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## Modernizing Your Wiring System

Cooperative Extension  
*South Dakota State University*

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## Modernizing Your Wiring System

**I**N MANY HOMES, the electrical use has "outgrown" the wiring system. Use of electrical energy has doubled in the last 5 to 10 years for most farms and homes. Also, the number of appliances and even the wattage of individual appliances has increased. For example, wattage of a new toaster was once 400 watts; now it is usually 1,100 watts.

This means more load on the wiring. Where wiring is not adequate, lights may dim, fuses may blow, heating-type appliances may take longer to do the job, and motors may overheat. You may find you have to disconnect one appliance before using another to avoid blowing a fuse. If larger fuses are used, wires in the wall can overheat, and worsens the problems of poor performance of appliances. Lack of provision for proper grounding of appliances can result in electric shocks.

Modernizing an inadequate wiring system will pay in both safety and better appliance performance. Some equipment costs less to operate if excess voltage drop from inadequate wiring is eliminated.

### OLD WIRING NEED NOT BE TAKEN OUT

Usually, if wiring was installed properly in the beginning, and you have not over-fused your circuits, most of your present wiring can be left in place. You may need:

1. **More service entrance capacity.** This is the main supply line to your house. The recommended size is now 100 amp or larger.
2. **More circuits.** Since each circuit and fuse will carry only so much load, there must be enough circuits to divide up the load and carry it.
3. **More outlets.** Most houses need more outlets to eliminate hazardous extension cords and increase convenience. Grounding-type (3 wire) outlets are needed for laundry, basement, garage, outdoors.

By William H. Peterson, Extension Rural Electric Specialist

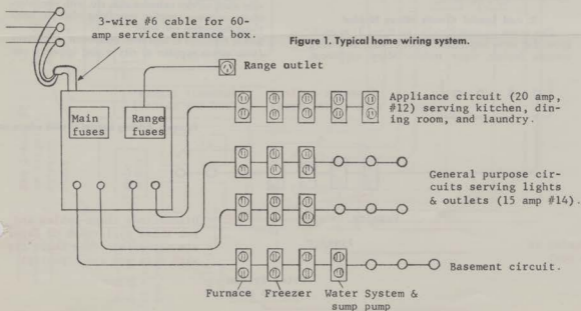
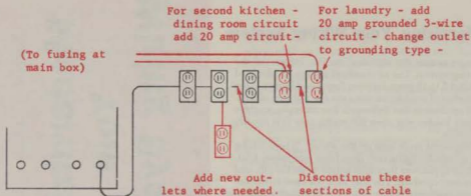


Figure 1. Typical home wiring system.

# Modernizing Your Wiring System

Cooperative Extension Service





### 1. Add Outlets and Divide Into More Circuits

Make a sketch of each circuit as in figure 2. You can check what a circuit serves by turning off the fuse, checking to see which lights and outlets are "off." Write beside each outlet the appliances used there, and figure the maximum number of watts you will use at once. The nameplate on the appliances will tell you its wattage. For 115-volt circuits, maximum wattage at one time is 2,300 watts on a 20-amp circuit (No. 12 wire) or not over 1,725 watts on a 15-amp circuit (No. 14 wire). Larger wire than this may be needed to reduce voltage drop. Never put more than 9 lighting and/or convenience outlets on one circuit. Most kitchen-dining room areas need at least two 20-amp circuits for outlets only.

Split up the circuits that are overloaded (as shown in figure 2) and plan for new circuits. Plan for grounding-type, three-wire outlets for laundry, basement, outdoors, and in outbuildings. These are needed for the three prong plugs on many power tools and appliances. The purpose of the third wire is to ground the frame of the appliance to prevent electric shock in case of breakdown.

(Note: Connection of appliance frames to water pipes or to ground rods is not a reliable means of grounding to prevent electric shock. A third-wire connection from the appliance frame to the service entrance neutral is required.)

### 2. Add Special Circuits Where Needed

Plan to run separate circuits (see figure 3) to appliances that serve important functions, such as heating systems, freezer, water system. Many appliances,

such as range, dryer, and water heater, require special circuits (see circuit chart). Remember that all circuits should be fused at the main fusebox location according to the current-carrying capacity of the wire to prevent overloading circuit wires.

Electric motors need special protection—either built into the motor or by a fustat or breaker rated at not over 1½ times the nameplate amps. The motor protector is usually located near the motor.

### 3. Add New Service Entrance with Plenty of Circuits

Select a new service entrance box with plenty of circuits to place beside the present one. Supply the present box through the main fuses of the new service entrance. A new, larger service entrance cable will be needed. You may need a service entrance box with more or fewer circuits than the one shown in figure 4. Recommended capacity is 100 amps or larger.

Service entrance boxes are available with fuses, breakers, or combinations of fuses and breakers. Breakers usually cost more, but do not have to be replaced when they trip. Type "S" non-temperable fuses (usually called fustats) are advised for circuits of less than 30 amp.

### 4. Getting Your Modernized Wiring System Installed and Inspected

1. Work out the number of circuits, number of outlets, wire sizes, service entrance size, etc. with your electrician or power supplier, specifying what you need to get the system you want.
2. Secure estimates of bids from competent electricians (your power supplier or city wiring inspector can

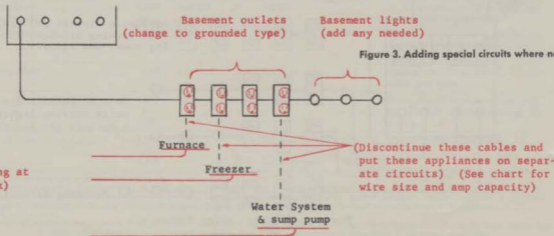
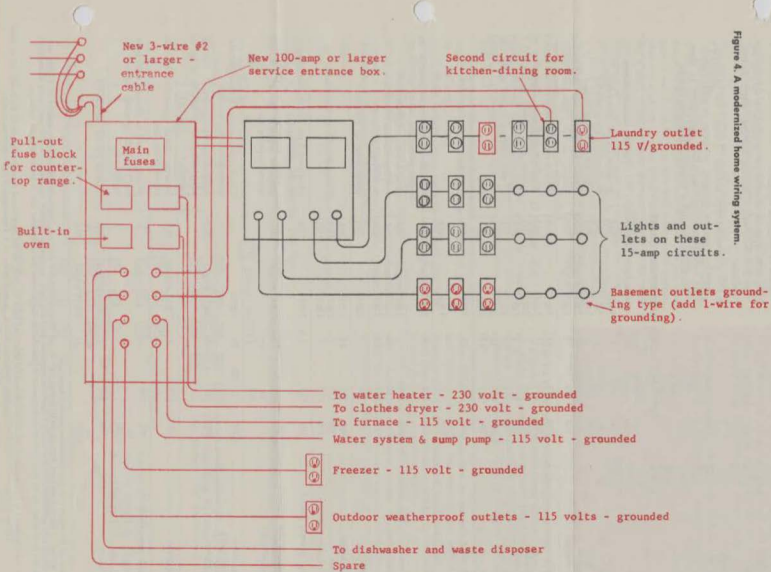


Figure 3. Adding special circuits where needed.

help you select your electrician).  
 3. Have the installed wiring inspected and passed before paying in full. It is usually advised to withhold 20% of the total. Securing of corrections will be much easier if you do this.

**Hints on Planning a Modernized Wiring System**  
 1. Plan wiring for all anticipated uses; this will cost less than adding it later.  
 2. Provide wall switches so it is never necessary to enter a dark room or hallway to reach a light switch.

Figure 4. A modernized home wiring system.



- Provide an outdoor light, controlled by an inside switch, for all exterior entrances. Locate to the side rather than above the door to avoid attracting insects in summer.
- Provide one wall outlet for every 12 lineal feet of wall around the perimeter of the room. An outlet should be provided for every wall space 3 feet or more wide.
- Provide at least two 20-amp circuits for kitchen-dining area outlets. Locate dining room outlets above table level.
- Be sure you have a light, wall-switch controlled, above each work area, such as kitchen sink, laundry tubs, workbench, etc., so that you will not have to work in your own shadow.
- Provide separate circuits for appliances serving important functions (heating system, water system, freezer).
- Use grounding-type outlets (3-wire) for basement, laundry, porches, garages, outdoors, in outbuildings. Be sure permanently-installed equipment in these locations is grounded through the wiring system.

#### APPLIANCE, LOAD, AND CIRCUIT CHART

Appliance	Typical wattage	Voltage needed	Amps load	Wires and size*	Size fuse or breaker†	Type of circuit and comments
Range	12,000	115/230	52	3#6	50A	Separate circuit—grounded
Countertop range	6,000	115/230	26	3#10	30A	Separate circuit—grounded
Oven built-in	5,000	115/230	22	3#10	30A	Separate circuit—grounded
Dishwasher	1,200	115	10	2#12 w/grd‡	20A	These two can be connected on one circuit; must be grounded.
Waste disposal	500	115	5	2#12 w/grd	20A	
Broiler	1,500	115	13	2#12	20A	Two or more 20-amp circuits needed for these appliances depending on number used at once. A 115/230 V "splitwired" circuit provides capacity of two ordinary circuits at any outlet. Ask your wiring inspector about this.
Fryer	1,300	115	11	2#12	20A	
Coffemaker	800	115	7	2#12	20A	
Refrigerator	400	115	4	2#12	20A	
Toaster	1,100	115	10	2#12	20A	
Frypan	1,200	115	10	2#12	20A	
Roaster	1,500	115	13	2#12	20A	
Clothes dryer	5,000 to 9,000	115/230	25	3#10 to 3#6	30A to 45A	Separate circuit—grounded.
Washer	500	115	9	2#12 w/grd	20A	Grounded—advise fused outlet for motor protection.
Hand iron	1,000	115	9	2#12 w/grd	20A	A 20-A circuit will carry only one of these in addition to washer.
Hot plate	1,500	115	13	2#12 w/grd	20A	
Ironer	1,650	115	15	2#12 w/grd	20A	
Workshop	—	115	—	2#12	20A	Separate circuit grounded
Portable heater	1,500	115	13	2#12	20A	Use on general-use circuits.
Television	300	115	3	2#14	15A	
Portable lights—(up to)	300	115	3	2#14	15A	
Lighting, general (each)	100	115	1½	2#14	15A	(Not over 9 per circuit, including convenience outlets.)
Air conditioner (window unit)	1,500	115 or 230	13 or 7	2#12 w/grd	20A	Requires separate circuit; 230 volt operation preferred.
Air conditioner (central unit)	3,400	115/230	20	3#10	—	Check manufacturer's recommendations; should be grounded.
Water system	500	115	5	2#12 w/grd	20A	Separate circuit—grounded. Provide motor protection (230V, for ½ hp. or larger).
Heating plant	600	115	6	2#12 w/grd	20A	Separate circuit—grounded. Provide motor protection.
Electric heaters (built-in)	750 to 4,500	230	—	—	—	Wiring should be planned with heating. Provide separate circuits for heating.
Water heater	1,500 to 4,500	230	7 to 20	2#12 w/grd to 2#10 w/grd	20A to 30A	Separate circuit—grounded.

\*Wire sizes are for copper wire. For aluminum, use next larger size.

†Fuses advised in place of ordinary fuses up to 30 amp as they do not blow on harmless short-time overloads and cannot be replaced by a larger size. ‡W/grd means with groundwire. This is usually a bare wire run inside the same cable but can be installed separately. Portable equipment is grounded through the third prong on the plug. Permanent equipment is grounded by direct connection of the third wire to the frame of the appliance.