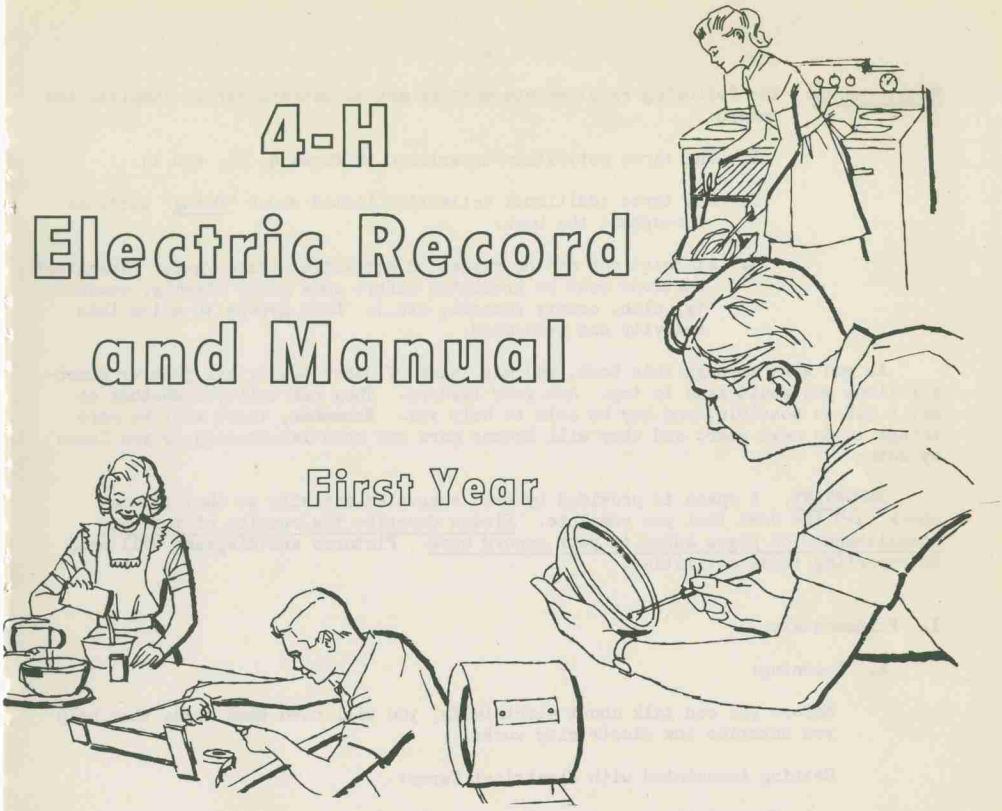
4-H Electric Record and Manual

First Year



Welcome to the 4-H Electric Project! By carefully studying this first year Electric Project book, you will learn many things about electricity and how it should be used. You cannot hope to learn everything in one year, but you should strive to increase your knowledge as you go along.

During the first year you will become acquainted with electrical terms and tools, the safe use of electricity, how to make extension cords and install plugs and sockets, some things about good lighting, how to read an electric meter, and how to care for certain small appliances.

Your Electric Record Book will not only provide information that you may learn, but it will also give suggestions for things that you may do, and ideas about how to teach others. You will note that each topic is divided into Learning, Doing, and Teaching activities. Do your best to keep your Record Book neat and orderly. You will be scored on your efforts to complete a good record book.

Outstanding 4-H electric records are selected for county, district, territory, and state awards. Ask your county Extension agent to explain about the trips to the State 4-H Electric Congress and to the National 4-H Club Congress that are awarded each year.

Requirements: The following requirements must be met to satisfactorily complete the record:

1. The three activities underlined on Pages 4, 11, and 14.

2. Any three additional activities listed under "Doing" sections throughout the book.

3. At least one of the suggested activities listed under "Teaching" sections must be presented before some group (family, community, club, county council, etc.). List groups to which this activity was presented.

As you work through this book, you may think of other electrical jobs or demonstrations you would like to try. Ask your leaders. They can tell you whether or not a job is possible, and may be able to help you. Remember, there will be more things to do next year, and they will become more and more interesting as you learn by doing.

IMPORTANT. A space is provided by each suggested activity so that you may check (✓) the ones that you complete. Please describe the results of your accomplishments on pages added to your record book. Pictures and diagrams will help in reporting these activities.

I. Fundamentals.

A. Learning:

Before you can talk about electricity, you will need some words that help you describe how electricity works.

Getting Acquainted with Electrical Terms:

Electricity is a form of energy that furnishes us with light, heat, and power. It cannot be seen or heard. It has no weight, and the only space it occupies is in the wires through which it travels.

Wires are the means of delivering electricity. They come in different sizes. The irrigation of a field would require a large water pipe, while a lawn could be watered with a hose. In the same way, it takes larger wire to supply a hay drier motor than a washing machine motor.

Circuit. Electricity flows through wires if there is a complete path, called a circuit. If a circuit is broken or opened, electricity will not flow. Two wires are generally used to make a circuit, as the wires in an extension cord.

Switch. A switch is used to open and close a circuit. This stops and starts the flow of electricity just as a valve is used to control the flow of water in a pipe.

Ordinary Plug Fuse

Fuse. The fuse is the safety valve in your electrical circuit. If too much current tries to flow in the circuit, the soft metal in the fuse melts. The circuit is opened, and the wires are protected. Each size wire has its own size fuse.

Electric Current. Electricity is neither a liquid nor a gas, yet it flows through a wire similar to water in a pipe. This flow of energy is called the electric current and is measured in amperes (amps).

Volt. The unit of measure of the electrical pressure or "push" which causes a current to flow. The power supplier furnishes 120 or 240 volts to the house or farmstead.

Watt. The unit of measure of the rate at which electric power is being used or developed (watts equal amperes times volts).

Kilowatt. One thousand watts equal one kilowatt.

Kilowatt Hour. The work done when 1000 watts of electric power are used for one hour.

How Electricity Is Made and Delivered:

Electricity is made in hydroelectric generating plants or in steam electric generating plants.

A hydroelectric generating plant makes use of the force of falling water to turn the generators to produce electricity.

A steam electric generating plant uses coal to produce steam to turn the generators.

Coal is stored in the open and lifted to bunkers for use as needed. It is weighed and dropped into pulverizers which crush it into the fineness of face powder. Then it is blown into the furnace where it burns almost instantaneously. This inferno burns the water in the boiler tubes into a dry steam so hot it would ignite a chunk of wood instantly. This steam packs a wallop. Its force is directed against the blades of a turbine. As big and heavy as a locomotive, this turbogenerator is balanced as delicately as a Swiss watch. It spins at 3600 revolutions per minute. Its outer edges travel over 900 miles an hour, faster than sound.

The generator is connected directly to the turbine shaft. Its revolving part, the rotor, is a powerful magnet that spins inside the heavy wire coils of a stationary part, the stator. This action creates electricity.

Generated at 13,800 volts, it is stepped up to 110,000 volts for efficient transmission into the distribution system. Transformers on the customer end of the line reduce the power to the proper voltage for use in the home or on the farm.

B. Doing:

( ) 1. Visit a modern electrified farm or home and list at least ten ways in which electricity is used. (Required)

( ) 2. Construct a simple bell ringing circuit.

( ) 3. Visit a modern electric generating station as a club group and report on your observations.

( ) 4. Identify and explain the use of five small electrical appliances.

( ) 5. Do part of the family ironing each week for four weeks.

( ) 6. Use and care for one other electrical appliance six times. (Vacuum cleaner, toaster, waffle iron, mixer, or coffee maker.)

C. Teaching:

( ) 1. Demonstrate the construction of a bell ringing circuit.

( ) 2. Demonstrate the use and care of one small appliance.

II. Tools.

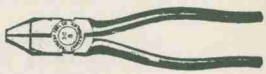
Before you can put electricity to use, you will need some tools and must know how to use them.

A. Learning:

Getting Acquainted with Tools:

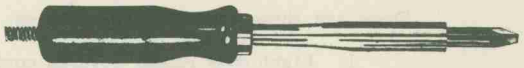
1. Screwdriver. A screwdriver with a plastic handle is a good one to use for electrical work since plastic will not allow electricity to flow through it. You are less likely to be shocked using a plastic handle. Always select a screwdriver that fits snugly in the screw slot. Never use your screwdriver as a chisel or a prybar. Carrying a screwdriver around in your pocket is hard on your clothes and could cause serious injury.

2. Side cutting pliers. A good pair of side cutting pliers is handy for electrical work. They can be used for cutting wires and pinching off insulation. Keep them clean, and never use them as a hammer.



3. Knife. A good pocketknife is another useful tool. It is used to cut off insulation and scrape the wires clean for good contact. Keep your knife dry, sharp, and clean. Use it wisely, and always cut away from you.

4. Soldering iron. A soldering iron is used to supply heat for melting solder. The point is made of copper, and it must not be overheated. Never dip it into water, but allow it to cool in the air. You cannot do a good job of soldering unless the point is kept bright and covered with a thin film of solder.



5. Tapes. Tapes are used in place of insulation where splices are made or where bare wire could cause a shock. One method of taping is to put rubber tape over the bare wires, and friction tape over the rubber tape. Never use friction tape alone over bare wires. Plastic tape is a new tape that can be used in place of the rubber and friction tapes. It is also useful for other jobs like wrapping tool handles, stopping squeaks between two pieces of metal, and temporarily stopping leaks in pipes.

B. Doing:

( ) 1. Check basic kit of tools required to maintain the electric wiring system. List the tools on hand and the tools purchased to complete the kit.

( ) 2. Build a kit in which to keep the tools.

C. Teaching:

( ) 1. Demonstrate the use of basic tools in making simple electrical repairs.

III. Cords, Plugs, and Sockets.

A. Learning:

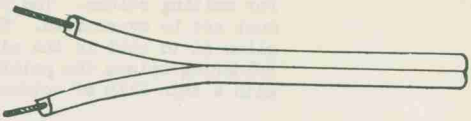
The flexible cord works as a messenger. One end reaches into an outlet to pick up the electricity, and the other end delivers it to you wherever you need it. The end opposite the plug is permanently attached to your appliance or equipment.

Sometimes in case of an emergency you can put two cords together to get a longer length. These extension cords are handy in a "pinch", but they should never be used as permanent wiring.

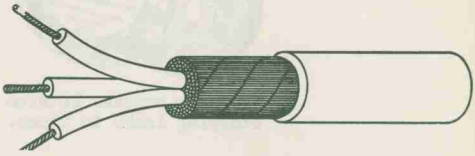
Regardless of how well you take care of cords and plugs, in time they will need repair or replacing. Never splice a lamp cord or an extension cord that has been broken. A new cord is inexpensive and safer.

There are three common types of cords. These are:

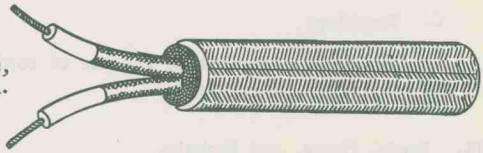
1. Light duty rubber covered cord. This type of cord is made of two wires covered with cotton braid and then enclosed in a solid mass of rubber insulation. As the name implies, this cord is designed to carry a minimum amount of electricity. It is commonly used for lamps, fans, radios, and sewing machines. Five hundred watts should be a maximum load for this cord under any circumstances.



2. Heavy duty rubber covered cord. This is a heavier cord made up of either two or three insulated wires. The space between wires is filled with cotton, jute, or twisted paper to make the cord round. This is usually covered with cotton braid, and a final covering of tough rubber is molded over the outside. This cord is used for extension cords, motors, vacuum cleaners, washing machines, or wherever it will receive hard usage.



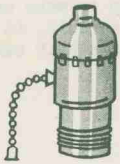
3. Heating appliance cord. Since this cord is near hot surfaces, extra protection from heat is provided. The copper wires are covered with layers of cotton thread, rubber insulation, asbestos, and a cotton braid. The asbestos protects the rubber insulation from heat. This cord is designed for heating appliances such as irons, toasters, roasters, and waffle irons.



For any of these cords to be used, they must be flexible enough to roll up easily and bend back and forth any number of times. To make this possible, stranded or small multiple wires are used in place of a single strand wire.

Types of Plugs:

A number of different types of cord plugs are on the market. They may be made of rubber, bakelite, or plastic. A good plug is made in such a way that you can easily get a firm grip on the plug when removing it from the outlet. Much unnecessary wear may occur when the plug is removed by jerking on the cord.



Sockets:

Just as you have different types of plugs, you also have different types of sockets. They too may be made of rubber, bakelite, or plastic; and probably more familiar to you is the brass shell socket. Oftentimes it becomes necessary for you to remove the socket for replacing it or repairing the cord near the socket. To be able to wire up a socket, you must know how to attach it to a cord. This can be done by:

1. Removing about three inches of the outer insulation of the cord.
2. Removing about one-half inch of the insulation on each wire end.
3. Remove the base cap of the socket and thread the cord through the opening.
4. Tie an underwriter's knot in the wire end.
5. Remove the insulating shell from the socket, and attach the wires to the binding screws. Place the wires around the screw in the direction the screw tightens.
6. Pull the underwriter's knot down into the base cap, and replace the shell. Lock in place by snapping the shell into the base cap.

B. Doing:

( ) 1. Check for frayed cords and broken plugs. Report number found and number repaired or replaced. _____

( ) 2. Make a 6-ft. extension cord.

C. Teaching:

( ) 1. Demonstrate making an extension cord, using proper tools.

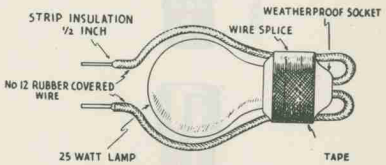
IV. Test Light

A. Learning:

You will find a test lamp very useful in testing circuits and in locating blown fuses, short circuits, and open circuits. It is easy to make, and the cost is small. To make a test lamp, you will need a weatherproof socket with two lengths of #12 rubber covered wire attached, a pig tail socket, and a roll of plastic tape.

Here are the steps to follow:

1. Screw a 25 watt 120 volt bulb in the weatherproof socket.
2. Remove the insulation from the ends of the wire leads. You will want 1 inch of bare wire exposed.
3. Bend the leads back over the light bulb as shown.
4. Tape the wires to the socket, using the plastic tape.



A TEST LAMP

Safety Rule:

Be sure to be careful in using the test lamp to keep your hands and fingers on the insulated section of the socket and wire. Do not touch the exposed ends of the leads.

You can check any 120 volt circuit with this test lamp to make certain whether the circuit is "hot". For use in a 240 volt circuit, it will be necessary for you to find a 25 watt 240 volt bulb. This bulb can be used on both 120 volt and 240 volt circuits.

B. Doing:

( ) 1. Make a test light

C. Teaching:

( ) 1. Demonstrate how to make a test light.

V. Safety.

A. Learning:

Most of the time we think of electricity as a safe, reliable helper. That is the way it should be. As long as we handle it the right way and treat it with respect, electricity will work for us. Treat it carelessly, and electricity will repay you with serious accidents or fires.

You have already learned of the good side of electricity. It pumps water, cooks meals, broods chickens, milks the cows, refrigerates our food, and does hundreds of other chores. The harmful side of electricity can be in the form of fire, shock, and burns.

Fire. When a water pipe is loaded beyond its physical strength, it bursts. When electric wires are overloaded with too much current, they become hot, even to the point of melting. Every day fires are caused by overloaded wiring.

Fuses are the policemen of an electrical system. When something goes wrong, they stop the traffic by turning off the current. Be sure you use the right size fuse for the circuit. You may have heard of a person putting a penny behind a blown fuse to turn the current on again. Do not be so foolish. That is just like taking all the stop signs off of Main Street.

Fuses are rated in amperes, and the size is stamped on the top of the fuse. The size of fuse should be determined by the size of wire in the circuit. The following table should help you determine wire sizes and proper fusing:

Wire Sizes Number	Bare Wire Thickness	Fuse Size Amps
14	1 penny	15
12	1 nickel	20
10	2 dimes	30

Poorly installed wire with loose connections is another cause of fire. Any time the current must jump a gap in the form of a spark as in a switch box, excessive heat developes.

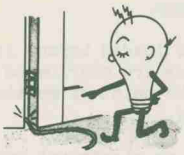
Improper use of light and heat lamps also causes fire. Ordinary cloth held over the regular lamp bulb will scorch and even burn. Heat lamps used for lamb and pig brooders can easily set litter on fire if carelessly mounted.

Shock. Electricity is stubborn. It is always trying to get back into the ground. If you give electricity a wire to travel along, it will use the wire as a road until it comes to some path that will ground it. If that is your body, you can receive a severe shock. Never touch any part of the wiring system unless the main switch is off.

Burns. Electricity, carelessly handled, may cause painful burns in addition to shock. Small children, probing into wall outlets with metal objects, have received severe burns. Disconnecting an appliance or extension cord by jerking on the wire instead of the plug is another way of receiving an electrical burn.

Fires, shock, and burns can all be prevented by following simple safety rules.

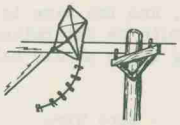
Safety Rules



(✓) Be sure your wiring circuits are properly fused. 15 ampere fuses are heavy enough for most circuits.

(✓) Never run an extension cord through a doorway or under a rug.

(✓) Never leave an iron or other heating appliances turned on when not in use.



(✓) Never place lamp bulbs or heat lamps near material that will burn.

(✓) Never fly a kite near overhead electrical wires.

(✓) Never place a lamp or a radio near the bathtub.

(✓) Repair or replace extension cords when the insulated covering becomes worn.

(✓) Do not loop or hang extension cords over nails, metal hooks, or near heaters.

(✓) Never allow your little brother or sister to probe into outlets with metal objects.

(✓) Always disconnect the main switch to replace a fuse or before you touch any part of a wiring system.

B. Doing: (One of the following required.)

( ) 1. Check fuses. Replace all oversize fuses with fuses of proper size.

( ) 2. Learn to reset a circuit breaker.

C. Teaching:

( ) 1. Demonstrate the proper method of replacing a fuse.

( ) 2. Read to your family the safety rules listed in this record book.

VI. Lighting.

A. Learning:

Electric lights are now considered part of our daily living. This was not always so with your parents and grandparents. Changing from oil and gas lamps to electric lights was probably one of the big reasons that they wanted electric service. The old hanging bare lamps were often installed without much serious thought being given to the type or quality of light needed for various jobs. Most of these bare lamps have been replaced, but many homes still lack sufficient light.

1. Light Quantity.

Changing a seeing task or changing your eyes may be impossible, but light can be changed and improved. Be sure you have the amount of light you need for each seeing task, such as reading or sewing. Reading fine print or sewing dark materials require more light than reading large print or sewing light colored materials.

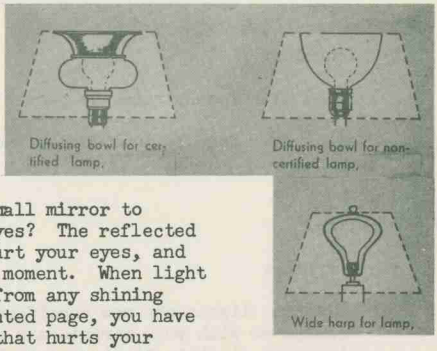
A light meter will measure the amount of light directly just as a thermometer measures temperature. You can use it to measure the amount of light available at any point. Your power supplier could likely loan you a light meter if you want to put on a demonstration or check the lighting at your home. The quantity of light is measured in foot candles. The recommended quantities of light for different conditions of work and play are given in foot candles. A foot candle is the amount of light needed to read one foot from a lighted standard candle.

2. Light Quality.

The right amount of light is not the only need for easy seeing. You should have good quality of lighting too. Fortunately there are also ways to improve the quality of lighting.

a. Glare:

If you try to read while you sit facing the window on a bright day, it will not be long before the glare of the daylight bothers your eyes. Glare is sometimes called "light out of place". Light that shines directly into your eyes from a lamp bulb that is not shaded or shielded has the same effect as glaring daylight.



Did anyone ever use a small mirror to shine light into your eyes? The reflected glare from the mirror hurt your eyes, and you could not see for a moment. When light bounces into your eyes from any shining surface, as a shiny printed page, you have the same kind of glare that hurts your eyes. When daylight from the window is shining in your eyes, you pull down the window shades to get rid of the glare. In the same way, when all the lighting in a room is well shaded or shielded, you have taken the first step in removing direct glare. Good floor and table lamps often have reflector bowls to soften and spread the light through the room. This helps cut out the reflected glare so that shiny objects do not act as mirrors and make seeing difficult.

b. Contrast:

A room is more cheerful and seems warm and pleasant when light is distributed throughout the room. Even more important, your seeing task will be easier.

Any bright light is difficult to look at, and especially when the surrounding area is dark. This fault is known as contrast. The better lamps for use in your home direct some light down on the book you are reading, and some light upward toward the walls and ceiling. Enough light reflected from light colored ceiling and walls can largely overcome contrast in a room and help your eyes in their seeing task.

c. Direction:

Be sure the light comes from the right direction whenever you are writing, studying, or using your hands for the

job. If you are right-handed, most of the light should come from the left. If you are left-handed, most of the light should come from your right. Place the lamps in the room so that the light is well directed from one side or the other. Light directly in front of you may cause glare; and if it is directly behind you, your shadow may fall on your work.

B. Doing:

( ) 1. Properly light your study center or dressing table.

( ) 2. Identify (wattage and type) and learn the use of six standard incandescent lamp bulbs.

( ) 3. Keep the lamp bulbs, bowls, and reflectors clean. You get up to 25% more light from a clean bulb than from a dirty one.

( ) 4. Use one high wattage bulb to replace several smaller ones. One 100 watt bulb will give 50% more light than four 25 watt bulbs.

( ) 5. Use light colored shade linings to reflect light. Dark ones absorb it.

( ) 6. Use flared shades for table lamps to spread the light over a wider area.

( ) 7. Raise short table lamps higher so the light will spread over a wider area and so your eyes cannot see the bulb through the top of the shade.

( ) 8. When a lamp bulb becomes black on the inside, there is nothing you can do to clean it. It should be replaced for best lighting results.

( ) 9. Have the light as close as possible to your work and still meet the requirements for good lighting.

C. Teaching:

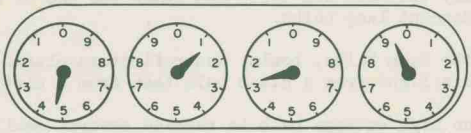
( ) 1. Demonstrate the method of cleaning lamp shades, diffusing bowls, and ceiling fixtures.

( ) 2. Demonstrate a well lighted study center or dressing table.

VII. Reading an Electric Meter.

A. Learning:

Anyone can read an electric meter, whether it be the type similar to a speedometer on a car, or the ordinary household meter which has four dials. When reading the latter type, you should simply read the position of the pointer on each dial. If the pointer is between two figures, read the figure that the hand has just passed, which will be the small number. Read the dial on the right side of your meter first, then work across to the dial on the left.



Meter Reading - 4129

B. Doing: (Required)

Read your meter for at least six months and record the kilowatt hours used. (Read meter on the first day of each month)

Date	KWHR Reading

C. Teaching:

( ) Demonstrate how to read an electric meter. (Borrow an old meter from your power distributor.)

Describe the results of your accomplishments on this page and other pages that you may add to your record book.

Electric Project Record

Year_____

_____ _____ _____
(Name of Member) (Age) (County)

Address_____

Name of Parents_____

Name of 4-H Club_____ Years in Club Work_____

Name of Adult 4-H Leader_____ Address_____

I PLEDGE:

My Head to clearer thinking;

My Heart to greater loyalty;

My Hands to larger service; and

My Health to better living for

My Club, my Community, and my Country.

THE CLUB MOTTO:
"To Make the Best Better."

I have checked this record and found it to be satisfactorily completed.

(Signature of Extension Agent)_____

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