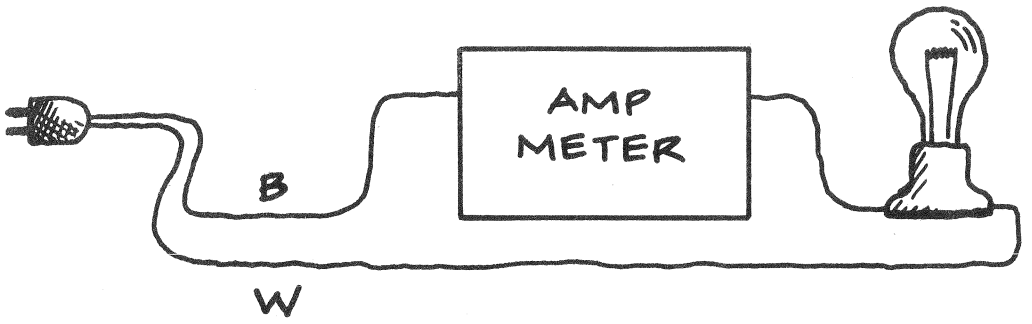
PARALLEL WIRING (4 LIGHTS IN PARALLEL)

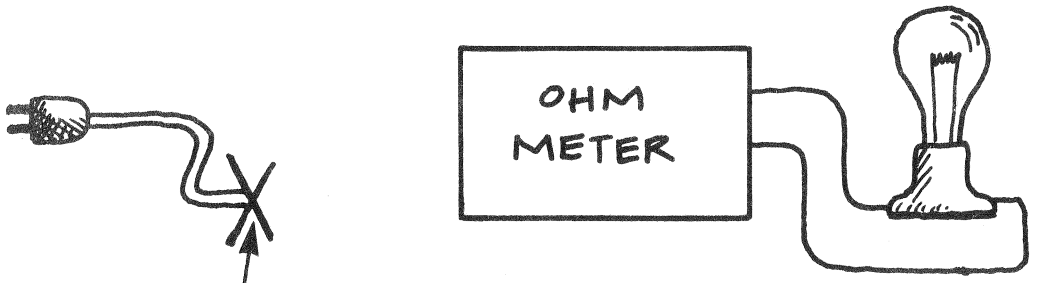


(CURRENT ADDITIVE – THE MORE LAMPS ADDED THE MORE CURRENT WILL FLOW)

METER HOOKUP



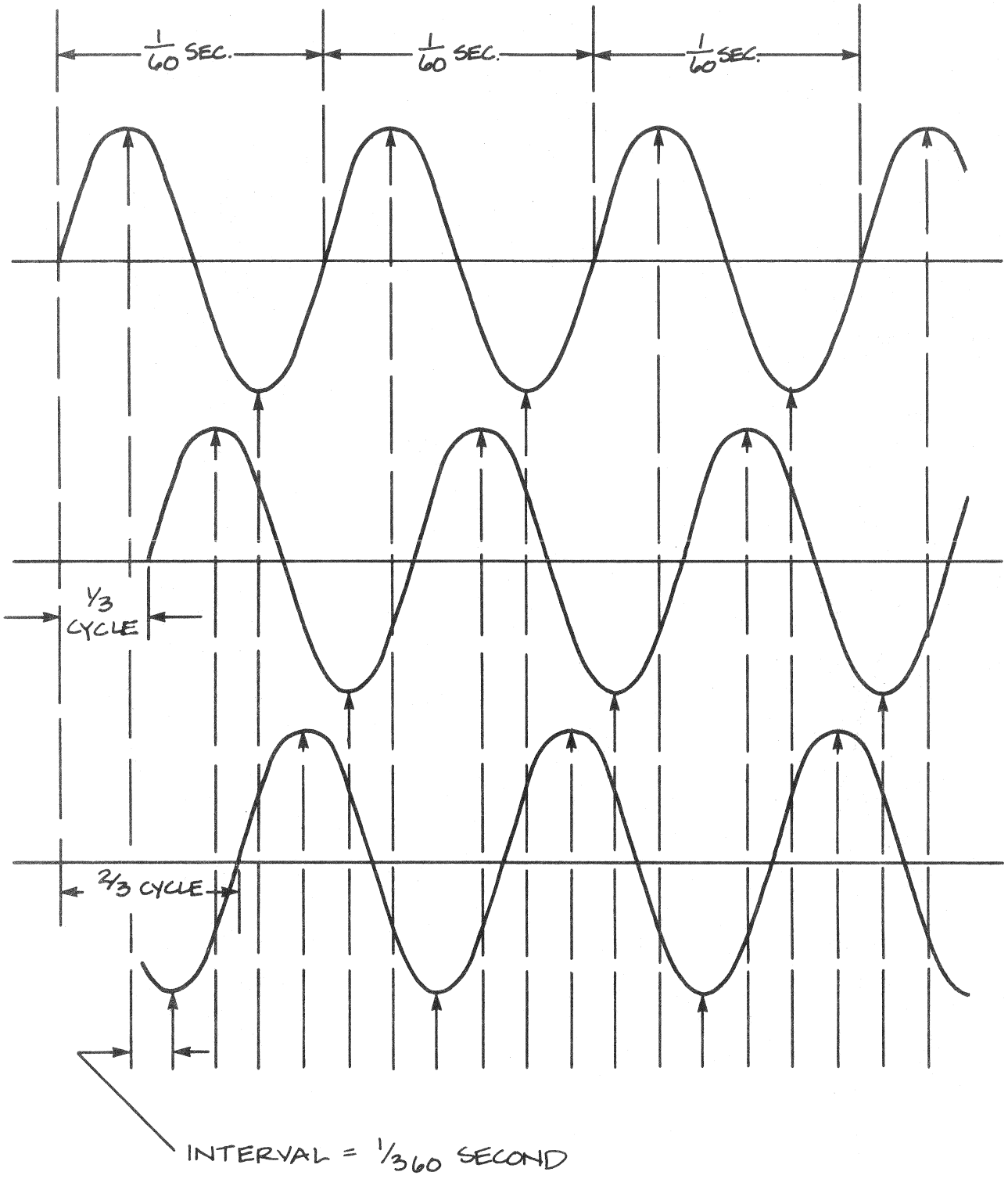




NOTE: OHM METER HAS ITS OWN POWER SUPPLY; MUST BE USED ON A DEAD CIRCUIT ONLY.

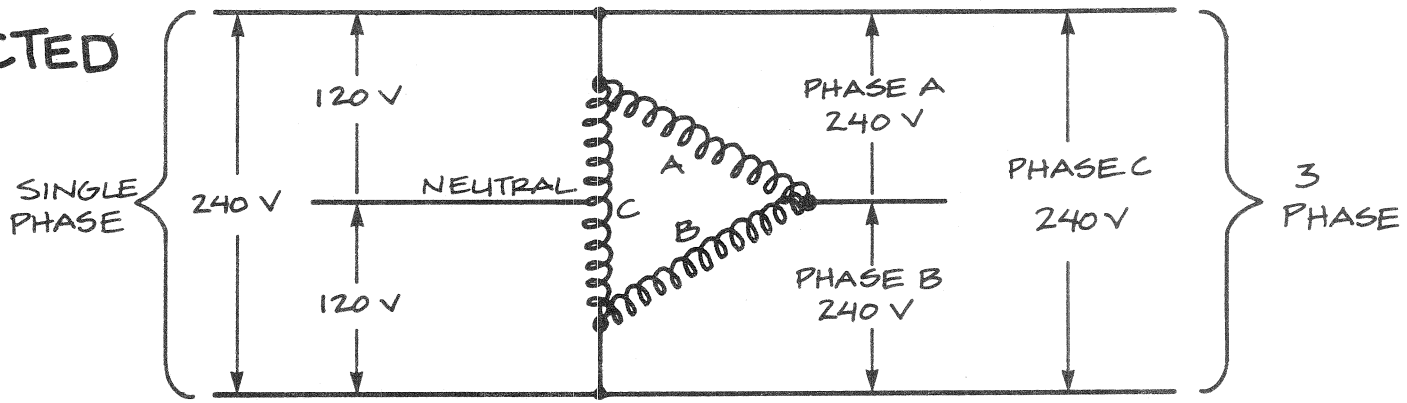
THREE PHASE CURRENT FROM THREE SINGLE PHASE CURRENTS

TM 5

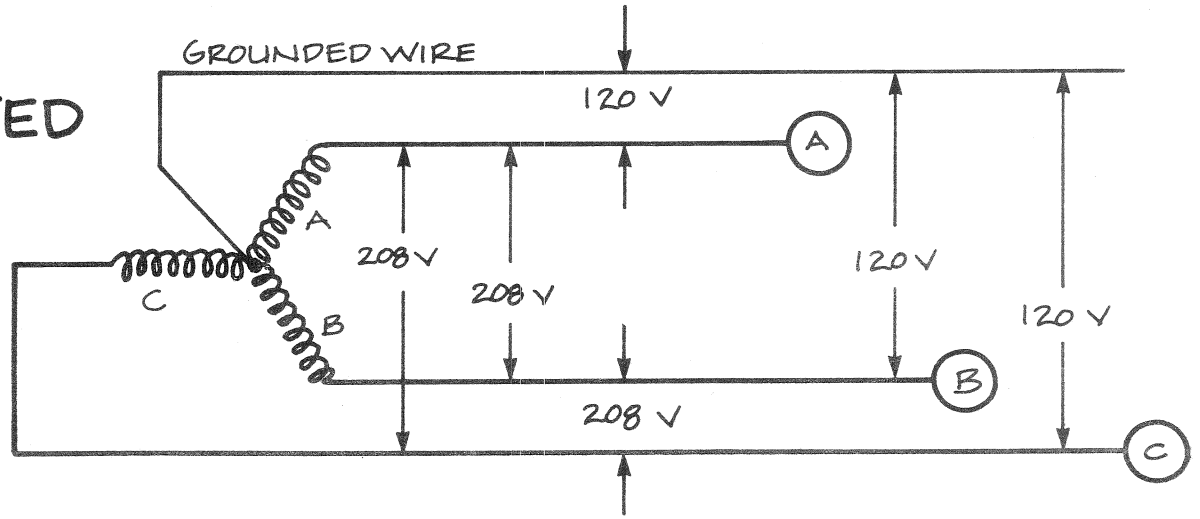


THREE PHASE HOOKUP

DELTA - CONNECTED



WYE - CONNECTED



DEFINITION OF TERMS -- Wiring Systems

Outlets: That point on a wiring system where provision is made to use the electric current may be called an outlet. At each outlet, switch or junction point of conduit, metallic tubing, armored cable or non-metallic sheathed cable, a standard box or fitting shall be used. At least six inches of free conductor wire is left at each outlet.

There are three classes of outlets. They are:

a. lighting outlets
b. convenience outlets
c. special purpose outlets

Lighting Outlets: A lighting outlet is used to connect a lighting fixture. It is usually controlled by a switch to turn the lights on and off. No wire smaller than #14 is used for lighting outlets.

Convenience Outlet: A convenience outlet is equipped with a plug-in type receptacle. The openings in this receptacle fit the prong of a cap attached to the conductors of various types of portable equipment. They are placed principally on 120-volt circuits.

Special Purpose Outlets: Special purpose outlets are usually installed for specific pieces of equipment such as ranges, welders, clothes dryers, motors etc. They may be on 120 or 240 volt circuits. The equipment may be plugged in or permanently connected with a disconnect switch to operate the machine. A circuit or circuits, supplying receptacle outlets in the kitchen, laundry, pantry, breakfast room, back porch, or one or more outlets in the dining room should not supply other outlets and such circuits should have conductors not smaller than #12 wire.

Split Convenience Outlet: A split convenience outlet is one so constructed that one outlet of the receptacle may be connected to one circuit and the other outlet or outlets of the receptacle used to control part of each outlet. Also, this type of outlet will permit the use of two or more high wattage appliances plugged into one outlet location, but on different separately fused circuits.

Wall Switches: Wall switches are placed in convenient positions to turn lights on and off as desired. They usually control the lights directly in the lighting outlets. In many cases they may be used to control outlets where floor lamps may be plugged in.

Branch Circuits: Those circuits that extend from the fuse panel to the lighting and convenience outlets are called branch circuits.

Branch Circuit Protection: Protection devices known as fuses or circuit breakers are used to limit the amount of current that may be carried by the conductors.

These protectors are always placed in the hot wire. They are located in the service box, at the beginning of feeder circuits in buildings, and in distribution panels where branch circuits begin.

Feeder Circuits:

Those circuits that extend from the farm electric service yard pole to the individual buildings are called feeder circuits. In present day wiring, they may be installed overhead or underground.

A circuit from a building service disconnect switch to a fuse panel in another part of the same building is also called a feeder circuit.

Grounding:

For safety reasons it is required that all wiring systems be grounded. A grounding wire is attached to the service entrance switch box and equipment in each building. The other end of this wire is connected to a driven ground rod at the building. These grounding rods are located at the farm electric service yard pole and at all buildings that are supplied with electricity.

Building Service Disconnect Switch:

The National Electrical Code requires that a service disconnect switch or circuit breaker be installed in every building and for each set of service entrance conductors where there is more than one source of supply to any building.

The Meter:

The meter is an instrument used to measure the amount of electricity used.

It is usually mounted on the farm electric service yard pole. Separate meters may be installed for electric water heaters on the building where that appliance is installed.

Service Entrance:

The service entrance consists of the conductors and their enclosure and related farm equipment that carry electric current from the service drop to the terminals of the service disconnect switch.

There is a service entrance on every building. The building entrance consists of the conductors and their enclosures and related equipment that carry the electric current from the feeder circuit to the terminals of the building disconnect switch. This may also be called an individual service.

Service Drop:

On a farm the service drop are those conductors and equipment that deliver electric energy from the transformer to the farm wiring system.

The power supplier usually supplies the conductors from their transformer pole to a connection point on the farm electric service yard pole.

BASIC DEFINITIONS NECESSARY FOR UNDERSTANDING MOTORS:

Alternating Current: The flow of electrons in one direction and then in the opposite direction at regular interverals.

Ampere: A unit used to express the rate of flow of electricity. It compares with gallons per minute when discussing the rate of flow of water.

Commutator: A device which changes the direction of the flow of electricity through the rotating part (rotor). It consists of copper segments which are bars insulated from each other with mica. The ends of the field coil wires are soldered to these bars.

Brushes: Small carbon blocks which make the electrical contact with the commutator bars.

Condenser or Capacitor: An electrical device consisting of two or more conducting plates insulated from each other in which an electrical charge may be stored.

Conductor: Any substance through which electrons may flow readily.

Current: The flow of electrons through a conductor; its unit is the amphere.

Cycle: A complete change from a given value in one direction to all values in the opposite direction and back to the same value in the original direction. The number of times complete changes occur in one second is known as frequency.

Efficiency: The efficiency of a motor is the ratio, expressed in percent, of the output to the input. For example, if it is necessary to put three horsepower (3 hp) into a motor in order to get two horsepower (2 hP) out, the efficiency is obtained by dividing 2 by 3 and multiplying by 100:

2/3 X 100 = 66 2/3; or the efficiency is 66 2/3%.

Integral Horsepower: An electric motor having a full load rating of one horsepower or more.

Fractional Horsepower: An electrical motor having a full load rating of less than one horsepower.

Horsepower: One horsepower is equal to 746 watts.

Magnetic Field: The space between the free ends of the poles in which the magnetic force is present.

Phase: This term, as used in practice, is applied to electrical circuits in two ways and should not be confused:

(1) The time relationship between current and voltage. In certain electrical circuits the current peak value is reached either before or after the voltage peak is reached. With an incandescent lamp the voltage and current peaks are both reached at the same time, so are said to be "in phase."

(2) One or more currents flowing in an electrical system. For example, in a single-phase system but one current flows while in a three-phase system three currents flow at the same time.

Pole: That part of the motor around which the field coils are wound. This creates a magnetic pole which concentrates the magnetic force over a small space. Pole pieces are generally made of special iron sheets placed close together.

Power Factor: A term which expresses the phase relationship between the current and the voltage. When the current and voltage peaks are reached at the same instant of time the power factor is 100%. It might also be described as the ratio of wattmeter reading (real power) to the product of volts times amperes (apparent power).

Resistance: The property of a conductor that offers opposition to the flow of electrons.

Rotor: The rotating part of a motor or generator.

Speed Regulation: The speed regulation of a motor is the change in speed as the load changes from no load to full load. For example, if a motor does not change speed from no load to full load, it is said to have perfect speed regulation. If, however, the speed drops a great deal as the load increases, the motor is said to have poor speed regulation (high slip).

Stator: The stationary part of a motor or generator. In most motors that stator contains the field windings.

Torque: The measure of the tendency of a force to rotate the body upon which it acts. Example: the pull of the belt on the rim of a pulley.

GLOSSARY -- GENERAL ELECTRICAL TERMS

Ammeter: An instrument used to measure the amount of current in a circuit. An a-c ammeter measures alternating current. A d-c ammeter measures direct current.

Ampere: The unit of measure for a specific quantity of electrons. A current of 1 ampere represents the movement of 6,280,000,000,000,000,000 electrons past a given point in a circuit in 1 second of time.

Arc, Electric: A visible glow of light that is formed under certain conditions when electrons move through gases or through the air space between two points in a circuit.

Armature: The moving part or parts of a magnetically operated device such as a motor, generator, buzzer, bell, relay, or loudspeaker.

Atom: The smallest part of a chemical element. An atom is made up of electrons, protons, neutrons, and other particles.

Automation:	The method of controlling the operating of machinery and equipment for the production of goods in such a way that the input and output of machines are controlled by the use of electronic circuits and devices.
Battery:	A combination of two or more cells connected together.
Brush:	A carbon or metal object used to make contact with the armature (rotating part) of a motor or a generator.
Capacitor or Condenser:	A device capable of storing electric energy. It is basically constructed of two conductor materials separated by an insulator material such as air, paper, mica, oil, glass, or a ceramic substance.
Cathode:	The part of an electronic device from which electrons are emitted.
Cell, Voltaic:	A device which produces voltage by means of chemical action. A voltaic cell is made up of two different kinds of conductor materials placed within a paste or a fluid (electrolyte) which is also a conductor of electricity.
Charge, Negative:	The electrical property of an object which contains more electrons than protons.
Charge, Positive:	The electrical property of an object which contains more protons than electrons.
Charger, Battery:	A device which supplies a direct current voltage for use in charging a cell or battery.
Circuit:	A system of conductors and devices through which electrons can move. A complete circuit contains: 1) conductors, 2) switch, 3) lead, and 4) electrical source. Circuit, open - an incomplete or broken circuit.
Circuit, Parallel:	A circuit in which the loads are connected across two wires or conductors of the power line.
Circuit, Short:	A circuit which contains a defect that causes electrons to follow a path that presents much less resistance than is normal.
Coil:	A device made up of turns of insulated wire wrapped around a hollow or solid core form.
Commutator:	A device used to reverse the direction of current. A motor or a generator commutator consists of a ring of insulated copper bars or segments mounted upon the shaft and connected to the coils of core that are wound into the amature core slots.

Conductor:	A solid, a liquid, or a gas through which electrons can pass easily.
Continuity Test:	The test made to determine if a circuit or a part of a circuit provides a complete path for the flow of electrons.
Current:	The movement of electrons through a conductor material.
Current, Alternating:	The movement of electrons through a conductor, first in one direction and then, in the opposite direction.
Current, Direct:	The movement of electrons through a conductor in one direction only.
Current, Induced:	A current present in a circuit because of the voltage produced by means of electromagnetic induction.
Electricity, Dynamic:	A form of energy present when electrons move through a circuit.
Electrolysis:	The process of producing a chemical change by passing current through a conducting solution.
Electrolyte:	A solution able to conduct current.
Electromagnet:	A magnet produced by passing current through a conductor. In its most common form, an electromagnet is made up of a coil of insulated wire wrapped around a soft iron core.
Electromagnetism:	The magnetism produced by an electric current.
Electromotive Force:	The electrical force which causes electrons to move through a conductor. Electromotive force is commonly known as voltage.
Electron:	A negatively charged particle that revolves about the nucleus of an atom.
Electron Tube:	A device that consists of two or more electrodes or elements enclosed within a glass or metal shell (envelope) from which most of the air has been removed. Also commonly known as a vacuum tube.
Electronics:	The study of electrons and how they move through space and through special conducting materials. The term electronics is usually applied to the study of how electrons flow in electron tubes and semiconductor materials.
Electroplating:	An electrochemical process of plating, or covering with metal, by means of passing current through a conducting solution.
Energy:	The ability to do work.
Filament:	A threadlike conductor usually made in the form of a small coil or spiral. Filaments are often found inside electron tubes where they serve to heat the cathode of the tube. They are also found inside ordinary light bulbs.

Fluorescent Lamps:	A lamp in which light is produced by the action of ultraviolet rays striking a phosphours-coated surface.
Friction:	A force that opposes motion.
Fuse:	A protective device made up of a piece of wire that melts and breaks when the current through it is more than the ampere rating of the fuse.
Fuse Puller:	A tonglike device used to remove cartridge-type fuses from their mounting clips.
Galvanometer:	A instrument used to measure very small amount of current.
Generator:	A machine used for changing mechanical energy into electric energy.
Ground:	An electrical connection between a circuit and the earth, or between a circuit and some metalic object that takes the place of the earth.
Hydrometer:	A device used to test the specific gravity of a storage battery cell.
Induction:	The process of magnetizing an object or of inducing a voltage in an object by placing it within a magnetic field.
Insulator:	A material that will not conduct current. The term insulator is commonly used to identify an object made of an insulator material and used to support or to separate the conductors in a circuit.
Junction:	A point in a circuit to which two or more wires or other types of conductors are connected together.
Lamp:	A device used to produce light.
Load:	The device in a circuit which is operated by the current through the circuit.
Magnet:	An object which has the property of magnetic polarity and which attracts magnetic materials.
Magnetic Field:	The space near a magnet in which magnetic forces are present.
Meter:	An instrument used to measure an electrical quantity.
Motor:	A machine which changes electric energy into mechanical energy.
National Electrical Code:	A set of standards - rules for the installation of electric wiring and apparatus prepared by the National Board of Fire Underwriters.
Negative:	The electrical property of an object which contains more than the normal number of electrons.
Neon Lamp:	A device which produces light by means of current passing through neon gas.

OHM:	The unit of electrical resistance. A circuit has a resistance of one ohm when one volt of voltage applied to it produces a current of one ampere in the circuit.
Ohmmeter:	An instrument used to measure resistance.
Ohm's Law:	A basic electrical law which states the relationship between current, voltage, and resistance, in a direct-current circuit.
Plug:	A device inserted into a jack for the purpose of making an electrical connection.
Points, Breaker:	A device which breaks up a continuous direct current into a pulsating direct current. In a automobile, the breaker points are located within the distributor unit.
Points, Contact:	A mechanism with special surfaces which make contact to complete or separate to open, a certain part of a circuit. Contact points are found in devices such as switches, relays, and breaker points.
Polarity:	An electrical condition which determines the direction of current. In a circuit, electrons move from a point of negative polarity to a point of positive polarity.
Polarization:	The process by which hydrogen gas is deposited upon the positive electrode of a dry cell.
Power:	A rate, or speed, at which work is done.
Receptacle:	A socket or an outlet into which a plug is inserted for the purpose of making an electrical connection.
Rectifier:	A device which changes alternating current into direct current.
Regulator, Generator:	An electromagnetically operated device used to control the current and voltage output of a generator.
Relay:	A switch operated by means of electromagnetism.
Resistance:	The tendency of a device or a circuit to oppose the movement of current through it. The unit of resistance is the ohm.
Resistor:	A device used to insert electrical resistance into a circuit.
Rheostat:	A variable resistor usually used in circuits through which a rather large amount of current moves.
Rotor:	The revolving part of an induction-type motor.
Series-Parallel Circuit:	A circuit which contains one or more combinations of series and parallel circuits.
Solenoid:	A coil of wire wrapped around a hollow form.

Terminal:	A screw-type connecting device used to fasten wires to cells, batteries, switches, panels, etc.
Thermostat:	A switch operated by the application of heat.
Transformer:	A device which transfers electric energy from one coil to another by means of electromagnetic induction.
Volt:	The unit of electromotive force or voltage.
Voltage:	The electromotive force that causes electrons to move through a circuit.
Voltmeter:	An instrument used to measure voltage.
Watt:	The unit of electric power.
Wire Stripper:	A tool used to remove the insulation from wire.

General References

Richter, Practical Electric Wiring

National Electric Code

AAVIM TM Electric Motors, Selection, Protection, Drives