

Electric Cords

**Selection
Use
Care**



Electric Cords SELECTION, USE, CARE

Extension Specialist in Housing-Home Furnishings
 Extension Specialists in Home Management
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TODAY'S HOME requires a large amount of "portable wiring." Insulated flexible cords carry electricity from wall outlets to electric housewares in every part of the house. This wiring is the responsibility of home occupants, and it is important to give it ample care and attention. Shocks, burns and fires can arise from misuse of electric cords and equipment.

Look for a UL label on the appliance too.



SELECTION

Select a cord designed to do the job you want done, a cord which has a label showing the approval of the Underwriters' Laboratories, Inc. (UL). Such a cord will be safe, efficient and economical as long as it is cared for and used properly. Look for the UL label when you purchase an electric cord, a cord set or an appliance with the cord attached. It is your assurance of both quality and safety.

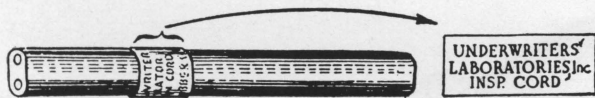
Cords Designed for the Job

Cords are rated for use by size of electrical conductors and by type and thickness of covering or insulation. The conductors of all flexible cords are made up of many strands of fine wires. These wires usually are covered with a layer of cotton or fiber and with rubber or thermoplastic insulation. Added layers of insulation, buffers and a covering protect the wires and insulation. In some cords the wires are molded in rubber or thermoplastic. The conductors of a good power supply cord or cord set are large enough to carry electricity safely for an appliance or lamp without overheating.

UL-Inspected Cords

A UL-labeled cord complies with construction and performance standards established by the Laboratories. It has been tested for electrical safety; resistance to pull, crushing, impact, abrasion and wear; and general fitness. Whether all or only part of the cord assembly is guaranteed for suitability and safety depends on the type of UL label attached.

Flexible cord size is indicated by number; the higher the number, the smaller the conductor. Electricity used by an appliance usually is stated in watts or amperes. The table shows maximum wattage loads for two sizes of electric cords.



THE BRACELET LABEL signifies approval of only the cord and is attached at 5-foot intervals.

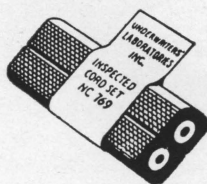
Maximum Loads for Cords, Sizes 16 and 18, attached to a 115-volt Circuit

American Wire Gauge (AWG)	Size 16		Size 18	
	Amp.	Watts	Amp.	Watts
Light usage cord				
Fabric covered	7	805	5	575
Rubber or thermoplastic	10	1,150	7	805
Hard usage cord	10	1,150	7	805
Extra hard usage cord	10	1,150	7	805
Heater cord	15	1,725	10	1,150



THE WASHER LABEL indicates approval of an entire cord assembly consisting of a cord, plug and cap. It is slipped over the cord.

THE FLAG LABEL indicates UL approval of a cord set or power supply cord.



The fact that the cord carries approval does not necessarily mean that the appliance is approved.

Size 16 cord must be used for high-wattage appliances and is efficient for lower wattage home appliances. When buying flexible cord, look on the end of the spool holding it to find the type of cord and cost per foot. Commonly used sizes and types for 115-volt circuits include the following:

USE

Light usage cords

Light usage cords are suitable for low-wattage equipment but should not be used for heating appliances or those given hard usage.

TYPE PO-1, size 18, cotton or rayon outer covering, parallel cord, is suitable only for lamps, small portable radios, clocks and similar low-wattage appliances which are not moved frequently and which require an attractive cord.

TYPE SP, sizes 16 and 18, all-rubber parallel cord has wires imbedded in rubber.

TYPE SPT, sizes 16 and 18, all-plastic parallel cord has wires molded in thermoplastic. Available in colors, it is suitable for lamps, clocks, radios and other low-wattage equipment.

Hard usage cords

Hard usage cords have an outside covering or jacket designed to protect them against abrasion, water, oil or grease. They are suitable for use as extension cords, in damp places and where given hard wear, but are not suitable for heating appliances. Hard usage cords have two or more conductors, with rubber or plastic insulation protected by cotton, jute or other filler encased in rubber or thermoplastic covering. They are available in colored thermoplastic.



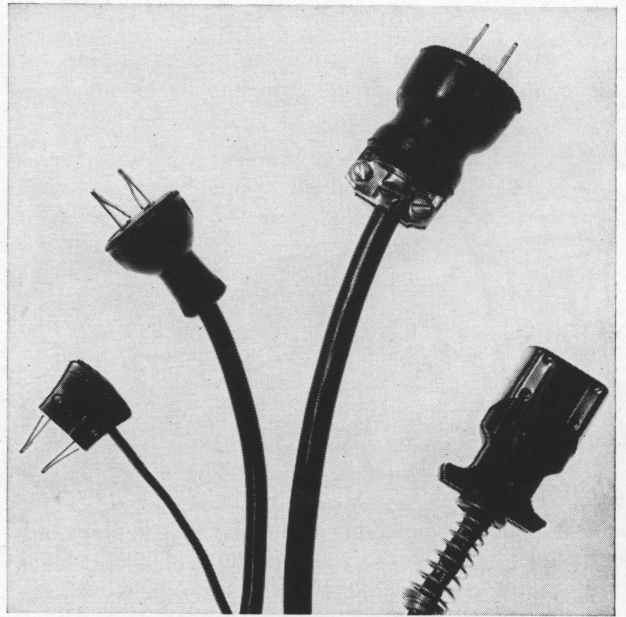
a. light usage cord b. hard usage cord c. heating appliance cord

VACUUM CLEANER CORD, TYPE SV, size 18, has rubber or thermoplastic covering. As in other hard usage cords, the individual conductors are twisted together inside the cord for added strength and flexibility.

JUNIOR HARD SERVICE CORD, TYPE SJ, sizes 16 and 18, is used for home appliances, food mixers, washing machines, vacuum cleaners and as an extension cord for lighting or power equipment.

Extra hard usage cords

TYPE S, sizes 18, 16, 14, 12 and 10, covered with rubber or thermoplastic, is the most durable cord. It is used in garages, workshops and other



Cords with suitable plugs attached, left to right: light usage cord, hard usage cord, extra hard usage cord and heater cord.

places where cords receive hard wear; for large motors; and for heavy-duty extension cords.

Cords for heating appliances

These cords are designed especially for appliances such as irons, heaters, toasters, roasters, wafflers, fryers and heating pads.

TYPE HPD, sizes 16, 14 and 12, has a layer of asbestos over the rubber insulation surrounding each conductor to resist high temperatures. The asbestos is enclosed by braided-cotton, rayon or rubber outer covering. Use size 16 HPD heater cord for an electric iron.

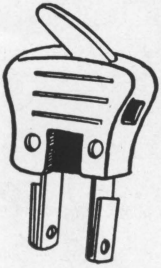
Extension cords

If an extension cord is necessary to perform a temporary service, use the shortest one that will reach from the appliance to the outlet. Extension cords should be replaced by installed outlets; they should never be used as a substitute for permanent wiring. Particularly with heating appliances, use an extension cord only in an emergency.

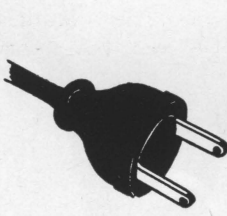
Use plastic or rubber-covered extension cords for lamps, radios and other low-wattage appliances; avoid fabric-covered ones. Use moisture-resistant cords with rubber sockets and plugs for all equipment used in damp locations, such as the laundry area, basement, barn and places exposed to the weather. For heavier work, such as for a 1/3-horsepower motor, use heavy-duty extension cord, size 16 or 14, covered with composition or rubber.

Suitable Plugs

Select an outlet plug and an appliance plug (attachment plug) to suit the cord and its intended use.



Automatic plug



Finger-grip plug



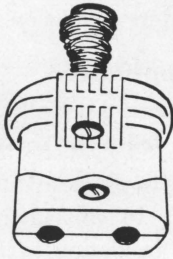
Heavy-duty plug

Outlet plugs

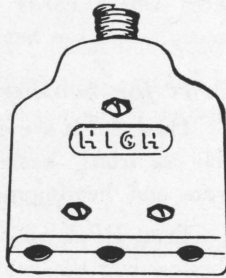
Use quick-connecting automatic plastic plugs only on light usage parallel cord for light electrical loads. To connect and disconnect the cord easily at the outlet, use a rubber or plastic plug with a finger-grip. Use the heavy-duty-type plug with a metal protecting band and a cord clamp for hard service.



Appliance Plug



Iron plug



Two-heat plug

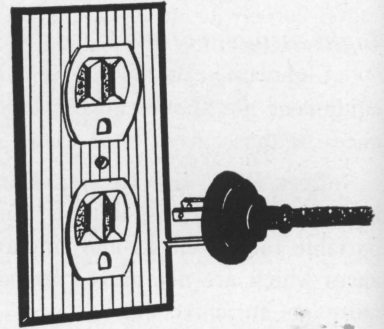
Appliance plugs

The trend is to attach the cord permanently to eliminate the need for appliance plugs. If an appliance plug is needed, choose the proper one. Three commonly required types are illustrated here. The holes for the prongs of the appliance are measured from the center of one to the center of the other. The appliance plug has holes $\frac{1}{2}$ inch apart. The iron plug has holes spaced further apart, $\frac{11}{16}$ inch. The two-heat plug provides for low heat in one position and high heat in the second.

Grounding Devices

Grounding is necessary for equipment used where there is moist dust or dampness. The utility area, basement, garage, workshop and farm buildings are examples. Appliances with a metallic covering should be grounded since it is possible for any person or animal touching such equipment to receive an electrical shock.

To ground the metal parts of an appliance for increased safety, use an electric cord with a grounding conductor. Illustrated is a type of grounding plug used with 115-volt equipment such as a washer. A contact prong on the plug is slightly longer than the two current-carrying prongs and connects the grounding conductor to the grounded outlet.



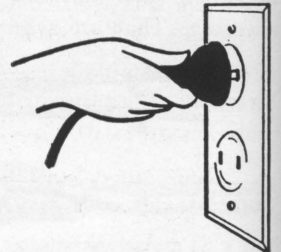
All grounding devices must be properly installed. Be sure to connect the green grounding conductor to the grounding contact prong of the outlet plug. Connect the white or light-colored conductor to the aluminum-colored screw. Connect the darker colored or black conductor to the brass screw.

CARE AND REPAIR

Flexible electric cords must be used and stored properly and kept in good repair to carry electricity efficiently.

To disconnect a cord from an outlet

- Switch off appliance.
- If there is an outlet switch, turn it to "off."
- Grasp the outlet plug and pull it quickly, straight out of the outlet to prevent sparking at the terminals.
- Remove the cord from the appliance if the cord is separate.
- Always grasp the plug cap instead of the cord. Pulling on the cord tends to loosen the wires and creates a trouble spot that could cause a fire or short circuit.



To connect a cord to an outlet

- See that appliance switch is "off."
- If the outlet has a switch, turn it to "off."
- If cord is detachable, connect it to appliance.
- Then grasp the outlet plug and connect the electric cord to the outlet.

To store cords

Choose a cool, dry place for storage. Wipe cords clean, smooth out any kinks and wind loosely on holders. Suitable holders are cord clips, a thread spool nailed in place, an adhesive-tape spool, large

rounded wooden pegs or two large hooks. Wind cords loosely to protect the fine wires of the conductors and lengthen the useful life of the cords. Wrapping cords tightly may loosen the connections and eventually break the insulation and wires.

To protect cords while in use

Keep cords free of kinks, knots and sharp bends, which tend to break the fine wires and insulation. Avoid cutting or scraping the insulation over sharp edges. Keep cords free of oil or grease since these are harmful to rubber insulation and covering.

Keep cord out of vacuum cleaner's path. On an upright vacuum cleaner, loop cord loosely and hang it from top hook of cord holder when not in use.

Overheating may soften the insulation or cause it to stiffen or crack. Keep cords away from heaters and heated appliances. Do not set a hot pan on or close to an appliance cord. When ironing, avoid touching the cord with the heated iron. Be sure the appliance is cool if you wrap the cord around it.

To protect yourself and your home

Employ qualified electricians to add outlets where you need them instead of using extension cords. The National Electric Code states, "Flexible cord shall not be used as a substitute for the fixed wiring of a structure." The Code prohibits electric cords, "where they run through doorways, windows or similar openings," or "where attached to building surfaces."

NEVER RUN A CORD UNDER A RUG; THIS IS A FIRE HAZARD. With proper additions to your house wiring, this hazard can be avoided.

USE THE SHORTEST CORD NECESSARY FOR THE JOB. Long cords may cause trips and falls.

ALWAYS DISCONNECT AN IRON CORD FROM THE OUTLET BEFORE YOU GO OUT OF THE ROOM. Leaving the iron connected could cause a fire. Always plug a heating appliance into a convenience outlet. Be sure to disconnect a heater cord from the outlet when heater is not in use.

The best of flexible electric cords eventually will need to be replaced. Defective and worn cords are a hazard. Inspect cords frequently for worn or loose parts so that they can be replaced or repaired.

Tools for Electrical Repairs

Your own set of tools, stored in a convenient place, will simplify the repair job. Choose well-made tools that fit your hand. Your kit of tools should include the following:

Screwdrivers

Choose two or more screwdrivers. They are sold according to length of shaft. The 1½ inch, 3 inch

or 6 inch will be useful sizes for electrical repairs. See that the tip of the screwdriver used for a job fits the slot in the screwhead. A useful laborsaving feature on some screwdrivers is a screw holder on the shank or a magnetized tip. A phillips-type screwdriver is necessary for some screws used in electrical appliances. It has a "star" tip. The screwdriver in the sewing machine kit can be used, but it may not be at hand when you want it.

Adjustable-end wrench

A small one often comes in handy.



Pliers

Choose the size most comfortable for you to hold and use, such as 5, 6 or 7-inch pliers. Diagonal-cutting pliers are good to clean up work, cut away loose ends and get into tight places. Linemen's side-cutting pliers, either blunt nose or round-nose, are called electrician's pliers. They have tempered side-cutting jaws to cut wires. Long-nose pliers, also called thin-nose pliers, have round and tapered jaws. The tapered point makes it easier to work where parts are close. It is especially useful in making a hook in wires that go under a screw.

Knife

A folding knife or jackknife is handy to cut away insulation and prepare the wires. An electrician's knife has one sharp blade and one screwdriver blade, with a safety catch to hold blade open. A sharp paring knife can be used.

Test light

A neon light bulb, with two wires and costing approximately 50 cents, will help you locate trouble. To find a break, test the outlet for power source, test the cord, test the appliance. A test lamp using an incandescent light bulb can be made. Ask your Extension agent or a 4-H electrical club member about it.

Tapes

Electrical plastic tape is wrapped around wires and junctions. No other tape is needed if this type is used. Be sure it is electrical tape. Or rubber tape is used as an insulator over bare wires and is covered with friction tape. Friction tape is used over rubber insulation and tape to protect the insulation, wires and junction.

Thread

Thread in light and dark colors is used to repair fabric coverings on cords. Tie it on the fabric ends to keep them from raveling.

Sandpaper, steel wool or emery cloth

Use a fine grade of these to clean and brighten up metal parts or wires in order to make good electrical connections.

Care of Tools

Take a few precautions to see that your tools will be in working order when you need them. Use a tool only for the job for which it was made. Keep cutting tools sharp and protect sharp edges before putting tools away. Lubricate tools to prevent rust. Oil moving parts occasionally with light machine oil.

The Tool Kit

Whatever kind of kit you use to keep your electrical repair tools together, store the tools in good order within reach. A kit can be improvised from a board with hooks or straps, a pegboard, a drawer, a well-arranged box with a lid and possibly a carrying handle.

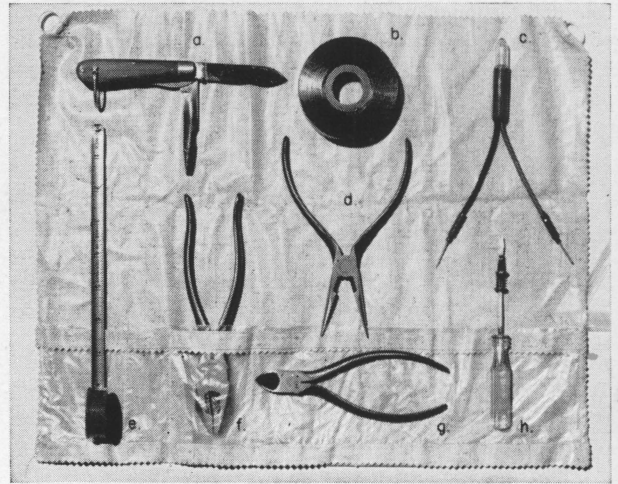
A fabric kit is handy since it can be rolled up and stored in a drawer or on a shelf near the work area. To make one use denim, heavy plastic or similar sturdy material. One-half yard makes two 18 by 18-inch kits. Fold up one edge of material 3 or 4 inches and stitch it to make 5 or 6 pockets, or attach a diagonal pocket strip. With a tape stitched to opposite edge it can be tied around the waist to use as an apron with pockets. Loops or grommets can replace the tape to hang the kit over the work area.

Repairs You Can Make

You can replace or repair many worn cords and plugs. Always disconnect the cord and appliance from the outlet before you attempt any repairs. This means safety for you and for the equipment. Do not work on an object held in the hand. The tool might slip. Rest the work on a table for safer use of the tools; use your hands to steady and guide the work.

Tighten loose connections

Insecure or loose connections at the screws are hazardous because they offer resistance to the flow of electric current, which causes heating at that point. Connections should be tight and properly insulated.

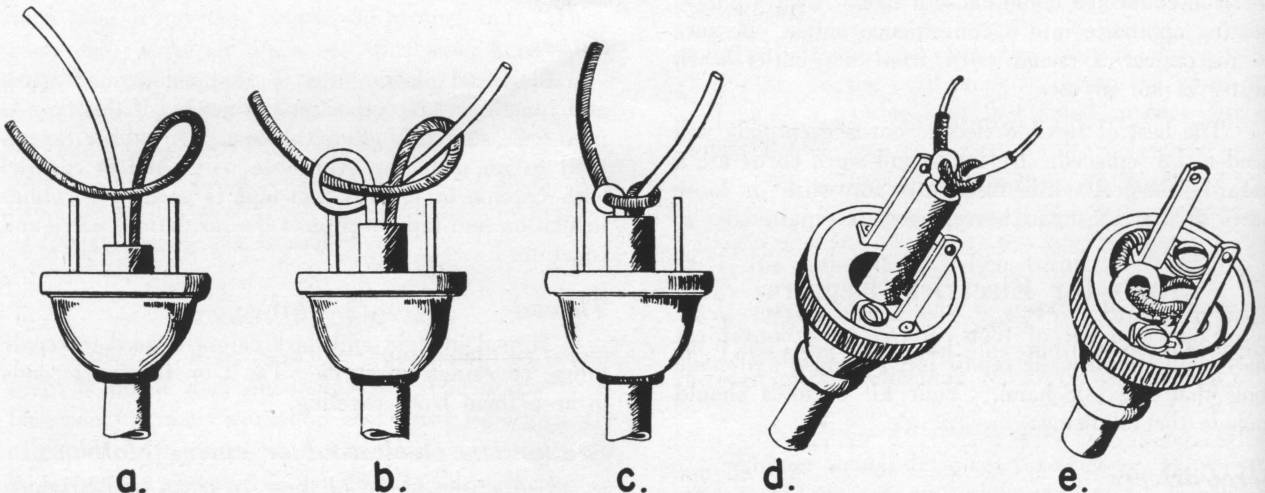


- a. Electrician's knife
- b. Electrical plastic tape
- c. Test light
- d. Long-nose pliers
- e. Measure
- f. Electrician's pliers
- g. Diagonal-cutting pliers
- h. Screwdriver with screw holder

Attach an outlet plug to a cord

(Read Entire Section Carefully Before You Begin.)

- Choose the plug you can grasp easily to connect or disconnect, and select the proper cord (see page 3). The electrical dealer will help you if you explain how the cord will be used.
- Remove the fiber protector disk from plug cap, and slip plug cap over end of cord.
- Cut away about $2\frac{1}{2}$ inches of outer covering or secondary insulation and fillers from end of cord. Be careful not to cut the primary insulation which covers wires. If cord has fabric covering, wind matching thread or tape around covering to keep it from fraying.
- Tie an Underwriter's or holding knot in the conductor. The purpose of the knot is to keep any tension or pull on the cord from loosening the wires from the screws.



Attaching an outlet plug: tying an Underwriter's knot (a., b. and c.), finishing the connection (d. and e.)

- If the size of the cap and cord does not leave room for the knot, omit it. In this case remove only 1½ inches of the secondary insulation and covering instead of the 2½ inches mentioned above.
- Remove the primary insulation from the last ½ inch of the wires. This bares just enough wire to go around the screw once without overlapping the wires.
- Carefully scrape the wires so that they are bright and clean, but avoid breaking any of the fine wires. Twist each bundle of wires to the right tightly so that there are no loose ends.
- Bend each conductor around a prong in a clockwise direction with the insulation covering the wires up to the screws.
- Fasten the wires under the screws in a clockwise direction. As the screws are tightened, the wires are tightened.
- Cut away excess material and replace the fiber protector disk.

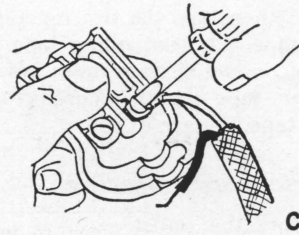
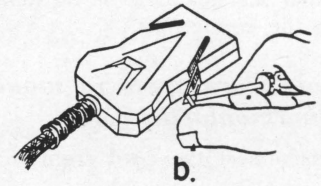
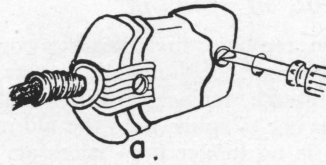
Replace an appliance plug

- Disconnect cord from outlet and from the appliance.
- Remove screws or clips to take plug apart (a., b.).
- Push the spring or rubber cord protector back on the cord.
- Loosen but do not remove the screws which hold the two conductor wires, then remove the wires from the contact clamps or tubes.
- Cutting evenly across the two conductors, remove ends of cord to the point where the wires are covered with firm rubber insulation. If cord is new, thread it through cord protector and cut evenly across the two conductors.
- Wrap electrical tape or thread around the cord about 2½ inches from the end to keep the outer covering from fraying.
- Remove ½ inch of asbestos insulation from ends of conductors and wrap remaining asbestos with strong thread to keep it in place.
- Remove ½ inch of rubber insulation from the ends of each conductor, and check to see that the ends are cut across evenly.
- Twist the wires firmly to the right and bend to form a hook. Fit wires around the screws in a clockwise direction, and be sure the conductors and the spring fit into the grooves.
- Fasten screws firmly.
- Fit the plug parts together and replace clips or screws.

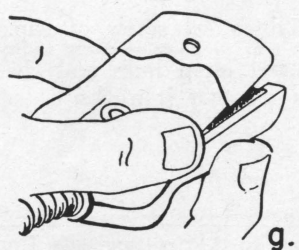
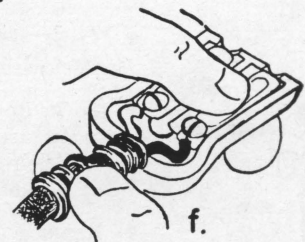
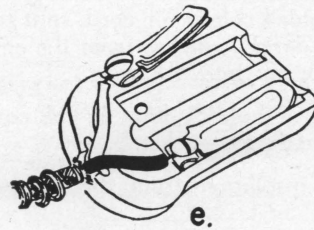
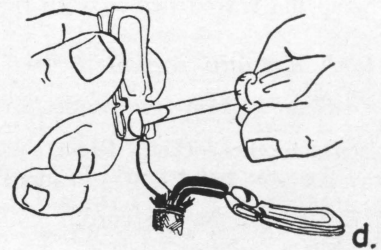
Attach automatic plug to light usage cord

- Several types of plugs are designed for use on light usage molded-plastic or rubber cord, but are not suitable for heavier cords.
- Disconnect the cord from the outlet.
- Cut the molded cord straight across, but do not remove the insulation.
- Follow the directions which come with the plug and be sure ends of wires are enclosed.

Removing
appliance
plug



Attaching
appliance
plug



Replace cord instead of splicing

The Electric Code requires that flexible cords, "be used in continuous lengths without splice or tap." If a cord is not long enough, replace it with one that will reach instead of trying to splice onto the old one. See that the new cord is no longer than necessary to make the connection.

Repair worn spots in moulded rubber or thermoplastic cord

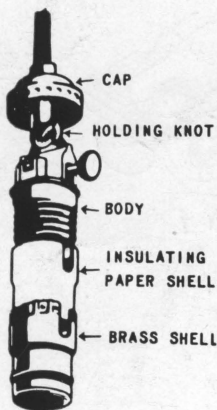
- Disconnect the cord from the outlet.
- Tape each conductor separately with electrical plastic tape from end to end of the break so that wires are completely covered; then tape the two together with the same type of tape. Or use rubber tape to cover the wires of each conductor separately; cover with friction tape; then tape the two conductors together with friction tape.

Repair a frayed fabric cord covering

- Disconnect the cord from the outlet.
- Use matching thread to crochet a new section or wrap the frayed section with thread.

Attach a lamp socket

- Disconnect lamp from outlet.
- Separate the socket. Press a screwdriver on the shell at the point marked "press" to take it apart.
- Slip the cap on the cord.
- On a fabric-covered cord, remove 1½ inches of the covering. With a molded conductor cord, split the two conductors apart for 1½ inches from the end. Be very careful not to cut into the wires.
- Tie an Underwriter's or holding knot in the cord if there is room for it in the socket.
- Remove ½ inch of insulation from the ends of the wires.



- Twist the fine wires tightly clockwise.
- Form hooks in ends of wires to fit around screws, and attach wires to screws on body of socket.
- Replace the insulating shell and the outer shell.
- Tighten set screw of cap.
- Insert lamp bulb and check to see that it works.

Replace an electric cord in a portable lamp

- Disconnect lamp from outlet.
- Remove shade, bulb, harp shade-holder, bowl.
- Separate socket and remove wires from screws.
- Attach new cord to old cord; pull new cord through lamp and remove old cord.
- Prepare wires and attach them to socket.
- Reassemble lamp and pull slack cord through the base of the lamp.
- Plug lamp into outlet to see that it works.

ACKNOWLEDGMENTS

Appreciation is expressed to Milo L. Mumgaard, assistant extension engineer, farm electrification, University of Nebraska, for technical assistance and to the publications division, University of Nebraska, for two photographs.

REFERENCES

The National Electric Code is a set of minimum safe standards for the installation and use of electrical wiring and appliances. It may be purchased from the National Board of Fire Underwriters, 222 West Adams Street, Chicago 6, Illinois or from the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Massachusetts. Copies also may be secured from the American Standards Association, 70 East 45th Street, New York 17, New York.

The National Electric Safety Code may be purchased from the American Standards Association or from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

SAFETY REMINDERS

Inspect all flexible cords used in the home at least once every 6 months; have all defects corrected.

Insist on flag-labeled cord sets and power supply cords bearing the words, "Inspected—Underwriters' Laboratories, Inc."

Connect appliances to convenience outlets only. Lamp sockets are inadequate, expensive and unsafe for use as outlets for appliance connections.

Grasp the plug itself when you remove a plug from an outlet. Do not yank the cord.

Be sure the floor you stand on is dry when you plug an electric cord into an outlet. A damp floor or puddle is dangerous.

Do not handle cords or electrical appliances with wet hands.

Do not run an electric cord under a rug or carpet, never over a radiator or pipe.

Employ a qualified electrician to install outlets where needed, and to make needed repairs. Adequate wiring eliminates hazards.